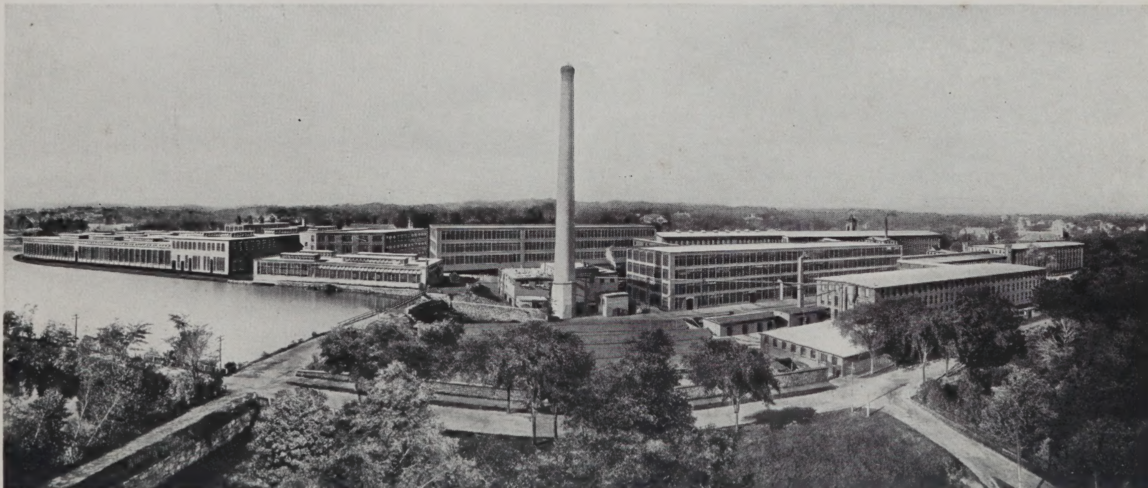
Cotton Card-Room Machinery



The Whitin Machine Works, 1912.

1912

Illustrated and Descriptive Catalog

OF

WHITIN
COTTON CARD-ROOM MACHINERY

AND

Handbook of Useful Information for Overseers and Operators

COMPILED BY

OSCAR L. OWEN

Issued by

THE WHITIN MACHINE WORKS,

WHITINSVILLE, MASS., U. S. A.

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Printed by The University Press, Cambridge, Mass.

INTRODUCTORY.

In presenting this catalog, covering simply **Card Room Machinery,** we have desired to omit the other machinery that we build, so that we might concisely bring to the attention of the trade the very complete line of Card Room Machinery which we are in a position to furnish, and, at the same time, incorporate in it complete tables, with rules and other information, which will be of considerable service to those who have the actual operation of the machinery in hand.

Accordingly, the following catalog covers Revolving Top Flat Cards, Drawing Frames, Railway Heads, Sliver Lap and Ribbon Lap Machines, Combing Machines, Slubbers, Intermediates, Roving and Jack Frames; also Full Roller Cards for woolen and cotton waste work, and Worsted Roving Frames, which we build in some variety, but which space allows us to but briefly mention and describe.

In addition to the above, we would call attention to the other machines which we build, namely, Spinning and Twister Frames, Spoolers, Reels, Long Chain Quillers, Looms, Dobbies, Warp Stop Motions, and special textile machinery.

In particular we would call your attention to the full line of Fly Frame Machinery which we are now presenting to the trade. In 1909 we took up the manufacture of all machines built by the Providence Machine Co., Providence, R. I., incorporating their extensive plant and organization with our own, so as to enable us to furnish practically the complete machinery for a cotton mill. The high reputation of the Providence Fly Frames we expect to sustain and increase.

In the last few years we have greatly increased our manufacturing facilities, both as regards improved tools and additional working space; and with strict attention to the requirements of the trade, feel confident in presenting our machinery to the most critical analysis and most exacting conditions.

To all users of Cotton Card Room Machinery, we trust this handbook will contain much of interest, and we solicit its careful examination, feeling confident it will be to our mutual advantage.

Catalogs and circulars of any of our line of machines can be had on application.

THE WHITIN MACHINE WORKS.

WHITINSVILLE, MASS., Jan. 1, 1912.

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DIVISION OF CONTENTS

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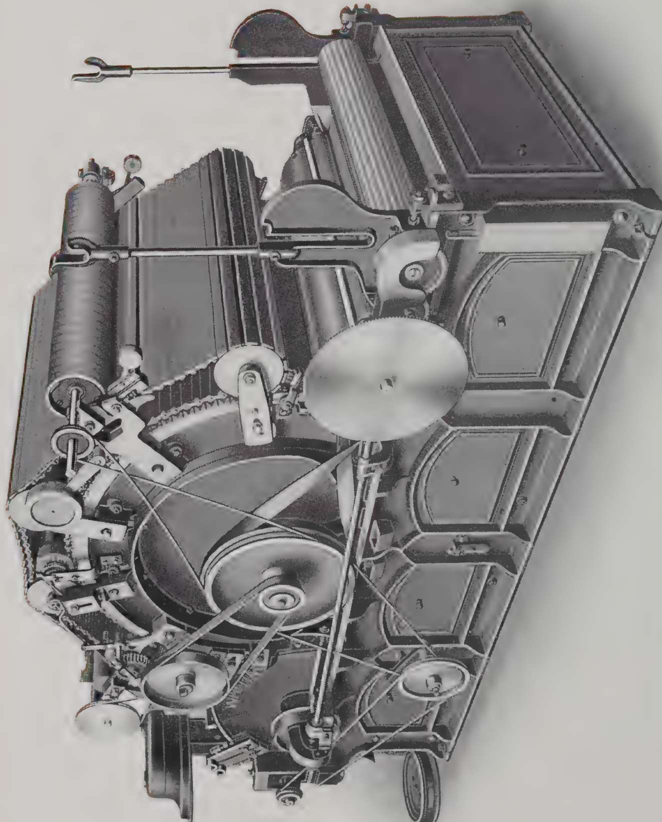
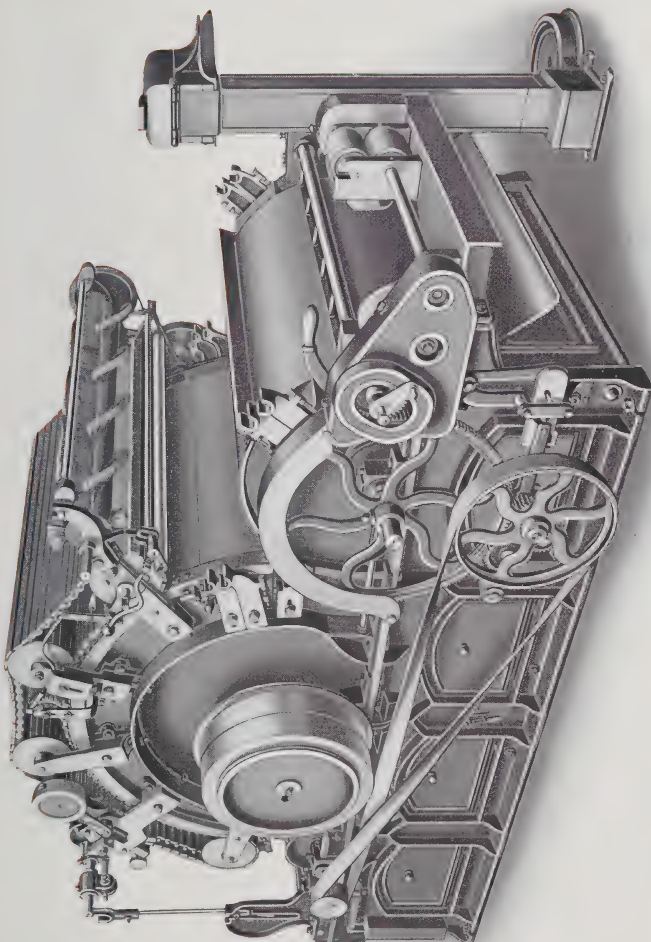
CARDING



Revolving Flat Card, (Tail End)



Revolving Flat Card, (Pulley End)

REVOLVING FLAT CARD

This machine has been the subject of our most skillful and constant consideration. Improvements in its mechanisms and construction have been made from time to time, so that to-day we present it as the most practical and durable card in the market.

We make two sizes of revolving flat cards, viz.:

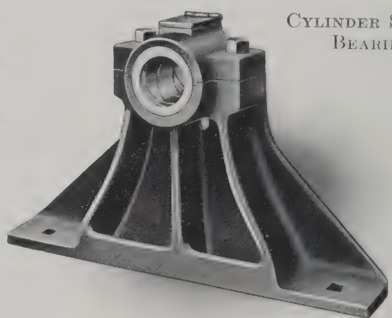
40-inch card with 27-inch diameter doffer and 110 flats.
45 " " " 27 " " " " 110 "

The design and proportion of the **frame** of the machine are such as to give great rigidity, thus insuring accurate and positive adjustments under the strain of the heaviest work that may be demanded.

The **Arches** are substantial in construction, the outer rims and faces being machined to afford accurate backing for the flexible bends. The seatings for the flat disc and grinder brackets are milled at their proper locations on the arches.

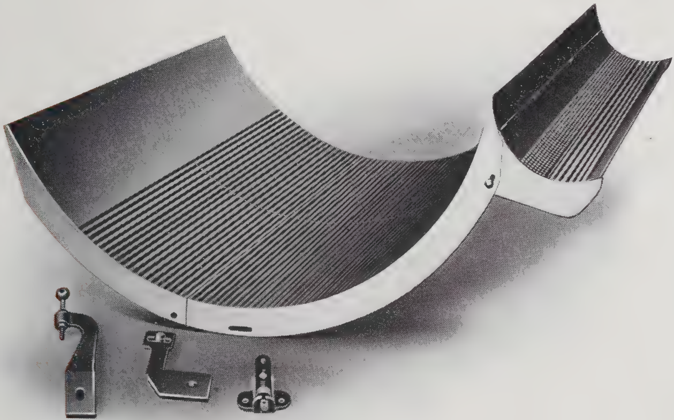
The **Front and Back Plates** are attached to brackets held in adjustable positions on the arches. The plates are set concentric with the cylinder, and as the clothing wears, the position of the plates can be readily adjusted to conform thereto.

The **Flexible Bends** are machined all over and polished on their outer surfaces. They are so formed that the flats may be set with extreme accuracy by means of five adjusting points on each side of the card.



Cylinder Shaft Bearing

The **Cylinder** is 50 inches in diameter, either 40 or 45 inches wide, and runs in removable bronze bushings, fitted in the pedestal boxes. In case of excessive wear, the bushing is easily replaced by a new one. The pedestals are so designed that an overflow of oil is prevented from getting on the cylinder and damaging the clothing. The cylinders are ground to an absolutely true surface and accurately balanced at a speed much higher than the customary working speed of the card, thus insuring perfect carding action of the clothing on the staple.

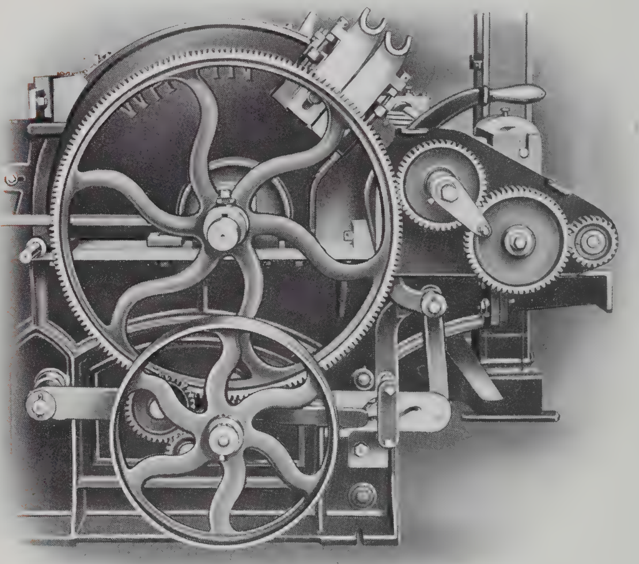


Cylinder and Licker-in Screen

The **Cylinder Screen** is made in two parts, of extra heavy tin and sheet steel; the grids being held in position by our **Patented Wire Bracing,** thus obtaining maximum stiffness with maximum space for dirt to fall through. The screen is supported on sliding brackets readily adjustable from the outside of the frame. The **Licker-in Screen** is hinged to the cylinder screen and is fastened to the licker-in shields, so that the position of the screen is controlled by the setting of the licker-in.

The **Knife Blades** under the licker-in, which are used for removing motes, have an independent adjustment whereby they can be placed in varying positions to get more or less waste. When finally set and fastened in place, they conform to the movements of the licker-in and screen.

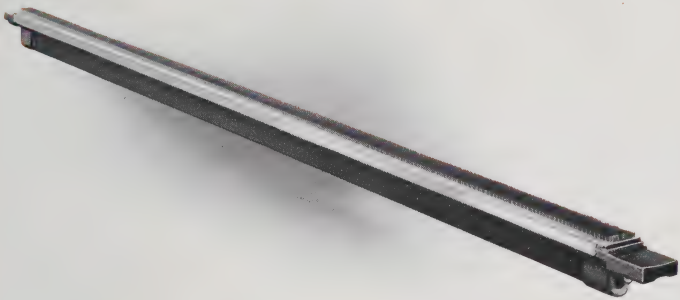
The **Doffing Cylinder** is 27 inches in diameter and width to correspond with the cylinder. By means of our **Patented Slow Motion** the doffer may be run at a reduced speed at the option of



DOFFER SLOW-MOTION

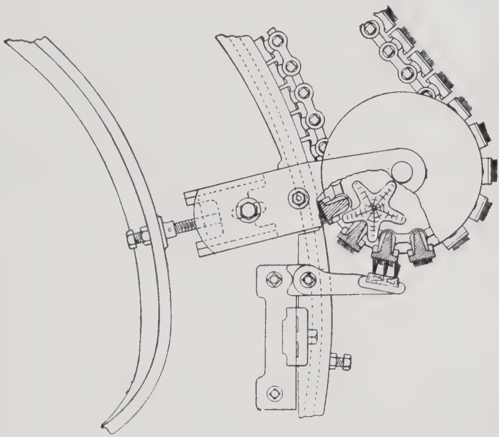
the operator. This enables him to piece up an end with a minimum amount of waste. After the piecing of the end is accomplished, the slow motion may be thrown out and the doffer then resumes full speed.

The **Construction of the Flats** is such that no deflection is perceptible while in their working positions. They are straightened and then ground to an even, smooth surface for the placing of the clothing. The ends are milled on their working surfaces to the same curvature as the flexible bend on which they slide, thus insuring that



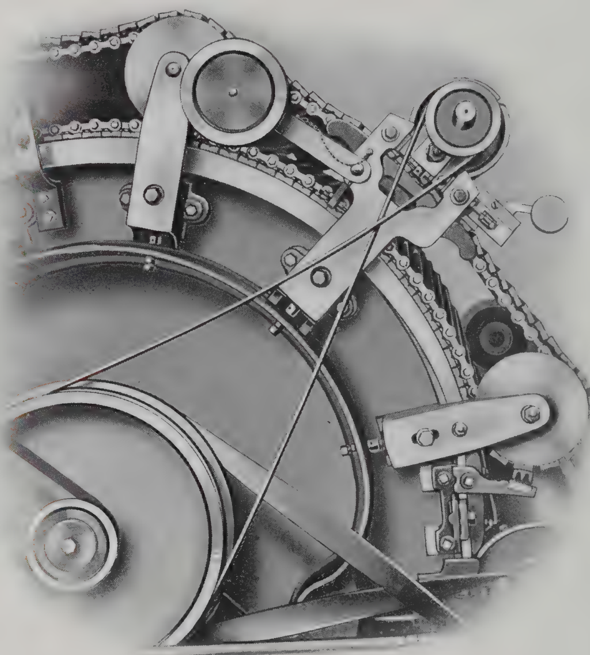
Top Flat

all the flats will be alike for the grinding operation on their clothing. Each card is equipped with 110 flats, $1\frac{3}{8}$ inches wide, $\frac{13}{16}$ inch clothing face, 44 of which are in working position all the time. The clothing of the flats is securely fastened on each side by the Ashworth serrated steel clips, which also affords additional means for the prevention of deflection in the flats. The clothing on the ends of the flat is fastened by steel clips which, in combination with the side clips, insures that the clothing on every flat is stretched alike and at an equal tension. In order that the tops of the flats may be kept free from lint, the card is provided with our **Patented Clearer.** This consists of a wooden star-shaped roll of a length to fit loosely between the flat discs. The motion of the flats



Patent Clearer

revolves the roll, which, being covered with felt, collects the lint. It can be readily taken out when desired, to remove the accumulation of lint.

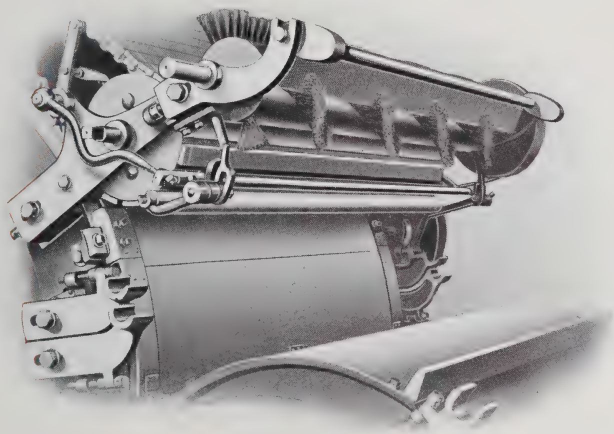


Top Flat-Grinder

The **Grinding Motion** for the flats is such that the flats are supported on the same surface and in the same plane while being ground as they are while carding, consequently the original pitch or heel is maintained with perfect accuracy, and when all the flats are in position on the flexible bend, they can be set to the cylinder by the same gauge. To facilitate the correct alignment of the grinding roll with the flats, the grinding motion brackets are provided with a novel adjusting device (patent pending).

The **Doffer Comb Motion** is run in oil, contained in an oil-tight box, thus allowing a high speed to be maintained without heat or noise. Different speeds of the comb may be had by the use of double step pulleys.

