COTTON MACHINERY

MASON MACHINE WORKS

TAUNTON, MASS., U.S.A.

1899

MASON MACHINE WORKS.

TAUNTON MASS.

THE

MASON MACHINE WORKS,

TAUNTON, MASSACHUSETTS,

U. S. A.

INVENTORS AND BUILDERS OF

COTTON MACHINERY.

FOUNDED 1842. INCORPORATED 1873.

FREDERICK MASON, PRESIDENT.

WILLIAM H. BENT, TREASURER.

JOHN T. MEATS, SUPERINTENDENT.

1898.

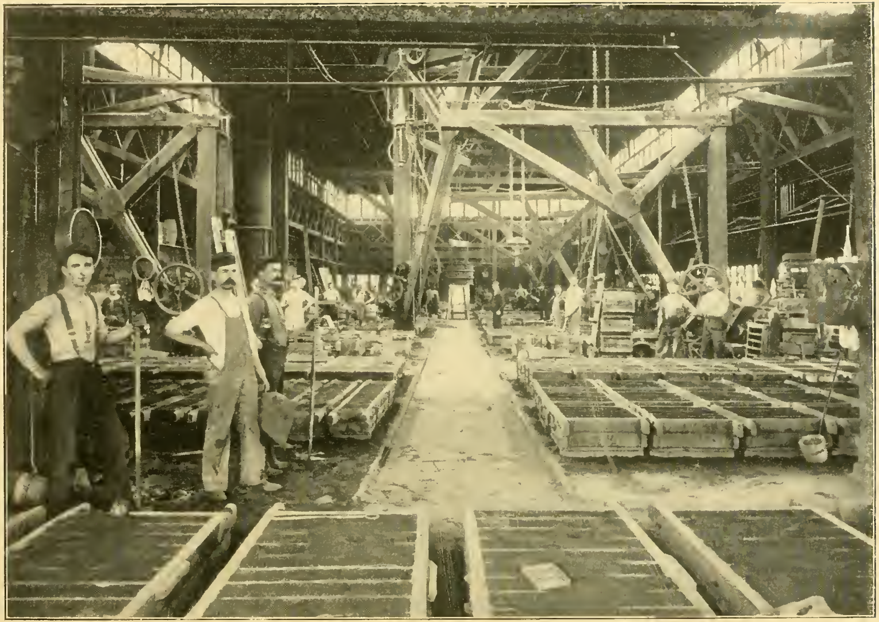
FOUNDRY. MELTING CUPOLAS.

INTRODUCTORY.

The founder of this establishment, Mr. William Mason, began his career as an inventor and builder of Cotton Machinery about seventy years ago. After a boyhood spent in a cotton mill and machine shop, during which he displayed remarkable talent and ingenuity, he began building Power Looms in 1829, when he was about twenty years old. The success which he made in Looms encouraged him to take up other lines of Cotton Machinery, and his genius found free play in the development of the art of spinning. In 1833 he brought out the first successful Ring Spinning Frames, and in 1842 he perfected his wonderful invention, the Self-Acting Mule. Though still a young man, he now became a recognized leader in textile mechanics, and an important factor in promoting the extension and improvement of cotton manufacturing in this country.

In 1842 he became the proprietor of the machine works formerly owned by Crocker & Richmond, in Taunton. Very soon the old shops proved to be inadequate for his business, and he erected the original plant on our present site in 1845. At the time this was built, it was the largest and most complete plant for the manufacture of Cotton Machinery in this country. Here he entered upon the production of a variety of machines required in the equipment of cotton mills, from new and improved designs after his own invention, a number of which became standards and were adopted by other builders who followed him.

From time to time additions have been made to the plant until now, after a general re-arrangement, it occupies over ten acres of ground, contains about nine acres of floor space, and is equipped with modern machines, special tools, and most approved appliances for doing excellent work. When running at full capacity about one thousand men can be employed.

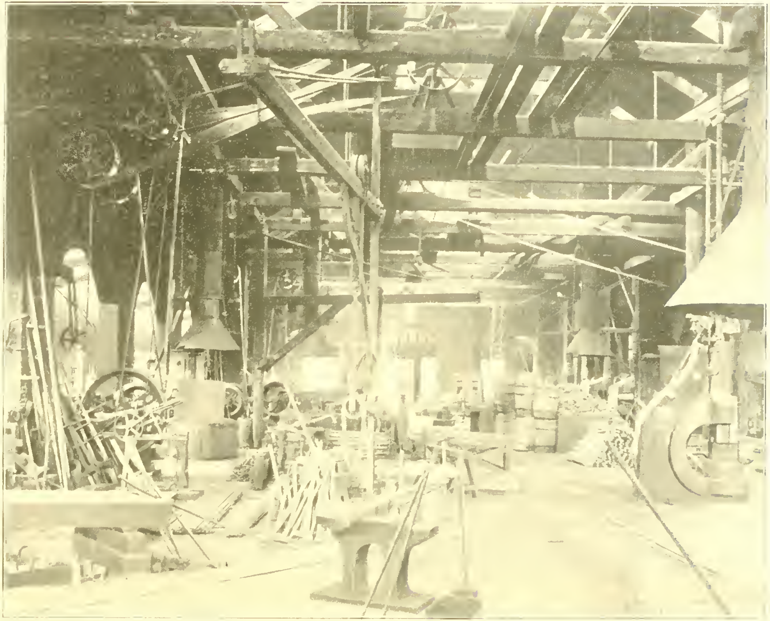


ANOTHER FOUNDRY VIEW.

There have been periods when this establishment was partially engaged in building other kinds of machinery, such as locomotives and printing presses, although its principal product has always been Cotton Machinery. This varied experience in widely different but important lines has been a source of much advantage to us in the education and training of our men, as well as in the discovery of improved methods of doing work. The extreme accuracy required, especially in the construction of printing presses, with the rigid inspection enforced, has developed greater skill and a higher standard of workmanship than would naturally be acquired in building only Cotton Machinery.

Since the death of Mr. Mason, in 1883, the management has been in the hands of those who were associated with him for a long time, and steady progress has been kept up in the march of improvement in all directions. New patterns, of modern designs, have been produced in the old lines of Spinning Frames, Mules and Looms in great variety, and new lines have been added, notably Revolving Flat Cards, Drawing Frames, Combers, Sliver Lap Machines and Ribbon Lap Machines, all embodying the best modern ideas. Each of these machines is the fruit of special study, long experience, the best mechanical talent, and a liberal expenditure of money, in designing, constructing, and experimenting; and the success which has attended their actual mill practice is the gratifying result of our earnest efforts.

We have for a long time recognized the fact that the tendency of cotton manufacturing in this country, especially in New England, is in the direction of finer yarns and more complex fabrics. It was our endeavor to anticipate the needs of manufacturers in that direction which led us to build Combing Machinery, to design special appliances for spinning fine yarns



THE SMITHY

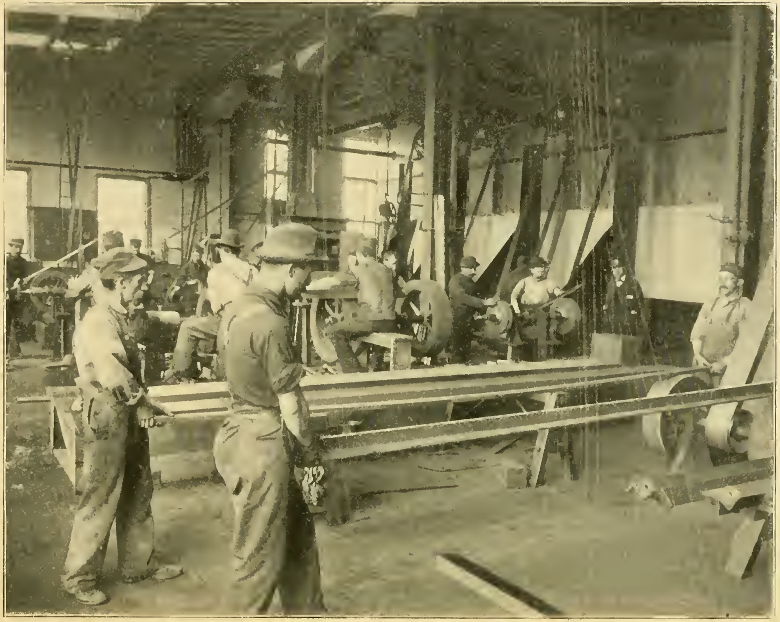
on our Ring Frames, and to bring out a new Mule specially adapted to high counts. We have also largely increased the variety of our Looms and their appliances in the direction of box motions, dobbies, and other minor devices.

The effort to build machinery for the manufacture of finer goods brings to notice certain points in design and workmanship where improvement is necessary to success; and, while the changes that are made may not have been found requisite for machinery intended for coarse and medium goods, yet, in most cases, they are of decided benefit to all grades of manufacture. Then, too, in these days of rapid advance, frequent changes of fashion, and severe competition, it often happens that a mill intended for coarse numbers must be put on to fine. So, in a general way, it may be said that what is best for fine work is none too good for coarse; and that a coarse mill this year may be made a fine mill next year.

We make our machinery to gauge and template, so that the parts are interchangeable with each other, without fitting. And each casting has its letter and number, by which it can be identified. With new machines we furnish blue print lists of all the parts, with their respective numbers and letters, for convenience in giving orders.

We invite attention to the illustrations and descriptions of our machinery contained herein, and we trust that the tables and suggestions given in connection herewith will prove to be useful information.

We have added a few illustrations and statements, relating to the Cotton raising and manufacturing industries, which we think will be found interesting and useful.



THE GRINDERY.

We Build

REVOLVING-FLAT CARDS,

RAILWAY HEADS,

DRAWING FRAMES,

COMBERS,

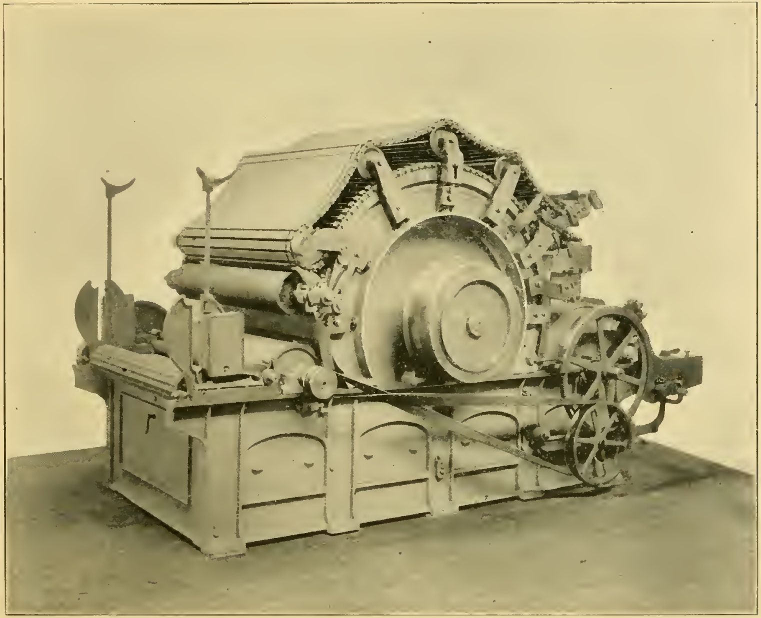
SLIVER-LAP MACHINES,

RIBBON-LAP MACHINES,

RING SPINNING FRAMES,

MULES,

LOOMS.



REVOLVING FLAT CARD.

FEEDER SIDE

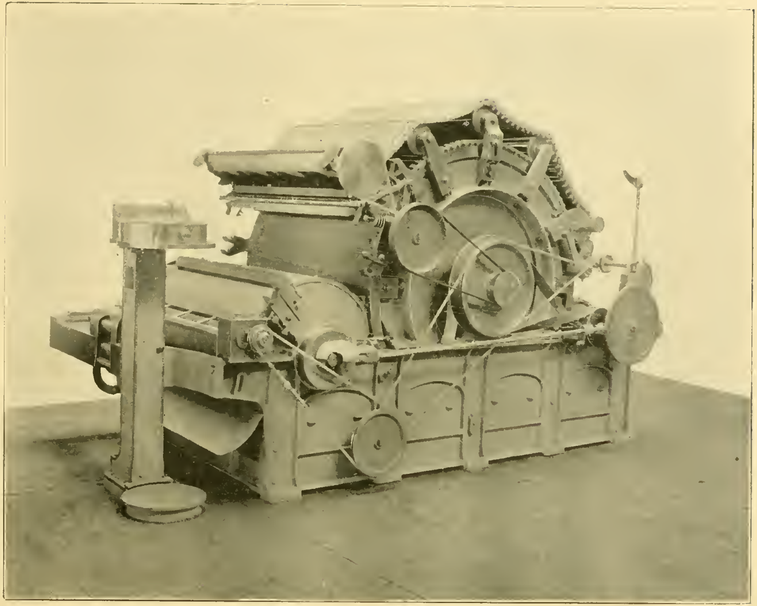
REVOLVING FLAT CARD.

This Card is the result of careful and critical observation of the construction and working of all others of this type, and is believed to be free from most of the faults which have been discovered in them, while it has numerous advantages over any card ever built. These advantages are not so much in a finely polished exterior, as in the design and finish of those parts which are of vital importance in the production of good work. In actual service this Card has far exceeded our expectations in its cleanliness and ease of operation, as well as in the quality and quantity of its production.

CYLINDER, DOFFER AND LICKER.

The Cylinder, Doffer and Licker of this Card are each cast solid, with its arms and stiffening and balancing ribs, obviating the possibility of errors in fitting and weaknesses which are always liable to occur in these parts when made in any other way, whether the arms are bolted in or the cylinders made in two sections, and bolted together in the middle. Cylinders and Doffers are cast without a cooling strain by our system of moulding and casting, and many years of experience with this method has demonstrated the correctness of our practice.

The shafts are larger and stiffer than any in use at the present time, and their bearings are ground true before being placed in the Cylinders and Doffers, after which the Cylinders and Doffers are turned, ground, and balanced from their working bearings. Special machines have been made to finish these parts, and being of recent design are far in advance of those



REVOLVING FLAT CARD.

DELIVERY SIDE.

heretofore in use. The bearings for Cylinder and Doffer are not only larger in diameter but are of greater length than in any other Card; the main cylinder bearing being 7 inches long and 3½ inches diameter. With our Self-Oiling Boxes, we have a combination of large bearings, with assured means of lubrication, which is an entirely new feature in machines of this description.

LICKER

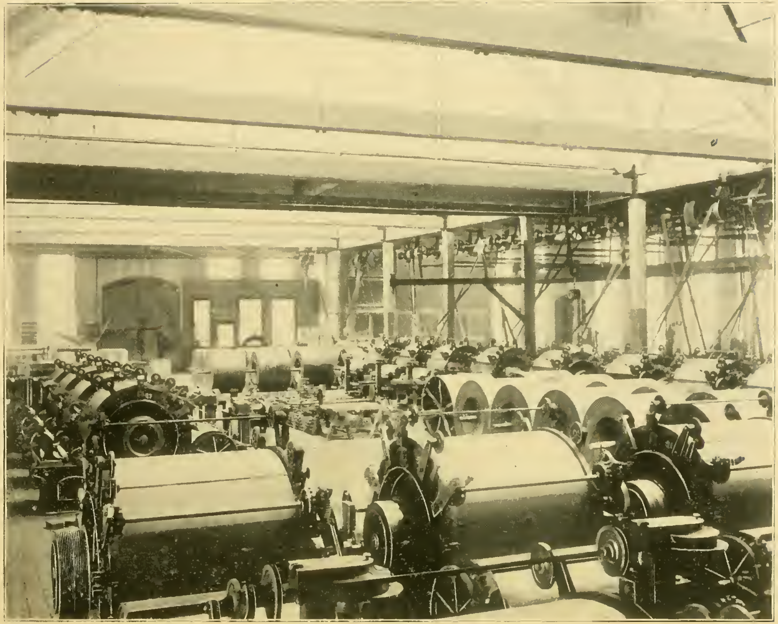
The Licker is cast solid, with the shaft cast in. The bearings are longer and of larger diameter than usually made, and they run in self-oiling boxes. The Licker is usually covered with garnet wire, saw tooth, is furnished with shrouded ends, and ground perfectly true after saw tooth is inserted.

SELF-OILING BOXES.

The foregoing advantages, taken together with the self-oiling bearing (making the wear imperceptible and the lubrication perfect), tend to prevent, in any way, any deterioration in the most vital parts of the card, besides saving oil, attention, and power, and ensuring cleanliness. Special attention has been given to the prevention of oil getting on to the clothing, with its consequent serious results.

FRAME.

The Frame-work is extra heavy, bolted, doweled, and planed as one piece with the greatest accuracy, and the arch and bend are so constructed that perfect rigidity in the flat path is secured.



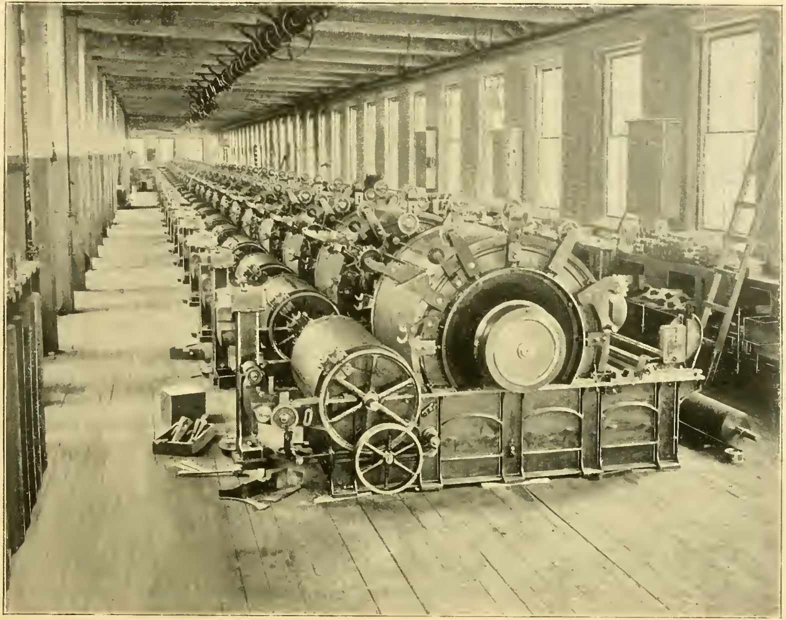
CARD ERECTING DEPARTMENT.

FLATS.

The Flats are so constructed that end play is impossible, and no space is left for the accumulation of side waste, or for "blowing-out." They are not subjected to annealing, hammering, or twisting, but are ground absolutely true to size and finish on the the face; and we thus avoid any factor which would tend to diminish the stiffness of the Flat. They are tested at every stage of their manufacture to the highest degree of accuracy. The clothing is attached to the Flat by a clip, which passes entirely around the edge of the Flat, gripping the clothing and protecting its foundation. We believe this method is superior to the drilling of Flats for lead rivets, and other similar methods.

PATENT GRINDING APPARATUS.

This improved form of Top-Flat renders possible a system of grinding differing entirely from any other, and which, in accuracy and simplicity, has never been equalled. By our system, the Flats are not only ground from the same face which forms the bearing in Carding, but also with the face of the wire down, so that the deflection of the Flat, while being ground, is in the same direction as when working, thus permitting a closer and more uniform setting of the Card, and consequently better work. Furthermore, the grinding being done at the back of the Card, over the licker casing, the emery from the grinder cannot possibly get into the cotton; and, as the grinding bridge and large carrying discs are thus dispensed with, the proportion of idle Flats is reduced, and that of the working Flats correspondingly increased. This arrangement permits the use of a full-sized



CARD ERECTING DEPARTMENT.

grinding roller, and is totally different from those which have been tried and condemned because of inconvenience, complication, and unreasonable increase of idle Flats. We do not hesitate to state that the new method has a great advantage over anything of the kind heretofore offered. We have had some of these grinding shoes in constant use for over three years in our Top-Flat grinding department, doing more work there in that time than would be required in double the lifetime of a Card (grinding it as often as once every four weeks), and they are to-day doing as good work as when first built — that is to say, practically perfect.

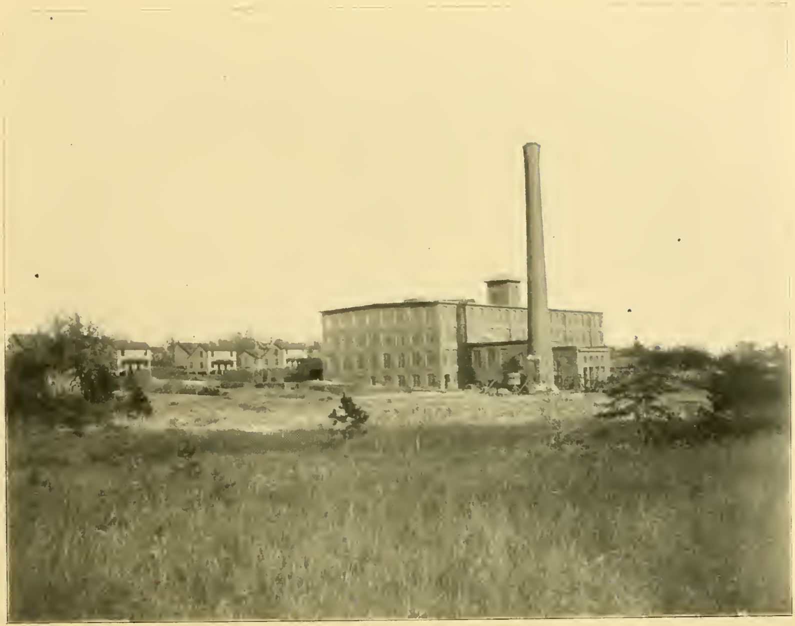
Those who have used this Patent Grinding Apparatus are unanimous in pronouncing it the best thing for the purpose ever introduced. Furthermore, there is positively no danger of springing the Flat during the process of grinding by this apparatus, a danger which is common to nearly all other arrangements for the purpose.

SPROCKETS.

Adjunctive to this grinding arrangement is the use of Sprockets at the back of the Card, instead of ordinary discs. These Sprockets serve to keep the Flats perfectly square with the roll while being ground, and also to parallel them before going on to the bend. This has entirely obviated the trouble which has arisen, after a few years' service, from an unequal stretching of the chains connecting the Top-flats.

SCREENS.

The Screens are made much stiffer than any heretofore used, so that a close adjustment may be made and preserved.



ABBEVILLE COTTON MILL, ABBEVILLE, S. C.

MASON CARDS, DRAWING AND SPINNING.

SCREEN SETTINGS.

The Screen Settings are all outside the frame, and are simple and accessible. The licker screen and the end of cylinder screen adjust with the licker box, so that when the licker is properly set after grinding the screens follow automatically. The Screens may also be set independently. The filling-in pieces may be taken off to permit gauging the Screens from the cylinder and licker. There are also holes in the flanges for gauging underneath the cylinder. The licker box is arranged so that the licker may be taken out without disturbing the setting.

CASINGS AND PATENT SETTINGS.

The making-up pieces to which the Casings are secured may be adjusted in relation to the cylinder; at one point without changing the angle, and at another point so as to change the angle without radial adjustment.

PATENT MOTE KNIVES.

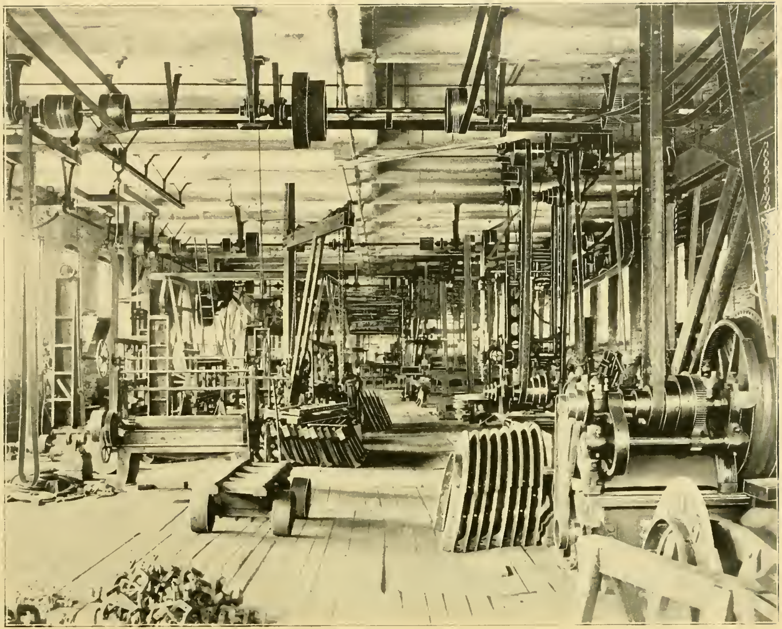
The Mote Knives adjust with the licker, and may be removed without disturbing their support.

CALENDER ROLLS.

The Calender Rolls are provided with convenient and substantial clearers made of iron and covered with clearer cloth.

PATENT COILER.

By a new improved arrangement of the front plate, the calender and coiler driving shaft is placed underneath, out of



MACHINE SHOP. CARD DEPARTMENT.

the way, and where it is not liable to accumulate fly. The coiler cover can be opened without breaking the sliver, and the coiler gearing cannot be broken by "balling-up" the rolls, because effective means are provided for preventing lapping-up. The bearings may be oiled without stopping. Our Patent Full-Can Stop Motion can be applied if desired.

DOFFER GEARING.

By an original and simple arrangement the Doffer Gearing can be thrown out by hand or foot, and it is so arranged as to prevent danger of breakage.

Our Patent Motion, for "slowing" the doffer while piecing-up, can be applied when desired; and it is remarkable for its simplicity as compared with other motions for that purpose. It is, at the same time, effective and safe.

COMB.

The Doffer Comb, driven by double-scored pulley, is noiseless, clean, durable, simple in construction, can be run at any desired speed, and will not throw oil.

FEED ROLL.

The Feed Roll is larger, and consequently stiffer, than those commonly used, and is ground absolutely straight and true. Its bearings are so arranged as to facilitate removal, and, at the same time, to give a uniform pressure upon the lap.

LAP STANDS.

The Lap Stands are adjustable for different widths of lap, and can be furnished with rests for spare lap whenever desired.

PATENT DIVISION SHEET.

The Patent Division Sheet, under the casing, to keep the licker waste separate, is hinged so that it does not interfere with the removal of cylinder waste, and is so arranged as to leave the floor space under the card clear of obstruction.

FLEXIBLE BEND.

The Flexible Bends are tested to ensure concentricity with the cylinder at all points and at all degrees of wear of the wire; and any bend not conforming to this test is destroyed.

FIXED BEND.

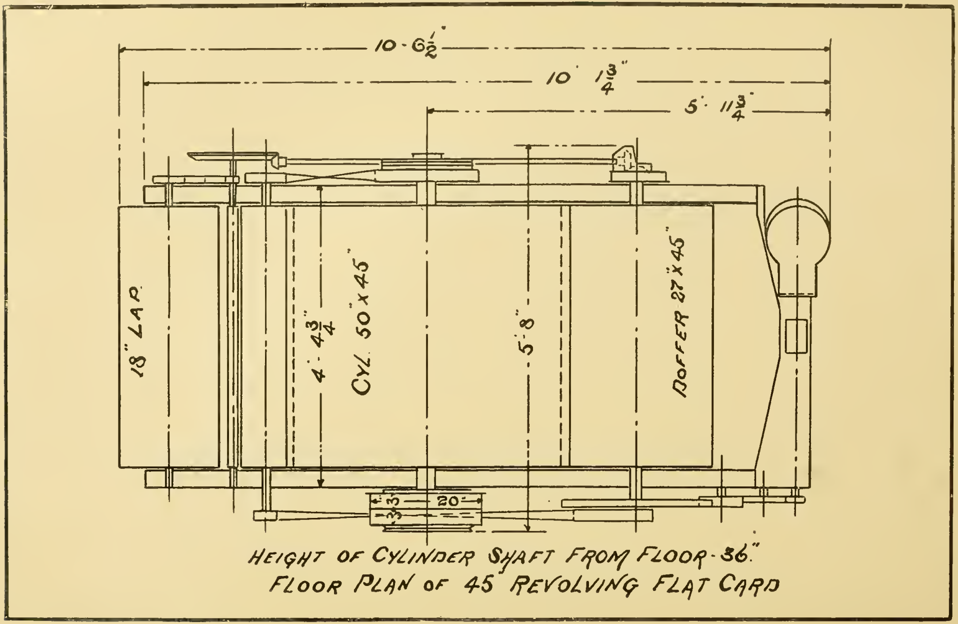
The Fixed Bend is fitted and secured close to the cylinder, so that the wind space is always kept down to the minimum, irrespective of any adjustment of the Flexible Bend.

CHAIN.

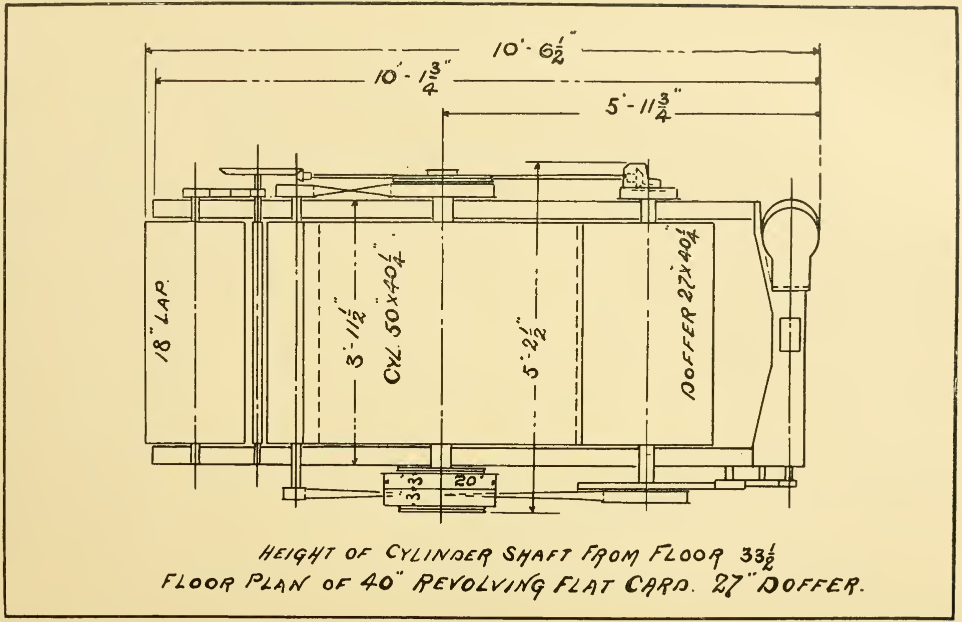
The Chain is so positioned on the flat that the point of contact or strain comes immediately over the bearing surface of the flat on the bend; and the bolts securing the chain to the flats are more accessible.

CONVENIENCE.

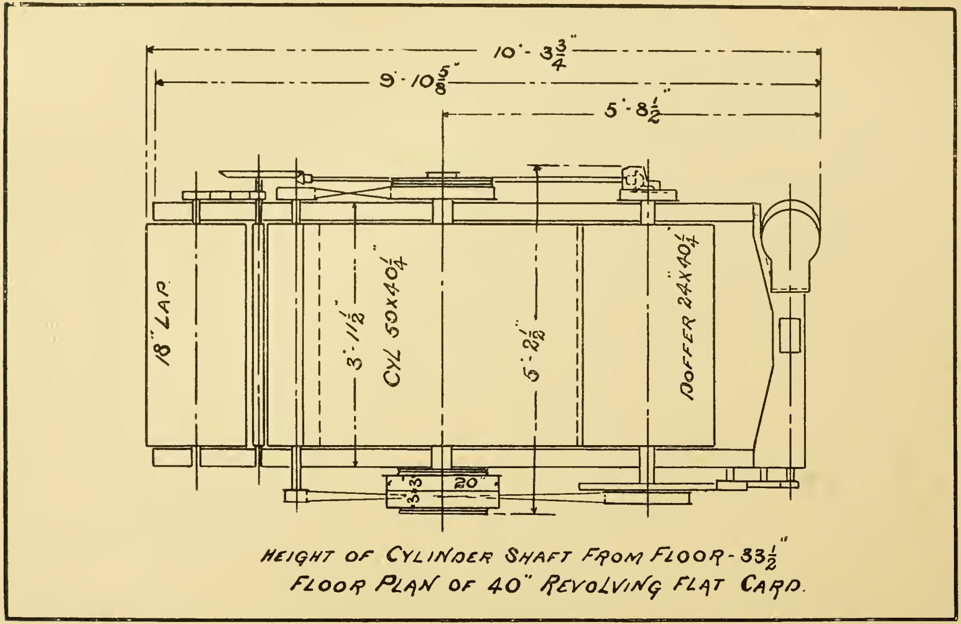
The doffer and feed roll can be thrown out of gear instantaneously from either the front or back of the card. The coiler can be arranged for cans of any size from 10 inches to 12 inches. Every convenience conducive to good work has been introduced, without sacrificing simplicity or safety of operation.



FLOOR PLAN. 45 IN. CARD, 27 IN. DOFFER.



FLOOR PLAN. 40 IN CARD, 27 IN. DOFFER.



FLOOR PLAN. 40 IN. CARD, 24 IN. DOFFER.

DIMENSIONS.

We build three sizes of Revolving Flat Cards.

One with cylinders $50\frac{3}{4}$ inches diameter outside of clothing, and 45 inches wide on the wire, with a doffer $27\frac{3}{4}$ inches in diameter outside of the clothing. This card has 112 flats. The licker is 45 inches wide and $9\frac{3}{8}$ inches in diameter. The floor space which it occupies with a full lap 18 inches in diameter, and with a coiler for 12-inch can, is 5 feet 8 inches wide and 10 feet $6\frac{1}{2}$ inches long over all.

Our narrower Card has cylinders $50\frac{3}{4}$ inches diameter outside of clothing, and 40 inches wide on the wire, and a doffer $27\frac{3}{4}$ inches in diameter outside of the clothing. This Card has 112 flats, and occupies a floor space of 5 feet 3 inches wide and 10 feet $6\frac{1}{2}$ long over all.

We also build this narrower Card with a doffer $24\frac{3}{4}$ inches in diameter outside of the clothing, and with 104 flats. The floor space which this occupies is 5 feet $2\frac{1}{2}$ inches wide and 10 feet 3 inches long over all.

PULLEYS.

The Driving Pulleys for all Cards are 20 inches in diameter and 3 inches face.

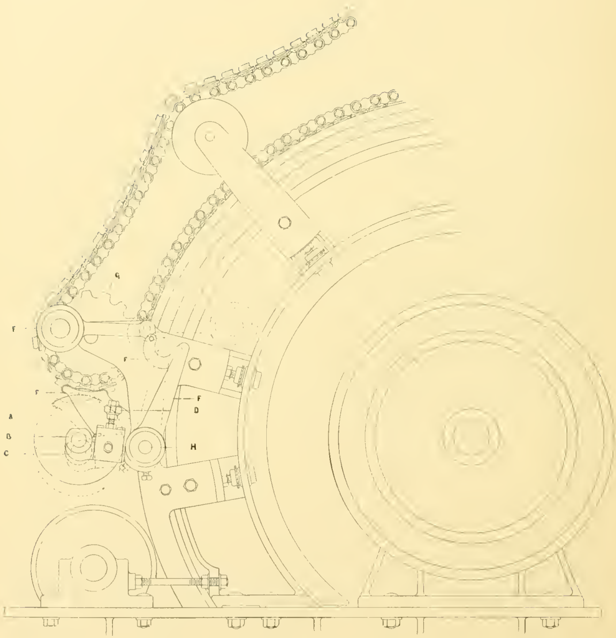
Note.—In ordering repair parts for Revolving Flat Cards use the letter and number found on each casting. Do not use poorly made or home-made gauges.

MASON MACHINE WORKS' PATENT APPARATUS

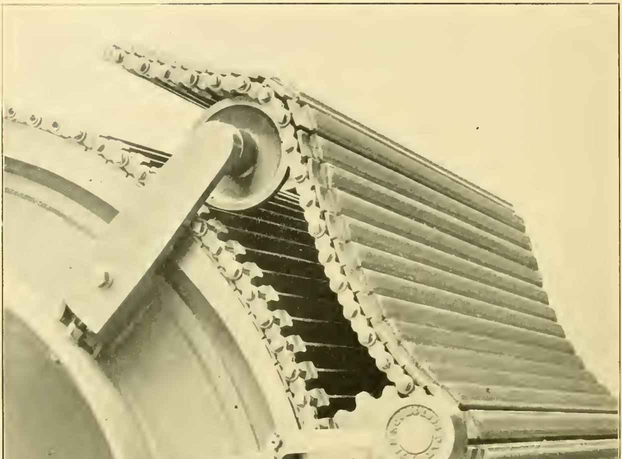
FOR GRINDING FLATS FROM THEIR WORKING SURFACES.

To those who have closely studied the introduction and development of the Revolving Flat Card the importance of some means of grinding the Flats, and placing them in relation to the cylinders with absolute accuracy, has become more and more apparent; for, with the exception of one or two unsuccessful efforts, the custom has uniformly prevailed of grinding the Flats in an inverted position on top of the Card, thus doubling the error of deflection, preventing even and true setting, permitting the atoms of emery and steel to go into the carded cotton, besides incurring the risk of injury to the clothing through carelessness of grinders in lifting the roll into its bearing. It is not remarkable, therefore, that those who have made the most exhaustive tests of the deflection of Flats of different kinds, and under various conditions, have been the first to devise means of grinding Flats so as to eliminate all the disadvantages above enumerated. Our apparatus, which grinds the Flat with the face of the wire downwards, has so far surpassed any device heretofore used for this purpose in accuracy, ease of handling, and simplicity, and has contributed so much to the admirable results which our Card has given, that a detailed description of it may not be out of place here.

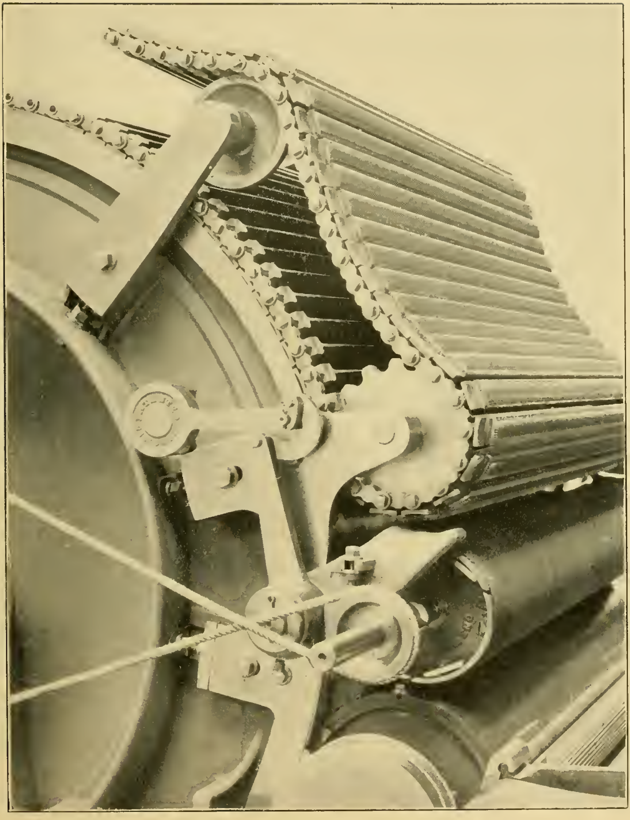
On the following page is a cut of our Patent Grinding Motion, which not only shows the apparatus but also its position and relation to the rest of the Carding Machine.


G
F
F
F
F
A
D
B
H
C

The grinding roll *A*, which is used, is similar to those used on other Cards of this type, and is preferably 7 inches in diameter, runs in self-adjusting bearings *B*, and is supported upon V-shaped brackets *C*, which are adjustable by means of set screws and check nuts *D* upon the grinding shoe or yoke *E*, which is held against the working surface of the flat, during the operation of grinding, by the weight lever *FFF*. The pressure of the weight lever is applied immediately opposite the shoe, so that the flat cannot be sprung during the grinding operation, as is commonly done by all other devices heretofore used for this purpose. The sprocket wheel *G* parallels the flat on the bend, takes up any unequal stretching that may occur in the flat chain, and allows the flat to approach and pass the grinder perfectly parallel. The shoe *E* has the surface which engages with the working surface of the flat, milled exactly to template, and is shaped upon a principle entirely different from that which is used on any of the other devices used for this purpose. It was only reached after careful study and exhaustive experiment, and is of such a shape as to ensure the grinding of the wire perfectly straight from heel to toe. All of these parts are pivoted upon the stud *H*, and, as each Card is supplied with the apparatus, no removal of any part is necessary from Card to Card as the grinding is carried on. Its extraordinary simplicity, and the location of the device immediately over the lickerin, where the mechanism can be got at to set the grinders, without having to pass from one side of the Card to the other, will, we believe, result in more time and attention being paid to the grinding of the Flats, and a consequent improvement in the quality of the work produced. The durability of this grinding arrangement has been proved beyond doubt, by a test covering the equivalent



PATENT GRINDING APPARATUS.



PATENT GRINDING APPARATUS.

of seventy-five years' service in the mill, and, at the end of that time, the Flats were found to be ground with the same accuracy as at first. We are prepared to show, by actual results, that this system of grinding is unequalled in accuracy or simplicity of operation. The dotted lines in the cut are intended to show the position assumed by the grinding apparatus when the operation of grinding has been accomplished and the roll removed to another Card.

Of the accompanying illustrations, the first one represents this grinding apparatus in working position. It shows the weight thrown forward, holding the grinding shoe in position against the working surface of the Flat, and also the sprocket wheels, carrying the Flat chain, which serve to exactly parallel the flats, before they approach the grinding drum. The adjusting screws, seen immediately above the grinding drum band pulley, show how easy of access are the adjustments for setting the grinder to the wire.

The second illustration shows the weight thrown back, and resting on the flange of the Card arch. It will be noticed that when the grinding apparatus is in this position the grinding shoe is entirely away from contact with the Flats. This prevents any undue wearing of the flat working surface when the grinding operation is not going on.

REVOLVING FLAT CARD.

Grains in 1 yard of Picker Lap.

(1 Avoirdupois ounce=437½ Grains Troy.)

Ounces.	Grains.	Ounces.	Grains.	Ounces.	Grains.
1	437½	8	3500	12½	5468¾
2	875	9	3937½	13	5687½
3	1312½	10	4375	13½	5906¼
4	1750	10½	4593¾	14	6125
5	2187½	11	4812½	14½	6343¾
6	2625	11½	5031¼	15	6562½
7	3062½	12	5250	15½	6781¼

RULE TO FIND CARD DRAFT.

Multiply the diameter of the feed roll by the number of teeth in the change draft gear, the number of teeth in the spur gear on the end of the calender roll shaft, the number of teeth in the bevel gear on upright shaft in coiler, and by the number of teeth in the bevel gear on coiler calender roll together, for a divisor, and multiply the diameter of the calender roll in the coiler by the number of teeth in the bevel gear on top of upright shaft in coiler, the number of teeth in the bevel gear on the end of the calender roll shaft, the number of teeth in the doffer spur gear, and the gear on the end of the feed roller together, for a dividend. Divide the dividend by the divisor, and the quotient will be the draft.

RULE TO FIND DOFFER SPEED OF CARD.

Multiply the speed of the cylinder shaft by the diameter of the pulley driving the lickerin, by the diameter of the small pulley on the lickerin driving the barrow pulley, and the number of teeth in the doffer change gear, together for a dividend, and multiply the diameter of the driven pulley on the lickerin, and the diameter of the barrow pulley, and the number of teeth in the doffer gear, together for a divisor. Divide the dividend by the divisor, and the quotient will be the speed of the doffer.

MASON MACHINE WORKS REVOLVING FLAT CARD.

Doffer $27\frac{3}{4}$ ins. outside of clothing.

FORMULA TO FIND DRAFT OF CARD.

Feed Roll 2 7-16 ins. dia
Calender shaft gear 28 teeth.
Draft change bevel 13 to 27 teeth.
Coiler shaft gear 15 teeth.
Coiler Calr. roll bevel 18 teeth.

Calender roll 1 11-16 ins. dia.
Doffer gear 212 teeth.
Gear on feed roll 130 teeth.
Calender shaft coiler gear 29 teeth.
Bevel on coiler shaft 24 teeth.

Constant No. 1756.57 divided by draft gear equals draft.

LIST OF DRAFT GEARS.

Change Gear.	Draft of Card.	Change Gear.	Draft of Card.	Change Gear.	Draft of Card.	Change Gear.	Draft of Card.
13	135.12	17	103.32	21	83.64	25	70.26
14	125.46	18	97.58	22	79.84	26	67.56
15	117.10	19	92.45	23	76.37	27	65.05
16	109.78	20	87.82	24	73.19		

FORMULA TO FIND SPEED OF DOFFER WITH CYLR. 165 R. P. M.

Pulley on licker 7 ins.
Barrow pulley 12 ins.
Clutch gear 40 teeth.
Doffer gear 212 teeth.

165 rev. of cylinder.
18 ins. pulley on cylinder shaft.
5 ins. pulley on licker.
Barrow pulley gear 20 teeth.
17 to 40 teeth change gear.

Constant No. .41694 multiplied by change gear equals speed of doffer.

LIST OF DOFFER CHANGE GEARS.

Change Gear.	Rev. of Doffer.	Change Gear.	Rev. of Doffer.	Change Gear.	Rev. of Doffer.	Change Gear.	Rev. of Doffer.
17	7.08	23	9.58	29	12.09	35	14.59
18	7.50	24	10 00	30	12.50	36	15.00
19	7.92	25	10.42	31	12.92	37	15.42
20	8.33	26	10 84	32	13.34	38	15.84
21	8.75	27	11.25	33	13.75	39	16.26
22	9.17	28	11.67	34	14.17	40	16.67

27-INCH DOFFER. TABLE SHOWING PRODUCTION PER CARD IN ONE DAY OF TEN HOURS.

Number of grains in one yard of sliver.

Rev. of Doffer per minute.	40 gr.	45 gr.	50 gr.	55 gr.	60 gr.	65 gr.	70 gr.	75 gr.	80 gr.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
7.08	66.26	74.54	82.82	91.11	99.39	107.67	115.96	124.24	132.32
7.50	70.19	78.96	87.74	96.51	105.28	114.06	122.83	131.61	140.38
7.92	74.12	83.38	92.65	101.91	111.18	120.44	129.71	138.97	148.24
8.33	77.96	87.70	97.45	107.19	116.94	126.68	136.43	146.17	155.92
8.75	81.89	92.12	102.36	112.60	122.83	133.07	143.30	153.54	163.78
9.17	85.82	96.51	107.27	118.00	128.73	139.46	150.18	160.91	171.64
9.58	89.65	100.86	112.07	123.28	134.48	145.69	159.90	168.10	179.31
10.04	93.96	105.71	117.45	129.20	140.94	152.69	164.43	176.18	187.93
10.42	97.52	109.71	121.90	134.09	146.28	158.47	170.66	182.85	195.04
10.84	101.45	114.13	126.81	139.49	152.17	164.85	177.53	190.21	202.89
11.25	105.28	118.44	131.61	114.77	157.93	171.09	184.25	197.41	210.57
11.67	109.22	122.88	136.53	150.18	163.84	177.49	191.14	204.80	218.45
12.09	113.15	127.29	141.43	155.58	169.72	183.87	198.01	212.15	226.30
12.50	116.98	131.61	146.23	160.85	175.47	190.10	204.72	219.34	233.97
12.92	120.91	136.03	151.14	166.26	181.37	196.49	211.60	226.72	241.83
13.34	124.84	140.45	156.06	171.66	187.27	202.87	218.48	234.09	249.69
13.75	128.68	144.77	160.85	176.94	193.03	209.11	225.20	241.28	257.37
14.17	132.61	149.19	165.77	182.34	198.92	215.50	232.07	248.65	265.23
14.59	136.54	153.61	170.68	187.75	204.81	221.88	238.95	256.02	273.09
15.00	140.38	157.93	175.48	193.02	210.57	228.12	245.67	263.22	280.76
15.42	144.31	162.35	180.39	198.43	216.47	234.51	252.54	270.58	288.62
15.84	148.24	166.77	185.30	203.83	222.36	240.89	259.42	277.95	296.48
16.26	152.26	171.30	190.33	209.36	228.40	247.43	266.46	285.49	304.53
16.67	156.11	175.62	195.14	214.65	231.16	253.63	273.19	292.71	312.22

NOTE.—In the above table 5 per cent. of ten hours has been allowed for stripping, etc.

Mason Machine Works Revolving Flat Card.

Doffer $24\frac{3}{4}$ ins. outside of clothing.

Formula to find Draft of Card.

Feed roll 2 7-16 ins. dia.
Calender shaft gear 28 teeth.
Draft change bevel 12 to 24 teeth.
Coiler shaft gear 15 teeth.
Coiler calr. roll bevel 18 teeth.
Calender roll 1 11-16 ins. dia.
Doffer gear 190 teeth.
Gear on feed roll 130 teeth.
Calr. shaft coiler gear 29 teeth.
Bevel on coiler shaft 24 teeth.

Constant No. 1574.35 divided by draft gear equals draft.

List of Draft Gears.

Change Gear.	Draft of Card.	Change Gear.	Draft of Card.	Change Gear.	Draft of Card.	Change Gear.	Draft of Card.
12	131.18	16	98.39	19	82.86	22	71.56
13	121 10	17	92.60	20	78.71	23	68.45
14	112.45	18	87.46	21	74.96	24	65.59
15	104.95						

Formula to find Speed of Doffer with Cylr. 165 R. P. M.

Pulley on licker 7 ins.
Barrow pulley 15 ins.
Doffer gear 190 teeth.
165 Rev. of cylinder.
18 ins. pulley on cylr. shaft.
4 ins. pulley on licker.
17 to 31 teeth change gear.

Constant No. .5954 multiplied by change gear equals speed of doffer.

List of Doffer Change Gears.

Change Gear.	Rev. of Doffer.	Change Gear.	Rev, of Doffer.	Change Gear.	Rev. of Doffer.	Change Gear.	Rev. of Doffer.
17	10 12	21	12 50	25	14.89	29	17.27
18	10.72	22	13.09	26	15.48	30	17.86
19	11.31	23	13.69	27	16.07	31	18.46
20	11.91	24	14 29	28	16 67		

24-INCH DOFFER.

TABLE SHOWING PRODUCTION PER CARD IN ONE DAY OF TEN HOURS.

Number of grains in one yard of sliver.

Rev. of Doffer per minute.	40 gr.	45 gr.	50 gr.	55 gr.	60 gr.	65 gr.	70 gr.	75 gr.	80 gr.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
9 53	79.93	89.92	99 91	109 90	119.89	129.88	139.88	149 87	159.86
10.12	84.88	95.49	106.10	116 71	127 32	137.93	148.54	159.15	169.76
10.72	89.91	101.15	112.39	123 63	134.87	146 11	157.35	168.59	179.83
11.31	94.86	106.71	118.56	130.41	142 26	154.11	165.96	177.81	189.66
11.91	99.89	112.37	124 85	137.33	149.81	162.29	174.77	187.25	199.73
12.50	104.84	117.94	131.04	144.14	157.24	170 34	183.41	196.54	209.64
13.09	107.79	124.51	138.23	151.95	165.67	179 39	193.11	206 83	220.55
13.69	114.82	129.17	143.52	157.87	172.22	186.57	200.92	215.27	229.67
14.29	119.86	134.84	149.82	161.80	179 78	194.76	209.74	224.72	239.70
14 89	124 86	140.50	156.11	171.72	187 33	202 94	218 55	234.16	249.77
15.48	129.84	146 07	162.30	178.53	194 76	210.99	227.22	243 45	259.68
16.07	134.79	151 64	168.49	185.34	202 19	219.04	235 89	252.74	269.59
16.67	139.82	157.30	174 78	192.25	209.73	227.21	244.69	262.16	279.64
17.27	144.84	162.95	181.05	199.16	217.27	235 37	253 48	271.58	289 69
17.86	149.80	168.53	187.25	205.98	224.71	243.43	262.16	280 88	299.61
18.46	154.83	174.19	193.54	212 90	232 25	251 61	270 96	290.32	309.67
19.05	159 78	179 75	199.72	219.70	239.67	259.64	279 62	299.59	319.56
19.65	164.82	185.42	206 02	226.62	247.22	267.83	288.43	309.03	329.63
20.24	169.77	190.99	212.21	233.43	254.65	275.87	297.09	318.31	339.53

NOTE.—In the above table 5 per cent. of ten hours has been allowed for stripping, etc.

Mason Machine Works 45-Inch Revolving Flat Card.

27-INCH DOFFER.

Belts and Bands used when Carding.

Main Belt,			3	in.	wide.
Cylinder to Licker-in,	8 ft.	8 in.	2	"	"
Licker-in to Doffer,	12 "	3 "	2	"	"
Cylinder to Flats,	6 "	0 "	1½	"	"
Cylinder to Comb Carrier,	9 "	5 "	⅜	"	round.
Comb Carrier to Comb,	7 "	2 "	⅜	"	"
Flat Brush,	5 "	0 "	⅜	"	"

Belt and Bands for Ordinary Grinding.

Cylinder to Doffer,	10 ft.	4 in.	2	in.	wide.
Cylinder to Traverse Grinder on Cylinder,	8 "	0 "	⅜	"	round.
Cylinder to Traverse Grinder on Doffer,	11 "	8 "	⅜	"	"
Doffer to Traverse End of both Grinders,	6 "	10 "	⅜	"	"
Doffer to Traverse End of Cylinder Grinder,	5 "	2 "	⅜	"	"
Doffer to Traverse End of Doffer Grinder,	5 "	1 "	⅜	"	"
Cylinder to Roll Grinder on Cylinder,	7 "	10 "	⅜	"	"
Cylinder to Roll Grinder on Flats,	7 "	10 "	⅜	"	"
Cylinder to Burnisher on Flats,	8 "	5 "	⅜	"	"
Cylinder to Stripper on Cylinder,	8 "	8 "	⅜	"	"
Cylinder to Stripper on Doffer,	11 "	6 "	⅜	"	"

Belt and Bands for Grinding with Cylr. at Slow Speed.

Cylinder to Doffer,	10 ft.	4 in.	2	in.	wide.
Loose Cylinder Pulley to Slow Motion,	10 "	8 "	⅜	"	round.
Slow Motion to Roll Grinder on both Cylinder and Doffer,	9 "	2 "	⅜	"	"
Slow Motion to Burnisher on Cylinder,	8 "	0 "	⅜	"	"
Slow Motion to Burnisher on Doffer,	8 "	4 "	⅜	"	"

Note.—Actual length is given for belts, but allowance has been made for splicing bands.

Mason Machine Works
40-Inch Revolving Flat Card.

27-INCH DOFFER.

Belts and Bands used when Carding.

Main Belt,			3 in.	wide.
Cylinder to Lickerin,	8 ft.	8 in.	2 "	"
Lickerin to Doffer,	12 "	3 "	2 "	"
Cylinder to Flats,	6 "	0 "	1½ "	"
Cylinder to Comb Carrier,	9 "	5 "	⅜ "	round.
Comb Carrier to Comb,	7 "	2 "	⅜ "	"
Flat Brush,	5 "	0 "	⅜ "	"

Belt and Bands for Ordinary Grinding.

Cylinder to Doffer,	10 ft.	4 in.	2 in.	wide.
Cylinder to Traverse Grinder on Cylinder,	8 "	0 "	⅜ "	round.
Cylinder to Traverse Grinder on Doffer,	11 "	8 "	⅜ "	"
Doffer to Traverse End of both Grinders,	6 "	10 "	⅜ "	"
Doffer to Traverse End of Cylinder Grinder,	5 "	2 "	⅜ "	"
Doffer to Traverse End of Doffer Grinder,	5 "	1 "	⅜ "	"
Cylinder to Roll Grinder on Cylinder,	7 "	10 "	⅜ "	"
Cylinder to Roll Grinder on Flats,	7 "	10 "	⅜ "	"
Cylinder to Burnisher on Flats,	8 "	5 "	⅜ "	"
Cylinder to Stripper on Cylinder,	8 "	8 "	⅜ "	"
Cylinder to Stripper on Doffer,	11 "	6 "	⅜ "	"

Belt and Bands for Grinding with Cyl. at Slow Speed.

Cylinder to Doffer,	10 ft.	4 in.	2 in.	wide.
Loose Cylinder Pulley to Slow Motion,	10 "	8 "	⅜ "	round.
Slow Motion to Roll Grinder on both Cylinder and Doffer,	9 "	2 "	⅜ "	"
Slow Motion to Burnisher on Cylinder,	8 "	0 "	⅜ "	"
Slow Motion to Burnisher on Doffer,	8 "	4 "	⅜ "	"

Note.—Actual length is given for belts, but allowance has been made for splicing bands.

MASON MACHINE WORKS
40-INCH REVOLVING FLAT CARD.

24-INCH DOFFER.

BELTS AND BANDS USED WHEN CARDING.

Main Belt,			3 in.	wide.
Cylinder to Lickerin,	8 ft.	8 in.	2 "	"
Lickerin to Doffer,	13 "	2 "	2 "	"
Cylinder to Flats,	5 "	$11\frac{1}{2}$ "	$1\frac{1}{2}$ "	"
Cylinder to Comb Carrier,	8 "	10 "	$\frac{3}{8}$ "	round.
Comb Carrier to Comb,	6 "	10 "	$\frac{3}{8}$ "	"
Flat Brush,	4 "	10 "	$\frac{3}{8}$ "	"

BELT AND BANDS FOR ORDINARY GRINDING.

Cylinder to Doffer,	10 ft.	0 in.	2 in.	wide.
Cylinder to Traverse Grinder on Cylinder,	8 "	0 "	$\frac{3}{8}$ "	round.
Cylinder to Traverse Grinder on Doffer,	11 "	0 "	$\frac{3}{8}$ "	"
Doffer to Traverse End of both Grinders,	6 "	2 "	$\frac{3}{8}$ "	"
Doffer to Traverse End of Cylinder Grinder,	4 "	9 "	$\frac{3}{8}$ "	"
Doffer to Traverse End of Doffer Grinder,	4 "	8 "	$\frac{3}{8}$ "	"
Cylinder to Roll Grinder on Cylinder,	7 "	10 "	$\frac{3}{8}$ "	"
Cylinder to Roll Grinder on Flats,	7 "	10 "	$\frac{8}{8}$ "	"
Cylinder to Burnisher on Flats,	8 "	5 "	$\frac{3}{8}$ "	"
Cylinder to Stripper on Cylinder,	8 "	8 "	$\frac{8}{8}$ "	"
Cylinder to Stripper on Doffer,	11 "	0 "	$\frac{3}{8}$ "	"

BELT AND BANDS FOR GRINDING WITH CYL. AT SLOW SPEED.

Cylinder to Doffer,	10 ft.	0 in.	2 in.	wide.
Loose Cylinder Pulley to Slow Motion,	10 "	7 "	$\frac{8}{8}$ "	round.
Slow Motion to Roll Grinder on both Cylinder and Doffer,	9 "	8 "	$\frac{3}{8}$ "	"
Slow Motion to Burnisher on Cylinder,	8 "	0 "	$\frac{8}{8}$ "	"
Slow Motion to Burnisher on Doffer,	8 "	4 "	$\frac{3}{8}$ "	"

NOTE.—Actual length is given for belts, but allowance has been made for splicing bands.

REVOLVING FLAT CARD.

GRINDING TACKLE REQUISITE.

One pair Traverse Grinders, for grinding Cylinders and Doffers, covered with emery fillet, for each 20 Cards.

One Flat Grinding Roll, for grinding Flats, covered with emery fillet, for every 20 Cards.

One Stripping Roller, covered with hardened and tempered steel stripping wire, for stripping Cylinders and Doffers, for every 30 Cards.

One Burnishing Brush, covered with hardened and tempered steel burnishing wire, for burnishing Flats, Cylinder and Doffer clothing, for every 20 Cards.

One Four Leaf Gauge, for setting Cylinder and Lickerin, etc.

One set Flat Gauge, to set Flats to Cylinder.

Grinders covered with emery filleting, using about No. 40 emery, will be found to give the best results.

DO NOT USE POORLY MADE OR HOME-MADE GAUGES.

CARD CLOTHING.

The Card Clothing generally adopted by American manufacturers is No. 32 wire, set about 72,000 points per square foot, and the filleting is 2 inches wide. For Doffers and Flats No. 33 wire is used, set about 79,200 points per square foot, and the filleting for Doffers is 1½ inches wide.

ENGLISH COUNTS AND AMERICAN EQUIVALENTS.

English Counts.	Points per Sq. Foot.	American No. of Wire.	English Count.	Points per Sq. Foot.	American No. of Wire.
80s	57,600	31	110s	79,200	34
90s	64,800	32	120s	86,400	35
100s	72,000	33			

SHEETS FOR TOP FLATS.

Table Showing Counts and Number of Wire.

Counts.	Crowns in Length of 1 Inch.		No. of Wire.	Counts.	Crowns in Length of 1 Inch.		No. of Wire.
	Plain Set.	Twill Set.			Plain Set.	Twill Set.	
				100	25 22½ 21	10½	31
80	20 18 17	8½	30	110	27½ 25 23	11½	32
90	22½ 20½ 19	9½	30	120	30 27 25	12½	32

RULE FOR DETERMINING THE COUNTS OF A FILLET.

Count the number of noggs in 1 inch downward, multiply this by 3 (because each nogg has 3 teeth), and again by 4, and this again by the number of ribs, or rows, in 1 inch across, divide this product by 10.

Example—A Cylinder Fillet 2 inches wide is found to have 23 noggs in 1 inch downward, then $23 \times 3 \times 4 \times$ the number of columns in 1 inch, usually $4, = \frac{1104}{10} = 110.4$, or the counts are 110s.

RULES FOR DETERMINING THE NUMBER OF POINTS IN A SQUARE FOOT.

Multiply the number of noggs in 1 inch downward by 3 (because each nogg has 3 teeth), and again by the number of ribs, or rows, in 1 inch, and this by 2 (because each tooth has two points), and the result is the number of points in one square inch.

EXAMPLE—$23 \times 3 \times 4 \times 2 = 552$. Multiply the result by 144 (square inches in a foot), and the result is the points in one square foot. $552 \times 144 = 79{,}488$ points per square foot.

FOR AMERICAN COTTON, ON COARSE YARNS, USE FOR

Cylinders	90s	64,800 points	No 31 Wire
Doffers and Flats	100s	72,000 points	No. 32 Wire

FOR MEDIUM COUNT YARNS, USE FOR

Cylinders	100s	72,000 points	No. 32 Wire
Doffers and Flats	110s	79,200 points	No. 33 Wire

REVOLVING FLAT CARD.

SPECIFICATION FOR REVOLVING FLAT CARDS.

No. of Cards .... Width .... No. Right Hand .... No. Left Hand ....

If to have Coilers .... Can, diameter .... height 36 in.

Kind of Cotton .... Weight of Lap .... per yard

Total Draft of Card ....

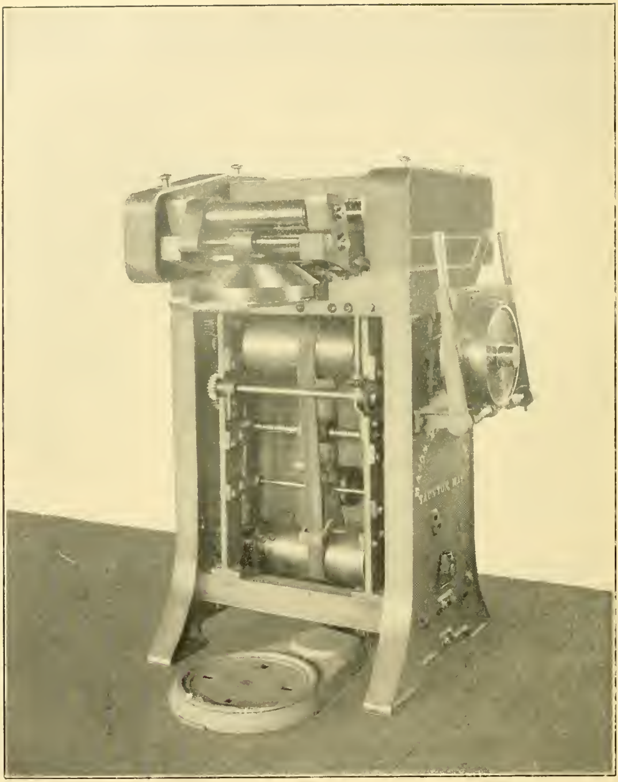
Weight of Sliver in Grains, per yard, in the Can ....

Production wanted per 10 hours ....

Give total percentage of Waste required ....

Speed of Cylinder .... Speed of Doffer

What kind of Clothing preferred ....



SINGLE RAILWAY HEAD.

DRIVING PULLEY ON UPPER CONE SHAFT.

Railway Head.

This machine is substantially made in single or double heads, is adapted to high speeds, and is built to double any number of ends up to twelve; or it can be arranged for the apron trough system.

STOP MOTIONS.

The stop motion at the back is similiar to that in use on the Coiler Drawing Frame; and a roller may be placed just forward of the spoons, to keep all the slivers at an even tension, ensuring the immediate stoppage of the head, when sliver fails at the back.

An automatic brake applied to the driving pulley effectually prevents an end getting through before the head is stopped. The front stop motion works when the trumpet is choked, or a lap-up occurs on the drawing roller, and the full-can stop motion stops the head when the can is full.