The **Thompson Stripping Roll,** which is furnished on all cards, is an arrangement for winding into a roll, on the front of the

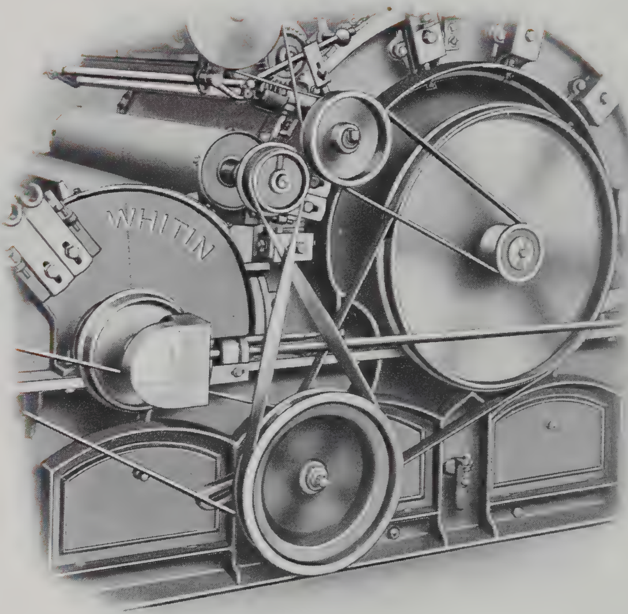


THOMPSON STRIPPER ROLL

card, the strippings as they are combed from the flats instead of allowing them to fall on the doffer cover, accumulate, and, if not removed, fall into the doffer, thus causing bad work.

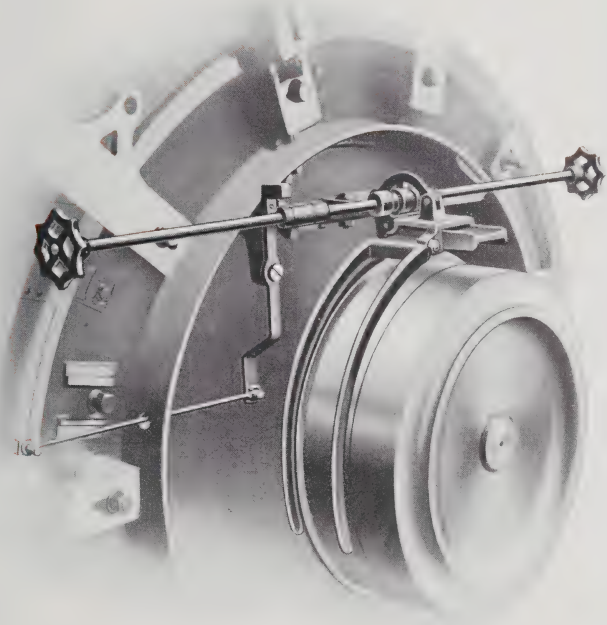
The **Coiler** is so constructed that the top cover may be lifted for oiling or cleaning, without breaking down the sliver while the card is running. Coilers are furnished for 10 11, or 12 inch cans, as required.

A **Fancy Roll** may be had where heavy carding is required from cotton waste or other short staple. Its utility comes in by preventing the cylinder clothing from choking, and therefore rolling and nepping the fibre. As the surface speed of the fancy is in excess



FANCY ROLL

of that of the cylinder, the clothing of the fancy raises the cotton to the points of the cylinder clothing, from which it is easily removed by the doffer. Stripping of the cylinder is not required so frequently when a fancy is used as without. The roll is made of wood and runs in bearings held in the usual cylinder grinding brackets. This renders it possible to easily remove the fancy for the purpose of grinding or stripping the cylinder. The roll is enclosed in a sheet iron cover which effectually prevents the emission of dust and fly. If so ordered, the card will be made with two coilers, so that the production can be divided at the doffer into two slivers of weights suitable for subsequent processes.



Belt Shipper and Card Door Lock

The **Driving Pulleys** are 20 inches in diameter by 3 inches face and should run 165 revolutions per minute. If desired, the card may be fitted with a belt shipping mechanism, and also a **front cylinder door locking device**. This latter feature (patent pending) is a preventative of accidents to operators, as the door cannot be opened while the card is running, neither can the card be started until the door is closed.

Production: See tables, pages 31, 32.

Horse Power: See page 24.

Clothing: The amount of *clothing* required is as follows:

Cylinder	50″ diam.,	40″ wide:	44 square feet,	or 268 lineal feet	2″ wide
"	50″ "	45″ "	50 "	" 297 "	2″ "
Doffer	27″ "	40″ "	27 "	" 194 "	$1\frac{1}{2}$″ "
"	27″ "	45″ "	30 "	" 218 "	$1\frac{1}{2}$″ "
Flats		40″ "	27 "	"	
"		45″ "	$30\frac{1}{4}$ "		

Belting required:

Doffer belt	14′ 6″ of 2″	belt
Licker-in belt	9′ 2″ " 2″	"
Top flat belt	6′ 0″ " $1\frac{1}{2}$″	"
Comb belt	16′ 10″ " $\frac{3}{8}$″	round belt
Brush belt	5′ 1″ " $\frac{3}{8}$″	" "

NOTE. — No allowance for lapping.

Weights:	40″ Card.	45″ Card.
Net weight. . . .	6200 pounds.	6500 pounds.
Shipping weight .	6700 "	7100 "

Car Load: Four 40″ or 45″ cards, Boxed.

Floor Spaces outside 18 inches diameter lap and 10 inches coiler:

40″ card with 27″ doffer: 10′ 6″ by 5′ $5\frac{1}{4}$″ over all.
45″ " " 27″ " 10′ 6″ " 5′ $10\frac{1}{4}$″ " "

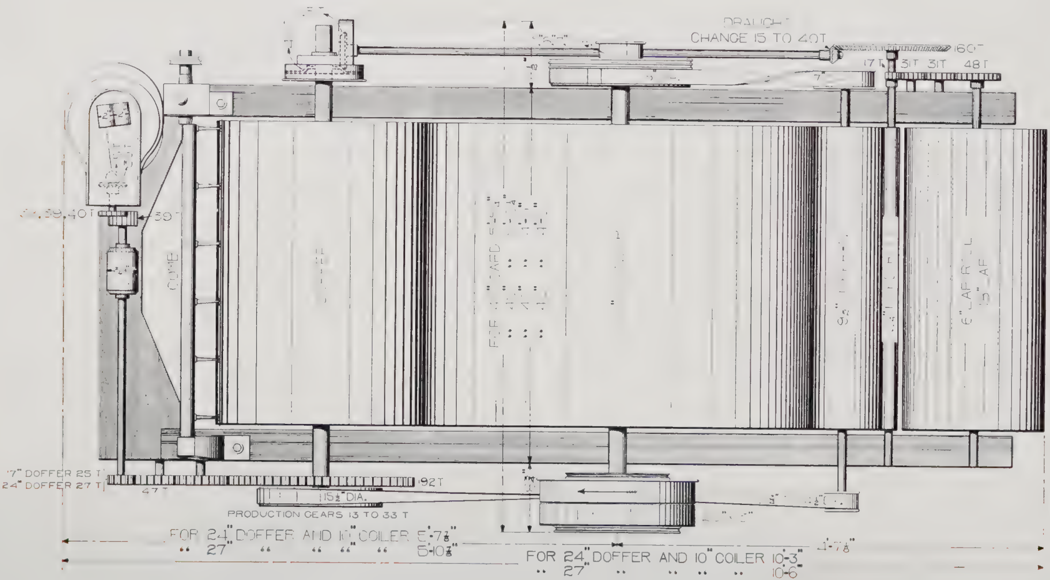
Extras required for every 20 cards:

One stripping roll for stripping doffers and cylinders.

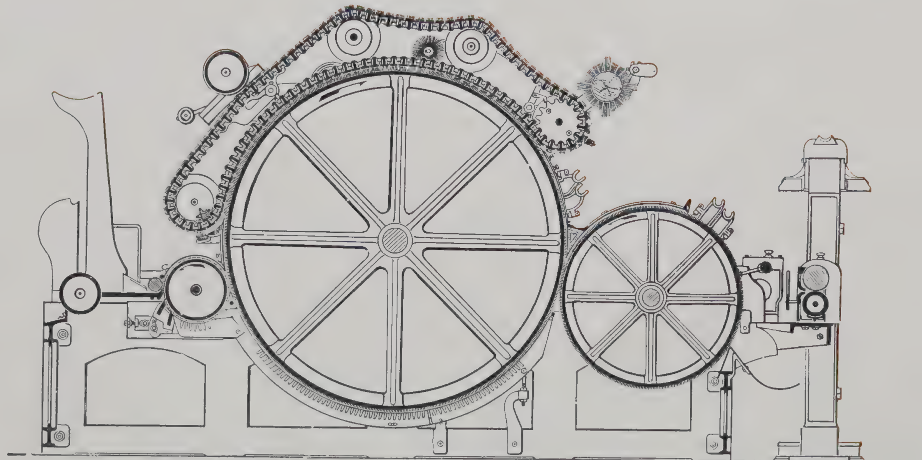
One burnishing roll for burnishing clothing of flats, cylinders, and doffers.

One long grinder roll for grinding flats.

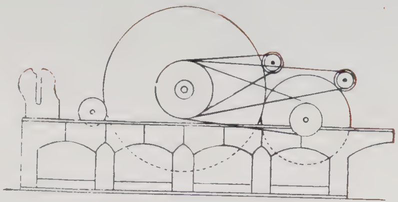
Two traverse grinders for grinding cylinders and doffers.



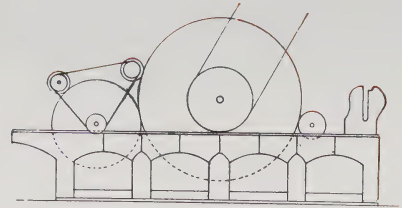
PLAN OF REVOLVING FLAT CARD



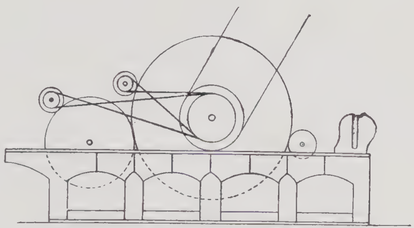
Section of Revolving Flat Card with 27 in. Doffer and 110 Top Flats



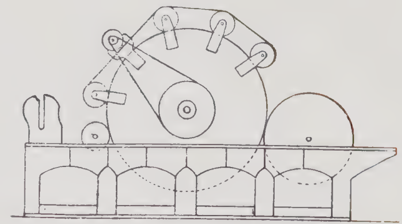
GRINDING CYLINDER AND DOFFER.



GRINDING CYLINDER AND DOFFER; PULLEY SIDE.



STRIPPING CYLINDER AND DOFFER; PULLEY SIDE



GRINDING TOP FLATS.

METHODS OF GRINDING AND STRIPPING

Horse Power of Whitin Revolving Flat Card.

Width of Lap 45 inches.

Weight 1 Yard of Sliver.	Production in 10 Hours.	Revolutions of Cylinder per Min.	Horse Power.
36 Grains	80 lbs.	165	.84
38 "	90 "	165	.90
40 "	100 "	165	1.00
46 "	110 "	165	1.06
48 "	120 "	165	1.12
52 "	140 "	165	1.19
56 "	148 "	165	1.24
60 "	158 "	165	1.30
64 "	177 "	165	1.37
68 "	190 "	165	1.40
72 "	200 "	165	1.45
76 "	220 "	165	1.53

The table shows that the power required is governed by the production.

Tests were made on a Webber Dynamometer.

Card Clothing

English Counts.	Points per Square Foot.	American No. of Wire.
60's	43200	28
70's	50400	30
80's	57600	31
90's	64800	32
100's	72000	33
110's	79200	34
120's	86400	35
130's	93600	36

For Coarse Yarns use on { Cylinders, Nos. 90's and 100's.
Doffers and Flats, Nos. 100's and 110's.

For Medium Yarns use on { Cylinders, Nos. 100's and 110's.
Doffers and Flats, Nos. 110's and 120's.

Fillet for Cylinders and Doffers

With 4 Crowns, or 24 Points per Inch.

Noggs per Inch.	Points per Square Foot.	American No. of Wire.
16	55296	31
17	58752	
18	62208	32
19	65664	
20	69120	33
21	72576	
22	76032	34
23	79488	
24	82944	35
25	86400	
26	89856	36

Sheets for Top Flats

Points per Inch in Length.	Points per Inch in Width.					
	25	24	23	22	21	20
	Points per Sq. Ft.	Points per Sq. Ft.	Points per Sq. Ft.	Points per Sq. Ft.	Points per Sq. Ft.	Points per Sq. Ft.
25	90000	86400	82800	79200	75600	72000
24	86400	82944	79488	76032	72576	69120
23	82800	79488	76176	72864	69552	66240
22	79200	76032	72864	69696	66528	63360
21	75600	72576	69552	66528	63504	60480
20	72000	69120	66240	63360	60480	57600

Table for Calculating the exact Lengths of Fillets required for Clothing various sizes of Cylinders, Doffers and Rollers of Whitin Cards.

Width in inches of Card on wire.	BREADTH OF FILLETS.									
	½ Inch.	¾ Inch.	1 Inch.	1⅛ Inch.	1¼ Inch.	$1\frac{5}{16}$ Inch.	1½ Inch.	1⅝ Inch.	1¾ Inch.	2 Inch.
30	15.708	10.472	7.8540	6.9810	6.2832	5.9839	5.2360	4.8332	4.4880	3.9270
31	16.231	10.821	8.1158	7.2137	6.4927	6.1834	5.4106	4.9943	4.6376	4.0576
32	16.755	11.170	8.3776	7.4464	6.7021	6.3829	5.5851	5.1554	4.7872	4.1888
33	17.278	11.519	8.6394	7.6791	6.9115	6.5823	5.7596	5.3165	4.9368	4.3197
34	17.802	11.868	8.9012	7.9118	7.1209	6.7818	5.9342	5.4776	5.0864	4.4506
35	18.326	12.217	9.1630	8.1445	7.3304	6.9813	6.1088	5.6387	5.2360	4.5815
36	18.849	12.556	9.4248	8.3772	7.5398	7.1800	6.2832	5.7998	5.3856	4.7124
37	19.373	12.915	9.6866	8.6099	7.7492	7.3800	6.4578	5.9609	5.5352	4.8433
38	19.896	13.264	9.9484	8.8426	7.9587	7.5797	6.6323	6.1221	5.6848	4.9742
39	20.420	13.613	10.2102	9.0753	8.1681	7.7791	6.8068	6.2832	5.8344	5.1051
40	20.944	13.962	10.4720	9.3080	8.3776	7.9787	6.9814	6.4443	5.9840	5.2360
41	21.467	14.311	10.7338	9.5407	8.5870	8.1781	7.1558	6.6054	6.1336	5.3669
42	21.991	14.660	10.9956	9.7734	8.7964	8.3775	7.3304	6.7665	6.2832	5.4978
43	22.514	15.010	11.2574	10.0061	9.0059	8.5770	7.5050	6.9276	6.4328	5.6287
44	23.038	15.359	11.5192	10.2388	9.2153	8.7765	7.6795	7.0887	6.5824	5.7596
45	23.562	15.708	11.7810	10.4715	9.4248	8.9759	7.8540	7.2498	6.7320	5.8905
46	24.085	16.057	12.0428	10.7042	9.6342	9.1754	8.0286	7.4109	6.8816	6.0214
47	24.619	16.406	12.3046	10.9369	9.8436	9.3749	8.2031	7.5721	7.0312	6.1523
48	25.132	16.755	12.5664	11.1696	10.0530	9.5743	8.3776	7.7332	7.1808	6.2832

RULE: — **Find** on first column the width of card, and on top line the breadth of fillet with which the cylinders, etc., **are** to be covered. The **figures** under the breadth of fillet, and in same column opposite width of card, give the constant **required**; multiply **diameter of** cylinder, etc., by **constant** and the result gives the length in feet of the fillet necessary.

EXAMPLE: — Cylinder 40 inches on wire **by** 50 **inches** in diameter, to be covered with 2 inch fillet. Constant 5.236 x 50 is equal to 261.800, or 262 feet, the length required.

RULES FOR CARDERS

To find the draught in a card when the weight of lap and sliver required are given:

Divide the weight of one yard of lap in grains by the weight of one yard of sliver in grains, and the quotient is the theoretical draught, from which an allowance for waste should be deducted to obtain the draught required.

Example. — Lap 14 ounces, card sliver 60 grains, waste 5%, draught required?

14 ounces = 6125 grains; $6125 \div 60 = 102.08$ theoretical draught; $102.08 \times .95 = 96.98$ draught.

To change the weight of sliver:

Multiply the weight of required sliver by the draught gear on card, and dividing the product by the weight of the present sliver gives the gear required.

Example. — What draught gear will be required to change the sliver from 54 grains to 60 grains, the present draught gear being 18 teeth?

$$\frac{60 \times 18}{54} = 20\text{-teeth draught gear required.}$$

To find the draught gear:

Multiply the draught of the card by the draught gear, and dividing the product by the required draught gives the gear required.

Example. — What draught gear will be required to give a draught of 100, when the present draught is 90 with a 20-teeth draught gear?

$$\frac{90 \times 20}{100} = 18\text{-teeth draught gear required.}$$

To find the draught required:

Multiply the present draught by the present weight of sliver, and dividing the product by the desired weight of sliver gives the draught required.

Example. — What draught will be required to give a 60-grain sliver, when the present sliver is 54 grains with 100 draught?

$$\frac{100 \times 54}{60} = 90 \text{ draught required.}$$

To change the production of the card:

Multiply the size of the production gear by the production required, and dividing the product by the present production gives the production gear required.