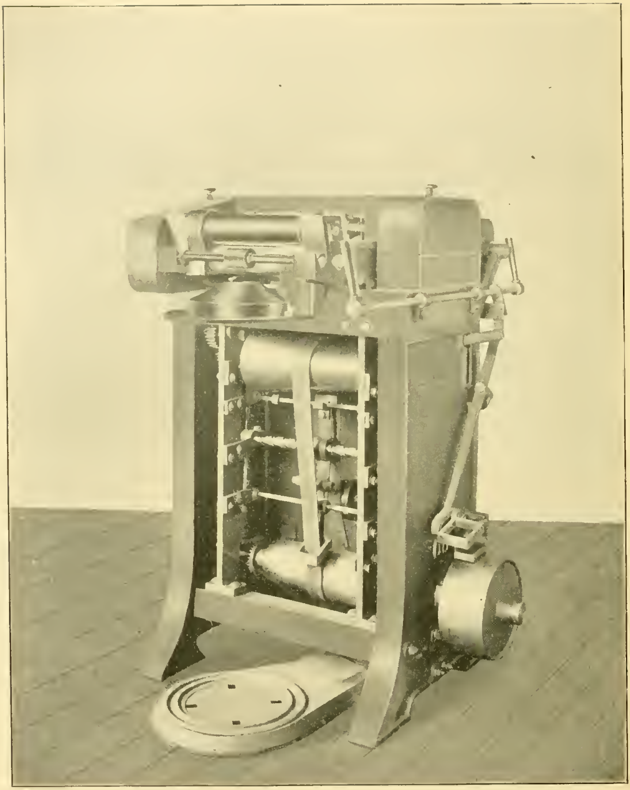
EVENING MOTION.

The evening motion works quickly, without being over sensitive. Any of the adjustable trumpets can be used, but for "all round" service we find the plain trumpet gives the least trouble.

The evener pawls are operated by a crank, driven by a train of gearing, which causes the ratchet gear to work quickly without jerking; and this, in connection with the coarse thread evener screw, allows the belt to ship quickly, yet smoothly.

The evener weights are strung to a rod, terminating in a scale pan.

An automatic safety stop is provided, which throws the pawls out of action when the cone belt runs to the extreme ends of



SINGLE RAILWAY HEAD.

DRIVING PULLEY ON LOWER CONE SHAFT.

the cone, thus preventing the shipper and screw from being strained.

ROLLS.

The rolls are made with bosses of suitable length, and the back roll is driven preferably by an upright shaft from the bottom cone shaft, the front roll being driven by a train of gearing from the top cone shaft.

Front fluted rolls are $1\frac{3}{8}$ inches diameter, and the other fluted rolls are $1\frac{1}{8}$ inches diameter.

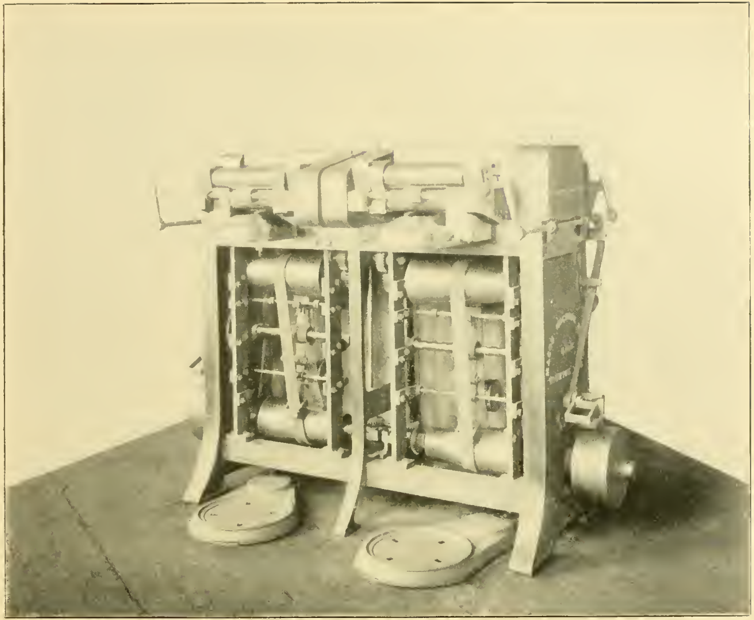
Metallic drawing rolls are applied when desired.

With leather-covered top rolls loose bosses are used, and the usual weight-relieving motion.

The calender rolls are of large diameter to ensure good calendering, and are provided with a third roller for guiding the sliver into the coiler gear tube. This prevents the necessity of threading the coiler tube.

CONES.

The cones are of iron, accurately balanced, and are longer than usual. Driving pulleys can be placed on the end of the top cone shaft on those heads arranged to take sliver from cans placed at the back, and the bottom cone is then driven from the top cone. From the bottom cone, by means of an upright shaft, the back roller is driven. This arrangement relieves the cone belt of driving the coiler, calender rolls, can table motion, and front roll gearing. In the case of heads arranged at the end of Card troughs, where it is necessary for the back roller to take up a given length of sliver from Card, the back roller is driven



DOUBLE RAILWAY HEAD.

positively, and the front roller is driven through the cones, as is customary in other machines of this description. The self-weighted binder is used to keep a good tension on the cone belt.

COILER.

The coiler is made for cans from 10 inches to 16 inches diameter, and 36 inches high. The can table need not be let into the floor.

GEARING.

All gearing is cut to ensure smooth and quiet running, and is carefully enclosed by means of convenient polished covers.

DIMENSIONS, ETC.

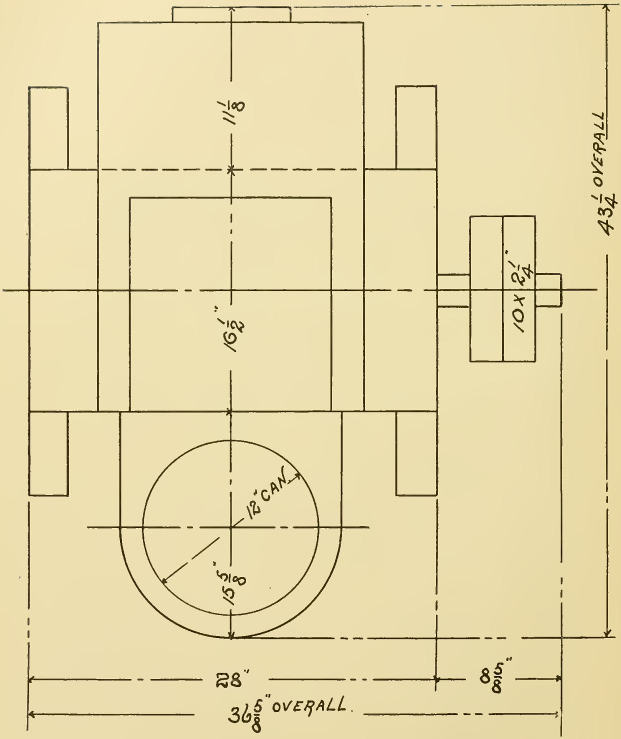
The space occupied by a single head, without the cans at the back, is 37½ inches long x 42 inches wide, and that of a double head 72½ inches long x 42 inches wide.

The driving pulleys are usually 10 inches diameter x 2¼ inches face, but can be made of any suitable diameter.

All roller stands are bushed with brass bearings, unless otherwise specified.

Careful attention has been paid to the oiling arrangements, and the whole design of the head is such as to ensure ease of operation and a large production.

NOTE.—In ordering repair parts for Railway Heads use the letter and number found on each casting.



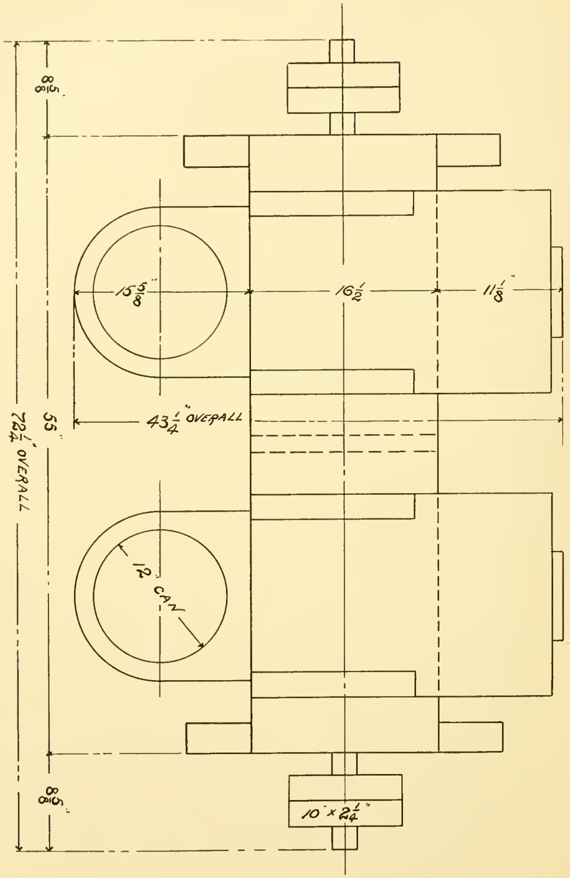
FLOOR PLAN. SINGLE RAILWAY HEAD.

MASON MACHINE WORKS RAILWAY HEAD.

PRODUCTION PER DAY—TEN HOURS.

Revo. of $1\frac{3}{8}$ inch Front Roll per minute.	GRAINS PER YARD.											Revo. of $1\frac{3}{8}$ inch Front Roll per minute.
	50 gr.	60 gr.	70 gr.	80 gr.	90 gr.	100 gr.	110 gr.	120 gr.	130 gr.	140 gr.	150 gr.	
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
300	138.86	166.63	194.40	222.17	249.94	277.71	305.48	333.25	361.03	388.8	416.57	300
315	145.8	174.96	204.12	233.28	262.44	291.60	320.76	349.92	379.08	408.24	437.4	315
330	152.75	183.30	213.85	244.4	274.95	305.5	336.05	366.6	397.15	427.7	458.25	330
345	159.69	191.62	223.56	255.5	287.43	319.37	351.31	383.24	415.18	447.12	479.06	345
360	166.63	199.95	233.28	266.61	299.93	333.26	366.58	399.91	433.24	466.56	499.89	360
375	173.57	208.28	243	277.71	312.43	347.14	381.85	416.56	451.28	486.	520.71	375
390	180.51	216.62	252.72	288.82	324.93	361.03	397.13	433.24	469.34	505.44	541.54	390
405	187.45	224.95	262.44	299.93	337.42	374.91	412.4	449.89	487.38	524.88	562.36	405
420	194.40	233.28	272.16	311.04	349.92	388.8	427.68	466.56	505.44	544.32	583.2	420
435	201.34	241.61	281.88	322.15	362.42	402.69	442.96	483.23	523.49	563.76	604.03	435
450	208.28	249.94	291.60	333.26	374.91	416.57	458.23	499.88	541.51	583.2	624.85	450
465	215.22	258.27	301.32	344.36	387.4	430.45	473.5	516.54	559.58	602.64	645.68	465
480	222.17	266.6	311.04	355.47	399.91	444.34	488.77	533.2	577.64	622.08	666.51	480
495	229.11	274.94	320.76	366.58	412.41	458.23	504.05	549.88	595.7	641.52	687.34	495
510	236.05	283.27	330.48	377.69	424.9	472.11	519.32	566.54	613.74	660.96	708.16	510
525	243.	291.6	340.2	388.8	437.4	486.	534.60	583.2	631.8	680.4	729.	525
540	249.94	299.93	349.92	399.9	449.89	499.88	549.87	599.86	649.81	699.84	749.82	540
555	256.88	308.26	359.64	411.02	462.39	513.77	565.15	616.52	667.9	719.28	770.65	555
570	263.83	316.60	369.36	422.13	474.89	527.66	580.43	633.19	685.96	738.72	791.49	570
585	270.77	324.92	379.08	433.23	487.39	541.54	595.69	649.84	704.	758.16	812.31	585
600	277.71	333.26	388.8	444.34	499.89	555.43	610.97	666.52	722.06	777.6	833.14	600

10 per cent. allowed for stops.

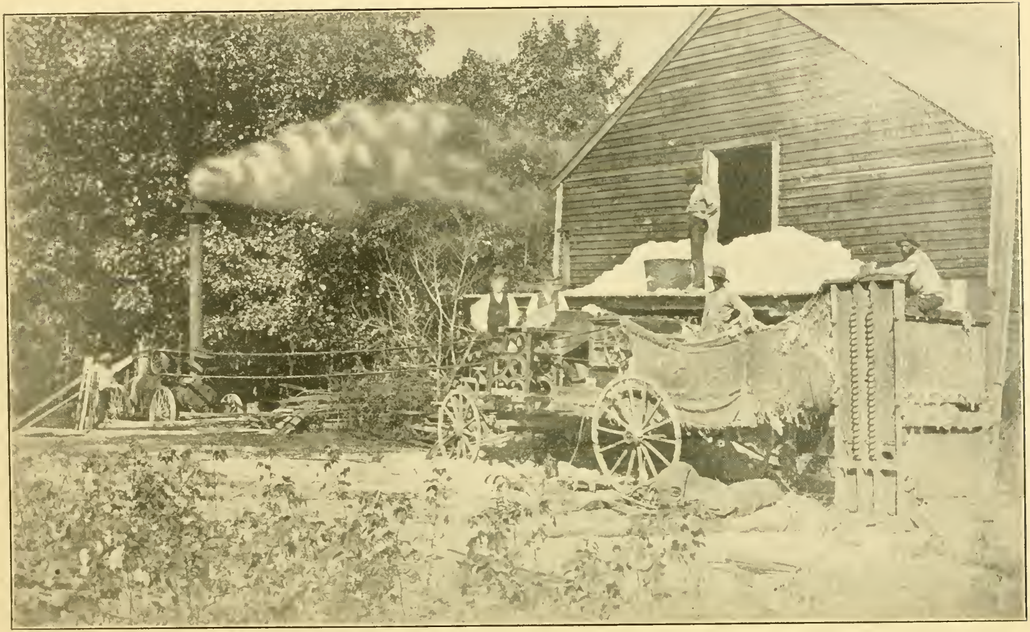


FLOOR PLAN. DOUBLE RAILWAY HEAD.

A convenient rule for ascertaining the production of a Railway Head is as follows:

Multiply the revolutions of the front roller by the weight of one yard of sliver in grains, and this product by .00926. The result is the pounds per day of 10 hours, allowing 10 per cent. for stoppage, etc.

Example—300 × 100 × .00926 = 277 lbs.



PORTABLE COTTON GIN.

Railway Head.

Specification for Railway Head with Coiler.

Number of Heads

Number of Single Heads

Number of Double Heads

If to have Coiler

Can diameter height 36 inches.

Weight of sliver in grains per yard from Card

To double ends into 1

Total draft of Head

Will Metallic Drawing Rolls be used

What kind of cotton is to be used

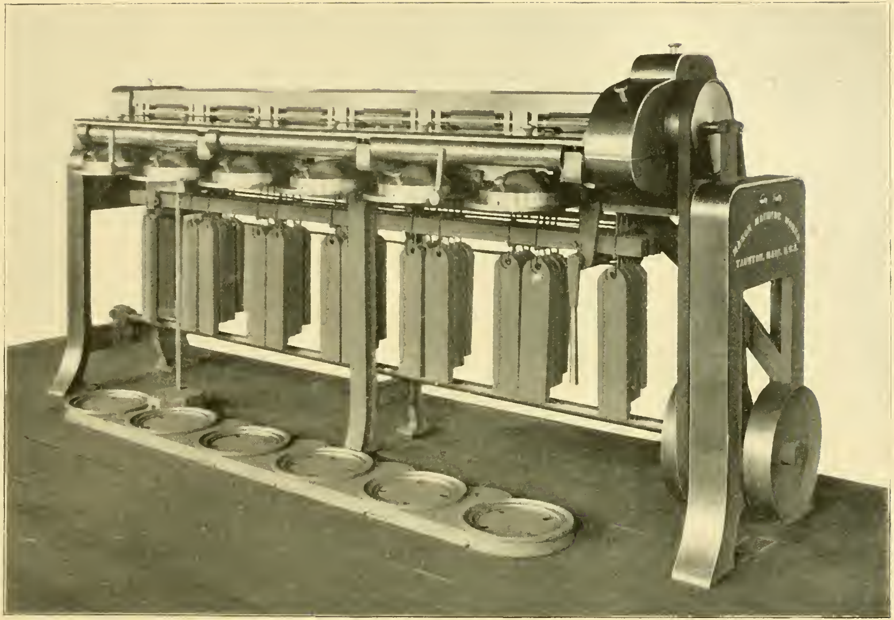
If leather-covered top rolls are used, are any to be of shell pattern

If so, state which line

Give R. P. M. of front roller.

We supply three Change Draft Gears with each Head.

Front Roller is usually $1\frac{3}{8}$ inches diameter; all others $1\frac{1}{8}$ inches diameter.



COILER DRAWING FRAME.

COILER DRAWING FRAME.

This Drawing Frame has four lines of steel drawing rolls, coilers, can tables, and stop motions at back, front, and for full can. All shafts throughout are provided with cap bearings, to facilitate removal, when occasion demands.

STEEL ROLL AND CALENDER ROLL STANDS.

These are cast in one piece, thus ensuring a very strong stand and rigid frame, with an absence of the vibration to the calender rolls so prevalent in drawing frames where solid calender rolls are used, running at high speed. The cap bar stands, for the drawing rolls, are separate, each being bolted to the roll stand independently, which allows of individual setting for any length of staple. They are heavily bushed with brasses, which are easily renewed, or they may be made of cast iron, without bushings, if desired. The calender roll portion of these stands is made in box-girder pattern.

DRAWING ROLLS.

Bottom rolls are made of steel, irregularly fluted to prevent cutting of the top rolls, and have case-hardened necks and squares, which, in connection with the brass bearings, ensures long life to the rolls; or the fluted rolls may be made solid, in one length, without coupling, if preferred. The top rolls are usually shell for the front roll, and solid for the others; we usually supply these covered, with 10 per cent. spare top rolls. We can also apply metallic drawing rolls, and metallic top rolls, if desired. The front roll is usually made $1\frac{3}{8}$ inch diameter, and all others $1\frac{1}{8}$ inch.

CALENDER ROLLS

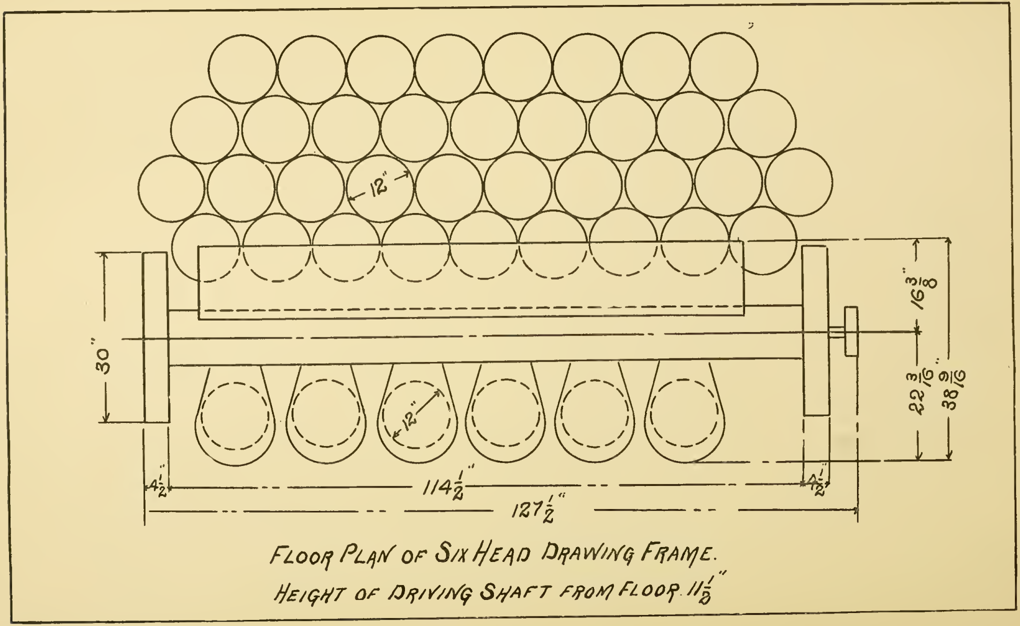
The calender rolls are 3 inches in diameter, and 27 inches long, of best quality of steel, turned and polished all over. By using this heavy calender roll, we get a perfect condensing of the sliver, by the weight of the rolls, without the use of screws, which, when a calender roll lap-up occurs, bind so tight that ordinary help cannot release them.

GEARING.

All the gearing throughout these frames is cut, the draft gears being made very much stronger than usual. All draft changes are made at one end of the frame, and with one gear. We use no steady pins for gearing, all gears being held by keys and set-screws. The intermediate draft gearing is at opposite end of rolls to draft gear; and the calender roll and coiler gearing is heavy, and runs very smoothly.

WEIGHTING.

All top rolls are dead weighted. For leather covered rolls we usually use 22 lbs. on first, 20 lbs. on second, 18 lbs. on third, and 16 lbs. on back roll. On metallic top rolls the weights are a little less. The weight hooks, for top rolls, are made of wrought steel, with brass bushings let in; this saves wear on the necks of the top rolls. The stirrup is made of steel, and the hook for hanging the weight is made of steel wire, compounded so as to give elasticity. By avoiding the use of any cast iron whatever in our weighting arrangements, we avoid the breakage of hooks and stirrups, and the consequent stoppage of the Frames, so prevalent when cast iron is used. When leather



FLOOR PLAN. DRAWING FRAME.

covered top rolls are used, we apply a weight relieving motion, quickly operated, and easily handled by small help.

COILER SHAFT AND COILER.

In connection with the box-girder calender roll stands, we can easily remove the entire coiler shaft, with all the bevel gears and connections to can-table motions intact, by simply removing the caps of shaft bearings; this is an advantage which all carding room overseers will appreciate. The coiler-tube gear is provided with a cover, which can be instantly removed, and is held in position without the use of springs or set screws. The coilers are made for 10 inch or 12 inch cans.

CAN TABLE MOTION.

The can tables are so arranged as not to require letting into the floor, the spider for the motion being simply screwed to the floor; and yet the frame is not increased in height by this arrangement, Ample provision has been made for lubrication, and also for the prevention of oil getting on to and disfiguring the floors. Can tables are covered all over, and are made with plates for either 10 inch or 12 inch cans.

STOP MOTIONS.

We build drawing frames with either mechanical, electrical, or combined electrical and mechanical stop motions.

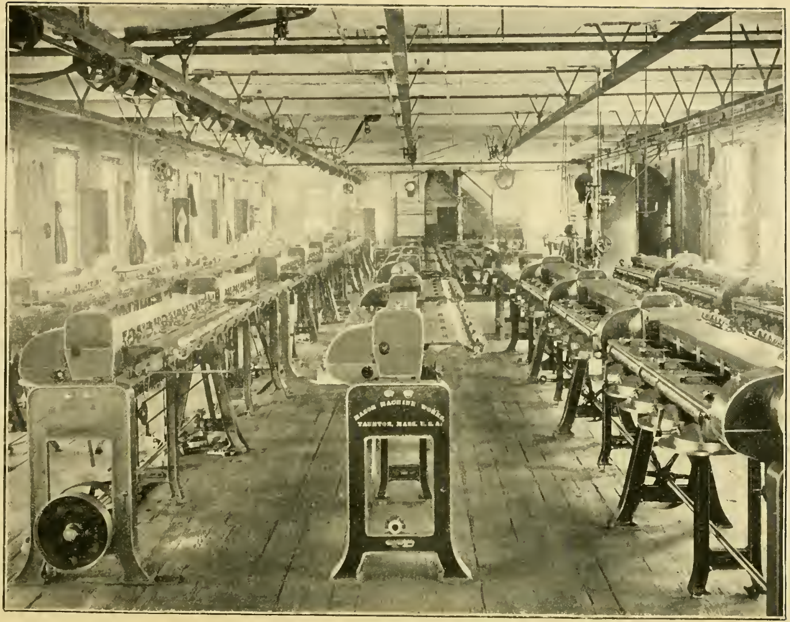
Our mechanical stop motion consists of a spider, on a quickly revolving shaft, driven by a train of gearing The spoons are balanced on a knife edge, and the instant that the friction of the sliver is removed from the spoon by an end breaking, or a can becoming empty, the spoon falls back and arrests the motion of the spider, when, by suitable mechanism, the belt is thrown off and the frame instantly stops. These spoons are so arranged in the frame that the ordinary help cannot remove them and run the machine with one or more spoons lacking when the frame is out of order.

The front stop motion consists of a lever, balanced from a stand on the beam, which, when the sliver from the front roll is passing through the trumpet, is caused by the friction of the sliver to be held down in front, and the rear end up out of contact with the spider. When a top or bottom roll laps up, or waste chokes the trumpet, or when from any cause the sliver fails to properly pass through the trumpet to the calender rolls, the friction in the trumpet is removed, and the rear end falls, and coming in contact with the revolving spider arrests its motion, and the frame is instantly stopped.

The full can stop motion is operated by the amount of cotton in the can. When the can gets full, the pressure of the cotton lifts the coiler tube gear about a sixteenth of an inch; this in turn operates on a small rod in connection with the front stop motion lever, and the frame instantly stops. The mechanism and connections to the belt shipper are simplicity itself.

Our electrical stop motion is based on the fact that cotton is a non-conductor of electricity.

The front calender roll is insulated from the beam. The back plate is insulated from the beam, but electrically connected with the front calender roll. The clearer covers are electrically connected to the back plate, but insulated from the rest of the frame. The operation is as follows: When an end runs out at the back, or breaks, the top carrying roll falls, and comes in contact with the bottom carrying roll; electrical connection is thus



DRAWING FRAME ERECTING DEPARTMENT

made, and the current attracts the armature on the magnet, arrests the motion of the clutch shaft, and the frame instantly stops.

When a top or bottom roll laps up, it raises the top roll just enough to make electrical contact with the top clearers when action takes place, same as when a can runs out. When for any reason (such as the sliver breaking between the front rolls and calender rolls, or clearer waste choking the trumpet,) the cotton fails to pass between the calender rolls, the front calender roll comes in contact with back calender roll, electrical contact is made, and the frame stops as before.

(The calender rolls are kept apart while the frame is in operation by the thickness of the sliver passing through)

The full can stop motion works by the pressure of cotton in the can lifting the coiler-tube gear just enough to bring it into contact with a flat spring set one sixteenth of an inch above the normal position of the coiler-tube gear; connection is thus made, and the frame stops as before. The magnets for attracting the armature are enclosed in a strong iron box, and entirely out of the way. The current can either be generated by ordinary batteries, or by a magneto-electric machine, driven by a small pulley, and which requires no attention other than an occasional oiling. We are prepared to supply these magneto machines, as well as the insulated wiring to connect the machine to drawing frame.

Our combined electrical and mechanical stop motion is so arranged that the back stop motion is operated similarly to our electrical stop motion machine. The contact rolls at the back also act as lifting rolls to help the sliver out of the cans at the back. This is an essential feature in mills using combed work.

The front stop motion, full can stop motion, and roll-lapping stop motion are operated in the same manner as on our well known mechanical stop motion frame.

A novel feature of our lifting rolls, which may be applied also to frames having the mechanical stop motions, is the ability to piece up an end at the back of the frame, without having to lift out or raise the top lifting roll, in order to get the sliver under the lifting roll, and in its proper place in the sliver guides at the back of the frame.

Our lifting rolls will thread themselves, and the end immediately goes to its particular place, without further attention from the operative. In mills where small help is used, this feature will be found to be of great practical value, as the operative need not go up close to the frame, in order to put the end under the lifting roll.

PULLEYS, ETC.

The tight and loose pulleys on front roll are 11 inches in diameter, and make 1.45 revolutions to one of the main driving shaft below. The driven pulley on bottom shaft is usually from 14 inches to 20 inches in diameter, and 3 inches face. The driving pulley on inside is usually 16 inches diameter, and four inches face. The main driving belt should be 3 inches wide. The driving belt for front rolls should be 1½ inches wide and 9 feet, 7 inches long.

All calender roll covers, top clearers, gear covers, etc., are polished, giving the frame a very handsome appearance.

The frame is built as low down as it can be, and still permit the use of a can 36 inches high at the front, thus enabling persons of small stature to attend it with ease.

PICKING COTTON.

All the gearing is most carefully covered, so that even the most careless cannot get caught.

It has been our aim to produce a high-grade machine, capable of doing the best work, and, at the same time, to have it free from the intricate adjustments so often seen on drawing frames. We believe our drawing frame is so simple in operation that the smallest and most incompetent help can operate it with ease.

Note—In ordering repair parts for drawing frames, please use the letter and number found on each casting.

RULE TO FIND THE DRAFT OF A DRAWING FRAME.

Multiply the diameter of the front roll, the number of teeth in the crown gear, and the number of teeth in the back roll gear, together, for a dividend, and multiply the diameter of the back roll, the number of teeth in the front roll gear, and the number of teeth in the change draft gear, for a divisor. Divide the dividend by the divisor, and the quotient will be the draft of the frame.

EXAMPLE.

Diameter of front roll $1\frac{3}{8}$ in. Diameter of back roll $1\frac{1}{8}$ in.
Crown gear 90 teeth. Draft change gear 30 to 60 teeth.
Back roll gear 24 or 48 teeth. Front roll gear 22 teeth.

$$\text{Then } \frac{11\times 90\times 24}{9\times 30\times 22}=4 \text{ draft.}$$

NOTE—The draft between front roller and calender roll is not included in the above.

To obtain a Constant Number for Draft, proceed as above, only omit the change draft gear.

EXAMPLE.

Diameter of front roll $1\frac{3}{8}$ in. Diameter of back roll $1\frac{1}{8}$ in.
Crown gear 90 teeth.
Back roll gear 24 teeth. Front roll gear 22 teeth.

$$\text{Then } \frac{11\times 90\times 24}{9\times - \times 22}=120.00 \quad \text{Draft Constant Number.}$$

The Constant Number divided by the draft gear gives the draft of the frame; and the Constant Number divided by the draft required will give the number of teeth in the draft gear.

MID-DAY SCENE IN ABBEVILLE, S. C.

SPECIFICATION FOR

COILER DRAWING FRAME.

Number of Frames Number of Heads

Number of deliveries per head

Give total draft required

Will you use metallic drawing rollers

To double how many slivers

Diameter of can Height of can

To double slivers into one

Mechanical or Electrical Stop Motion

If leather covered top rolls to be used, are any to be shell patterns

If so, state which line of steel rollers

Weight relieving motion to be used

Specify any preference for top clearers

Give weight of sliver from Card, in grains, per yard

What kind of cotton to be used

Give R. P. M. of front roller

We supply 3 Change Draft Gears with every Head.

Front Roller is usually $1\frac{3}{8}$ inches diameter; all others $1\frac{1}{8}$ inches diameter.

Mason Machine Works Drawing Frame.

PRODUCTION PER DELY. PER DAY—TEN HOURS.

Revo. of 1⅜ inch Front Roll per minute.	GRAINS PER YARD.											Revo. of 1⅜ inch Front Roll per minute.
	30 gr.	35 gr.	40 gr.	45 gr.	50 gr.	55 gr.	60 gr.	65 gr.	70 gr.	75 gr.	80 gr.	
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
300	74.06	86.40	98.74	111.08	123.43	135 77	148.12	160.46	172.8	185.14	197.48	300
310	76.53	89.28	102.04	114.79	127.54	140.30	153.06	165.8	178.56	191.31	204.08	310
320	78.99	92.16	105.33	118.49	131.66	144.82	157.98	171.15	184.32	197.48	210.66	320
330	81.46	95.04	108.62	122.19	135.77	149.35	162.92	176.5	190.08	203.66	217.24	330
340	83.93	97.92	111.91	125.9	139.89	153.88	167.86	181.85	195.84	209.83	223.82	340
350	86.4	100.8	115.20	129.6	144.	158.40	172 8	187.2	201.6	216.	230.40	350
360	88.87	103.68	118.49	133.3	148.11	162.92	177.74	192.55	207.36	222.17	236.98	360
370	91.34	106.56	121.78	137.01	152.23	167.45	182.68	197.9	213.12	228.34	243.56	370
380	93.80	109.44	125.08	140.72	156.35	171.98	187.6	203.25	218.88	234.52	250.16	380
390	96.27	112.32	128.37	144.41	160.46	176.5	192.54	208.6	224.64	240.69	256.74	390
400	98.74	115.20	131.66	148.11	164.57	181.03	197.48	213.94	230.4	246.86	263.32	400
410	101.20	118.07	134.94	151.8	168.67	185.54	202.41	219.27	236.14	253.01	269.88	410
420	103.68	120.96	138.24	155.52	172.8	190.08	207.36	224.64	241.92	259.2	276.48	420
430	106.14	123.83	141.52	159.21	176.9	194.59	212 28	229.97	247.66	265.35	283.04	430
440	108.62	126.72	144.82	162.92	181.02	199.12	217.24	235.34	253.44	271.54	289.64	440
450	111.08	129.59	148.1	166.62	185.13	203.64	222.16	240.67	259.18	277.76	296.27	450
460	113.56	132.48	151.4	170.32	189.26	208.18	227.12	246.02	264.96	283.88	302.08	460
470	116.01	135.35	154.68	174.02	193.36	212.69	232.03	251.37	270.70	290.04	309.37	470
480	118.48	138.24	157.98	177.74	197.48	217.22	236.96	256.72	276.48	296.22	315.92	480
490	120.95	141.11	161.27	181.43	201.58	221.74	241.90	262.06	282.22	302.38	322.54	490
500	123.42	144.	164.56	185.14	205.72	226.28	246 84	267.42	288.	308.58	329.12	500

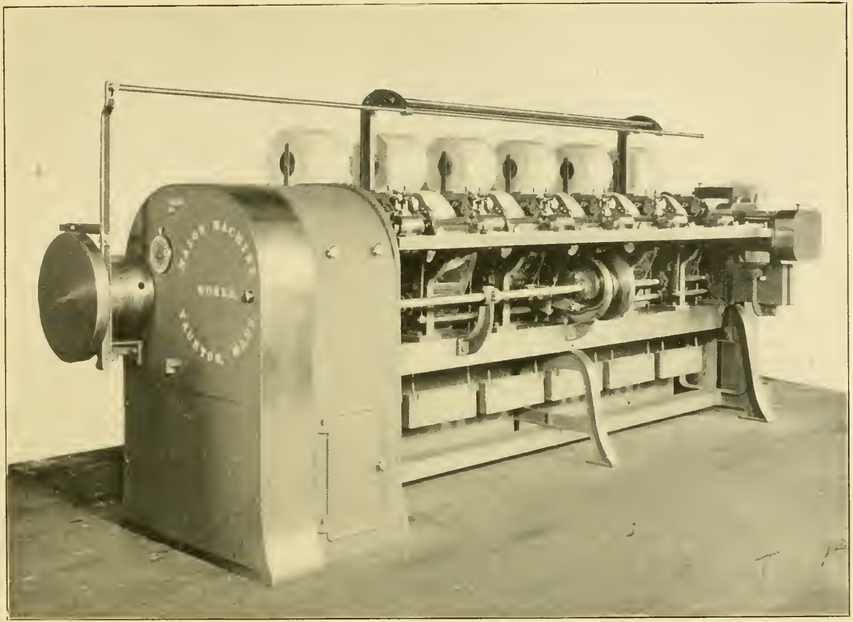
20 per cent. allowed for stops

DRAFT TABLE.

Draft between Front Roll and Calender Rolls is 1 026.

Drafts as given for Metallic Top Rolls are approximate only and will vary with weight of sliver, etc.

CHANGE GEAR.		DRAFT.		CHANGE GEAR.		DRAFT.	
		BACK ROLL GEAR.				BACK ROLL GEAR.	
Leather Top Rolls.	Metallic Top Rolls.	24	48	Leather Top Rolls.	Metallic Top Rolls	24	48
30	33	4.10	8.20	46	50	2.66	5 32
31	34	3 97	7.94	47	51	2 61	5.22
32	35	3.84	7.69	48	52	2.56	5.12
33	36	3.77	7.54	49	53	2.51	5.02
34	37	3.62	7.24	50	54	2 46	4.92
35	38	3.51	7.02	51	55	2.44	4.88
36	39	3 41	6.82	52	57	2.37	4.74
37	40	3.32	6 64	53	58	2.31	4.62
38	41	3.24	6.48	54	59	2.27	4.54
39	42	3 14	6.28	55	60	2.23	4.46
40	44	3.07	6.14	56	61	2.17	4.34
41	45	3.00	6.00	57	62	2 14	4.28
42	46	2 93	5 86	58	63	2.11	4.22
43	47	2.86	5.72	59	64	2.08	4 16
44	48	2.80	5.60	60	65	2.05	4.10
45	49	2.72	5.44	61	66	2.01	4.02



COTTON COMBING MACHINE.

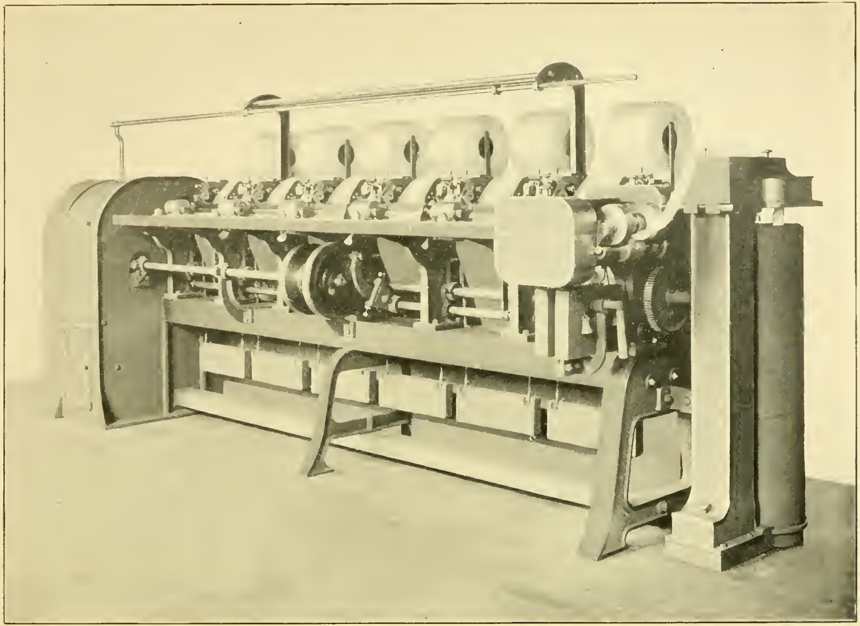
HEAD END VIEW.

Cotton Combing Machine.

The Combing Machine is usually built with six or eight heads, but we are prepared to build them with more or less heads, as may be desired. Laps of usual width are used on this machine. We make and needle our own cylinders and top combs; all the fluted segments and brass comb strips, on our cylinders, are interchangeable, a feature that will be appreciated. In designing this machine, we have departed from the usual construction of Combers, in that we do not place the pulleys, cams, notch wheel, feed gearing, etc., on the end of the beam, and overhanging it. We have provided a head end with separate support for all these motions, and this feature, in connection with the stronger parts employed throughout, and the additional bearings we have introduced, prevents the vibration so prevalent in machines of this description. All the head gearing, cams, etc., are encased in the head end, reducing the liability of help getting caught in the working parts, making the machine more cleanly, and giving it a more finished appearance. By the employment of larger shafts, all torsion on the longer machines has been eliminated. All setting and adjusting screws are of a standard, uniform size; and the ease of access to setting points has been carefully provided for. The dial plate is in full view at all times, so that the overseer can at once see the adjustment of any machine.

CAMS.

All cams and cam grooves are accurately finished, enabling the cam rolls to work smoothly and regularly. The cams which operate the nippers and detaching rollers are placed in the middle of the machine, thus obviating torsion.



COTTON COMBING MACHINE.

COILER END VIEW.

NOTCH WHEEL.

This is usually made with 20 T, but other sizes can be used if desired.

NIPPER MOTION.

The leather cushion for the nipper can be placed either on the lower plate or on the nipper knife, as may be desired.

CYLINDERS.

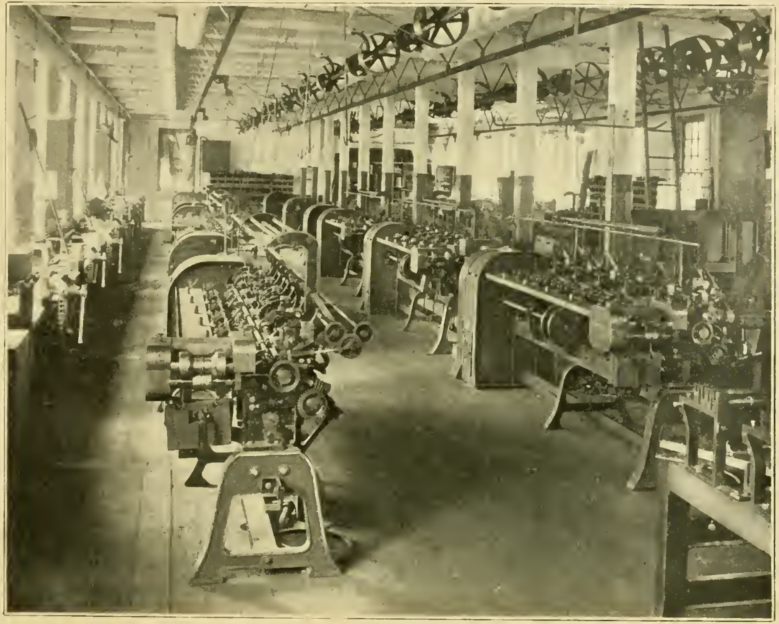
By our interchangeable method of building up the half laps, our cylinders are always a true circle, and concentric with the cylinder shaft. The comb strips and half-laps are interchangeable.

BRUSHES.

Our arrangement of the Brushes, for cleaning the needles on combing cylinder, is such that all wear of bristles can be taken up. Brushes are so covered that objectionable fly is dispensed with.

On the waste doffer we can apply a roll, for winding up the waste in lap form, instead of having it combed into waste cans. We do not recommend the use of a lap weighing more than 270 grains per yard, if good work is expected, and only when the laps are well prepared and put forward to the needles in good shape. We are aware that many mills are using a much heavier lap, where combed hosiery yarn is made.

The draft in our drawing head, on Combing Machine, is usually 4.32. The following table will be useful to those who have our Combing Machine:

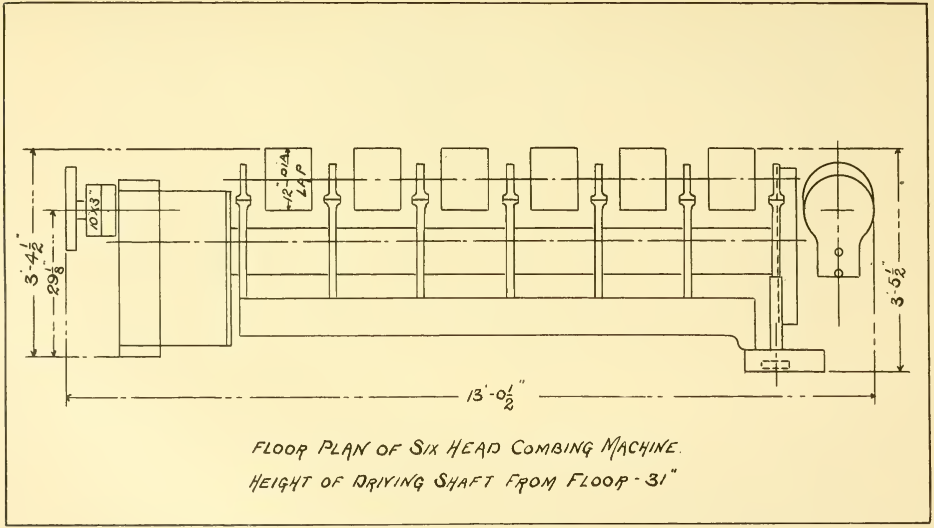


COMBING MACHINE ERECTING DEPARTMENT.

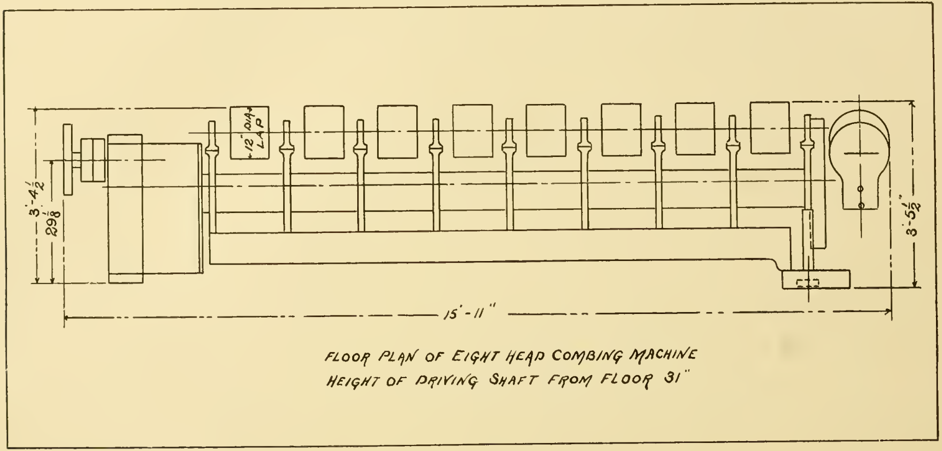
Draft Table—Combing Machine.

Draft in Drawing Head, 4 32.

Gear.	Total Draft.	Gear.	Total Draft.	Gear.	Total Draft.
15	28.29	17	24 96	19	22.33
16	26.52	18	23.57	20	21.22



FLOOR PLAN. 6 HEAD COMBING MACHINE.



FLOOR PLAN. 8 HEAD COMBING MACHINE.

Specification for

Cotton Combing Machine.

Number of Machines

To have.... heads to each machine.

Number of "nips" per minute (usually 80)

Total draft in machine to be

Diameter of Can on Coiler inches, 36 inches high.

Shall we furnish galvanized iron Waste Cans

Shall we cover Leather Rolls

Do you prefer the Cushion placed on lower nipper blade or on the upper nipper blade

What weight of Lap will be used grains per yard

What weight of Combed Sliver required in Coiler Can

What kind of Cotton will be used

What percentage of Waste do you wish to extract

We usually furnish three Change Feed Gears with each machine.

Driving Pulleys are 10 inches diameter and 3 inches face, and should make about 300 revolutions per minute.

A Combing Machine, with six heads, occupies a space 13 feet long and 3 feet 5½ inches wide.

COMBING MACHINE.

PRODUCTION PER 6 HEAD MACHINE PER DAY—10 HOURS.

WITH ORDINARY DRAFT—24.96—AND SET FOR 15 PER CENT. WASTE.

Nips per Minute.	GRAINS PER YARD IN LAP.											Nips per Minute.
	200	210	220	230	240	250	260	270	280	290	300	
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
75	39.87	41.86	43.86	45.85	47.84	49.84	51.83	53.82	55.82	57.81	59.80	75
80	42.53	44.66	46.78	48.91	51.03	53.16	55.28	57.41	59.54	61.67	63.79	80
85	45.18	47.44	49.70	51.96	54.22	56.48	58.74	61.00	63.26	65.52	67.78	85
90	47.84	50.23	52.63	55.02	57.41	59.80	62.19	64.59	66.98	69.37	71.76	90
95	50.50	53.03	55.55	58.08	60.60	63.13	65.65	68.18	70.70	73.23	75.75	95
100	53.16	55.82	58.47	61.13	63 79	66.45	69.11	71.76	74.42	77.08	79.74	100

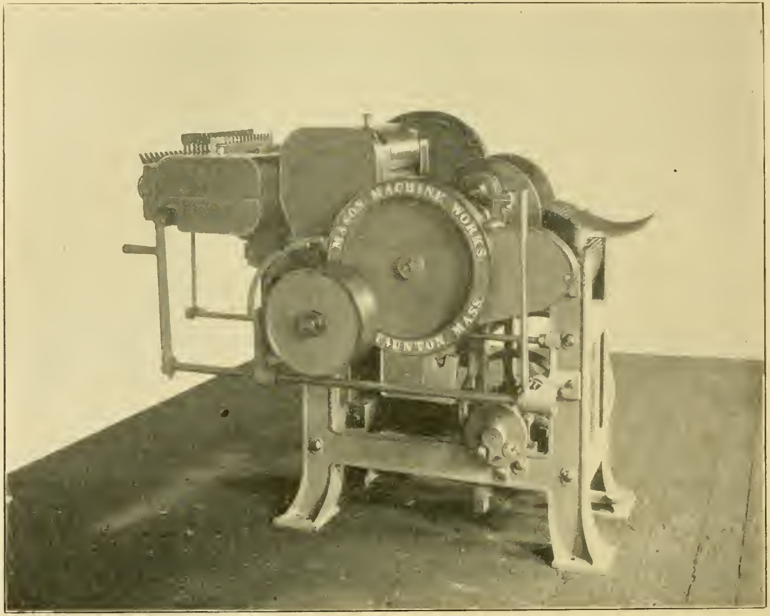
3.80 revolutions of driving pulley to 1 nip.

MASON MACHINE WORKS COMBING MACHINE.

LIST OF SETTINGS.

These settings are approximate only and must be varied for different varieties of cotton and lengths of staple, etc.

		Gauge No.		Dial No.
COMB CYLINDERS.	Edge of Fluted Segment to Detaching Roll	$1\frac{1}{8}$ in.	at	5
FEED.	Feed Roll to Detaching Roll (at bearing)	$1\frac{15}{16}$ in.		
	Feed Roll starts		at	$4\frac{1}{4}$
NIP.	Edge of Cushion Plate to Detaching Roll			
	Long Staple	$1\frac{1}{4}$ in.		
	Short Staple	$1\frac{1}{8}$ in.		
	Edge of Cushion Plate to Cylinder Combs	19 to 21	at	17
	Nippers close		at	9
	Nipper Screws open from Bracket	$\frac{1}{4}$ in.		
DETACHING AND PIECING-UP.	Pawl drops in Notch Wheel		at	$1\frac{1}{4}$
	Leather Roll touches Fluted Segment		at	$6\frac{3}{4}$
	Leather Roll leaves Fluted Segment		at	$9\frac{1}{2}$
	Leather Roll Bearings leave Slides	Thickness of Brown Paper.		
	Brass Roll to Leather Roll	14		
TOP COMBS.	Top Combs down		at	$5\frac{3}{4}$
	Top Combs to Fluted Segment	19		



SLIVER-LAP MACHINE.

SLIVER-LAP MACHINE,

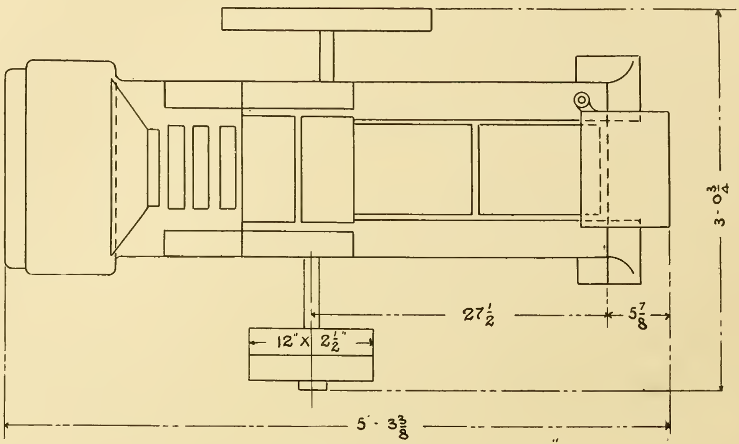
WITH STOP MOTION.

The object of this machine is to take the slivers from the Cards or coarse Drawing Frames, and unite them into a continuous sheet or ribbon, and wind them in a lap, or roll form, for use on the Combing Machine. It is an absolute necessity that this lap should have perfect selvages, and should be properly calendered, so that it will unwind on the Comber, without licking or splitting. From 16 to 24 ends are placed at the back of the machine, are drawn through guides and over stop motion spoons to the drawing rolls, where the necessary draft in applied; from these rolls the sheet of cotton passes between calender rolls, which press it into a uniformly condensed ribbon, which is then wound on a wooden lap roll, revolving between two plates, forming a smooth selvage.

This machine has a full-lap stop motion, which ensures all the laps being of an uniform length. The stop motion is of the same style as that in use on our Railway Head and Drawing Frame.

The rack motion is provided with adjustments, so that both sides of the lap build up alike. All gearing is cut, and, in every way, the machine is built with a view of making the best lap for use on Combing Machines or Ribbon-Lap Machines.

NOTE.—In ordering repair parts for Sliver-Lap Machine, use the letter and number found on each casting.



HEIGHT OF DRIVING SHAFT FROM FLOOR. 27¼"

FLOOR PLAN OF SLIVER LAP MACHINE.

FLOOR PLAN. SLIVER-LAP MACHINE.

Specification for

Sliver-Lap Machine.

Number of machines..

What width of lap

How many ends up at back.

Will you use metallic rolls

If leather covered rolls used, is weight relieving motion required

What kind of cotton will be worked

What weight of slivers at back of machine, per yard

What weight of one yard of finished lap required

Laps can be made from $7\frac{1}{2}$ to $10\frac{1}{2}$ inches wide.

All top drawing rolls covered, and spare rolls supplied.

Floor space 5 feet $3\frac{1}{2}$ inches long by 3 feet 1 inch wide, which does not include space required for cans at the back.

SLIVER LAP MACHINE.

PRODUCTION PER DAY—10 HOURS.

Revo. per Min. of 5-inch Cal. Rolls.	GRAINS PER YARD IN LAP. 200	210	220	230	240	250	260	270	280	290	300	Revo. per Min. of 5-inch Cal. Roll.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
50	336.60	353.43	370.26	387.09	403.92	420.75	437.58	454.41	471.24	488.07	504.90	50
60	403.92	424.11	444.31	464.51	484.70	504.90	525.09	545.29	565.49	585.68	605.88	60
70	471.24	494.80	518.36	541.92	565.49	589.05	612.61	636.17	659.73	683.30	706.86	70
80	538.56	565.49	592.41	619.34	646.27	673.20	700.13	727.05	753 98	780.91	807.84	80
90	605.88	636.17	666.47	696.76	727.05	757.35	787.64	817.94	848.23	878.52	908.82	90
100	673.20	706.86	740.52	774.18	807.84	841.50	875.16	908.82	942.48	976.14	1009.80	100

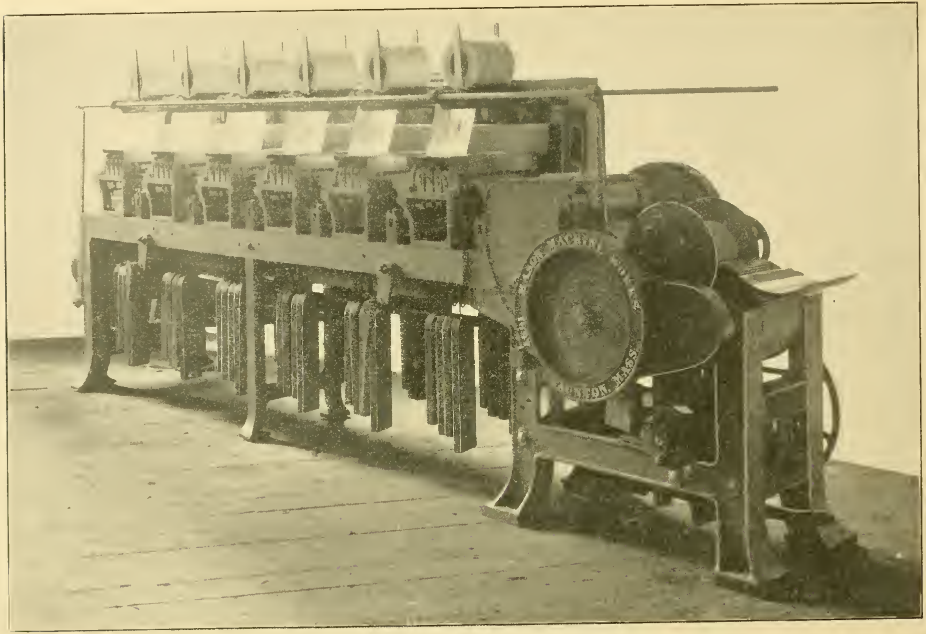
Ten per cent. allowed for stops.

The 12 inch driving pulley makes 2.48 revolutions to 1 of the 5 inch calender rolls, and the $1\frac{3}{8}$ inch front draft roll makes 3.57 revolutions to 1 of the 5 inch calender rolls.

Sliver Lap Machine.

DRAFT TABLE.

Change Gear.	Draft.	Change Gear.	Draft.	Change Gear.	Draft.
33	1.50	45	2.04	57	2.59
34	1.54	46	2.09	58	2.63
35	1.59	47	2.13	59	2.68
36	1.63	48	2.18	60	2.73
37	1.68	49	2.23	61	2.77
38	1.73	50	2.27	62	2.82
39	1.77	51	2.32	63	2.86
40	1.82	52	2.36	64	2.91
41	1.86	53	2.41	65	2.95
42	1.91	54	2.45	66	3.00
43	1.95	55	2.50		
44	2.00	56	2.54		



RIBBON-LAP MACHINE.

Ribbon-Lap Machine.

WITH STOP MOTIONS.

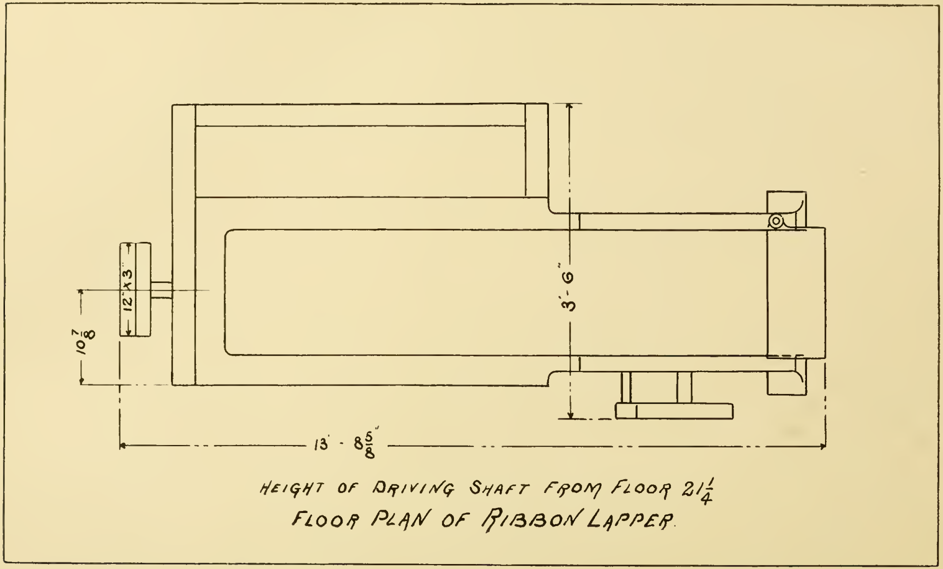
In the manufacture of high-grade fine yarns, it is desirable to have better comber laps than can be made of slivers, and so another process is introduced before the combing, which is performed on the Ribbon-Lap Machine.

The sliver laps are placed upon this machine, where they are drawn and doubled, making a more even web, and placing the fibres in better condition for the action of the Comber needles.

As heretofore made, the Ribbon-Lap Machine consisted of a line of drawing rolls, through which each lap was passed, and the requisite amount of drawing performed; after which the thin sheet or web of cotton was passed, at right angles to the drawing rolls, over a polished angle plate. The web or sheet of cotton, at this stage, is very thin, and great trouble has been experienced with these plates during cold and humid weather in trying to prevent the breakage of the sheet at this point, and to avoid the frequent piecing-up with its resulting evil of uneven places in the lap.

We have done away with the angle plate, and change in direction of the path of the cotton on its way to the lap head; and the results thus obtained are such as to warrant the statement that, in this machine, all of the evils of the Ribbon-Lap Machine have been eliminated, while all its good features have been retained.

The sliver laps are unwound on a set of fluted wooden rolls, similar to those in use on the Comber, and the web or sheet passes directly down and through sets of drawing rolls, from which it passes to the condensing and lap-winding mechanism,



FLOOR PLAN. RIBBON-LAP MACHINE.

same as used on the Sliver-Lap Machine. It will be seen from the accompanying illustration, that the web is travelling continuously in the same direction. By reason of this, our machine can be run much faster than others, in which the thinness of the web restricts the speed when the direction of its course is changed.

Positive stop motions are used so as to stop the machine in the event of a lap running out at the back of the drawing rolls, or in the event of a lap-up occurring on the drawing rolls, also when the lap is full; a combination against bad work and waste, which we believe has never before been applied to a Ribbon-Lapper.

All gearing in connection with the drawing rolls is cut, ensuring smooth running. A weight relieving motion is applied to relieve the top rolls from weight, when the machine is stopped. The lap head in use on this machine is similar to the one on our Sliver-Lap Machine, and is provided with stop motion, for making the laps of uniform length.

The draft commonly used on this machine is about six, when six laps are doubled into one.

We are also prepared to build the old style of Ribbon-Lap Machine.

Note.—In ordering repair parts for Ribbon-Lap Machine, use the letter and number found on each casting.

RIBBON LAP MACHINE.

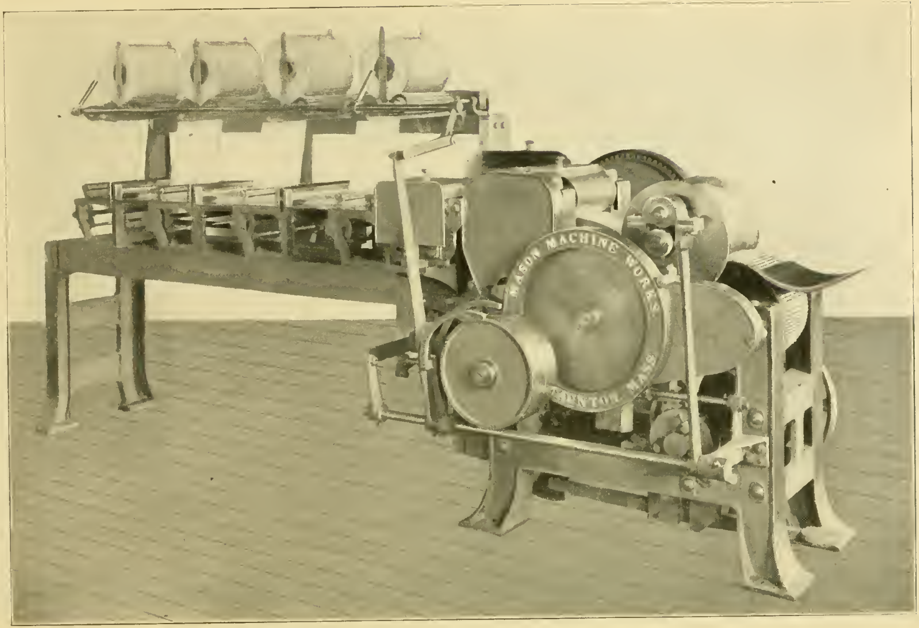
PRODUCTION PER DAY—10 HOURS.

This production table is based on actual productions obtained by mill test, and is, we believe, at least 50 per cent. larger than can be obtained on any type of Ribbon Lap Machine heretofore built.

Revolutions per minute of 5-inch Cal. Rolls.	GRAINS PER YARD IN LAP.											Revolutions per minute of 5-inch Cal. Rolls.
	200	210	220	230	240	250	260	270	280	290	300	
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs	lbs.	lbs.	
90	605.88	636.17	666.46	696.76	727.05	757.35	787.64	817 93	848.23	878.52	908.82	90
95	639.54	671.51	703.49	735.47	767.44	799.42	831.40	863.37	895.35	927.33	959.31	95
100	673.20	706.86	740.52	774.18	807.84	841.50	875.16	908.82	942.48	976.14	1009.80	100
105	706.80	742.14	777.48	812.82	848.16	883.50	918.84	954.18	989.52	1024.86	1060.20	105
110	740.52	777.54	814.57	851.59	888.62	925.65	962.67	999.70	1036.72	1073.75	1110.78	110

10 per cent. allowed for stops.

The 12-inch Driving Pulley makes 4.96 revolutions to 1 of the 5-inch Cal. Rolls, and the $1\frac{3}{8}$-inch Front Draft Roll makes 3.55 revolutions to 1 of the 5-inch Cal. Rolls.



LAP DOUBLING MACHINE.

ROVING MACHINERY.

Although we are not building Roving Machinery at the present time, yet we publish the following tables, which we think will be useful to Cotton Manufacturers who may receive this book.

They were kindly furnished by the Woonsocket Machine & Press Company and are published with their consent.

SLUBBING FRAME.

Revolutions of Flyer per minute 660. 10-inch Space. Bobbins 12x6 inches

Number of Roving.	Twist per Inch.	Revolutions per minute of $1\frac{1}{4}$ inch Front Roll.	Sets per Day.	Hanks per Spindle per Day.	Pounds per Spindle per Day.
.20	.54	308	20.42	11.74	58.71
.30	.66	251	14.47	12.48	41.60
.40	.76	220	10.85	12.47	31.19
.50	.85	195	8.36	12.01	24.03
.60	.93	179	6 72	11 59	19.32
.70	1.00	164	5.48	11.02	15.75
.80	1.07	154	4.61	10.60	13.25
.90	1.14	144	3.91	10.11	11.24
1.00	1.20	138	3.42	9.83	9.83

SLUBBING FRAME.

Revolutions of Flyer per minute 750. 9-inch Space. Bobbins $11 \times 5\frac{1}{2}$ inches.

Number of Roving.	Twist per Inch.	Revolutions per minute of $1\frac{1}{4}$ inch Front Roll.	Sets per Day.	Hanks per Spindle per Day.	Pounds per Spindle per Day.
.30	.66	286	18.95	11.73	39.09
.40	.76	251	14.88	12.27	30.69
.50	.85	221	11.78	12.14	24.29
.60	.93	204	9.72	12.03	20.05
.70	1.00	187	8.05	11.62	16.60
.80	1.07	175	6.85	11.30	14.13
.90	1.14	163	5.84	10.83	12.04
1.00	1.20	157	5.16	10.64	10.64
1.10	1.26	152	4.62	9.53	10.48

SLUBBING FRAME.

Revolutions of Flyer per minute 800. 9-inch Space. Bobbins 10x5 inches.

Number of Roving.	Twist per Inch.	Revolutions per minute of 1¼ inch Front Roll.	Sets per Day.	Hanks per Spindle per Day.	Pounds per Spindle per Day.
.40	.76	267	17.40	11.74	29.36
.50	.85	239	14.22	11.99	23.99
.60	.93	218	11.82	11.97	19 95
.70	1.00	203	10.03	11.84	16.92
.80	1.07	189	8.57	11.57	14.46
.90	1.14	175	7 33	11.12	12.36
1.00	1.20	168	6.50	10.97	10.97
1.10	1.26	161	5.78	10.72	9.75
1.20	1.31	154	5.16	10.44	8.70

INTERMEDIATE FRAME.

Revolutions of Flyer per minute 900. 8-Inch Space. Bobbins 10x5 inches.

Number of Roving.	Twist per Inch.	Revolutions per minute of 1¼ inch Front Roll.	Sets per Day.	Hanks per Spindle per Day.	Pounds per Spindle per Day.
.80	1.07	214	9.44	12.74	15 93
.90	1.14	197	8.06	12.24	13.60
1.00	1.20	192	7.25	12.23	12.23
1.10	1.26	180	6.35	11.78	10.71
1.20	1.31	175	5.76	11.66	9.72
1 30	1.37	163	5.05	11.07	8.52
1.40	1.42	158	4.61	10.89	7.78
1.50	1.47	152	4.19	10.60	7.07
1.60	1.52	147	3.83	10.33	6.46

INTERMEDIATE FRAME.

Revolutions of Flyer per minute 1,000. 7-inch Space. Bobbins 9x4½ inches

Number of Roving.	Twist per Inch.	Revolutions per minute of 1¼ inch Front Roll.	Sets per Day.	Hanks per Spindle per Day.	Pounds per Spindle per Day.
.90	1.14	219	10.61	12.52	13.92
1.00	1.20	207	9.40	12.33	12.33
1.10	1.26	200	8.50	12.26	11.15
1.20	1.31	194	7.74	12.19	10.16
1.30	1.37	182	6.88	11.73	9.03
1.40	1.42	175	6.26	11.49	8.21
1.50	1.47	169	5.73	11.28	7.52
1.60	1.52	163	5.25	11.02	6.89
1.70	1.56	163	4.98	10.04	5.91

INTERMEDIATE FRAME.

Revolutions of Flyer per minute 1,150. 6-Inch Space. Bobbins 8x4 inches

Number of Roving.	Twist per Inch.	Revolutions per minute of 1⅛ inch Front Roll.	Sets per Day.	Hanks per Spindle per Day.	Pounds per Spindle per Day.
1.00	1.20	271	12.88	12.88	12.88
1.25	1.34	239	10.04	12.55	10.04
1.50	1.47	219	8.15	12.22	8.15
1.75	1.58	207	6.87	12.02	6.87
2.00	1.70	187	5.63	11.26	5.63
2.25	1.80	181	4.94	11.11	4.94
2.50	1.89	168	4.21	10.52	4.21
2.75	1.98	161	3.72	10.23	3.72
3.00	2.08	155	3.32	9.96	3.32

ROVING FRAME.

Revolutions of Flyer per minute 1200. 5¼-inch space. Bobbins 8x3½ inches.

Number of Roving.	Twist per Inch.	Revolutions per minute of 1⅛ inch Front Roll.	Sets per Day.	Hanks per Spindle per Day.	Pounds per Spindle per Day.
1.50	1.47	230	9.40	12.33	8.22
2.00	1.70	196	6.56	11.48	5.74
2.50	1.89	179	5.02	10.97	4.39
3.00	2.08	163	3.92	10.29	3.43
3 50	2.24	151	3.18	9.73	2.78
4.00	2.40	140	2.62	9.16	2.29
4.50	2.54	135	2.26	8.91	1.98
5.00	2.68	123	1.87	8.15	1.63
5.50	2.81	117	1.63	7.81	1.42

ROVING FRAME.

Revolutions of Flyer per minute 1300. 5-inch space. Bobbins 7x3½ inches.

Number of Roving.	Twist per Inch.	Revolutions per minute of 1⅛ inch Front Roll.	Sets per Day.	Hanks per Spindle per Day.	Pounds per Spindle per Day.
2.00	1.70	216	8.95	11.74	5.87
2.50	1.89	191	6.78	11.12	4.45
3.00	2.08	175	5.39	10.62	3.54
3.50	2.24	165	4.47	10.25	2.93
4.00	2.40	150	3.64	9.56	2.39
4.50	2.54	144	3.15	9.31	2.07
5.00	2.68	134	2.67	8.75	1.75
5.50	2.81	129	2.35	8.47	1.54
6.00	2.94	124	2.09	8.22	1.37

ROVING FRAME.

Revolutions of Flyer per minute 1400. $4\frac{1}{2}$-inch space. Bobbins 6x3 inches.

Number of Roving.	Twist per Inch.	Revolutions per minute of $1\frac{1}{8}$ inch Front Roll.	Sets per Day.	Hanks per Spindle per Day.	Pounds per Spindle per Day.
3 00	2.08	189	7.63	10.71	3.57
4.00	2.40	161	5.23	9.80	2.45
5.00	2.68	145	3.91	9.15	1.83
6.00	2.94	133	3.06	8.58	1.43
7.00	3.17	122	2 45	8.05	1.15
8.00	3 39	116	2.06	7.72	.965
9.00	3.60	106	1.68	7.09	.787
10.00	3.79	100	1.44	6.75	.675
11.00	3.98	100	1.31	6.75	.614

JACK FRAME.

Revolutions of Flyer per minute 1600. $4\frac{1}{4}$-inch space. Bobbins $6x2\frac{1}{2}$ inches.

Number of Roving.	Twist per Inch.	Revolutions per minute of $1\frac{1}{8}$ inch Front Roll.	Sets per Day.	Hanks per Spindle per Day.	Pounds per Spindle per Day.
8.00	3.39	132	3.10	8.48	1.06
9.00	3.60	126	2.66	8.19	.914
10.00	3.79	120	2.30	7.90	.790
11.00	3.98	114	2.00	7.55	.687
12.00	4.16	108	1.75	7.20	.600
13.00	4.33	105	1.58	7.06	.543
14.00	4.49	99	1.39	6.68	477
15.00	4.64	95	1.25	6.43	.429
16.00	4.80	92	1.13	6.21	.388

JACK FRAME.

Revolutions of Flyer per minute 1700. 4¼-inch space. Bobbins 5x2½ inches.

Number of Roving.	Twist per Inch.	Revolutions per minute of 1⅛ inch Front Roll.	Sets per Day.	Hanks per Spindle per Day.	Pounds per Spindle per Day.
10.00	3.79	128	3.29	8.22	.822
12.00	4.16	114	2.49	7.46	.622
14.00	4.49	105	1.99	6.95	.497
16.00	4.80	98	1.64	6.56	.410
18.00	5.09	95	1.42	6.39	.355
20.00	5.37	88	1.19	5.94	.297
22.00	5 63	85	1.08	5.76	.262
24.00	5 88	82	.935	5.59	.233
26.00	6.12	78	.824	5.35	.206

JACK FRAME.

Revolutions of Flyer per minu'e 1750. 4-inch space. Bobbin 4½x2¼ inches.

Number of Roving.	Twist per Inch.	Revolutions per minute of 1⅛ inch Front Roll.	Sets per Day.	Hanks per Spindle per Day.	Pounds per Spindle per Day.
16	4.80	101	2.22	6.65	.416
18	5.09	98	1.93	6.49	.361
20	5.37	91	1.63	6.10	.305
22	5.63	88	1.44	5.94	.270
24	5.88	84	1.26	5.66	.236
26	6.12	81	1.13	5.48	.211
28	6.35	77	1.00	5.23	.187
30	6.57	74	.901	5.04	.168
32	6.79	71	.812	4.86	.152

TABLE FOR NUMBERING ROVING,

BY THE WEIGHT OF TWELVE YARDS IN GRAINS.

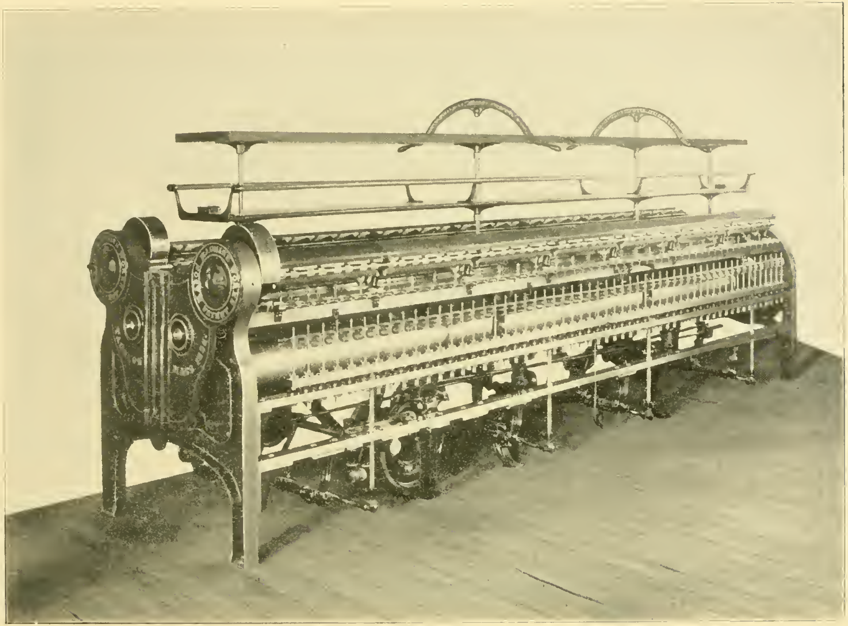
12 Yards Weigh in Grains.	Hank Roving.	Square Root.	Twist per Inch.	12 Yards Weigh in Grains.	Hank Roving.	Square Root.	Twist per Inch.
500.0	.20	.447	.54	55.6	1.80	1.342	1.61
400.0	.25	.500	.60	54.2	1.85	1.360	1.63
333.3	.30	.548	.66	52.6	1.90	1 378	1.65
285.0	.35	.592	.71	51.2	1.95	1.396	1.67
250.0	.40	.632	.76	50.0	2.00	1.414	1.70
222.2	.45	.671	.80	48.8	2.05	1.431	1.72
200.0	.50	.707	.85	47.6	2.10	1.449	1.74
181.8	.55	.742	.89	44.6	2.15	1.466	1.76
166.6	.60	.775	.93	45.4	2.20	1.483	1.78
154.0	.65	.806	.97	44.4	2.25	1.500	1.80
142.8	.70	.837	1.00	43.4	2.30	1.516	1.81
133.3	.75	.866	1.04	42 6	2.35	1.532	1.83
125.0	.80	.894	1.07	41.6	2.40	1.549	1.86
117.6	.85	.922	1.10	40.8	2.45	1.565	1.87
111.1	.90	.949	1.14	40.0	2 50	1.581	1.89
105.2	.95	.974	1.17	39.2	2 55	1.597	1.92
100.0	1.00	1.000	1.20	38.5	2.60	1.612	1.93
95.2	1.05	1.024	1.23	37.8	2.65	1.627	1.95
91.0	1.10	1.049	1.26	37.1	2.70	1.643	1.97
87.0	1.15	1.072	1.28	36 4	2.75	1 658	1.98
83.5	1.20	1.095	1.31	35.7	2.80	1.673	2.00
80.0	1.25	1.118	1.34	35 1	2.85	1.688	2.03
76 9	1.30	1.140	1.37	34.5	2.90	1.702	2.04
74.0	1.35	1.161	1.39	33.9	2.95	1.717	2.06
71.5	1.40	1.183	1.42	33.3	3.00	1.732	2.08
69.0	1.45	1.204	1.44	32.8	3.05	1.746	2.09
66.5	1.50	1 225	1.47	32.3	3.10	1.760	2.11
64.5	1.55	1 244	1.49	31.7	3.15	1.774	2.13
62.5	1.60	1.265	1.52	31.2	3.20	1.788	2.14
60.5	1.65	1.284	1.54	30.8	3.25	1.802	2.16
58.8	1.70	1.304	1.56	30.3	3.30	1.816	2.18
57.1	1.75	1.322	1.58	29.8	3.35	1.830	2.19

TABLE FOR NUMBERING ROVING,

(CONTINUED.)

BY THE WEIGHT OF TWELVE YARDS IN GRAINS.

12 Yards Weigh in Grains.	Hank Roving.	Square Root.	Twist per Inch.	12 Yards Weigh in Grains.	Hank Roving.	Square Root.	Twist per Inch.
29.4	3.40	1.843	2.21	12.1	8.25	2.874	3.45
29.0	3.45	1.857	2.23	11.7	8.50	2.915	3.49
28.6	3.50	1.870	2.24	11.4	8.75	2.961	3.55
28.2	3.55	1.884	2.27	11.1	9.00	3.000	3.60
27.8	3.60	1.897	2.28	10.8	9.25	3.043	3.65
27.4	3.65	1.910	2.29	10.5	9.50	3.082	3.70
27.0	3.70	1.923	2.30	10.3	9.75	3.122	3.74
26.7	3.75	1.936	2.32	10.0	10.00	3.162	3.79
26.3	3.80	1.949	2.34	9.8	10.25	3.200	3.84
26.0	3.85	1.962	2.35	9.5	10.50	3.241	3.89
25.6	3.90	1.974	2.37	9.3	10.75	3.278	3.93
25.3	3.95	1.987	2.38	9.1	11.00	3.316	3.97
25.0	4.00	2.000	2.40	8.9	11.25	3.353	4.02
24.7	4.05	2.012	2.41	8.7	11.50	3.390	4.07
24.4	4.10	2.024	2.43	8.5	11.75	3.427	4.11
23.5	4.25	2.059	2.47	8.3	12.00	3.464	4.15
22.2	4.50	2.121	2.54	8.2	12.25	3.501	4.20
21.1	4.75	2.177	2.61	8.0	12.50	3.535	4.24
20.0	5.00	2.236	2.68	7.9	12.75	3.570	4.28
19.1	5.25	2.289	2.75	7.7	13.00	3.605	4.32
18.2	5.50	2.343	2.81	7.5	13.25	3.640	4.37
17.4	5.75	2.397	2.88	7.4	13.50	3.674	4.41
16.7	6.00	2.447	2.94	7.1	14.00	3.741	4.49
16.0	6.25	2.500	3.00	6.9	14.50	3.807	4.57
15.4	6.50	2.547	3.06	6.7	15.00	3.872	4.65
14.8	6.75	2.600	3.12	6.4	15.50	3.937	4.72
14.3	7.00	2.643	3.17	6.2	16.00	4.000	4.80
13.8	7.25	2.692	3.23	6.1	16.50	4.062	4.87
13.3	7.50	2.742	3.29	5.9	17.00	4.123	4.95
12.9	7.75	2.783	3.34	5.7	17.50	4.182	5.02
12.5	8.00	2.828	3.39	5.5	18.00	4.242	5.09



RING SPINNING FRAME.

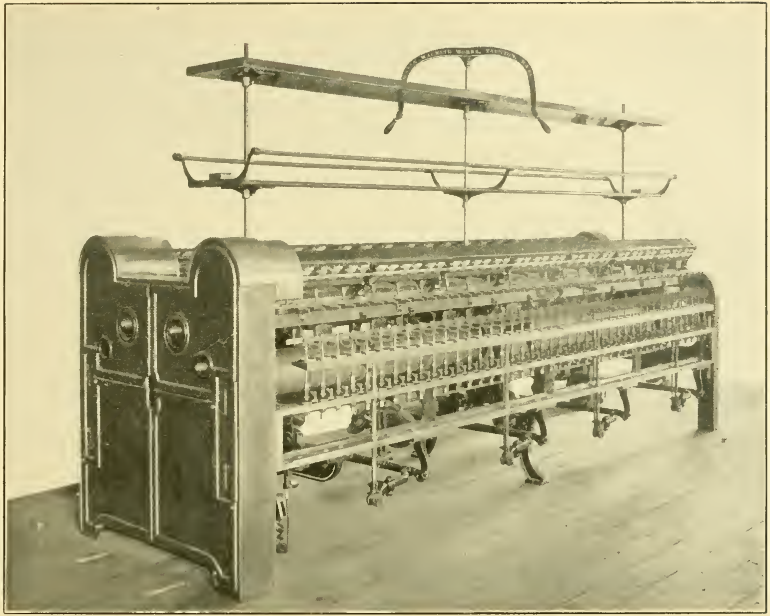
Ring Spinning Frame.

We respectfully invite cotton manufacturers to investigate the merits of our Spinning Frame, which we believe to be worthy of their personal inspection, as one of the improvements of the day. In general design, it combines comprehensiveness with perfection of detail; that is, while possessing all the elements of proportion and position which go to produce the best results in breaking strength and smoothness of yarn, it can readily be adapted to any class of work to which Ring Frames are applicable; this result has only been obtained by experiments and competitive tests, extending through many years.

PULLEYS.

This machine may be built with the driving pulleys and gearing at one and the same end, or with the driving pulleys at one end and the gearing at the other, as may be preferred; the latter plan is much more convenient and safe, on Frames of ordinary length, particularly in cases where it is necessary to make frequent changes in the twist.

The claim that the steel rolls should not be driven through the length of the tin cylinder, thereby adding to the strain imposed on the cylinder, does not have much weight, as actual tests prove that to drive the rolls, traverse motion, and gearing, only about 11 per cent. is used of the entire power necessary to drive the frame when spinning. The loose pulley runs on a stationary bushing, and not on the cylinder shaft; an arrangement practically equal to a self-oiling pulley, and better than the ordinary self-oiling pulley, inasmuch as, in this case, the loose pulley stands still when the Frame is spinning. Any of



RING SPINNING FRAME

BOX RAIL PATTERN.

the patent self-oiling pulleys now in use can be applied if desired. The loose pulley is turned smaller in diameter than the tight pulley, unless otherwise specified, thereby easing the belt when off the tight pulley, and reducing the danger of heating the loose pulley.

HEAD END.

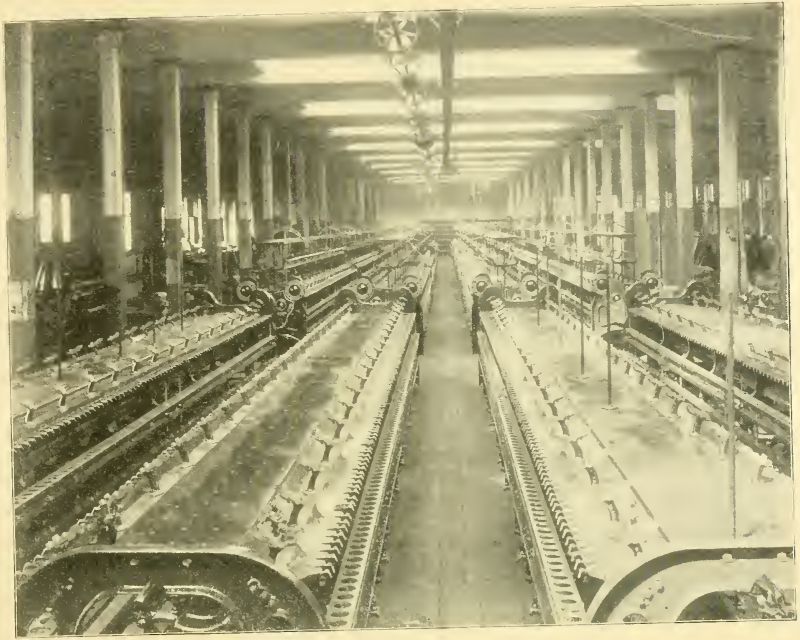
This is made very strong, and of convenient design. All gearing is carefully covered, and, at the same time, the stud gears can be oiled from the outside. The head end doors swing back, so that changing of twist gears is easily accomplished. The draft gearing is protected with a hinged cover, allowing ease of access in making draft changes, yet effectually guarding the gears when down into place.

TIN CYLINDERS.

The main cylinder shaft is preferably arranged with bearings both inside and outside of the driving pulley, the support of the outside bearing serving also as a pulley guard. In Frames of wide gauge, and of considerable length, we usually make the cylinder in three lengths.

SPINDLE RAILS.

We have two forms of construction, as illustrated herein; one with "box rails," so-called (i. e., with the upper and lower fixed rails cast together), and the other with these rails secured together by double knees or brackets. The latter arrangement permits, by use of knees of exactly the correct length, a finer adjustment of the rails in relation to each other, and to the



SPINNING FRAME ERECTING DEPARTMENT.

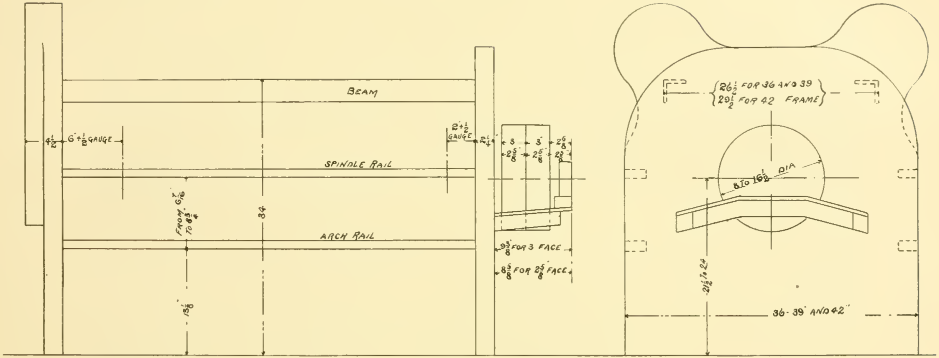
roller beam, as well as of the spindle, in relation to the rolls; and it also allows, in every case, the maximum distance between the fixed rails, giving a steadier lifting motion to the ring rail, and consequently better results, especially on fine numbers.

SUPPORTS.

The patent intermediate bearings for the cylinder are adjustably arranged on one or other of the patent movable cross-stiffeners, so that, in leveling the Frame, the cylinder may be perfectly aligned; and, by detaching the necessary number of cross-stiffeners and adjustable legs, it may be removed from the frame, without even breaking an end of yarn. The adjustable legs also facilitate leveling the Frames to the extent of saving three-fourths of the time usually required, besides doing away with the use of packing blocks, within reasonable limits.

BUILDING MOTION.

This can be arranged for warp or filling, or both, as may be desired; and the counter-weights may be made to work with the wind motion or against it, the latter arrangement involving much more weight, but being at the same time preferred by those who are accustomed to doff their Frames in the same manner as Mules are doffed, (i. e., by running the thread below the lowest point of the normal wind). A winding-down motion has been devised for running the ring rail down for doffing at any point in the traverse. This motion is arranged to work with the lighter method of counter-weighting. Our list of designs covers every kind of building motion that has ever been applied to Spinning Frames, so far as we know, and we there-



SIDE AND END ELEVATION OF SPINNING FRAME
WITH VARIABLE DISTANCE BETWEEN RAILS

ELEVATIONS OF SPINNING FRAME.

fore have confidence in our ability to meet the wishes of our patrons in this particular. The changes from warp to filling wind, and vice versa, are easily accomplished.

PATENT ROCKER SHAFT.

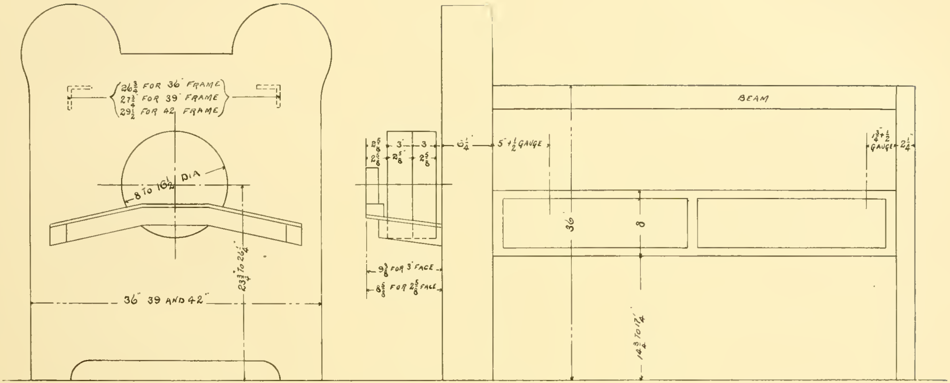
The patent rockers, which transmit the motion from the builder to the ring rails, combine adjustability with the strength of solid iron; that is, the strain of lifting is removed entirely from the bolt.

PATENT ROLLER STAND.

Our patent roller stand and sectional cap bar, in combination, possess this advantage: the cap bar remains securely in place when thrown back, or when in working position, without the use of pins, and yet it can be removed at an intermediate point with ease.

STEEL FLUTED ROLLS.

The fluted rolls are made of steel throughout; are fluted irregularly, to prevent cutting top roll leather, and are case-hardened in the essential parts. Our facilities for making the very best fluted rolls are unsurpassed. For Frames to spin fine numbers of yarn, our rolls are ground so as to ensure their being perfectly round and of uniform diameter. We limit the extreme variation in size of such rolls to less than 2-1000 of an inch.



SIDE AND END ELEVATION OF SPINNING, WITH BOX RAILS
WITH FIXED DISTANCE BETWEEN RAILS

ELEVATIONS OF BOX RAIL SPINNING FRAME.

TOP ROLLS.

The Top Rolls may be weighted with saddles, stirrups, levers and dead weights, in the usual manner, or they may be self-weighted, the latter arrangement being preferable for certain classes of work. We furnish either long or short boss rolls, and the gudgeons project above the fingers of the cap bars, facilitating the cleaning process. We furnish either solid top rolls, shell top rolls, or Jackson's Patent Interlocking Self-oiling Rolls.

PATENT ROVING TRAVERSE MOTION.

This is substantial, durable, self-contained, in constant movement, and is fitted with metallic rods and adjustable brass roving guides.

SEPARATORS.

We can apply a new form of automatic Separator, called by us, to distinguish it from other makes which we use, the "Mason Machine Works" separator; or we can apply either the old style "Doyle," the improved "Doyle," using either cast iron or stamped steel blades, or the "Rhoades-Chandler," with large or small stamped steel blades. A detailed description of our "Mason" separator is given on another page.

SPINDLES.

We furnish all varieties of Spindles now in use, such as Draper No. 2, Whitin Gravity, Sherman, Rabbeth, etc.

CORR MANUFACTURING COMPANY, TAUNTON, MASS.

MASON CARDS DRAWING AND SPINNING.

RINGS.

We can furnish any of the various rings that may be wanted, but, for general use, we recommend the double adjustable. This ring, when set in a plate holder with a turned-up traveler cleaner, forms a combination of ring and holder difficult to surpass.

THREAD BOARD.

The devices for lifting the Thread Guide Board, and for holding it up during doffing, are of the most modern and approved patterns. Our thread board is hinged at short intervals, to prevent sagging.

GEARING.

All the gears are cut with standardized cutters, so as to ensure smooth and quiet running, and are arranged so as to afford a wide and finely divided range of draft and twist, if desired. The changes in draft and twist are effected without the possibility of throwing the crown or jack gear out of proper position, so that one gear only requires attention in making a change; and, by our patent twist-gear change, the use of keys, set screws, or pins, is done away with, affording a remarkably simple, convenient and durable arrangement.

CREELS.

These are made for single or double roving, either one story or two stories, as may be desired, and are adjustable in height to receive any length of roving bobbin. We use glass or porcelain steps, whichever is preferred. At each end of the creel is placed a fixed iron box as a receptacle for a supply of travellers. Their use contributes to convenience, neatness and economy.

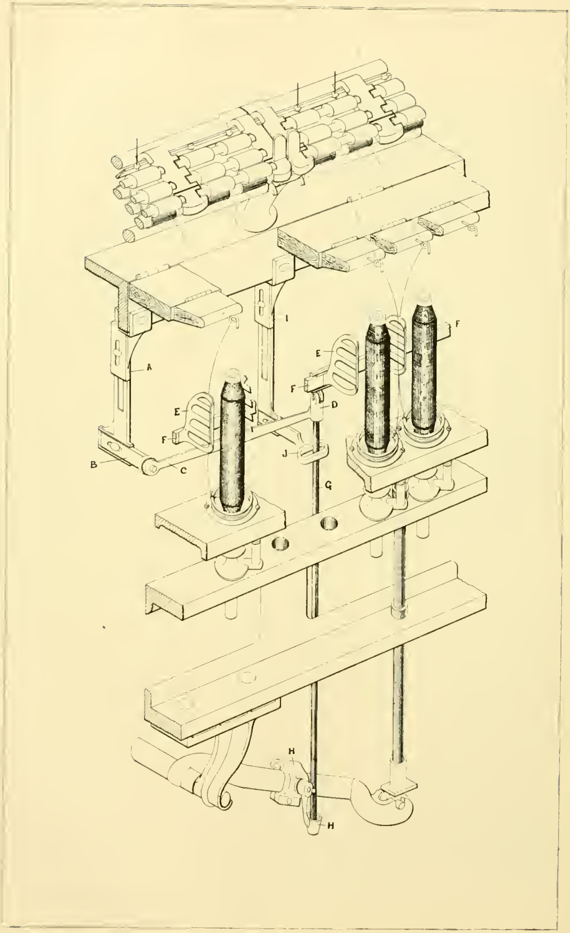
GENERAL CONSTRUCTION.

In convenience and strength, we believe this Frame to be unsurpassed; its workmanship is as good as modern ideas and appliances can make it; and, by our method of construction, its essential parts are made absolutely interchangeable.

Note—In ordering repair parts for Spinning Frames, please order by the letter and number found on each casting.

F. W. POE MANUFACTURING COMPANY GREENVILLE, S. C.

MASON SPINNING AND LOOMS.



MASON MACHINE WORKS SEPARATOR.

Mason Machine Works Separator.

The necessity of separators on Spinning Frames, owing to the continued demand for larger rings, longer traverse, and higher speed of spindles, has greatly increased; and any Separator, devised with a view of reducing the number of parts, which is simple in action, not liable to get out of order, and more cleanly when in operation, will meet the approval of spinners and mill men generally.

The accompanying illustration shows as much of a Spinning Frame as is necessary to present the working parts of our Separator, which we now explain.

The stand *A* bolts to the front of the roller beam under the thread board, and is provided with an extension bracket. The stand or bracket *B*, which is also provided with extension slots, bolts to the foot of the bracket *A*. These extension arrangements allow of a wide range in adjustment of the separator for long or short traverse, and for large or small rings. The arm *C*, pivoted on *B*, carries at its end the knuckle joint or hinge *D*. On the separator rod *F* is a corresponding hinge, which allows the entire separator blades and rods to be turned back under the thread board. The separator blades *E* are attached to the rod *F* in the usual manner. The rod *F* is supported by the auxiliary lifting rod *G*, which, in turn, is supported by the bracket and foot step *H*, attached to the ordinary rocker shaft. Additional brackets *I* and *J* control the forward position of the separator blades.

Attention is called to the particular shape of the blades on this Separator. It will be noticed that they are curved slightly in the same direction that the thread takes in the action of ballooning. At the point of largest balloon (or when the rail is at the bottom), the thread will be deflected by the curved portion, and, at the same time, the next blade edge is turned away from the ballooning thread, and all whipping around the blades is entirely overcome. The operation of this separator is practically a straight lift, up and down, controlled entirely by the rocker shaft arm, thus dispensing with objectionable balance weights; and it is free from the evils resulting from the operation of the separator by the ring rail. The blades can be turned back entirely out of the way, and a single movement restores them to normal position. It is particularly desirable, when the traverse is long, that the separator should travel continuously, and at such a rate of speed (slower, of course, than the ring rail), as will maintain the blade in the centre, vertically, of the balloon at all times. By the same means which render this result possible with our separator, the pressure of the separator upon the wind motion is made uniform, and the result is a better wind than is possible with separators which work intermittently, and which often produce an enlargement of the bobbin at the point where the separator begins its movement. By our patent arrangement of open guides, which, while positive in their action, reduce the friction to the minimum, we are enabled to guarantee a combination of freedom and accuracy of movement which has not been attained with any separator heretofore placed upon the market. The extent of vertical movement of this separator can also be regulated at will by means of the patent adjustable connection with the lifter arm. On account of its simplicity, freedom of movement, and small number of parts, we believe that for cleanliness in operation and ease in handling this separator will commend itself to all. Blades can be made of stamped steel of any of the usual sizes. This separator can be applied to old frames of any pattern.

STANDARD WEIGHT OF MODERN HIGH SPEED SPINDLES.

Name of Spindle.	Weight of Spindle, Complete.
Draper No. 4	22 oz.
Draper No. 3	22½ "
Draper No. 2	16¼ "
Draper No. 1	16¾ "
Rabbeth 49 D, short wind	16 "
Rabbeth 49 D, long wind	16¼ "
Rabbeth 81 D	22 "
Whitin Gravity, standard	14¼ "
Whitin Gravity, medium	19 "
Whitin Gravity, large	25 "
Sherman, standard, No. 77, 5 inch traverse	14½ "
Sherman, heavy, No. 72, 6 inch traverse	15 "
McMullan, standard	15 "
McMullan, medium	15¾ "
McMullan, heavy	17¼ "

No twister spindles are included in the above list.

SPECIFICATION FOR

RING SPINNING FRAME.

Number of Frames

Number of spindles in each frame

Gauge, centre to centre of spindles

Name of spindle to be used

Long or short boss rolls

Top rolls, whether solid or shell, or Jackson's Patent

If to have separators, state which kind

Length of traverse

Diameter of ring What kind

What kind of ring holder

What wind motion, warp, filling, or combination

Lever screw, whether plain or Speakman's Patent

Saddles, whether plain or Dixon's Interlocking

Number of yarn to be spun and what hank roving

Draft range from to.....

Twist range from to

Kind of thread guide

Diameter and face of driving pulley

Are pulleys to be at geared end or foot end

Creels for roving. story high

Shall we cover top rolls, or do you prefer to do it

How to be belted, above or below What angle

What width of frame, 36-inch, 39-inch, or 42-inch

Give length of creel skewer and diameter of full roving bobbin.

Are ring rails to be bored for a ring larger than specified above

If so, give diameter of ring

Included with Frame, 5 per cent. spare top rolls, 3 sets each draft and twist gears.

SPINNING FRAMES.

DIMENSIONS.

Widths, 36 in., 39 in. and 42 in.

Lengths of various gauges and number of spindles given in following tables.

No. of Spindles.	2 1-2 in. Gauge.	2 5-8 in. Gauge.	2 3-4 in. Gauge.	No. of Spindles	3 in. Gauge.	3 1-4 in. Gauge.	3 1-2 in. Gauge.
128	15.6	16.2	16.10	120	17.2	18.5	19.8
144	17.2	17.11	18.8	132	18 8	20.0½	21.5
160	18.10	19.8	20.6	144	20.2	21.8	23.2
176	20.6	21.5	22.4	156	21.8	23.3½	24.11
192	22.2	23.2	24.2	168	23.2	24.11	26.8
208	23.10	24.11	26.0	180	24.8	26.6½	28.5
224	25.6	26.8	27.10	192	26 2	28.2	30.2
240	27.2	28.5	29.8	204	27.8	29.9½	31.11
256	28.10	30.2	31.6	216	29.2	31.5	33.8
272	30.6	31.11	33.4	228	30.8	33.0½	35.5
288	32.2	33.8	35.2	240	32.2	34.8	37.2
304	33.10	35.5	37.0	252	33.8	36.3½	38.11
320	35 6	37.2	38.10	264	35.2	37.11	40.8
336	37.2	38.11	40.8	276	36.8	39.6½	42.5

NOTE.—The above lengths of Frames over all are figured with tight and loose pulleys of 2½ inch face. If 3 inch face pulleys are used, add 1 inch to the above leifgths.

Production Table

OF RING WARP YARN, AND TABLE FOR NUMBERING COTTON YARN BY THE WEIGHT IN GRAINS, OF 120 YARDS, OR 1 SKEIN.

No. of Yarn.	Square Root.	Twist per Inch.	Rev. of Spindle per Minute.	Rev. per Minute of 1 inch Front Roll	Hanks per Spindle per Day of 10 Hours.	Pounds per Spindle per Week of 60 Hours.	Weight 120 Yards or 1 Skein in Grains.	No. of Yarn.
1	1.00	4.75						1
4	2.00	9.50	5200	154	8.64	12.96	250.00	4
5	2.23	10.62	5400	158	8.70	10.44	200.00	5
6	2.45	11.63	5800	156	8.60	8.60	166.60	6
7	2.65	12.56	6100	154	8.50	7.28	142.85	7
8	2.83	13.43	6400	152	8.40	6.30	125.00	8
9	3.00	14.25	6700	151	8.30	5.53	111.11	9
10	3.16	15.02	7000	150	8.20	4.92	100.00	10
11	3.32	15.75	7200	149	8.10	4.41	90.90	11
12	3.46	16.45	7500	148	8.00	4.00	83 33	12
13	3.60	17.12	7700	146	7.90	3.64	76.90	13
14	3.74	17.77	7900	144	7.80	3.34	71.43	14
15	3.87	18.39	8100	142	7.70	3.08	66.66	15
16	4.00	19.00	8300	140	7.60	2.85	62.50	16
17	4.12	19.58	8500	138	7.50	2.64	58.83	17
18	4.24	20.15	8600	136	7.40	2.46	55.53	18
19	4.36	20.70	8700	134	7.30	2.31	52.62	19
20	4.47	21.24	8800	132	7.22	2.16	50.00	20
21	4.58	21.76	8900	130	7.14	2.04	47.62	21
22	4.69	22.27	9000	128	7.06	1.92	45.45	22
23	4.80	22.78	9100	126	6.98	1.82	43.48	23
24	4.90	23.27	9100	124	6.90	1.72	41.66	24
25	5.00	23.75	9200	122	6.82	1.63	40.00	25
26	5.10	24.22	9200	120	6.74	1.55	38.45	26
27	5.20	24.68	9300	119	6.66	1.48	37.00	27
28	5.29	25.13	9300	118	6.60	1.41	35.70	28
29	5.39	25.58	9400	117	6.55	1.35	34.45	29

Production Table, &c.

(CONTINUED.)

No. of Yarn.	Square Root.	Twist per Inch.	Rev. of Spindle per Minute.	Rev. per Minute of 1 inch Front Roll	Hanks per Spindle per Day of 10 Hours	Hanks per Spindle per Week of 60 Hours.	Weight 120 Yards or 1 Skein in Grains.	No. of Yarn.
30	5.48	26.02	9500	116	6.50	1.30	33.33	30
31	5.57	26.45	9500	115	6.46	1.25	32.25	31
32	5 66	26.87	9500	115	6.43	1.20	31.25	32
33	5.74	27.29	9500	114	6.40	1.16	30.30	33
34	5.83	27.70	9600	114	6.36	1.12	29.45	34
35	5.91	28.10	9600	113	6.32	1.08	28.58	35
36	6.00	28.50	9600	112	6.28	1.04	27.78	36
37	6.08	28 89	9700	111	6.24	1.01	27.05	37
38	6.16	29.28	9700	110	6.20	.97	26.03	38
39	6.24	29.66	9700	109	6.15	.94	25.65	39
40	6.32	30.04	9700	108	6.10	.91	25.00	40
41	6.40	30.41	9700	106	6.00	.87	24.40	41
42	6.48	30.78	9700	105	5.92	.84	23.80	42
43	6.56	31.15	9700	104	5.85	.81	23.25	43
44	6.63	31.51	9700	103	5.79	.79	22 75	44
45	6 70	31.86	9700	102	5.70	.76	22.25	45
46	6.78	32.22	9700	100	5.65	.73	21.75	46
47	6.86	32.56	9700	99	5.60	.71	21.27	47
48	6.93	32.91	9600	97	5.55	.69	20.88	48
49	7.00	33.25	9600	96	5.52	.67	20.40	49
50	7.07	33.59	9500	95	5.50	.66	20.00	50
55	7.41	35.23	9500	91	5.25	.57	18.20	55
60	7.74	36.79	9500	88	5.00	.50	16.60	60
65	8.06	38.30	9500	85	4.80	.44	15.40	65
70	8.36	39 74	9500	83	4.60	.39	14.30	70
75	8.66	41.14	9500	80	4.47	.35	13 30	75
80	8.94	42.49	9500	76	4.35	.32	12.50	80

NOTE—In computing the above tables, proper allowance has been made for cleaning, oiling and doffing. Under favorable conditions it is possible that the above production can be exceeded.

TABLE

OF PRODUCTION OF RING FRAME FILLING YARN, SHOWING SPEED OF FRONT ROLL, TWIST PER INCH, HANKS PER SPINDLE PER DAY, POUNDS PER SPINDLE PER WEEK, AND A TABLE FOR NUMBERING COTTON YARN BY WEIGHT OF 120 YARDS, OR 1 SKEIN, IN GRAINS.

No. of Yarn.	Square Root.	Twist per Inch.	Revolutions of 1 Inch Front Roll per Minute	Hanks per Spindle per Day.	Pounds per Spindle per Week.	Weight of 120 Yards (or 1 Skein) in Grains.	No. of Yarn.
1	1.00	3.25					1
4	2.00	6.50	180			250.0	4
5	2.23	7.27	179			200.0	5
6	2.45	7.96	178	8.95	8.95	166 6	6
7	2.65	8.60	176	8.90	7.62	142.6	7
8	2.83	9.19	174	8.85	6.64	125 0	8
9	3.00	9.75	172	8.80	5.86	111.1	9
10	3.16	10.27	170	8.75	5.25	100.0	10
11	3.32	10.78	168	8.70	4.74	90.9	11
12	3.46	11.26	166	8.63	4.31	83 3	12
13	3.60	11.72	164	8.56	3.95	76.9	13
14	3.74	12.16	162	8.48	3.62	71.5	14
15	3.87	12.59	160	8.40	3.36	66.7	15
16	4.00	13.00	158	8.32	3.12	62.5	16
17	4.12	13.40	156	8.24	2.90	58.8	17
18	4.24	13.79	154	8.16	2.72	55.6	18
19	4.36	14.17	152	8.08	2.55	52.6	19
20	4.47	14.53	150	8.00	2.40	50.0	20
21	4.58	14.89	148	7.92	2.26	47.6	21
22	4.69	15.24	146	7.84	2.13	45.4	22
23	4.80	15.59	144	7.76	2.02	43.4	23
24	4.90	15.92	142	7.68	1.91	41.6	24
25	5.00	16.25	140	7.60	1.82	40.0	25
26	5.10	16 57	138	7.52	1.73	38.5	26

TABLE

OF PRODUCTION OF RING FRAME FILLING YARN, &C. (CONTINUED.)

No. of Yarn.	Square Root.	Twist per Inch.	Revolutions of 1 Inch Front Roll per Minute.	Hanks per Spindle per Day.	Pounds per Spindle per Week.	Weight of 120 Yards (or 1 Skein) in Grains.	No. of Yarn.
27	5.20	16.89	136	7.44	1.65	37.0	27
28	5.29	17.20	134	7.36	1.57	35.7	28
29	5.39	17.50	132	7.28	1.50	34.4	29
30	5.48	17.80	130	7.20	1.44	33.3	30
31	5.57	18.10	128	7.10	1.37	32.2	31
32	5.66	18.38	126	7.00	1.31	31.2	32
33	5.74	18.67	124	6.90	1.25	30.0	33
34	5.83	18.95	122	6.80	1.20	29.4	34
35	5.91	19.23	120	6.70	1.14	28.6	35
36	6.00	19.50	118	6.60	1.10	27.8	36
37	6.08	19.77	116	6.50	1.05	27.0	37
38	6.16	20.03	114	6.40	1.01	26.3	38
39	6.24	20.30	112	6.30	.97	25.6	39
40	6.32	20.55	110	6.20	.93	25.0	40
41	6.40	20.81	108	6.10	.89	24.4	41
42	6.48	21.06	106	6.00	.85	23.8	42
43	6.56	21.31	104	5.90	.82	23.3	43
44	6.63	21.56	102	5.80	.79	22.7	44
45	6.70	21.80	100	5.70	.76	22.2	45
46	6.78	22.04	98	5.60	.73	21.7	46
47	6.86	22.28	96	5.50	.70	21.3	47
48	6.93	22.52	94	5 40	.67	20.8	48
49	7.00	22.75	92	5.30	.65	20.4	49
50	7.07	22 97	90	5.20	.62	20.0	50

In presenting this table, we realize the difficulty of arriving at positive results regarding twist and speed of spindles. There is a great variation in the speed at which spindles are run in different mills. Then, too, the quality of stock used, or the uses for which the cloth is intended, will have an effect on the twist and the quantity of yarn produced; but, for ordinary purposes, this table will show the production per spindle of Frame Filling Yarn. Under specially favorable conditions, these figures of production can be exceeded.

The following table of the breaking weight in pounds of Warp Yarn in skeins of 120 yards is used by permission of Messrs. C. R. Makepeace & Co., mill engineers, Providence, R. I.

This table was prepared from a series of tests made by them from yarn spun by over 250 of the leading cotton mills of the country.

Number of Yarn.	ENGLISH TABLE. Ordinary.	Fair.	Good.	Extra.	AMERICAN TABLE. Average Strength.	Number of Yarn.
10	119.2	124.3	128.8	134.3	170.1	10
11	103.7	105.2	107.4	110.6	158.3	11
12	99.1	99.8	102.1	104.4	144.7	12
13	92.8	95.3	97.6	99.8	132.6	13
14	91.1	92.9	94.8	96.7	122.1	14
15	85.4	86.5	88.5	91.1	116.8	15
16	82.2	84.8	86.3	88.6	110.2	16
17	77.3	79.6	81.2	83.1	104.5	17
18	73.6	74.8	76.7	78.7	98.9	18
20	68.7	70.1	71.8	73.5	89.8	20
22	62.5	64.6	65.9	66.8	80.4	22
24	58.4	60.8	61.9	63.1	73.6	24
26	54.3	56.4	57.8	59.2	67.9	26
28	50.6	51.9	52.8	54.9	62.7	28
30	48.9	49.9	51.2	52.8	58.4	30
32	45.8	46.8	48.1	49.1	55.1	32
34	44.3	45.6	46.3	48.1	52.2	34
36	42.1	42.8	43.7	44.9	49.9	36
38	39.3	40.0	41.7	42.6	47.8	38
40	38.4	39.6	40.9	41.7	45.7	40
42	37.5	38.7	39.6	40.8	44.1	42
44	35.1	36.4	38.9	37.9	42.2	44
46	33.5	34.9	35.6	36.1	41.4	46
48	32.1	33.3	33.9	34.7	39.1	48
50	31.9	32.7	33.4	34.1	38.4	50
55	30.7	31.3	32.1	33.2	35.9	55
60	28.1	29.8	30.7	29.7	32.8	60
65	25.0	26.4	27.3	27.8	30.9	65
70	23.9	24.3	25.4	26.1	28.5	70
75	22.4	23.1	24.1	24.7	27.8	75
80	21.0	22.7	23.2	23.9	25.6	80
85	19.6	20.5	21.1	22.1	24.1	85
90	18.7	19.3	20.2	20.9	22.3	90
95	17.9	18.7	19.1	20.1	21.4	95
100	17.3	18.1	18.7	19.4	20.8	100

RULE TO FIND THE DRAFT OF A SPINNING FRAME.

Multiply the diameter of the front roll, the number of teeth in the crown gear, and the number of teeth in the back roll gear, together for a dividend; multiply the diameter of the back roll, the number of teeth in the change draft gear, and the number of teeth in the front roll gear, together for a divisor. Divide the dividend by the divisor, and the quotient is the draft of the Frame.

EXAMPLE:

Dia. of Front Roll 1 in. or $\frac{8}{8}$ in.
Crown Gear 84T.
Back Roll Gear 84T.

Gear on Front Roll 30T.
Change Draft Gear 36T.
Dia. of Back Roll $\frac{7}{8}$ in.

$$\text{Then } \frac{8\times84\times84}{30\times36\times7}=7.46 \text{ Draft.}$$

To obtain a constant number for draft, proceed as above, except omit the draft gear.

EXAMPLE:

Dia. of Front Roll 1 in. or $\frac{8}{8}$ in.
Crown Gear 84T.
Back Roll Gear 84T.

Gear on Front Roll 30T.
Dia. of Back Roll $\frac{7}{8}$ in.

$$\text{Then } \frac{8\times84\times84}{30\times-\times7}=268.8 \text{ Draft Constant Number.}$$

The constant number divided by the draft gear gives the draft; and the constant number divided by the draft required will give the number of teeth in draft gear.

CORR MANUFACTURING COMPANY'S WARP SPINNING ROOM.

RULE TO FIND THE TWIST OF A SPINNING FRAME.

Relation of Cylinder, 7 in. diameter, to Whirl:

$\frac{3}{4}$ in. Whirl makes 8.125 revolutions to 1 of Cylinder.

$\frac{13}{16}$ in. Whirl makes 7.75 revolutions to 1 of Cylinder.

$\frac{7}{8}$ in. Whirl makes 7.00 revolutions to 1 of Cylinder.

Multiply the number of teeth in the gear on the end of front roll, the number of teeth in the twist crown gear, and the relation of cylinder to whirl, together for a dividend; and multiply the number of teeth in the cylinder gear on the end of the cylinder, the number of teeth in the twist change gear, and the circumference of the front roll, together for a divisor. Divide the dividend by the divisor, and the quotient is the Twist of the Frame.

EXAMPLE.

Front Roll Gear 112T.
Twist Crown Gear 90T.
Relation of Cylinder to Whirl 7.75.

Cylinder Gear 30T.
Twist Change Gear 30T.
Circumference of Front Roll 3.1416.

$$\text{Then } \frac{112\times90\times7.75}{30\times30\times3.1416}=27.63 \text{ Twist.}$$

NOTE.—The above is the theoretical twist, and deduction therefrom must be made for slip of the bands.

To obtain a constant number for twist, proceed as above, except omit the change twist gear.

EXAMPLE:

Front Roll Gear 112T.

Twist Crown Gear 90T.

Relation of Cylinder to Whirl 7.75.

Cylinder Gear 30T.

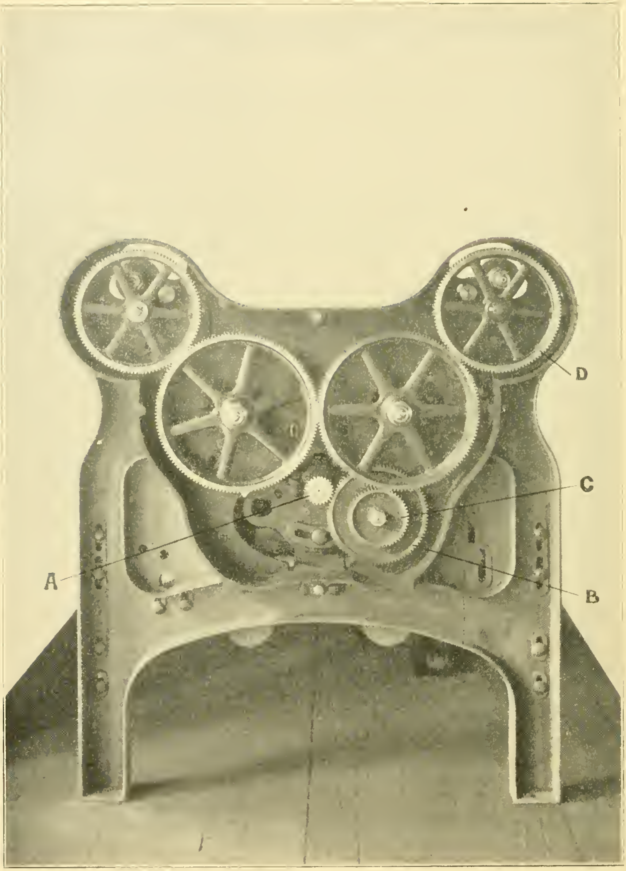
Circumference of Front Roll 3.1416.

Then $\frac{112 \times 90 \times 7.75}{30 \times - \times 3.1416} = 829.3$ Twist Constant Number.

The above constant number for twist is the theoretical constant number, and deduction therefrom must be made for slip of bands.

The constant number divided by the twist gear will give the twist of the Frame; and the constant number divided by the twist required will give the twist change gear.

All of our twist tables are figured with 5 per cent. allowance for slip.


D
C
A
B

FORMULA FOR FIGURING TWIST.

A, cylinder gear.

B, stud gear.

C, twist change gear.

D, front roll gear.

$$\frac{B \times D \times \text{relation of cylinder to whirl}}{A \times C \times \text{circumference of front roll}} = \text{Twist.}$$

RING FRAME CHANGE TWIST GEAR TABLE.

Front Roll 1 inch diameter. Cylinder 7 inches diameter.
Spindle Whirl $\frac{13}{16}$ inch diameter. Relation of Cylinder to Whirl, 7.75.

Cyl. 18T, Crown 92T. Change Twist G'r 30 to 66. Front Roll Gear 112T.		Cylinder 24T, Crown 90T. Change Twist G'r 30 to 60T. Front Roll Gear 112T.		Cylinder 30T, Crown 90T. Change Twist G'r 30 to 66. Front Roll Gear 112T.	
TWIST CONSTANT 1342.20.		TWIST CONSTANT 984.30.		TWIST CONSTANT 787.20.	
Change Gear.	Twist.	Change Gear.	Twist.	Change Gear.	Twist.
30	44.74	30	32.81	30	26.24
31	43.13	31	31.75	31	25.40
32	41.94	32	30.76	32	24.60
33	40.67	33	29.83	33	23.83
34	39.48	34	28.95	34	23.15
35	38.06	35	28.12	35	22.49
36	37.28	36	27.34	36	21.87
37	36.27	37	26.60	37	21.28
38	35.31	38	25.90	38	20.72
39	34.41	39	25.24	39	20.19
40	33.55	40	24.61	40	19.68
41	32.69	41	24.01	41	19.20
42	31.95	42	23.44	42	18.74
43	31.21	43	22.89	43	18.31
44	30.50	44	22.37	44	17.89
45	29.82	45	21.87	45	17.49
46	29.18	46	21.40	46	17.11
47	28.56	47	20.94	47	16.75
48	27.96	48	20.51	48	16.40
49	27.39	49	20.09	49	16.07
50	26.84	50	19.77	50	15.74
51	26.32	51	19.30	51	15.43
52	25.81	52	18.93	52	15.14
53	25.32	53	18.57	53	14.85
54	24.85	54	18.23	54	14.58
55	24.40	55	17.90	55	14.31
56	23.97	56	17.58	56	14.06
57	23.55	57	17.27	57	13.81
58	23.14	58	16.97	58	13.57
59	22.75	59	16.68	59	13.34
60	22.36	60	16.41	60	13.12

Twist figured with 5 per cent. allowance for slip.

RING FRAME CHANGE TWIST GEAR TABLE.

Front Roll 1 inch diameter. Cylinder 7 inches diameter. Spindle Whirl $\frac{13}{16}$ inch diameter. Ratio of Cylinder to Whirl, 7.75.				Front Roll 1 in. dia. Cylinder 7 in. dia. Spindle Whirl $\frac{3}{4}$ in. diam. Ratio of Cyl. to Whirl 8.125.	
Cyl. 36T, Crown 84T. Change Twist G'r 30 to 60T. Front Roll 112T.		Cylinder 52T, Crown 68T. Change Twist G'r 28 to 70T. Front Roll Gear 112T.		Cylinder 18T, Crown 100T. Change Twist G'r 30 to 60T. Front Roll Gear 112T.	
TWIST CONSTANT 612.60.		TWIST CONSTANT 343.20.		TWIST CONSTANT 1529.10.	
Change Gear.	Twist.	Change Gear.	Twist.	Change Gear.	Twist.
30	20.42	28	12.25	30	50.97
31	19.77	29	11.83	31	49.32
32	19.15	30	11.44	32	47.78
33	18.57	31	11.07	33	46.33
34	18.02	32	10.72	34	44.97
35	17.51	33	10.40	35	43.69
36	17.02	34	10.09	36	42.47
37	16.56	35	9.80	37	41.33
38	16.12	36	9.53	38	40.24
39	15.71	37	9.27	39	39.21
40	15.42	38	9.03	40	38.23
41	14.94	39	8.80	41	37.29
42	14.59	40	8.58	42	36.41
43	14.25	41	8.37	43	35.56
44	13.70	42	8.17	44	34.75
45	13.61	43	7.98	45	33.98
46	13.32	44	7.80	46	33.24
47	13.04	45	7.62	47	32.53
48	12 76	46	7.46	48	31.86
49	12.50	47	7.30	49	31.20
50	12.25	48	7.15	50	30.58
51	12.01	49	7.00	51	29.98
52	11.78	50	6.86	52	29.40
53	11.56	51	6.73	53	28.85
54	11.34	52	6.60	54	28.32
55	11.12	53	6.47	55	27.80
56	10.96	54	6.35	56	27.30
57	10.75	55	6 24	57	26.83
58	10.56	56	6.12	58	26.36
59	10.38	57	6.02	59	25.92
60	10.21	58	5.91	60	25.48

Twist figured with 5 per cent. allowance for slip.

RING FRAME CHANGE TWIST GEAR TABLE.

Front Roll 1 inch diameter.
Spindle Whirl $\frac{3}{4}$ inch diameter.

Cylinder 7 inches diameter.
Ratio of Cylinder to Whirl, 8.125.

Cylinder 18T Crown 130T. Change Twist G'r 30 to 60. Front Roll Gear 84T. TWIST CONSTANT 1490.70.		Cylinder 18T, Crown 92T. Change Twist G'r 30 to 62T. Front Roll Gear 112T. TWIST CONSTANT 1407.30		Cylinder 24T, Crown 90T. Change Twist G'r 30 to 62T. Front Roll Gear 112T. TWIST CONSTANT 1032.30.	
Change Gear.	Twist.	Change Gear.	Twist.	Change Gear.	Twist.
30	49.69	30	46.91	30	34.41
31	48.08	31	45.39	31	33.30
32	46.58	32	43.97	32	32.26
33	45.17	33	42.64	33	31.29
34	43.84	34	41.39	34	30.37
35	42.59	35	40.21	35	29.50
36	41.40	36	39.09	36	28.68
37	40.29	37	38.03	37	27.90
38	39.22	38	37.03	38	27.17
39	38.22	39	36.08	39	26.47
40	37.28	40	35.18	40	25.81
41	36.35	41	34.32	41	25.18
42	35.49	42	33.50	42	24.58
43	34.66	43	32.73	43	24.01
44	33.88	44	31.98	44	23.46
45	33.12	45	31.27	45	22.95
46	32.40	46	30.59	46	22.44
47	31.71	47	29.94	47	21.97
48	31.05	48	29.32	48	21.51
49	30 40	49	28.72	49	21.07
50	29.94	50	28.14	50	20.65
51	29.22	51	27.59	51	20.24
52	28.66	52	27.06	52	19.85
53	28.12	53	26.55	53	19.48
54	27.59	54	26.06	54	19.12
55	27.10	55	25.59	55	18.77
56	26 61	56	25.13	56	18.44
57	26.15	57	24.69	57	18.11
58	25.70	58	24.26	58	17.80
59	25 09	59	23.85	59	17.50
60	24.08	60	23.45	60	17.21
		61	23.07	61	17.08
		62	22.70	62	16.80

Twist figured with 5 per cent. allowance for slip.

RING FRAME CHANGE TWIST GEAR TABLE.

Front Roll 1 inch diameter. Cylinder 7 inches diameter. Spindle Whirl $\frac{3}{4}$ inch diameter. Ratio of Cylinder to Whirl 8.125.				Front Roll $1\frac{1}{16}$ in. dia. Cylinder 7 in. dia. Spindle Whirl $1\frac{3}{16}$ in. dia. Ratio of Cyl. to Whirl 7.75.	
Cylinder 30T, Crown 90T. Change Twist G'r 30 to 74T. Front Roll Gear 112T.		Cylinder 35T, Crown 70T. Change Twist G'r 50 to 76. Front Roll Gear 112T.		Cylinder 24T, Crown 90T. Change Twist G'r 30 to 62T. Front Roll Gear 112T.	
TWIST CONSTANT 825.90.		TWIST CONSTANT 550.00.		TWIST CONSTANT 926.40.	
Change Gear.	Twist.	Change Gear.	Twist.	Change Gear.	Twist.
30	27.53	50	11.00	30	30.88
31	26.64	51	10.79	31	29.89
32	25.81	52	10.59	32	28.93
33	25.03	53	10.39	33	28.08
34	24.29	54	10.19	34	27.25
35	23.60	55	10.01	35	26.47
36	22.94	56	9.83	36	25.71
37	22.32	57	9.66	37	25.04
38	21.74	58	9.49	38	24.38
39	21.18	59	9.33	39	23.75
40	20.65	60	9.17	40	23.16
41	20.15	61	9.02	41	22.60
42	19.67	62	8.88	42	22.06
43	19.21	63	8.74	43	21.54
44	18.77	64	8.60	44	21.05
45	18.36	65	8.47	45	20.59
46	17.96	66	8.34	46	20.14
47	17.57	67	8.21	47	19.71
48	17.21	68	8.09	48	19.30
49	16.86	69	7.98	49	18.91
50	16.52	70	7.86	50	18.53
51	16.20	71	7.75	51	18.16
52	15.88	72	7.64	52	17.81
53	15.58	73	7.54	53	17.48
54	15.30	74	7.44	54	17.16
55	15.02	75	7.34	55	16.84
56	14.75	76	7.24	56	16.54
57	14.49			57	16.25
58	14.25			58	15.97
59	14.00			59	15.70
60	13.77			60	15.43
61	13.54			61	15.18
62	13.32			62	14.94

Twist figured with 5 per cent. allowance for slip.

RING FRAME CHANGE TWIST GEAR TABLE.

Front Roll $1\frac{1}{16}$ in. dia. Cylinder 7 in. dia. Spindle Whirl $\frac{13}{16}$ in. dia. Ratio of Cyl. to Whirl 7.75.	Front Roll 1 in. dia. Cylinder 7 in. dia. Spindle Whirl $\frac{7}{8}$ in. dia. Ratio of Cyl. to Whirl 7.00.	Front Roll $1\frac{1}{8}$ in. dia. Cylinder 7 in. dia. Spindle Whirl $\frac{3}{4}$ in. dia. Ratio of Cyl. to Whirl 8.125.
Cylinder 30T, Crown 90T. Change Twist G'r 30 to 67T. Front Roll Gear 112T.	Cyl. 36T, Crown 84T. Change Twist G'r 30 to 60T. Front Roll Gear 112T.	Cylinder 18T, Crown 92T. Change Twist G'r 30 to 62T. Front Roll Gear 112T.
TWIST CONSTANT 741.30.	TWIST CONSTANT 553.20.	TWIST CONSTANT 1249.80.

Change Gear.	Twist.	Change Gear.	Twist.	Change Gear.	Twist.
30	24.71	30	18.44	30	41 66
31	23.92	31	17.84	31	40.33
32	23.15	32	17.29	32	39.07
33	22.47	33	16.76	33	37.89
34	21.80	34	16.27	34	36.77
35	21.18	35	15.80	35	35.72
36	20.57	36	15.37	36	34.73
37	20.04	37	14.94	37	33.79
38	19 51	38	14.56	38	32.90
39	19.00	39	14.18	39	32.06
40	18.73	40	13.83	40	31.26
41	18 08	41	13.49	41	30.49
42	17.65	42	13 17	42	29.77
43	17.24	43	12.86	43	29.07
44	16.84	45	12.57	44	28.41
45	16.48	44	12.27	45	27.78
46	16.12	46	12.02	46	27.18
47	15.77	47	11.75	47	26.60
48	15.44	48	11.52	48	26.05
49	15.13	49	11.29	49	25.51
50	14.83	50	11.06	50	25.00
51	14.53	51	10.84	51	24.51
52	14.25	52	10.63	52	24.04
53	13.99	53	10.43	53	23.59
54	13.73	54	10.24	54	23.15
55	13.48	55	10.07	55	22.73
56	13.24	56	9.87	56	22.32
57	13.00	57	9.70	57	21.93
58	12.78	58	9.53	58	21.56
59	12.56	59	9.37	59	21.19
60	12.35	60	9.22	60	20.84
61	12.15			61	20.49
62	11.96			62	20.16

Twist figured with 5 per cent. allowance for slip.

RING FRAME CHANGE TWIST GEAR TABLE.

Front Roll ⅞ inch diameter.
Spindle Whirl $\frac{13}{16}$ inch diameter.

Cylinder 7 inches diameter.
Ratio of Cylinder to Whirl 7.75.