Example. — The present production of a card is 150 pounds per day, with a 25-teeth production gear; what gear will be required to give 125 pounds per day?

$$\frac{25 \times 125}{150} = 20.83 \text{ or 21-teeth production or change gear.}$$

To find the draught constant of 27″ Doffer Card:

$$\frac{\underset{\text{Lap Roll Gear.}}{48} \times \underset{\text{Feed Roll Bevel.}}{160} \times \underset{\text{Doffer Gear.}}{192} \times \underset{\text{Calender Shaft Gear.}}{39} \times \underset{\text{Coiler Gear.}}{30} \times \underset{\text{Diameter Coiler Roll.}}{2''}}{\underset{\text{Feed Roll Gear.}}{17} \times \underset{\text{Change Gear.}}{} \times \underset{\text{Calender Shaft Gear.}}{25} \times \underset{\text{Coiler. Gear.}}{38} \times \underset{\text{Coiler Shaft Gear.}}{15} \times \underset{\text{Diameter Lap Roll.}}{6''}} = \text{Constant } 2373.90$$

Constant divided by draught equals change gear.
Constant divided by change gear equals draught.

To find production of a card in 10 hours:

$$\frac{\text{Minutes in 10 hours} \times \text{Rev. Coiler Roll per min.} \times \text{Circ. Coiler Roll in inches} \times \text{Grains per yard sliver}}{\text{36 inches in a yard} \times \text{7000 grains in a pound}} = \text{pounds per 10 hours}$$

NOTE:—An allowance of 5% for stoppages, etc. should be deducted from above production.

Card Settings

Feed plate from licker-in, 7–1000″ to 15–1000″.
Mote knives from licker-in, 10–1000″ to 17–1000.″
Licker-in from cylinder, 7–1000″.
Back knife plate, bottom edge from cylinder, 17–1000″.
Front knife plate, bottom edge from cylinder, 17–1000″.
Stripping plate from cylinder, about 24–1000″.
Cylinder screen from cylinder, 22–1000″.
Flats from cylinder, 7–1000″ to 9–1000″.
Doffer from cylinder, 7–1000″.
Comb from doffer, 10–1000″.
Flat comb from flats, 12–1000″.

Draught Table of Revolving Flat Card.

27 in. Doffer with $3\frac{9}{10}$ in. dia. Card Calender Rolls.

Diameter of { Lap Roll, 6 in.
{ Coiler Calender Rolls, 2 in.

Lap Roll Gear 48 Teeth. Doffer Gear, 192 Teeth.

Feed Roll Gear, 17 Teeth. Feed Roll Bevel Gear 160 Teeth.

Card Calender Roll Shaft Gear, 25 Teeth.

Driver, Coiler Shaft Gear, 30 Teeth.

Coiler Shaft Gear, 15 Teeth.

Change Gears.	Compensating Gears.		
	38 Teeth.	39 Teeth.	40 Teeth.
	Draught.	Draught.	Draught.
15 Teeth.	158.26	154.20	150.35
16	148.36	144.56	140.95
17	139.65	136.06	132.66
18	131.87	128.50	125.29
19	124.94	121.74	118.69
20	118.69	115.65	112.76
21	113.04	110.14	107.39
22	107.91	105.14	102.51
23	103.22	100.57	98.06
24	98.92	96.38	93.97
25	94.96	92.52	90.21
26	91.30	88.96	86.74
27	87.92	85.67	83.53
28	84.78	82.61	80.54
29	81.86	79.76	77.77
30	79.13	77.10	75.17
31	76.57	74.61	72.74
32	74.18	72.29	70.48
33	71.93	70.09	68.34
34	69.82	68.04	66.33
35	67.82	66.09	64.43
36	65.94	64.25	62.64
37	64.16	62.51	60.95
38	62.47	60 87	59.35
39	60.87	59.31	57.83
40	59.35	57.83	56.38

Revolving Flat Card.

Cylinder 165 rev. Cyl. Pul'y 18'' dia. Licker-in Driven 7'' dia. Licker-in Driver $4\frac{1}{4}$'' dia.		Table showing number pounds Card Sliver produced in one day of 10 hours. Doffer $27\frac{3}{4}$ in. Diameter outside of Clothing. Number of Grains in one yard of Sliver.										Side Pulley $15\frac{1}{2}$'' dia. Doffer Gear 192 T.
Change Gear.	Rev. of Doffer per Minute.	38 LBS.	40 LBS.	42 LBS.	44 LBS.	46 LBS.	48 LBS.	50 LBS.	52 LBS.	54 LBS.	56 LBS.	Rev. of Doffer per Minute.
13T	7.88	65.37	68.81	72.25	75.70	79.13	82.57	86.01	89.46	92.90	96.33	7.88
14	8.48	70.34	74.04	77.73	81.44	85.14	88.85	92.54	96.24	99.95	103.65	8.48
15	9.09	75.41	79.37	83.35	87.31	91.28	95.25	99.22	103.18	107.15	111.12	9.09
16	9.70	80.48	84.71	88.95	93.18	97.42	101.64	105.88	110.12	114.35	118.59	9.70
17	10.30	85.44	89.93	94.43	98.92	103.43	107.92	112.42	116.91	121.40	125.91	10.30
18	10.91	90.50	95.27	100.03	104.79	109.55	114.31	119.08	123.84	128.60	133.36	10.91
19	11.52	95.57	100.59	105.62	110.66	115.68	120.71	125.74	130.77	135.81	140.83	11.52
20	12.12	100.54	105.83	111.12	116.41	121.70	127.00	132.28	137.58	142.87	148.16	12.12
21	12.73	105.60	111.15	116.71	122.27	127.83	133.38	138.94	144.50	150.05	155.61	12.73
22	13.34	110.64	116.48	122.30	128.12	133.94	139.77	145.59	151.51	157.24	163.06	13.34
23	13.94	115.64	121.73	127.81	133.90	139.98	146.07	152.15	158.25	164.33	170.42	13.94
24	14.55	120.69	127.04	133.39	139.75	146.09	152.44	158.80	165.15	171.52	177.85	14.55
25	15.15	125.68	132.29	138.91	145.52	152.13	158.74	165.36	171.97	178.59	185.20	15.15
26	15.76	130.74	137.62	144.50	151.38	158.26	165.14	172.02	178.90	185.79	192.66	15.76
27	16.37	135.80	142.94	150.09	157.23	164.38	171.52	178.66	185.82	192.96	200.11	16.37
28	16.97	140.78	148.18	155.59	163.01	170.41	177.82	185.23	192.64	200.05	207.45	16.97
29	17.58	145.83	153.51	161.17	168.85	176.53	184.20	191.87	199.56	207.23	214.90	17.58
30	18.18	150.81	158.74	166.68	174.62	182.56	190.49	198.43	206.36	214.30	222.24	18.18
31	18.79	155.88	164.08	172.28	180.49	188.69	196.89	205.09	213.30	221.51	229.70	18.79
32	19.40	160.94	169.40	177.87	186.34	194.81	203.28	211.75	220.21	228.70	237.16	19.40
33	20.00	165.91	176.85	183.37	192.10	200.83	209.57	218.30	227.03	235.77	244.49	20.00

NOTE: — In the above table 5 per cent. of the time is allowed for cleaning, stripping, etc.

Revolving Flat Card.

Cylinder 165 rev. Cyl. Pul'y 18'' dia. Licker-in Driven 7'' dia. Licker-in Driver $4\frac{1}{4}$'' dia.		Table showing number pounds Card Sliver produced in one day of 10 hours. Doffer $27\frac{3}{4}$ in. Diameter outside of Clothing. Number of Grains in one yard of Sliver.										Side Pulley $15\frac{1}{2}$'' dia. Doffer Gear 192 T.
Change Gear.	Rev. of Doffer per Minute.	58	60	62	64	66	68	70	72	74	76	Rev. of Doffer per Minute.
		LBS.	LBS.	LBS.	LBS.	LBS.	LBS.	LBS.	LBS.	LBS.	LBS.	
13T	7.88	99.77	103.22	160.66	110.10	113.53	116.98	120.42	123.86	127.31	130.74	7.88
14	8.48	107.36	111.05	114.75	118.46	122.16	125.87	129.56	133.26	136.97	140.67	8.48
15	9.09	115.09	119.06	123.03	127.00	130.97	134.93	138.91	142.87	146.84	150.81	9.09
16	9.70	122.82	127.06	131.[illegible]0	135.53	139.77	144.00	148.24	152.48	156.71	160.95	9.70
17	10.30	130.40	134.90	139.39	143.89	148.39	152.89	157.38	161.88	166.37	170.88	10.30
18	10.91	138.12	142.89	147.65	152.41	157.17	161.93	166.70	171.46	176.22	180.98	10.91
19	11.52	145.86	150.90	155.92	160.96	165.98	171.00	176.05	181.07	186.11	191.13	11.52
20	12.12	153.45	158.74	164.04	169.33	174.62	179.91	185.20	190.49	195.77	201.08	12.12
21	12.73	161.17	166.73	172.28	177.84	183.40	188.95	194.51	200.07	205.63	211.18	12.73
22	13.34	168.89	174.71	180.53	186.35	192.18	198.00	203.82	209.64	215.47	221.26	13.34
23	13.94	176.50	182.58	188.67	194.77	200.84	206.03	213.02	219.11	225.20	231.27	13.94
24	14.55	184.20	190.56	196.91	203.27	209.61	215.96	222.32	228.67	235.03	241.36	14.55
25	15.15	191.82	198.43	205.05	211.66	218.28	224.89	231 51	238.11	244.74	251.34	15.15
26	15.76	199.55	206.43	213.31	220.19	227.07	233.95	240.84	247.71	254.60	261.47	15.76
27	16.37	207.25	214.40	221.55	228.70	235.85	242.99	250.14	257.29	264.43	271.58	16.37
28	16.97	214.87	222.27	229.68	237.10	244.50	251.91	259.33	266.73	274.14	281.54	16.97
29	17.58	222.58	230.26	237.93	245.60	253.28	260.95	268.62	276.31	283.98	291.65	17.58
30	18.18	230.18	238.12	246.05	253.99	261.93	269.86	277.80	285.74	293.68	301.61	18.18
31	18.79	237.92	246.12	254.32	262.53	270.73	278.93	287.13	295.34	303.54	311.74	18.79
32	19.40	245.63	254.10	262.57	271.04	279.51	287.97	296.44	304.91	313.39	321.86	19.40
33	20.00	253.23	261.96	270.69	279.43	288.15	296.88	305.62	314.35	323.09	331.81	20.00

NOTE: — In the above table 5 per cent. of the time is allowed for cleaning, stripping, etc.

CARE OF CARDS

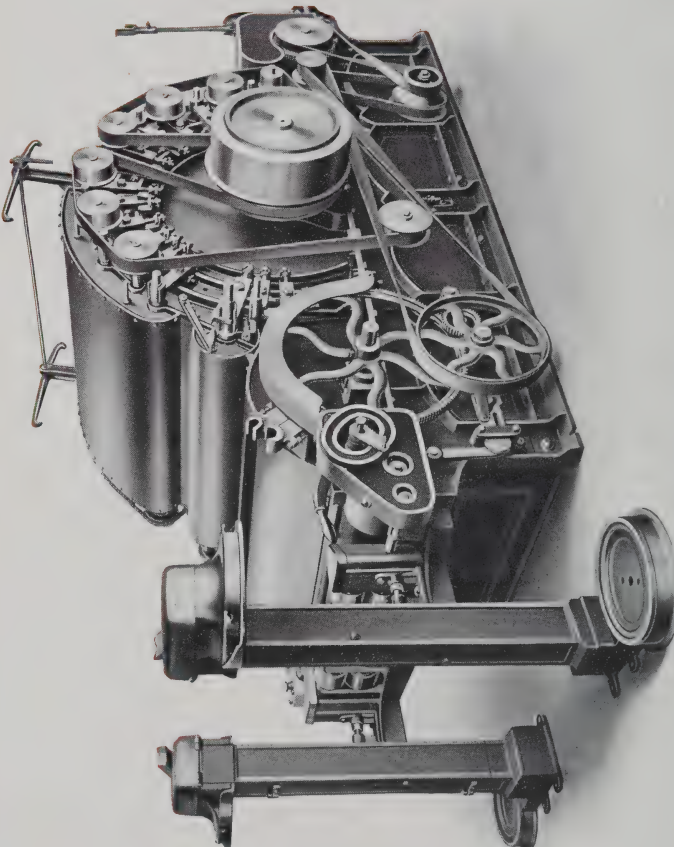
However well a machine may be made, its durability and efficiency depend to a great extent on the care given to it by the operator. We give a few suggestions, which, if followed, will add to the life and productive capacity of the card.

All Bearings should be kept clean and well supplied with oil. The cylinder and licker-in shaft, and also doffer shaft bearings, should be kept filled with grease, and well oiled once a day. Daily oiling should also be given to the bearings of the side shaft, calender roll shaft, doffer and coiler shafts, coiler roll shaft, and all other component revolving mechanisms. Extreme care should be used in oiling the bearings of the doffer and cylinder, so as not to allow the oil to come in contact with and damage the clothing. All oil holes should be kept free from dust and lint in order that the oil can have free access to the bearings.

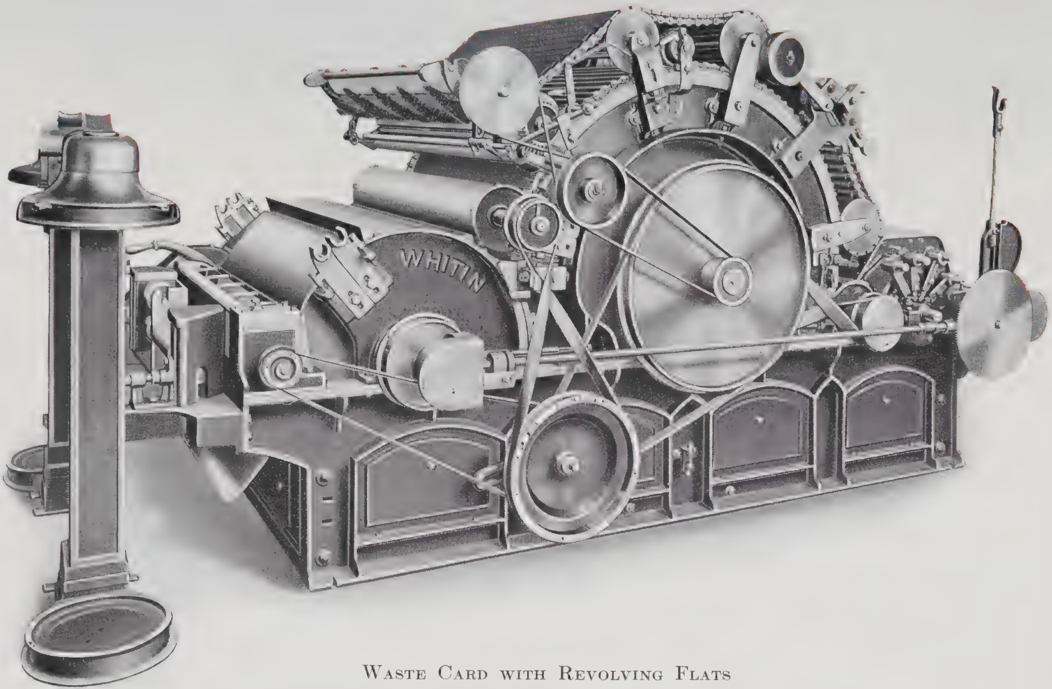
All parts of the card should be kept free from dust and fly; the cleaning should be done immediately after the card is stripped. Dust and fly that collect under the card should be removed daily, and at the same time the screens should be cleaned. Periodical attention should be given to the condition of the feed roll, licker-in, doffer comb, and flat motions.

For ordinary work the cards should be ground lightly at least every three or four weeks. Before grinding, be sure to pick up all jammed and bent wires. The clothing on the flats should be kept sharp and the grinder shoes so set as to present the flats to the grinder roll in such a way as to grind evenly across the face of the wire.

The cards should be stripped at least three times a day, and care should be taken not to set the stripping brush in deep enough to injure the clothing. See that the stripping brush is maintained in good condition, and do not allow the ends to become loose or the wires bent or jammed, as this will prevent the edges of the cylinder and doffer from being stripped, resulting in a ragged selvage to the web of sliver.



Full Roller Card



WASTE CARD WITH REVOLVING FLATS

CARDING MACHINES FOR WASTE OR SHORT STAPLE

In the illustrations on pages 34 and 35, attention is called to our improved cards for the treatment of short staple cotton and cotton waste. They are made in two styles, viz., the revolving flat and full roller styles. The former is best adapted for stock suitable for 8s to 15s yarns, while the latter gives best results on coarser counts, from $\frac{1}{2}$s to 8s. The most prominent feature of these cards is the introduction of a breast between the feed rolls and the licker-in, whereby the stock is so treated that all bunches are eliminated, thus improving the quality of the production and preventing damage to the cylinder clothing. Another special feature is the adoption of a fancy roll, which keeps the cylinder clean and insures a heavy production. These cards may be fitted with either one, two, or four cans to hold the sliver delivered by the calender rolls, or if it is desired that the production be still further divided, then our **Improved Card Front** (patent pending) should be used. This provides means for running the production into 8 or 12 cans as ordered. We will be pleased to demonstrate to manufacturers the value of these cards in utilizing their waste products.

Our **Improved Stripping Truck** (patent pending) is a useful adjunct to full roller cards. By means of this machine time and labor are saved and liability of damage to the rolls and clothing is reduced to a minimum.