Cylinder 24T, Crown 90T. Change Twist G'r 30 to 62T. Front Roll Gear 112T.		Cylinder 35T, Crown 85T. Change Twist G'r 30 to 62T. Front Roll Gear 112T.		Cylinder 46T, Crown 74T. Change Twist G'r 30 to 62T. Front Roll Gear 112T.	
TWIST CONSTANT 1124.40.		TWIST CONSTANT 728.10.		TWIST CONSTANT 482.70.	
Change Gear.	Twist.	Change Gear.	Twist.	Change Gear.	Twist.
30	37.48	30	24.27	30	16.09
31	36.27	31	23.49	31	15.57
32	35.14	32	22.75	32	15.08
33	34 07	33	22.06	33	14.62
34	33.06	34	21.41	34	14.19
35	32.12	35	20.84	35	13.79
36	31.23	36	20.23	36	13.40
37	30.39	37	19.68	37	13.04
38	29.59	38	19.16	38	12.70
39	28.83	39	18.67	39	12.37
40	28 10	40	18.20	40	12.06
41	27.42	41	17.76	41	11.77
42	26.77	42	17.33	42	11.49
43	26.15	43	16.93	43	11.22
44	25.55	44	16.55	44	10.97
45	24.98	45	16.18	45	10.72
46	24.43	46	15.83	46	10.49
47	23.92	47	15.49	47	10.27
48	23.42	48	15.17	48	10.05
49	22.94	49	14.86	49	9.85
50	22.49	50	14.56	50	9.65
51	22.04	51	14.27	51	9.46
52	21.62	52	14.00	52	9.28
53	21.21	53	13.74	53	9.10
54	20.82	54	13.48	54	8.93
55	20.44	55	13.23	55	8.77
56	20.08	56	13.00	56	8.61
57	19.72	57	12.77	57	8.46
58	19.36	58	12.53	58	8.32
59	19.05	59	12.34	59	8.18
60	18.74	60	12.13	60	8.00
61	18.43	61	11.93	61	7.91
62	18.13	62	11.74	62	7.78

Twist figured with 5 per cent. allowance for slip.

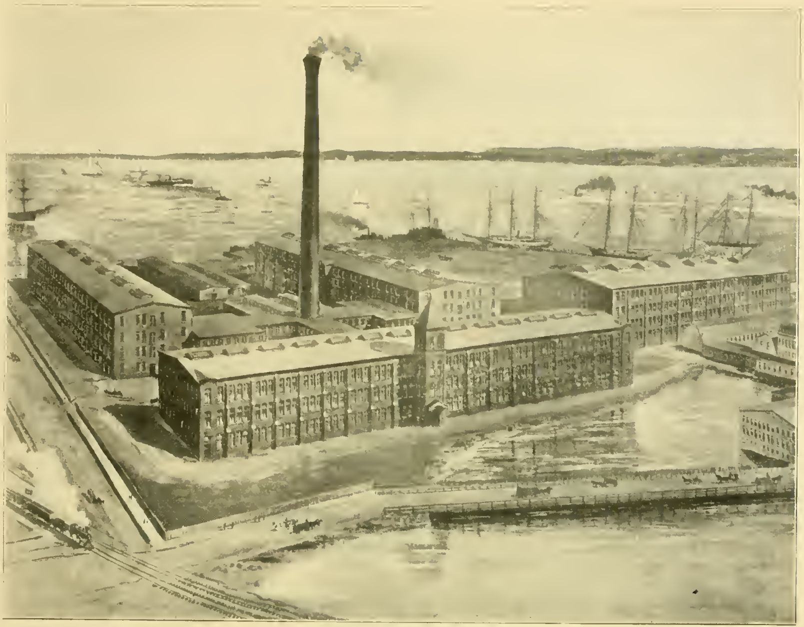
TABLE OF DRAFTS
OF RING SPINNING FRAMES.

Diameter of Front Roll 1 inch. Back Roll 7/8 inch.	Diameter of Front Roll 1 inch. Back Roll 7/8 inch.	Diameter of Front Roll 1 inch. Back Roll 7/8 inch.	Diameter of Front Roll 1 inch. Back Roll 7/8 inch.
Front Roll Gear 30 teeth. Crown Gear 140 teeth. Change Gear 27 to 64 t'th. Back Roll Gear 84 teeth.	Front Roll Gear 30 teeth. Change Gear 24 to 54 t'th. Crown Gear 128 teeth. Back Roll Gear 84 teeth.	Front Roll Gear 30 teeth. Crown Gear 116 teeth. Change Gear 24 to 54 t'th. Back Roll Gear 84 teeth.	Front Roll Gear 30 teeth. Change Gear 24 to 54 t'th. Crown Gear 84 teeth. Back Roll Gear 84 teeth.
DRAFT CONSTANT 447.90.	DRAFT CONSTANT 409.50.	DRAFT CONSTANT 371.10.	DRAFT CONSTANT 268.80.

Change Gear.	Draft.	Change Gear.	Draft.	Change Gear.	Draft.	Change Gear.	Draft.
27	16.59	24	17.06	24	15.47	24	11.20
28	16.00	25	16.38	25	14.85	25	10.75
29	15.45	26	15.71	26	14.28	26	10.33
30	14 93	27	15.17	27	13.74	27	9.95
31	14 45	28	14.63	28	13.26	28	9.60
32	14.00	29	14.13	29	12 80	29	9 26
33	13.58	30	13.65	30	12.37	30	8.96
34	13.18	31	13.21	31	11 97	31	8.67
35	12.80	32	12.80	32	11.60	32	8.40
36	12.44	33	12 41	33	11.25	33	8.14
37	12.11	34	12.05	34	10.92	34	7.90
38	11.79	35	11.70	35	10.61	35	7.68
39	11.49	36	11.38	36	10.31	36	7.46
40	11.20	37	11.07	37	10.03	37	7.26
41	10.93	38	10.78	38	9.77	38	7.07
42	10.67	39	10.50	39	9.52	39	6.89
43	10.42	40	10.24	40	9.28	40	6.72
44	10.18	41	9.99	41	9.05	41	6.55
45	9.96	42	9.75	42	8.84	42	6.40
46	9.74	43	9.53	43	8.63	43	6.25
47	9.53	44	9.31	44	8.44	44	6 11
48	9.33	45	9.10	45	8.25	45	5.97
49	9.14	46	8.90	46	8.07	46	5.84
50	8.96	47	8.72	47	7.89	47	5.71
51	8.78	48	8.53	48	7 73	48	5.60
52	8.62	49	8 36	49	7.57	49	5.48
53	8.45	50	8.19	50	7.42	50	5.37
54	8.30	51	8.03	51	7.29	51	5 27
55	8.16	52	7.88	52	7.14	52	5.16
56	8.00	53	7.73	53	7.00	53	5.07
57	7.86	54	7.59	54	6.87	54	4.97
58	7.72						
59	7.59						
60	7 47						
61	7.34						
62	7.23						
63	7.11						
64	7.00						

TABLE OF DRAFTS
OF RING SPINNING FRAMES
(CONTINUED)

Diameter of Front Roll 1 inch. Back Roll 7/8 inch.		Diameter of Front Roll 1 1-16 inch. Back Roll 1 1-16 inch.		Diameter of Front Roll 1 1-16 inch. Back Roll 1 1-16 inch.		Diameter of Front Roll 1 1/8 inch. Back Roll 1 1/8 inch.	
Front Roll Gear 36 teeth. Crown Gear 78 teeth. Change Gear 26 to 52 t'th. Back Roll Gear 84 teeth.		Front Roll Gear 30 teeth. Crown Gear 116 teeth. Change Gear 24 to 56 t'th. Back Roll Gear 84 teeth.		Front Roll Gear 30 teeth. Crown Gear 84 teeth. Change Gear 24 to 60 t'th. Back Roll Gear 84 teeth.		Front Roll Gear 30 teeth. Crown Gear 128 teeth. Change Gear 24 to 54 t'th. Back Roll Gear 84 teeth.	
DRAFT CONSTANT 207.90.		DRAFT CONSTANT 324.90.		DRAFT CONSTANT 235.20.		DRAFT CONSTANT 358.32.	
Change Gear.	Draft.	Change Gear.	Draft.	Change Gear.	Draft.	Change Gear.	Draft.
27	7.70	24	13.54	24	9.80	24	14.93
28	7.42	25	13.00	25	9.41	25	14.33
29	7.17	26	12.50	26	9.04	26	13.78
30	6.93	27	12.03	27	8.71	27	13.27
31	6.70	28	11.61	28	8.40	28	12.80
32	6.50	29	11.20	29	8.11	29	12.36
33	6.30	30	10.83	30	7.84	30	11.94
34	6.11	31	10.48	31	7.59	31	11.56
35	5.94	32	10.15	32	7.35	32	11.20
36	5.77	33	9.85	33	7.12	33	10.86
37	5.62	34	9.56	34	6.92	34	10.54
38	5.47	35	9.29	35	6.72	35	10.24
39	5.33	36	9.03	36	6.53	36	9.95
40	5.20	37	8.78	37	6.36	37	9.68
41	5.07	38	8.55	38	6.19	38	9.43
42	4.95	39	8.33	39	6.03	39	9.18
43	4.83	40	8.12	40	5.88	40	8.96
44	4.72	41	7.92	41	5.74	41	8.74
45	4.62	42	7.74	42	5.60	42	8.53
46	4.52	43	7.56	43	5.47	43	8.33
47	4.42	44	7.39	44	5.35	44	8.14
48	4.33	45	7.22	45	5.23	45	7.96
49	4.23	46	7.07	46	5.11	46	7.79
50	4.16	47	6.91	47	5.00	47	7.62
51	4.09	48	6.77	48	4.90	48	7.46
52	4.00	49	6.63	49	4.80	49	7.31
		50	6.50	50	4.70	50	7.16
		51	6.38	51	4.62	51	7.02
		52	6.25	52	4.52	52	6.89
		53	6.13	53	4.44	53	6.76
		54	6.02	54	4.35	54	6.63
		55	5.90	55	4.27		
		56	5.80	56	4.20		
				57	4.12		
				58	4.05		
				59	3.99		
				60	3.93		



FALL RIVER IRON WORKS CO. PRINT CLOTH MILLS.

MASON SPINNING FRAMES, 266,000 SPINDLES. MASON LOOMS, 7550.

A Notable Manufacturing Establishment.

We present herein a view of the Print Cloth Mills of the Fall River Iron Works Company, at Fall River, Massachusetts.

This is one of the largest cotton mill plants in this country, and it is all of modern construction, equipped with the latest improved machinery.

There are four mills, grouped around a central steam plant.

No. 1, built in 1889, is 386x120 feet, 4 stories.

No. 2, built in 1892, is 575x120 feet, 3 stories.

No. 3, built in 1893, is 309x142 feet, 4 stories.

No. 4, built in 1895, is 372x165 feet, 4 stories.

About twenty acres of floor surface.

Four triple expansion engines, furnishing 9000 horse-power.

Forty-five horizontal tubular boilers.

Chimney 350 feet high.

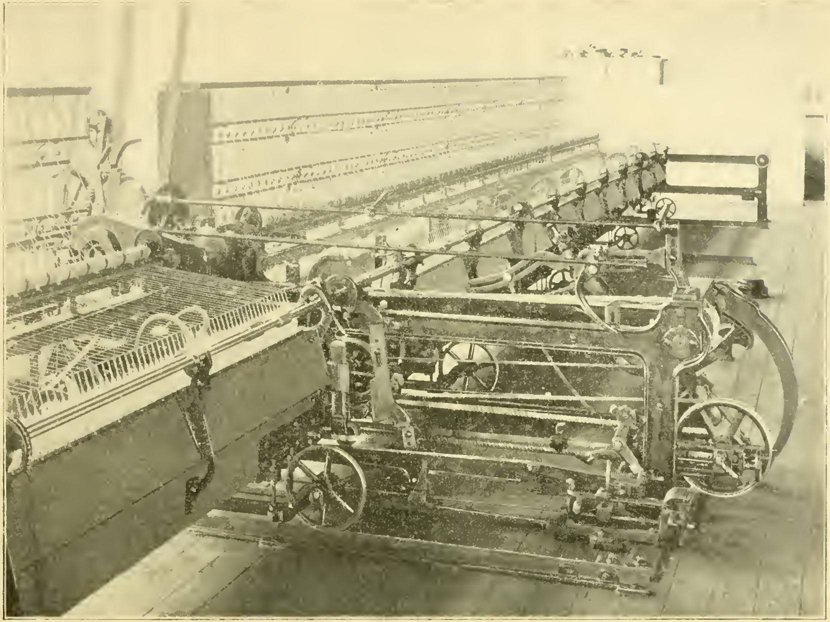
Production 50,000 pieces per week.

Employees 2700.

There are 1176 Ring Spinning Frames, containing 266,000 spindles, and 7550 Looms, of various widths, all built by us.

Probably no mills were ever erected and equipped in this country so rapidly and yet so thoroughly as were these.

The No. 4 is the largest. The foundation of this mill was begun in May, 1895. We received the order for 333 Spinning Frames, containing 78,688 spindles, and 2348 Looms, of three widths, on May 23; on the 12th of July following we began the erection of the machinery in the mill; the engine was started on October 17, when over two-thirds of the Frames and Looms were ready to run; and the whole order was finished in November.



MASON SELF-ACTING MULE.

WITH ROPE-DRIVEN CARRIAGE.

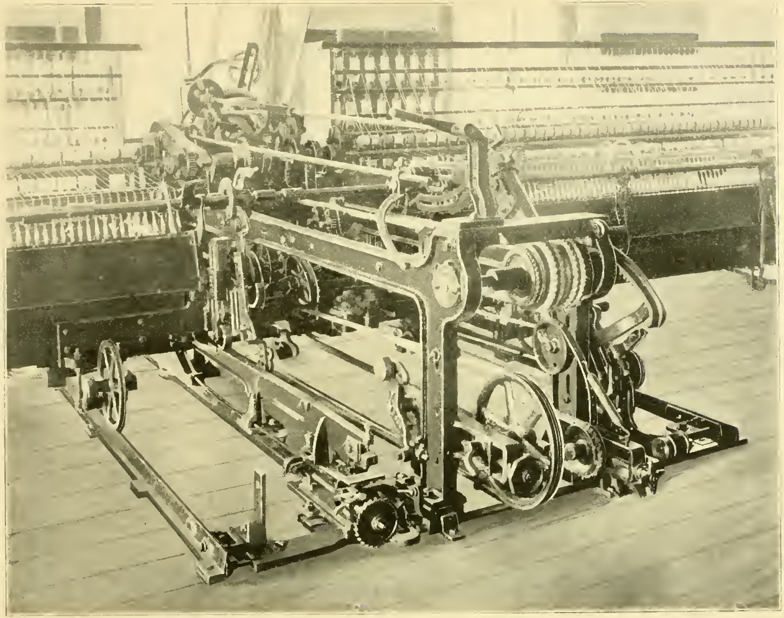
SELF-ACTING MULE.

The Mason Mule, as built to-day, is in many particulars an improvement upon all preceding Mules. If it were not so, the greatly increased production now attained would not be possible. Besides the increased spindle speed which has been made possible by means of the flexible bolster bearing, improvements have been made in the motions, which go to ensure convenience, safety and certainty of operation, so that while much higher speed is attained in all the different operations the spinner can successfully tend as large a number of spindles as ever. Speeds which ten or fifteen years ago were in vogue on what were then considered medium numbers are now attained on numbers nearly twice as fine. As on 80s, for example, 4½ draws per minute, 67 inches per draw, is now obtained with good preparation, giving a production of 30 hanks per spindle per week of 58 hours.

Many of the improvements which have been made during the past few years have consisted, essentially, of a more complete automaticity in the motions which were previously only partly automatic. New principles have been applied, and the amount and cost of production have been greatly improved by the increased speed rendered possible without diminishing the number of spindles which a spinner can tend.

The Mule has been under such a constant state of improvement during the last ten years that almost every motion has been entirely remodeled, adding either to its range, strength, capacity or delicacy of operation.

After the spindle and bearing had been so improved as to permit of much higher spindle speed, came the demand for more positive, and, at the same time, more sensitive motions for wind-



MASON SELF-ACTING MULE.

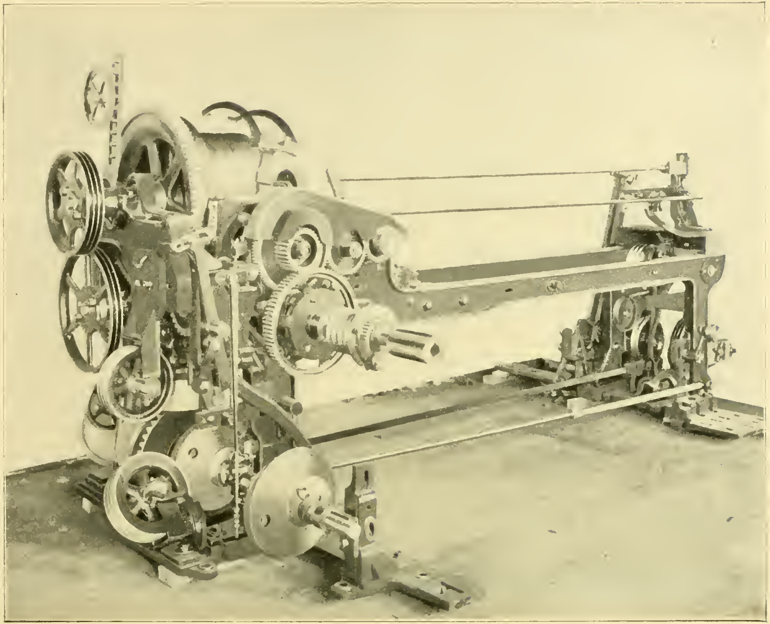
WITH ROPE-DRIVEN CARRIAGE.

ing the yarn so that it might not be strained on the one hand nor kinked on the other. Positive wind motions were therefore devised to work in connection with the locking of the faller, by means of which motions the wind chain is always taut and ready to start winding the instant the carriage moves towards the beam. Then, when the winding motion is completed, and the faller is unlocked free to rise, a faller check motion is brought into play, and, being governed by the cylinder, gives the proper speed to the faller, to guide the yarn to the top of the spindle without straining or kinking.

To ensure a proper relation between the carriage and the rolls at the time of commencing the spinning operation, an improved roll governor has been devised, by means of which the starting of the rolls may be hastened or retarded at will, and a uniform tension of the yarn obtained at this important point. In addition to larger possibilities in spinning and winding, and in the changes effected between those operations, the motions, which may be called auxiliary to them, have been much improved. For instance, the point or nosing motion is now made fully automatic and self-governing, and, being worked from the builder shoe, it will instantly correct any effort on the part of the spinner to slacken the yarn.

Improvements in the double stretch and jacking motions, for very fine yarns, have also been made, so as to facilitate any desired variations in these motions at will.

Our object has been to build a Mule that shall lead all others in ease and safety of operation, economy in repairs, and large production of first quality yarns; and the results we have obtained have far exceeded our most sanguine expectations. Safety motions are provided, preventing the simultaneous operation of antagonistic motions, thereby saving breakage. By our



MULE HEAD.

RIM AT BACK

system of construction all essential parts are made interchangeable. This Mule is built with the rim pulley parallel to the carriage, or with the rim pulley at right angles to the carriage. We designate the latter our "Attic Drive," as it is most suitable for existing mills which use the attic, or top story, for Mules, or where the main line of shafting runs parallel to the Mules. It is built with 50 inch, or 56 inch, or 60 inch, or 64 inch draw, according to the number of yarns to be spun.

HEADSTOCK.

The Headstock, Head Run and Cop Rail Plates are set on heavy foundation plates, and are bolted in such a manner that it is impossible for them to get out of place. All fast running bearings in the Headstock are furnished with oil tanks, cast in the frames.

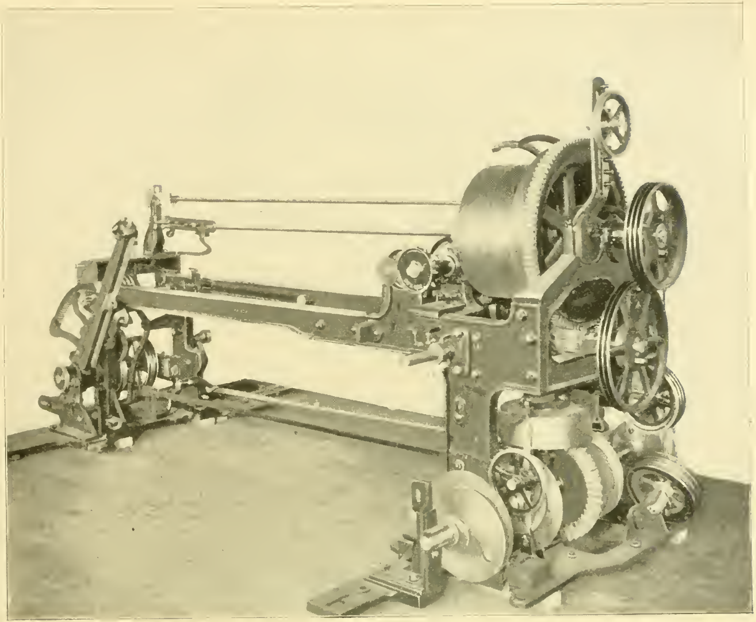
The shafts run in bronze bushings provided with self-oiling chains or rings. These bearings require no attention other than to occasionally refill the oil reservoirs.

RIM SHAFT.

This is of large diameter, with long bearings. The shaft bushings are held in place with caps and screws, and can easily be taken out and replaced without disturbing the shaft or its alignment, or without removing any of the work thereon. All pulleys are accurately balanced, thus allowing a high rate of shaft speed without jar or vibration.

CENTRE CYLINDER SHAFT OR WIND SHAFT.

This is made in a short length, and connected to the cylinder with face couplings, allowing easy removal without



MULE HEAD.

RIM AT BACK.

disturbing the cylinder. Wind pulleys can be supplied from 9 inches to 12 inches diameter, with two or three grooves, and can be made in halves if desired.

WIND MOTION.

For certain classes of work we have adopted the positive wind motion, worked by the locking of the fallers, which admits of a sure wind and firm bottom. For other kinds of work we use the clasp spring wind. The wind coincides so exactly with the motion of the carriage as to prevent either kinks or strained yarn.

NOSING MOTION.

We can apply our patent automatic nosing motion, which is self-setting, and a certain means of making a firm cop nose; or we can furnish the point arm commonly used if desired.

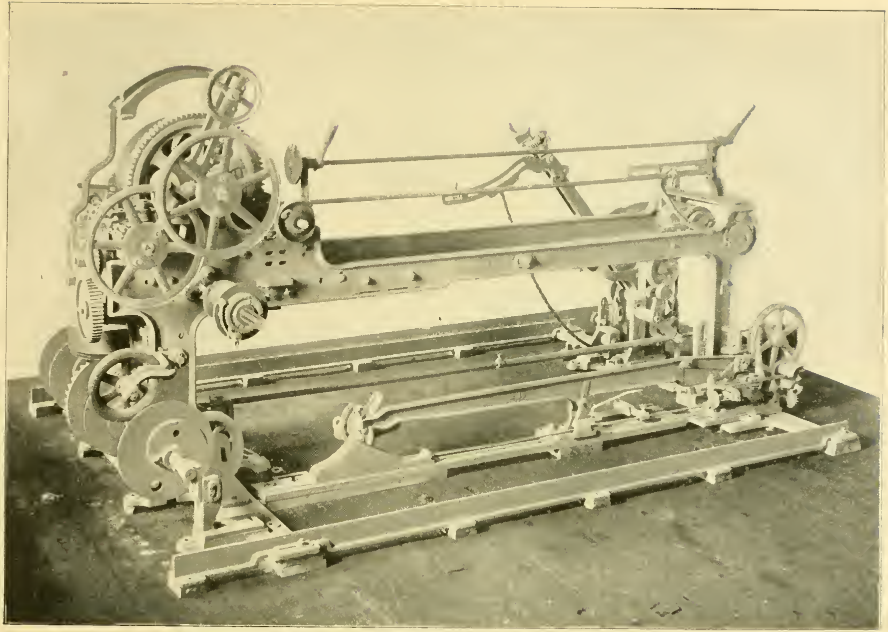
TAKING-IN SCROLLS.

We use two taking-in scrolls, with a single band passing around pulleys and regulated by a screw. These can be set while the mule is in motion.

CHANGE MOTIONS.

The changes are usually made by means of cams worked by the cam shaft, the latter being operated by either cone frictions or clutches, as may be desired.

After a careful trial of levers and cams in making changes, the verdict of most spinners is in favor of cams, except for very fine numbers.



MULE HEAD.

RIM AT SIDE.

BACKING-OFF FRICTION.

The backing-off friction is of the largest diameter made, with large surface, which gives a surplus of power and results in quicker and easier changes being made, even on the longest mules.

BACKING-OFF SHORTENING LEVER.

This is worked automatically from the builder shoe, and requires no attention. We can also work the faller chain tight, which is preferred on fine yarns.

QUADRANT.

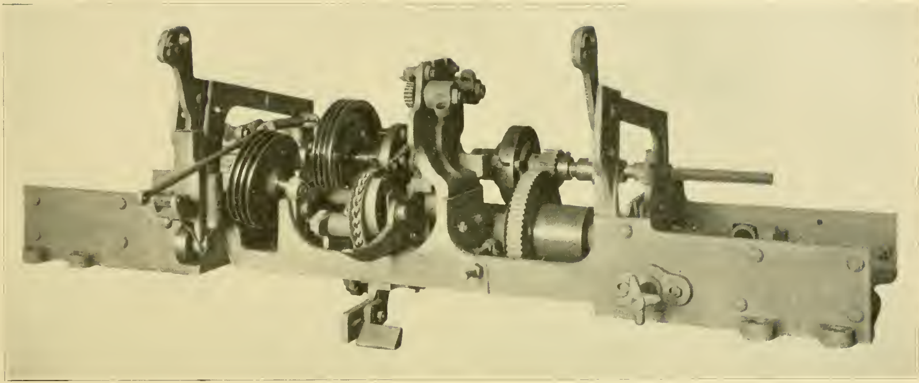
The quadrant sector gear is bolted to the quadrant frame, and is easily removed and replaced, if necessary.

AUTOMATIC HASTENING MOTION.

The hastening motion is so arranged that the driving belt can be led on to the tight pulley earlier and earlier as the cop is built, towards the close of the inward run of the carriage, and automatically increases the spindle speed near the beam when the faller rises. This motion is regulated by the cop builder, and requires no attention after being once set. This ensures a smooth wind and firm cop nose.

SELF-ACTING, BELT LEADING-OFF MOTION.

This motion is worked by the carriage, towards the close of its outward run, thereby reducing the momentum of the spindles, preparatory to backing off and changing, allowing the spinner to effect his changes as easily as if on low speeds.



MULE CARRIAGE CENTRE.

ROLLER MOTION.

We can apply a roller motion which will deliver from 4 to 7 per cent. of yarn, during the inward run of the carriage, as may be desired.

RETARDING MOTION

The fluted roll can be governed by the retarding motion, so as to deliver a little later than the carriage, thus taking out any kinks that may be left after the guide faller has been unlocked.

FLUTED ROLLS.

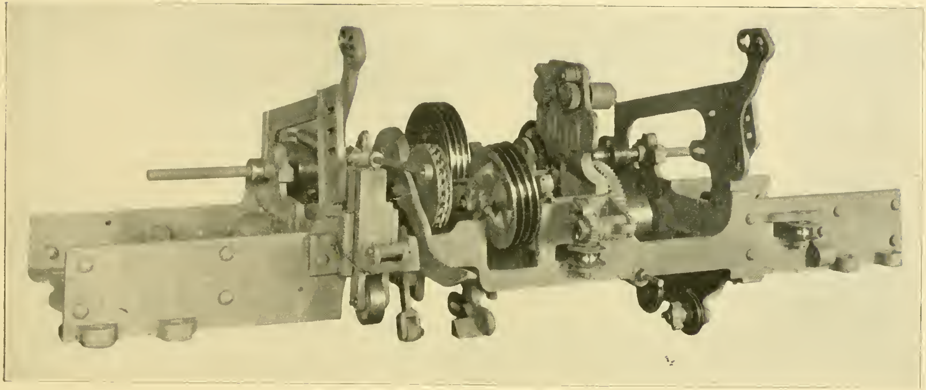
The fluted rolls are made of steel throughout; are fluted irregularly, to prevent cutting top roll leather, and are case hardened in the essential parts. Our facilities for making the very best fluted rolls are unsurpassed. For mules to spin fine counts, our rolls are ground absolutely true. We limit the extreme variation in size of such rolls to $\frac{2}{1000}$ of an inch. The centre spindle for fluted rolls in headstock is secured to the fluted rolls on either side with face couplings, and can be removed with ease without disturbing the rolls.

SPINDLES.

We make our own mule spindles from very carefully selected stock, and are prepared to furnish spindles fully equal to the best in existence. They are all run at high speed before leaving our testing room.

TOP ROLLS.

We are prepared to furnish these of such form as to suit the individual preferences of manufacturers. We can apply all three



MULE CARRIAGE CENTRE.

lines of top rolls with leather covers, either solid or shell pattern; or can apply a leather covered front top roll, with self-weighted iron back and middle top rolls. They are made so that the gudgeons extend above the fingers in cap bars, thus facilitating the cleaning operation. We can weight top rolls with stirrups and levers, or by means of dead weights, as preferred.

FLOOR SPACE.

This can be accurately determined by consulting the accompanying floor plans and tables of length.

PATENT BOLSTERS AND SPINDLE STEPS.

Our patent bolster is self-adjusting, and will admit of a greater spindle speed than any form of rigid bolster.

The step is so constructed as to be self-oiling, which provides a positive and reliable means of lubrication.

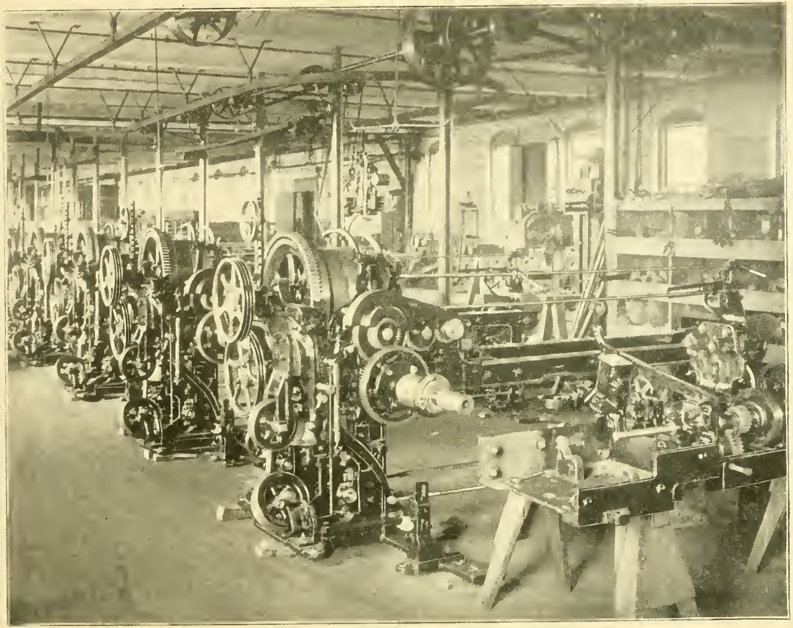
CARRIAGE.

This is very strongly built, being well braced, and runs very smoothly at even six draws per minute. It is boarded underneath, supported and stiffened by diagonal braces and iron rods at frequent intervals, and is altogether the strongest mule carriage ever built.

CYLINDERS.

These are made in short lengths, and run in ball bearings, and are easily removed from the carriage.

Wind pulleys made in halves can be furnished, if desired.



MULE ERECTING DEPARTMENT.

CLEARERS AND SCAVENGERS.

We furnish the ordinary revolving top clearer, or the cone travelling clearer, according to the style of top rolls used; also the wooden underclearer, covered or not, as preferred; and can, if desired, furnish travelling cleaners for brushing the beams, and wipers for cleaning the top of carriages.

COUNTER SHAFT.

The counter shaft hangers are double, adjustable, and furnished with self-oiling boxes. The shaft is of large diameter. The loose pulley is of the self-oiling type, and is furnished in sizes from 14 inches to 20 inches diameter, and up to 6 inches face.

The drum ranges from 16 inches to 26 inches diameter, and 10 inches face.

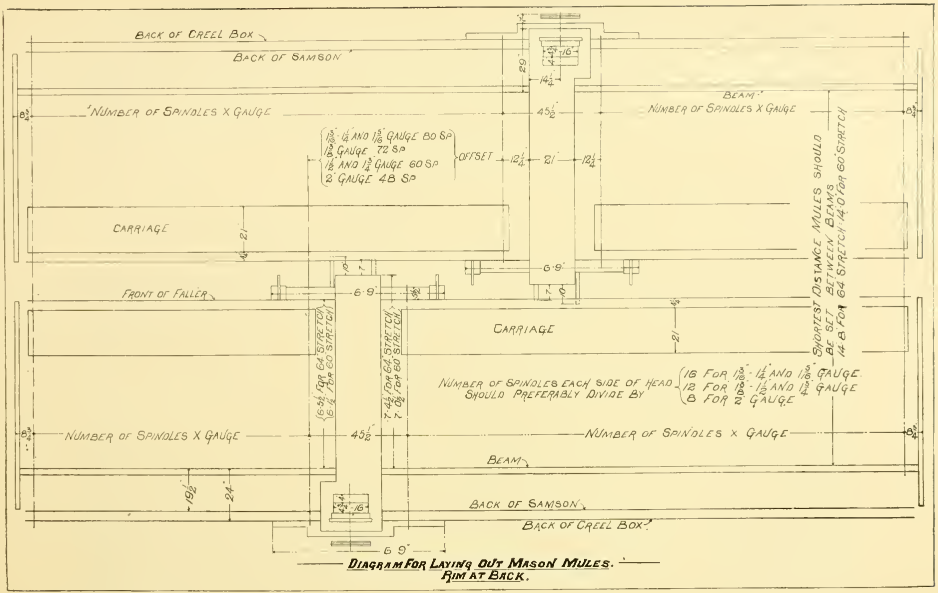


DIAGRAM FOR LAYING OUT MASON MULES.

RIM AT BACK.

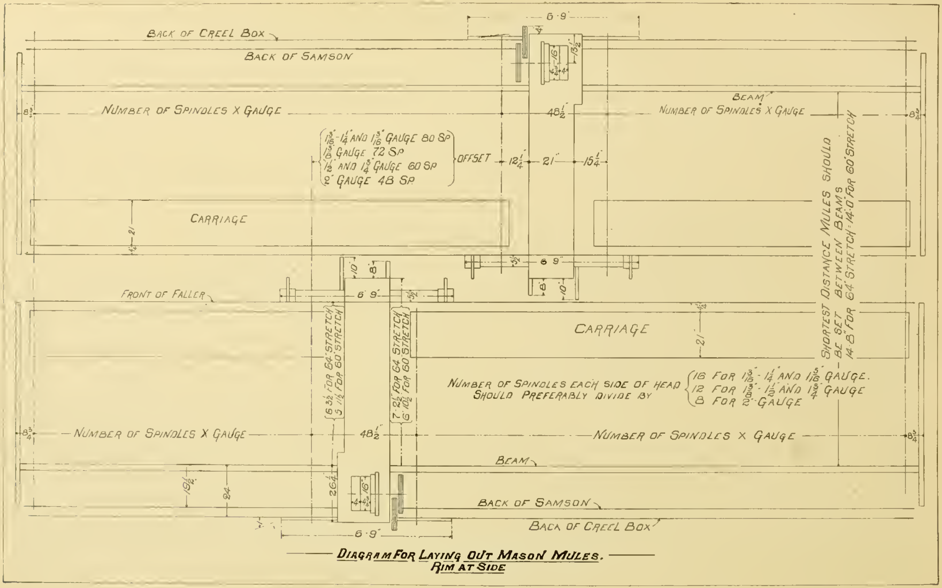


DIAGRAM FOR LAYING OUT MASON MULES.

RIM AT SIDE.

POTOMSKA MILLS, NEW BEDFORD.

MASON CARDS, DRAWING AND MULES.

Special Mule for Fine Yarn.

In addition to the foregoing motions for medium and coarse numbers, we are prepared to furnish the following special adaptations for spinning the finest numbers of yarn:

Second Stretch.

Jacking Motion.

Head Twist, with roll delivering motion.

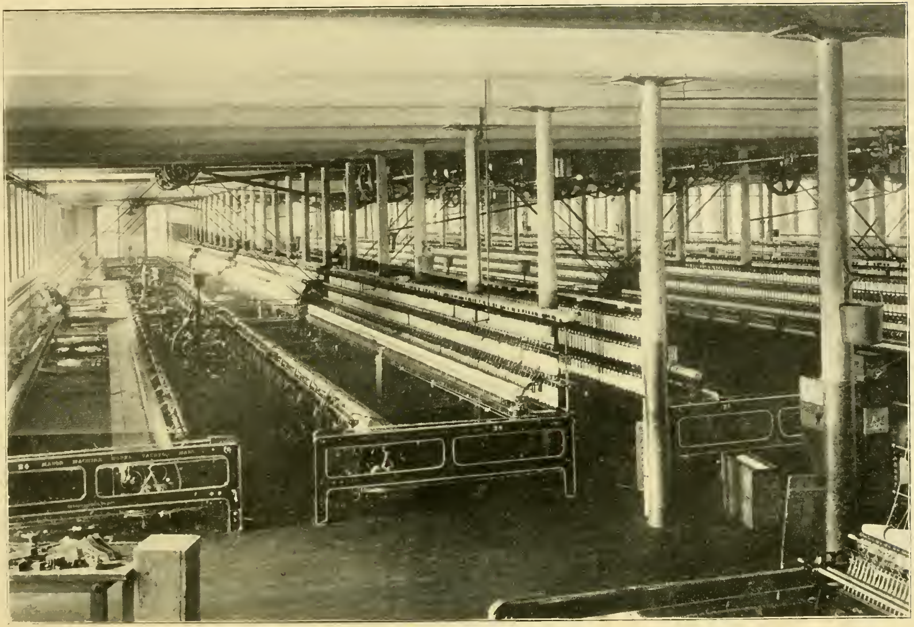
Double Speed.

Faller Check Motion, to wind the yarn up to the point of the spindle, when the carriage is at the beam.

Single Boss Rolls, *i. e.*, one thread to a boss.

Top Rolls, single boss, front roll covered with leather and dead-weighted; middle and back rolls polished iron, self-weighted.

Anti-Friction Rolls for Faller Shafts.



POTOMSKA MILLS, MULE ROOM.

MASON MULES ON FINE YARNS.

Special Features of All Mason New Mules.

Spindles, our own manufacture, unsurpassed in quality, and every one tested at the extreme speed before leaving our works.

Patent Spindle Bolsters and Steps. These allow of very high speed, requiring much less power, and so constructed as to ensure proper lubrication.

Carriages, the strongest made, well stayed, and boarded underneath; with arrangements for adjusting the angle of the spindles independently of the carriage.

Steel Rolls, of best quality, ground to uniform size, and case-hardened.

Backing-off and Taking-in Frictions, of largest diameter made, independently driven.

Interchangeability. All essential parts are made interchangeable.

Pulleys are turned and carefully balanced. Loose pulleys are provided with self-oiling arrangements.

Patent Automatic Nosing Motion, for ensuring tight, uniformly wound cop noses. This motion is fully automatic and self-governing; being worked from the builder shoe, it will correct any effort on the part of the spinner to slacken the yarn.

Positive Winding Motion, working in connection with the fallers, by which means the winding chain is always taut and ready to start winding the instant the carriage moves towards the beam.

Faller Check Motion, to check the faller when it is unlocked and ready to rise, so that it is given the proper speed, thereby guiding the yarn to the top of the spindle without straining or kinking it.

COHANNET MILLS, TAUNTON, NOS. 1 AND 2.

MASON MULES.

Improved Roller Governing Motion, by means of which the starting of the fluted rolls may be hastened or retarded at will, thereby ensuring an uniform tension on the yarn at the beginning of the stretch.

Back Shafts, Faller and Counter Faller Shafts of very large diameter. The faller shafts work on anti-friction rolls.

High Speed Bearings, fitted with bronze bushings, in addition to our patent self-oiling arrangements.

Rim Band. Provision is made to prevent fraying, and a self-adjusting tightener takes up the slack in the rim band, thus preventing the tendency of a slack band to fly off.

Scroll Shaft, Rim Shaft, Front Roll Spindle, and Cylinder Shaft can be readily removed without interfering with any of the settings.

Cylinders are perfectly balanced and run in self-adjusting brass bearings.

Counter Shafts and Overhead Motions have adjustable hangers, with self-oiling bearings, and the loose pulleys are of the self-oiling type.

Cam Shaft can be worked either with a friction or a clutch, as preferred.

Keyways. All keys are sunk one-half in the shaft, and the keys cannot slip.

Headstock is planed, milled and drilled at one operation, ensuring accuracy in all parts.

COHANNET MILLS, TAUNTON, NO. 3.

MASON MULES.

Specification for

Self-Acting Mules.

Number of mules Number of spindles in each

Gauge, centre to centre of spindles

Length of stretch inches.

Are heads to be offset If so, how many spindles on each side

Shall rim pulley be at back or side

Will roving be used single or double

Twist range to be from to. Draft range to be from to

What length of spindle and height above bolster

[If spindles are to match others, send sample marked where top of bolster comes.]

Diameter of fluted rolls, front middle back

How many threads to a boss What kind of top rolls

Will front top roll be shell or solid

Give speed of shaft that drives mules, and diameter of pulley to be used thereon

Creels, how many stories what length of skewer

what diameter of full bobbin of roving

Mules to be started on No. with turns of twist.

[If plan for layout is to be furnished, send sketch showing location of posts centre and centre, and location of shaft that will drive mules.]

MAYO MILLS, MAYODAH, N. C.

MASON DRAWING AND MULES.

SELF-ACTING MULE.

TABLE OF LENGTHS OVER ALL.

No. Spindles.	2 in. Gauge.		No. Spindles.	1 3-4 in. Gauge.		1 1-2 in. Gauge.		1 3-8 in. Gauge.	
	ft.	in.		ft.	in.	ft.	in.	ft.	in.
300	55	3	408	64	9	56	3	52	0
310	56	11	420	66	6	57	9	53	4½
320	58	7	432	68	3	59	3	54	9
330	60	3	444	70	0	60	9	56	1½
340	61	11	456	71	9	62	3	57	6
350	63	7	468	73	6	63	9	58	10½
360	65	3	480	75	3	65	3	60	3
370	66	11	492	77	0	66	9	61	7½
380	68	7	504	78	9	68	3	63	0
390	70	3	516	80	6	69	9	64	4½
400	71	11	528	82	3	71	3	65	9
410	73	7	540	84	0	72	9	67	1½
420	75	3	552	85	9	74	3	68	6
430	76	11	564	87	6	75	9	69	10½
440	78	7	576	89	3	77	3	71	3
450	80	3	588	91	0	78	9	72	7½
460	81	11	600	92	9	80	3	74	0
470	83	7	612	94	6	81	9	75	4½
480	85	3	624	96	3	83	3	76	9
490	86	11	636	98	0	84	9	78	1½
500	88	7	648	99	9	86	3	79	6
510	90	3	660	101	6	87	9	80	10½
520	91	11	672	103	3	89	3	82	3
530	93	7	684	105	0	90	9	83	7½
540	95	3	696	106	9	92	3	85	0
550	96	11	708	108	6	93	9	86	4½
560	98	7	720	110	3	95	3	87	9
570	100	3	732	112	0	96	9	89	1½
580	101	11	744	113	9	98	3	90	6
590	103	7	756	115	6	99	9	91	10½
600	105	3	768	117	3	101	3	93	3
610	106	11	780	119	0	102	9	94	7½
620	108	7	792	120	9	104	3	96	0
630	110	3	804	122	6	105	9	97	4½
640	111	11	816	124	3	107	3	98	9
650	113	7	828	126	0	108	9	100	1½
660	115	3	840	127	9	110	3	101	6
670	116	11	852	129	6	111	9	102	10½
680	118	7	864	131	3	113	3	104	3
690	120	3	876	133	0	114	9	105	7½
700	121	11	888	134	9	116	3	107	0
710	123	7	900	136	6	117	9	108	4½

SELF-ACTING MULE.

TABLE OF LENGTHS OVER ALL. (CONTINUED.)

No. of Spindles	1 5-16 inch Gauge		1 1-4 inch Gauge.		1 3-16 inch Gauge.		1 1-8 inch Gauge.	
	ft.	in.	ft.	in.	ft.	in.	ft.	in.
400	49	0	46	11	44	10	42	9
416	50	9	48	7	46	5	44	3
432	52	6	50	3	48	0	45	9
448	54	3	51	11	49	7	47	3
464	56	0	53	7	51	2	48	9
480	57	9	55	3	52	9	50	3
496	59	6	56	11	54	4	51	9
512	61	3	58	7	55	11	53	3
528	63	0	60	3	57	6	54	9
544	64	9	61	11	59	1	56	3
560	66	6	63	7	60	8	57	9
576	68	3	65	3	62	3	59	3
592	70	0	66	11	63	10	60	9
608	71	9	68	7	65	5	62	3
624	73	6	70	3	67	0	63	9
640	75	3	71	11	68	7	65	3
656	77	0	73	7	70	2	66	9
672	78	9	75	3	71	9	68	3
688	80	6	76	11	73	4	69	9
704	82	3	78	7	74	11	71	3
720	84	0	80	3	76	6	72	9
736	85	9	81	11	78	1	74	3
752	87	6	83	7	79	8	75	9
768	89	3	85	3	81	3	77	3
784	91	0	86	11	82	10	78	9
800	92	9	88	7	84	5	80	3
816	94	6	90	3	86	0	81	9
832	96	3	91	11	87	7	83	3
848	98	0	93	7	89	2	84	9
864	99	9	95	3	90	9	86	3
880	101	6	96	11	92	4	87	9
896	103	3	98	7	93	11	89	3
912	105	0	100	3	95	6	90	9
928	106	9	101	11	97	1	92	3
944	108	6	103	7	98	8	93	9
960	110	3	105	3	100	3	95	3
976	112	0	106	11	101	10	96	9
992	113	9	108	7	103	5	98	3
1008	115	6	110	3	105	0	99	9
1024	117	3	111	11	106	7	101	3
1040	119	0	113	7	108	2	102	9
1056	120	9	115	3	109	9	104	3
1072	122	6	116	11	111	4	105	9
1088	124	3	118	7	112	11	107	3
1104	126	0	120	3	114	6	108	9
1120	127	9	121	11	116	1	110	3

TABLE OF PRODUCTION

OF SELF-ACTING MULE,

SHOWING STRETCHES PER MINUTE, HANKS PER SPINDLE PER DAY OF 10 HOURS, POUNDS PER SPINDLE PER WEEK OF 60 HOURS.

No. of Yarn.	Stretches per Minute, 64-inch Stretch.	Hanks per Spindle per Day.	Pounds per Spindle per Week.	
			Without Roller Motion.	With 5 per cent. Roller Motion.
6	6.00	6.85	6.85	7.20
8	6.00	6.85	5.13	5.39
10	6.00	6.85	4.11	4.31
12	6.00	6.85	3.42	3.59
14	5.50	6.28	2.69	2.82
16	5.50	6.28	2.35	2.47
18	5.50	6.28	2.09	2.20
20	5.50	6.28	1.88	1.97
22	5.50	6.28	1.71	1.79
24	5.50	6.28	1.57	1.64
26	5.25	6.00	1.38	1.45
28	5.25	6.00	1.28	1.34
30	5.25	6.00	1.20	1.26
32	5.25	6.00	1.12	1.17
34	5.25	6.00	1.05	1.11
36	5.125	5.85	.97	1.02
38	5.125	5.85	.92	.97
40	5.00	5.71	.85	.89
42	5.00	5.71	.81	.85
44	4.75	5.42	.73	.77
46	4.75	5.42	.70	.74
48	4.50	5.24	.65	.68
50	4.50	5.24	.62	.66
52	4.25	4.85	.55	.58
54	4.25	4.85	.53	.56
56	4.25	4.85	.51	.54
58	4.25	4.85	.50	.52
60	4.125	4.71	.47	.50
62	4.125	4.71	.45	.47
64	4.125	4.71	.44	.46
66	4.125	4.71	.42	.44
68	4.00	4.57	.40	.42
70	4.00	4.57	.39	.41
72	4.00	4.57	.38	.40
74	4.00	4.57	.37	.38
76	4.00	4.57	.36	.37
78	4.00	4.57	.35	.36

Allowance has been made for stoppage for cleaning and doffing.

RULE TO FIGURE THE TWIST OF A SELF-ACTING MULE WITH THE RIM PULLEY ON THE BACK.

Multiply the diameter of the rim pulley, the diameter of the cylinder, the number of teeth in the spur portion of spur and bevel compound gear, and the number of teeth in the bevel gear on front roll sleeve together, for a dividend; and multiply the diameter of the spindle whirl, the diameter of pulley on cylinder shaft, the number of teeth in the speed gear on end on rim shaft, the number of teeth in the bevel portion of spur and bevel compound gear, and the circumference of the front roll together, for a divisor.

Divide the dividend by the divisor, and the quotient is the theoretical twist of the mule.

EXAMPLE.

Diameter of Rim Pulley 16 inches.

Diameter of Cylinder 6 inches.

Spur portion of Spur and Bevel Compound Gear 50 teeth.

Bevel Gear on Front Roll Sleeve 48 teeth.

Diameter of Spindle Whirl 1 inch.

Diameter of Pulley on Cylinder Shaft 10 inches.

Speed Change Gear 24 teeth.

Bevel portion of Spur and Bevel Compound Gear 24 teeth.

Circum. of Front Roll 3.1416 in.

$$\text{Then } \frac{16 \times 6 \times 50 \times 48}{1 \times 10 \times 24 \times 24 \times 3.1416} = 12.73 \text{ Theoretical Twist.}$$

The above is the theoretical twist, and allowance must be made for loss of twist owing to the fact that the spindle band does not bottom in the spindle whirl, and for slippage of bands.

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT BACK.

Cylinder 6 inches dia.
Spur portion of Spur and Bevel Compound Gear 50 teeth.
Bevel portion of Spur and Bevel Compound Gear 24 teeth.

Bevel Gear on Front Roll Sleeve 48 teeth.
Front Roll 1 inch dia.
Spindle Whirl $\frac{3}{4}$ inch dia.

PULLEY ON CYLINDER SHAFT 10 INCHES DIAMETER.

Change Speed Gear.	DIAMETER OF RIM PULLEY IN INCHES.										
	10	11	12	13	14	15	16	17	18	19	20
	TWIST PER INCH.										
24	10.08	11.08	12.19	13.20	14.21	15.22	16.22	17.23	18.24	19.25	20.26
25	9.67	10.63	11.60	12.57	13.53	14.50	15.47	16.43	17.45	18.37	19.34
26	9.30	10.23	11.16	12.09	13.02	13.95	14.88	15.81	16.74	17.67	18.60
27	8.96	9.85	10.75	11.64	12.54	13.44	14.33	15.23	16.12	17.02	17.92
28	8.64	9.50	10.36	11.23	12.09	12.96	13.82	14.68	15.55	16.41	17.28
29	8.34	9.17	10.00	10.84	11.67	12.51	13.34	14.17	15.01	15.84	16.68
30	8.06	8.86	9.66	10.46	11.26	12.06	12.86	13.66	14.46	15.26	16.06
31	7.80	8.58	9.36	10.14	10.92	11.70	12.48	13.26	14.04	14.82	15.60
32	7.56	8.31	9.07	9.82	10.58	11.34	12.09	12.85	13.60	14.36	15.12
33	7.33	8.06	8.79	9.52	10.26	10.99	11.72	12.46	13.19	13.92	14.66
34	7.11	7.82	8.53	9.24	9.95	10.66	11.37	12.08	12.79	13.50	14.22
35	6.91	7.60	8.29	8.98	9.67	10.36	11.03	11.74	12.43	13.12	13.82
36	6.72	7.39	8.06	8.73	9.40	10.08	10.75	11.42	12.09	12.76	13.44
37	6.53	7.18	7.83	8.48	9.14	9.79	10.44	11.10	11.75	12.40	13.06
38	6.36	6.99	7.63	8.26	8.90	9.54	10.17	10.81	11.44	12.08	12.72

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT BACK.

Cylinder 6 inches dia.
Spur portion of Spur and Bevel Compound Gear 50 teeth.
Bevel portion of Spur and Bevel Compound Gear 24 teeth.

Bevel Gear on Front Roll Sleeve, 48 teeth.
Front Roll 1 inch dia.
Spindle Whirl $\frac{3}{4}$ inch dia.

PULLEY ON CYLINDER SHAFT 11 INCHES DIAMETER.

Change Speed Gear.	DIAMETER OF RIM PULLEY IN INCHES.										
	10	11	12	13	14	15	16	17	18	19	20
	TWIST PER INCH.										
24	9.16	10.07	10.99	11.90	12.82	13.74	14.65	15.57	16.48	17.40	18.32
25	8.79	9.66	10.54	11.42	12.30	13.18	14.06	14.95	15.82	16.70	17.58
26	8.46	9.30	10.15	10.99	11.84	12.69	13.53	14.38	15.22	16.07	16.92
27	8.14	8.95	9.76	10.58	11.39	12.21	13.02	13.83	14.65	15.46	16.28
28	7.85	8.63	9.42	10.20	10.99	11.77	12.56	13.34	14.13	14.91	15.70
29	7.58	8.33	9.09	9.90	10.60	11.36	12.11	12.87	13.62	14.38	15.14
30	7.32	8.05	8.78	9.51	10.24	10.98	11.71	12.44	13.17	13.90	14.64
31	7.09	7.79	8.50	9.21	9.92	10.63	11.34	12.05	12.76	13.47	14.18
32	6.87	7.55	8.24	8.93	9.61	10.30	10.99	11.67	12.36	13.05	13.74
33	6.66	7.32	7.99	8.65	9.32	9.99	10.65	11.32	11.98	12.65	13.32
34	6.46	7.10	7.75	8.39	9.04	9.69	10.33	10.98	11.62	12.27	12.92
35	6.28	6.90	7.53	8.16	8.79	9.42	10.04	10.67	11.30	11.93	12.56
36	6.11	6.72	7.33	7.94	8.55	9.16	9.77	10.38	10.99	11.60	12.22
37	5.94	6.53	7.12	7.72	8.31	8.91	9.50	10.09	10.69	11.28	11.88
38	5.78	6.35	6.93	7.51	8.09	8.67	9.24	9.82	10.40	10.98	11.56

All our twist tables are figured with 5 per cent. deducted for slip.

Twist Table—Self-Acting Mule.

Rim Pulley at Back.

Cylinder 6 inches dia.
Spur portion of Spur and Bevel Compound Gear 50 teeth.
Bevel portion of Spur and Bevel Compound Gear 24 teeth.

Spindle Whirl $\frac{3}{4}$ inch dia.
Bevel Gear on Front Roll Sleeve 48 teeth.
Front Roll 1 inch dia.

Pulley on Cylinder Shaft 12 Inches Diameter.

Change Speed Gear.	Diameter of Rim Pulley in Inches.										
	10	11	12	13	14	15	16	17	18	19	20
	Twist per Inch.										
24	8 40	9.24	10.08	10.92	11.76	12.60	13 44	14.28	15.12	15.96	16.80
25	8 06	8.86	9.67	10.47	11.28	12.08	12.89	13.70	14.50	15.31	16.11
26	7.75	8.52	9.30	10.07	10.35	11.62	12.40	13.17	13.95	14.72	15.50
27	7.46	8.20	8 95	9.69	10.44	11.19	11.93	12.68	13.42	14.17	14 92
28	7.20	7 92	8.64	9.36	10.08	10.80	11.52	12.24	12.96	13.68	14.40
29	6.95	7.64	8.34	9.03	9.73	10.42	11.12	11.81	12.51	13.20	13 90
30	6.71	7.38	8.05	8.72	9.39	10.06	10 73	11.40	12.07	12.74	13.42
31	6.50	7.15	7.80	8.45	9.10	9.74	10.39	11.05	11.72	12.35	13.01
32	6.30	6 93	7.56	8.19	8 82	9 45	10 07	10.70	11.33	11.96	12.59
33	6.11	6.72	7.33	7.94	8.55	9.16	9.77	10.38	10.99	11.60	12.22
34	5.93	6.52	7.11	7.71	8.30	8.91	9.49	10.08	10.68	11.27	11.87
35	5.76	6 32	6.90	7.48	8.06	8.64	9.21	9.79	10.37	10.95	11.53
36	5.60	6.16	6.72	7.28	7.84	8.40	8 96	9.52	10.08	10.64	11.20
37	5.44	5.98	6.52	7 07	7.61	8.16	8.70	9.24	9.79	10.33	10.88
38	5.30	5.83	6.36	6.89	7.42	7.95	8.48	9.01	9.54	10.07	10.60

All our twist tables are figured with 5 per cent. deducted for slip.

Twist Table--Self-Acting Mule.

Rim Pulley at Back.

Cylinder 6 inches dia. Spindle Whirl $\frac{3}{4}$ in. dia.
Spur portion of Spur and Bevel Compound Gear, - - 60 teeth.
Bevel portion of Spur and Bevel Compound Gear, - - 24 teeth.
Bevel Gear on Front Roll Sleeve, - - - - - - 48 teeth.
Front Roll 1 inch dia.

Pulley on Cylinder Shaft 10 Inches Diameter.

Change Speed Gear.	Diameter of Rim Pulley in Inches.										
	10	11	12	13	14	15	16	17	18	19	20
	Twist per Inch.										
16	18.14	19.96	21.78	23.59	25.41	27.22	29.04	30.85	32.67	34.48	36.30
17	17.07	18.78	20.49	22.20	23.90	25.61	27.32	29.03	30.73	32.44	34.15
18	16.12	17.74	19.35	20.96	22.57	24.19	25.80	27.41	29.03	30.64	32.25
19	15.28	16.80	18.33	19.86	21.39	22.92	24.48	25.97	27.50	29.03	30.55
20	14.51	15.96	17.41	18.87	20.32	21.77	23.22	24.67	26.12	27.58	29.03
21	13.82	15.20	16.58	17.97	19.35	20.73	22.11	23.50	24.88	26.26	27.64
22	13.15	14.46	15.78	17.09	18.41	19.72	21.04	22.35	23.67	24.98	26.30
23	12.62	13.88	15.14	16.40	17.67	18.93	20.19	21.45	22.71	23.98	25.24
24	12.09	13.30	14.51	15.72	16.93	18.14	19.35	20.56	21.77	22.98	24.19
25	11.61	12.77	13.93	15.09	16.25	17.41	18.57	19.73	20.89	22.05	23.21
26	11.16	12.28	13.39	14.51	15.63	16.74	17.86	18.98	20.09	21.20	22.32
27	10.75	11.82	12.90	13.97	15.05	16.12	17.20	18.27	19.35	20.42	21.50
28	10.36	11.40	12.44	13.47	14.51	15.55	16.58	17.62	18.66	19.69	20.73
29	10.01	11.01	12.01	13.01	14.01	15.01	16.01	17.01	18.01	19.02	20.02
30	9.67	10.64	11.61	12.58	13.54	14.51	15.48	16.45	17.41	18.38	19.35
31	9.36	10.30	11.23	12.17	13.11	14.07	14.98	15.92	16.85	17.79	18.73
32	9.07	9.97	10.88	11.79	12.70	13.60	14.51	15.42	16.32	17.23	18.14
33	8.79	9.67	10.53	11.43	12.31	13.19	14.07	14.95	15.83	16.71	17.59
34	8.53	9.38	10.24	11.19	11.94	12.80	13.65	14.50	15.36	16.21	17.06
35	8.29	9.12	9.95	10.78	11.61	12.44	13.27	14.09	14.92	15.75	16.58
36	8.06	8.87	9.67	10.48	11.28	12.09	12.90	13.70	14.51	15.32	16.12
37	7.84	8.63	9.41	10.19	10.98	11.76	12.55	13.33	14.12	14.90	15.69
38	7.64	8.40	9.16	9.93	10.69	11.46	12.21	12.98	13.75	14.51	15.28

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT BACK.

Cylinder 6 inches dia. Spindle Whirl $\frac{3}{4}$ inch dia.
Spur portion of Spur and Bevel Compound Gear, - - 60 teeth.
Bevel portion of Spur and Bevel Compound Gear, - - 24 teeth.
Bevel Gear on Front Roll Sleeve, - - - - - - 48 teeth.
Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 11 INCHES DIAMETER.

Change Speed Gear.	Diameter of Rim Pulley in Inches.										
	10	11	12	13	14	15	16	17	18	19	20
	Twist per Inch.										
16	16.49	18.14	19.79	21.44	23.09	24.75	26.40	28.05	29.70	31.35	33.04
17	15.52	17.08	18.63	20.18	21.73	23.28	24.81	26 40	27.94	29.49	31.05
18	14.66	16.13	17.59	19.06	20.52	21.99	23.46	24.92	26.39	27.86	29.32
19	13.89	15.28	16.67	18.05	19.44	20.83	22.22	23.61	25.05	26.39	27.78
20	13.19	14.51	15.83	17.15	18 43	19.79	21.11	22.43	23.75	25.07	26.39
21	12.56	13.82	15.08	16.33	17.55	18 85	20.11	21.36	22 62	23.88	25.13
22	11.99	13.19	14.39	15.59	16.79	17.99	19.19	20.39	21.59	22.79	23.99
23	11.47	12.62	13 77	14.91	16.06	17.21	18.36	19.50	20.65	21 80	22 95
24	10.99	12.09	13.19	14.29	15.39	16.49	17.59	18.69	19.79	20.89	21.99
25	10.55	11.61	12.66	13.72	14.78	15.83	16.89	17.94	19.00	20.06	21.11
26	10.15	11.16	12.18	13.19	14.21	15 22	16.24	17.25	18 27	19.28	20.30
27	9.77	10 75	11.73	12.70	13.68	14.66	15.64	16.61	17.59	18.57	19.55
28	9.42	10.32	11.30	12.24	13.18	14.13	15.07	16.01	16 95	17.89	18.84
29	9.10	10.01	10.92	11.83	12.74	13.65	14.56	15.47	16 38	17.29	18 20
30	8.79	9.67	10.55	11.43	12.31	13.19	14.07	14.95	15.83	16.71	17.59
31	8.51	9.36	10.21	11.06	11.91	12.77	13.62	14.47	15.32	16.17	17.01
32	8.24	9.07	9.89	10.72	11.54	12.37	13.19	14.02	14.84	15.67	16.49
33	7.99	8.79	9.59	10.39	11.19	11.99	12.79	13.59	14.39	15.19	15 99
34	7.76	8.53	9.31	10.09	10.87	11.65	12.42	13.21	13.98	14.76	15.54
35	7.54	8.29	9.04	9.80	10.55	11.31	12.06	12.81	13 67	14.42	15.18
36	7.33	8.06	8.79	9.53	10.26	10.99	11.73	12.46	13.19	13.93	14.66
37	7.13	7 81	8.56	9 27	9 98	10.70	11.41	12.12	12.84	13.55	14.26
38	6.94	7.64	8.33	9.03	9.73	10.42	11.12	11.80	12.51	13.20	13.90

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT BACK.

Cylinder 6 inches dia. Spindle Whirl $\frac{3}{4}$ inch dia.
Spur portion of Spur and Bevel Compound Gear, - - 60 teeth.
Bevel portion of Spur and Bevel Compound Gear, - - 24 teeth.
Bevel Gear on Front Roll Sleeve, - - - - - - 48 teeth.
Front Roll 1 inch diameter.

PULLEY ON CYLINDER SHAFT 12 INCHES DIAMETER.

Change Speed Gear.	Diameter of Rim Pulley in Inches.										
	10	11	12	13	14	15	16	17	18	19	20
	Twist per Inch.										
16	15.12	16.63	18.15	19.66	21.17	22.69	24.20	25.71	27.22	28.74	30.25
17	14.23	15.66	17.08	18.50	19.93	21.35	22.77	24.20	25.62	27.05	28.47
18	13.43	14.77	16.12	17.46	18.80	20.15	21.49	22.83	24.18	25.52	26.87
19	12.73	14.01	15.28	16.55	17.83	19.10	20.37	21.65	22.92	24.20	25.47
20	12.10	13.31	14.52	15.73	16.94	18.15	19.36	20.57	21.78	22.99	24.20
21	11.52	12.67	13.83	15.08	16.33	17.58	18.84	20.09	21.34	22.59	23.85
22	11.00	12.10	13.20	14.30	15.40	16.50	17.60	18.70	19.80	20.90	22.00
23	10.52	11.57	12.63	13.68	14.73	15.78	16.84	17.89	18.94	19.99	21.05
24	10.08	11.09	12.10	13.11	14.11	15.12	16.13	17.14	18.15	19.16	20.17
25	9.68	10.64	11.61	12.58	13.55	14.52	15.48	16.45	17.42	18.39	19.36
26	9.30	10.23	11.17	12.10	13.03	13.96	14.89	15.82	16.75	17.68	18.61
27	8.96	9.86	10.75	11.65	12.54	13.44	14.34	15.23	16.13	17.03	17.93
28	8.64	9.50	10.37	11.23	12.10	12.96	13.83	14.69	15.55	16.41	17.27
29	8.34	9.18	10.01	10.84	11.68	12.51	13.35	14.18	15.02	15.85	16.69
30	8.06	8.87	9.68	10.48	11.29	12.10	12.90	13.71	14.52	15.32	16.13
31	7.80	8.58	9.36	10.14	10.92	11.71	12.49	13.27	14.05	14.83	15.61
32	7.56	8.31	9.07	9.83	10.58	11.34	12.10	12.85	13.61	14.36	15.12
33	7.33	8.06	8.80	9.53	10.26	11.01	11.73	12.46	13.20	13.43	14.66
34	7.11	7.82	8.54	9.25	9.96	10.67	11.38	12.10	12.81	13.52	14.23
35	6.91	7.50	8.19	8.88	9.57	10.26	10.95	11.65	12.34	13.03	13.72
36	6.72	7.39	8.06	8.73	9.41	10.08	10.75	11.42	12.10	12.77	13.44
37	6.54	7.19	7.84	8.50	9.15	9.81	10.46	11.19	11.77	12.42	13.08
38	6.36	7.00	7.64	8.27	8.91	9.55	10.19	10.82	11.46	12.10	12.73

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT BACK.