Roll Stripping Truck

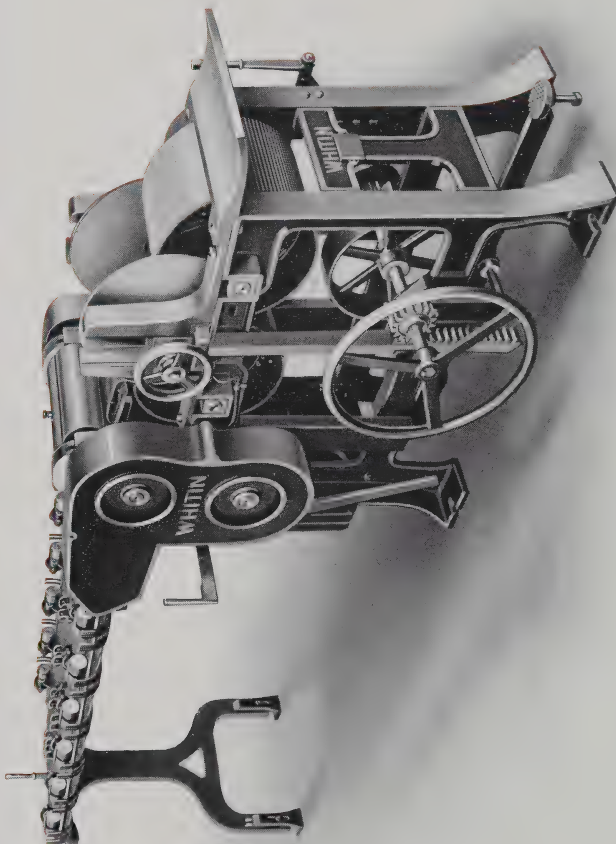
COMBING

COMBING MACHINERY

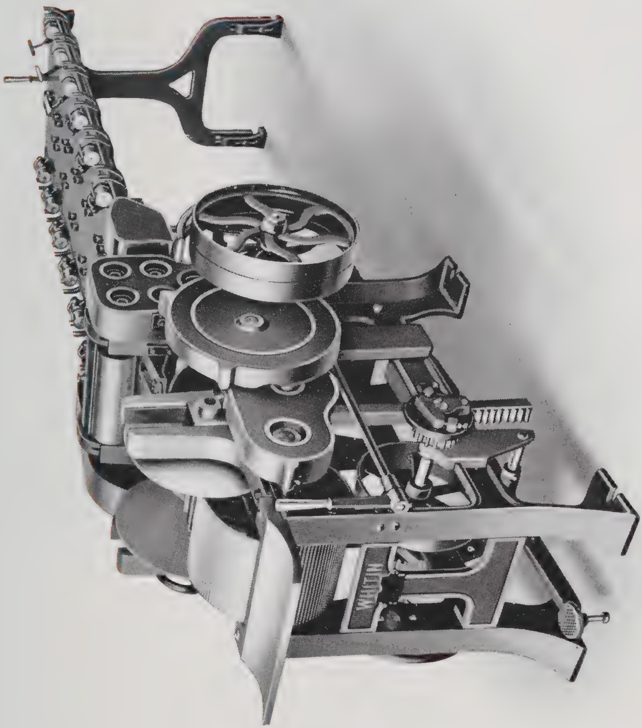
With the introduction of the **Whitin Improved Comber,** whereby it has been made possible for the mill to obtain a large production, together with the best quality of work, the cost of combing and of the installation of combers has been reduced to such an economical point that to-day the comber is a machine which every mill should consider, if not as a necessity, yet as a possibility in its organization of machinery. The simplification of the comber and its accompanying preparatory machines, the ribbon and sliver lap, are such that the question of skilled labor attendance is eliminated. From being considered one of the most complicated machines that the mill has to deal with, it is to-day one of the simplest in its operation and one of the least apt to give trouble to its attendants. Accordingly the field and usefulness of the comber have been widely extended from that of full-combed work to what is termed semi-combed work and the reclamation of good fibre from top flat strips. The fact that the same machine, owing to improved construction, can be used in the mill on both the longest and shortest staple, and the change from one to the other can be quickly accomplished with the simplest of adjustments, and the percentage of waste absolutely regulated, makes it a flexible unit in the mill. We particularly call to the attention of the trade what we term the **semi-combing** of moderate staple cottons, say staples running from 1 inch to $1\frac{3}{16}$ inches, whereby, with a minimum waste percentage, yarn can be produced which will equal the strength of carded yarns made from cotton $\frac{1}{16}$-inch to $\frac{1}{8}$-inch longer staple. These semi-combed yarns, as direct competitors of carded yarns, show more evenness, more lustre, and greater strength; and the saving in staple, with full allowance for waste taken out, and cost of the process, makes a material saving to the mill.

Before calling attention to the individual machines, it may be of interest to follow through briefly the combing processes as usually installed, whereby it will be seen that the whole process makes for superior yarn in the paralleling of the fibres and the cleansing from them of impurities and all short and imperfect fibres.

First, 16 to 24 card slivers are taken, these slivers being delivered from the card with their fibres matted and tangled. These are formed into a lap by means of the sliver lap machine, which starts the paralleling of the fibres by putting in a draught from two or three. This lap goes to the ribbon lap machine, which doubles four laps into one, the purpose being to obtain additional evenness from the doublings and additional paralleling by its draught of between four and five. The laps from the ribbon lap machine are placed on the comber, which doubles eight into one. These fibres are now thoroughly straightened out and combed by the needles of the half laps and top combs. The short fibres and the impurities in the cotton are removed and a lustrous combed sliver delivered for the subsequent processes of the mill. It can, therefore, be readily seen that a yarn coming from a combed sliver must be more even, due to approximately 640 additional doublings, and smoother and more lustrous, due to the removal of the impurities and the frictional contact of the needles, and is stronger, owing to the absolute paralleling of the fibres. In the following pages we briefly describe the machines of the combing process in the order in which they are used in the mill. Where, however, a process of drawing is substituted for the ribbon lap machine we furnish the sliver lap machine in the $11\frac{3}{4}$ inches width.



Sliver Lap Machine



Sliver Lap Machine

SLIVER LAP MACHINE

The object of the sliver lap machine is to form the sliver as it comes from the card or drawing frame into a lap suitable for use on the ribbon lap machine or comber. From 16 to 24 cans are placed at the back of the machine, the number depending on the weight and width of lap desired. The sliver is drawn from the cans through guides over lifting rolls equipped with stop motions, onto a particularly efficient Derby back of special design, and there the slivers are drawn in parallel lines to a draw head consisting of three or four lines of top and bottom rolls arranged with a slight amount of draught. From the drawing rolls the web is passed through two pairs of heavy calender rolls and is then formed into a lap 14 inches to 16 inches in diameter either $9\frac{3}{4}$ inches or $11\frac{3}{4}$ inches wide, according to the size of machine it is to supply. The $9\frac{3}{4}$-inch lap machine is used to form laps for use in the ribbon lap machine, while the $11\frac{3}{4}$-inch machine is used where the ribbon lap machine is eliminated and the drawing frame substituted, the laps being taken in the latter case direct from the sliver lap machine to the comber.

The Draw Box of the $9\frac{3}{4}$-inch lap machine is fitted with three lines of top and bottom rolls, while that of the $11\frac{3}{4}$-inch machine has four lines. Metallic or leather covered **Top Rolls** are furnished as ordered. The machine is patented in certain of its essential features and is amply provided with **Stop Motions** in order to stop the machine when an end of sliver breaks out at the back, and also when the lap reaches its full diameter. All gearing is thoroughly guarded with covers, preventing injury to operatives.

A Weight Relieving Motion is provided to remove pressure of the weights during any extended stoppage of the machine when leather-covered rolls are supplied. The construction is substantial, all fits being made on milled surfaces, and the machine generally highly finished.

Driving Pulleys: 24 inches in diameter by $2\frac{1}{2}$ inches face; the speed ratio of the driving pulleys being one revolution of the pulleys to one revolution of the 5-inch calender rolls.

Speed of the machines is according to the production required, being usually from 90 to 100 revolutions of the 5-inch calender rolls.

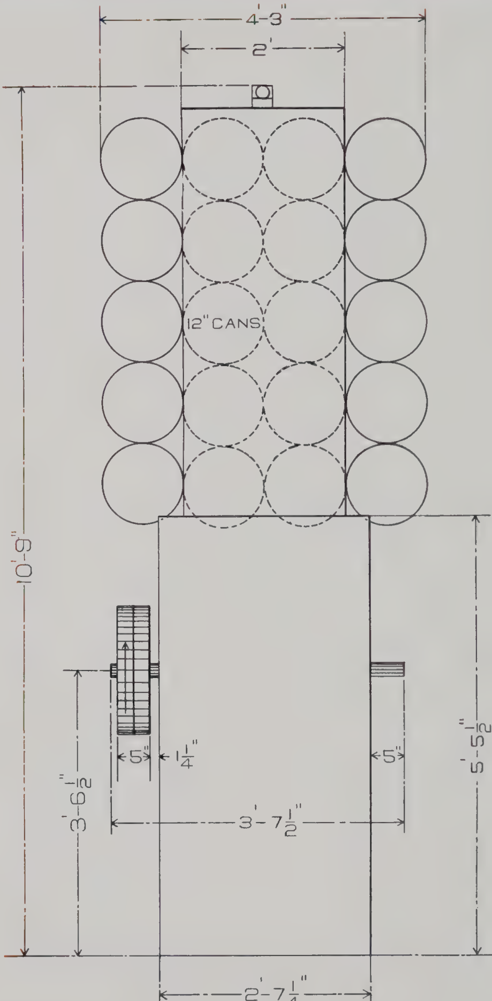
The production of one sliver lap machine is sufficient to supply six eight-head combers.

Power: $\frac{1}{2}$ horse power is required.

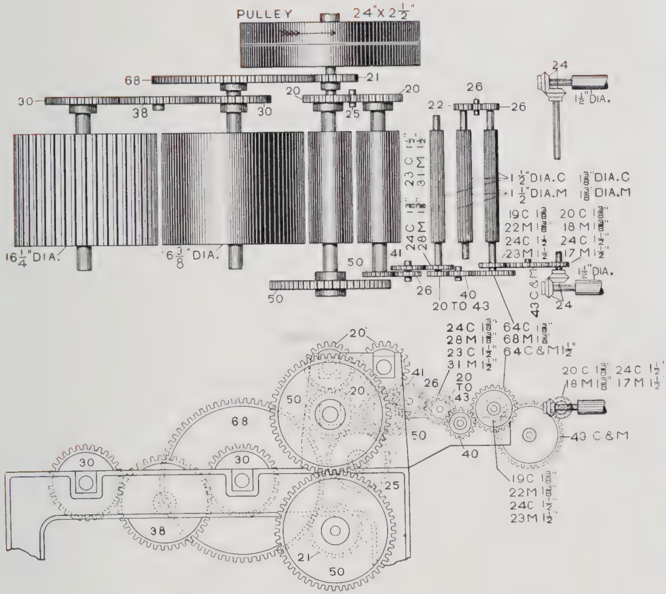
Floor Space: Including twenty 12-inch cans, 10 ft. 6 in. by 4 ft. 3 in.

Weights: Shipping weight, 2700 pounds; net weight, 2500 pounds.

Car Load: Two sliver lap and two ribbon lap machines, set up.



FLOOR PLAN OF SLIVER LAP MACHINE



NOTE: C SIGNIFIES COMMON ROLLS
M METALLIC "

9¾" SLIVER LAP MACHINE DIAGRAM OF GEARING

Draught Table of 9¾ in. Sliver Lap Machine

TABLE GIVES TOTAL DRAUGHT BETWEEN BACK ROLL AND FLUTED LAP-DRUM

Change Gear	1½ in. Common Rolls	1⅜ in. Common Rolls	1½ in. Metallic Rolls	1⅜ in. Metallic Rolls	Change Gear	1½ in. Common Rolls	1⅜ in. Common Rolls	1½ in. Metallic Rolls	1⅜ in. Metallic Rolls
20	3.12	3.56	2.96	3.03	32	1.95	2.22	1.85	1.89
21	2.97	3.39	2.82	2.89	33	1.89	2.15	1.79	1.84
22	2.84	3.23	2.69	2.75	34	1.84	2.09	1.74	1.78
23	2.72	3.09	2.57	2.63	35	1.78	2.03	1.69	1.73
24	2.60	2.96	2.47	2.52	36	1.73	1.98	1.64	1.68
25	2.50	2.84	2.37	2.42	37	1.69	1.92	1.60	1.64
26	2.40	2.73	2.28	2.33	38	1.64	1.87	1.56	1.59
27	2.31	2.63	2.19	2.24	39	1.60	1.82	1.52	1.55
28	2.23	2.54	2.11	2.16	40	1.56	1.78	1.48	1.51
29	2.15	2.45	2.04	2.09	41	1.52	1.73	1.44	1.48
30	2.08	2.37	1.97	2.02	42	1.49	1.69	1.41	1.44
31	2.01	2.29	1.91	1.95	43	1.45	1.65	1.37	1.41

Calculations for Draught Constant — See Gearing Diagram

1½ in. Common Rolls

$$\frac{64 \times 23 \times 26 \times 20 \times 50 \times 21 \times 30 \times 16.25}{C \times 41 \times 50 \times 20 \times 50 \times 68 \times 30 \times 1.5} = \frac{62.459}{\text{Change Gear}} = \text{Total Draught}$$

1½ in. Metallic Rolls

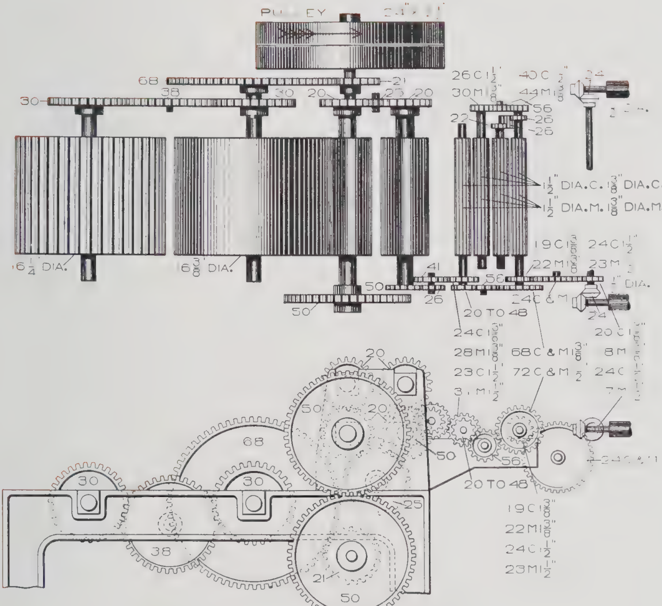
$$\frac{64 \times 31 \times 26 \times 20 \times 50 \times 21 \times 30 \times 16.25}{C \times 41 \times 50 \times 20 \times 50 \times 68 \times 30 \times 2.13} = \frac{59.285}{\text{Change Gear}} = \text{Total Draught}$$

1⅜ in. Common Rolls

$$\frac{64 \times 24 \times 26 \times 20 \times 50 \times 21 \times 30 \times 16.25}{C \times 41 \times 50 \times 20 \times 50 \times 68 \times 30 \times 1.375} = \frac{71.10}{\text{Change Gear}} = \text{Total Draught}$$

1⅜ in. Metallic Rolls

$$\frac{68 \times 28 \times 26 \times 20 \times 50 \times 21 \times 30 \times 16.25}{C \times 41 \times 50 \times 20 \times 50 \times 68 \times 30 \times 2.00} = \frac{60.59}{\text{Change Gear}} = \text{Total Draught}$$



NOTE: C SIGNIFIES COMMON ROLLS.
M " METALLIC " .

DIAGRAM OF GEARING. $11\frac{3}{4}$" SLIVER LAP MACHINE.

Draught Table of 1$\frac{3}{4}$ in. Sliver Lap Machine

TABLE GIVES TOTAL DRAUGHT BETWEEN BACK ROLL AND FLUTED LAP-DRUM

Change Gear	$1\frac{1}{2}$ in. Common Rolls	$1\frac{1}{2}$ in. Metallic Rolls	$1\frac{3}{8}$ in. Common Rolls	$1\frac{3}{8}$ in. Metallic Rolls	Change Gear	$1\frac{1}{2}$ in. Common Rolls	$1\frac{1}{2}$ in. Metallic Rolls	$1\frac{3}{8}$ in. Common Rolls	$1\frac{3}{8}$ in. Metallic Rolls
20	3.51	3.33	3.78	3.03	35	2.01	1.91	2.16	1.73
21	3.34	3.18	3.60	2.88	36	1.95	1.85	2.10	1.68
22	3.19	3.03	3.43	2.75	37	1.90	1.80	2.04	1.64
23	3.05	2.90	3.28	2.63	38	1.85	1.76	1.99	1.59
24	2.93	2.78	3.15	2.52	39	1.80	1.71	1.94	1.55
25	2.81	2.67	3.02	2.42	40	1.76	1.67	1.89	1.51
26	2.70	2.57	2.91	2.33	41	1.71	1.63	1.84	1.48
27	2.60	2.47	2.80	2.24	42	1.67	1.59	1.80	1.44
28	2.51	2.38	2.70	2.16	43	1.63	1.55	1.76	1.41
29	2.42	2.30	2.60	2.09	44	1.60	1.52	1.72	1.38
30	2.34	2.22	2.52	2.02	45	1.56	1.48	1.68	1.35
31	2.27	2.15	2.44	1.95	46	1.53	1.45	1.64	1.32
32	2.20	2.08	2.36	1.89	47	1.49	1.42	1.61	1.29
33	2.13	2.02	2.29	1.84	48	1.46	1.39	1.57	1.26
34	2.07	1.96	2.22	1.78					

Calculations for Draught Constant — See Gearing Diagram

1½ in. Common Rolls

$$\frac{72 \times 23 \times 26 \times 29 \times 50 \times 21 \times 30 \times 16.25}{C \times 41 \times 50 \times 20 \times 50 \times 68 \times 30 \times 1.5} = \frac{70.267}{\text{Change Gear}} = \text{Total Draught}$$

1½ in. Metallic Rolls

$$\frac{72 \times 31 \times 26 \times 20 \times 50 \times 21 \times 30 \times 16.25}{C \times 41 \times 50 \times 20 \times 50 \times 68 \times 30 \times 2.13} = \frac{66.69}{\text{Change Gear}} = \text{Total Draught}$$

1⅜ in. Common Rolls

$$\frac{68 \times 24 \times 26 \times 20 \times 50 \times 21 \times 30 \times 16.25}{C \times 41 \times 50 \times 20 \times 50 \times 68 \times 30 \times 1.375} = \frac{75.54}{\text{Change Gear}} = \text{Total Draught}$$

1⅜ in. Metallic Rolls

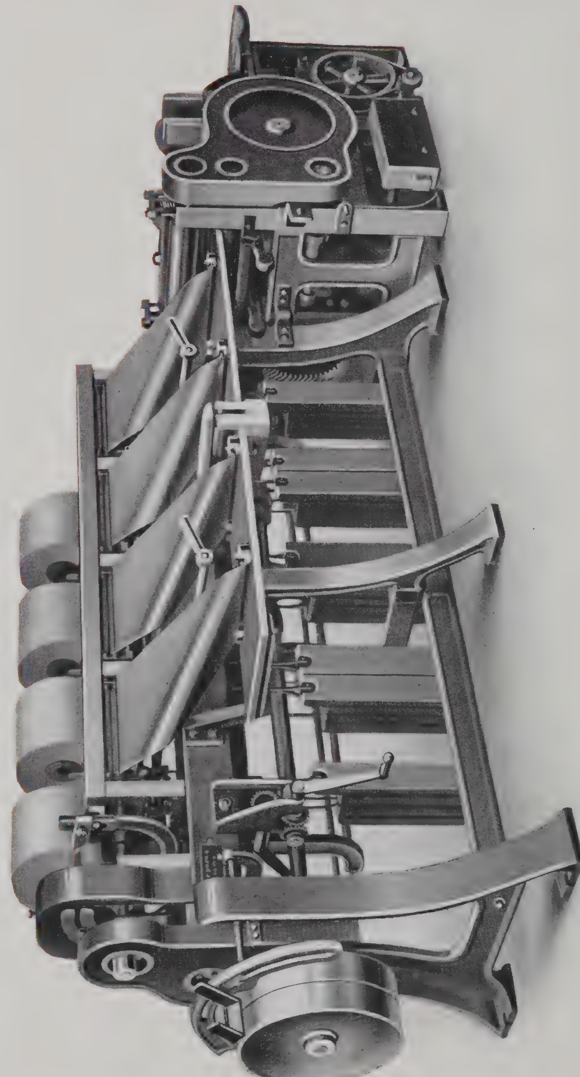
$$\frac{68 \times 28 \times 26 \times 20 \times 50 \times 21 \times 30 \times 16.25}{C \times 41 \times 50 \times 20 \times 50 \times 68 \times 30 \times 2.00} = \frac{60.592}{\text{Change Gear}} = \text{Total Draught}$$

Sliver Lap Machine

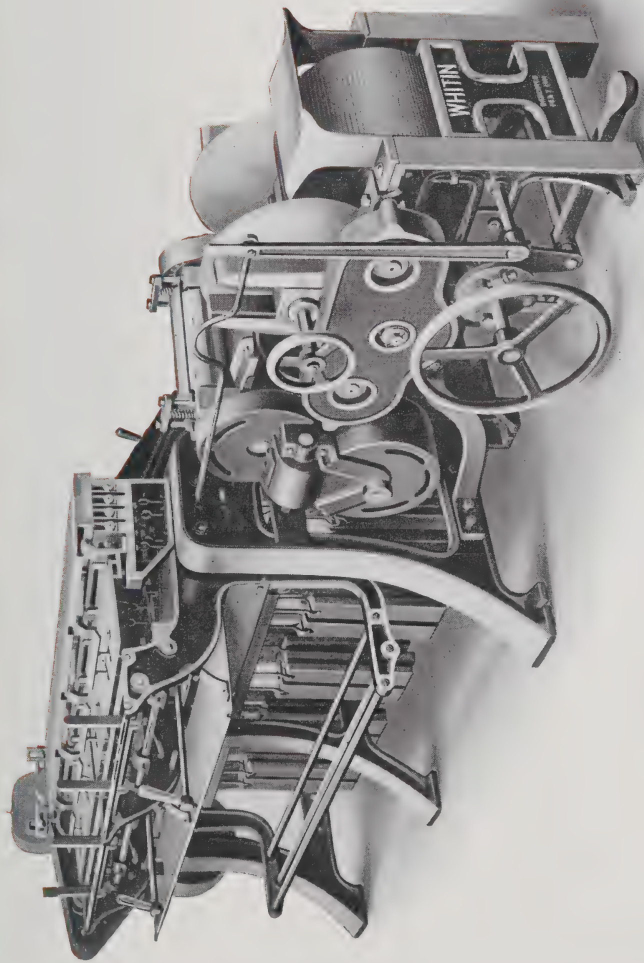
Production per day of ten hours, allowing 25 per cent off for oiling, cleaning, etc.

Revolutions per min. of 5 in. Calender roll	Grains per yard of lap produced													
	350	360	370	380	390	400	410	420	430	440	450	460	470	480
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
85	834.7	858.5	882.3	906.1	929.9	953.7	978.3	1001.3	1025.9	1049.7	1073.5	1097.3	1121.1	1144.9
90	883.8	909.0	934.2	959.4	984.6	1009.8	1035.9	1062.2	1086.3	1111.5	1136.7	1161.9	1187.1	1212.3
95	932.9	959.5	986.1	1012.7	1039.3	1065.9	1093.4	1119.1	1146.9	1173.2	1199.8	1226.4	1253.0	1279.6
100	982.0	1010.0	1038.0	1066.0	1094.0	1122.0	1151.0	1178.0	1207.0	1235.0	1263.0	1291.0	1319.0	1347.0
105	1031.1	1060.5	1089.9	1119.3	1148.7	1178.1	1208.5	1236.9	1267.3	1296.7	1326.1	1355.5	1384.9	1414.3
110	1080.2	1111.0	1141.8	1172.6	1203.4	1234.2	1266.1	1295.8	1327.7	1358.5	1389.3	1420.1	1450.9	1481.7
120	1178.4	1212.0	1245.6	1279.2	1312.8	1346.4	1381.2	1413.6	1448.4	1482.0	1515.6	1549.2	1582.8	1616.4

One revolution of driving pulley to one revolution of 5-inch calender roll.



Ribbon Lap Machine (Front)



Ribbon Lap Machine
(Back)

RIBBON LAP MACHINE

The object of the ribbon lap machine is to so prepare the laps for the comber that they will be subjected to a minimum waste in the combing operation and also by the addition of doublings add to the evenness of the work. The laps formed by the sliver lap machine are placed upon the lap rolls at the back of the ribbon frame, which deliver their sliver to four lines of top and bottom rolls arranged with the necessary amount of draught ranging from four to five. This draught parallels the fibre, and the resulting ribbons are carried over highly polished curved brass plates and formed one upon another upon the sliver plate, along which the resultant web is drawn through several pressing rolls to the lap head and there formed into a lap $11\frac{3}{4}$ inches wide and from 14 inches to 16 inches in diameter. The construction of this machine has been so simplified as to reduce the element of waste to a minimum.

Stop Motions are provided, so as to instantly stop the machine whenever the sliver breaks down at the back, or when a lap in the creel breaks or runs out; a full-stop motion operates when the lap at the delivery attains its full diameter, and a third stop motion prevents breakage due to sliver lapping up on the front steel rolls.

Extra laps are carried in a **Low Hung Creel** at the back of the machine, and are protected from lint and dust falling from above by sheet-iron guards of neat design. Owing to this novel construction, it is possible to operate the machine with small help.

The Drawing Rolls are made $1\frac{1}{8}$ inches, $1\frac{1}{4}$ inches or $1\frac{1}{2}$ inches in diameter, the sizes being governed by the length of the staple to be worked. Metallic or leather-covered top rolls are furnished as ordered. All gearing is thoroughly guarded with covers to prevent injury to the operator, and the table on which the cotton is drawn is highly polished and nickeled so as to present minimum friction to the web passing over it.

A Weight Relieving Motion is provided which will remove pressure by the weights during any extended stoppage of the machine, thereby preventing creasing of leather rolls.

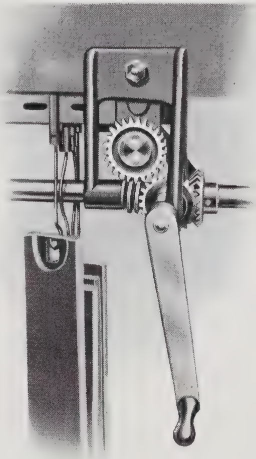
Driving Pulleys: 16 inches in diameter by 3 inches face, running at a ratio of three revolutions of the driving pulleys to one revolution of the 5-inch calender roll. Speed is regulated by the production desired, ordinarily from 90 to 100 revolutions of the 5-inch calender roll.

One ribbon lap machine is sufficient to handle six combers.

Power: 1 horse power is required.

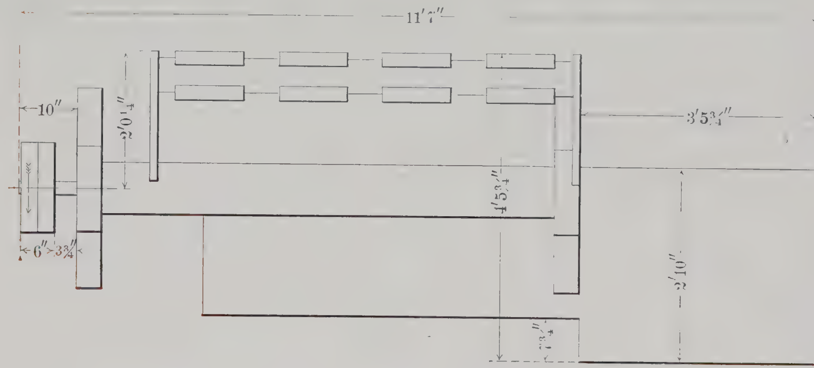
Floor Space: 11 ft. 7 in. by 4 ft. 6 in.

Weights: Shipping weight, 4250 pounds; net weight, 4100 pounds.



Weight Reliever

Car Load: Two sliver lap and two ribbon lap machines, set up.



Floor Plan of Four Lap Ribbon Lap Machine

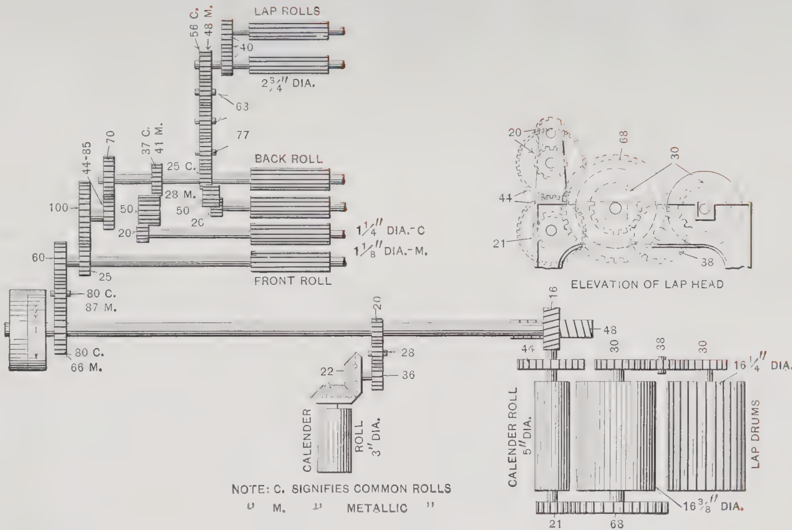


Diagram of Gearing of Ribbon Lap Machine

Draught Table of Ribbon Lap Machine

Table gives Total Draught between $2\frac{3}{4}$ in. Lap Rolls and $16\frac{1}{4}$ in. Lap Drums

Change Gear	Draught with Common Rolls	Draught with Metallic Rolls	Change Gears	Draught with Common Rolls	Draught with Metallic Rolls
47	6.09	5.64	67	4.27	3.96
48	5.96	5.53	68	4.21	3.90
49	5.84	5.41	69	4.15	3.84
50	5.72	5.30	70	4.09	3.79
51	5.61	5.20	71	4.03	3.73
52	5.50	5.10	72	3.97	3.68
53	5.40	5.00	73	3.92	3.63
54	5.30	4.91	74	3.86	3.58
55	5.20	4.82	75	3.81	3.54
56	5.11	4.74	76	3.76	3.49
57	5.02	4.65	77	3.71	3.44
58	4.93	4.57	78	3.66	3.40
59	4.85	4.49	79	3.62	3.36
60	4.77	4.42	80	3.58	3.31
61	4.69	4.35	81	3.53	3.27
62	4 61	4.28	82	3.49	3.23
63	4.54	4.21	83	3.45	3.19
64	4.47	4.14	84	3.41	3.16
65	4.40	4.08	85	3.36	3.12
66	4.34	4.02			

Calculations for Draught Constant — See Gearing Diagram

$1\frac{1}{4}$ in. Common Rolls

$$\frac{56 \times 70 \times 100 \times 60 \times 16 \times 21 \times 30 \times 16\frac{1}{4}}{25 \times C \times 25 \times 80 \times 48 \times 68 \times 30 \times 2\frac{3}{4}} = \frac{286.14}{\text{Change Gear}} = \text{Total Draught}$$

$1\frac{1}{8}$ in. Metallic Rolls

$$\frac{48 \times 70 \times 100 \times 60 \times 16 \times 21 \times 30 \times 16\frac{1}{4}}{28 \times C \times 25 \times 66 \times 48 \times 68 \times 30 \times 2\frac{3}{4}} = \frac{265.435}{\text{Change Gear}} = \text{Total Draught}$$

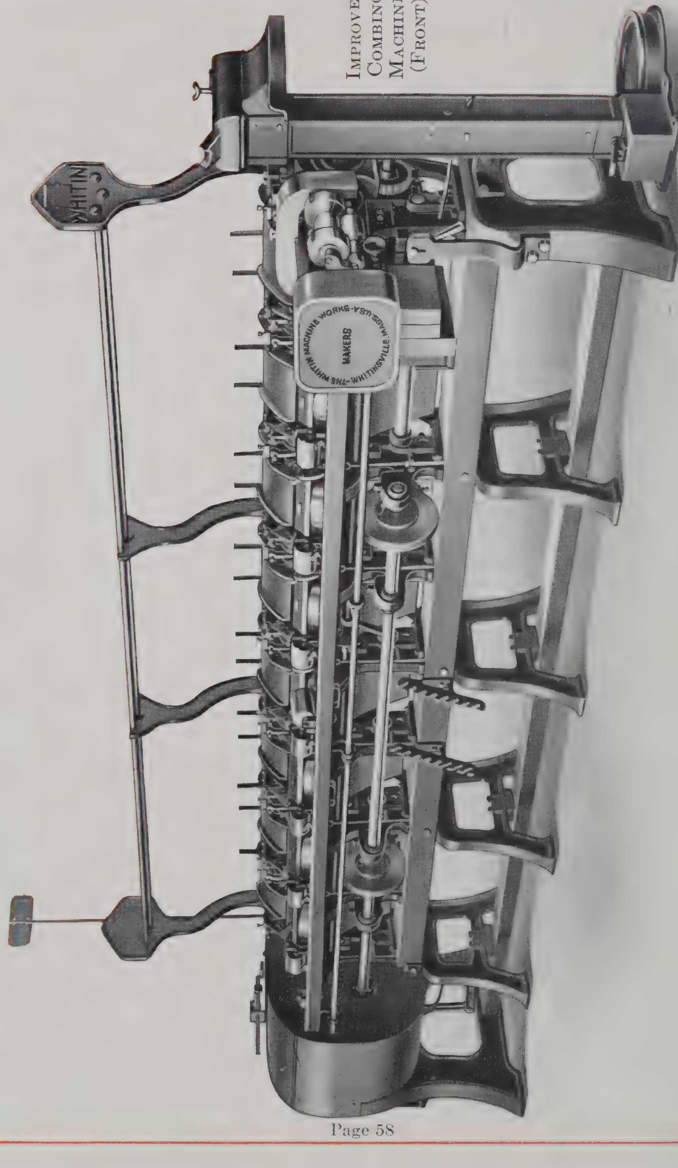
Ribbon Lap Machine

PRODUCTION PER DAY OF TEN HOURS, ALLOWING 25% OFF FOR OILING, CLEANING, ETC.

Revolutions per min. of 5 in. Calender roll	Grains per yard of lap produced													
	400	410	420	430	440	450	460	470	480	490	500	510	520	530
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
85	953.7	978.3	1001.3	1025.9	1049.7	1073.5	1097.3	1121.1	1144.9	1168.8	1192.6	1216.4	1240.2	1264.0
90	1009.8	1035.9	1060.2	1086.3	1111.5	1136.7	1161.9	1187.1	1212.3	1237.5	1262.7	1287.9	1313.1	1338.3
95	1065.9	1093.4	1119.1	1146.6	1173.2	1199.8	1226.4	1253.0	1279.6	1306.3	1332.9	1359.5	1386.1	1412.7
100	1122.0	1151.0	1178.0	1207.0	1235.0	1263.0	1291.0	1319.0	1347.0	1375.0	1403.0	1431.0	1459.0	1487.0
105	1178.2	1208.5	1236.9	1267.3	1296.7	1326.1	1355.5	1384.9	1414.3	1443.8	1473.2	1502.6	1532.0	1561.4
110	1234.2	1266.1	1295.8	1327.7	1358.5	1389.3	1420.1	1450.9	1481.7	1512.5	1543.3	1514.1	1604.9	1635.7
120	1346.4	1381.2	1413.6	1448.4	1482.0	1515.6	1549.2	1582.8	1616.4	1650.0	1683.6	1717.2	1750.8	1784.4

3 revolutions of driving pulley tc 1 revolution of 5-inch calender roll.

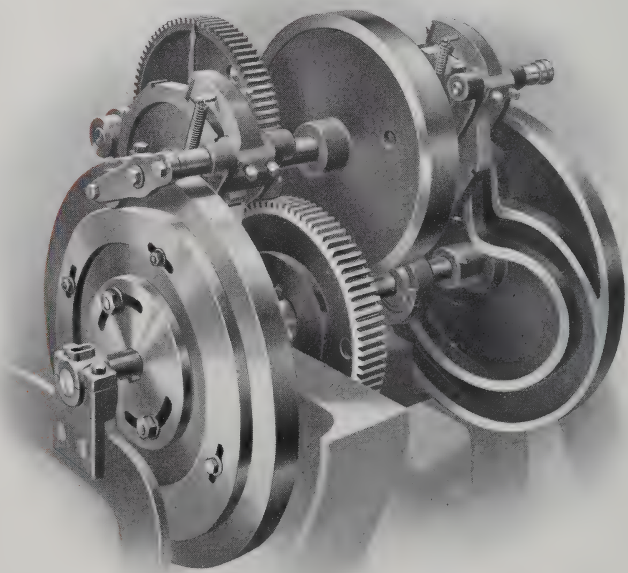
IMPROVED COMBING MACHINE (FRONT)



Improved
Combing Machine
(Back)

IMPROVED COMBING MACHINE

The Improved Combing Machine which we present to the trade is one which has been an unqualified success since its first installation. Something like 3000 machines installed in the mills of this country, and all running, testify to its popularity and efficiency. In its manufacture special attention has been given to every detail of its construction, the best material obtainable used, and no expense spared to furnish a substantial and well-built machine. We feel confident that the machine we now present to the attention of the manufacturer is not only a most durable one, but can be



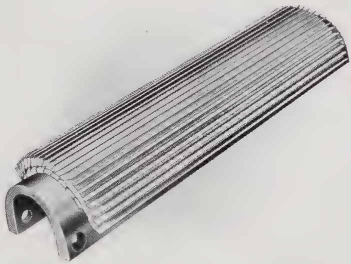
DETACHING
ROLL MECHANISM

operated with more economy and less trouble than any other comber on the market, and at the same time is capable of maximum production with first-quality work. Some of the more prominent features of the machine are briefly described as follows:

Absence of Vibration: Owing to the fixed position of several parts which formerly gave excessive vibration, as well as to the use of easy cam motions and patented improvements, it has been possible to practically do away with the vibrat˙on of the machine and so obtain a much easier and simpler running mechanism, even at greatly increased speed.