Cylinder 6 inches dia. Spindle Whirl $\frac{7}{8}$ inch dia.
Spur portion of Spur and Bevel Compound Gear, 50 teeth. Bevel Gear on Front Roll Sleeve, 48 teeth.
Bevel portion of Spur and Bevel Compound Gear, 24 teeth. Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 10 INCHES DIAMETER.

Change Speed Gear.	DIAMETER OF RIM PULLEY IN INCHES.										
	10	11	12	13	14	15	16	17	18	19	20
	TWIST PER INCH.										
24	8.64	9.50	10.36	11.23	12.09	12 96	13.82	14.68	15.55	16.41	17 28
25	8.29	9 11	9.91	10.77	11.60	12.43	13.26	14.09	14.92	15.75	16.58
26	7.97	8.76	9.56	10.36	11.15	11.95	12.75	13.54	14.34	15.14	15.94
27	7.68	8.44	9.21	9.98	10.75	11.52	12.28	13 05	13.82	14.59	15.36
28	7.40	8.11	8 88	9.62	10.36	11.10	11.84	12.58	13.32	14 06	14.80
29	7.15	7.86	8 58	9 30	10.01	10 73	11.45	12.17	12.88	13.60	14.32
30	6.91	7.60	8.29	8.98	9.67	10.36	11.05	11.74	12.43	13.12	13 82
31	6 68	7.35	8.02	8.68	9.35	10.02	10.63	11.35	12.01	12.68	13.35
32	6 48	7.13	7.78	8.42	9.07	9 72	10.36	11 01	11.65	12.30	12.95
33	6.28	6.70	7.53	8.16	8.79	9.12	10.04	10.67	11.30	11.93	12.56
34	6.09	6.69	7.30	7.91	8.52	9.13	9.74	10.35	10.96	11.57	12.19
35	5.92	6.51	7.10	7.70	8.29	8.90	9.48	10.07	10.67	11.26	11.86
36	5.76	6.32	6.90	7.48	8 06	8.64	9.21	9.79	10 37	10.95	11.53
37	5.60	6.16	6.72	7.28	7.84	8.40	8 96	9.52	10.08	10.64	11.20
38	5.45	5.99	6 54	7.08	7.63	8 17	8.72	9.26	9.81	10.35	10.90

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT BACK.

Cylinder 6 inches dia.
Spur portion of Spur and Bevel Compound Gear, 50 teeth.
Bevel portion of Spur and Bevel Compound Gear, 24 teeth.
Spindle Whirl $\frac{7}{8}$ inch dia.
Bevel Gear on Front Roll Sleeve, 48 teeth.
Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 11 INCHES DIAMETER.

Change Speed Gear.	DIAMETER OF RIM PULLEY IN INCHES.										
	10	11	12	13	14	15	16	17	18	19	20
	TWIST PER INCH.										
24	7.85	8 63	9.42	10 20	10.99	11.77	12.56	13 34	14.13	14.91	15.70
25	7.54	8 28	9 04	9.79	10.55	11.31	12 06	12.82	13.57	14.33	15.09
26	7.25	7.79	8.70	9.42	10.14	10.87	11 60	12 32	13.05	13.78	14.51
27	6.98	7 67	8.37	9 07	9.77	10.47	11.16	11.86	12.56	13.26	13.96
28	6.73	7.38	8 05	8.72	9.39	10.07	10.74	11.41	12.08	12 75	13.43
29	6.50	7.15	7.80	8.45	9.11	9.76	10.41	11.07	11.72	12 37	13.03
30	6 28	6 90	7.53	8.16	8.79	9.42	10.04	10.67	11.30	11.93	12.56
31	6.08	6 68	7.29	7.90	8.51	9.14	9.73	10.34	10.95	11.56	12.18
32	5 89	6.47	7.06	7.65	8.24	8.84	9.43	10 02	10 61	11.20	11.79
33	5.71	6.28	6.85	7.42	7.99	8.56	9 13	9.70	10.27	10 84	11.42
34	5.54	6 09	6 64	7.20	7 75	8.31	8.86	9.41	9.97	10.52	11.08
35	5.38	5.91	6.45	6.99	7.53	8 07	8.60	9.14	9 68	10.22	10.76
36	5.23	5 75	6.27	6.79	7.32	7.84	8.76	8.89	9.41	9.93	10.46
37	5.09	5.59	6 10	6.61	7.12	7.63	8.14	8.65	9.16	9.67	10.18
38	4.96	5.45	5.94	6.44	6.94	7.44	7.93	8.43	8.92	9.42	9.92

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT BACK.

Cylinder 6 inches dia.
Spur portion of Spur and Bevel Compound Gear, 50 teeth.
Bevel portion of Spur and Bevel Compound Gear, 24 teeth.

Spindle Whirl $\frac{7}{8}$ inch dia.
Bevel Gear on Front Roll Sleeve, 48 teeth.
Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 12 INCHES DIAMETER.

Change Speed Gear.	DIAMETER OF RIM PULLEY IN INCHES.										
	10	11	12	13	14	15	16	17	18	19	20
	TWIST PER INCH.										
24	7.20	7.92	8.64	9.36	10.08	10.80	11.52	12.24	12.96	13.68	14.40
25	6.91	7.60	8.29	8.98	9.67	10.36	11.05	11.74	12.43	13.12	13.82
26	6.64	7.29	7.96	8.62	9.29	9.96	10.62	11.29	11.95	12.62	13.29
27	6.40	7.04	7.68	8.32	8.96	9.60	10.24	10.88	11.52	12.16	12.80
28	6.17	6.78	7.40	8.02	8.63	9.25	9.87	10.48	11.10	11.72	12.34
29	5.95	6.54	7.13	7.73	8.32	8.92	9.51	10.10	10.70	11.29	11.89
30	5.76	6.32	6.90	7.48	8.06	8.64	9.21	9.79	10.37	10.95	11.53
31	5.57	6.13	6.68	7.24	7.79	8.35	8.90	9.45	10.01	10.56	11.12
32	5.40	5.94	6.48	7.02	7.56	8.10	8.64	9.18	9.72	10.26	10.80
33	5.23	5.75	6.27	6.79	7.32	7.84	8.36	8.89	9.41	9.93	10.46
34	5.08	5.58	6.09	6.60	7.11	7.62	8.13	8.64	9.15	9.66	10.17
35	4.93	5.41	5.90	6.40	6.90	7.40	7.89	8.39	8.88	9.38	9.88
36	4.80	5.28	5.76	6.24	6.72	7.20	7.68	8.16	8.64	9.12	9.60
37	4.67	5.13	5.60	6.07	6.53	7.00	7.47	7.93	8.40	8.87	9.34
38	4.54	4.99	5.44	5.90	6.35	6.81	7.26	7.71	8.17	8.62	9.08

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT BACK.

Cylinder 6 inches dia. Spindle Whirl $\frac{7}{8}$ inch dia.
Spur portion of Spur and Bevel Compound Gear, - - 55 teeth.
Bevel portion of Spur and Bevel Compound Gear, - - 24 teeth.
Bevel Gear on Front Roll Sleeve, - - - - - - 48 teeth.
Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 10 INCHES DIAMETER.

Change Speed Gear.	DIAMETER OF RIM PULLEY IN INCHES.										
	10	11	12	13	14	15	16	17	18	19	20
	TWIST PER INCH.										
16	14.25	15.68	17.10	18.53	19.95	21.38	22.80	24.23	25.66	27.08	28.51
17	13.41	14.75	16.10	17.44	18.78	20.12	21.46	22.80	24.15	25.49	26.83
18	12.62	13.93	15.20	16.47	17.74	19.00	20.27	21.54	22.80	24.07	25.34
19	12.00	13.20	14.40	15.60	16.80	18.00	19.20	20.40	21.60	22.80	24.01
20	11.40	12.54	13.68	14.82	15.96	17.10	18.24	19.38	20.52	21.66	22.81
21	10.86	11.95	13.04	14.12	15.21	16.30	17.39	18.47	19.56	20.65	21.73
22	10.36	11.40	12.44	13.47	14.51	15.55	16.58	17.62	18.65	19.68	20.72
23	9.91	10.90	11.90	12.89	13.88	14.87	15.86	16.85	17.85	18.84	19.83
24	9.50	10.45	11.40	12.35	13.30	14.25	15.20	16.15	17.10	18.05	19.00
25	9.12	10.03	10.94	11.86	12.77	13.68	14.59	15.51	16.42	17.33	18.24
26	8.77	9.65	10.52	11.40	12.28	13.15	14.03	14.91	15.79	16.66	17.54
27	8.44	9.29	10.13	10.98	11.82	12.67	13.51	14.36	15.20	16.05	16.89
28	8.14	8.96	9.77	10.58	11.40	12.21	13.03	13.84	14.66	15.47	16.29
29	7.86	8.65	9.43	10.22	11.01	11.79	12.58	13.37	14.15	14.94	15.72
30	7.60	8.36	9.12	9.88	10.64	11.40	12.16	12.92	13.68	14.44	15.20
31	7.35	8.09	8.82	9.56	10.29	11.03	11.76	12.50	13.23	13.97	14.71
32	7.12	7.83	8.54	9.35	9.96	10.68	11.39	12.10	12.81	13.52	14.24
33	6.91	7.60	8.29	8.98	9.67	10.37	11.06	11.75	12.44	13.13	13.83
34	6.70	7.37	8.04	8.72	9.30	10.06	10.73	11.40	12.07	12.74	13.41
35	6.51	7.17	7.82	8.47	9.12	9.78	10.43	11.08	11.73	12.38	13.03
36	6.33	6.96	7.60	8.23	8.87	9.50	10.13	10.77	11.40	12.03	12.77
37	6.16	6.78	7.38	8.01	8.62	9.24	9.86	10.47	11.09	11.71	12.32
38	6.00	6.60	7.20	7.80	8.40	9.00	9.60	10.20	10.80	11.40	12.00

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT BACK.

Cylinder 6 inches dia. Spindle Whirl $\frac{7}{8}$ inch dia.
Spur portion of Spur and Bevel Compound Gear, - - 55 teeth.
Bevel portion of Spur and Bevel Compound Gear, - - 24 teeth.
Bevel Gear on Front Roll Sleeve, - - - - - - 48 teeth.
Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 11 INCHES DIAMETER.

Change Speed Gear.	DIAMETER OF RIM PULLEY IN INCHES.										
	10	11	12	13	14	15	16	17	18	19	20
	TWIST PER INCH.										
16	12.96	14.25	15.50	16.79	18.09	19.39	20.68	21.98	23.27	24.57	25.87
17	12.19	13.41	14.63	15.85	17.07	18.29	19.51	20.73	21.95	23.17	24.39
18	11.52	12.67	13.82	14.97	16.12	17.28	18.43	19.58	20.73	21.88	23.04
19	10.91	12.00	13.09	14.18	15.27	16.36	17.46	18.55	19.64	20.73	21.82
20	10.36	11.40	12.44	13.47	14.51	15.55	16.58	17.62	18.66	19.69	20.73
21	9.87	10.86	11.84	12.83	13.82	14.80	15.89	16.88	17.87	18.88	19.84
22	9.42	10.36	11.31	12.25	13.19	14.11	15.06	16.00	16.94	17.88	18.83
23	9.01	9.91	10.81	11.71	12.62	13.52	14.42	15.32	16.22	17.12	18.03
24	8.64	9.51	10.37	11.24	12.10	12.97	13.83	14.69	15.56	16.42	17.29
25	8.29	9.12	9.95	10.78	11.60	12.43	13.26	14.08	14.91	15.74	16.57
26	7.97	8.77	9.57	10.36	11.16	11.96	12.76	13.55	14.35	15.15	15.95
27	7.68	8.44	9.21	9.98	10.75	11.52	12.28	13.05	13.82	14.59	15.36
28	7.40	8.14	8.88	9.62	10.36	11.10	11.84	12.58	13.32	14.06	14.81
29	7.15	7.86	8.58	9.29	10.01	10.72	11.44	12.15	12.87	13.58	14.30
30	6.91	7.60	8.28	8.97	9.66	10.36	11.05	11.75	12.44	13.12	13.82
31	6.68	7.35	8.02	8.69	9.36	10.03	10.70	11.36	12.03	12.70	13.37
32	6.47	7.12	7.76	8.41	9.06	9.70	10.35	11.00	11.65	12.29	12.94
33	6.28	6.91	7.53	8.16	8.79	9.42	10.05	10.68	11.30	11.93	12.56
34	6.09	6.70	7.31	7.92	8.53	9.14	9.75	10.36	10.97	11.58	12.19
35	5.91	6.50	7.09	7.68	8.27	8.86	9.45	10.05	10.64	11.23	11.82
36	5.76	6.33	6.91	7.48	8.06	8.64	9.21	9.79	10.36	10.94	11.52
37	5.60	6.16	6.72	7.28	7.84	8.40	8.96	9.52	10.08	10.64	11.20
38	5.45	6.00	6.54	7.09	7.63	8.18	8.72	9.27	9.82	10.36	10.91

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT BACK.

Cylinder 6 inches dia. Spindle Whirl $\frac{7}{8}$ inch dia.
Spur portion of Spur and Bevel Compound Gear, - - 55 teeth.
Bevel portion of Spur and Bevel Compound Gear, - - 24 teeth.
Bevel Gear on Front Roll Sleeve, - - - - - - 48 teeth.
Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 12 INCHES DIAMETER.

Change Speed Gear.	DIAMETER OF RIM PULLEY IN INCHES.										
	10	11	12	13	14	15	16	17	18	19	20
	TWIST PER INCH.										
16	11.88	13.06	14.25	15.44	16.63	17.82	19.00	20.19	21.38	22.57	23.76
17	11.18	12.29	13.41	14.53	15.65	16.77	17.88	19.00	20.12	21.24	22.38
18	10.56	11.61	12.66	13.72	14.78	15.83	16.89	17.94	19.00	20.06	21.11
19	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00
20	9.50	10.45	11.40	12.35	13.30	14.25	15.20	16.12	17.10	18.05	19.00
21	9.05	9.95	10.86	11.76	12.67	13.57	14.48	15.38	16.29	17.19	18.10
22	8.64	9.51	10.37	11.24	12.10	12.97	13.83	14.69	15.56	16.42	17.29
23	8.26	9.07	9.90	10.72	11.56	12.39	13.21	14.14	14.96	15.79	16.52
24	7.92	8.72	9.51	10.30	11.09	11.88	12.67	13.46	14.25	15.04	15.81
25	7.60	8.36	9.12	9.88	10.64	11.40	12.16	12.92	13.68	14.44	15.20
26	7.31	8.04	8.77	9.50	10.24	10.97	11.70	12.44	13.17	13.90	14.64
27	7.01	7.73	8.44	9.14	9.84	10.55	11.25	11.95	12.66	13.36	14.06
28	6.78	7.46	8.14	8.82	9.50	10.18	10.86	11.54	12.21	12.89	13.57
29	6.55	7.19	7.85	8.51	9.16	9.83	10.48	11.13	11.79	12.42	13.10
30	6.33	6.96	7.60	8.23	8.87	9.50	10.13	10.77	11.40	12.03	12.67
31	6.12	6.73	7.35	7.96	8.57	9.18	9.80	10.41	11.02	11.63	12.25
32	5.93	6.52	7.12	7.71	8.30	8.90	9.49	10.08	10.68	11.27	11.86
33	5.76	6.33	6.91	7.48	8.06	8.64	9.21	9.79	10.36	10.94	11.52
34	5.59	6.14	6.70	7.26	7.82	8.38	8.94	9.50	10.06	10.62	11.17
35	5.42	5.97	6.51	7.05	7.59	8.14	8.64	9.22	9.77	10.31	10.85
36	5.28	5.80	6.33	6.86	7.39	7.92	8.44	8.97	9.50	10.03	10.55
37	5.16	5.64	6.15	6.66	7.18	7.70	8.21	8.73	9.24	9.76	10.28
38	5.00	5.50	6.00	6.50	7.00	7.50	8.00	8.50	9.00	9.50	10.00

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT BACK.

Cylinder 6 inches dia. Spindle Whirl $\frac{7}{8}$ inch dia.
Spur portion of Spur and Bevel Compound Gear, - - 60 teeth.
Bevel portion of Spur and Bevel Compound Gear, - - 24 teeth.
Bevel Gear on Front Roll Sleeve, - - - - - - 48 teeth.
Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 10 INCHES DIAMETER.

Change Speed Gear.	DIAMETER OF RIM PULLEY IN INCHES.										
	10	11	12	13	14	15	16	17	18	19	20
	TWIST PER INCH.										
16	15.52	17.10	18.66	20.21	21.77	23.32	24.88	26.43	27.99	29.54	31.10
17	14.61	16.08	17.54	19.00	20.46	21.92	23.39	24.85	26.31	27.71	29.23
18	13.80	15.18	16.56	17.94	19.32	20.70	22.08	23.46	24.84	26.22	27.60
19	13.07	14.38	15.68	16.99	18.30	19.60	20.91	22.22	23.53	24.83	26.14
20	12.41	13.67	14.92	16.16	17.40	18.65	19.89	21.13	22.37	23.61	24.86
21	11.82	13.01	14.19	15.37	16.55	17.72	18.92	20.10	21.29	22.47	23.66
22	11.29	12.41	13.54	14.67	15.80	16.93	18.06	19.20	20.33	21.46	22.59
23	10.80	11.88	12.96	14.04	15.12	16.20	17.28	18.36	19.44	20.52	21.60
24	10.35	11.38	12.42	13.45	14.49	15.52	16.56	17.59	18.63	19.66	20.70
25	9.93	10.92	11.92	12.91	13.91	14.89	15.88	16.88	17.88	18.88	19.88
26	9.55	10.50	11.46	12.41	13.37	14.32	15.28	16.24	17.19	18.15	19.10
27	9.20	10.12	11.04	11.96	12.88	13.80	14.72	15.64	16.56	17.48	18.41
28	8.87	9.75	10.64	11.53	12.41	13.30	14.19	15.08	15.96	16.85	17.74
29	8.56	9.42	10.27	11.13	11.99	12.84	13.70	14.56	15.41	16.27	17.13
30	8.28	9.10	9.93	10.76	11.59	12.42	13.24	14.07	14.90	15.73	16.56
31	8.01	8.81	9.61	10.41	11.21	12.01	12.81	13.62	14.42	15.23	16.03
32	7.76	8.54	9.32	10.09	10.87	11.64	12.42	13.19	13.97	14.74	15.52
33	7.52	8.25	9.01	9.76	10.52	11.28	12.03	12.79	13.54	14.30	15.08
34	7.30	8.03	8.76	9.49	10.23	10.96	11.69	12.43	13.16	13.89	14.63
35	7.09	7.80	8.51	9.22	9.93	10.64	11.45	12.16	12.87	13.58	14.29
36	6.90	7.60	8.28	8.97	9.66	10.35	11.04	11.73	12.42	13.11	13.81
37	6.71	7.38	8.05	8.72	9.39	10.07	10.74	11.41	12.08	12.75	13.43
38	6.53	7.19	7.84	8.49	9.15	9.81	10.46	11.12	11.77	12.43	13.08

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT BACK.

Cylinder 6 inches dia. Spindle Whirl $\frac{7}{8}$ inch dia.
Spur portion of Spur and Bevel Compound Gear, - - 60 teeth.
Bevel portion of Spur and Bevel Compound Gear, - - 24 teeth.
Bevel Gear on Front Roll Sleeve, - - - - - - 48 teeth.
Front Roll 1 inch diameter.

PULLEY ON CYLINDER SHAFT 11 INCHES DIAMETER.

Change Speed Gear.	Diameter of Rim Pulley in Inches.										
	10	11	12	13	14	15	16	17	18	19	20
	Twist per Inch.										
16	14.13	15.55	16.96	18.37	19.79	21.20	22.62	24.03	25.44	26.86	28.27
17	13.28	14.61	15.93	17.26	18.59	19.92	21.25	22.57	23.90	25.23	26.56
18	12.54	13.79	15.05	16.30	17.56	18.81	20.07	21.32	22.58	23.83	25.09
19	11.88	13.07	14.26	15.44	16.63	17.82	19.01	20.20	21.39	22.57	23.76
20	11.29	12.41	13.54	14.67	15.80	16.93	18.06	19.19	20.32	21.45	22.58
21	10.75	11.82	12.90	13.97	15.05	16.12	17.20	18.27	19.35	20.42	21.50
22	10.23	11.25	12.28	13.30	14.33	15.35	16.37	17.40	18.42	19.44	20.47
23	9.81	10.79	11.78	12.76	13.74	14.72	15.70	16.68	17.66	18.64	19.62
24	9.40	10.34	11.28	12.22	13.16	14.10	15.04	15.98	16.92	17.86	18.80
25	9.03	9.93	10.83	11.74	12.64	13.54	14.45	15.35	16.25	17.16	18.06
26	8.68	9.55	10.42	11.29	12.15	13.02	13.89	14.76	15.63	16.50	17.36
27	8.36	9.19	10.03	10.87	11.70	12.52	13.37	14.21	15.05	15.88	16.72
28	8.06	8.87	9.67	10.48	11.28	12.09	12.90	13.70	14.51	15.32	16.10
29	7.78	8.56	9.34	10.12	10.90	11.68	12.45	13.24	14.01	14.79	15.57
30	7.52	8.26	9.02	9.77	10.53	11.29	12.04	12.80	13.55	14.31	15.09
31	7.28	8.01	8.73	9.46	10.19	10.92	11.65	12.38	13.10	13.83	14.56
32	7.05	7.75	8.46	9.16	9.87	10.57	11.28	11.98	12.69	13.39	14.10
33	6.84	7.52	8.21	8.89	9.57	10.26	10.94	11.62	12.31	12.99	13.68
34	6.64	7.30	7.96	8.63	9.29	9.96	10.62	11.28	11.95	12.61	13.28
35	6.45	7.09	7.75	8.39	9.04	9.68	10.33	10.97	11.62	12.27	12.91
36	6.27	6.89	7.52	8.15	8.77	9.40	10.03	10.65	11.28	11.91	12.54
37	6.10	6.71	7.32	7.93	8.54	9.15	9.76	10.37	10.98	11.59	12.20
38	5.91	6.53	7.12	7.72	8.31	8.91	9.50	10.09	10.69	11.28	11.88

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT BACK.

Cylinder 6 inches dia. Spindle Whirl $\frac{7}{8}$ inch dia.
Spur portion of Spur and Bevel Compound Gear, - - 60 teeth.
Bevel portion of Spur and Bevel Compound Gear, - - 24 teeth.
Bevel Gear on Front Roll Sleeve, - - - - - - 48 teeth.
Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 12 INCHES DIAMETER.

Change Speed Gear.	Diameter of Rim Pulley in Inches.										
	10	11	12	13	14	15	16	17	18	19	20
	Twist per Inch.										
16	12.94	14.23	15.52	16.82	18.11	19.41	20.70	21.99	23.29	24.88	25.88
17	12.17	13.39	14.61	15.83	17.04	18.26	19.48	20.69	21.91	23.14	24.36
18	11.50	12.65	13.80	14.95	16.10	17.25	18.40	19.55	20.70	21.85	23.01
19	10.89	11.97	13.06	14.15	15.24	16.33	17.42	18.51	19.60	20.69	21.78
20	10.35	11.38	12.42	13.45	14.49	15.52	16.55	17.58	18.62	19.65	20.69
21	9.85	10.83	11.82	12.80	13.79	14.77	15.76	16.74	17.73	18.71	19.71
22	9.40	10.34	11.28	12.22	13.16	14.10	15.04	15.98	16.92	17.86	18.80
23	9.00	9.90	10.80	11.70	12.61	13.51	14.41	15.51	16.21	17.11	18.01
24	8.62	9.48	10.34	11.20	12.06	12.93	13.79	14.65	15.51	16.37	17.24
25	8.28	9.10	9.93	10.76	11.59	12.42	13.24	14.07	14.90	15.73	16.56
26	7.96	8.75	9.55	10.34	11.14	11.94	12.73	13.53	14.32	15.12	15.92
27	7.66	8.42	9.19	9.95	10.72	11.49	12.25	13.02	13.78	14.55	15.32
28	7.39	8.14	8.88	9.62	10.36	11.10	11.84	12.58	13.32	14.06	14.81
29	7.13	7.84	8.56	9.28	9.99	10.71	11.43	12.15	12.86	13.58	14.30
30	6.90	7.59	8.28	8.97	9.66	10.35	11.04	11.73	12.42	13.11	13.80
31	6.67	7.33	8.00	8.67	9.33	10.00	10.67	11.33	12.00	12.67	13.34
32	6.46	7.10	7.76	8.40	9.05	9.69	10.34	10.98	11.63	12.28	12.92
33	6.26	6.88	7.51	8.14	8.76	9.39	10.02	10.64	11.27	11.90	12.53
34	6.08	6.68	7.29	7.90	8.51	9.12	9.73	10.34	10.95	11.56	12.18
35	5.91	6.50	7.09	7.69	8.28	8.88	9.47	10.06	10.66	11.25	11.85
36	5.75	6.31	6.89	7.47	8.05	8.63	9.20	9.78	10.36	10.94	11.52
37	5.58	6.16	6.72	7.28	7.84	8.40	8.96	9.52	10.08	10.64	11.21
38	5.47	6.01	6.56	7.10	7.65	8.19	8.74	9.28	9.83	10.37	10.93

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT BACK.

Cylinder 6 inches dia.
Spur portion of Spur and Bevel Compound Gear, 50 teeth.
Bevel portion of Spur and Bevel Compound Gear, 24 teeth.
Spindle Whirl 1 inch dia.
Bevel Gear on Front Roll Sleeve, 48 teeth.
Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 10 INCHES DIAMETER.

Change Speed Gear.	DIAMETER OF RIM PULLEY IN INCHES.										
	10	11	12	13	14	15	16	17	18	19	20
	TWIST PER INCH.										
24	7.56	8.30	9.06	9.82	10.58	11.34	12.09	12.85	13.60	14.36	15.12
25	7.25	7.97	8.70	9.42	10.14	10.87	11.60	12.32	13.05	13.78	14.51
26	6.97	7.67	8.37	9.07	9.77	10.47	11.16	11.86	12.56	13.26	13.96
27	6.72	7.37	8.04	8.71	9.38	10.06	10.73	11.40	12.07	12.74	13.42
28	6.48	7.12	7.77	8.42	9.08	9.72	10.38	11.01	11.65	12.30	12.95
29	6.25	6.87	7.50	8.12	8.75	9.37	10.00	10.62	11.25	11.87	12.50
30	6.04	6.64	7.24	7.85	8.45	9.06	9.66	10.26	10.87	11.46	12.07
31	5.85	6.43	7.02	7.60	8.19	8.77	9.36	9.94	10.53	11.11	11.70
32	5.67	6.23	6.80	7.37	7.93	8.50	9.07	9.63	10.20	10.77	11.34
33	5.49	6.03	6.58	7.13	7.68	8.23	8.78	9.33	9.88	10.43	10.98
34	5.33	5.86	6.39	6.92	7.46	7.99	8.52	9.05	9.58	10.11	10.65
35	5.18	5.69	6.21	6.73	7.25	7.77	8.28	8.80	9.32	9.84	10.36
36	5.04	5.54	6.04	6.55	7.05	7.50	8.06	8.56	9.07	9.57	10.08
37	4.90	5.39	5.88	6.37	6.86	7.35	7.84	8.33	8.82	9.31	9.80
38	4.77	5.24	5.72	6.20	6.67	7.15	7.63	8.10	8.58	9.06	9.54

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT BACK.

Cylinder 6 inches dia.
Spur portion of Spur and Bevel Compound Gear, 50 teeth.
Bevel portion of Spur and Bevel Compound Gear, 24 teeth.
Spindle Whirl 1 inch dia.
Bevel Gear on Front Roll Sleeve, 48 teeth.
Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 11 INCHES DIAMETER.

Change Speed Gear.	DIAMETER OF RIM PULLEY IN INCHES.										
	10	11	12	13	14	15	16	17	18	19	20
	TWIST PER INCH.										
24	6.87	7.55	8.24	8.93	9.61	10.30	10.99	11.67	12.36	13.05	13.74
25	6.59	7.24	7.90	8.56	9.22	9.88	10.54	11.20	11.86	12.52	13.18
26	6.34	6.96	7.60	8.23	8.87	9.51	10.14	10.78	11.41	12.05	12.69
27	6.10	6.71	7.32	7.93	8.54	9.15	9.76	10.37	10.98	11.59	12.21
28	5.89	6.47	7.06	7.65	8.24	8.84	9.41	10.00	10.60	11.19	11.77
29	5.65	6.22	6.77	7.36	7.92	8.47	9.06	9.65	10.22	10.81	11.37
30	5.49	6.03	6.58	7.13	7.68	8.23	8.78	9.33	9.88	10.43	10.98
31	5.32	5.85	6.38	6.91	7.45	7.98	8.51	9.04	9.58	10.11	10.65
32	5.15	5.66	6.18	6.70	7.21	7.73	8.24	8.76	9.28	9.80	10.32
33	4.99	5.48	5.98	6.48	6.98	7.48	7.98	8.48	8.98	9.48	9.98
34	4.85	5.33	5.82	6.30	6.79	7.27	7.76	8.24	8.73	9.21	9.70
35	4.71	5.18	5.65	6.12	6.59	7.06	7.53	8.00	8.47	8.94	9.42
36	4.58	5.03	5.49	5.95	6.41	6.87	7.32	7.79	8.25	8.71	9.17
37	4.45	4.89	5.34	5.78	6.23	6.67	7.12	7.56	8.01	8.46	8.91
38	4.34	4.77	5.20	5.64	6.07	6.51	6.94	7.37	7.81	8.24	8.68

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT BACK.

Cylinder 6 inches dia.
Spur portion of Spur and Bevel Compound Gear 50 teeth.
Bevel portion of Spur and Bevel Compound Gear 24 teeth.
Spindle Whirl 1 inch dia.
Bevel Gear on Front Roll Sleeve 48 teeth.
Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 12 INCHES DIAMETER.

Change Speed Gear.	DIAMETER OF RIM PULLEY IN INCHES. 10	11	12	13	14	15	16	17	18	19	20
	TWIST PER INCH.										
24	6.30	6.93	7.56	8.19	8.82	9.45	10.07	10.70	11.33	11.96	12.59
25	6.04	6.64	7.21	7.85	8.45	9.06	9.66	10.26	10.87	11.46	12.07
26	5.81	6.38	6.96	7.55	8.13	8.71	9.28	9.86	10.44	11.02	11.60
27	5.60	6.16	6.72	7.28	7.84	8.40	8.96	9.52	10.08	10.64	11.20
28	5.40	5.94	6.48	7.02	7.56	8.10	8.64	9.18	9.72	10.26	10.80
29	5.21	5.72	6.24	6.76	7.28	7.80	8.32	8.84	9.36	9.88	10.40
30	5.04	5.54	6.04	6.55	7.05	7.50	8.06	8.56	9.07	9.57	10.08
31	4.87	5.35	5.84	6.33	6.81	7.30	7.79	8.27	8.76	9.25	9.74
32	4.72	5.19	5.66	6.12	6.60	7.07	7.54	8.01	8.48	8.94	9.42
33	4.58	5.03	5.49	5.95	6.41	6.87	7.32	7.79	8.25	8.71	9.17
34	4.44	4.88	5.33	5.77	6.22	6.66	7.11	7.55	8.00	8.45	8.90
35	4.32	4.74	5.17	5.61	6.04	6.48	6.91	7.34	7.78	8.21	8.65
36	4.20	4.62	5.04	5.46	5.88	6.30	6.72	7.14	7.56	7.98	8.40
37	4.08	4.48	4.89	5.30	5.71	6.12	6.52	6.93	7.34	7.75	8.16
38	3.97	4.36	4.76	5.16	5.55	5.95	6.35	6.74	7.14	7.53	7.93

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT BACK.

Cylinder 6 inches dia. Spindle Whirl 1 inch dia.
Spur portion of Spur and Bevel Compound Gear, - - 55 teeth.
Bevel portion of Spur and Bevel Compound Gear, - - 24 teeth.
Bevel Gear on Front Roll Sleeve, - - - - - - 48 teeth.
Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 10 INCHES DIAMETER.

Change Speed Gear.	Diameter of Rim Pulley in Inches.										
	10	11	12	13	14	15	16	17	18	19	20
	Twist per Inch.										
16	12.47	13.72	14.96	16.21	17.46	18.70	19.95	21.20	22.45	23.69	24.94
17	11.74	12.91	14.09	15.27	16.44	17.62	18.79	19.96	21.14	22.31	23.49
18	11.08	12.19	13.30	14.41	15.52	16.63	17.75	18.84	19.95	21.06	22.17
19	10.50	11.55	12.60	13.65	14.70	15.75	16.80	17.85	18.90	19.95	21.00
20	9.97	10.97	11.97	12.97	13.97	14.96	15.96	16.96	17.96	18.96	19.96
21	9.50	10.45	11.40	12.35	13.30	14.25	15.20	16.16	17.11	18.06	19.01
22	9.07	9.97	10.88	11.79	12.69	13.60	14.50	15.41	16.32	17.22	18.13
23	8.67	9.54	10.41	11.28	12.14	13.01	13.88	14.75	15.61	16.48	17.35
24	8.31	9.14	9.97	10.81	11.65	12.48	13.31	14.14	14.97	15.80	16.64
25	7.98	8.78	9.57	10.37	11.17	11.97	12.77	13.57	14.36	15.16	15.96
26	7.67	8.44	9.21	9.97	10.74	11.51	12.28	13.04	13.81	14.58	15.35
27	7.39	8.13	8.86	9.60	10.34	11.08	11.82	12.56	13.30	14.04	14.78
28	7.12	7.83	8.55	9.26	9.97	10.69	11.40	12.11	12.82	13.54	14.25
29	6.88	7.56	8.25	8.94	9.63	10.32	11.00	11.69	12.38	13.07	13.76
30	6.65	7.31	7.98	8.64	9.31	9.97	10.64	11.30	11.97	12.63	13.30
31	6.43	7.08	7.72	8.36	9.01	9.65	10.30	10.94	11.58	12.23	12.87
32	6.23	6.85	7.48	8.10	8.73	9.35	9.97	10.60	11.22	11.84	12.47
33	6.04	6.65	7.25	7.86	8.46	9.07	9.67	10.27	10.88	11.48	12.09
34	5.87	6.45	7.04	7.63	8.21	8.80	9.39	9.97	10.56	11.15	11.74
35	5.70	6.27	6.84	7.41	7.98	8.55	9.12	9.69	10.26	10.83	11.40
36	5.54	6.09	6.65	7.20	7.76	8.31	8.86	9.42	9.97	10.53	11.08
37	5.39	5.93	6.47	7.01	7.55	8.09	8.63	9.16	9.70	10.24	10.78
38	5.25	5.77	6.30	6.82	7.35	7.87	8.40	8.92	9.45	9.97	10.50

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT BACK.

Cylinder 6 inches dia. Spindle Whirl 1 inch dia.
Spur portion of Spur and Bevel Compound Gear, - - 55 teeth.
Bevel portion of Spur and Bevel Compound Gear, - - 24 teeth.
Bevel Gear on Front Roll Sleeve, - - - - - - 48 teeth.
Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 11 INCHES DIAMETER.

Change Speed Gear.	DIAMETER OF RIM PULLEY IN INCHES.										
	10	11	12	13	14	15	16	17	18	19	20
	TWIST PER INCH.										
16	11.33	12.47	13.60	14.74	15.87	17.00	18.14	19.27	20.41	21.54	22.67
17	10.67	11.73	12.80	13.87	14.94	16.00	17.07	18.14	19.20	20.27	21.34
18	10.07	11.08	12.09	13.10	14.11	15.11	16.12	17.13	18.14	19.15	20.15
19	9.54	10.50	11.45	12.41	13.36	14.32	15.27	16.23	17.18	18.14	19.09
20	9.07	9.97	10.88	11.79	12.69	13.60	14.50	15.41	16.32	17.22	18.13
21	8.64	9.50	10.36	11.23	12.09	12.96	13.82	14.68	15.55	16.41	17.28
22	8.24	9.07	9.89	10.71	11.54	12.36	13.19	14.01	14.84	15.66	16.49
23	7.88	8.67	9.46	10.25	11.04	11.83	12.61	13.40	14.09	14.98	15.77
24	7.55	8.31	9.07	9.82	10.58	11.33	12.09	12.85	13.60	14.36	15.12
25	7.25	7.98	8.71	9.44	10.16	10.89	11.62	12.34	13.07	13.79	14.52
26	6.97	7.67	8.37	9.07	9.76	10.46	11.16	11.86	12.56	13.25	13.95
27	6.71	7.38	8.06	8.73	9.40	10.07	10.78	11.42	12.09	12.76	13.43
28	6.47	7.12	7.77	8.42	9.07	9.71	10.36	11.01	11.66	12.31	12.95
29	6.25	6.87	7.50	8.13	8.75	9.38	10.00	10.63	11.25	11.88	12.50
30	6.04	6.65	7.25	7.86	8.46	9.07	9.67	10.27	10.88	11.48	12.09
31	5.85	6.43	7.02	7.60	8.19	8.77	9.36	9.95	10.54	11.12	11.71
32	5.66	6.23	6.80	7.36	7.93	8.50	9.07	9.63	10.20	10.77	11.33
33	5.49	6.04	6.59	7.14	7.69	8.24	8.79	9.34	9.89	10.44	10.99
34	5.33	5.86	6.40	6.93	7.47	8.00	8.53	9.07	9.60	10.13	10.67
35	5.18	5.70	6.21	6.73	7.25	7.76	8.28	8.80	9.32	9.84	10.36
36	5.03	5.54	6.04	6.55	7.05	7.55	8.06	8.56	9.07	9.57	10.07
37	4.90	5.39	5.88	6.37	6.86	7.35	7.84	8.33	8.82	9.31	9.80
38	4.77	5.25	5.72	6.20	6.68	7.16	7.63	8.11	8.59	9.07	9.54

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT BACK.

Cylinder 6 inches dia. Spindle Whirl 1 inch dia.
Spur portion of Spur and Bevel Compound Gear, - - 55 teeth.
Bevel portion of Spur and Bevel Compound Gear, - - 24 teeth.
Bevel Gear on Front Roll Sleeve, - - - - - 48 teeth.
Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 12 INCHES DIAMETER.

Change Speed Gear.	DIAMETER OF RIM PULLEY IN INCHES.										
	10	11	12	13	14	15	16	17	18	19	20
	TWIST PER INCH.										
16	10.39	11.43	12.47	13.51	14.55	15.58	16.61	17.64	18.68	19.72	20.75
17	9.78	10.76	11.73	12.71	13.69	14.67	15.65	16.63	17.60	18.58	19.56
18	9.23	10.16	11.08	12.00	12.93	13.85	14.78	15.70	16.62	17.75	18.47
19	8.75	9.62	10.50	11.37	12.25	13.12	14.00	14.88	15.75	16.63	17.50
20	8.31	9.14	9.97	10.81	11.65	12.48	13.31	14.14	14.97	15.80	16.64
21	7.92	8.71	9.50	10.29	11.08	11.88	12.67	13.46	14.25	15.04	15.84
22	7.55	8.31	9.07	9.82	10.58	11.33	12.09	12.85	13.60	14.36	15.12
23	7.23	7.95	8.67	9.39	10.12	10.84	11.56	12.29	13.01	13.73	14.46
24	6.92	7.62	8.31	9.00	9.70	10.39	11.08	11.77	12.47	13.16	13.85
25	6.65	7.31	7.98	8.64	9.31	9.97	10.64	11.30	11.97	12.63	13.30
26	6.39	7.03	7.67	8.31	8.95	9.59	10.23	10.87	11.51	12.15	12.79
27	6.15	6.77	7.39	8.00	8.62	9.23	9.85	10.47	11.08	11.70	12.31
28	5.93	6.53	7.12	7.72	8.31	8.90	9.50	10.09	10.69	11.28	11.87
29	5.73	6.30	6.87	7.45	8.02	8.59	9.17	9.75	10.32	10.90	11.47
30	5.54	6.09	6.65	7.20	7.76	8.31	8.86	9.42	9.97	10.53	11.08
31	5.36	5.90	6.43	6.97	7.51	8.04	8.58	9.12	9.65	10.19	10.73
32	5.19	5.71	6.23	6.75	7.27	7.79	8.31	8.83	9.39	9.87	10.39
33	5.03	5.54	6.04	6.55	7.05	7.55	8.06	8.56	9.07	9.57	10.07
34	4.89	5.38	5.86	6.35	6.84	7.33	7.82	8.31	8.80	9.29	9.78
35	4.71	5.22	5.70	6.17	6.65	7.12	7.60	8.07	8.55	9.02	9.50
36	4.60	5.07	5.54	6.00	6.46	6.92	7.38	7.84	8.31	8.77	9.23
37	4.49	4.94	5.39	5.84	6.29	6.74	7.19	7.64	8.09	8.54	8.99
38	4.37	4.81	5.25	5.68	6.12	6.56	7.00	7.43	7.87	8.31	8.75

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT BACK.

Cylinder 6 inches dia. Spindle Whirl 1 inch dia.
Spur portion of Spur and Bevel Compound Gear, - - 60 teeth.
Bevel portion of Spur and Bevel Compound Gear, - - 24 teeth.
Bevel Gear on Front Roll Sleeve, - - - - - - 48 teeth.
Front Roll 1 inch diameter.

PULLEY ON CYLINDER SHAFT 10 INCHES DIAMETER.

Change Speed Gear.	DIAMETER OF RIM PULLEY IN INCHES.										
	10	11	12	13	14	15	16	17	18	19	20
	TWIST PER INCH.										
16	13.63	14.99	16.35	17.72	19.08	20.44	21.80	23.17	24.53	25.89	27.26
17	12.82	14.11	15.39	16.67	17.95	19.24	20.52	21.80	23.08	24.37	25.65
18	12.11	13.32	14.53	15.74	16.95	18.16	19.38	20.59	21.80	23.01	24.22
19	11.47	12.61	13.76	14.91	16.06	17.20	18.35	19.50	20.64	21.79	22.94
20	10.90	11.99	13.08	14.17	15.26	16.35	17.44	18.53	19.62	20.71	21.80
21	10.38	11.42	12.46	13.49	14.53	15.57	16.61	17.65	18.69	19.72	20.76
22	9.91	10.90	11.89	12.78	13.77	14.77	15.76	16.75	17.74	18.73	19.72
23	9.48	10.42	11.37	12.32	13.27	14.22	15.16	16.11	17.06	18.01	18.96
24	9.08	9.99	10.80	11.71	12.62	13.52	14.43	15.34	16.52	17.16	18.07
25	8.72	9.59	10.46	11.33	12.21	13.08	13.95	14.82	15.70	16.57	17.44
26	8.38	9.22	10.06	10.90	11.74	12.57	13.40	14.24	15.08	15.92	16.76
27	8.07	8.88	9.69	10.50	11.30	12.11	12.92	13.72	14.53	15.34	16.15
28	7.78	8.56	9.34	10.12	10.90	11.68	12.46	13.23	14.01	14.79	15.57
29	7.52	8.27	9.02	9.77	10.52	11.28	12.03	12.78	13.53	14.28	15.04
30	7.26	7.99	8.72	9.44	10.17	10.90	11.63	12.35	13.08	13.81	14.53
31	7.03	7.73	8.44	9.14	9.84	10.55	11.25	11.95	12.66	13.36	14.06
32	6.81	7.49	8.17	8.85	9.54	10.22	10.90	11.58	12.26	12.94	13.63
33	6.60	7.26	7.92	8.59	9.25	9.91	10.57	11.23	11.89	12.55	13.21
34	6.41	7.05	7.69	8.33	8.97	9.62	10.26	10.90	11.54	12.18	12.82
35	6.23	6.85	7.47	8.09	8.72	9.34	9.96	10.59	11.21	11.83	12.46
36	6.05	6.66	7.26	7.84	8.47	9.08	9.69	10.29	10.90	11.50	12.11
37	5.89	6.48	7.07	7.66	8.25	8.84	9.43	10.01	10.60	11.19	11.78
38	5.73	6.21	6.78	7.36	7.93	8.50	9.08	9.65	10.23	10.80	11.38

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT BACK.

Cylinder 6 inches dia. Spindle Whirl 1 inch dia.
Spur portion of Spur and Bevel Compound Gear, - - 60 teeth.
Bevel portion of Spur and Bevel Compound Gear, - - 24 teeth.
Bevel Gear on Front Roll Sleeve, - - - - - - 48 teeth.
Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 11 INCHES DIAMETER.

Change Speed Gear.	Diameter of Rim Pulley in Inches. 10	11	12	13	14	15	16	17	18	19	20
	Twist per Inch.										
16	12.39	13.62	14.86	16.10	17.34	18.58	19.82	21.06	22.30	23.54	24.78
17	11.64	12.80	13.97	15.13	16.30	17.46	18.63	19.79	20.96	22.12	23.29
18	11.01	12.11	13.21	14.31	15.41	16.52	17.62	18.72	19.82	20.92	22.02
19	10.42	11.47	12.51	13.55	14.60	15.64	16.68	17.72	18.77	19.81	20.85
20	9.91	10.90	11.89	12.88	13.87	14.87	15.86	16.85	17.84	18.83	19.82
21	9.44	10.38	11.32	12.27	13.21	14.16	15.10	16.04	16.99	17.93	18.89
22	9.01	9.91	10.81	11.71	12.61	13.51	14.42	15.32	16.22	17.12	18.02
23	8.61	9.48	10.34	11.20	12.06	12.92	13.79	14.65	15.51	16.37	17.24
24	8.26	9.08	9.91	10.73	11.56	12.39	13.21	14.14	14.96	15.79	16.52
25	7.93	8.72	9.51	10.30	11.10	11.89	12.68	13.48	14.27	15.06	15.86
26	7.62	8.38	9.15	9.92	10.68	11.44	12.20	12.97	13.73	14.49	15.25
27	7.34	8.07	8.81	9.54	10.27	11.01	11.74	12.48	13.21	13.94	14.68
28	7.08	7.78	8.49	9.20	9.91	10.62	11.32	12.03	12.74	13.45	14.16
29	6.83	7.51	8.20	8.88	9.56	10.25	10.93	11.62	12.30	12.98	13.67
30	6.60	7.26	7.92	8.59	9.25	9.91	10.57	11.23	11.89	12.55	13.21
31	6.39	7.03	7.62	8.31	8.95	9.59	10.23	10.86	11.50	12.14	12.78
32	6.19	6.81	7.43	8.05	8.67	9.29	9.91	10.52	11.14	11.76	12.38
33	6.07	6.60	7.20	7.80	8.40	9.01	9.61	10.21	10.81	11.41	12.01
34	5.83	6.41	6.99	7.57	8.16	8.74	9.32	9.91	10.49	11.07	11.66
35	5.66	6.22	6.79	7.36	7.92	8.49	9.06	9.62	10.19	10.75	11.32
36	5.50	6.05	6.60	7.15	7.70	8.25	8.80	9.36	9.91	10.46	11.01
37	5.35	5.89	6.42	6.96	7.50	8.03	8.57	9.10	9.64	10.18	10.71
38	5.21	5.73	6.26	6.78	7.30	7.82	8.34	8.86	9.39	9.91	10.43

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT BACK.

Cylinder 6 inches dia. Spindle Whirl 1 in. dia.
Spur portion of Spur and Bevel Compound Gear, - - 60 teeth.
Bevel portion of Spur and Bevel Compound Gear, - - 24 teeth.
Bevel Gear on Front Roll Sleeve, - - - - - - 48 teeth.
Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 12 INCHES DIAMETER.

Change Speed Gear.	DIAMETER OF RIM PULLEY IN INCHES.										
	10	11	12	13	14	15	16	17	18	19	20
	TWIST PER INCH.										
16	11.35	12.49	13.62	14.76	15.90	17.03	18.17	19.30	20.44	21.58	22.71
17	10.69	11.75	12.82	13.87	14.96	16.03	17.10	18.17	19.24	20.31	21.38
18	10.08	11.09	12.10	13.11	14.12	15.13	16.13	17.14	18.15	19.16	20.17
19	9.56	10.52	11.47	12.43	13.39	14.34	15.30	16.26	17.21	18.17	19.13
20	9.08	9.99	10.80	11.71	12.62	13.52	14.43	15.34	16.25	17.16	18.02
21	8.65	9.52	10.39	11.25	12.12	12.98	13.85	14.71	15.58	16.44	17.31
22	8.26	9.08	9.91	10.73	11.56	12.39	13.21	14.18	14.96	15.79	16.52
23	7.90	8.69	9.48	10.27	11.06	11.85	12.64	13.43	14.22	15.01	15.80
24	7.57	8.32	9.08	9.84	10.59	11.35	12.11	12.87	13.62	14.38	15.14
25	7.26	7.79	8.71	9.44	10.17	10.89	11.62	12.35	13.08	13.80	14.53
26	6.98	7.68	8.38	9.08	9.78	10.48	11.18	11.87	12.57	13.28	13.98
27	6.73	7.40	8.07	8.74	9.42	10.09	10.76	11.44	12.11	12.78	13.46
28	6.49	7.13	7.78	8.43	9.08	9.73	10.38	11.03	11.68	12.33	12.98
29	6.26	6.89	7.51	8.14	8.77	9.39	10.02	10.65	11.27	11.90	12.53
30	6.05	6.66	7.26	7.87	8.47	9.08	9.69	10.29	10.90	11.50	12.11
31	5.86	6.44	7.03	7.61	8.20	8.79	9.37	9.96	10.54	11.13	11.72
32	5.67	6.24	6.81	7.38	7.94	8.51	9.08	9.65	10.22	10.78	11.35
33	5.50	6.05	6.60	7.15	7.70	8.25	8.80	9.36	9.91	10.46	11.01
34	5.34	5.87	6.41	6.94	7.48	8.01	8.54	9.08	9.61	10.15	10.68
35	5.19	5.71	6.22	6.74	7.26	7.78	8.30	8.82	9.34	9.86	10.38
36	5.04	5.55	6.05	6.56	7.06	7.57	8.08	8.59	9.10	9.60	10.11
37	4.91	5.40	5.89	6.38	6.87	7.36	7.85	8.34	8.83	9.33	9.82
38	4.78	5.26	5.73	6.21	6.69	7.17	7.65	8.12	8.60	9.08	9.56

All our twist tables are figured with 5 per cent. deducted for slip.

RULE TO FIGURE THE TWIST OF A SELF-ACTING MULE WITH THE RIM PULLEY AT THE SIDE (ATTIC DRIVE).

Multiply the diameter of the rim pulley, the diameter of the cylinder, the number of teeth in the stud gear, and the number of teeth in the gear on front roll sleeve, together, for a dividend, and multiply the diameter of the spindle whirl, the diameter of the pulley on cylinder shaft, the number of teeth in the main shaft gear, the number of teeth in the change speed gear, and the circumference of the front roll, together, for a divisor.

Divide the dividend by the divisor, and the quotient is the theoretical twist of the mule.

Example.

Diameter of Rim Pulley 10 inches.
Diameter of Cylinder 6 inches.
Stud Gear 62 teeth.
Gear on Front Roll Sleeve 40 teeth.

Diameter of Spindle Whirl 1 inch.
Diameter of Cylinder Shaft Pulley 10 inches.
Main Shaft Gear 18 teeth.
Change Speed Gear 16 teeth.
Circum. of Front Roll 3.1416 in.

$$\text{Then } \frac{10\times6\times62\times40}{1\times10\times18\times16\times3.1416}=16.45 \text{ Theoretical Twist.}$$

The above is the theoretical twist, and allowance must be made for loss of twist owing to the fact that the spindle band does not bottom in the spindle whirl, and for slippage of bands.

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT SIDE (ATTIC DRIVE).

Cylinder 6 inches dia. Spindle Whirl ¾ inch dia.
Main Shaft Gear, - - - - - - - - - - 18 teeth.
Stud Gear, - - - - - - - - - - 62 teeth.
Gear on Front Roll Sleeve, - - - - - - - - 40 teeth.
Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 10 INCHES DIAMETER.

Change Speed Gear.	DIAMETER OF RIM PULLEY IN INCHES. TWIST PER INCH. 10	11	12	13	14	15	16	17	18	19	20
16	20.83	22.91	25.00	27.08	29.16	31.25	33.33	35.41	37.50	39.58	41.66
17	19.60	21.56	23.52	25.48	27.44	29.40	31.36	33.32	35.28	37.24	39.21
18	18.51	20.37	22.22	24.07	25.92	27.77	29.63	31.48	33.33	35.18	37.04
19	17.54	19.29	21.05	22.80	24.56	26.31	28.06	29.82	31.57	33.33	35.08
20	16.66	18.33	20.01	21.66	23.33	25.00	26.66	28.33	30.00	31.66	33.33
21	15.87	17.46	19.04	20.63	22.22	23.80	25.39	26.98	28.57	30.15	31.74
22	15.15	16.66	18.18	19.69	21.21	22.72	24.24	25.75	27.27	28.78	30.30
23	14.49	15.94	17.39	18.84	20.29	21.73	23.18	24.63	26.08	27.53	28.98
24	13.88	15.27	16.66	18.05	19.44	20.83	22.22	23.61	25.04	26.38	27.77
25	13.33	14.66	15.99	17.33	18.66	19.99	21.33	22.66	23.96	25.33	26.66
26	12.82	14.10	15.38	16.66	17.94	19.23	20.51	21.79	23.07	24.35	25.64
27	12.31	13.58	14.81	16.04	17.28	18.51	19.75	20.98	22.22	23.45	24.69
28	11.90	13.09	14.28	15.47	16.66	17.85	19.04	20.23	21.42	22.61	23.81
29	11.49	12.64	13.79	14.94	16.09	17.24	18.39	19.53	20.68	21.83	22.98
30	11.11	12.22	13.33	14.44	15.55	16.66	17.77	18.88	19.99	21.11	22.22
31	10.75	11.82	12.90	13.97	15.05	16.13	17.21	18.29	19.36	20.44	21.51
32	10.41	11.45	12.50	13.54	14.58	15.62	16.66	17.75	18.75	19.79	20.83
33	10.10	11.11	12.12	13.13	14.14	15.15	16.16	17.17	18.18	19.19	20.20
34	9.80	10.78	11.76	12.74	13.72	14.70	15.68	16.66	17.64	18.62	19.60
35	9.52	10.47	11.42	12.43	13.38	14.33	15.28	16.24	17.19	18.14	19.07
36	9.25	10.18	11.11	12.03	12.96	13.88	14.81	15.74	16.66	17.59	18.51
37	9.09	9.90	10.81	11.71	12.61	13.51	14.41	15.31	16.21	17.11	18.01
38	8.74	9.62	10.49	11.36	12.24	13.11	13.99	14.86	15.74	16.61	17.49

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT SIDE (ATTIC DRIVE).

Cylinder 6 inches dia. Spindle Whirl $\frac{3}{4}$ inch dia.
Main Shaft Gear, - - - - - - - - 18 teeth.
Stud Gear, - - - - - - - - - - 62 teeth.
Gear on Front Roll Sleeve, - - - - - - - 40 teeth.
Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 11 INCHES DIAMETER.

Change Speed Gear.	Diameter of Rim Pulley in Inches.										
	10	11	12	13	14	15	16	17	18	19	20
	Twist per Inch.										
16	18.94	20.84	22.73	24.63	26.52	28.42	30.31	32.21	34.10	36.00	37.89
17	17.82	19.60	21.38	23.16	24.95	26.73	28.51	30.29	32.07	33.86	35.64
18	16.83	18.51	20.20	21.88	23.56	25.24	26.92	28.60	30.29	31.97	33.65
19	15.94	17.54	19.13	20.73	22.32	23.92	25.51	27.11	28.70	30.30	31.89
20	15.15	16.66	18.18	19.69	21.21	22.72	24.24	25.75	27.27	28.78	30.30
21	14.43	15.87	17.31	18.75	20.20	21.64	23.08	24.53	25.97	27.41	28.86
22	13.77	15.15	16.52	17.90	19.28	20.66	22.03	23.41	24.79	26.17	27.54
23	13.17	14.49	15.81	17.12	18.44	19.76	21.08	22.39	23.71	25.03	26.35
24	12.62	13.88	15.15	16.41	17.67	18.93	20.20	21.46	22.72	23.98	25.25
25	12.12	13.38	14.54	15.75	16.96	18.18	19.39	20.60	21.81	23.02	24.24
26	11.65	12.82	13.98	15.15	16.31	17.48	18.64	19.81	20.97	22.14	23.31
27	11.22	12.34	13.46	14.58	15.71	16.83	17.95	19.07	20.20	21.32	22.44
28	10.82	11.86	12.94	14.02	15.11	16.19	17.27	18.35	19.43	20.52	21.60
29	10.44	11.49	12.53	13.58	14.62	15.67	16.71	17.76	18.80	19.85	20.89
30	10.10	11.11	12.12	13.13	14.14	15.15	16.16	17.17	18.18	19.19	20.20
31	9.77	10.75	11.73	12.70	13.68	14.66	15.64	16.61	17.59	18.57	19.55
32	9.40	10.41	11.36	12.31	13.25	14.20	15.15	16.09	17.04	17.99	18.94
33	9.18	10.10	11.01	11.93	12.85	13.77	14.69	15.60	16.52	17.44	18.36
34	8.91	9.80	10.69	11.58	12.47	13.36	14.25	15.15	16.04	16.93	17.82
35	8.65	9.52	10.38	11.25	12.12	12.98	13.85	14.71	15.58	16.44	17.30
36	8.41	9.25	10.10	10.94	11.78	12.62	13.46	14.30	15.15	15.99	16.83
37	8.19	9.00	9.82	10.64	11.46	12.28	13.10	13.92	14.74	15.56	16.38
38	7.95	8.74	9.54	10.33	11.13	11.92	12.72	13.51	14.31	15.10	15.90

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT SIDE (ATTIC DRIVE).

Cylinder 6 inches dia. Spindle Whirl $\frac{3}{4}$ inch dia.
Main Shaft Gear, - - - - - - - - - - 18 teeth.
Stud Gear, - - - - - - - - - - 62 teeth.
Gear on Front Roll Sleeve, - - - - - - 40 teeth.
Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 12 INCHES DIAMETER.

Change Speed Gear.	DIAMETER OF RIM PULLEY IN INCHES.										
	10	11	12	13	14	15	16	17	18	19	20
	TWIST PER INCH.										
16	17.36	19.09	20.83	22.56	24.30	26.04	27.77	29.51	31.24	32.98	34.72
17	16.33	17.96	19.60	21.23	22.87	24.50	26.13	27.77	29.40	31.03	32.67
18	15.42	16.97	18.51	20.05	21.60	23.14	24.68	26.22	27.77	29.31	30.85
19	14.61	16.08	17.54	19.00	20.46	21.92	23.39	24.85	26.31	27.71	29.23
20	13.88	15.27	16.66	18.05	19.44	20.83	22.22	23.61	25.00	26.38	27.77
21	13.22	14.54	15.87	17.19	18.51	19.83	21.16	22.48	23.81	25.14	26.46
22	12.62	13.88	15.15	16.41	17.67	18.93	20.20	21.46	22.72	23.98	25.25
23	12.05	13.26	14.46	15.67	16.88	18.08	19.29	20.49	21.70	22.91	24.16
24	11.57	12.73	13.88	15.04	16.20	17.35	18.51	19.67	20.83	21.98	23.14
25	11.11	12.22	13.33	14.44	15.55	16.66	17.77	18.88	19.99	21.11	22.22
26	10.68	11.17	12.81	13.88	14.95	16.02	17.09	18.16	19.22	20.29	21.36
27	10.28	11.31	12.34	13.37	14.40	15.43	16.45	17.48	18.51	19.54	20.57
28	9.92	10.91	11.90	12.89	13.88	14.88	15.87	16.86	17.85	18.84	19.84
29	9.57	10.53	11.49	12.45	13.40	14.36	15.32	16.28	17.23	18.19	19.15
30	9.25	10.18	11.11	12.03	12.96	13.88	14.81	15.74	16.66	17.59	18.50
31	8.95	9.85	10.75	11.64	12.54	13.43	14.33	15.23	16.12	17.02	17.91
32	8.68	9.54	10.41	11.28	12.51	13.02	13.88	14.75	15.62	16.49	17.36
33	8.41	9.25	10.10	10.94	11.78	12.62	13.46	14.30	15.15	15.99	16.83
34	8.16	8.98	9.80	10.62	11.44	12.26	13.07	13.89	14.71	15.52	16.34
35	7.93	8.72	9.52	10.31	11.11	11.90	12.69	13.49	14.28	15.07	15.87
36	7.71	8.48	9.25	10.02	10.80	11.57	12.34	13.11	13.88	14.65	15.45
37	7.50	8.25	9.00	9.75	10.50	11.26	12.01	12.76	13.51	14.26	15.01
38	7.28	8.01	8.74	9.47	10.20	10.93	11.65	12.38	13.11	13.84	14.57

All our twist tables are figured with 5 per cent. deducted for slip.

Twist Table—Self-Acting Mule.

Rim Pulley at Side (Attic Drive).

Cylinder 6 inches dia. Spindle Whirl $\frac{3}{4}$ inch dia.
Main Shaft Gear, - - - - - - - - 20 teeth.
Stud Gear, - - - - - - - - - - 62 teeth.
Gear on Front Roll Sleeve, - - - - - - 40 teeth.
Front Roll 1 inch dia.

Pulley on Cylinder Shaft 10 Inches Diameter.

Change Speed Gear.	Twist per Inch. — Diameter of Rim Pulley in Inches.										
	10	11	12	13	14	15	16	17	18	19	20
16	18.75	20.62	22.50	24.37	26.25	28.12	30.00	31.87	33.75	35.62	37.50
17	17.64	19.41	21.17	22.94	24.70	26.47	28.23	29.99	31.76	33.52	35.29
18	16.66	18.33	19.99	21.66	23.33	24.99	26.66	28.33	29.99	31.66	33.33
19	15.78	17.36	18.94	20.52	22.10	23.68	25.26	26.84	28.42	29.99	31.57
20	15.00	16.50	18.00	19.50	21.00	22.50	24.00	25.50	27.00	28.50	30.00
21	14.28	15.71	17.14	18.57	19.99	21.42	22.85	24.28	25.71	27.14	28.57
22	13.63	14.99	16.36	17.72	19.09	20.45	21.81	23.18	24.54	25.90	27.27
23	13.04	14.34	15.65	16.95	18.26	19.56	20.86	22.17	23.47	24.78	26.08
24	12.50	13.75	15.00	16.25	17.50	18.75	20.00	21.25	22.50	23.75	25.00
25	12.00	13.20	14.50	15.70	16.90	18.10	19.30	20.50	21.70	22.90	24.10
26	11.53	12.69	13.84	14.99	16.15	17.30	18.46	19.61	20.76	21.92	23.09
27	11.11	12.22	13.33	14.44	15.55	16.66	17.77	18.88	19.99	21.11	22.22
28	10.71	11.78	12.85	13.92	14.99	16.07	17.14	18.21	19.28	20.35	21.42
29	10.34	11.37	12.41	13.44	14.48	15.51	16.55	17.58	18.61	19.65	20.68
30	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00
31	9.67	10.64	11.61	12.58	13.54	14.51	15.48	16.45	17.41	18.38	19.35
32	9.37	10.31	11.25	12.18	13.12	14.06	15.00	15.93	16.87	17.81	18.75
33	9.09	9.99	10.19	11.81	12.72	13.63	14.54	15.45	16.36	17.27	18.18
34	8.81	9.69	10.58	11.46	12.34	13.22	14.10	14.98	15.87	16.75	17.63
35	8.57	9.42	10.28	11.14	11.99	12.85	13.71	14.57	15.42	16.28	17.14
36	8.33	9.16	9.99	10.38	11.66	12.49	13.33	14.16	14.99	15.83	16.66
37	8.10	8.91	9.72	10.54	11.35	12.16	12.97	13.78	14.59	15.40	16.21
38	7.87	8.68	9.47	10.26	11.05	11.84	12.63	13.41	14.20	14.99	15.78

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT SIDE (ATTIC DRIVE).

Cylinder 6 inches dia. Spindle Whirl $\frac{3}{4}$ inch dia.
Main Shaft Gear, - - - - - - - - 20 teeth.
Stud Gear, - - - - - - - - - - - 62 teeth.
Gear on Front Roll Sleeve, - - - - - - 40 teeth.
Front Roll 1 inch diameter.

PULLEY ON CYLINDER SHAFT 11 INCHES DIAMETER.