Simplified Settings and Adjustments. Adjustments on the machine may readily and quickly be made for all lengths of staple from $\frac{7}{8}$ inch to 2 inches.

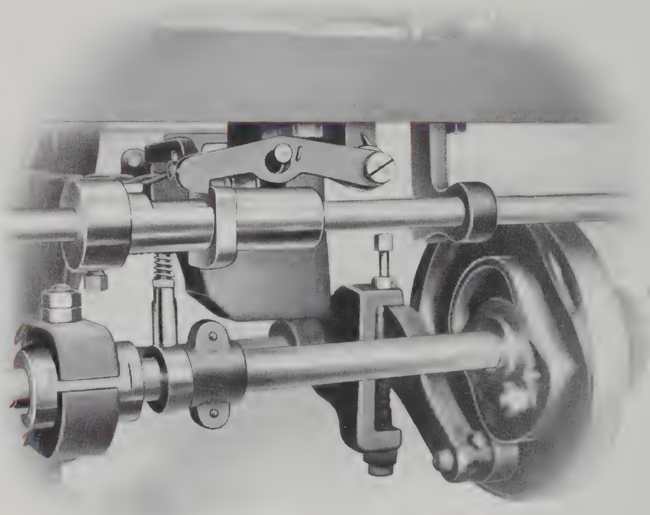
Large Combing Capacity. The combing area of the half laps has been greatly increased. Nearly 18 per cent increased needle surface is provided by the addition of three rows of needles to the half lap, making 20 rows per lap, as compared with 17 on other combers.



NEEDLE LAP

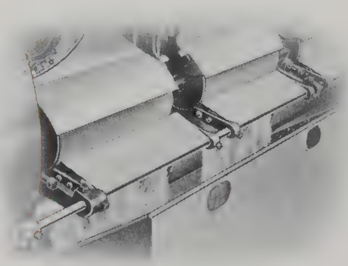
The efficiency of the top comb, in its action on the sliver, is greatly increased by the use of our **Automatic Brushing Device** (patent pending), which effectually prevents the clogging of the comb and eliminates the frequent cleanings by the operator, which are now common on other styles of combing machines.

Automatic Stop Motions. Automatic electric stop motions of simplified construction, easily understood and accessible, cover every point where breakage of sliver is likely to occur. A telltale signal immediately communicates the stoppage of the machine to the operator. This stop motion reduces to a minimum the responsibility of the operator for the care of the machine, and an operator is enabled to attend six to eight eight-head combers with perfect ease. Also, through the use of our patented devices for handling



Stop-Motion

waste off the back of the comber, the extra yardage of cotton on laps, due to the increased size, the simplicity of the machine and system of gear covering, the care of the machines and handlings are reduced to a minimum; and it is possible for the operator to attend a greater number of deliveries and handle the increased production with greater ease than heretofore.



Waste Packer

The application of our improved sliver pan and new **anti-slug device** tends to produce a very smooth sliver on the table and also has eliminated the possibility of slugs being drawn into the work from the corners of the pan, which has always been a source of trouble on all combers.

As on the ribbon and sliver lap machines, the patent **Weight-relieving Motions** release the weight from the leather detaching rolls when the comber is stopped for any length of time.

Accuracy of Adjustment. The percentage of waste can be perfectly controlled between six and twenty-four per cent, with absolute accuracy on appropriate grades of cotton. The change from one stock to another is readily made and practically no adjustment is necessary.

The Machine is built with eight heads, the laps 12 inches in width. All parts are highly finished; gears and cams are cut, to give quiet and easy running, and thoroughly guarded with covers, which can be readily opened for cleaning and oiling. All parts are made on jigs and templates, so that no trouble is experienced in replacing parts, should occasion require.

The **production** of the machine depends upon the grade of cotton used and the class of work desired: roughly speaking, anywhere from 600 to 1000 pounds per week of sixty hours of combed sliver. Coilers can be furnished 9 inches, 10 inches, 11 inches, and 12 inches in diameter.

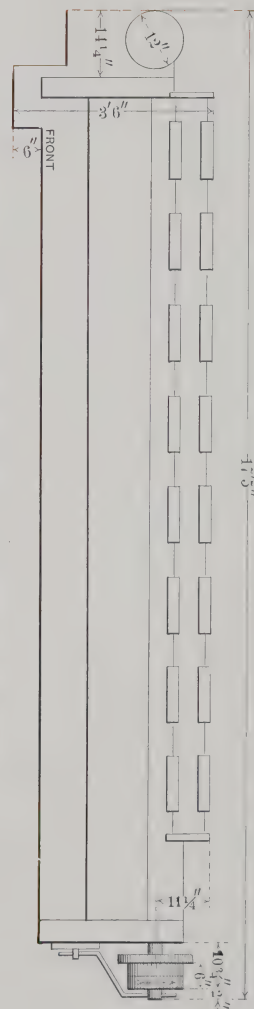
Driving Pulleys: 12 inches in diameter by 3 inches face, running 2.66 revolutions to one nip of the comber. The speed recommended is around 130 nips per minute on short stock and coarse work to 120 nips per minute on long stock, laps to weigh from 450 to 500 grains per yard.

Power: $\frac{5}{8}$ horse power at 130 nips per minute.

Floor Space: 17 ft. 5 in. by 3 ft. 6 in.

Weight: Shipping weight, 5000 pounds; net weight, 4600 pounds.

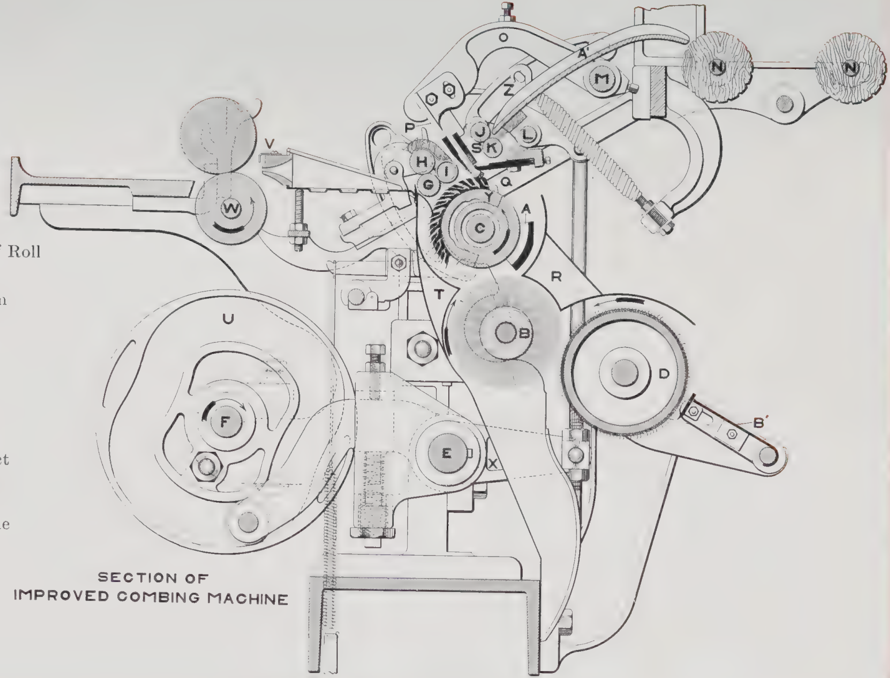
Car Load: Four machines, set up.



Floor Plan of Eight Head Combing Machine

REFERENCES

A — Fluted Segment
B — Brush
C — Cylinder
D — Doffer
E — Nipper Shaft
F — Cam Shaft
G — Steel Drawing-off or Detaching Roll
H — Brass Clearing Roll
I — Leather Drawing-off Roll
J — Top Feed Roll
K — Bottom Feed Roll
L — Nipper Arm Fulcrum
M — Top Comb Shaft
N — Lap Roll Shaft
O — Top Comb Arm
P — Top Comb
Q — Cushion Plate
R — Doffer Cover
S — Nipper Knife
T — Waste Chute
U — Nipper Cam
V — Stop-Motion Contact
W — Calender Roll Shaft
X — Nipper Shaft Lever
Y — Half Lap
Z — Top Feed Roll Saddle
A′ — Lap Plate
B′ — Waste Packer



SECTION OF
IMPROVED COMBING MACHINE

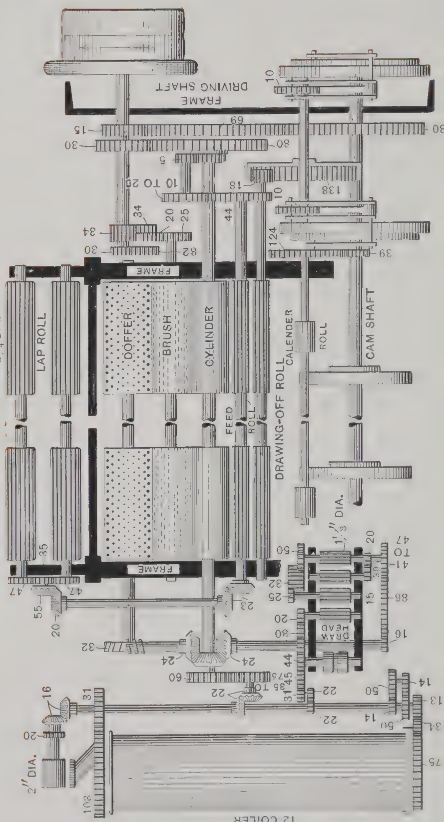


DIAGRAM OF GEARING OF IMPROVED COMBING MACHINE

Draught Table

Improved Combing Machine

Table gives total draught between $2\frac{3}{4}''$ Lap Rolls and $2\frac{3}{4}''$ Coiler Calender Rolls

With draw-head back roll change gear 41 Teeth

With coiler connection shaft change gear 50 Teeth

Total draught in draw-head 5.29

Feed Gear	Total Draught	Feed Gear	Total Draught
10 Teeth	70.90	16 Teeth	44.31
11 "	64.45	17 "	41.70
12 "	59.08	18 "	39.39
13 "	54.54	19 "	37.31
14 "	50.64	20 "	35.45
15 "	47.26		

Calculations for Draught Constant — See Gearing Diagram

$$\frac{47 \times 55 \times 23 \times 44 \times 5 \times 60 \times 2''}{35 \times 20 \times 23 \times \underset{\text{Gear}}{\text{Feed}} \times 1 \times \underset{\text{Gear}}{\text{Coiler}} \times 2\frac{3}{4}''} = \frac{35451.428}{\text{Feed Gear} \times \text{Coiler Gear}} = \text{Total Draught}$$

Production Table of Whitin Improved Comber

Showing the number of pounds of Combed Sliver produced in one day of ten hours allowing 5% off for cleaning, oiling, etc.

Coiler connection gear 50 teeth.

Nips per min.	Grains per yard of Combed Sliver.																		
	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
100	68.22	71.63	75.04	78.45	81.86	85.27	88.68	92.09	95.50	98.91	102.32	105.73	109.15	112.56	115.97	119.38	122.79	126.20	129.61
105	71.63	75.20	78.79	82.37	85.95	89.54	93.12	96.70	100.28	103.86	107.44	111.02	114.60	118.19	121.77	125.35	128.93	132.51	136.09
110	75.04	78.79	82.54	86.30	90.05	93.80	97.55	101.30	105.05	108.80	112.56	116.31	120.06	123.81	127.57	131.32	135.07	138.82	142.57
115	78.45	82.37	86.29	90.22	94.14	98.06	101.98	105.90	109.83	113.75	117.67	121.59	125.52	129.44	133.36	137.28	141.21	145.13	149.05
120	81.86	85.95	90.05	94.14	98.23	102.33	106.41	110.51	114.60	118.70	122.79	126.88	130.98	135.07	139.16	143.25	147.35	151.44	155.53
125	85.27	89.54	93.80	98.06	102.33	106.59	110.85	115.12	119.38	123.64	127.91	132.17	136.44	140.70	144.96	149.23	153.49	157.75	162.02
130	88.68	93.12	97.55	101.99	106.42	110.85	115.29	119.72	124.16	128.59	133.02	137.46	141.89	146.33	150.76	155.19	159.63	164.06	168.50
135	92.09	96.70	101.30	105.91	110.51	115.12	119.72	124.32	128.93	133.53	138.14	142.74	147.35	151.95	156.56	161.16	165.77	170.37	174.97
140	95.50	100.28	105.05	109.83	114.61	119.38	124.16	128.93	133.71	138.48	143.26	148.03	152.81	157.58	162.36	167.13	171.91	176.68	181.46

2.66 revolutions of driving pulley to one nip.

DIRECTIONS FOR SETTING
The Whitin Improved Combing Machine

The following directions are not of an arbitrary nature, but are merely intended as an aid to those whose experience with Combing machines is of a limited nature. Experience with different grades of staple will suggest changes which may, with advantage, be adopted in preference to our directions.

Cleaning the Parts of Combing Machine. All shafts in the Combing machine should be taken out and thoroughly cleaned. All the shaft bearings should also be cleaned before the shafts are replaced, as well as other parts of the machine that may be covered with grease or other preservatives.

Assembling of the Combing Machine. Users will find it most convenient to replace the shafts in the following order: Nipper shaft $1\frac{1}{2}$ inch diameter running in the base of the upright stands; Cylinder shaft, coupling this to the short shaft that carries the Index gear; Driving shaft; Cam shaft; Notched Wheel shaft. See that all caps are screwed firmly to their places and that all shafts run freely after the caps are well set up.

Setting the Actuating Cams. Put on the Pawl arms with the Cam Rolls on them. Set those caps up hard, throw the 80-tooth gear out of mesh by sliding endwise and turn the cam shaft until the roller on the pawl arm is in the heel of the large cam on the end of the machine. Turn the index gear until No. 5 stands opposite the pointer and slide the 80-tooth gear into mesh and bolt it to its sleeve.

Smooth and Needle Segments. See that the smooth segments are screwed down firmly and then put on the needle half laps and screw them down firmly. Be sure and have them thoroughly clean. Put small tin casings between the two segments and see that they fit closely.

Setting Steel Detaching Roll. Put brass bushing in detaching roll bearings and place the detaching roll in bushings. See that this roll is free after the caps are screwed on and that the $\frac{5}{8}$-inch shaft is tight. They are under the same cap. The detaching roll should be set to the segment with a No. 22 gauge.

Setting Cylinders. Put on the large tin waste chutes, being particular to have each square and true, particularly at the point where they come between the upright stands. Then set the cylinders in the proper place by turning the index gear until No. 5 is opposite the pointer. Then turn the cylinders on the shaft till they all stand with the front edge of the segment $1\frac{1}{8}$ inches from the back side of the detaching roll. Use the $1\frac{1}{8}$-inch gauge to caliper this distance. Screw the cylinders firmly to the shaft by the set screws at ends of each cylinder. See that each cylinder stands midway of the waste chutes, particularly at the point where they cover the ends of the cylinders.

Draw Head. Put doffer worm-gear shaft in place. Put draw-head together and place gears and covers in position and connect with the gear on end of the cylinder shaft.

Setting Top Comb Shaft. Put top comb shaft in its bearings. Screw on the caps and set 7 inches from the back side of the detaching roll to the front side of the top comb shaft.

Setting Brushes. Put in the brush shaft and set the brushes so that the bristles will just touch the face of the brass needle bars. Do not set the brushes hard against the needles.

Setting the Leather Detaching Rolls. Put the leather detaching rolls in place. See that the flat side of the bushings on the ends of the rolls bear against the slides. Attach the roll weights to the stirrups and hang the stirrups in the bearings made for them in the bushings. Turn the combing machine until the segments come under the leather detaching roll or index gear stands at No. 8. Set so that No. 25 gauge will go between the flat side of the bushing and the adjusting slides. Make them all secure and see that there is no chance for them to slip back.

Setting Feed Roll. Set the feed roll from the detaching roll to the $1\frac{3}{4}$-inch gauge for short stock and 2 inches for long stock. Feed roll should start when the figure 4 is opposite the pointer. Set the cross shaft from the feed roll to the corrugated lap roll.

Setting the Nippers. Put on the nipper plates and adjust them by the small screws at the back so that the front edges of the plates are the thickness of the No. 22 gauge from the lip of the nipper knife. Be sure and have the nipper knife perfectly straight. Fasten the plates securely to place by the binding screws and try the settings after tightening the binding screws. Always be sure that the nipper knife holds paper on the bite of the plate the full length of the plate. Place the nipper frames all on the floor and connect them with the nipper stands and slide the feed roll into place endwise, then lift them together into place. Set the arms (with the stop screws in them) so that the nipper knife will have about an angle of 34 degrees, by adjusting the stop screws. Then set the front edge of the plate $1\frac{1}{4}$ inches from the detaching roll for short stock, and for long stock the angle of the nipper knife should be about 40 degrees and the front side of cushion plate set to $1\frac{7}{16}$ inches. Use only one screw in each frame to make this setting, and when nipper plates are set fasten the stop screws you have used with the check nut. After all the frames have been set in this manner, set the other stop screws with the one that is set with paper so that both screw points in each end of the frame will hit the stand at the same time. While gauging this distance, set the nipper frame up or down until the nipper plate is the thickness of the No. 19 gauge from the segment. This is to level the frame merely, as they are all reset to half lap needles later. The nipper knife will now stand at about an angle of 34 degrees. In setting the nippers, it is always best to begin in the center of the machine and work each way.

Setting the Nipper Rods. Connect nipper frames to the nipper shaft. See that the rods enter the swivels freely. Turn the Comber until the first row of needles on the half laps points to the center of the detaching roll or until pointer is $14\frac{1}{4}$ on the index gear. See that the roll is in high part of nipper cam under sliver plate. Put No. 25 gauge under the point of the stop screw and adjust the nuts on the connecting rods until the pressure is nearly taken off the gauge. At the same time set the nipper frames up or down until the nipper knife gauges No. 20 from the needles. Tighten lock bolts and check nuts and try gauges again to see if the setting has moved. Now tighten the stop screws in the other arms at the back onto the nipper stands and tighten the check nuts.

Timing the Nippers. Set the nipper cams so that the knives touch the plates at 11 on the index gear. Do this by moving the cams on their sleeves.

Setting the Top Combs. See that the tin strips that hold one set of needles stand about $\frac{1}{32}$ inch further down than the fixed needles (when double combs are used). Turn the Comber until the segment is under the top comb needles or index gear is at No. 8.

Give top comb an angle of about 27 degrees and set it about $\frac{1}{32}$ from the leather roll for short stock. More angle should be used for long stock. Gauge combs so that they will stand No. 22 or No. 23 gauge from segment.

Setting Doffers. Put the doffers in place and set them about $\frac{1}{32}$ of an inch from the brushes. Do not have the doffer wire touch the brush; the waste will be nepped if it does. Set the doffer comb the same relation to the doffer as the doffer is to the brushes. Put the doffer covers on castings, setting them so that they are close to the "bite" of brush and half lap on cylinder, and high enough to throw the waste down. Set them close to the doffer on the back side.

Setting Lap Aprons. Put in place the aprons that reach from the wooden corrugated lap rolls to the steel feed roll and see that the brush on the end of apron strikes onto the steel feed roll. Have index wheel at $14\frac{1}{4}$ in making this setting.

Setting Top Feed Rolls. Put the feed rolls in their bearings and adjust so the top feed roll is parallel with the feed roll proper. Hook on the springs and give a tension of $\frac{1}{4}$ inch. Set the wooden corrugated lap rolls so that the laps will feed fair with the aprons.

Timing the Detaching Roll. Adjust the large cam on the end of the comber on its sleeve, so that the detaching roll will begin to move forward when No. 6 on the index gear stands opposite the pointer. Then turn the comber over to No. 6 again, and set the inside actuating cam so that it will move the detaching roll forward at No. 6. Be sure to tighten these cams up hard.

Setting Brass Clearing Rolls. These rolls should simply be set parallel with the steel detaching roll and quite clear from the leather detaching rolls. Set the brass rolls the thickness of No. 18 gauge from the leather rolls.

Recapitulation of Timing of Parts of Combing Machine

Nippers close at 11.
Detaching roll moves forward at 6.
Feed roll moves forward at 4.

To Increase Waste

By setting the top comb closer.
By feeding later.
By putting more angle on the nipper knife and top comb.

Rules and Regulations for Supervising Lap and Combing Machines

1. The man having charge of the combing machines should carefully observe, the very first thing Monday and Wednesday mornings, that the comber tenders oil their machines properly, teaching them how it should be done and seeing that they do it.

2. At the same time he should see that the oiler oils his backs and head ends in the proper manner. The backs should be oiled like the fronts twice a week, as before stated, Mondays and Wednesdays. The fast running parts and gearing should be oiled every morning by the oiler.

3. Monday morning all half laps and top combs should be carefully inspected by the Third Hand, changing any if in bad condition.

4. It should be the duty of the Third Hands to respond quickly to the call of the Comber Tenders, for if the machine is running badly it is producing uneven work and is not getting out the production it should and is very apt to drive the tender out.

5. The Third Hands should see that the stop motions are always in order, as it saves the largest amount of breakage and relieves the Comber Tender of all responsibility.

6. The Third Hands should see that all weights are released every Saturday. Each combing machine is equipped with a weight-relieving device, which takes the pressure off of the rolls and locks the machine so that it cannot be started up while the pressure is off the rolls.

7. The Third Hands should see that the Comber Tenders do not cut roller laps off of the steel rolls with a knife. A brass hook can be used to pick these laps off, and a little lever is very convenient for removing roller laps from the lower feed roll, and each Tender should be provided with one.

8. The combers and sliver lap machines should be scoured at least twice a year. In scouring the combers, the sliver pans, lap

aprons, brass, steel and leather detaching rolls, top feed rolls, draw-box rolls, brass guides and doffer bonnets should be taken out and the hood taken off of the gearing end, and the comber given a general cleaning. The sliver and ribbon lap machine rollers should be taken out and thoroughly cleaned likewise.

9. The combers should be reset once a year to be kept in good condition. In resetting, the comber should be practically taken down to the upright stands. If any parts should be worn, they should be replaced and the comber should be thoroughly reset.

10. The Third Hands, upon starting up the machines that they reset, should see that the percentage of waste is just what it should be. They should take the percentage of waste once a month, all around the room, thus insuring the evenness of noils and sliver.

11. Leather detaching rolls should be varnished and changed throughout the room each week. The best way to do this is to have a little truck that will go between the draw box covers of the combers with a place for the varnish pot and varnish board, removing the rolls, varnishing and replacing them. This can be done at the noon hour while the machines are stopped, varnishing and changing all rollers each week.

12. It is the duty of the man in charge of the combers to see that the lap machine tenders make good work, for if they make laps with bunches in them it always breaks down the ends in the sliver pan and injures the top combs and half laps. The laps should be carefully handled and placed on the creels, which makes the room look tidy and saves a lot of waste.

13. It is the duty of the man in charge of the combers to enforce carefully these rules. Combers should not be cleaned while in operation, not only because many breakages occur from so doing, but the tenders are liable to be caught in the machinery and injured.

14. It is the duty of the man in charge of the combers to size the laps each day and on very fine counts twice a day, keeping them of a uniform weight.

Rules and Regulations for Caring for Combers

1. Commencing Monday morning and Wednesday morning of each week, comber tenders should carefully oil combers under personal supervision of the man in charge of same. He should make it a point to do nothing but pass back and forth through the combers and carefully observe that the tenders do not put too much oil on the machine, but see that they oil every place as they should, for if an unnecessary amount of oil is used, it makes the machine dirty and of course causes it to run badly, while not enough will cause the parts to wear out, and the machine to break down.

2. Comber tenders, after oiling, should wipe over all parts oiled (to clean up the oil that runs out of the oil hole) with waste. This saves them an unnecessary amount of cleaning.

3. Comber tenders should clean their combers with the finger brush around the rolls at 8.30 a. m. and at 2.00 p. m.

4. Comber tenders should clean their backs and fronts and wipe all lint from the comber at 10.30 a. m. and 5 p. m.

5. Comber tenders should sweep the floor around their machines at 8.30 a. m., 11.30 a. m., 2.30 p. m. and 5.30 p. m.

6. Comber tenders should clean their top combs at 8.00 a. m., 11.00 a. m., 2.00 a. m. and 5.00 p. m.

7. Every morning comber tenders should polish with whiting their sliver plates, coiler tops and draw box covers.

8. Comber tenders should not let tail ends of laps pass through the comber, for every one that slips through the rolls breaks the needles out of the top comb and the half laps, while if the lap is put in at the proper time the needles are kept in good condition.

9. If a comber tender finds anything out of order with her combers she must immediately report it to the boss comber and see that it is attended to, for if a comber runs badly it must be reset and re-adjusted, to insure satisfactory results.

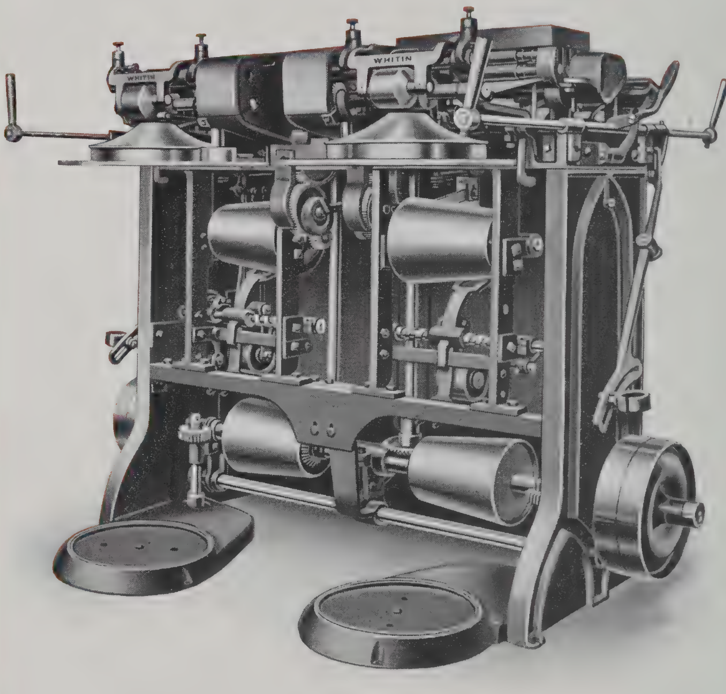
10. Wednesday of each week at 1.00 p. m. comber tenders should clean thoroughly the draw boxes, replacing the top rolls with newly varnished rolls.

11. Tuesdays and Fridays of each week at 1.00 p. m. comber tenders should clean gearing and cams.

NOTE. This insures cleanliness of Comber Department, and should be carefully followed up by the man in charge of same to see that these rules are strictly enforced. Machines should be stopped while being cleaned.

12. Comber tenders should be responsible for two sets of combers, laid out in pairs. If a tender leaves her comber for anything whatsoever, the other tender should be notified and should look out for her combers while she is away.

DRAWING



Double Railway Head

THE COILER RAILWAY HEAD

Since the advent of the English system of carding, in which revolving flat cards with two or three processes of drawing frames are used, the use of the **Railway Head** has been gradually passing into disuse; but in order to satisfy the wants of manufacturers who prefer the railway head evening process, we are prepared to furnish a railway head of a type that has proven satisfactory in the many mills that are using it.

The heads are made single or double delivery. The double head has the advantage of a saving in floor space over the use of two single heads. In the double head each delivery is entirely independent of the other. They are arranged to double from three to ten ends into one.

The heads are fitted with four lines of **Steel Bottom Rolls.** The front roll is $1\frac{3}{8}$ inch diameter and the others are $1\frac{1}{8}$ inch diameter, all having fluted bosses 8 inches long. A leather-covered shell, front top roll, is used, the other top rolls being solid unless all shell rolls are preferred. Either direct or lever weighting of top rolls, as ordered. A weight relieving motion is also provided for readily taking the pressure from the top rolls when desired. Metallic drawing rolls may be had if preferred.

By means of an auxiliary swinging calender roll the necessity of threading the coiler funnel is avoided.

Pressure is applied to the top calender roll by means of spring clamps, which, in combination with our patented **Knock-off Attachment,** prevents breakages due to a lap-up of the calender rolls.

Simple and reliable **Stop-motions** are provided to stop the machine when a sliver breaks or runs out at the back, when the sliver breaks at the front, and also when the coiler can becomes full.

The **Evener Motion** responds instantly to the least variations in the weight of the sliver owing to the use of a coarse-threaded screw, a wide cone belt, and an efficient cone belt binder.

Cut Gearing is used, thus insuring a quiet and easy running machine. All gearing is thoroughly guarded with covers, thus preventing accidents to the operator.

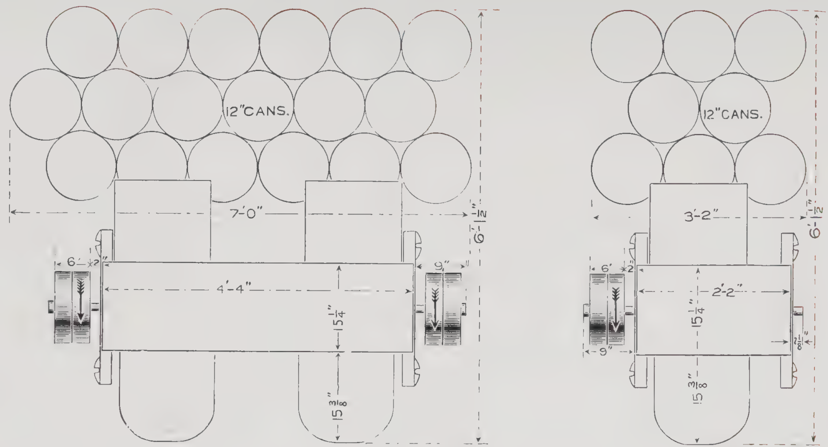
Production: See table, page 85.

Can Tables: For 10-inch, 11-inch, 12-inch, and 14-inch diameter cans.

Driving Pulleys: $8\frac{1}{4}$ inches to 16 inches diameter, 2 inches or 3 inches face.

Horse Power: $\frac{1}{3}$ horse power per delivery.

Floor Space without cans at back: Single Head over all, 3 feet 2 inches long by 3 feet 8 inches wide. Double Head, 5 feet 10 inches long by 3 feet 8 inches wide.



Coiler Railway Heads. Floor Plans

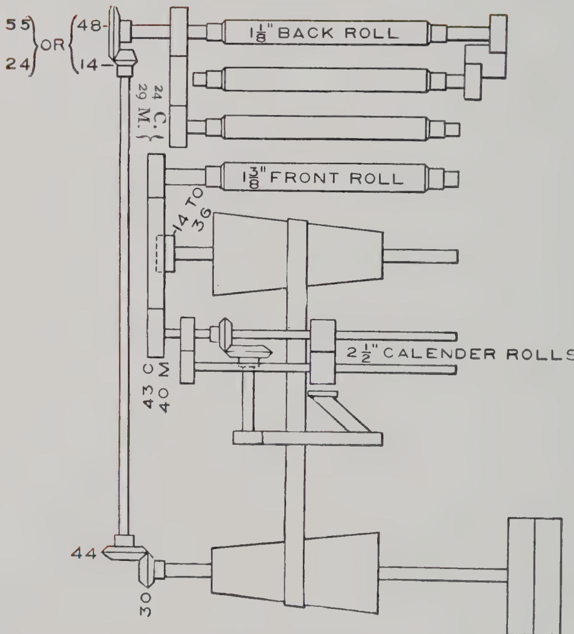


Diagram of Gearing of Coiler Railway Head

Draught Table of Finisher Railway Head
With Upright Shaft.

Table showing total Draught between Back Roll and Calender Roll.

Diameter of { Back Roll, $1\frac{1}{8}$ inches.
Calender Roll, $2\frac{1}{2}$ inches.

Back Roll Bevel Gear, 48 Teeth.

Upright Shaft Top Bevel, 14 Teeth.

Change Pinion on Cone.	Draught with Common Rolls.	Draught with Metallic Rolls.
14 T.	3.64	2.64
15	3.90	2.83
16	4.16	3.02
17	4.42	3.21
18	4.68	3.39
19	4.94	3.58
20	5.20	3.77
21	5.46	3.96
22	5.72	4.15
23	5.98	4.34
24	6.24	4.53
25	6.50	4.71
26	6.76	4.90
27	7.02	5.09
28	7.28	5.28
29	7.54	5.47
30	7.80	5.66
31	8.06	5.85
32	8.32	6.03
33	8.58	6.22
34	8.84	6.41
35	9.10	6.60
36	9.36	6.79

In the above table, the draught with metallic rolls is only approximately correct, and will generally vary with weight of sliver, etc.

Draught Table of Finisher Railway Head

Table showing total draught between back roll and calender roll, when back roll is driven either by belt or by upright shaft with 24 tooth bevel gear at top, into 55 tooth bevel gear on back roll.

Diameter of { Back Roll, $1\frac{1}{8}$ inches. Calender Roll, $2\frac{1}{2}$ inches.

Change Pinion on Cone.	Draught with Common Rolls.	Draught with Metallic Rolls.
14 T.	2.43	1.76
15	2.61	1.89
16	2.78	2.02
17	2.95	2.14
18	3.13	2.27
19	3.30	2.39
20	3.47	2.52
21	3.65	2.65
22	3.82	2.77
23	4.00	2.90
24	4.17	3.02
25	4.34	3.15
26	4.52	3.28
27	4.69	3.40
28	4.86	3.53
30	5.21	3.78
32	5.56	4.03
34	5.91	4.29
36	6.25	4.54
38	6.60	4.79
40	6.95	5.04
42	7.30	5.29
45	7.82	5.67

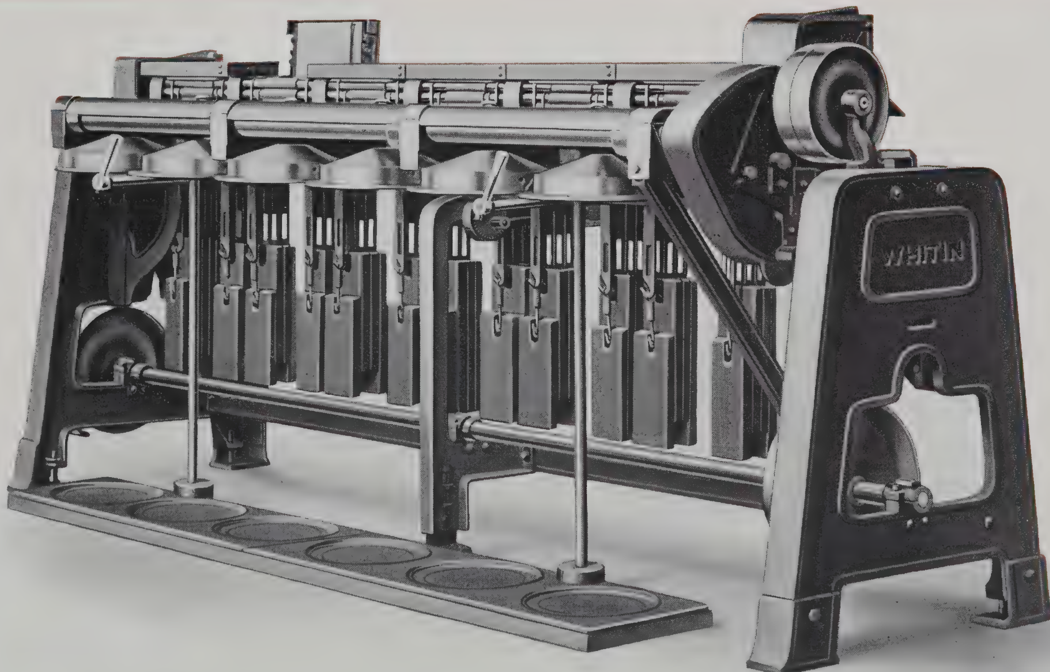
In the above table, the draught with metallic rolls is only approximately correct, and will generally vary with weight of sliver, etc.