Change Speed Gear.	DIAMETER OF RIM PULLEY IN INCHES. 10	11	12	13	14	15	16	17	18	19	20
	TWIST PER INCH.										
16	17.04	18.74	20.45	22.15	23.86	25.56	27.27	28.97	30.68	32.38	34.10
17	16.04	17.64	19.25	20.85	22.45	24.06	25.66	27.27	28.87	30.47	32.08
18	15.15	16.66	18.18	19.69	21.21	22.72	24 24	25.75	27.27	28.78	30.30
19	14.35	15.78	17.22	18.65	20.09	21.52	22 96	24.40	25.83	27.27	28.70
20	13.63	14.99	16.36	17.72	19.09	20.45	21.81	23.18	24.54	25.90	27.27
21	12.98	14.28	15.58	16.88	18.18	19.47	20.77	22.07	23.37	24.67	25.97
22	12.39	13.63	14.87	16.11	17.35	18.59	19 83	21.07	22.31	23.55	24.79
23	11.85	13.04	14.22	15.41	16.59	17.78	18 97	20.15	21.34	22.52	23.71
24	11.36	12.49	13.63	14.77	15.90	17.04	18.18	19.31	20.45	21.58	22.72
25	10.90	11.99	13 09	14.18	15.27	16.36	17.45	18.54	19.63	20.72	21.81
26	10.48	11.53	12 58	13.63	14.68	15.73	16.78	17.83	18.88	19.92	20.97
27	10.10	11.11	12.12	13.13	14.14	15.15	16.16	17.17	18.18	19.19	20.20
28	9.74	10.71	11.68	12.66	13.63	14.61	15.58	16.56	17.54	18.51	19.49
29	9.40	10.34	11.28	12.22	13.16	14.10	15.04	15.98	16.92	17.86	18.80
30	9.09	9.99	10.90	11.81	12.72	13.63	14.54	15.45	16.36	17.27	18.18
31	8.79	9.67	10.55	11.43	12.31	13.19	14.07	14.95	15.83	16.71	17.59
32	8.52	9.37	10.22	11.07	11.93	12.78	13 63	14.48	15.33	16.19	17.04
33	8.26	9.08	9 91	10.74	11.56	12.39	13.22	14.04	14.87	15.69	16.52
34	8.01	8.81	9 61	10.41	11.22	12.02	12.82	13.62	14.42	15.22	16.03
35	7.79	8.57	9.34	10.12	10.90	11.68	12.46	13 24	14.02	14.80	15.58
36	7.57	8.33	9.09	9.84	10.60	11 36	12.12	12.87	13.63	14.39	15.15
37	7.37	8.10	8.84	9.58	10.31	10.05	11.79	12.52	13.26	14.00	14.73
38	7.17	7.89	8.61	9.32	10.04	10.76	11.48	12.19	12.91	13.63	14.35

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT SIDE (ATTIC DRIVE).

Cylinder 6 inches dia. Spindle Whirl $\frac{3}{4}$ inch dia.
Main Shaft Gear, - - - - - - - - - - 20 teeth.
Stud Gear, - - - - - - - - - - - - - 62 teeth.
Gear on Front Roll Sleeve, - - - - - - - 40 teeth.
Front Roll 1 inch diameter.

PULLEY ON CYLINDER SHAFT 12 INCHES DIAMETER.

Change Speed Gear.	DIAMETER OF RIM PULLEY IN INCHES.										
	10	11	12	13	14	15	16	17	18	19	20
	TWIST PER INCH.										
16	15.62	17.18	18.75	20.31	21.87	23.43	25.00	26.51	28.12	29.68	31.25
17	14.70	16.17	17.64	19.11	20.58	22.05	23 52	24.99	26.46	27 93	29.41
18	13.88	15.27	16.66	18.05	19.44	20.83	22 22	23.63	24.99	26.38	27.77
19	13.15	14.46	15.78	17.09	18.41	19.73	21.04	22.35	23.67	24.98	26.30
20	12.50	13.75	15.00	16.25	17.50	18.75	20.00	21.25	22.50	23.75	25.00
21	11.90	13.09	14.28	15.47	16 66	17.85	19.04	20.23	21.42	22.61	23.80
22	11.36	12.49	13.63	14.77	15.90	17.04	18.18	19.31	20.45	21.58	22.72
23	10.86	11.95	13 04	14.12	15.21	16.30	17.38	18.47	19.56	20.64	21.73
24	10.41	11.45	12.50	13.54	14.58	15.62	16.67	17.70	18.75	19.79	20.83
25	10.00	11.00	12.00	13 00	14.00	15.00	16 00	17.00	18.00	19.00	20.00
26	9 61	10.57	11.53	12.49	13.46	14.42	15.38	16.34	17.30	18.26	19.23
27	9.25	10.18	11.11	12.03	12.96	13.88	14.81	15.74	16.66	17.59	18.51
28	8.92	9.82	10 71	11.60	12.49	13.39	14.28	15.17	16.07	16.97	17.86
29	8.62	9.48	10.34	11.20	12.06	12 93	13.79	14.65	15.51	16 37	17.24
30	8.33	9.16	9.99	10.83	11.66	12.49	13.33	14.16	14.99	15.83	16.66
31	8 06	8.86	9 67	10.48	11.28	12.09	12.90	13.70	14.51	15 32	16.12
32	7.81	8.59	9 37	10.15	10.93	11.71	12.49	13.28	14.06	14.84	15.62
33	7.57	8.33	9.09	9.84	10.60	11.36	12.12	12.87	13.63	14.39	15.15
34	7.34	8.08	8.81	9.55	10.28	11.02	11.75	12.48	13.22	13.95	14.69
35	7.15	7.86	8.58	9.27	9.98	10.70	11.42	12.13	12.85	13.57	14.29
36	6.94	7.63	8.33	9.02	9.72	10.41	11.11	11.80	12.49	13.19	13.88
37	6.75	7.43	8.10	8.78	9.45	10.13	10.80	11.46	12.16	12.83	13.51
38	6.57	7.23	7.89	8.55	9 20	9.86	10.52	11.18	11.84	12.49	13.15

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT SIDE (ATTIC DRIVE).

Cylinder 6 inches dia. Spindle Whirl $\frac{7}{8}$ inch dia.
Main Shaft Gear, - - - - - - - - - - 18 teeth.
Stud Gear, - - - - - - - - - - - - - 62 teeth.
Gear on Front Roll Sleeve, - - - - - - - - 40 teeth.
Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 10 INCHES DIAMETER.

Change Speed Gear.	DIAMETER OF RIM PULLEY IN INCHES. 10	11	12	13	14	15	16	17	18	19	20
	TWIST PER INCH.										
16	17.85	19.63	21.42	23.20	24.99	26.77	28.56	30.34	32.13	33.91	35.70
17	16.80	18.48	20.16	21.84	23.02	25.22	26.88	28.56	30.24	31.93	33.60
18	15.86	17.44	19.03	20.62	22.20	23.79	25.38	26.96	28.55	30.13	31.72
19	15.06	16.53	18.04	19.54	21.05	22.55	24.05	25.56	27.06	28.56	30.07
20	14.28	15.71	17.14	18.56	19.99	21.42	22.85	24.28	25.71	27.14	28.56
21	13.60	14.96	16.32	17.68	19.04	20.40	21.76	23.12	24.48	25.84	27.20
22	12.98	14.28	15.58	16.38	18.18	19.47	20.77	22.07	23.37	24.67	25.97
23	12.42	13.66	14.90	16.14	17.38	18.60	19.85	21.09	22.33	23.57	24.81
24	11.90	13.09	14.28	15.47	16.66	17.85	19.04	20.23	21.42	22.61	23.80
25	11.42	12.56	13.70	14.84	15.98	17.13	18.27	19.41	20.54	21.68	22.83
26	10.98	12.08	13.18	14.28	15.38	16.48	17.58	18.67	19.77	20.87	21.97
27	10.58	11.63	12.69	13.75	14.81	15.87	16.92	17.98	19.04	20.10	21.16
28	10.20	11.22	12.24	13.26	14.28	15.30	16.32	17.34	18.36	19.38	20.40
29	9.85	10.83	11.82	12.80	13.79	14.77	15.76	16.74	17.73	18.73	19.72
30	9.52	10.47	11.42	12.37	13.33	14.28	15.23	16.18	17.13	18.09	19.04
31	9.21	10.13	11.05	11.98	12.90	13.82	14.74	15.66	16.58	17.51	18.43
32	8.92	9.82	10.71	11.60	12.49	13.39	14.28	15.17	16.07	16.96	17.85
33	8.65	9.52	10.38	11.25	12.11	12.98	13.85	14.71	15.58	16.44	17.31
34	8.40	9.24	10.08	10.92	11.76	12.60	13.44	14.28	15.12	15.96	16.80
35	8.16	8.97	9.79	10.68	11.41	12.24	13.05	13.87	14.68	15.50	16.32
36	7.93	8.73	9.52	10.31	11.11	11.90	12.69	13.49	14.29	15.09	15.88
37	7.72	8.49	9.26	10.03	10.81	11.58	12.35	13.12	13.89	14.67	15.44
38	7.51	8.26	9.02	9.77	10.52	11.27	12.02	12.78	13.53	14.28	15.03

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT SIDE (ATTIC DRIVE).

Cylinder 6 inches dia. Spindle Whirl $\frac{7}{8}$ inch dia.
Main Shaft Gear, - - - - - - - - - 18 teeth.
Stud Gear, - - - - - - - - - 62 teeth.
Gear on Front Roll Sleeve, - - - - - - - - 40 teeth.
Front Roll 1 inch diameter.

PULLEY ON CYLINDER SHAFT 11 INCHES DIAMETER.

Change Speed Gear.	DIAMETER OF RIM PULLEY IN INCHES.										
	10	11	12	13	14	15	16	17	18	19	20
	TWIST PER INCH.										
16	16.23	17 85	19.47	21.10	22.72	24 34	25.97	27.59	29 21	30.84	32.46
17	15.27	16 80	18.33	19.85	21.38	22.91	24.44	25.96	27.49	29.02	30.55
18	14.42	15.86	17.30	18.74	20.18	21.63	23 07	24.51	25 95	27.39	28.84
19	13.39	14.73	16 07	17.41	18 75	20.09	21.43	22.77	24.11	25.45	26.79
20	12.98	14.28	15.58	16.88	18.18	19.47	20.77	22.07	23.37	24.67	25.97
21	12.36	13 60	14.84	16.07	17.31	18.55	19.78	21.02	22.27	23.49	24.73
22	11.80	12.98	14.16	15.34	16.52	17 70	18.80	20.06	21.24	22.42	23.61
23	11.29	12 42	13.54	14.67	15.80	16.93	18.06	19.19	20.32	21.45	22.58
24	10.82	11.86	12.94	14.02	15.11	16.19	17.27	18.35	19.43	20.52	21.64
25	10.38	11.41	12.45	13.49	14.53	15.57	16 60	17.64	18.68	19.72	20.76
26	9.98	10.98	11.98	12.98	13.98	14.98	15.98	16.98	17.98	18.98	19.97
27	9.61	10.58	11.54	12.50	13 46	14.42	15.39	16.35	17.31	18.27	19.23
28	9.27	10.20	11.13	12.05	12.98	13.91	14.83	15.76	16.69	17.62	18.54
29	8.95	9.85	10.74	11.64	12.53	13.43	14.32	15.22	16.11	17.01	17.91
30	8.65	9.52	10.38	11.25	12.11	12.98	13.85	14.71	15.58	16.44	17.31
31	8.37	9.21	10.05	10.89	11.72	12.56	13.40	14.24	15 08	15.97	16.75
32	8.11	8.92	9.73	10.55	11.36	12 17	12.98	13.79	14.60	15.42	16.23
33	7.87	8.65	9.44	10.23	11.01	11.80	12.59	13.37	14.16	14.95	15.74
34	7.63	8.40	9.16	9.92	10.69	11.45	12.22	12.98	13.74	14.51	15.27
35	7.40	8.14	8.88	9.62	10.36	11.10	11.84	12.58	13.32	14.06	14.80
36	7 21	7.93	8.65	9.38	10.10	10.82	11.54	12.26	12.98	13.71	14.43
37	7.01	7.72	8.42	9.12	9.82	10.52	11.23	11.93	12.63	13.33	14.03
38	6.83	7.51	8.20	8.88	9.56	10.25	10.93	11.61	12.30	12.98	13.66

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT SIDE (ATTIC DRIVE).

Cylinder 6 inches dia. Spindle Whirl $\frac{7}{8}$ inch dia.
Main Shaft Gear, - - - - - - - - - 18 teeth.
Stud Gear, - - - - - - - - - 62 teeth.
Gear on Front Roll Sleeve, - - - - - - - 40 teeth.
Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 12 INCHES DIAMETER.

Change Speed Gear.	Diameter of Rim Pulley in Inches.										
	10	11	12	13	14	15	16	17	18	19	20
	Twist per Inch.										
16	14.88	16.36	17.85	19.34	20.83	22.32	23.80	25.29	26.78	28.27	29.76
17	14.00	15.40	16.80	18.20	19.60	21.00	22.40	23.80	25.20	26.60	28.00
18	13.21	14.53	15.85	17.17	18.49	19.81	21.11	22.45	23.77	25.10	26.48
19	12.53	13.78	15.03	16.28	17.54	18.79	20.04	21.38	22.53	23.73	25.06
20	11.90	13.09	14.28	15.47	16.66	17.85	19.04	20.23	21.42	22.61	23.80
21	11.33	12.46	13.60	14.73	15.87	17.00	18.13	19.27	20.40	21.53	22.67
22	10.82	11.86	12.94	14.02	15.11	16.19	17.27	18.35	19.43	20.52	21.64
23	10.35	11.38	12.42	13.45	14.48	15.51	16.55	17.58	18.62	19.65	20.69
24	9.92	10.91	11.90	12.89	13.88	14.88	15.87	16.86	17.85	18.84	19.84
25	9.51	10.46	11.40	12.37	13.32	14.27	15.27	16.17	17.12	18.08	19.03
26	9.15	10.07	10.98	11.90	12.81	13.73	14.64	15.56	16.47	17.39	18.31
27	8.89	9.78	10.66	11.55	12.44	13.33	14.22	15.11	16.00	16.89	17.78
28	8.50	9.35	10.20	11.05	11.90	12.75	13.60	14.45	15.30	16.15	17.00
29	8.20	9.02	9.85	10.67	11.49	12.31	13.13	13.95	14.77	15.59	16.41
30	7.93	8.72	9.52	10.31	11.10	11.90	12.69	13.48	14.28	15.07	15.87
31	7.68	8.44	9.21	9.93	10.75	11.52	12.28	13.05	13.82	14.59	15.36
32	7.44	8.18	8.92	9.67	10.41	11.16	11.90	12.64	13.39	14.13	14.88
33	7.21	7.93	8.65	9.37	10.09	10.81	11.53	12.25	12.97	13.69	14.42
34	7.00	7.70	8.40	9.10	9.80	10.50	11.20	11.90	12.80	13.30	14.00
35	6.79	7.46	8.16	8.84	9.51	10.19	10.87	11.55	12.21	12.91	13.59
36	6.61	7.27	7.93	8.59	9.26	9.92	10.58	11.24	11.91	12.57	13.23
37	6.43	7.07	7.72	8.36	9.00	9.65	10.29	10.93	11.58	12.22	12.86
38	6.26	6.89	7.51	8.14	8.77	9.39	10.02	10.65	11.27	11.90	12.53

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT SIDE (ATTIC DRIVE).

Cylinder 6 inches dia. Spindle Whirl $\frac{7}{8}$ inch dia.
Main Shaft Gear, - - - - - - - - 20 teeth.
Stud Gear, - - - - - - - - - 62 teeth.
Gear on Front Roll Sleeve, - - - - - - 40 teeth.
Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 10 INCHES DIAMETER.

Change Speed Gear.	Diameter of Rim Pulley in Inches.										
	10	11	12	13	14	15	16	17	18	19	20
	Twist per Inch.										
16	16.07	17.67	19.28	20.88	22.48	24.09	25.69	27.30	28.90	30.50	32.12
17	15.12	16 63	18.15	19.66	21.18	22.69	24.20	25.72	27.23	28.74	30.25
18	14.28	15.71	17.14	18.57	19.99	21.42	22.85	24.28	25.71	27.13	28.56
19	13.53	14.88	16.23	17.58	18.94	20.29	21.74	23.00	24.35	25.70	27.06
20	12 85	14.13	15.42	16.70	17.99	19.27	20.56	21.84	23.13	24.41	25.71
21	12.24	13.46	14.68	15.91	17.13	18.96	19.58	20.80	22.03	23.25	24.48
22	11.68	12.84	14.01	15.18	16.35	17.52	18.68	19.85	21.02	22.19	23.36
23	11.18	12.29	13.40	14.53	15.65	16.77	17.88	19.00	20.12	21.24	22.38
24	10.71	11.78	12.86	13.93	15.01	16.08	17.16	18.23	19.31	20 38	21.46
25	10.28	11.31	12.34	13.37	14.40	15.43	16.45	17.48	18.51	19.54	20.57
26	9.89	10.87	11 86	12.85	13.84	14.83	15.82	16.81	17 80	18.79	19.78
27	9.52	10.47	11.42	12.37	13.32	14.27	15.22	16.18	17.13	18.06	19.03
28	9.18	10.07	11.01	11.93	12.85	13.77	14.68	15.60	16.52	17.44	18.36
29	8.86	9.74	10.63	11.51	12.39	13.28	14.17	15.05	15.93	16.82	17.70
30	8.57	9.42	10.28	11.14	11.99	12.85	13.71	14.56	15.42	16.28	17.14
31	8.29	9.11	9.94	10.77	11.60	12.43	13.26	14.09	14 92	15.78	16.58
32	8.03	8.83	9.63	10.43	11.24	12.01	12.84	13.63	14.44	15.24	16.05
33	7.79	8.56	9.34	10.12	10.90	11.68	12.46	13.24	14.02	14.80	15.58
34	7.56	8.34	9.10	9.85	10.61	11.37	12.13	12.88	13.64	14.40	15.16
35	7.34	8.04	8.80	9.53	10 28	10.99	11.72	12.45	13 18	13.91	14.66
36	7.14	7.85	8.57	9.28	9.99	10.71	11.42	12.14	12.85	13.56	14.28
37	6.95	7.63	8.33	9.02	9.72	10.41	11.11	11.80	12.49	13 19	13.88
38	6.76	7.42	8.10	8.78	9.46	10.13	10.81	11.49	12.17	12 86	13.52

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT SIDE (ATTIC DRIVE).

Cylinder 6 inches dia. Spindle Whirl $\frac{7}{8}$ inch dia.
Main Shaft Gear, - - - - - - - - - - - - - 20 teeth.
Stud Gear, - - - - - - - - - - - - - - - - 62 teeth.
Gear on Front Roll Sleeve, - - - - - - - - - 40 teeth.
Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 11 INCHES DIAMETER.

Change Speed Gear.	Diameter of Rim Pulley in Inches: 10	11	12	13	14	15	16	17	18	19	20
	Twist per Inch.										
16	14.61	16.07	17.53	18.99	20.45	21.91	23.37	24.83	26.92	27.75	29.22
17	13.75	15.12	16.50	17.87	19.25	20.63	22.01	23.38	24.76	25.97	27.51
18	12.98	14.28	15.58	16.88	18.18	19.47	20.77	22.07	23.37	24.67	25.97
19	12.30	13.53	14.76	15.99	17.22	18.45	19.68	20.91	22.14	23.37	24.60
20	11.68	12.84	14.01	15.18	16.35	17.52	18.68	19.85	21.02	22.19	23.36
21	11.13	12.25	13.35	14.47	15.59	16.70	17.82	18.94	20.05	21.16	22.28
22	10.62	11.68	12.74	13.80	14.86	15.93	16.99	18.05	19.11	20.17	21.24
23	10.16	11.17	12.19	13.20	14.22	15.23	16.25	17.26	18.28	19.29	20.31
24	9.74	10.71	11.68	12.66	13.03	14.61	15.58	16.55	17.53	18.50	19.48
25	9.35	10.28	11.21	12.15	13.09	14.02	14.96	15.90	16.83	17.77	18.71
26	8.98	9.88	10.77	11.67	12.56	13.46	14.36	15.25	16.15	17.05	17.95
27	8.65	9.53	10.39	11.26	12.12	12.99	13.85	14.71	15.58	16.44	17.31
28	8.31	9.17	10.00	10.84	11.67	12.50	13.34	14.17	15.00	15.84	16.67
29	8.06	8.87	9.67	10.47	11.28	12.00	12.88	13.67	14.48	15.28	16.09
30	7.88	8.67	9.46	10.25	11.04	11.82	12.60	13.39	14.18	14.97	15.86
31	7.54	8.30	9.06	9.81	10.57	11.33	12.09	12.84	13.60	14.36	15.12
32	7.30	8.04	8.76	9.49	10.22	10.95	11.68	12.41	13.14	13.87	14.60
33	7.08	7.78	8.49	9.20	9.91	10.62	11.32	12.03	12.74	13.45	14.16
34	6.87	7.56	8.25	8.94	9.63	10.31	11.00	11.70	12.38	13.07	13.76
35	6.67	7.33	7.99	8.66	9.32	9.99	10.65	11.31	11.98	12.64	13.31
36	6.49	7.13	7.79	8.43	9.08	9.72	10.37	11.01	11.66	12.31	12.95
37	6.31	6.94	7.57	8.20	8.83	9.46	10.09	10.73	11.36	11.99	12.62
38	6.15	6.76	7.38	7.99	8.61	9.22	9.84	10.45	11.06	11.66	12.29

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT SIDE (ATTIC DRIVE).

Cylinder 6 inches dia. Spindle Whirl $\frac{7}{8}$ inch dia.
Main Shaft Gear, - - - - - - - - - - 20 teeth.
Stud Gear, - - - - - - - - - - - - 62 teeth.
Gear on Front Roll Sleeve, - - - - - - - 40 teeth.
Front Roll 1 inch diameter.

PULLEY ON CYLINDER SHAFT 12 INCHES DIAMETER.

Change Speed Gear.	Diameter of Rim Pulley in Inches.										
	10	11	12	13	14	15	16	17	18	19	20
	Twist per Inch.										
16	13.39	14.73	16.07	17.41	18.75	20 09	21.43	22 77	24.11	25.45	26.79
17	12 60	13.85	15.12	16 38	17.64	18.90	20 17	21.43	22 69	23.95	25.22
18	11.90	13 09	14.28	15.47	16.66	17.85	19.04	20.29	21.42	22.61	23.81
19	11.27	12.40	13.52	14.65	15.78	16.91	18.04	19.17	20.30	21.43	22.56
20	10.71	11.78	12.86	13.93	15.01	16.08	17.16	18.23	19.31	20.38	21.46
21	10.20	11.22	12.24	13.26	14 28	15.30	16.32	17.34	18.36	19.38	20.40
22	9.74	10 71	11.68	12 66	13.63	14.61	15.58	16.55	17.53	18.50	19.48
23	9.31	10.24	11 18	12 11	13 04	13.97	14.90	15.83	16.76	17.69	18 61
24	8.92	9.82	10.71	11.60	12 49	13 38	14.27	15.17	16.08	16.95	17.84
25	8.57	9.42	10.28	11.14	11.99	12 85	13.71	14.56	15.42	16 28	17.14
26	8.24	9.05	9.88	10 70	11.54	12.37	13.19	14.12	14.94	15.77	16.50
27	7.93	8.73	9.52	10.31	11.10	11.89	12.68	13.47	14.26	15.05	15 85
28	7.65	8 42	9.18	9 94	10.71	11.47	12.24	13.00	13.76	14.53	15.29
29	7.38	8.11	8.85	9.59	10.33	10.07	11.81	12.54	13.28	14.02	14.75
30	7.14	7.85	8.57	9.28	9.99	10.71	11.42	12.14	12.85	13.56	14.28
31	6.91	7.60	8.30	8.99	9.69	10.38	11.08	11.77	12.46	13.16	13.85
32	6.68	7.35	8.02	8.69	9.36	10.03	10.70	11.36	12.03	12.70	13.37
33	6.49	7.14	7.78	8.42	9.07	9.72	10 37	11.02	11.67	12.32	12.97
34	6.30	6.93	7.56	8 19	8.82	9.45	10.08	10.71	11.35	11.98	12.61
35	6.12	6.73	7.35	7.96	8.58	9.19	9.81	10.42	11.03	11.65	12.26
36	5.95	6 54	7.14	7.74	8.34	8.94	9 53	10.13	10.73	11.33	11.93
37	5.79	6.36	6.94	7.52	8.10	8 68	9.25	9.83	10.41	10.99	11.57
38	5.63	6.18	6 75	7.31	7.88	8.44	9.00	9.56	10.12	10.69	11.25

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT SIDE (ATTIC DRIVE).

Cylinder 6 inches dia. Spindle Whirl 1 inch dia.
Main Shaft Gear, - - - - - - - - - - 18 teeth.
Stud Gear, - - - - - - - - - - - - - 62 teeth.
Gear on Front Roll Sleeve, - - - - - - - - 40 teeth.
Front Roll 1 inch diameter.

PULLEY ON CYLINDER SHAFT 10 INCHES DIAMETER.

Change Speed Gear.	DIAMETER OF RIM PULLEY IN INCHES. 10	11	12	13	14	15	16	17	18	19	20
	TWIST PER INCH.										
16	15.62	17.18	18.75	20.31	21.87	23.43	25.00	26.56	28.12	29.68	31.25
17	14.70	16.17	17.64	19.11	20.58	22.05	23.52	24.99	26.46	27.93	29.40
18	13.88	15.27	16.66	18.05	19.44	20.83	22.22	23.60	24.99	26.38	27.77
19	13.15	11.47	15.78	17.10	18.41	19.73	21.04	22.36	23.68	24.99	26.31
20	12.50	13.75	15.00	16.25	17.50	18.75	20.00	21.25	22.50	23.77	25.00
21	11.90	13.09	14.28	15.47	16.66	17.85	19.04	20.23	21.42	22.61	23.80
22	11.36	12.49	13.63	14.77	15.90	17.04	18.18	19.31	20.45	21.58	22.72
23	10.86	11.95	13.04	14.12	15.21	16.30	17.39	18.47	19.56	20.65	21.73
24	10.41	11.45	12.49	13.53	14.58	15.62	16.66	17.70	18.74	19.78	20.83
25	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00
26	9.61	10.57	11.53	12.49	13.46	14.42	15.38	16.34	17.30	18.26	19.23
27	9.25	10.18	11.11	12.03	12.96	13.88	14.81	15.74	16.66	17.59	18.51
28	8.92	9.82	10.71	11.60	12.49	13.39	14.28	15.17	16.07	16.96	17.85
29	8.62	9.48	10.34	11.20	12.06	12.93	13.79	14.65	15.51	16.33	17.24
30	8.33	9.16	9.99	10.83	11.66	12.49	13.33	14.16	14.99	15.83	16.66
31	8.06	8.87	9.67	10.48	11.28	12.09	12.90	13.70	14.51	15.32	16.12
32	7.81	8.59	9.37	10.15	10.93	11.71	12.49	13.28	14.06	14.84	15.62
33	7.57	8.33	9.09	9.81	10.60	11.36	12.12	12.87	13.63	14.39	15.15
34	7.35	8.08	8.82	9.55	10.29	11.02	11.76	12.49	13.23	13.96	14.70
35	7.14	7.85	8.57	9.28	9.99	10.71	11.42	12.14	12.85	13.56	14.28
36	6.94	7.63	8.33	9.02	9.72	10.41	11.11	11.80	12.50	13.19	13.88
37	6.75	7.43	8.11	8.78	9.46	10.13	10.81	11.49	12.16	12.84	13.51
38	6.57	7.23	7.89	8.55	9.21	9.86	10.52	11.18	11.84	12.50	13.15

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT SIDE (ATTIC DRIVE).

Cylinder 6 inches dia. Spindle Whirl 1 inch dia.
Main Shaft Gear, - - - - - - - - - 18 teeth.
Stud Gear, - - - - - - - - - - - 62 teeth.
Gear on Front Roll Sleeve, - - - - - - - 40 teeth.
Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 11 INCHES DIAMETER.

Change Speed Gear.	DIAMETER OF RIM PULLEY IN INCHES. TWIST PER INCH. 10	11	12	13	14	15	16	17	18	19	20
16	14.20	15.62	17.04	18.46	19.88	21.30	22.72	24.14	25.56	26.98	28.40
17	13.36	14.70	16.01	17.37	18.71	20.05	21.38	22.72	24.06	25.39	26.73
18	12.62	13.88	15.15	16.41	17.67	18.93	20.20	21.46	22.72	23.99	25.26
19	11.95	13.14	14.34	15.54	16.74	17.94	19.14	20.34	21.54	22.74	23.94
20	13.63	12.49	13.63	14.77	15.90	17.04	18.18	19.31	20.45	21.58	22.72
21	10.82	11.86	12.94	14.02	15.11	16.19	17.27	18.35	19.43	20.52	21.64
22	10.33	11.36	12.39	13.42	14.46	15.49	16.52	17.56	18.59	19.62	20.66
23	9.88	10.86	11.85	12.84	13.83	14.82	15.80	16.79	17.78	18.77	19.76
24	9.46	10.41	11.36	12.30	13.25	14.20	15.15	16.09	17.04	17.99	18.93
25	9.09	9.99	10.90	11.81	12.72	13.63	14.54	15.45	16.36	17.27	18.18
26	8.74	9.61	10.48	11.36	12.23	13.11	13.98	14.85	15.73	16.60	17.48
27	8.41	9.25	10.10	10.94	11.78	12.62	13.46	14.30	15.15	15.99	16.83
28	8.11	8.92	9.74	10.55	11.36	12.17	12.98	13.79	14.61	15.42	16.23
29	7.83	8.61	9.40	10.18	10.97	11.75	12.53	13.32	14.10	14.88	15.67
30	7.57	8.33	9.09	9.84	10.60	11.36	12.12	12.87	13.63	14.39	15.15
31	7.33	8.06	8.79	9.52	10.26	10.99	11.72	12.46	13.19	13.92	14.66
32	7.10	7.81	8.52	9.23	9.94	10.65	11.36	12.07	12.78	13.49	14.20
33	6.88	7.57	8.26	8.95	9.64	10.32	11.01	11.70	12.39	13.08	13.77
34	6.68	7.35	8.01	8.68	9.35	10.02	10.69	11.36	12.02	12.69	13.36
35	6.49	7.14	7.78	8.42	9.07	9.72	10.37	11.02	11.67	12.32	12.97
36	6.31	6.94	7.57	8.20	8.83	9.46	10.09	10.73	11.36	11.99	12.62
37	6.14	6.75	7.37	7.98	8.60	9.21	9.83	10.44	11.05	11.67	12.28
38	5.98	6.57	7.17	7.77	8.37	8.97	9.56	10.17	10.76	11.36	11.96

All our twist tables are figured with 5 per cent. deducted for slip.

Twist Table—Self-Acting Mule.

Rim Pulley at Side (Attic Drive).

Cylinder 6 inches dia. Spindle Whirl 1 inch dia.
Main Shaft Gear, - - - - - - - - - - - 18 teeth.
Stud Gear, - - - - - - - - - - - 62 teeth.
Gear on Front Roll Sleeve, - - - - - - - - - 40 teeth.
Front Roll 1 inch diameter.

Pulley on Cylinder Shaft 12 Inches Diameter.

Change Speed Gear.	Diameter of Rim Pulley in Inches.										
	10	11	12	13	14	15	16	17	18	19	20
	Twist per Inch.										
16	13.02	14.32	15.62	16.92	18.22	19.53	20.83	22.13	23.43	24.73	26.04
17	12.25	13.47	14.70	15.93	17.15	18.38	19.60	20.83	22.05	23.28	24.50
18	11.57	12.73	13.88	15.04	16.20	17.35	18.51	19.67	20.83	21.98	23.14
19	10.76	12.05	13.15	14.25	15.34	16.44	17.53	18.63	19.73	20.82	21.92
20	10.41	11.45	12.50	13.54	14.58	15.62	16.66	17.75	18.75	19.79	20.83
21	9.92	10.91	11.90	12.89	13.88	14.88	15.87	16.86	17.85	18.84	19.84
22	9.46	10.41	11.36	12.30	13.25	14.20	15.15	16.09	17.04	17.99	18.93
23	9.05	9.96	10.86	11.77	12.67	13.58	14.49	15.39	16.30	17.20	18.11
24	8.68	9.54	10.41	11.28	12.15	13.02	13.88	14.75	15.62	16.49	17.36
25	8.33	9.16	9.99	10.83	11.66	12.49	13.33	14.16	14.99	15.83	16.66
26	8.01	8.81	9.61	10.41	11.21	12.01	12.80	13.61	14.41	15.21	16.01
27	7.71	8.48	9.25	10.02	10.80	11.57	12.34	13.11	13.88	14.65	15.43
28	7.44	8.18	8.92	9.67	10.41	11.16	11.90	12.64	13.39	14.13	14.87
29	7.18	7.90	8.61	9.33	10.05	10.77	11.49	12.21	12.92	13.64	14.36
30	6.94	7.63	8.32	9.02	9.71	10.41	11.10	11.79	12.49	13.18	13.88
31	6.72	7.39	8.06	8.73	9.40	10.08	10.75	11.42	12.09	12.76	13.44
32	6.51	7.16	7.81	8.46	9.11	9.76	10.41	11.06	11.71	12.36	13.02
33	6.31	6.91	7.57	8.20	8.83	9.46	10.08	10.71	11.34	11.97	12.62
34	6.12	6.73	7.35	7.96	8.57	9.18	9.80	10.41	11.02	11.63	12.25
35	5.95	6.56	7.14	7.74	8.34	8.93	9.52	10.11	10.71	12.30	11.90
36	5.78	6.36	6.94	7.52	8.10	8.67	9.25	9.83	10.41	10.99	11.58
37	5.63	6.19	6.75	7.32	7.88	8.44	9.01	9.57	10.13	10.70	11.26
38	5.48	6.03	6.57	7.12	7.67	8.22	8.77	9.31	9.86	10.41	10.96

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT SIDE (ATTIC DRIVE).

Cylinder 6 inches dia. Spindle Whirl 1 inch dia.
Main Shaft Gear, - - - - - - - - 20 teeth.
Stud Gear, - - - - - - - - - - 62 teeth.
Gear on Front Roll Sleeve, - - - - - - 40 teeth.
Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 10 INCHES DIAMETER.

Change Speed Gear.	DIAMETER OF RIM PULLEY IN INCHES.										
	10	11	12	13	14	15	16	17	18	19	20
	TWIST PER INCH.										
16	14.06	15.47	16.87	18.28	19.68	21.09	22.50	23.90	25.31	26.72	28.12
17	13.23	14.54	15.87	17.19	18 51	19.83	21.16	22.48	23.81	25.14	26.46
18	12.50	13.75	15.00	16.25	17.50	18.75	20.00	21.25	22.50	23.75	25.00
19	11.84	13.02	14.20	15.39	16.57	17.76	18.95	20.13	21.32	22.50	23.68
20	11.25	12.38	13.50	14.62	15.75	16.87	18.00	19.13	20.26	21.39	22.51
21	10.71	11.78	12.86	13.93	15.01	16.08	17.16	18.23	19.31	20.38	21.46
22	10.22	11.24	12.26	13.28	14.30	15.33	16.35	17.37	18.39	19.41	20.45
23	9.78	10.76	11.74	12.71	13.69	14.67	15.65	16.62	17.60	18.59	19 57
24	9.37	10.31	11.25	12.18	13.12	14.06	15.00	15 93	16.87	17.81	18 75
25	9.00	9.90	10.80	11.70	12.60	13.50	14.40	15.30	16 20	17.10	18.00
26	8.65	9.51	10.37	11.24	12.10	12.97	13.83	14.69	15.56	16 42	17.29
27	8.33	9.16	9.99	10.83	11.66	12 49	13 33	14.16	14.99	15.83	16 66
28	8.03	8.83	9.63	10.43	11.24	12.04	12.84	13.64	14.44	15.24	16 05
29	7.75	8 52	9.30	10.07	10.85	11.62	12.40	13.17	13 95	14.72	15.50
30	7.50	8.24	9.00	9.75	10.50	11.25	12 00	12.76	13.51	14.26	15.01
31	7.25	7.97	8.70	9.42	10.14	10.87	11.60	12.32	13.05	13.78	14 51
32	7.03	7.73	8.44	9.14	9.84	10.55	11.25	11.95	12.66	13.36	14.06
33	6.81	7.49	8.17	8.85	9.54	10.22	10 90	11.58	12.26	12.94	13.63
34	6.61	7.27	7.93	8 60	9.26	9.92	10.58	11 24	11.90	12.56	13 22
35	6.42	7.06	7.70	8.34	8.98	9.63	10.27	11.91	11.55	12.19	12.83
36	6 25	6.87	7.49	8.11	8.74	9.36	9.98	10.61	11.23	11.85	12.48
37	6.08	6.68	7.29	7.90	8.51	9.14	9.73	10.34	10.95	11.56	12.18
38	5.92	6.51	7.10	7.70	8 29	8.90	9.48	10.07	10.67	11.26	11.86

All our twist tables are figured with 5 per cent. deducted for slip.

Twist Table—Self-Acting Mule.

Rim Pulley at Side (Attic Drive).

Cylinder 6 inches dia. Spindle Whirl 1 inch dia.
Main Shaft Gear, - - - - - - - - - - 20 teeth.
Stud Gear, - - - - - - - - - - - 62 teeth.
Gear on Front Roll Sleeve, - - - - - - - 40 teeth.
Front Roll 1 inch dia.

Pulley on Cylinder Shaft 11 Inches Diameter.

Change Speed Gear.	Diameter of Rim Pulley in Inches.										
	10	11	12	13	14	15	16	17	18	19	20
	Twist per Inch.										
16	12.78	14.05	15.33	16.61	17.89	19.17	20.46	21.71	22.99	24.27	25.56
17	12.03	13.23	14.43	15.63	16.84	18.04	19.24	20.45	21.65	22.85	24.06
18	11.36	12.49	13.63	14.77	15.90	17.04	18.18	19.31	20.45	21.58	22.72
19	10.76	11.81	12.91	13.98	15.06	16.14	17.22	18.30	19.37	20.45	21.52
20	10.22	11.24	12.26	13.28	14.30	15.33	16.35	17.37	18.39	19.41	20.45
21	9.84	10.82	11.81	12.79	13.78	14.76	15.75	16.73	17.72	18.71	19.71
22	9.29	10.22	11.14	12.07	13.00	13.92	14.85	15.78	16.71	17.64	18.58
23	8.89	9.77	10.66	11.55	12.43	13.32	14.21	15.10	15.98	16.87	17.76
24	8.52	9.37	10.23	11.18	11.93	12.79	13.64	14.49	15.35	16.20	17.05
25	8.18	8.99	9.81	10.63	11.45	12.27	13.09	13.91	14.73	15.55	16.37
26	7.86	8.65	9.44	10.22	11.01	11.79	12.58	13.36	14.15	14.93	15.72
27	7.57	8.34	9.10	9.85	10.61	11.37	12.13	12.88	13.64	14.40	15.16
28	7.30	8.03	8.76	9.49	10.22	10.95	11.68	12.41	13.14	13.87	14.60
29	7.05	7.75	8.46	9.16	9.87	10.57	11.28	11.98	12.69	13.39	14.12
30	6.81	7.49	8.17	8.85	9.54	10.22	10.90	11.58	12.26	12.94	13.63
31	6.59	7.24	7.90	8.56	9.22	9.88	10.54	11.20	11.86	12.52	13.18
32	6.39	7.03	7.67	8.31	8.95	9.59	10.23	10.86	11.50	12.14	12.78
33	6.19	6.81	7.43	8.05	8.66	9.28	9.90	10.51	11.13	11.75	12.37
34	6.01	6.61	7.21	7.81	8.41	9.02	9.62	10.22	10.82	11.42	12.02
35	5.84	6.42	7.01	7.59	8.18	8.76	9.35	9.93	10.52	11.10	11.69
36	5.68	6.24	6.74	7.36	7.93	8.50	9.07	9.64	10.20	10.79	11.36
37	5.52	6.07	6.62	7.17	7.72	8.28	8.83	9.39	9.93	10.49	11.05
38	5.35	5.88	6.41	6.95	7.48	8.01	8.55	9.07	9.60	10.13	10.68

All our twist tables are figured with 5 per cent. deducted for slip.

TWIST TABLE—SELF-ACTING MULE.

RIM PULLEY AT SIDE (ATTIC DRIVE).

Cylinder 6 inches dia. Spindle Whirl 1 inch dia.
Main Shaft Gear, - - - - - - - - 20 teeth.
Stud Gear, - - - - . - - - - - 62 teeth.
Gear on Front Roll Sleeve, - - - - - - - 40 teeth.
Front Roll 1 inch dia.

PULLEY ON CYLINDER SHAFT 12 INCHES DIAMETER.

Change Speed Gear.	DIAMETER OF RIM PULLEY IN INCHES.										
	10	11	12	13	14	15	16	17	18	19	20
	TWIST PER INCH.										
16	11.72	12.89	14.06	15.23	16.40	17.58	18.75	19.92	21.09	22.26	23.43
17	11.03	12.13	13.23	14.34	15.44	16.54	17.65	18.75	19.85	20.95	22.05
18	10.41	11.45	12.50	13.54	14.58	15.62	16.67	17.70	18.75	19.79	20.83
19	9.87	10.85	11.84	12.83	13.82	14.81	15.80	16.79	17.78	18.77	19.76
20	9.37	10.31	11.25	12.18	13.12	14.06	15.00	15.93	16.87	17.81	18.74
21	8.92	9.82	10.71	11.60	12.49	13.38	14.27	15.17	16.06	16.95	17.84
22	8.52	9.37	10.22	11.07	11.93	12.78	13.63	14.48	15.33	16.19	17.04
23	8.15	8.96	9.77	10.59	11.40	12.22	13.03	13.84	14.66	15.47	16.29
24	7.81	8.59	9.37	10.15	10.93	11.71	12.49	13.28	14.06	14.84	15.62
25	7.50	8.24	9.00	9.75	10.50	11.25	12.00	12.76	13.51	14.26	15.01
26	7.21	7.93	8.65	9.37	10.09	10.81	11.53	12.25	12.97	13.69	14.41
27	6.94	7.63	8.32	9.02	9.71	10.49	11.10	11.79	12.49	13.18	13.88
28	6.69	7.36	8.04	8.70	9.37	10.04	10.70	11.37	12.03	12.70	13.37
29	6.46	7.11	7.76	8.40	9.05	9.70	10.34	10.99	11.63	12.28	12.93
30	6.25	6.86	7.49	8.12	8.74	9.38	10.02	10.63	11.26	11.89	12.52
31	6.04	6.64	7.24	7.85	8.45	9.06	9.66	10.26	10.87	11.46	12.07
32	5.86	6.44	7.03	7.61	8.20	8.79	9.37	9.96	10.54	11.13	11.72
33	5.68	6.24	6.74	7.36	7.93	8.50	9.07	9.64	10.20	10.79	11.36
34	5.51	6.06	6.61	7.16	7.71	8.26	8.81	9.37	9.92	10.47	11.02
35	5.35	5.88	6.41	6.95	7.48	8.01	8.55	9.07	9.60	10.13	10.68
36	5.20	5.72	6.25	6.77	7.29	7.81	8.33	8.85	9.38	9.90	10.41
37	5.06	5.56	6.07	6.58	7.09	7.60	8.11	8.62	9.13	9.64	10.15
38	4.93	5.42	5.91	6.40	6.89	7.38	7.87	8.36	8.85	9.35	9.84

All our twist tables are figured with 5 per cent. deducted for slip.

SELF-ACTING MULE.

RULE TO FIND THE DRAFT OF A MULE.

Multiply the diameter of the front roll, the number of teeth in the crown gear, and the number of teeth in the back roll gear, together, for a dividend; and multiply the diameter of the back roll, the number of teeth in the change draft gear, and the number of teeth in the front roll gear, together, for a divisor.

Divide the dividend by the divisor, and the quotient is the draft of the mule.

EXAMPLE.

Dia. of Front Roll 1 in. or $\frac{8}{8}$.
Crown Gear 110 teeth.
Back Roll Gear 70 teeth.

Gear on Front Roll 30 teeth.
Change Draft Gear 30 teeth.
Dia. of Back Roll $\frac{7}{8}$ in.

$$\text{Then } \frac{8\times110\times70}{30\times30\times7}=9.77\text{, Draft.}$$

To obtain a constant number for draft, proceed as above, only omit the draft gear.

EXAMPLE.

Dia. of Front Roll 1 in. or $\frac{8}{8}$.
Crown Gear 110 teeth.
Back Roll Gear 70 teeth.

Gear on Front Roll 30 teeth.
Dia. of Back Roll $\frac{7}{8}$ in.

$$\text{Then } \frac{8\times110\times70}{30\times-\times7}=293.30\text{, Draft Constant Number.}$$

The constant number divided by the number of teeth in the change draft gear gives the draft; and the constant number divided by the draft required will give the number of teeth in the draft gear.

SELF-ACTING MULE.

TABLE OF DRAFTS.

Diameter of Front Roll 1 inch.
Diameter of Back Roll ⅞ inch.
Front Roll Gear 30 teeth.
Change Gear 26 to 58 teeth.
Crown Gear 110 teeth.
Back Roll Gear 70 teeth.

DRAFT CONSTANT 293.40

Change Gear.	Draft.	Change Gear.	Draft.
26	11.28	43	6.82
27	10.86	44	6.67
28	10.48	45	6.52
29	10.11	46	6.38
30	9.78	47	6.24
31	9.46	48	6.11
32	9.17	49	5.99
33	8.89	50	5.87
34	8.63	51	5.75
35	8.38	52	5.64
36	8.15	53	5.53
37	7.93	54	5.43
38	7.72	55	5.33
39	7.52	56	5.24
40	7.33	57	5.15
41	7.15	58	5.06
42	6.98		

Diameter of Front Roll 1 inch.
Diameter of Back Roll ⅞ inch.
Front Roll Gear 30 teeth.
Change Gear 26 to 58 teeth.
Crown Gear 130 teeth.
Back Roll Gear 70 teeth.

DRAFT CONSTANT 346.58.

Change Gear.	Draft.	Change Gear.	Draft.
26	13.33	43	8.06
27	12.84	44	7.87
28	12.38	45	7.70
29	11.95	46	7.54
30	11.56	47	7.37
31	11.18	48	7.22
32	10.83	49	7.07
33	10.51	50	6.93
34	10.20	51	6.80
35	9.90	52	6.67
36	9.63	53	6.54
37	9.37	54	6.43
38	9.12	55	6.30
39	8.89	56	6.19
40	8.67	57	6.05
41	8.45	58	5.96
42	8.25		

We recommend the following weights of full cops for the different gauges of mule as being the most desirable size and most economical in operation and handling.

2 inch gauge.	Full cop to weigh 1200 grains.
$1\frac{3}{4}$ " "	" " " " 1000 "
$1\frac{1}{2}$ " "	" " " " 600 "
$1\frac{3}{8}$ " "	" " " " 500 "
$1\frac{5}{16}$ " "	" " " " 350 "
$1\frac{1}{4}$ " "	" " " " 300 "
$1\frac{3}{16}$ " "	" " " " 250 "
$1\frac{1}{8}$ " "	" " " " 200 "

Our general practice is to use the following dimensions in determining the length of spindle and size of cop.

Gauge of Mule.	Height of Spindle Above Bolster.	Length of Cop.
2 inches.	9 inches.	8 inches.
$1\frac{3}{4}$ "	9 "	8 "
$1\frac{1}{2}$ "	$8\frac{1}{2}$ "	$7\frac{1}{2}$ "
$1\frac{3}{8}$ "	$8\frac{1}{4}$ "	$7\frac{1}{4}$ "
$1\frac{5}{16}$ "	7 "	6 "
$1\frac{1}{4}$ "	$6\frac{3}{4}$ "	$5\frac{3}{4}$ "
$1\frac{3}{16}$ "	$6\frac{3}{4}$ "	$5\frac{3}{4}$ "
$1\frac{1}{8}$ "	$6\frac{3}{4}$ "	$5\frac{3}{4}$ "

SELF-ACTING MULE.

RULE TO OBTAIN THE NUMBER OF YARDS IN A COP OF ANY NUMBER OF YARN, THE WEIGHT OF COP BEING KNOWN.

Multiply the weight of a cop in grains, the number of yards in a hank, and the number of the yarn in the cop, together, for a dividend; and divide by the number of grains in a pound avoirdupois.

EXAMPLE.

Cop weighs 1200 grains.
Number of yds. in a hank 840. Grains in a pound 7000.
Number of yarn in the cop 30.

$$\text{Then } \frac{1200 \times 840 \times 30}{7000} = 4320 \text{ Yards.}$$

Thus a cop of

No. 1	yarn,	2	inch gauge,	contains	144	yards.
No. 2	"	2	"	"	288	"
No. 30	"	2	"	"	4320	"

and so on.

SELF-ACTING MULE.

RULE TO OBTAIN THE NUMBER OF STRETCHES IN A COP OF ANY NUMBER OF YARN, THE WEIGHT OF COP BEING KNOWN.

Multiply the weight of the cop in grains by the number of inches in one hank together, for a dividend; and multiply the number of grains in a pound (avoirdupois weight) by the number of inches in the stretch of the mule, for a divisor.

Divide the dividend by the divisor, and the quotient will be the number of stretches in the cop.

EXAMPLE.

Take a cop which, for example, we find weighs 1200 grains, on 2 inch gauge. Then

Grains in cop=1200.
Yards in hank=840.
Inches in yard=36.

7000 grains in pound.
64 inch stretch.

$$\text{And } \frac{1200 \times 840 \times 36}{7000 \times 64} = 81 \text{ Stretches.}$$

Thus, with a stretch of 64 inches, a cop of

No. 1	yarn	contains	81	stretches.
No. 2	"	"	162	"
No. 30	"	"	2430	"

and so on.

SELF-ACTING MULE.

RULE TO FIND THE CHANGE GEAR ON BUILDER SCREW.

Multiply the length of screw used in inches by the number of threads per inch in the screw, and the result is the constant number for builder change gear.

Thus: $6\frac{1}{2}$ inches of screw used $\times 8$ threads per inch $= 52$, which is the builder constant.

Next, ascertain the number of stretches in a cop (as before explained) and divide the number of stretches by the builder constant.

Thus:

Example to Find the Change Gear for 30 Yarn.

No. 30 Yarn has 2430 Stretches in a Cop of 1200 Grains.	Builder Constant 52.

$\frac{2430}{52} = 47$ Tooth Ratchet Change Gear, picking 1 tooth.

SELF-ACTING MULE.

TABLE OF BUILDER SCREWS, WITH THREADS PER INCH, AND YARDS AND STRETCHES PER COP.

2 inch gauge.

Screw has 8 threads per in. $6\frac{1}{2}$ ins. of screw used to build cop.

No. 1 yarn has 144 yards in a cop.
No. 2 " " 288 " " " "
No. 30 " " 4320 " " " "
and so on.

NUMBER OF STRETCHES IN A COP.

64 Inch Stretch.	60 Inch Stretch.
No. 1 yarn has 81 stretches in a cop.	No. 1 yarn has 86.4 stretches in a cop.
No. 2 yarn has 162 stretches in a cop.	No. 2 yarn has 172.8 stretches in a cop.
No. 30 yarn has 2430 stretches in a cop.	No. 30 yarn has 2592 stretches in a cop.
And so on.	And so on.

The above calculations are based on a full cop made on the above gauge mule, weighing 1200 grains.

SELF-ACTING MULE.

TABLE OF BUILDER SCREWS, WITH THREADS PER INCH, WITH YARDS AND STRETCHES PER COP.

$1\frac{3}{4}$ inch gauge.

Screw has 8 threads per in. $6\frac{1}{2}$ ins. of screw used to build cop.

No. 1 yarn has 120 yards in a cop.
No. 2 " " 240 " " " "
No. 30 " " 3600 " " " "
and so on.

NUMBER OF STRETCHES IN A COP.

64 Inch Stretch.	60 Inch Stretch.
No. 1 yarn has 67.5 stretches in a cop.	No. 1 yarn has 72 stretches in a cop.
No. 2 yarn has 135 stretches in a cop.	No. 2 yarn has 144 stretches in a cop.
No. 30 yarn has 2025 stretches in a cop.	No. 30 yarn has 2160 stretches in a cop.
And so on.	And so on.

The above calculations are based on a full cop made on the above gauge mule, weighing 1000 grains.

SELF-ACTING MULE.

TABLE OF BUILDER SCREWS, WITH THREADS PER INCH, WITH YARDS AND STRETCHES PER COP.

1½ inch gauge.

Screw has 8 threads per in. 6½ ins. of screw used to build cop.

No. 1	yarn	has	72	yards	in a cop.
No. 2	"	"	144	"	" " "
No. 30	"	"	2160	"	" " "

and so on.

NUMBER OF STRETCHES IN A COP.

64 Inch Stretch.	60 Inch Stretch.
No. 1 yarn has 40.5 stretches in a cop.	No. 1 yarn has 43.2 stretches in a cop.
No. 2 yarn has 81 stretches in a cop.	No. 2 yarn has 86.4 stretches in a cop.
No. 30 yarn has 1215 stretches in a cop.	No. 30 yarn has 1296 stretches in a cop.
And so on.	And so on.

The above calculations are based on a full cop made on the above gauge mule, weighing 600 grains.

SELF-ACTING MULE.

TABLE OF BUILDER SCREWS, WITH THREADS PER INCH, WITH YARDS AND STRETCHES PER COP.

$1\frac{3}{8}$ inch gauge.

Screw has 8 threads per in. $6\frac{1}{2}$ ins. of screw used to build cop.

No. 1 yarn	has	48	yards in a cop.
No. 2 "	"	57.6	" " " "
No. 30 "	"	864	" " " "

and so on.

NUMBER OF STRETCHES IN A COP.

64 Inch Stretch.	60 Inch Stretch.
No. 1 yarn has 27 stretches in a cop.	No. 1 yarn has 28.8 stretches in a cop.
No. 2 yarn has 54 stretches in a cop.	No. 2 yarn has 57.6 stretches in a cop.
No. 30 yarn has 810 stretches in a cop.	No. 30 yarn has 86.4 stretches in a cop.
And so on.	And so on.

The above calculations are based on a cop made on the above gauge mule, weighing 500 grains.

SELF-ACTING MULE.

TABLE OF BUILDER SCREWS, WITH THREADS PER INCH, WITH YARDS AND STRETCHES PER COP.

$1\frac{5}{16}$ inch gauge.

Screw has 8 threads per in. $6\frac{1}{2}$ ins. of screw used to build cop.

No. 1	yarn has	42	yards in a cop.
No. 2	" "	84	" " " "
No. 30	" "	1260	" " " "

and so on.

NUMBER OF STRETCHES IN A COP.

64 Inch Stretch.	60 Inch Stretch.
No. 1 yarn has 23.6 stretches in a cop.	No. 1 yarn has 25.2 stretches in a cop.
No. 2 yarn has 47.2 stretches in a cop.	No. 2 yarn has 50.4 stretches in a cop.
No. 30 yarn has 708 stretches in a cop.	No. 30 yarn has 756 stretches in a cop.
And so on.	And so on.

The above calculations are based on a cop made on the above gauge mule, weighing 350 grains.

SELF-ACTING MULE.

TABLE OF BUILDER SCREWS, WITH THREADS PER INCH, WITH YARDS AND STRETCHES PER COP.

$1\frac{1}{4}$ inch gauge.

Screw has 8 threads per in. $6\frac{1}{2}$ ins. of screw used to build cop.

No. 1	yarn has	36 yards in a cop.
No. 2	" "	72 " " " "
No. 30	" "	1080 " " " "

and so on.

NUMBER OF STRETCHES IN A COP.

64 Inch Stretch.	60 Inch Stretch.
No. 1 yarn has 20 stretches in a cop.	No. 1 yarn has 22 stretches in a cop.
No. 2 yarn has 40 stretches in a cop.	No. 2 yarn has 44 stretches in a cop.
No. 30 yarn has 600 stretches in a cop.	No. 30 yarn has 660 stretches in a cop.
And so on.	And so on.

The above calculations are based on a cop made on the above gauge mule, weighing 300 grains.

SELF-ACTING MULE.

TABLE OF BUILDER SCREWS, WITH THREADS PER INCH, WITH YARDS AND STRETCHES PER COP.

$1\frac{3}{16}$ inch gauge.

Screw has 8 threads per in. $6\frac{1}{2}$ ins. of screw used to build cop.

No. 1 yarn has 30 yards in a cop.
No. 2 " " 60 " " " "
No. 30 " " 900 " " " "
and so on.

NUMBER OF STRETCHES IN A COP.

64 Inch Stretch.	60 Inch Stretch.
No. 1 yarn has 17 stretches in a cop.	No. 1 yarn has 18 stretches in a cop.
No. 2 yarn has 34 stretches in a cop.	No. 2 yarn has 36 stretches in a cop.
No. 30 yarn has 510 stretches in a cop.	No. 30 yarn has 540 stretches in a cop.
And so on.	And so on.

The above calculations are based on a cop made on the above gauge mule weighing 250 grains.

SELF-ACTING MULE.

TABLE OF BUILDER SCREWS, WITH THREADS PER INCH, WITH YARDS AND STRETCHES PER COP.

$1\frac{1}{8}$ inch gauge.

Screw has 8 threads per in. $6\frac{1}{2}$ ins. of screw used to build cop.

No. 1 yarn has 24 yards in a cop.
No. 2 " " 48 " " " "
No. 30 " " 720 " " " "
and so on.

NUMBER OF STRETCHES PER COP.

60 Inch Stretch.	50 Inch Stretch.
No. 1 yarn has 14 stretches in a cop.	No. 1 yarn has 16 stretches in a cop.
No. 2 yarn has 28 stretches in a cop.	No. 2 yarn has 32 stretches in a cop.
No. 30 yarn has 420 stretches in a cop.	No. 30 yarn has 480 stretches in a cop.
And so on.	And so on.

The above calculations are based on a cop made on the above gauge mule, weighing 200 grains.

SPOOLERS AND WARPERS.

Although we are not building Spoolers and Warpers at the present time, yet we publish the following tables, which we think will be useful to cotton manufacturers who may receive this book. We do this with the consent of the Draper Company, from whose book they are taken.

PRODUCTION OF SPOOLERS.

Dimensions of Spool.		Number of Yarn.	Revolutions per Minute of the			Number of Rabbeth spindles to one spooler, spindle running at 825 revolutions per minute.
Length between Heads.	Diameter of Heads.		Cylinder, 200. Spindle, 750.	Cylinder, 220. Spindle, 825.	Cylinder, 240. Spindle, 900.	
			Pounds per Spindle per Week.			
		8	64.3	70.7	77.1	
		10	51.4	56.6	61.7	12
6	5...	12	42.9	47.1	51.4	
		14	36.7	40.4	44.1	
		16	32.1	35.3	38.6	13
		18	28.6	31.4	34.3	
		20	25.7	28.3	30.9	
		22	23.4	25.7	28.1	14
		24	21.4	23.6	25.7	
		26	19.8	21.8	23.7	
5	4...	28	18.4	20.2	22.0	15
		29	17.7	19.5	21.3	
		30	17.1	18.9	20.6	
		32	16.1	17.7	19.3	16
		34	15.1	16.6	18.1	
		36	14.3	15.7	17.1	17
		38	13.5	14.9	16.2	
4½	3½..	40	12.9	14.1	15.4	18
		44	11.7	12.9	14.0	19
		50	10.3	11.3	12.3	20
		60	8.6	9.4	10.3	21
3½	3¼..	70	7.3	8.1	8.8	23
		80	6.4	7.1	7.8	25

PRODUCTION OF WARPERS.

Revolutions per minute of Cylinder, 30; Pulleys, 163.

Number of Ends.	260	300	320	340	360	380	410	440
Number of Yarn.	POUNDS WARPED IN SIXTY HOURS.							
8	4,179	4,821	5,143	5,465	5,786	6,107	6,589	7,071
10	3,343	3,857	4,114	4,372	4,629	4,886	5,271	5,657
12	2,786	3,214	3,429	3,643	3,857	4,071	4,393	4,714
14	2,388	2,755	2,939	3,123	3,306	3,490	3,765	4,041
16	2,089	2,411	2,571	2,733	2,893	3,053	3,295	3,535
18	1,857	2,143	2,285	2,429	2,571	2,714	2,929	3,143
20	1,671	1,928	2,055	2,186	2,314	2,443	2,636	2,829
22	1,519	1,753	1,870	1,987	2,104	2,221	2,396	2,571
24	1,393	1,607	1,714	1,821	1,929	2,036	2,197	2,357
26	1,286	1,483	1,582	1,681	1,780	1,879	2,027	2,176
28	1,194	1,377	1,469	1,561	1,653	1,745	1,883	2,021
29	1,152	1,330	1,418	1,507	1,596	1,685	1,818	1,950
30	1,114	1,285	1,371	1,457	1,543	1,629	1,757	1,885
32	1,044	1,205	1,285	1,346	1,447	1,527	1,647	1,768
34	983	1,135	1,210	1,286	1,361	1,437	1,551	1,664
36	929	1,071	1,143	1,214	1,286	1,357	1,464	1,571
38	880	1,015	1,083	1,150	1,218	1,285	1,387	1,489
40	836	964	1,029	1,093	1,157	1,221	1,318	1,414
44	760	877	935	993	1,051	1,110	1,198	1,286
50	669	771	823	874	926	977	1,054	1,131

PRODUCTION OF WARPERS.

Revolutions per minute of Cylinder, 33; Pulleys, 180.

Number of Ends.	260	300	320	340	360	380	410	440
Number of Yarn.	POUNDS WARPED IN SIXTY HOURS.							
8	4,597	5,303	5,657	6,011	6,365	6,718	7,248	7,773
10	3,677	4,243	4,525	4,809	5,091	5,375	5,799	6,223
12	3,065	3,535	3,771	4,007	4,243	4,479	4,832	5,185
14	2,627	3,030	3,233	3,435	3,637	3,839	4,142	4,445
16	2,298	2,652	2,829	3,006	3,182	3,359	3,624	3,889
18	2,043	2,357	2,514	2,671	2,829	2,985	3,221	3,457
20	1,839	2,121	2,263	2,405	2,546	2,687	2,899	3,111
22	1,671	1,929	2,057	2,186	2,315	2,443	2,635	2,829
24	1,532	1,768	1,885	2,003	2,121	2,239	2,416	2,587
26	1,415	1,631	1,740	1,849	1,958	2,067	2,230	2,393
28	1,313	1,515	1,616	1,717	1,818	1,919	2,070	2,223
29	1,268	1,463	1,560	1,658	1,755	1,853	2,000	2,146
30	1,225	1,414	1,509	1,603	1,697	1,791	1,933	2,074
32	1,149	1,326	1,414	1,503	1,591	1,679	1,812	1,945
34	1,081	1,248	1,331	1,415	1,497	1,581	1,706	1,831
36	1,021	1,179	1,257	1,335	1,415	1,493	1,611	1,729
38	968	1,117	1,191	1,265	1,340	1,414	1,526	1,637
40	919	1,061	1,131	1,202	1,273	1,343	1,450	1,555
44	836	964	1,029	1,093	1,157	1,221	1,318	1,415
50	735	849	905	961	1,019	1,075	1,159	1,245

Production of Warpers.

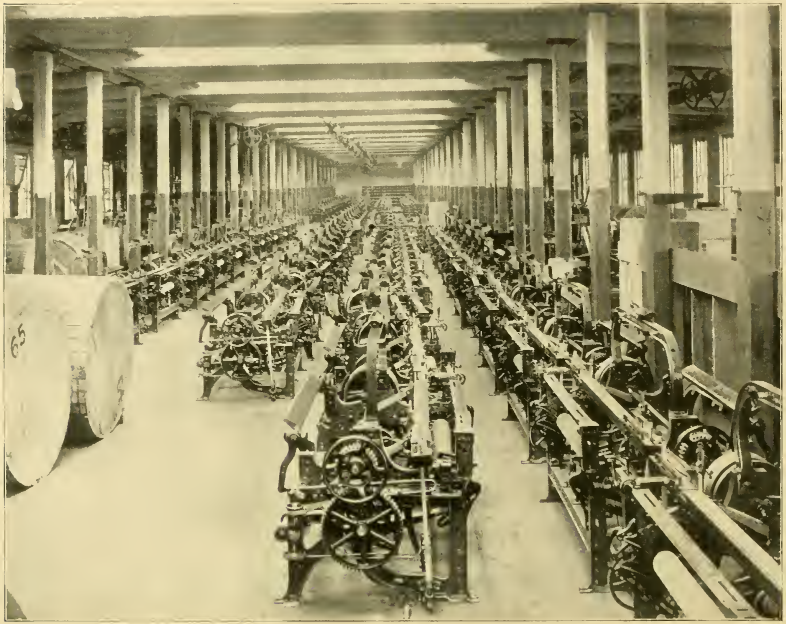
Revolutions per Minute of Cylinder, 36; Pulleys, 196.

Number of Ends.	260	300	320	340	360	380	410	440
Number of Yarn.	POUNDS WARPED IN SIXTY HOURS.							
8	5,015	5,785	6,171	6,557	6,943	7,329	7,907	8,485
10	4,011	4,629	4,937	5,246	5,555	5,863	6,325	6,789
12	3,343	3,857	4,181	4,372	4,629	4,885	5,271	5,657
14	2,865	3,305	3,527	3,747	3,967	4,188	4,519	4,849
16	2,507	2,893	3,085	3,279	3,471	3.664	3,953	4,243
18	2,229	2,571	2,743	2,915	3,085	3,257	3,515	3,771
20	2,005	2,315	2,468	2,623	2,777	2,931	3,163	3,395
22	1,823	2,101	2,244	2,385	2,525	2,665	2,875	3,085
24	1,671	1,925	2,057	2,185	2,315	2,443	2,636	2,829
26	1,543	1,780	1,899	2,017	2,136	2,255	2,433	2,611
28	1,433	1,653	1,763	1,873	1,983	2,094	2,259	2 425
29	1,383	1,596	1,703	1,809	1,915	2,021	2,181	2,341
30	1,337	1,543	1,645	1,749	1,851	1,955	2,109	2,263
32	1,253	1,447	1,543	1,639	1,736	1,832	1,977	2,121
34	1,180	1,361	1,452	1,543	1,633	1,725	1,861	1,997
36	1,115	1,285	1,371	1,457	1,543	1,629	1,757	1,885
38	1,056	1,219	1,299	1,380	1,461	1,543	1,665	1,787
40	1,003	1,157	1,235	1,311	1,389	1,465	1,581	1,697
44	912	1,052	1,123	1,192	1,262	1,332	1,437	1.543
50	806	925	987	1,049	1,111	1,171	1,265	1,357

PRODUCTION OF WARPERS.

Revolutions per minute of Cylinder, 40; Pulleys, 218.

Number of Ends.	260	300	320	340	360	380	410	440
Number of Yarn.	POUNDS WARPED IN SIXTY HOURS.							
8	5,571	6,428	6,857	7,286	7,715	8,143	8,785	9,428
10	4,457	5,142	5,485	5,828	6,171	6,515	7,028	7,543
12	3,715	4,285	4,571	4,857	5,143	5,428	5,857	6,285
14	3,184	3,673	3,918	4,163	4,408	4,653	5,020	5,387
16	2,785	3,214	3,428	3,643	3,857	4,071	4,393	4,713
18	2,476	2,857	3,047	3,238	3,428	3,619	3,905	4,190
20	2,228	2,571	2,742	2,915	3,086	3,257	3,515	3,771
22	2,025	2,337	2,493	2,649	2,805	2,961	3,195	3,428
24	1,857	2,143	2,285	2,428	2,571	2,715	2,929	3,143
26	1,715	1,977	2,109	2,241	2,373	2,505	2,703	2,901
28	1,592	1,836	1,959	2,081	2,203	2,326	2,510	2,694
29	1,537	1,773	1,891	2,009	2,128	2,246	2,424	2,600
30	1,485	1,713	1,828	1,943	2,057	2,171	2,343	2,513
32	1,393	1,607	1,713	1,821	1,929	2,035	2,196	2,357
34	1,311	1,513	1,613	1,715	1,815	1,916	2,067	2,219
36	1,238	1,428	1,523	1,619	1,714	1,809	1,952	2,095
38	1,173	1,353	1,443	1,533	1,624	1,713	1,849	1,985
40	1,115	1,285	1,371	1,457	1,543	1,628	1,757	1,885
44	1,013	1,169	1,247	1,324	1,403	1,480	1,597	1,715
50	892	1,028	1,097	1,165	1,235	1,303	1,405	1,508



LOOM ERECTING DEPARTMENT.

LOOMS.

The Looms which are illustrated and described in the following pages are the result of an experience of over fifty years in Loom building, and they combine the latest improvements in design with the best materials and excellent workmanship. Our constant aim has been to attain high speed, superior quality of cloth, durability of wearing parts, economy in "fixing," convenience in operating, and saving of floor space.

FRAMES.

In these the maximum strength of the metal used is attained by its judicious distribution, the weight being put where experience has taught us that it is most needed; and a great variety of patterns are used, from the lightest silk loom to one for weaving heavy jute fabrics. The girts and breast beams are usually of iron, and users of our looms know that they are not subject to the continual shrinkage which takes place where wooden girts and beams are used, with the consequent necessity of tightening bolts, and of re-adjustment of parts.

CRANK SHAFTS AND CAM SHAFTS.

By a new and patented process of forming, unlike that used by any other loom builder, we are enabled to guarantee greater strength and durability than can be attained by any other method; and, after a trial of more than 20,000 crank shafts made in this way, without a single failure, we feel justified in making the claim that our process has not yet been equaled, or even approached, by any other.

The cam shafts are made of large diameter cold-rolled steel, and are provided with boxes having long bearings. The boxes are usually made with caps, which are held by screws. This admits of the easy removal of both shafts, when the occasion demands.

GEARING.

We can apply either the epicycloidal tooth or the so-called "saw tooth" on our cam and crank shaft gears. We believe that our saw tooth gears, with faces on the involute principle, have given better satisfaction and shown less wear, with the consequent back-lash, than those of any other builder. This tooth was designed on scientific principles, and is free from the defects ordinarily found in gears with this shape of tooth. We provide all gears with three keyways, so that their position can be changed as they wear. In some cases we provide our crank shaft gear with a detachable hand wheel, so that, if a gear breaks, only the gear proper is lost.

It is admitted by those who use our loom that the gears are provided with every possible device to prolong their life and reduce the wear and back-lash to the lowest limit.

PICKING CAMS AND PICK SHAFT.

These cams are so designed as to ensure an easy pick. They are provided with detachable points, and these points are cast in chills, to ensure hardness. When desired, we furnish a pick cam which is provided with a hub, keyed to the shaft. To the face of the hub is bolted the pick cam proper, which is furnished with slots, to allow of the adjustment of the pick without disturbing the hub, or burring up the cam shaft, by the constant changing of pick cams. The face of the cam is of sufficient width and of such a shape as to allow the pick shaft ball to revolve flat on the face of the cam. Our patent pick shaft, with cover for pick ball, is made in one solid casting, and of such a size and shape as experience has proved best, with the result that a broken pick shaft (if properly adjusted) is a rarity with our looms. The cover for the pick ball is so arranged that oil cannot be thrown from it upon the warp; and the cover, being cast in one piece with the shaft, is an element of strength, whereas, when bolted to the shaft, the shaft is weakened. This is an important claim in our patent, as is also the self-oiling pin upon which the pick ball revolves.

HARNESS CAMS.

These are of such a shape that they impart an easy rolling motion to the harnesses, entirely free from any jerk or harsh strains on the yarn. We have various sizes of cams, so that users of large shuttles can be sure of opening the shed sufficiently to allow the shuttle to pass through without chafing the warp threads at either side.

TWILL MOTIONS.

Our auxiliary shaft and twill motion is notable for its simplicity and the ease with which changes can be made from plain to twill weaves, and vice versa, or from one twill to another.

The twill motions are supported by two cross girts, provided with bearings or boxes for the auxiliary shaft, upon which the cams are placed. We usually furnish with all twill motion looms a triple gear, which is placed on the pick cam shaft; this provides for three speeds for the auxiliary shaft, for either three, four, or five harness work, without changing either of the driving gears. Twill cams are built up, and arrangements are made to suit the wishes of any weaver in the matter of the number of harnesses up or down.

SELVAGE MOTIONS.

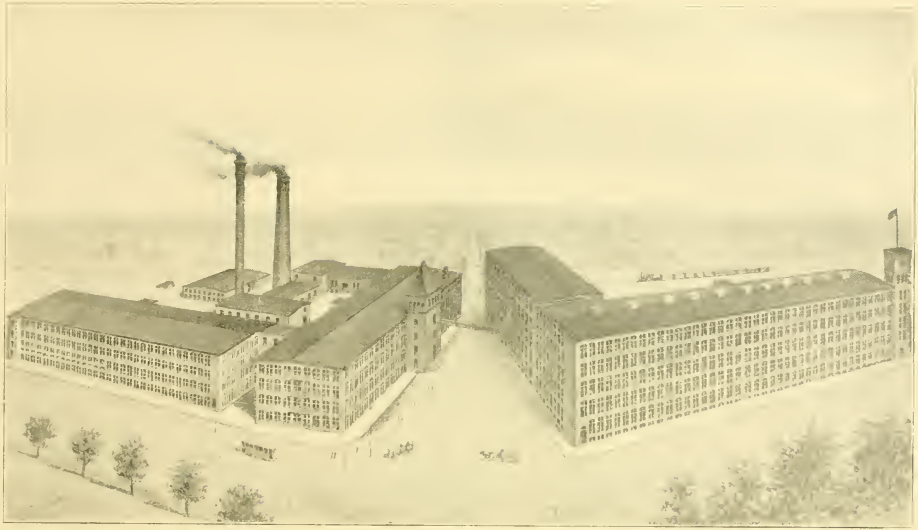
We have two kinds of selvage motions. One, to be used when weaving twills, is worked by the regular two-harness cams, and the other, a tape selvage motion, is operated by a gear placed on the cam shaft, driving a shaft to which are attached two small cams for operating the selvage heddles at each side.

LAYS.

These are made of best quality seasoned lumber, and are provided with either hard wood or iron race-plates, as may be desired.

SWORDS.

Iron swords are used and specially designed to guard against breaking; they are supported by cold-rolled steel shafts. These shafts run in boxes, thus doing away with the wear of the loom side. Slots are provided in the side frame, so as to admit of adjustment of height of lay to suit the circumstances.



BERKSHIRE COTTON MANUFACTURING CO., ADAMS, MASS.

3750 MASON LOOMS. MASON COMBERS.

SHUTTLE BOXES.

These are of iron, and can be made to bind either at back or front, as may be desirable.

Note.—At this point we would inform intending purchasers of looms built to receive the Northrop devices that such looms must bind at the back of the box.

PROTECTION.

We arrange to protect either at one side, both sides, or in the centre. On looms over 36 inches wide we prefer to protect at both sides. This distributes the jar and strain more evenly throughout the whole lay.

BRAKES.

We supply brakes worked either from the filling fork or from the bunter, or from both, as may be desired.

Special attention is called to our new "Patent Compound Brake." This is the term which we have given to that one of our patent brakes which operates through the bunter, when the shuttle fails to reach its proper place in the box, and also operates through a weighted lever, when the filling fails. In other words, it combines the function of the filling brake with that of the bunter brake; and, as we own the pioneer patent on this combination, we desire, in fairness to those who may wish to use such a combination, to say that we shall take steps, when the proper time comes, to collect royalties on all looms which have had such a combination applied to them, by other builders, since the issue of our patent. We use several different arrangements of this compound brake, one of the latest of which is illustrated hereafter.

The advantages of the Compound brake over either of the old single brakes are so manifest in the relief from strains which it affords to the loom when it stops automatically that it would be superfluous to dwell on them here. Nevertheless, our customers are offered the choice of either of the simple or compound brakes which they may desire.

WHIP BARS AND ROLLS.

In connection with our improved let-off motions, we have increased the adjustability of the whip bar or whip roll, as the case may be. By our arrangement weavers can adjust the height of the yarn at the whip roll, and, with the adjustability of our lay and breast beam strip or roll, can obtain a good face on the most difficult weaves.

LET-OFF MOTIONS.

In let-off motions, as in take-up motions, we are in a position to offer any of the arrangements for the purpose which have proved efficient beyond doubt. We can apply any of the various let-off motions now on the market, such as "Rope Friction," "Bartlett," "Morton," or "Thompson." Special attention is called to the "Thompson Patent Let-off," which we control. It is, in our judgment, phenomenally efficient (particularly on medium and light goods), producing, when properly adjusted, perfectly even cloth from the full yarn beam to the empty barrel.

It is so constructed that it is automatic in operation, as the constantly diminishing diameter of the yarn on the warp beam determines the amount of yarn released at each pick. A "shuttle smash" preventative is provided, whereby when a shuttle is caught in the warp the yarn beam is released and sufficient slack provided to prevent a smash. This let-off motion can be applied to advantage to old looms which require renewal at that point, as it is comparatively inexpensive.

The Bartlett let-off has been applied by us to thousands of looms. Our arrangement of this motion, besides embodying many little improvements and conveniences, including the patent adjustable whip roll or bar, has lately been much increased in efficiency by the addition of our "Patent Auxiliary Yielding Whip Bar," which not only aids in the production of evener cloth, with a better face, but also adds very much to the production of the loom, by reducing the breakage of warp threads to a degree never before known with this let-off.

For fancy work we make various arrangements of friction let-off, with modern conveniences for taking up the stretch of the rope without disconnecting it. For very heavy, high picked work we have applied chain friction, with the same conveniences.

TAKE-UP MOTIONS.

We believe that, in making looms for the various fabrics from wire cloth to the finest silk, we have used a greater variety of take-up motions than any other builder. Some of the motions which are advertised as new by others have been used by us for many years for special work to which they were peculiarly

BERKSHIRE COTTON MANFG. CO WEAVING ROOM.

adapted. This varied and extensive experience has enabled us to arrive at last at a take-up motion which absolutely prevents the weaving of thin places in the cloth, inasmuch as, by this device, it is rendered impossible to "pull down" on the cloth without stopping the loom; while, if the loom is automatically stopped by the filling running out, the adjustable let-back pawl may be set to let back one, two, three, or more picks, as may be desired. That this device is new in principle may be inferred from the fact that the United States Patent Office has allowed all the broad claims asked for it, without modification. For weaving cloth as nearly perfect as possible, this take-up motion offers advantages never before attained. Our improved take-up motion provides for ease in handling the warp, or in changing picks, and is provided with a let-back pawl (instead of the old shell dog), which pawl can be readily adjusted to let back any desired amount, when the filling fails.

The take-up motion can be so arranged as to operate from the filling fork lever, from a cam placed on the end of the cam shaft, can be positively driven by gearing from the cam shaft, or can be worked by a lever and pawl from the lay rocker shaft. The first named arrangement is the one we have commonly employed in the past, as it materially reduces the number of parts, besides enabling us to put all of our change gearing inside the loom frame.

Our positive take-up motion consists of a side shaft, driven by gearing from the cam shaft. This side shaft terminates in a worm, driving a worm gear, on the face of which is a clutch, engaging with a similar clutch ratchet gear, which forms the holding-back gear. When the filling runs out or the loom is stopped, the clutch is thrown out of contact, and the cloth can be turned backward or forward, as occasion may demand; but, while the operation of weaving is in process, the weaver cannot pick up a few teeth on the cloth, as is the case with any motion not positively driven. This take-up motion is a sure remedy for the habit of weavers kicking the ratchet gear, and making thin places in the cloth, while it retains all the other advantages of any take-up ever devised. The change pick gearing in this arrangement of take-up motion gives two picks in the cloth for one tooth in the change pick gear.

Where the class of goods woven is such that the number of picks per inch is not often changed, we prefer to put on take-up motion gearing, so that the ratchet gear will be the change gear. By this means we can regulate the picks in the cloth to the exact number called for.

PATENT CLOTH ROLL AND CLOTH ROLL STANDS.

Our looms can be built with cloth roll stands to wind up single cuts, or, by using our patent cloth roll stands, a larger or smaller roll may be wound, as desired, the maximum being 19 inches diameter of roll in this particular case.

We also have several arrangements for winding up cloth rolls other than the above named, and our methods and patterns are so varied that we can meet the views of all weavers on this point.

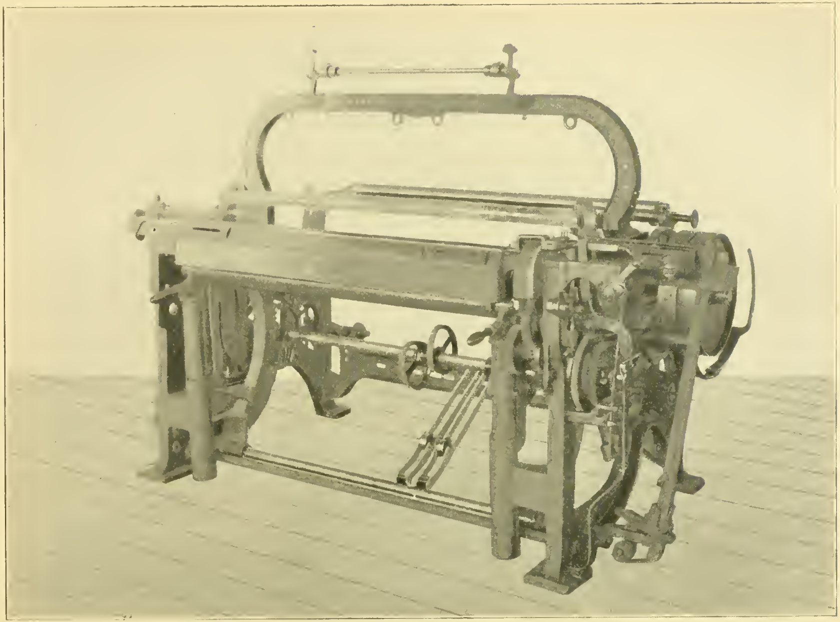
The take-up rolls are usually 4 inches in diameter, made from carefully seasoned lumber, turned true to size, and covered either with quartz, fine or coarse sand paper, perforated steel or tin in in either sheets or fillet, as the nature of the fabric to be woven may determine, or to meet the individual views of weavers and others. We have, in some instances, furnished looms with the cloth roll made of wrought iron pipe, properly fitted with heads and shafts, and the pipe drilled for wooden plugs, to which the sand paper or metal covering is tacked; also with short steel pins in the pipe, for very accurate work. With this roll there is no possibility for variation in diameter of the roll, and consequent variation of picks in the cloth, due to swelling or contraction of the wooden roll, nor danger of breaking the filleting from the same cause. However, with a wooden roll made of seasoned lumber there is no trouble on either score.

With our arrangement of take-up and patent cloth roll stands, the looms can be quickly changed from winding single cuts to winding a large roll of several cuts. We can also place our sand roll immediately below the breast beam, and have the cloth roll held up to it by means of springs. By this arrangement a roll of cloth 22 inches in diameter can be wound. In some cases it is important that the cloth should be wound as nearly free from wrinkles as possible, and also to keep the cloth of an even width. Elsewhere we give a description of our Breast Beam Take-up Roll, which will meet these difficulties, because the distance from the fell of the cloth is reduced to a minimum. This distance being so short, the amount of cloth exposed to atmospheric and other influences, before being wound up, is so small that the width is not seriously affected.

DRIVING PULLEYS.

These can be placed either at the same end as the cam and crank shaft gears, or at the opposite end, as may be preferred. For looms intended to weave high class goods, particularly silks, a simple and efficient friction driving pulley has been devised, which not only effects a saving in belts and width of overhead pulleys but enables the weaver to instantaneously stop the loom. We make this friction pulley with either the flat or face friction, or with the wedge or cone friction, as may be desired. Considering the many advantages and the slight additional cost, this method of driving should commend itself to all weavers.

COTTON PLANT.



NEW STANDARD LOOM.

New Standard Loom.

There is a constantly increasing demand for a loom which will weave the higher grades of cloth, with the least possible imperfections, and without much increase of the cost of weaving over that of lower grades. This loom is specially designed for that purpose; and, although it costs somewhat more, there is a large margin of economy in its use, as compared with all others, on this kind of work, in quantity, quality, and cost of the product. Its superiority has been demonstrated by running it with other modern looms, under like conditions, in the same mill; and it surpassed all others in speed, ease of operation, quantity produced, and appearance of the cloth. It is adapted to all grades of cloth, from the lightest to the heaviest sheeting, and is adapted to receive the Northrop Filling Change and Warp Stop Motion, also twill motions, drop box motions, and dobbies. The loom illustrated has extra heavy frames; increased harness space, permitting the use of dobbies with a large number of harnesses; our patent positive take-up motion, for the prevention of thin places; our breast beam take-up roll, permitting the winding of a large roll of cloth free from wrinkles and variation in width of cloth; and also our improved patent auxiliary yielding whip bar, which materially lessens the breakage of warp threads, thereby increasing the quantity, and improving the quality, of the production.

Any of the let-offs in use, which may be best adapted to the cloth to be woven, may be used on this loom.

We believe that an investigation or trial of this loom will show that, for the purposes for which it is intended, it is superior to anything yet offered.

New Standard Loom.

DIMENSIONS.

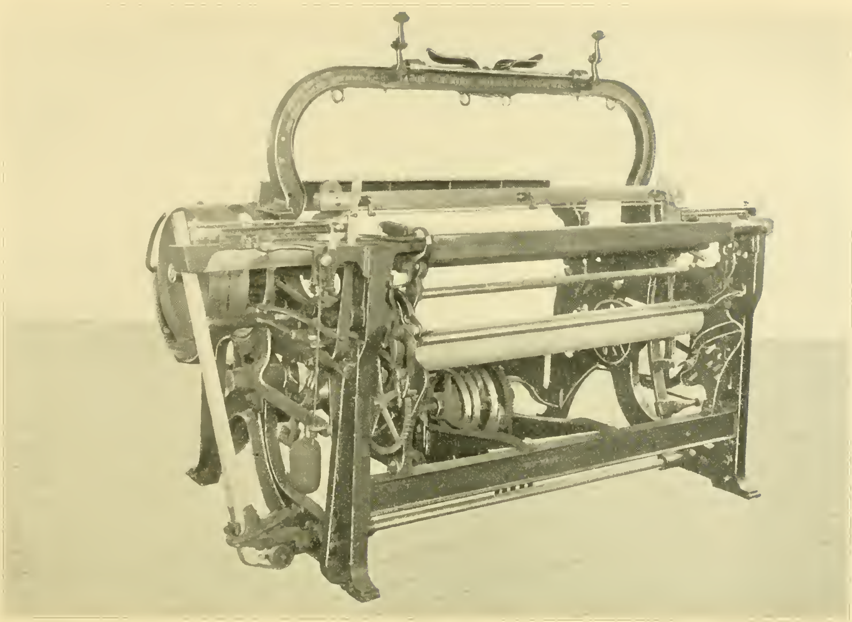
Name.	Length of Lay.	Harness Space.	Reed Space.	Between Swords.	Maximum between Beam-heads.	Front to back outside Take-up to outside Beam-head
30 in.	75½ in.	36 in.	36 in.	38 in.	34 in.	44 in.
32 "	77½ "	38 "	38 "	40 "	36 "	44 "
34 "	79½ "	40 "	40 "	42 "	38 "	44 "
36 "	81½ "	42 "	42 "	44 "	40 "	44 "
38 "	83½ "	44 "	44 "	46 "	42 "	44 "
40 "	85½ "	46 "	46 "	48 "	44 "	41 "
42 "	87½ "	48 "	48 "	50 "	46 "	44 "
44 "	89½ "	50 "	50 "	52 "	48 "	44 "
46 "	91½ "	52 "	52 "	54 "	50 "	44 "
48 "	93½ "	54 "	54 "	56 "	52 "	44 "
50 "	95½ "	56 "	56 "	58 "	54 "	44 "
52 "	97½ "	58 "	58 "	60 "	56 "	44 "
54 "	99½ "	60 "	60 "	62 "	58 "	44 "
62 "	107½ "	68 "	68 "	70 "	66 "	44 "

We do not recommend this loom for cloth wider than the name implies. For instance, the 36-inch loom is intended to weave cloth 36 inches wide.

The length of lay is based on a shuttle box to receive a shuttle 14½ inches long over all.

If necessary, this loom can be built so that from front to back, from outside of take-up to outside of 18-inch beam head, the measurement is only 41 inches.

FROM THE COTTON FIELD TO THE GINNERY.



OLD STANDARD SHEETING LOOM.

Old Standard Heavy Sheeting Loom.

In many respects this is similar to our New Standard Loom. It is heavier, and specially adapted to weaving heavy sheetings, osnaburgs, light duck, sateens, and similar fabrics. Its sides, girts and arch were specially designed to distribute the weight of metal where it is most needed for strength and durability. The let-off motion may be any of those now in use. We can apply our auxiliary whip bar roll, which eases the strain on the warp at the instant of the beating-up of the filling. This is a a very useful improvement, and its application has materially increased the production by saving the warp from breaking, and has also made a marked improvement in the evenness of the cloth.

The take-up motion provides for ease in changing, and for winding a large roll of cloth.

Twill motions and selvage motions can readily be applied.

It can be built so that the application of the Northrop devices can be successfully made.

OLD STANDARD HEAVY SHEETING LOOM.

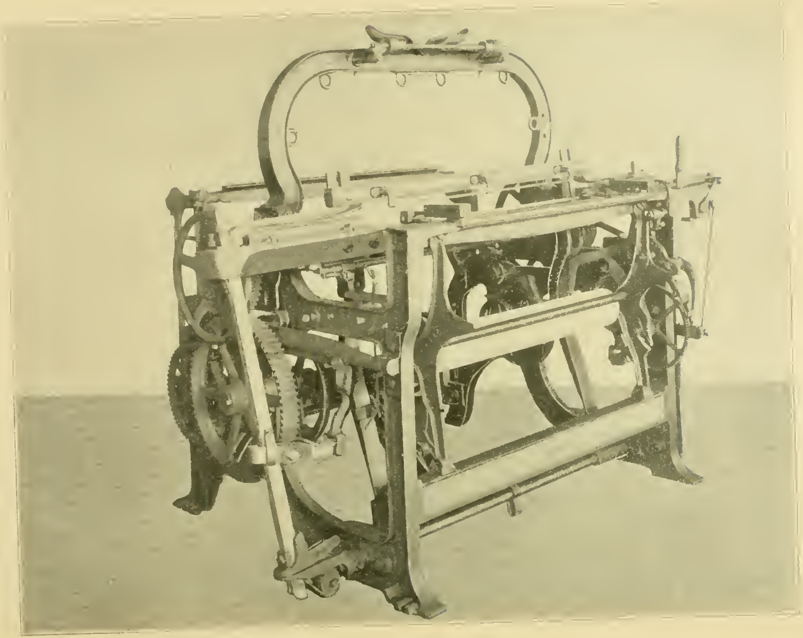
DIMENSIONS.

NAME.	Length of Lay.	Harness Space.	Reed Space.	Between Swords.	Maximum between Beam-heads.	Front to back outside Take-up to outside Beam-head.
30 in.	75½ in.	36 in.	36 in.	38 in.	34 in.	44 in.
32 "	77½ "	38 "	38 "	40 "	36 "	44 "
34 "	79½ "	40 "	40 "	42 "	38 "	44 "
36 "	81½ "	42 "	42 "	44 "	40 "	44 "
38 "	83½ "	44 "	44 "	46 "	42 "	44 "
40 "	85½ "	46 "	46 "	48 "	44 "	44 "
42 "	87½ "	48 "	48 "	50 "	46 "	44 "
44 "	89½ "	50 "	50 "	52 "	48 "	44 "
46 "	91½ "	52 "	52 "	54 "	50 "	44 "
48 "	93½ "	54 "	54 "	56 "	52 "	44 "
50 "	95½ "	56 "	56 "	58 "	54 "	44 "
52 "	97½ "	58 "	58 "	60 "	56 "	44 "
54 "	99½ "	60 "	60 "	62 "	58 "	44 "
62 "	107½ "	68 "	68 "	70 "	66 "	44 "

These dimensions are based on a shuttle box to take a shuttle 14½ inches long over all.

We do not recommend this loom for cloth wider than the name implies. For instance, a 30-inch loom is intended to weave cloth 30 inches wide.

OLD STYLE COTTON GIN.



PRINT CLOTH LOOM.

Print Cloth Loom

For Print Cloths and Other Light or Medium Fabrics.

This Loom is specially adapted to the highest speeds, with a small consumption of power, and minimum cost of maintenance and repairs. For a given width of cloth, it occupies the smallest possible space, and has adaptability to a large variety of goods, at a moderate cost of time and money in making changes. It is adapted to receive either three, four, or five harness motions, and either tape or plain selvage motions.

A roll of cloth 19 inches diameter can be wound with our ordinary cloth roll stands.

The take-up mechanisms furnished provide for ease in handling the warp and changing picks.

An improved let-back pawl, or the old shell dog, whichever is desired, allows of letting back one or more picks when the filling falls.

It can be fitted with either a bunter brake, or an adjustable filling brake, or our patent compound brake.

The picking cam shaft and lay rocker shaft are of cold-rolled steel, the latter working in detachable and adjustable bearings, thus avoiding the wearing of the loom frame itself. The crank shafts are of improved manufacture.

All the bearings are of the most approved forms, with bolted caps.

It has patent pick shaft, ball and cover, a sure and simple precaution against throwing oil.

The let-offs furnished are such as the class of goods would require; and, as our list comprises all the most approved let-offs known, we can meet the wishes of all weavers.

If the looms are not intended to receive the Northrop devices at a later date, we can arrange the shuttle binders at either back or front, as may be desired; but looms built with a view of receiving the Northrop devices will have the binder invariably at the back. Shuttle binders can be of wood, cast iron, wrought steel, or wood faced with leather or steel.

The change pick motion can be arranged so that one tooth in the pick change gear represents two picks in the cloth, or so that one tooth in the ratchet gear represents one pick in the cloth, as may be preferred.

The pulleys and beam-heads can be of such size as circumstances require, as we have numerous sizes and patterns.

We have built over 33,000 of such looms for mills in Fall River alone, weaving a large variety of fabrics. For the economical weaving of medium and light weight cloths, we believe this loom is unsurpassed.

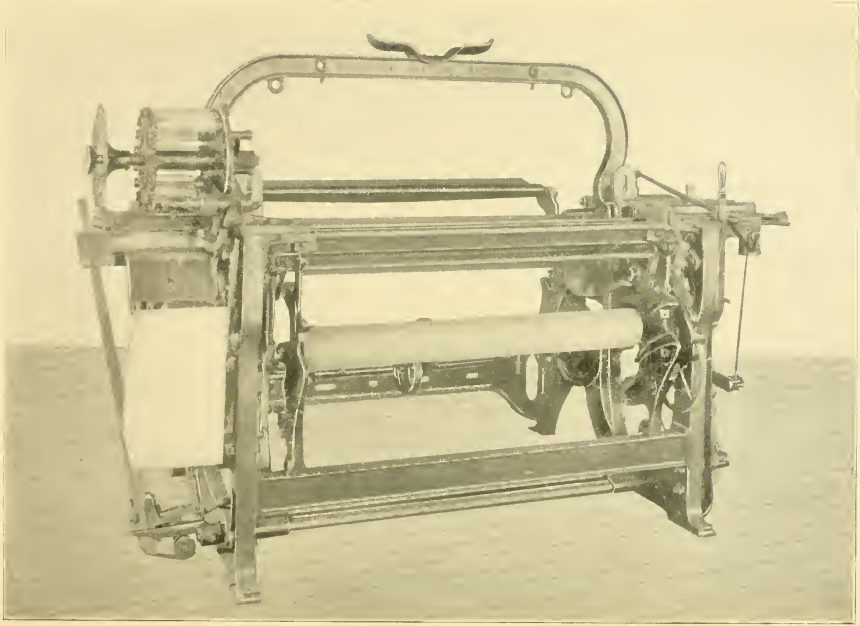
PRINT CLOTH LOOM.

FOR PRINT CLOTHS AND OTHER LIGHT OR MEDIUM FABRICS.

DIMENSIONS.

NAME.	Length of Lay.	Harness Space.	Reed Space.	Between Swords.	Maximum between Beam-heads.	Front to back outside Take-up to outside Beam-head.
24 in.	71½ in	32 in.	32 in.	34 in.	30 in.	44 in.
28 "	75½ "	36 "	36 "	38 "	34 "	44 "
30 "	77½ "	38 "	38 "	40 "	36 "	44 "
32 "	79½ "	40 "	40 "	42 "	38 "	44 "
34 "	81½ "	42 "	42 "	44 "	40 "	44 "
36 "	83½ "	44 "	44 "	46 "	42 "	44 "
38 "	85½ "	46 "	46 "	48 "	44 "	44 "
40 "	87½ "	48 "	48 "	50 "	46 "	44 "
42 "	89½ "	50 "	50 "	52 "	48 "	44 "
44 "	91½ "	52 "	52 "	54 "	50 "	44 "
46 "	93½ "	54 "	54 "	56 "	52 "	44 "
48 "	95½ "	56 "	56 "	58 "	54 "	44 "
50 "	97½ "	58 "	58 "	60 "	56 "	44 "
52 "	99½ "	60 "	60 "	62 "	58 "	44 "
60 "	107½ "	68 "	68 "	70 "	66 "	44 "

Will weave light fabrics 4 inches wider than name implies.



MASON-NORTHROP LOOM.

MASON-NORTHROP LOOM.

The basis of this loom is our Heavy Sheeting Loom, which is especially adapted to receive and operate the well-known Northrop Automatic Filling Changer and Warp Stop Motion. We build it under a license from the Draper Company, from whom we purchase the Northrop devices. Our prices for the complete Northrop Loom are the same as theirs, and we guarantee it to be fully equal to their loom.

We have built nearly 7000 looms, guaranteed to receive successfully the Northrop devices, and have proved that they will do so. This special adaptation does not in any way affect their operation as plain intermittent weaving looms for their lifetime; so that a purchaser of new looms who is not ready to adopt the Northrop attachments, and yet desires to provide for their future adoption, can do so with perfect safety, and without expense, by buying of us. With our loom as a foundation, the application of the Northrop motions is simply an addition, not an alteration; and their removal is equally simple, easily effecting a restoration to a first-class regular loom.

We can equip this loom with our latest improvements, such as the Patent Positive Take-up Motion, the High Roll Take-up, the Auxiliary Whip Bar, etc. Twill motions can be applied, and all the good features of the Mason Loom retained in their perfection.

TWO HARNESS MOTION

Plain Harness Motion.

The illustration shows our usual arrangement of two-harness motion.

The shape of the cams gives to the harness an easy rolling motion, free from shock to the warp. It is the result of many years experience in a great variety of fabrics, under all kinds of conditions.

The treadles rest on top of the back girt. They have iron rolls, on which the cams work, and the strap-ends are provided with extra slots, so that the harnesses can be properly adjusted to each other.

The harness roll stands, on the arch, are also adjustable in and out, and have large drip cups, to prevent the dropping of oil upon the warp.

The harness rolls are of polished iron, with bosses or blocks so proportioned as to give the proper lift and drop to each harness.

We have another arrangement of two-harness motion, in which we place the plain cams on an auxiliary shaft, which is driven from the pick cam shaft.

Our cams and treadle rolls are cast in chills, giving hard working surfaces, and consequent freedom from wear.

We have a great variety of patterns, and can meet the wishes of any weaver as to the size of cams and the opening of the shed.

The relative positions of all the parts of our harness motions, the shape of the cams, and the method of strapping, all tend to prolong the life of the harnesses and strapping, to give the easiest treatment of the warp, to ensure durability of the loom itself, and to provide for the convenience of the loom-fixer and weaver.

Twill Motions.

Our twill motions are placed on an auxiliary shaft, working in adjustable boxes, supported on cross girts extending from the front girt of loom to the back girt. These cross girts serve not only to support the auxiliary shaft, but are an additional element of strength to the loom.

On the regular pick cam shaft is placed a triple gear; that is, a gear cast in one piece, but comprising, in its entirety, three gears of different sizes, to drive the cams at the different speeds required for the three different motions — three harness, four harness, and five harness. This gear drives a gear fixed on the auxiliary shaft. The hub of this latter gear has clutches, and the separate cams also have clutches, which fit into each other and into this gear. The whole are then firmly bolted together and tightened by means of a check nut on the end of the shaft. It will thus be seen that the loosening of a single check nut allows the cams to be instantly removed from the shaft, and yet, while in operation, the cams and gear cannot get misplaced, but must always move together as one factor. The loosening of two bolts allows the removal of cams, gear, and shaft, intact.

Our twill motion cams, as well as our plain cams, are of such shapes as will impart a rolling motion to the harnesses, entirely free from sudden or abrupt changing, and are consequently easy on the warp.

The treadles have chilled rolls, and the strap-ends have several slots, so that the position of the harnesses, in relation to each other, can be readily adjusted, same as on the plain harness motion. On the back girt is a small hanger, on which the treadles hang.

The harness roll stands are adjustable in and out, having wide bearings and large drip cups, to prevent oil falling on the warp.

The harness rolls are of polished iron, and the blocks are of such sizes as to give the best results.

We believe that our twill motions will raise a more prominent "wale" or twill effect than any other we have seen. In many styles of goods this is an important feature. They can be applied to other looms by simply making the patterns for the cross girts to support them.

For simplicity in design, ease of operation, and convenience in changing from one weave to another, our harness motions are unsurpassed.

THREE HARNESS MOTION.

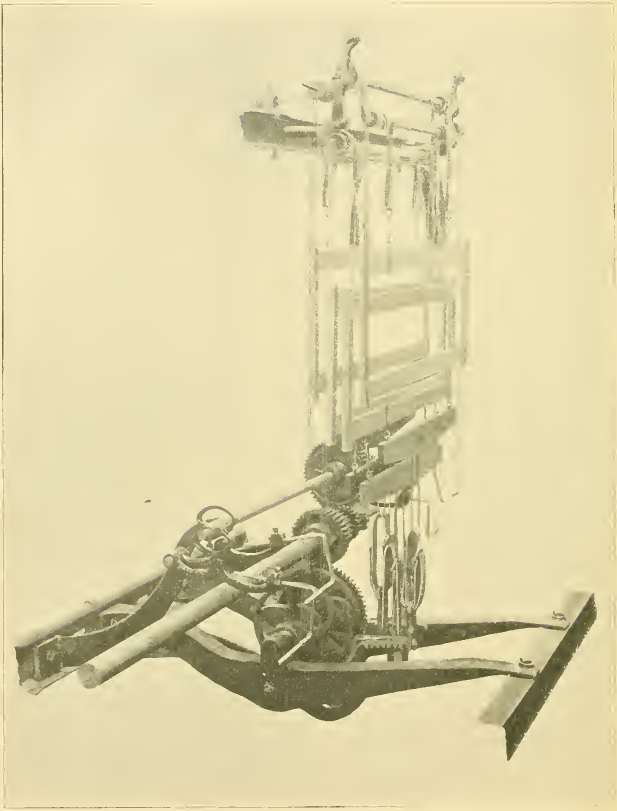
WITH PLAIN SELVAGE MOTION, WORKED BY PLAIN CAMS.

Three Harness Motion,

WITH PLAIN SELVAGE MOTION, WORKED BY PLAIN CAMS.

The illustration serves to show the various parts as well as they can be presented, and also to indicate the arrangement of strapping for one kind of twill.

A detailed description is given in the preceding article on "Twill Motions," and a special description of the plain selvage motion is given hereafter.



FOUR HARNESS MOTION.

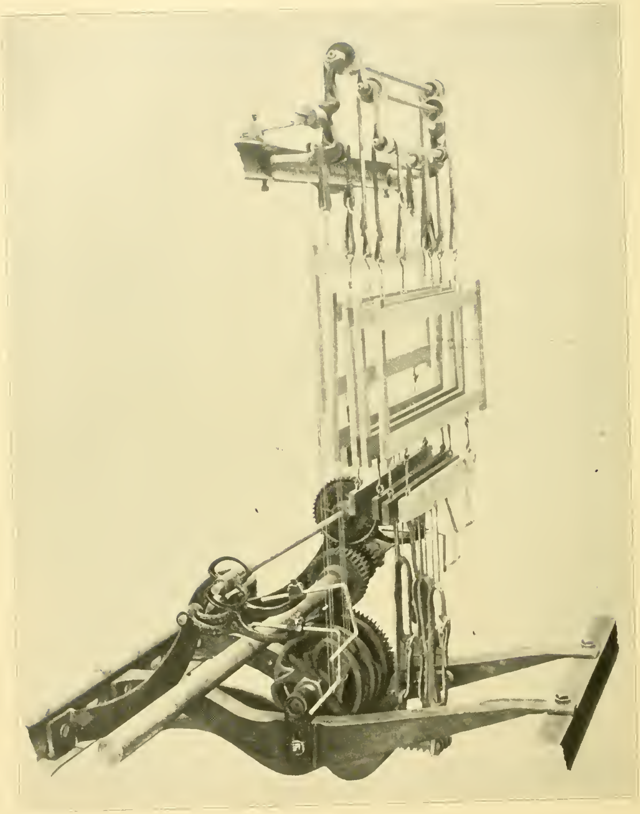
WITH TAPE SELVAGE MOTION.

Four Harness Motion,

WITH TAPE SELVAGE MOTION.

The illustration serves to show the various parts as well as they can be presented, and also to indicate the arrangement of strapping for one kind of twill.

A detailed description is given in the preceding article on "Twill Motions," and a special description of the tape selvage motion is given hereafter.



FIVE HARNESS MOTION.

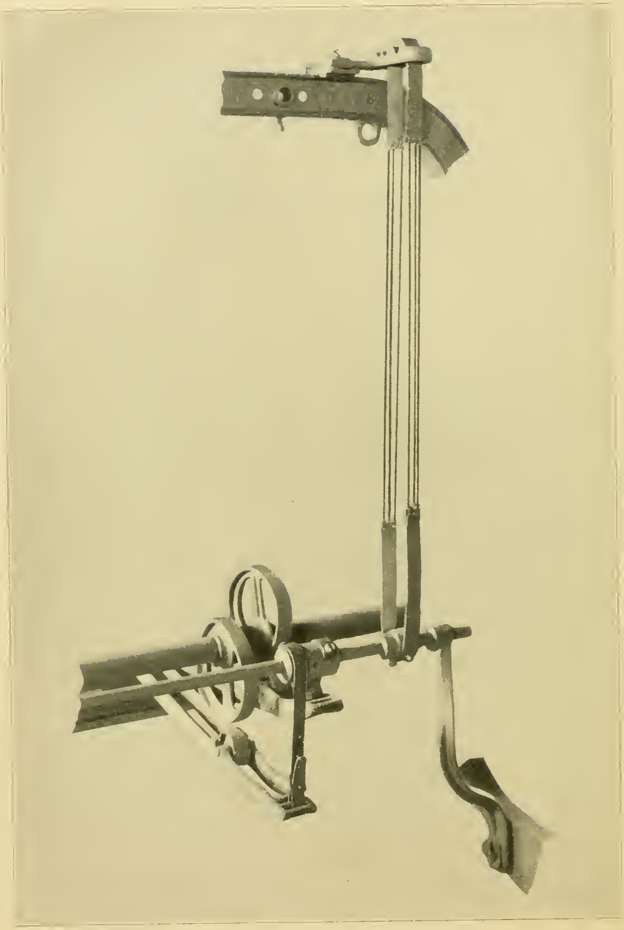
WITH TAPE SELVAGE MOTION.

Five Harness Motion,

WITH TAPE SELVAGE MOTION.

The illustration serves to show the various parts as well as they can be presented, and also to indicate the arrangement of strapping for one kind of twill.

A detailed description is given in the preceding article on "Twill Motions," and a special description of the tape selvage motion is given hereafter.

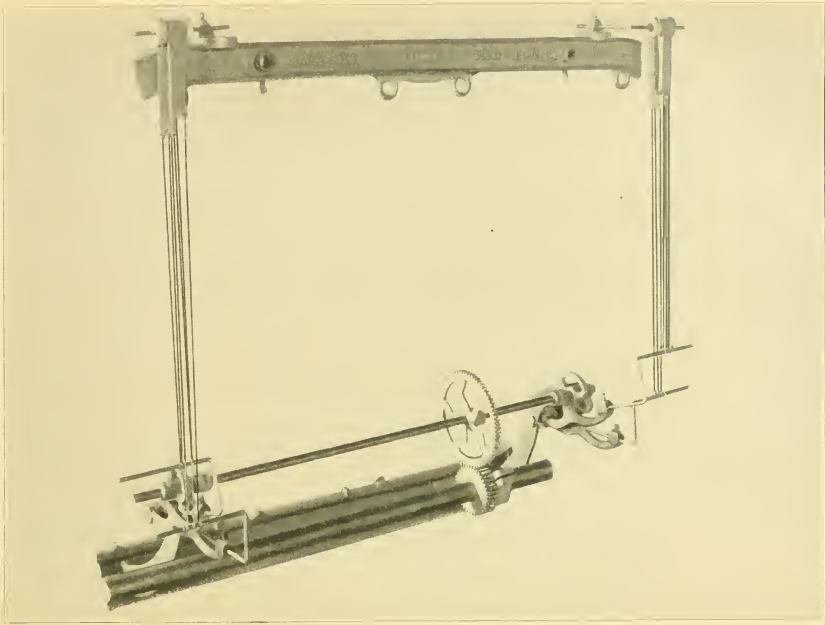


PLAIN SELVAGE MOTION.

Plain Selvage Motion.

This is used when weaving twill goods, as seen in the illustration. To make room for the twill cams the regular two harness cams are slipped to one side and fastened to the pick cam shaft, as usual. The two harness treadles are moved to one side, and work, as is usual with most of our looms, on top of the back girt. Two small stands bolted to the loom sides (inside) support an iron shaft. On this shaft is a harness block, similar to that used on the top harness roll for plain weaving. Straps pass from this block to the two harness treadles, and so the shaft is revolved at every pick. On the ends of this small shaft are placed plain blocks, to which are connected the selvage heddles. On the loom arch is bolted a small stand, arranged so that the selvage heddles can be adjusted in and out. Working in this stand is a plain roll, to which is fastened the upper strap of the selvage heddles.

This selvage motion works at every pick, and produces a plain weave. It is very simple in operation, and can be easily and quickly applied. It is recommended for all kinds of twill weaving requiring a plain selvage.

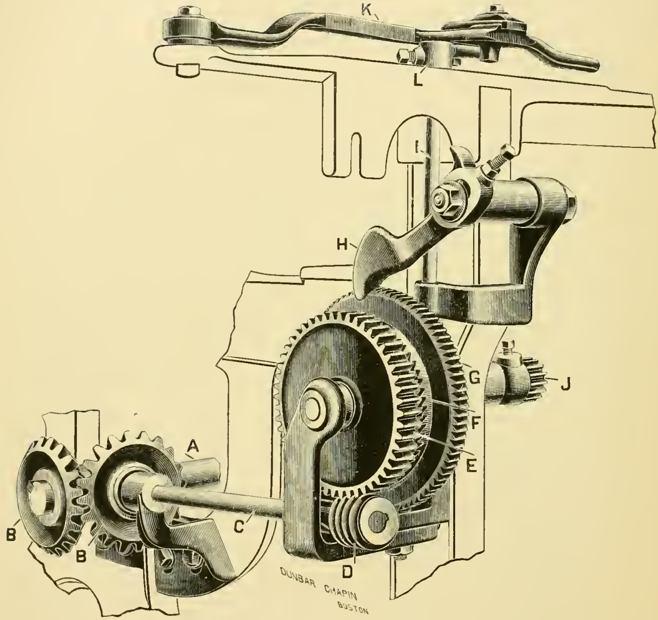


TAPE SELVAGE MOTION.

Tape Selvage Motion.

The tape selvage motion works at every other pick, and is more generally used on four, five, or six harness weaves. It produces a very handsome selvage, and, in contrast with the twilled effect of the body of the cloth is thrown out very boldly. As it is often removed, the driving gear is generally made in halves, to facilitate removal, and is clamped on pick cam shaft. This gear drives another gear, which has twice as many teeth as its driver. This larger gear is fastened to a small shaft, which is supported by two small stands bolted to the back bottom girt of the loom. These stands also support the small treadles which operate the selvage heddles. On the ends of this shaft are two small plain cams, which operate the heddles. Bolted to the arch are two small stands, carrying the wires which support the spools, over which the strap for the heddles passes.

From this description it will be seen that the motion operates at every other pick, producing the tape weave effect. It can be applied to other looms than ours at a very small expense.



PATENT POSITIVE TAKE-UP MOTION.

PATENT POSITIVE TAKE-UP MOTION,

WITH ADJUSTABLE LET-BACK PAWL, PREVENTING "PULLING DOWN" BY THE WEAVER WHILE LOOM IS RUNNING.

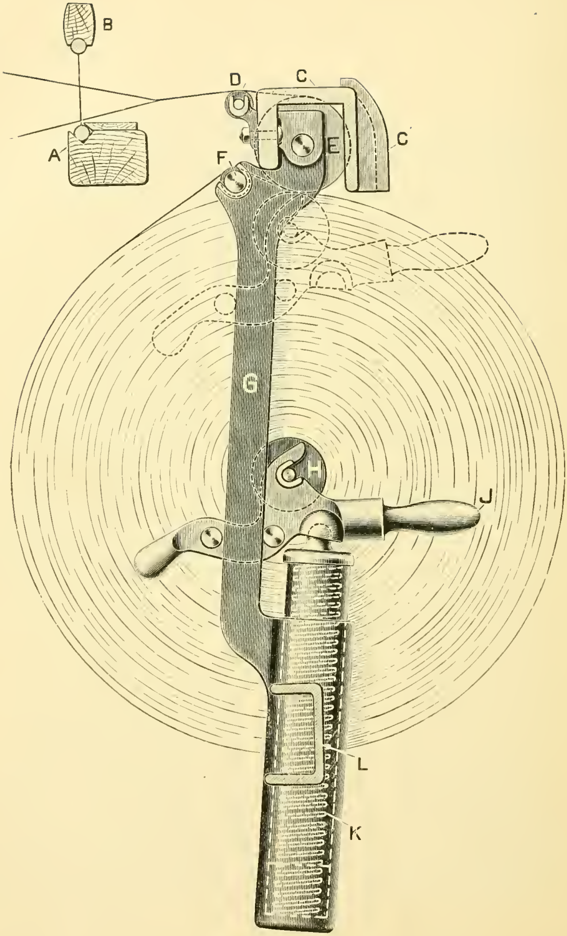
The cut illustrates the working parts of this motion, and their application to the loom.

A is the pick cam shaft of the loom; *B* and *B′* bevel driving gears; *C* the side shaft; *D* the worm; *E* the worm gear, having on one face half of the clutch *F*; *G* the pawl ratchet gear, having on one face the other half of the clutch *F*; *H* the adjustable let-back pawl; *I* the upright shaft, operated by the shipper handle and filling fork, through the top lever *L*, (the former throws the clutch in, and the latter throws it out of gear); *J* the gear leading to the regular train of pick gearing; *K* the lever worked by the filling fork and shipper handle; *L* the top lever, operating the upright shaft *I*.

The operation of this motion is as follows: The worm *D* is positively driven from the pick cam shaft by means of the bevel gears. This worm drives the worm gear *E*, and, by means of the clutch, the regular train of pick gearing. When the loom is stopped automatically, because of the failure of the filling, the clutch *F* is thrown out of gear; but, when it is stopped by hand by the operative, the clutch *F* is not necessarily (although it may be) thrown out of contact. This allows the pick gearing and the sand roll to be turned forward or back at will. When, however, the shipper handle is in position for the belt to be on the tight pulley, the clutch must be in contact, and the "winding down" of the cloth roll, with consequent thin places in the cloth, is positively prevented. Arrangements are provided for letting the cloth back any desired number of picks, when the filling runs out, by means of the pawl gear and adjustable let-back pawl. This gear has, on one of its faces, half the clutch referred to, the other half being on the worm gear. It will readily be seen by the description that, so long as the loom is in operation, it is impossible to produce thin places in the cloth by the weaver "winding down"; and, at the same time, the arrangements are such that the cloth and the warp are easily rotated, when occasion demands. To manufacturers desiring to produce cloth as nearly perfect as possible, this take-up motion offers advantages never before attained.

When this take-up is used in connection with a dobby, or on cloth which will require a stoppage of the take-up mechanism necessary to produce heavy stripes, or checks, with the filling, we furnish a special device whereby a pair of small, finely toothed clutches are thrown in and out of operation, arresting the motion of the side shaft, and, through its connections, the take-up roll and the cloth, as long as may be necessary to produce the desired width of stripe. This clutch is operated from one of the ordinary harness levers on the dobby, from which runs a wire or strap connection to a small bell crank placed on the side of the loom, throwing the clutch in and out. The whole device is very simple and not easily disarranged or likely to get out of order.

SOUTHERN COTTON MARKET.



BREAST BEAM TAKE-UP ROLL.

WITH PATENT CLOTH WINDING ARRANGEMENT.

BREAST BEAM TAKE-UP ROLL.

WITH PATENT CLOTH WINDING ARRANGEMENT.

We have adopted this name (for lack of a better) for that style of take-up roll which has, for a long time, been used on bag looms and on woolen and worsted looms, for the double purpose of better controlling the width of the cloth, and of preventing wrinkles. We call attention to the combination of this take up-roll with the improved arrangement for winding up a large roll of cloth, as illustrated in our "New Standard Loom," and also by the accompanying illustration.

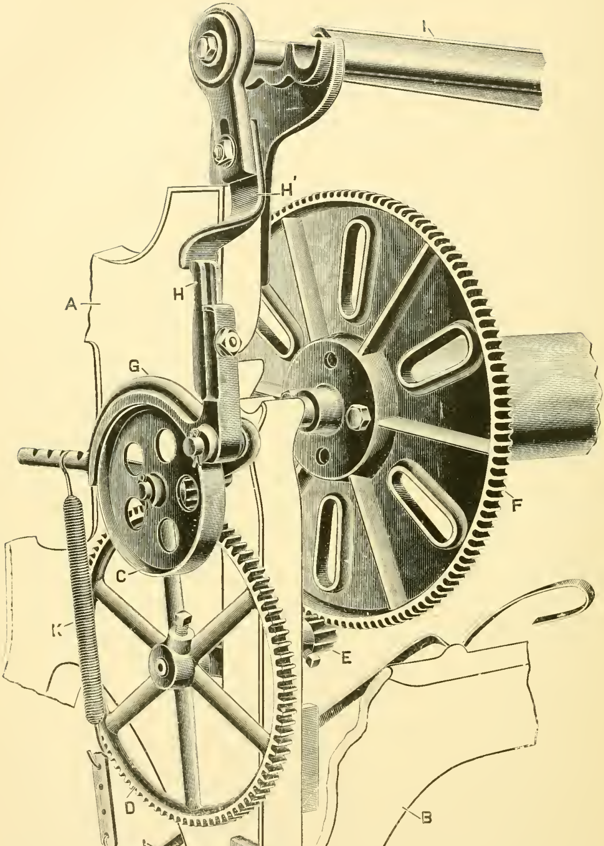
Among the difficulties encountered by some mills have been the prevalence of wrinkles in the cloth, and contraction and expansion in the width of woven cloth, due to atmospheric influence on such a large expanse of cloth as is usually exposed on looms winding long cuts. Reference to our "New Standard Loom" and the accompanying illustration will show that we place the cloth roll immediately below the take-up roll (usually called the sand roll), and the distance from the fell of the cloth to the point of winding contact on the sand roll is always the same, whether at the commencement of a cut or when the cloth roll is filled to its utmost capacity. This distance is so short that the only cloth exposed is that on the cloth roll, and this tends, in a large measure, to prevent the cloth from wrinkling, or contracting, or expanding in width. We do not claim anything original in this "breast roll," as the idea has been in use for more than a hundred years; but we illustrate our arrangement of it, because we believe it possesses advantages over the ordinary breast beam system of winding.

A is the loom lay; *B* the hand rail, or reed cap; *C* and *C'* the breast beam in section, and showing the breast beam also as a cover for the high take-up or sand roll; *D* a removable iron roll, supported in brackets or bearings at each end, over which the cloth passes before coming in contact with the take-up or sand roll; this roll is adjustable up and down, so that any additional needed face can be assisted at this point; *E* the take-up or sand roll, made of wood or of iron, as preferred, and covered with perforated tin, steel, or sand paper, as may be desired, having on one end a gear, which engages with the regular train of pick gearing; *F* an auxiliary roll, supported in the cloth roll stands *G*, and over which the cloth passes before being wound on the cloth roll; *H* the wooden roll, having iron gudgeons resting in bearings on the sliding toggles. These toggles slide up and down in slots in the cloth roll stands *G*, and are, when the cloth roll is empty, pressed up close to the take-up or sand roll *E*, as shown in dotted lines, by means of the spiral spring *K*. This spiral spring is encased in a socket or boot leg, cast in as a part of the cloth roll stand, at its foot. *L* a portion of the bottom front bracket, which secures the cloth roll stands to the loom sides. The handle *J* is removable, so that it does not project into the loom alley.

The illustration shows our arrangement of this take-up roll with the cloth roll full and ready for removal. The dotted lines show the position it will take when the cloth is removed, and the empty cloth roll returned to its bearings in the toggles. It will be readily seen that the amount of cloth that is actually exposed to atmospheric influence is only that from the fell of the cloth to its point of contact with the cloth roll; and it is always practically the same, however much or little may be wound on the roll. To remove the full cloth roll from the loom it is only necessary to exert a slight pressure on the front handle *J*, and the corresponding lug on the back, when the toggle will release and allow it to be depressed and self-locked in position, so that the cloth roll will be free to revolve, thus allowing enough of an end to be cut off and wound around the cloth roll to form the basis of the new cut.

Our construction of these sliding toggles is such that no matter to what point in the cloth roll stand slides the weaver may see fit to depress them, for removal of the cloth roll, there they will firmly remain until the front handle *J* is depressed, releasing them, and allowing their gradual ascent to the initial point of winding, by means of the coiled springs.

That portion of the breast beam which covers the front side of the take-up or sand roll serves not only as a front top girt for the loom, but also as a shield to protect the cloth from dirt. It is also provided with depressed slots for the reception of the temple base, allowing the temple to be kept square to its work. At the gearing end it also serves as a cover for a portion of the pick train gearing. With this take-up roll we can use any of the many styles of take-up gearing, etc., which we build. We believe this arrangement is a remedy for many of the troubles caused by wrinkles, unevenness in width, dirt, and other defects in the cloth; and, when used in connection with our patent positive take-up motion, leaves nothing to be desired at these most vital points of a loom. A roll of cloth 22 inches diameter can be wound on this arrangement, and yet not project into the weavers' alley far enough to obstruct a free passage.



THOMPSON PATENT LET-OFF MOTION.

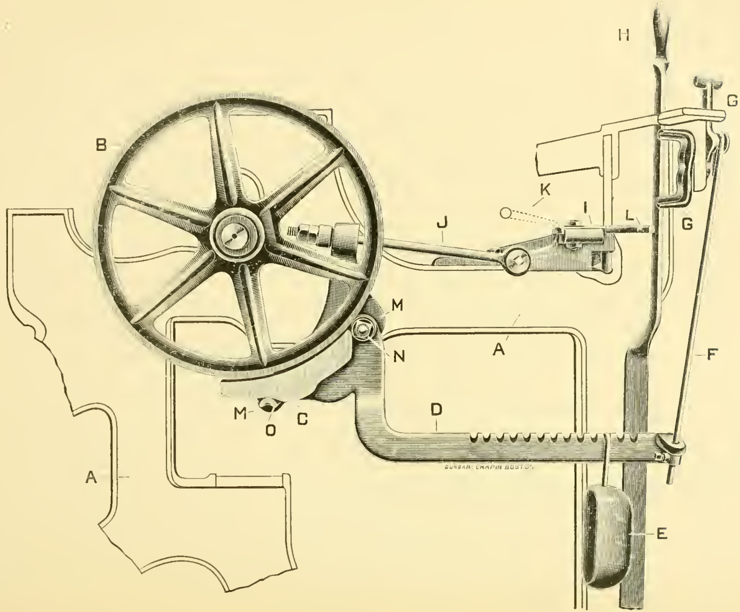
THOMPSON PATENT LET-OFF MOTION.

The illustration shows a portion of the side and back of our loom, of which *A* is the side, and *B* the back bottom girt; *C* is the friction wheel of the let-off motion, with a gear on its hub, gearing into the large let-off gear *D*, on the same shaft with which is the small let-off gear *E*, gearing into the loom beam gear *F*; *G* is the friction lever, having that portion of it which contacts with the friction wheel *C* covered with leather. The projecting arm of this lever is provided with notches for regulating the amount of tension. *H* and *H′* are the adjustable connections between the friction lever and the whip bar or whip roll *I*; *J* is the flat steel compensating connection, which regulates the amount of tension on the spiral spring *K*, as the warp is consumed from the beam, and this completes the automaticity of the motion. Its operation is as follows: The beating up of the filling depresses the whip bar, which, through the connections *H*, releases the friction lever *G*, so that the pull of the yarn allows the beam to let off the desired amount; and, when the loom lay resumes its backward course (after beating up the filling), the pull on the warp is relaxed, and the spiral spring *K* holds the friction lever down to the friction wheel *C*, so that neither it, nor the large let-off gear, nor the warp beam, can move, the result being that no more yarn is let off than is desired; the uniformity of strain on the warp being very plainly shown by the evenness of the cloth, as compared with that woven with other let-offs. The flat compensating connection *J* is held up against the warp yarn on the beam, and, as the yarn is gradually let off the beam, it follows the yarn up to the empty beam barrel, and, at the same time as the diameter of the beam decreases, it automatically decreases the tension of the spring *K*, on the friction lever *G*, thereby allowing the warp beam to be revolved faster as the warp decreases. It will thus be seen that, with the combination of the spiral spring and the friction lever, the tension on the warp can be increased or decreased at will; and, by the use of a stronger spring, the let-off can be adjusted so as to hold tight enough for any ordinary weave.

We can also construct this let-off with compounded gearing from the friction wheel, which will make it strong enough to hold the hardest weaves.

This let-off, properly adjusted, is an effectual preventive of shuttle smashes, etc., because, in the event of a shuttle getting caught in the warp, the adjustable connections between the whip bar and the friction lever are so arranged as to slip by each other when any undue strain is put on them. This slipping causes the whip bar to make part of a revolution forward, instantly slacking the warp.

HOME OF THE COTTON PICKERS.



PATENT COMPOUND BRAKE.

PATENT COMPOUND BRAKE.

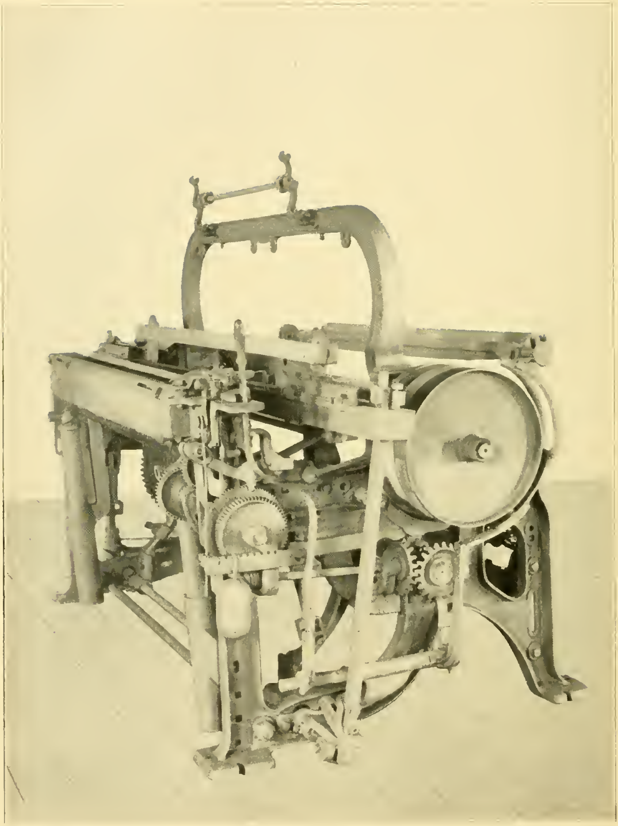
This is the name which we have given to that one of our patent brakes which operates through the bunter of the loom, when the shuttle fails to reach its proper place in the box, and also through a weighted lever, when the filling fails. In other words, it combines the functions of the filling brake and the bunter brake.

We have several different arrangements of this compound brake, one of the latest of which we illustrate. Its advantages over either of the old single brakes are so manifest in the relief from strains which it affords when the loom stops automatically that a description seems superfluous. Nevertheless, we are prepared to furnish either of the single or compound brakes which may be desired, and therefore invite attention to the following description of the illustration.

A is enough of the outline of the loom side to show the application of the mechanism, and its relative position to other parts of the loom; *B* the hand wheel, or brake wheel; *C* the easily removed brake shoe, covered with a leather friction; *D* the adjustable filling brake lever; *E* the movable counter weight; *F* an adjustable connecting rod from the brake lever to the belt shipper and hand mechanism; *GG* the hand mechanism, one part of which allows the weaver to operate the brake at will, and the other part is operated by the belt shifting lever *H*; *I* the ordinary bunter frog; *J* the adjustable connecting rod which connects the bunter with the brake shoe and lever; *K* the protection rod in section, and protection rod dagger; *L* the connecting finger from the bunter frog to the shipper handle; *M* the bunter brake lever, which is fulcrumed on the hub *N*, of the filling brake lever *D*, and which, by means of the lug *O*, presses the brake shoe *C* against the wheel *B*, whenever the bunter frog *I* is acted upon.

The operation of this brake is as follows: The loom being in running order, the brake wheel revolves with the crank shaft. Should, however, the shuttle fail to box itself, the shuttle binder becomes inoperative, allowing the protection rod to be drawn down by its spring, presenting the protection rod dagger in such a position that it will engage with, and slightly push forward, the bunter frog. This slight forward movement accomplishes two things. It pushes forward the bunter connection finger, thereby releasing the shipper handle from its engaging notch, shifting the belt from the tight to the loose pulley; at the same time it also pulls forward the top end of the pivoted lever *M*, holding the brake shoe by means of the adjustable connecting rod, while the released weight *E* holds the brake shoe against the face of the hand wheel, instantly stopping the loom. The operator can release the brake by means of the handle *G*; or the simple act of putting the shipper handle into position for the belt to run on the tight pulley would restore the whole mechanism, releasing the brake, leaving the loom free to operate.

The compound feature of this brake consists in the ability to operate it not only as above described, from the bunter frog, but also from the filling fork, in the absence of the filling. When the filling breaks, or becomes exhausted, or when, from any cause, the filling fork fails to tilt, the filling cam lever is free to push back the filling fork slide; and, in doing this, it pushes back a lever, pivoted on the end of the belt shipper slot bracket (commonly called the shipper end piece), the other end of this lever being held up against the end of the fork slide by the belt shipper. The pushing back of this lever releases the belt shipper from its holding notch. On its release it springs to the end of its slide, thereby shipping the belt, and, in so doing, actuates the mechanism *GG*. These parts describe a part of a circle, thereby lowering the weighted end of the brake lever *D*. This forces the brake shoe up against the face of the brake or hand wheel, instantly stopping the loom. Shipping the belt to the tight pulley automatically restores the entire mechanism to its normal position, leaving the loom free to operate; or it may be done without starting the loom, by means of the handle *G*, as follows: After the brake has stopped the loom, and before the belt shipper is placed in such a position that the belt would pass from the loose to the tight pulley, and automatically release the brake, it is often necessary to place the lay in such a position that the shuttle can be placed in the box, or to turn the loom over by hand, so that it will start up without banging off. In such a case, it is necessary to release the brake by hand, and to accomplish this all that is necessary is the single simple movement of the handle *G*, which instantly releases the whole brake mechanism, allowing the weaver to turn the loom forward or back. This device is so very simple that so lengthy a description may seem out of place, but we wish to emphasize this fact of its extraordinary simplicity. We believe that its adoption will prevent more breakages and consequent stoppage of looms than anything which we have devised for a long time, and we invite a thorough investigation of its merits.

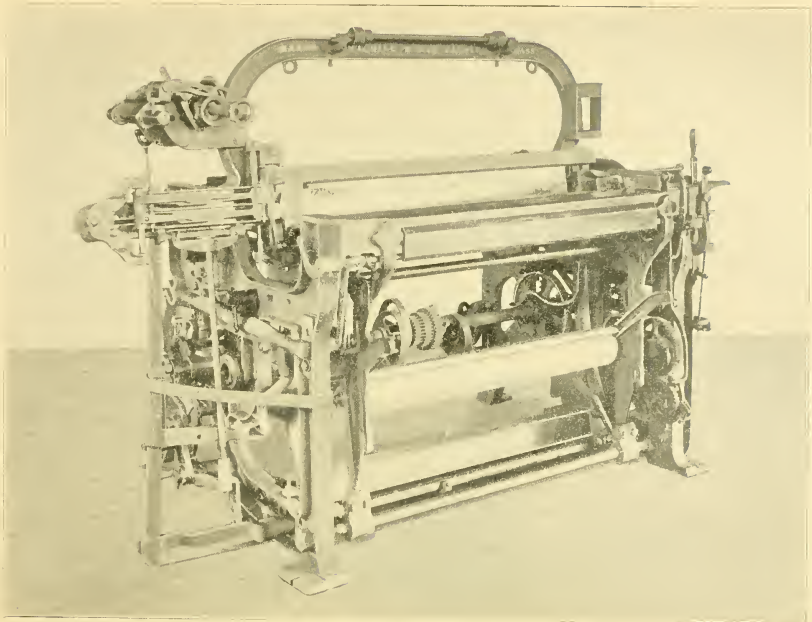


NEW STANDARD LOOM,
WITH BELT SHIPPER TO PULL ON.

PULLING-ON BELT SHIPPER MECHANISM.

Heretofore our looms have been so constructed that the belt was shipped to the tight pulley by *pushing* the belt shipper handle; and, in order to meet a demand for our looms in localities where other kinds of looms are in use, in which the belt shipper is *pulled* on, we have designed a mechanism which, while accomplishing the desired end, has resulted in our dispensing with a great deal of the mechanism which other loom builders use.

Referring to the accompanying illustration, it will be seen that we attach the foot of the ordinary belt shipper to a short shaft, working in stands secured to the bottom of the loom side, at the other end of which is the belt fork. An adjustable flat spring is furnished, so that the tension on the shipper handle need be no more than is alsolutely necessary to properly ship the belt. With this arrangement we are able to dispense with placing the handle, fork, slide, stud, and connections up close to the top of the loom side. The simplicity of this mechanism will commend it in all localities where the weavers are accustomed to pulling on, instead of pushing on, the shipper handle.



STANDARD TWO BOX LOOM

STANDARD DROP BOX LOOM,

WITH PATENT BOX CHANGING MOTION.

This loom has for its basis our ordinary heavy sheeting loom, and may be made in any of the various widths. For the economical weaving of checks, ginghams, and similar fabrics, we deem it worthy of the investigation of manufacturers of such goods.

The box motions are operated by sliding teeth, and are moved in their respective positions by means of a connection operated by the pattern chain, and the operation of the tooth is positive, both in and out of position. The bell crank, operating the sliding tooth, is counterbalanced, ensuring positive action. The levelling or aligning of the boxes is obtained by means of eccentric face plates. The necessary throw is given to the box levers by these face plates; and the adjustment of the boxes with the race plate is obtained by the adjusting nuts on the rod which connects the boxes with the box levers. This method of adjustment allows each box to be brought exactly level with the race plate; and the arrangement of our patent box guide ensures the preservation of that alignment. A "release motion" is provided to prevent breaking the boxes or box motion, in the event of a picker getting stuck, or a shuttle failing to box itself. This release motion consists of the box lever being in two parts, held rigidly as one solid lever by a spring strong enough to hold the lever intact when the boxes are in working order; and, in the event of any obstruction preventing the operation of the boxes, the spring releases enough to allow the lever to "buckle." When the obstruction is removed, a simple pull or push of the boxes restores the lever to its normal position. The pattern chain is supported on the ordinary loom arch by brackets, and the barrel is driven by an upright rod from the cam shaft by means of pawls. The pattern chain has its bars made of wood, with small dobby pins inserted. This arrangement requires no oiling of the chain, and there is no liability of the pattern chain throwing oil on the warp.

We have devised and patented a very simple "multiplier" motion, which is worked by a separate pin on the pattern chain, which raises a lever, throwing the multiplier pawl into, and the chain pawl out of, operation. This allows the multiplier ratchet to work, and brings into operation the face plate. This face plate may have one point or two points, for engagement with the multiplier ratchet. If it has one point, one pin on the pattern chain will equal sixteen picks; and, if it has two points, it will equal eight picks to one pin on the chain bar. If more than eight or sixteen repeats of a pick are required, we generally use more pattern chain bars, each bar being equal to eight or sixteen picks. Should any number of picks be required to be repeated, which is not a multiple of eight or sixteen, we generally make use of one bar on the pattern chain for every two picks.

The filling stop motion, or "still box" motion, is worked from the filling fork, which operates a bell crank which raises the pawl operating the pattern chain ratchet gear. This arrests the motion of the pattern mechanism. The absence of the filling having worked the "still box" motion, it also automatically releases the shipper handle, thereby stopping the loom right on the pick, dispensing with the necessity of the weaver finding the pick.

The protection of this loom is usually in the middle, and, by an arrangement entirely new with us, it prevents the moving of the drop box mechanism, should a shuttle remain in the single box end. When this occurs, the protection motion, at the single box end, would still be in working order, were it not that, by means of a double protecting finger, operated by the shuttle binder on the empty box on the drop box end, the boxes are prevented from rising or dropping. Then the absence of the filling at the fork would stop the loom in the usual manner. When the loom has been so adjusted again that the shuttle will be thrown from the single box end, it will enter its own particular box, at the drop box end, as if nothing had occurred. This device prevents smashes at the drop box side of the warp when two shuttles try to enter the same box.

The take-up motion on this loom is worked from the foot of the lay sword, the pawl and lever operating a ratchet gear. A throw-out circle is provided on one side of the ratchet gear, which throws out the operating pawl and the hold-back pawl. This allows the weaver to turn the cloth forward or backward at will, without having to hold the pawls out by hand. The hold-back pawl can be connected with the filling fork slide, and can be adjusted so as to allow the letting back of as many picks as may be desired. With this style of take-up motion, the ratchet gear is the change gear, and is so arranged that the number of teeth in the change gear represents the number of picks in the cloth.

We are not confined to this particular form of take-up. We have a large variety to choose from, which are the results of our long experience, some of which are entirely new, and admirably adapted to the uses for which they were designed.

Any let-off can be used on this loom, and we have a large number to choose from.

Shuttle holders are provided for extra shuttles.

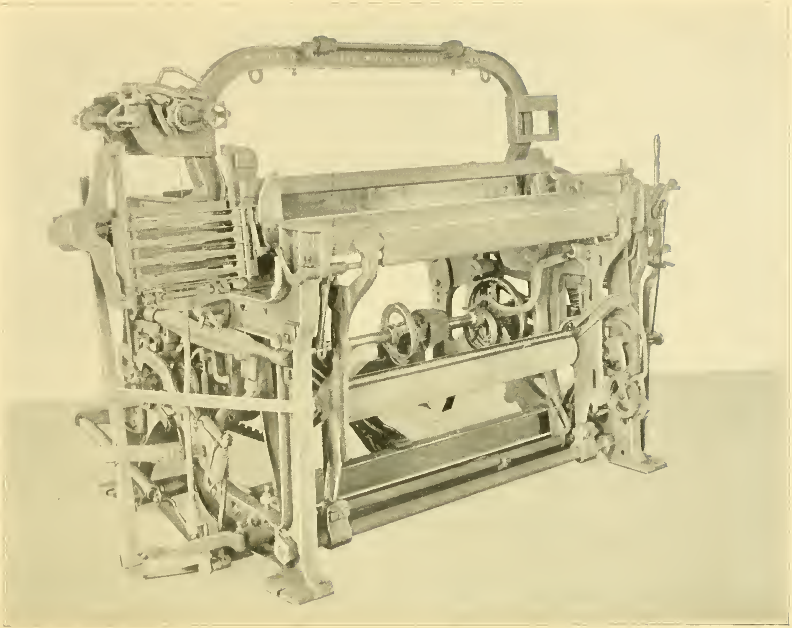
We generally drive looms of this description with a friction pulley, which may be either of the flat or face friction, or the cone or wedge friction, or we can use tight and loose pulleys, if desired.

Twill motions for three, four, or five harnesses can be applied, and, by making a few changes in the arch, dobbies of from eight to twenty-four harnesses can be applied.

Our aim has been to produce a box loom simple in construction and operation, capable of the highest speed consistent with good work, and we have no hesitation in recommending this one.

As we can apply this box motion to almost any pattern of our own looms, and also to other looms beside our own, at comparatively small outlay, and with but few alterations in the loom itself, we are in a position to serve anyone wishing to add box motions to plain looms.

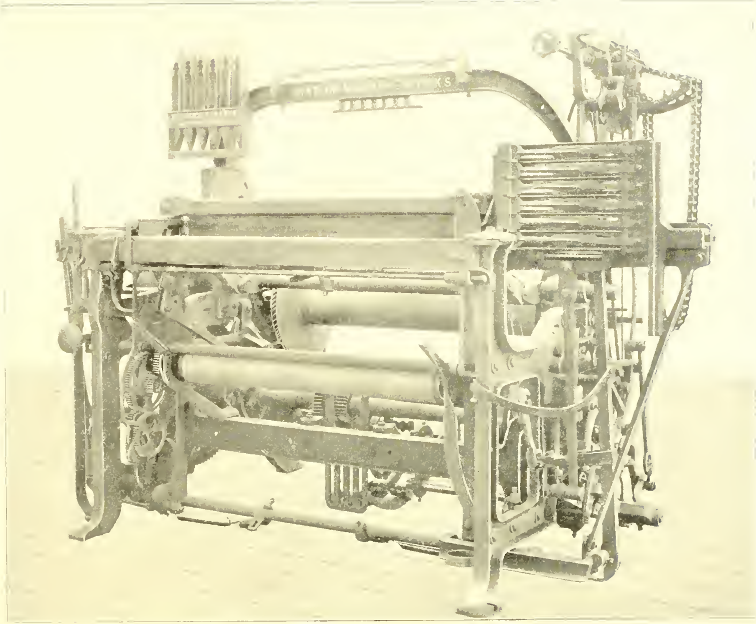
COTTON AWAITING SHIPMENT.



STANDARD FOUR BOX LOOM.

Standard Four Box Loom.

The detailed description given on the preceding pages applies to our four box loom as well as to our two box. The only change made necessary by the larger number of boxes is the addition of an extra sliding gear, and the connections to the pattern chain. An additional pin is inserted in the pattern chain, to govern the extra pattern chain lever, which will control the extra sliding tooth and its connections.



AMOSKEAG STYLE DROP BOX LOOM.

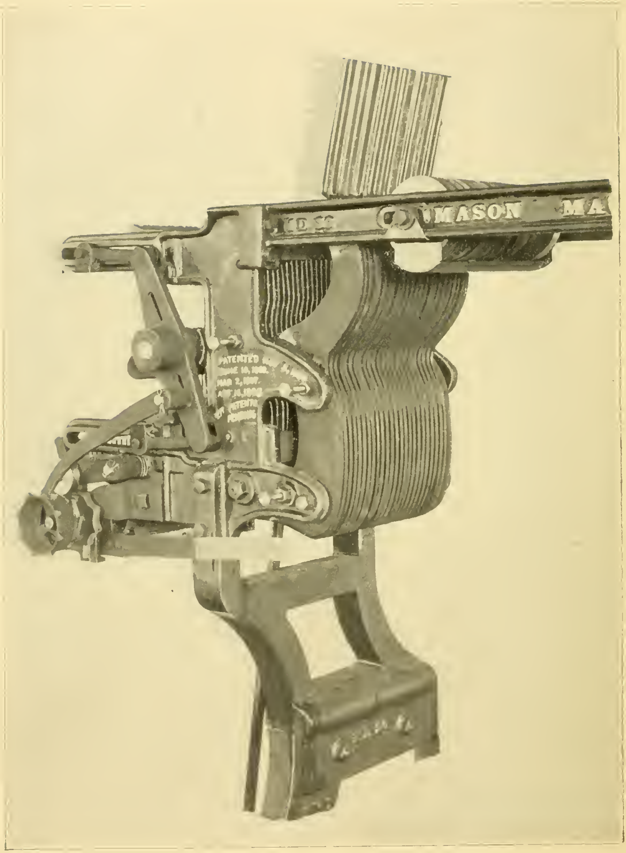
"AMOSKEAG" STYLE DROP BOX LOOM.

In addition to our New Standard Drop Box Loom, in which the boxes are operated by a sliding gear, or sliding tooth, we also build a drop box loom with the boxes operated on the latch and step principle, which has found much favor in certain localities. There are certain features of this loom worthy of consideration, and we offer the following description.

The box motion is operated by a cam placed on the end of the pick cam shaft, outside the loom, which depresses the steps; the action of the cam being to always depress the step to its lowest point, when the step, coming in contact with the latch bar or positioning bar, which slides on the box lever, the box lever is raised or lowered, as the case may be; and, through the connection from the box lever and rod, the boxes are raised or lowered. The latch bar or positioning lever is worked by means of a bell crank from the pattern chain, which, in turn, is operated by a rod connected to a quadrant controlled by the box cam. The pattern chain is composed of pins or studs of various lengths, and the pattern finder travels a greater or shorter distance, as may be required by the length of pin, and, through its bell crank connection, operates the latch or positioning bar. As no balls or rolls are used on the pattern chain, it is always clean, and will not throw oil.

A simple multiplier is used, which can be removed from the loom, when not needed, and gives from eight to forty-eight repeats of the pick to one bar in the chain.

A box relief motion is provided, which releases the box mechanism when a picker gets caught, when a shuttle fails to enter a box, or when, from any reason, the box fails to work properly.



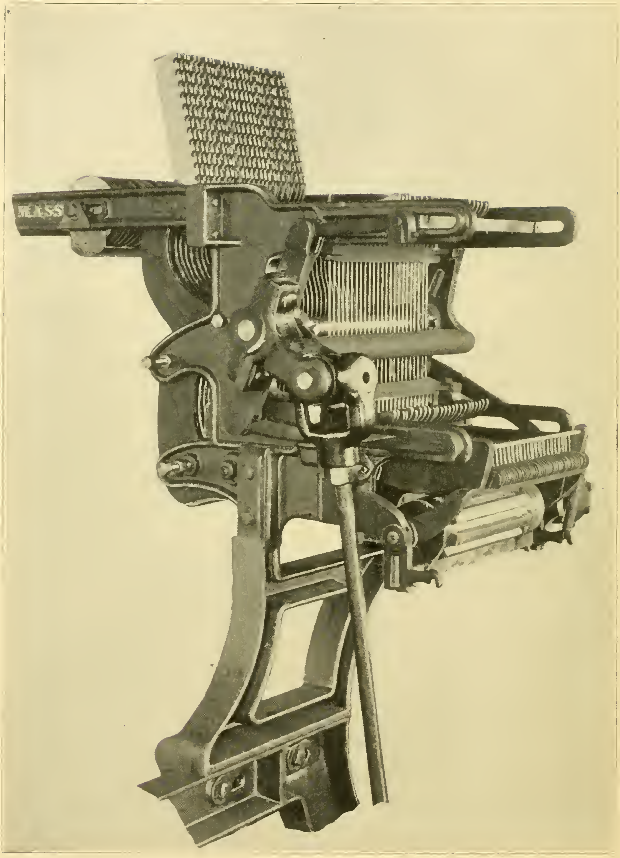
MASON DOBBY.

Mason Dobby.

In calling attention to our improved dobby, it is but fair to the original inventor (Hattersley of England) of this type of shedding motion to say that our machine is (as is also true of other dobbies), in its fundamental principles, simply a modification of the original invention, strengthened and improved, in order to meet the increased demands placed upon it.

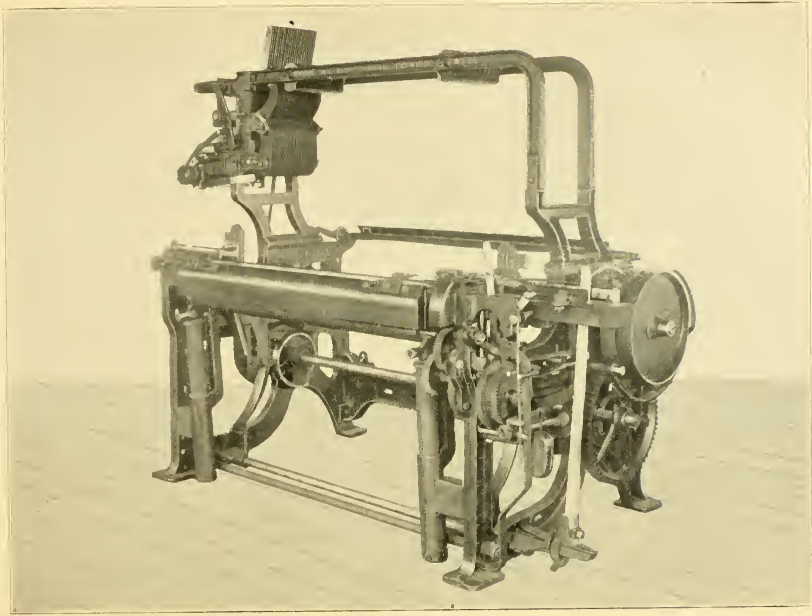
As now made, this motion is capable of weaving a large range of patterns, and the growing demand for a device that will require no extraordinary skill in weaving has induced us to carefully revise our dobby, to which we invite your attention.

The jack, or harness levers, in this dobby, are similar in design to those in use in other dobbies, and are so constructed that the ribs on the levers keep them in their respective positions, and also hold the compound levers in place. On the jack levers are bosses, which serve as bearings for the compound levers. The hooks are attached to the compound levers in such a way that it is not necessary to spring the compound lever apart, as is done on many dobbies, in order to put in or take out the hooks; but they are so shaped that either a top or a bottom hook can be removed without taking the dobby apart, and, at the same time, under normal conditions, they cannot fall out. The hooks have large bearing surfaces, and will outwear other methods of connecting. The knives for operating these hooks are of chilled iron, and the connections from the knives to the driving lever are also made in such a way that there are no steel pins to become worn; and yet, by the removal of one



MASON DOBBY.

split pin, the connecting arms can be readily removed from the dobby. The jack levers are supported on a pivot shaft, running through the dobby from side to side, serving also as a girt to the frame, and a back shaft prevents them falling out of place. The rocking arm which operates the knives, instead of being keyed to a shaft which ordinarily runs through and revolves in the dobby frame sides, rocks on a shaft which is held in position by set screws. The rocking arm is all in one casting, and rocks on the ends of fixed shaft referred to above, which projects beyond the sides of the dobby frame. Several advantages are obtained by this method of construction, one of which is that the rocking arms being solid prevents one end from running ahead of the other; another is that the shaft is not rocking in the sides of the dobby, and wearing. The upper hooks are controlled by wires running down to the tilting levers. These wires are guided by passing down through two holes in the cross girts, which hold the frame of the dobby together, one girt at the top and the other at the bottom. These cross girts also serve to separate the hooks. The lower hooks are operated by coming directly in contact with the tilting levers, which are operated by pins in the pattern chain. The upper hooks have their own independent set of tilting levers, operated by a double row of pins in the chain. The chain barrel is worked by a pawl attached to the bottom of the rocking lever, operating a ratchet gear placed on the inside hub of the hand wheel; and a check roll, bearing against a recess friction wheel, prevents the pattern chain barrel from turning any further than is necessary to bring the pattern chain bar, with its pin, directly under the tilting levers. The outer guide for the tilting lever also acts as a levelling device, and rocks on the chain barrel shaft. Attached to it is a handle



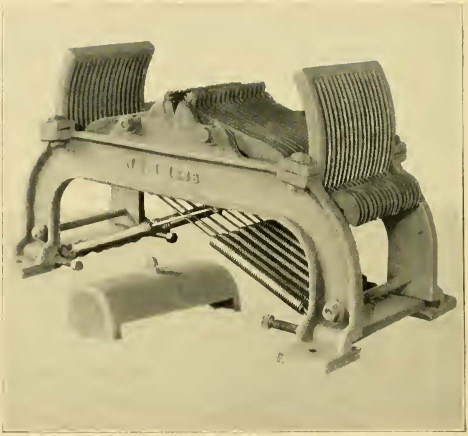
NEW STANDARD LOOM WITH MASON DOBBY

extending toward the centre of the loom, where it is held firmly in position. Should the weaver desire to lift all the harnesses, she depresses this handle, which lifts all the tilting levers the same as if a pin should be placed under each lever.

As constructed by us, to be placed on our looms, we prefer to drive the dobby by means of an upright shaft and knuckle joints from the outer end of the pick cam shaft. By means of adjusting nuts on each end of this driving rod, we can set this motion so that there will be no back-lash. In the use of gears, a driving chain, and a crank arm, the danger of lost motion and back-lash is always present. On looms other than our own, where there is no opportunity to drive from the pick cam shaft, we use the gear, chain, and crank arm, driven from the crank shaft.

The strap sheaves are of seasoned hard wood, and are provided with covers, to keep the dirt and oil from the warps.

The double arch and dobby stand are very strong, and the whole mechanism (the dobby and its attachments) is of the best materials and workmanship.



HARNESS JACK.

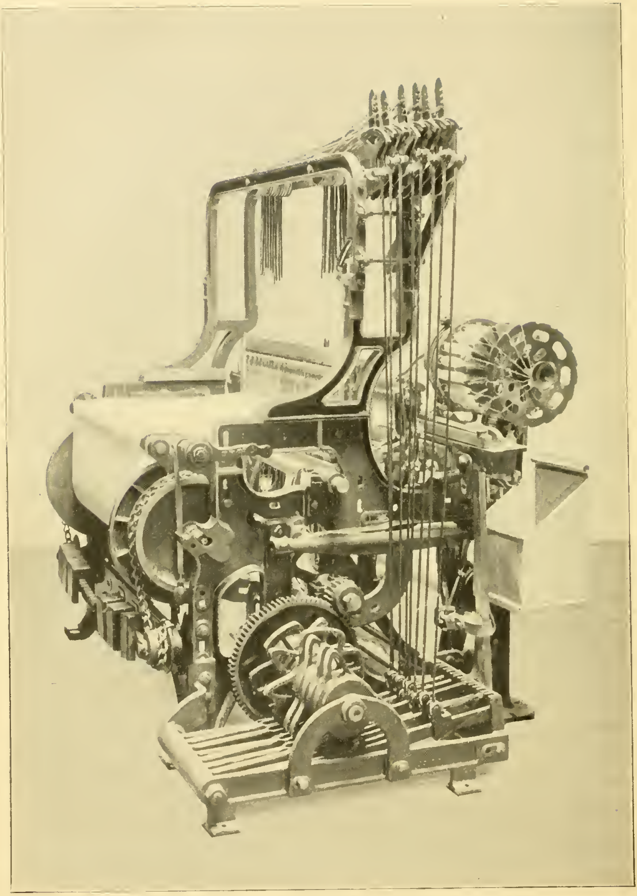
Harness Jack.

We have designed this Harness Jack, shown in the illustration, as an alternative for the old style floor spider and coiled springs heretofore used for pulling the harnesses down on dobbies and similar motions.

It is arranged as a frame, which is secured to the floor, and has two shafts which serve as girts or stay-rods to the frame, as well as carrying the levers, to one end of which are fastened the connections to the under side of the harness frames. The toothed arc of a circle on each end of the levers has, in our machine, been made very much longer than heretofore, so that in the event of a harness being raised higher than is necessary the levers do not pull by and get out of mesh. This fault, on many machines, causes serious smashes in the warp, and vexatious delays in resetting the levers. Ribs are cast on the sides of each lever, and ground to gauge, ensuring accurate meshing of the teeth. A rack is bolted to the top side of the frame, which separates the levers at the hook or harness connection end of the levers, which tends to still further ensure accuracy of working in the levers. The springs which pull the levers down are not fastened to the framework, but are attached to a sliding bar provided with adjusting screws and lock-nuts, thereby allowing the tension of the springs to be regulated as desired.

A cover is provided, which protects the working parts from damage, should anything fall from above.

The whole arrangement is self-contained, occupies small space, is very simple, and of strong construction. Wherever it has been used it has given perfect satisfaction. We are prepared to build this Jack for from eight to twenty-four harnesses.



VELVET LOOM,

WITH SIDE CAMS AND NORTHROP FILLING SUPPLY.

Velvet Loom (Patented).

WITH SIDE CAMS AND NORTHROP AUTOMATIC FILLING CHANGER.

The basis of this loom is our "Heavy Sheeting Loom," which has a large depth of harness space, in order to accommodate the large number of harnesses required to weave velvets, corduroys, plushes, fustians, etc.

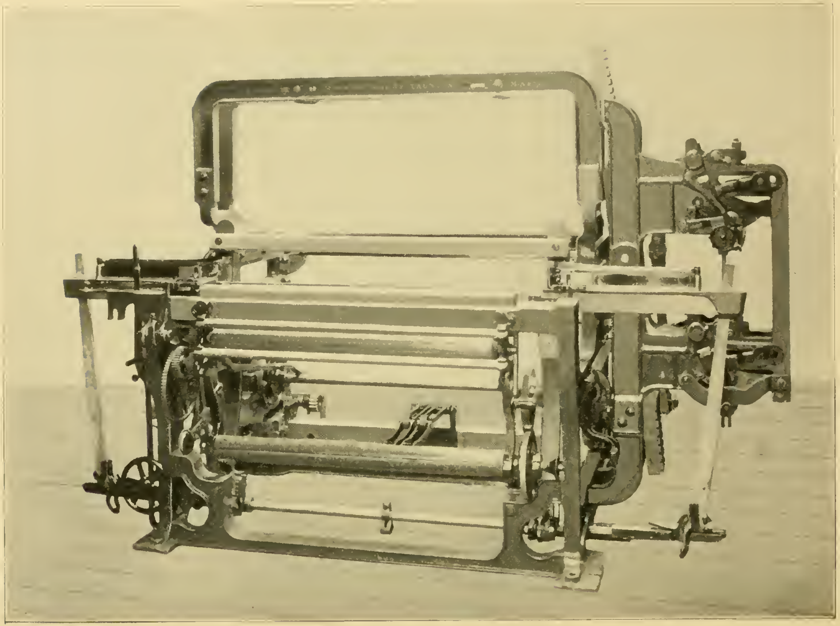
From the illustration it will be seen that we have placed the cams on the outside of the loom. The cams and cam gear are on a single shaft, and the cams are cast separately, but provided with interlocking jaws; in other words, the hub of each cam fits in the hub of the one next to it, and all are firmly held together with a check nut, in the same manner as our ordinary three, four, and five harness cams. The harness treadles are provided with rolls for the cam bearings. The connections to the top work are furnished with means of adjustment. The bell cranks, operating the harnesses, are all arranged on a cross girt at one end of the double arch, and no oil can get on the warp, as their position is outside of the loom frame proper.

The fabrics for which this loom is intended are of very high pick, and the take-up mechanism is specially designed for such work. It is operated by the number of picks put in the cloth, and the picks are held firm by a ratchet gear, operated by a weighted lever, which works the cloth down on the take-up roll, as the fell of the cloth is crowded by the loom reed. Manufacturers of such fabrics are familiar with this form of take-up; to them we will say that we have improved and modernized it, making it more perfect than it has heretofore been.

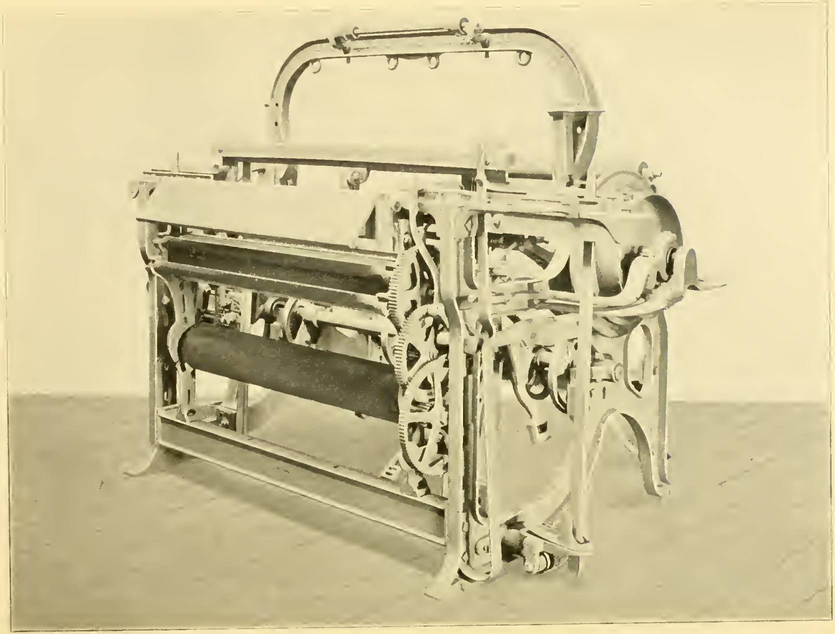
The let-off motion illustrated is a very strong chain friction, but we can apply other styles to suit the circumstances.

The motion for drawing the harnesses down is our improved harness jack, previously illustrated.

The take-up motion provides for winding a very large roll of cloth.



POSITIVE FANCY HARNESS MOTION LOOM.



SILK LOOM.

Silk Loom.

This loom was specially designed to weave plain silks at a high speed, and yet to be easy on the warp and woven goods. It has friction pulley, adjustable breast beam strip, loose or receding reed for prevention of warp smashes, and revolving whip bar. The breast beam strip is held in adjustable stands, so that its height can be varied at will. A wooden cover directly in front of the breast beam protects the goods when passing over the breast beam down on to the cloth roll. As delicate colors are often woven, it is very desirable to have this permanent means for protecting the cloth from the weaver's clothing and other possible means of soiling.

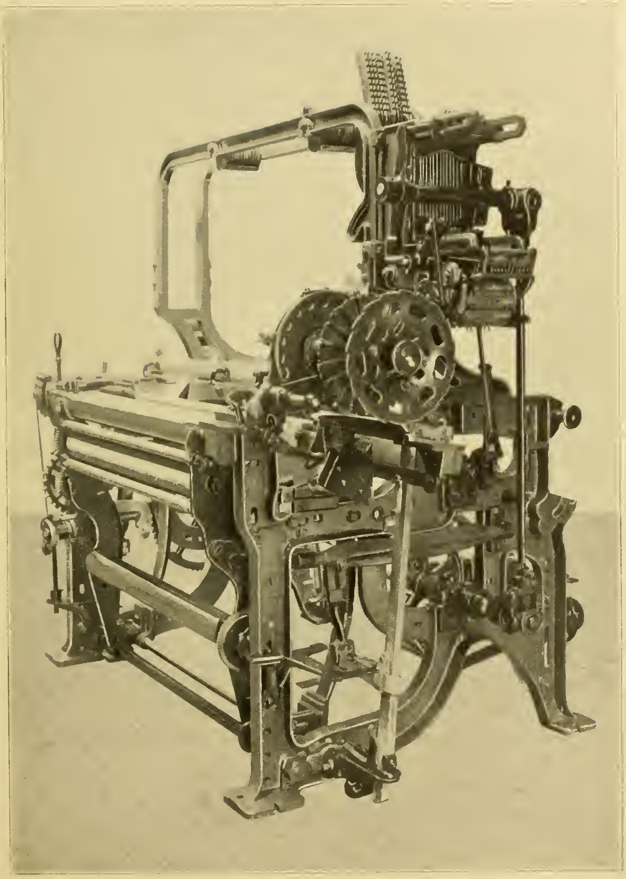
The friction pulley is very simple, and, when released by the shipper handle, the loom instantly stops.

The take-up mechanism is worked from the foot of the lay sword, and, as we have not described it elsewhere (although we have used it for a long time on many looms of our build), a description of it may not be out of place here.

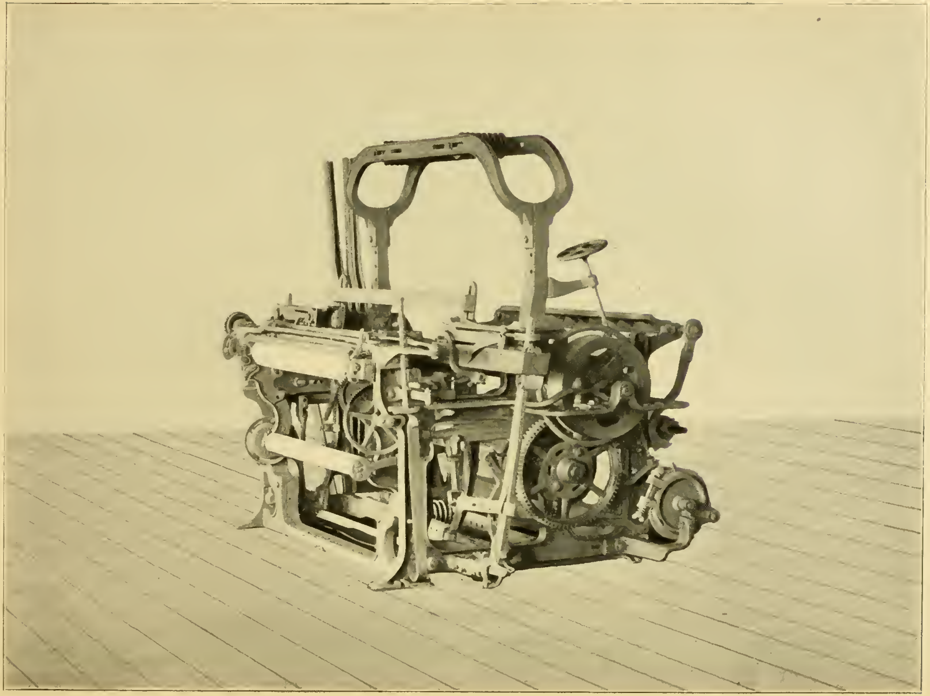
As stated, the ratchet gear is worked from an adjustable lever, placed at the *foot* of the lay sword, directly operating the ratchet gear, which is connected with the regular train of pick gearing. With this style of take-up motion, the ratchet gear can be made the change gear, and it can represent the number of picks required; or the pinion can be made the change pick gear, if desired. A let-back pawl, operated by the filling fork and loom bunter, provides for letting-back the cloth as much as is desired. A very handy device, in the form of a throw-out disc, allows the weaver to turn the cloth roll forward or back, without having to use both hands on the take-up, the disc simply throwing out the operating lever and hold-back pawl.

The cloth roll stands are provided with revolving rolls, over which the cloth passes on its way to the roll, thereby protecting delicate fabrics from injury, so far as possible.

We also build Silk Looms with dobbies and box motions, and of widths to suit all kinds of goods.



DOBBY LOOM WITH NORTHROP FILLING SUPPLY.

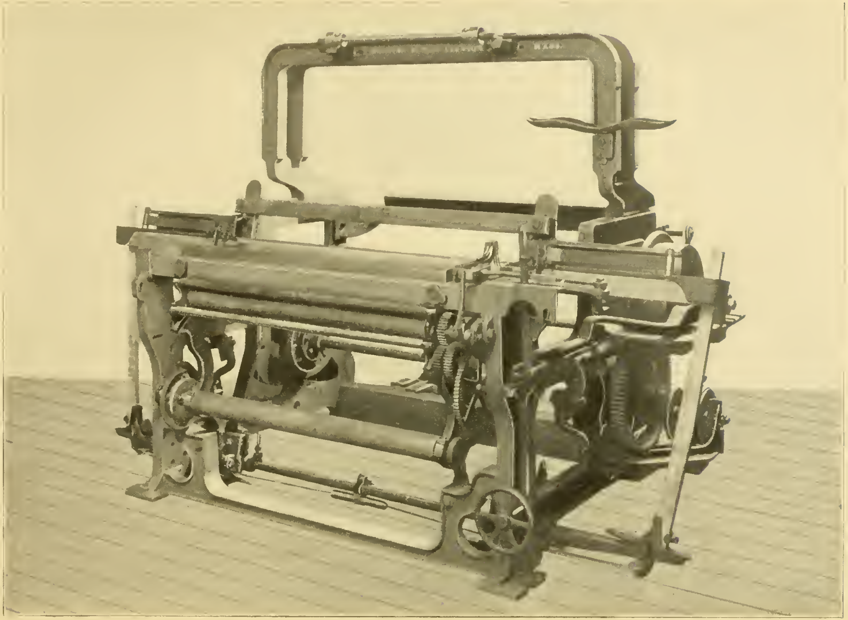


HEAVY BAG LOOM.

HEAVY BAG LOOM.

This loom is built for weaving seamless bags and similar fabrics. It has heavy frame, outside cams, large depth of harness space, strong let-off motion, improved take-up mechanism, an efficient friction driving pulley, when desirable; take-up arranged to wind up a large roll of cloth, and a patented measuring roll, for governing the length of the bag. It will carry a large shuttle, and a beam head 26 inches in diameter, if desired. The patent measuring roll is believed to be the best for seamless bags that has ever been used, and, when the desired length of tube has been made, the bottom of the bag is automatically woven in without stopping the loom; and, when the bottom has been woven in, the tubular weave is automatically resumed. On some kinds of goods the take-up roll is covered with fine steel pins.

The length or depth of the bag can be altered by merely changing one gear.

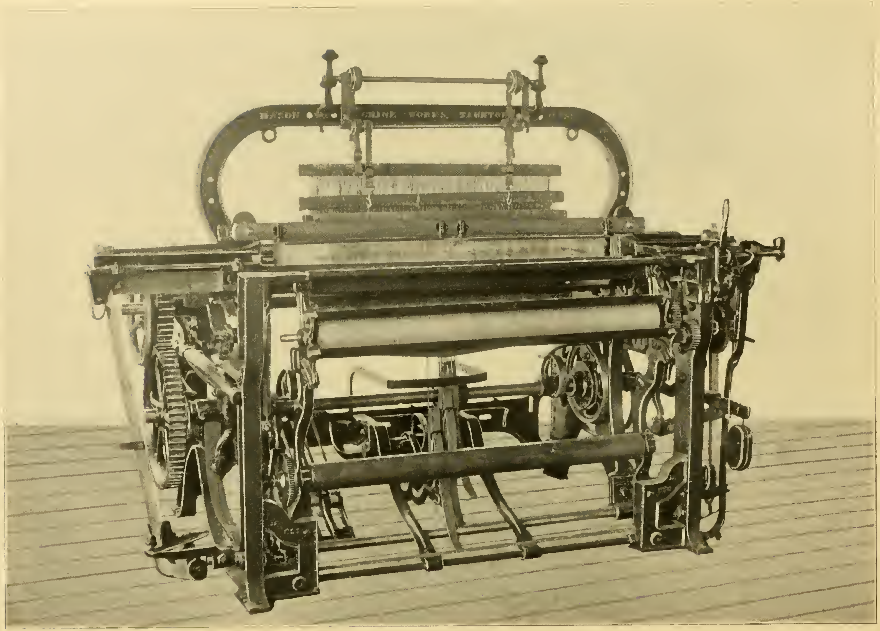


JUTE LOOM.

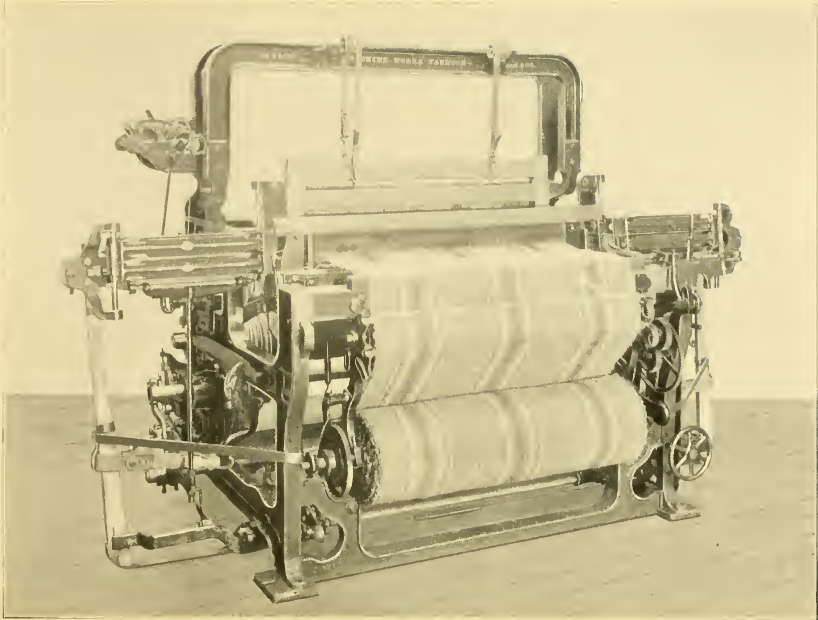
JUTE LOOM.

This loom was designed for weaving jute burlaps, carpeting, and similar heavy fabrics, in either plain or fancy styles. The frame and all essential parts are made heavy and strong. The shuttle boxes are large enough to use a shuttle 19½ inches by 2¼ inches by 2 inches. The beam head can be 26 inches diameter, if desired. The harness space is ample for a dobby or a positive harness motion, with several harnesses. The take-up roll is usually covered with fine steel pins, and provision is made for winding a very large roll of cloth. The take-up roll has been made of iron pipe, with steel pins inserted, and the ends fitted with iron heads. The let-off motion is adapted to very heavy goods, and is operated by the pull or tension on the whip bar. As the pull becomes more pronounced, it brings forward a lever against a small cam placed on the pick cam shaft. As this cam revolves, it forces this lever outward and away from the center, and thus imparts motion to a lever, operating the pawl, which operates the ratchet wheel. The friction is a leather covered circle, which encircles the friction wheel. The ends of this circle are pivoted together with spring connections, and can be so adjusted as to give any desired amount of friction. To operate this motion by hand, we have, on the let-off shaft, a large bevel gear meshing into a small bevel gear on the end of a side shaft, on the front end of which is a hand-wheel. A lever and bell crank, operated by hand, raises a pawl, thereby releasing the ratchet gear, when the beam can be turned forward or back by means of the hand wheel. By means of this let-off motion, a uniform pick of wide range may be attained. For a driving pulley on this loom, we prefer an efficient friction, but can furnish the tight and loose pulleys if desired.

We are prepared to furnish this loom either single box, two box, four box, or four box pick and pick.



SHEETING LOOM, WITH SPECIAL TAKE-UP.



HEAVY PICK AND PICK TWO BOX LOOM.

Heavy Pick and Pick Loom.

This loom is adapted to the weaving of jute carpets, grass cloth, fancy burlaps, and similar goods requiring the use of different colors of filling.

It is substantial and convenient for the work for which it was designed. The box motion is of our sliding-tooth form, which commends itself for its simplicity and easy operation.

The take-up arrangements provide for a large roll of cloth, the roll being made of wood with fine steel pins inserted; sometimes we use a roll of iron pipe with the steel pins inserted for this purpose.

For a more extended description, reference is had to the preceding article on the Jute Loom.

RULE TO FIND THE NUMBER OF TEETH IN CHANGE PICK GEAR REQUIRED TO GIVE ANY DESIRED NUMBER OF PICKS PER INCH.

FIRST.

On looms taking up each alternate pick, by means of pawl and ratchet gear, worked by filling cam, take-up change gear attached to ratchet gear, and take-up roll gear, proceed as follows:—

Multiply the number of teeth in the ratchet gear by the number of teeth in the take-up roll gear and by 2, for a dividend; multiply the circumference of the take-up roll in inches by the number of picks required per inch, for a divisor. Divide the dividend by the divisor, and the quotient will be the number of teeth required in the pick gear.

EXAMPLE.

Number of teeth in ratchet gear 110.
Number of teeth in take-up roll gear 68.
Multiplied by 2.

$12\frac{1}{4}$ in.=circumference of take-up roll.
64 picks required per inch.

$$\text{Then } \frac{110\times68\times2}{12.25\times64}=19,$$

which is the number of teeth required in the pick gear to put in 64 picks per inch with this style of take-up motion and gearing.

NOTE.—With an 80 toothed take-up roll gear, and 13 toothed ratchet pinion gear, taking up every other pick, the number of picks per inch in the cloth will be the same as the number of teeth in the take-up ratchet gear.

RULE TO FIND THE NUMBER OF TEETH IN CHANGE PICK GEAR REQUIRED TO GIVE ANY DESIRED NUMBER OF PICKS PER INCH.

SECOND.

On looms taking up every pick, either from the lay rocker shaft, or by eccentric on crank shaft, and requiring 1 tooth in the change gear to 2 picks in the cloth, proceed as follows:—

Multiply the number of teeth in the ratchet gear, the number of teeth in the take-up roll gear, and the number of picks required per inch in the cloth, together, for a dividend; and multiply the number of teeth in the ratchet pinion gear, and the number of teeth in the stud pinion gear, and the circumference of the take-up roll, in inches, by 4, for a divisor. Divide the dividend by the divisor, and the quotient will be the number of teeth required in the change pick gear.

Example.

Number of teeth in ratchet gear 100.
Number of teeth in take-up roll gear 68.
Number of picks required per inch 64.

17 teeth in ratchet pinion gear.
16 teeth in stud pinion gear.
$12\frac{1}{2}$ in.=circumference of take-up roll.
Multiplied by 4.

$$\text{Then } \frac{100\times68\times64}{17\times16\times12.50\times4}=32,$$

which is the number of teeth required in the pick gear to put in 64 picks per inch with this style of take-up motion and gearing.

In very high pick goods, with 4 picks to 1 tooth in change gear, multiply by 8 instead of 4, for a divisor; and, in very low pick goods, with 1 pick in the cloth, representing 1 tooth in the change gear, multiply by 2 instead of 4, for a divisor.

RULE TO FIND THE NUMBER OF TEETH IN CHANGE PICK GEAR REQUIRED TO GIVE ANY DESIRED NUMBER OF PICKS PER INCH.

THIRD.

On looms having Patent Positive Take-up Motion, with 1 tooth in the change pick gear representing 2 picks in the cloth, proceed as follows:—

Multiply the number of teeth in the bevel driven gear on worm shaft, the number of teeth in the worm gear, the number of teeth in the take-up roll gear, and the number of picks per inch required in the cloth, together, for a dividend; multiply the number of teeth in bevel gear on pick cam shaft, the number of teeth in pinion on stud with worm gear, the number of teeth in pinion driving take-up roll gear, the circumference of the take-up roll, in inches, and by 2, together, for a divisor. Divide the dividend by the divisor, and the quotient will be the number of teeth required in the pick gear.

Example.

Number of teeth in bevel driving gear 20.
No. of teeth in worm gear 50.
Number of teeth in take-up roll gear 48.
Picks per inch required in cloth 96.

20 teeth in driven bevel gear.
16 teeth in gear on stud with worm gear.
12 teeth in pinion driving take-up roll.
$12\frac{1}{2}$ in.=circumference of take-up roll.
Multiplied by 2.

$$\text{Then } \frac{20\times50\times48\times96}{20\times16\times12\times12.50\times2}=48,$$

which is the number of teeth required in the pick gear to put in 96 picks per inch with this style of take-up motion and gearing.

YARDS OF CLOTH PER LOOM WOVEN PER DAY OF 10 HOURS.

Picks per Inch.	PICKS PER MINUTE. 100	105	110	115	120	125	130	135	140	145	150
20	83.3	87.5	91.7	95.8	100.0	104.2	108.3	112.5	116.7	120.8	125.0
22	75.8	79.5	83.3	87.1	90.9	94.7	98.5	102.3	106.1	109.8	113.6
24	69.4	72 9	76 4	79.9	83 3	86.8	90.3	93.7	97.2	100.7	104.2
26	64.1	67.3	70.5	73.7	76.9	80.1	83.3	86 5	89.7	92.9	96.2
28	59.5	62.5	65 5	68.5	71.4	74 4	77.4	80.4	83.3	86.3	89.3
30	55 6	58.3	61.1	63.9	66.7	69 4	72.2	75.0	77.8	80.6	83.3
32	52.1	54.7	57.3	59.9	62.5	65.1	67.7	70.3	72.9	75.5	78.1
34	49.0	51.5	53.9	56.4	58.8	61.3	63.7	66.2	68.6	71.1	73.5
36	46.3	48.6	50.9	53.2	55.6	57.9	60.2	62.5	64.8	67.1	69.4
38	43.9	46 1	48.2	50.4	52.6	54 8	57.0	59.2	61.4	63.6	65 8
40	41.7	43.7	45.8	47.9	50.0	52.1	54.2	56.3	58.3	60.4	62.5
42	39.7	41.7	43.7	45.6	47.6	49.6	51.6	53.6	55.6	57.5	59.5
44	37.9	39.8	41.7	43.6	45.5	47.3	49.2	51.1	53.0	54.9	56.8
46	36.2	38.0	39.9	41.7	43.5	45.3	47.1	48.9	50.7	52.5	54.3
48	34.7	36.5	38 2	39 9	41.7	43.4	45.1	46.9	48.6	50.3	52.1
50	33.3	35.0	36 7	38.3	40.0	41.7	43 3	45 0	46.7	48.3	50.0
52	32.1	33.7	35.3	36.9	38 5	40.1	41.7	43.3	44.9	46.5	48 1
54	30.9	32.4	34.0	35.5	37.0	38.6	40.1	41.7	43 2	44.8	46.3
56	29.8	31.3	32.7	34.2	35.7	37.2	38.7	40.2	41.7	43.2	44.6
58	28.7	30.2	31.6	33.0	34.5	35.9	37.4	38.8	40.2	41.7	43.1
60	27.8	29.2	30 6	31.9	33.3	34.7	36.1	37.5	38.9	40.3	41.7
62	26 9	28 2	29.6	30.9	32.3	33.6	34.9	36.3	37.6	39.0	40.3
64	26 0	27.3	28.6	29.9	31 3	32.6	33.9	35.2	36.5	37.8	39.1
66	25.3	26 5	27.8	29.0	30 3	31.6	32.8	34.1	35.4	36.6	37.9
68	24.5	25.7	27.0	28.2	29.4	30.6	31.9	33.1	34.3	35.5	36.8
70	23 8	25.0	26.2	27.4	28.6	29.8	31.0	32.1	33.3	34.5	35.7
72	23.1	24.3	25.5	26.6	27.8	28.9	30.1	31.3	32.4	33.6	34.7
74	22.5	23.6	24.8	25.9	27.0	28.2	29.3	30.4	31.5	32.7	33.8
76	21.9	23 0	24.1	25.2	26.3	27.4	28.5	29.6	30.7	31.8	32.9
78	21.4	22.4	23.5	24.6	25 6	26.7	27.8	28.8	29.9	31.0	32.1
80	20.8	21.9	22.9	24.0	25.0	26.0	27.1	28.1	29.2	30.2	31.3
82	20.3	21.3	22.4	23.4	24.4	25.4	26 4	27.4	28.5	29.5	30.5
84	19.8	20 8	21.8	22.8	23.8	24.8	25.8	26.8	27.8	28.8	29.8
86	19.4	20.3	21.3	22.3	23 3	24.2	25.2	26.2	27.1	28.1	29.1
88	18.9	19.9	20.8	21.8	22.7	23.7	24.6	25.6	26.5	27.5	28.4

In the above table no allowance for stoppages has been made, as the quality of the yarn and make-up of the cloth will materially affect the stoppage.

YARDS OF CLOTH PER LOOM WOVEN PER DAY OF 10 HOURS.

Picks per Inch.	PICKS PER MINUTE.										
	155	160	165	170	175	180	185	190	195	200	205
20	129.2	133.3	137.5	141.7	145.8	150.0	154.2	158.3	162.5	166.7	170.8
22	117.4	121.2	125.0	128.8	132.6	136.4	140.2	143.9	147.7	151.5	155.3
24	107 6	111.1	114.6	118.1	121.5	125 0	128.5	131.9	135.4	138.9	142.4
26	99.4	102.6	105.8	109.0	112.2	115.4	118.6	121.8	125.0	128.2	131.4
28	92.3	95 2	98.2	101.2	104.2	107.1	110.1	113.1	116.1	119.0	122.0
30	86.1	88.9	91.7	94.4	97.2	100.0	102.8	105.5	108.3	111 1	113.9
32	80.7	83.3	85.9	88.5	91.1	93.7	96.4	99 0	101.6	104.2	106.8
34	76.0	78.4	80.9	83.3	85.8	88.2	90.7	93.1	95.6	98.0	100.5
36	71.8	74.1	76.4	78.7	81.0	83.3	85.6	88.0	90.3	92.6	94.9
38	68.0	70.2	72.4	74.6	76.8	78.9	81.1	83.3	85.5	87.7	89.9
40	64.6	66.7	68.7	70.8	72.9	75.0	77.1	79.2	81.3	83.3	85.4
42	61.5	63.5	65 5	67.5	69.4	71.4	73.4	75.4	77.4	79.4	81.3
44	58.7	60 6	62 5	64.4	66.3	68.2	70.1	72.0	73.9	75.8	77.7
46	56.2	58.0	59.8	61.6	63 4	65.2	67.0	68.8	70.7	72.5	74.3
48	53.8	55.6	57.3	59.0	60.8	62.5	64.2	66.0	67.7	69.4	71.2
50	51.7	53.3	55.0	56.7	58.3	60.0	61.7	63.3	65.0	66.7	68 3
52	49 7	51.3	52 9	54.5	56 1	57.7	59.3	60.9	62.5	64.1	65 7
54	47.8	49.4	50.9	52.5	54.0	55.6	57.1	58.6	60 2	61.7	63.3
56	46 1	47.6	49.1	50.6	52.1	53.6	55 1	56.5	58 0	59.5	61.0
58	44.5	46.0	47.4	48.8	50.3	51.7	53.2	54.6	56.0	57.5	58.9
60	43.1	44 4	45.8	47.2	48.6	50.0	51.4	52 8	54.2	55.6	56.9
62	41.7	43.0	44 4	45.7	47.0	48.4	49.7	51.1	52 4	53.8	55.1
64	40.4	41.7	43.0	44.3	45 6	46.9	48.2	49.5	50.8	52.1	53 4
66	39.1	40.4	41.7	42.9	44.2	45.5	46.7	48.0	49.2	50 5	51.8
68	38.0	39.2	40.4	41.7	42 9	44.1	45.3	46 6	47.8	49.0	50.2
70	36.9	38.1	39.3	40 5	41.7	42.9	44.0	45.2	46.4	47.6	48.8
72	35 9	37 0	38.2	39.4	40.5	41.7	42.8	44.0	45.1	46.3	47.5
74	34.9	36.0	37.2	38.3	39.4	40.5	41.7	42.8	43.9	45 0	46.2
76	34.0	35.1	36.2	37.3	38.4	39.5	40 6	41 7	42.8	43.9	45.0
78	33.1	34 2	35.3	36.3	37.4	38.5	39.5	40.6	41.7	42.7	43.8
80	32.3	33.3	34.4	35.4	36.5	37.5	38.5	39.6	40 6	41.7	42.7
82	31.5	32.5	33.5	34.6	35.6	36.6	37.6	38.6	39 6	40.7	41.7
84	30.8	31.7	32.7	33.7	34.7	35.7	36 6	37.7	38.7	39.7	40.7
86	30.0	31.0	32.0	32.9	33.9	34.9	35.8	36.8	37.8	38.8	39.7
88	29.4	30.3	31.3	32.2	33.1	34 1	35.0	36.0	36.9	37.9	38.8

In the above table no allowance for stoppages has been made, as the quality of the yarn and make-up of the cloth will materially affect the stoppage.

YARDS OF CLOTH PER LOOM WOVEN PER DAY OF 10 HOURS.

Picks per Inch.	PICKS PER MINUTE. 100	105	110	115	120	125	130	135	140	145	150
90	18 5	19.4	20.4	21.3	22.2	23.1	24.1	25.0	25.9	26.9	27.8
92	18.1	19.0	19.9	20 8	21.7	22.6	23.6	24.5	25.4	26.3	27.2
94	17.7	18.6	19.5	20.4	21.3	22.2	23.0	23 9	24 8	25.7	26 6
96	17.4	18.2	19.1	20.0	20.8	21.7	22.6	23.4	24.3	25.2	26.0
98	17.0	17.9	18.7	19.6	20.4	21.3	22.1	23.0	23.8	24.7	25.5
100	16.7	17.5	18.3	19.2	20.0	20.8	21 7	22.5	23.3	24.2	25.0
102	16.3	17.2	18.0	18.8	19.6	20.4	21.2	22.1	22.9	23.7	24.5
104	16.0	16.8	17.6	18.4	19.2	20.0	20.8	21.6	22 4	23.2	24.0
106	15.7	16.5	17.3	18.1	18 9	19.7	20.4	21 2	22.0	22.8	23.6
108	15.4	16.2	17.0	17.7	18.5	19.3	20.1	20.8	21.6	22.4	23.1
110	15.2	15.9	16.7	17.4	18.2	18.9	19.7	20.5	21.2	22.0	22.7
112	14.9	15.6	16.4	17.1	17.9	18.6	19.3	20.1	20.8	21.6	22.3
114	14.6	15.4	16 1	16.8	17.5	18.3	19.0	19.7	20.5	21.2	21.9
116	14.4	15 1	15.8	16.5	17.2	18.0	18.7	19.4	20.1	20.8	21.6
118	14.1	14.8	15 5	16.2	16.9	17.7	18.4	19.1	19.8	20.5	21.2
120	13.9	14.6	15 3	16.0	16.7	17.4	18.1	18.7	19.4	20.1	20.8
122	13.7	14.3	15.0	15 7	16.4	17.1	17.8	18.4	19.1	19.8	20.4
124	13.4	14 1	14.8	15.5	16.1	16.8	17.5	18.1	18.8	19.5	20.1
126	13.2	13.9	14.6	15.2	15.9	16.5	17.2	17.9	18.5	19 2	19.8
128	13.0	13.7	14.3	15.0	15.6	16.3	16.9	17.6	18.2	18.9	19 5
130	12.8	13.5	14.1	14.7	15.4	16.0	16.7	17.3	17.9	18.6	19.2
134	12 4	13.1	13.7	14 3	14.9	15.5	16.2	16.8	17.4	18.0	18.7
136	12.3	12.9	13 5	14.1	14.7	15.3	15.9	16.5	17.2	17.8	18.4
140	11.9	12.5	13.1	13.7	14.3	14.9	15.5	16 1	16 7	17.3	17 9
144	11.6	12.2	12.7	13.3	13.9	14.5	15.0	15.6	16.2	16.8	17.4
146	11.4	12.0	12.6	13.1	13.7	14.3	14.8	15.4	16.0	16.6	17.1
150	11.1	11.7	12.2	12.8	13.3	13 9	14.4	15.0	15.6	16.1	16.7
154	10.8	11.4	11.9	12.4	13.0	13.5	14.1	14.6	15.2	15.7	16.2
156	10.7	11.2	11.8	12.3	12.8	13.4	13.9	14.4	15.0	15.5	16 0
160	10.4	10.9	11.5	12.0	12.5	13.0	13 5	14 1	14.6	15.1	15.6
164	10.2	10 7	11.2	11.7	12.2	12.7	13.2	13.7	14.2	14.7	15.2
166	10.0	10.5	11.0	11.5	12.0	12.6	13.1	13 5	14.1	14.6	15.1
170	9.8	10.3	10.8	11.3	11.8	12.3	12.7	13.2	13.7	14.2	14.7
174	9.6	10.1	10.5	11.0	11.5	12.0	12.5	12.9	13.4	13.9	14.4
176	9.5	9.9	10.4	10.9	11.4	11 8	12.3	12.8	13.3	13.7	14.2
180	9 3	9.7	10.2	10.6	11.1	11.6	12.0	12.5	13.0	13.4	13 9

In the above table no allowance for stoppages has been made, as the quality of the yarn and make-up of the cloth will materially affect the stoppage.

YARDS OF CLOTH PER LOOM WOVEN PER DAY OF 10 HOURS.

Picks per Inch.	PICKS PER MINUTE.										
	155	160	165	170	175	180	185	190	195	200	205
90	28.7	29.6	30.6	31.5	32.4	33.3	34.3	35.2	36.1	37.0	38.0
92	28.1	29.0	29 9	30.8	31.7	32.6	33.5	34.4	35.3	36.2	37.1
94	27.5	28.4	29.3	30.1	31.0	31.9	32.8	33.7	34.6	35.5	36.3
96	26.9	27.8	28.6	29.5	30.4	31.3	32.1	33 0	33.9	34.7	35.6
98	26.4	27.2	28.1	28.9	29.8	30.6	31.5	32.3	33.2	34.0	34.9
100	25.8	26.7	27.5	28.3	29.2	30.0	30.8	31.7	32.5	33.3	34.4
102	25.3	26.1	27.0	27.8	28.6	29.4	30.2	31.0	31.9	32.7	33.5
104	24.8	25.6	26.4	27.2	28.0	28.8	29.6	30.4	31.3	32.1	32.9
106	24.4	25.2	25.9	26.7	27.5	28.3	29.1	29.9	30.7	31.4	32.2
108	23.9	24.7	25.5	26.2	27.0	27.8	28.5	29.3	30.1	30.9	31.6
110	23.5	24.2	25.0	25.8	26.5	27.3	28.0	28.8	29.5	30.3	31.1
112	23.1	23.8	24.6	25.3	26.0	26.8	27.5	28.3	29 0	29.8	30.5
114	22 7	23.4	24.1	24.9	25.6	26.3	27.0	27.8	28.5	29.2	30.0
116	22 3	23.0	23.7	24.4	25.1	25.9	26.6	27.3	28.0	28 7	29.5
118	21.9	22.6	23.3	24.0	24.7	25.4	26.1	26.8	27 5	28.2	29.0
120	21.5	22.2	22.9	23.6	24.3	25.0	25.7	26.4	27.1	27.8	28.5
122	21.2	21.9	22.5	23.2	23.9	24.6	25.3	26 0	26.6	27 3	28.0
124	20.8	21.5	22.2	22.8	23.5	24.2	24.9	25 5	26.2	26.9	27.6
126	20.5	21.2	21.8	22.5	23.1	23.8	24.5	25 1	25.8	26.5	27.1
128	20.2	20.8	21.5	22.1	22.8	23.4	24.1	24.7	25.4	26.0	26.7
130	19.9	20.5	21 2	21.8	22.4	23.1	23.7	24 4	25.0	25.6	26.3
134	19.3	19.9	20.5	21.1	21.8	22.4	23.0	23.6	24.3	24.9	25.5
136	19.0	19.6	20.2	20.8	21.4	22.1	22.7	23.3	23.9	24.5	25.1
140	18.5	19.0	19.6	20.2	20.8	21.4	22.0	22 6	23.2	23.8	24.4
144	17.9	18.5	19.1	19.7	20.3	20.8	21.4	22.0	22.6	23.1	23.7
146	17.7	18.3	18.8	19.4	20.0	20.5	21.1	21.7	22.3	22.8	23.4
150	17.2	17.8	18.3	18.9	19 4	20.0	20.6	21.1	21.7	22.2	22.8
154	16.8	17.3	17.9	18.4	18.9	19.5	20.0	20.6	21.1	21.6	22.2
156	16 6	17.1	17.6	18.2	18.7	19.2	19.8	20.3	20.8	21.4	21.9
160	16.1	16.7	17.2	17.7	18.2	18.7	19.3	19.8	20.3	20.8	21.4
164	15.8	16.3	16.8	17.3	17.8	18.3	18.8	19.3	19.8	20.3	20.8
166	15.6	16.1	16.6	17.1	17.6	18.1	18.6	19.1	19.6	20.1	20.6
170	15.2	15.7	16.2	16.7	17.2	17.6	18.1	18.6	19.1	19.6	20.1
174	14.8	15.4	15.8	16.3	16.8	17.2	17.7	18.2	18.7	19.2	19.6
176	14.7	15.2	15.6	16.1	16.6	17.0	17.5	18.0	18 5	18.9	19.4
180	14.4	14 8	15.3	15.7	16.2	16.7	17.1	17.6	18.1	18.5	19.0

In the above table no allowance for stoppages has been made, as the quality of the yarn and make-up of the cloth will materially affect the stoppage.

SPECIFICATION FOR

LOOMS.

Total number of looms

Number of R. H. looms   Number of L. H. looms

Number of looms to belt from above

Number of looms to belt from below

To weave cloth   inches wide.

Warp yarn to be No.   yarn.   Filling yarn to be No.   yarn.

Weight of cloth per yard   Number of picks per inch

Stearns or Mason parallel motion

What kind of let-off motion

Diameter of beam head preferred

Is high breast roll preferred, or common breast beam with adjustable strip

Kind of take-up motion   and the pick gearing arranged to put in   picks in the cloth for every tooth in the change gear.

Take-up roll to be covered with

Protection to be at   side, or in the centre

Shuttle binders to be at

Shuttle binders to be made of ....

Diameter of pulleys required

Will T. and L. pulley or friction pulley be used

If friction pulley is used, state whether face or cone friction

Race plate to be

Will auxiliary shafts, girts, and gears for twill motions be needed...

For how many harnesses ....

Arrangement of harnesses to be ... ...up and ...down.

Will a selvage motion be used If so, which kind.

Is the loom to be constructed to take a dobby motion.. If so, for how many harnesses..

If loom is to have a box motion, for how many boxes...

How many yards of cloth are to be wound in a roll

State any preference for the shape of loom gear tooth

Shall the loom brake be worked from the filling fork, protection bunter, or from both

Is loom to be built to receive the Northrop devices If so, give the exact number of threads in the warp, and state how many of these are double threads, for selvage

If possible, send us a sample shuttle, with sample cop, or bobbin of yarn.

We furnish with each loom three change gears.

Blue prints can be furnished, showing the length and shape of each strap required in operating Mason Looms.

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1898.

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