Production of Railway Head with Back Stop-Motion.

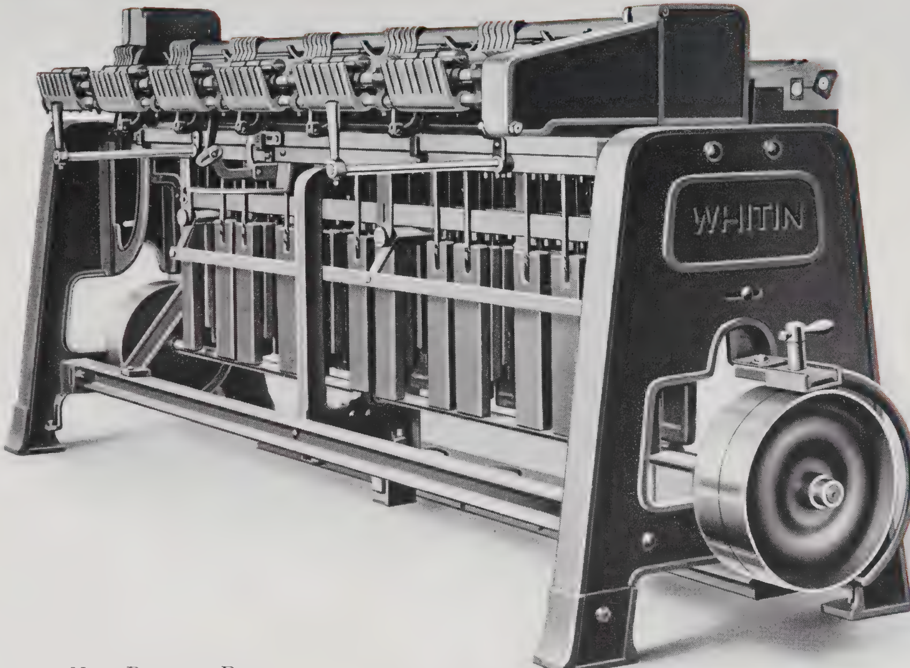
Table showing number pounds Railway Sliver produced in one day of 10 hours, allowing 5 per cent. for cleaning, oiling, etc.

Rev. of Front Roll per Min.	Number of Grains in one yard of Sliver.																Rev. of Front Roll per Min.
	40		50		60		70		80		90		100		110		
	Com. Roll	Met. Roll	Com. Roll	Met. Roll	Com. Roll	Met. Roll	Com. Roll	Met. Roll	Com. Roll	Met. Roll	Com. Roll	Met. Roll	Com. Roll	Met. Roll	Com. Roll	Met. Roll	
300	118.8	154.8	148.5	193.5	178.2	232.2	207.9	270.9	237.6	309.6	267.3	348.3	297.0	387.0	326.7	425.7	300
315	124.7	162.5	155.9	203.2	187.1	243.8	218.3	288.4	249.5	325.1	280.7	365.7	311.9	406.4	343.0	447.0	315
330	130.7	170.3	163.4	212.9	196.0	255.4	228.7	298.0	261.4	340.6	294.0	383.1	326.7	425.7	359.4	468.3	330
345	136.6	178.0	170.8	222.5	204.9	267.0	239.1	311.5	273.2	356.0	307.4	400.5	341.6	445.1	375.7	489.6	345
360	142.6	185.8	178.2	232.2	213.8	278.6	249.5	325.1	285.1	371.5	320.8	418.0	356.4	464.4	392.0	510.8	360
375	148.5	193.5	185.6	241.9	222.8	290.2	259.9	338.6	297.0	387.0	334.1	435.4	371.3	483.8	408.4	532.1	375
390	154.4	201.2	193.1	251.6	231.7	301.9	270.3	352.2	308.9	402.5	347.5	452.8	386.1	503.1	424.7	553.4	390
405	160.4	209.0	200.5	261.2	240.6	313.5	280.7	365.7	320.8	418.0	360.9	470.2	401.0	522.5	441.1	574.7	405
420	166.3	216.7	207.9	270.9	249.5	325.1	291.1	379.3	332.6	433.4	374.2	487.6	415.8	541.8	457.4	596.0	420
435	172.3	224.5	215.3	280.6	258.0	336.7	301.5	392.8	344.5	448.9	387.6	505.0	430.7	561.2	473.7	617.3	435
450	178.2	232.2	222.8	290.3	267.3	348.3	311.9	406.4	356.4	464.4	401.0	522.5	445.5	580.5	490.1	638.6	450
465	184.1	239.9	230.2	299.9	276.2	359.9	322.2	419.9	368.3	479.9	414.3	539.9	460.4	599.9	506.4	659.8	465
480	190.1	247.7	237.6	309.6	285.1	371.5	332.6	433.4	380.2	495.4	427.7	557.3	475.2	619.2	522.7	681.1	480
495	196.0	255.4	245.0	319.3	294.0	383.1	343.0	447.0	392.0	510.8	441.0	574.7	490.1	638.6	539.1	702.4	495
510	202.0	263.2	252.5	329.0	302.9	394.7	353.4	460.5	403.9	526.3	454.4	592.1	504.9	657.9	555.4	723.7	510
525	207.9	270.9	259.9	338.6	311.9	406.4	363.8	474.1	415.8	541.8	467.8	609.5	519.8	677.3	571.7	745.0	525
540	213.8	278.6	267.3	348.3	320.8	418.0	374.2	487.6	427.7	557.3	481.1	626.9	534.6	696.6	588.1	766.2	540
555	219.8	286.4	274.7	358.0	329.7	429.6	384.6	501.2	439.6	572.8	494.5	644.4	549.5	716.0	604.4	787.5	555
570	225.7	294.1	282.2	367.7	338.6	441.2	395.0	514.7	451.4	588.2	507.9	661.8	564.3	735.3	620.7	808.8	570
585	231.7	301.9	289.6	377.3	347.5	452.8	405.4	528.3	463.3	603.7	521.2	679.2	579.2	754.7	637.1	830.1	585
600	237.6	309.6	297.0	387.0	356.4	464.4	415.8	541.8	475.2	619.2	534.6	696.6	594.0	774.0	653.4	851.4	600

NOTE: — Met.——Metallic. Com.——Common.



NEW PATTERN DRAWING FRAME. (FRONT)



NEW PATTERN DRAWING
FRAME. (BACK)

THE WHITIN "NEW PATTERN" DRAWING FRAME

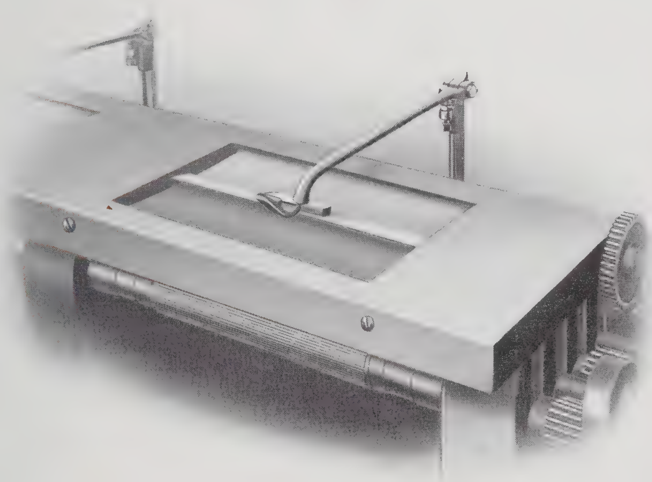
This frame, which is the result of considerable experiment, investigation, and study, has met with such success in the many mills in which it has been installed that a few words of description as to its salient features may be of interest.

In the first place, our aim has been to build a strong, rigid frame which will be simple in its construction, providing ready accessibility to its parts, and intelligently designed to meet the varying exacting conditions in the cotton mill which a Drawing Frame must meet. The first impression that this frame gives is that of unusually strong and rigid construction. The tables are extra heavy, being supported by rugged end legs and a sampson or middle support, the whole frame being firmly held together by a tie bar. Adjustable feet are provided, thus facilitating the levelling of the frame, and doing away with the unsightly wooden blocks commonly used for this purpose.

The **Drawing Rolls** are made of crucible steel, arranged in four lines, with bearings 16 inches on centres. These bearings are provided with brass steps to form a smooth wearing surface. For regular work, the customary diameters are used, namely, $1\frac{3}{8}$ inches diameter bottom front roll, and $1\frac{1}{8}$ inches for the three bottom back rolls. Where it is found desirable to run the shortest grades of cotton, $1\frac{1}{8}$ inches, diameter bottom front roll, is used. This arrangement for providing for a roll in the drawing frame such as can be set to the staple of the cotton to be used is an especially desirable feature of the frame for the reason that there is probably more poor work coming from drawing frames to-day, owing to inability to set to the staple, than from any other cause.

For most classes of work **Metallic Rolls** are strongly recommended, in that they do away with the trouble and expense connected with the frequent renewing of leather rolls, and also give at least 25 per cent more production. The **Top Rolls** for both the common and metallic rolls are made with loose end bearings, which possess the advantage of being easily oiled without the necessity of removing weights or stopping the machines. They also cause less friction, as the weight hooks are not in contact with the moving surface of the rolls. Direct weighting of the top rolls is used, and when leather top rolls are specified a **Weight Relieving Motion** is applied to take the pressure from the top rolls when the machine is not in operation, thus preventing the flattening or marking of the leather rolls by the flutes of the bottom steel rolls.

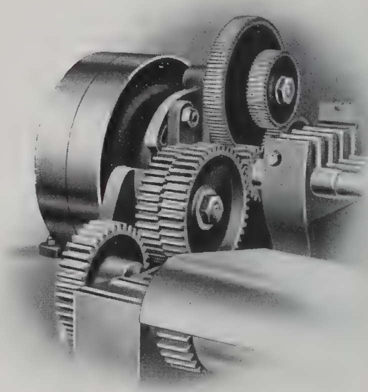
The matter of **Clearers** is well taken care of by an arrangement of cast-iron clearers between the calender rolls and our patented clearer cloth holder over the top rolls, which keeps the cloth always in contact with the rolls. When desired, the Ermen Top Roll Clearer can also be applied.



Ermen Clearer

The **Calender Rolls** are made of steel, 3 inches in diameter, the driving calender roll running in fixed bearings, while the front calender roll bearings are movable in inclined bearing seats by means of which the weight of the roll effects a thorough condensation of the sliver. A particularly desirable feature of the frame is found in the arrangement of the calender roll covers, these being inclined in such a way that the sliver does not touch the cover in its passage from the front roll to the trumpet, thus preventing the collection of dirt in the sliver and doing away with the tendency to breakage of the web at this point, which very often occurs with the old-style straight cover.

The **Draught Gear** is easily and quickly changed by means of a swivel adjusting stand which is concentric with the front roll gear. Also, in order to meet the varying weather conditions and differences in stock which sometimes render it necessary to make a slight alteration in the draught between the front and the calender rolls in order to take up the sag of the web, three compensating gears are furnished.



Draught Gearing

Mechanical Stop Motions are furnished throughout, consisting of Front, Back, and Full Can Stop Motions. The sliver trumpet is removably held in the holding lever, and is so adjusted that it not only stops the frame when the sliver breaks between the front and calender roll, but can be set by means of a sliding weight to knock off for a light sliver when a portion of the front sliver is lapping on the front roll. The convenient arrangement of the stop motions, and the novel method in which they are set so as to provide for the most economical running of the various staples of cotton, are the subject of several patent applications.

The **Finger Heads,** or sliver guides, are also made so that it is impossible for one sliver to ride over onto another. The openings are small enough at the bottom to prevent the sliver from running "bunchy" or snarling up, yet wide enough at the top for the sliver to be easily thrown or dropped in.

The **Stop Motion** at the back consists of accurately balanced sliver spoons acting in conjunction with the usual knock-off motion. Where an especially short staple cotton or a very light sliver is to be worked, which breaks back easily, a back lifting roll motion is used, consisting of a line of fluted steel rolls with plain top cast-iron rolls. The bottom roll is bossed for each delivery and the top rolls are suitable in length for two slivers. This aids in the lifting of the sliver from the can to the drawing rolls, in that it lifts the sliver to the spoons, so reducing the tension of a long drag on the sliver.

Cut-tooth Gearing is used everywhere throughout the frame, and insures a quiet and easy running machine. The gearing is also effectively guarded with covers, which, acting with patented automatic locking devices, avoid any liability of accident to the operatives while oiling or cleaning, it being impossible to start the machine with any of the gear covers open.

The **Finish of the Frame** is in keeping with the general effort on our part to make it embody the best of everything, nearly all the parts being polished. The bearings used throughout are grooved with the patent Osgood oil groove, allowing perfect lubrication, so that the machine runs smoothly and without vibration.

Driving Pulleys on the lower shaft are from 8 inches to 16 inches in diameter, and from 2 inches to $5\frac{1}{2}$ inches face, running one revolution to $1\frac{5}{11}$ revolutions of the front roll.

The excessive wear common to old-style drawing frames in the bearing of the loose pulley on the front roll arbor has been eliminated in this frame by mounting the loose pulley on a sleeve which is integral with the support of the arbor; when the belt is on the tight pulley, the loose pulley does not revolve.

The frames are built in heads of from 3 to 6 deliveries each, fitted for either 10, 11, or 12 inch cans.

Floor Lengths, exclusive of driving pulleys and sides of frames, are as follows:

3 deliveries,	5 feet 8 inches.
4 "	7 " 0 "
5 "	8 " 4 "
6 "	9 " 8 "

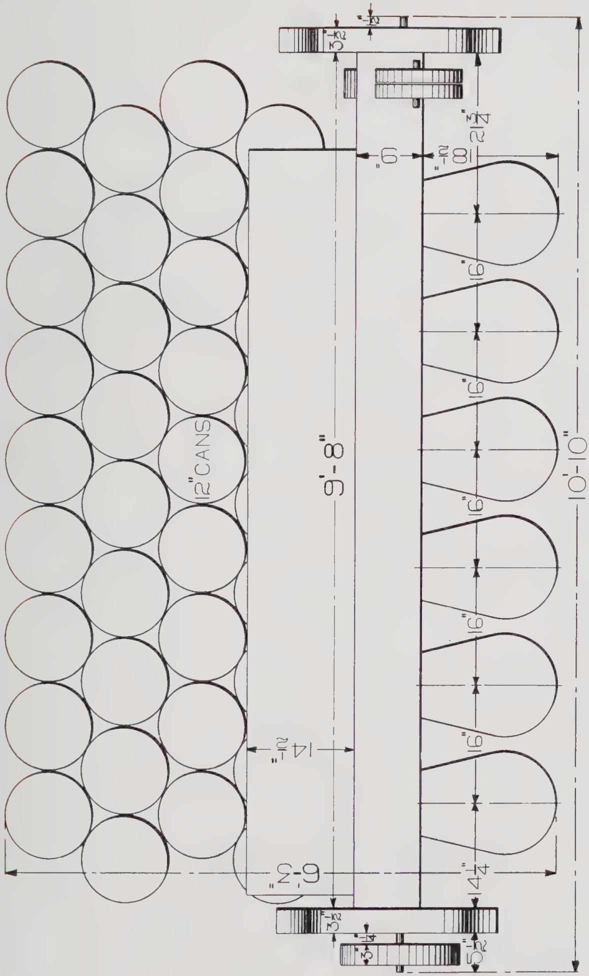
To obtain length of frame over all add 14 inches to above lengths. To economize in floor space, two or more tables may be coupled together. For width, see plan, page 93.

Production: See tables, pages 103, 104.

Horse Power: 4 deliveries per horse power.

Weights: Shipping weight, 600 pounds per delivery; net weight, 540 pounds per delivery.

Car Load: Five frames of six deliveries each, set up.



COILER DRAWING FRAME

RULES FOR DRAWING FRAME OPERATORS

To find constant for total draught in machine:

Multiply the number of teeth in back roll gear, the number of teeth in crown gear, the number of teeth in front roll gear, the number of teeth in compensating gear, the diameter of calender roll gear, together, for a dividend, and multiply the number of teeth in gear on front roll driving crown gear, the number of teeth in gear driving compensating gear, the number of teeth in calender roll gear, the diameter of back roll, for a divisor; divide the dividend by the divisor and the quotient is the constant required.

Example. —

Diameter of front roll	$1\frac{3}{8}''$
" " back roll	$1\frac{1}{8}''$
" " calender roll	$3''$
Front roll gear driving crown	30 teeth
Front roll gear driving compensating .	19 "
Back roll gear	70 "
Crown gear	96 "
Calender roll gear	37 "
Compensating gear	42 "
" " driver	45 "

Therefore, $\dfrac{70 \times 96 \times 19 \times 42 \times 3}{30 \times 45 \times 37 \times 1.125} = 286.29$, Constant.

The constant divided by the draught gear gives the draught of the frame, and the constant divided by the required draught gives the change gear.

In calculating the draught with metallic rolls, the diameters of the rolls are figured as larger, owing to the intermeshing of the flutes, viz.:

Rolls with 16 pitch

$1\frac{1}{8}''$	diameter	figured	as	$1.66''$
$1\frac{1}{4}''$	"	"	"	$1.83''$
$1\frac{3}{8}''$	"	"	"	$2''$
$1\frac{1}{2}''$	"	"	"	$2.13''$

Rolls with 24 pitch

$1\frac{1}{8}''$	diameter	figured	as	$1.50''$
$1\frac{1}{4}''$	"	"	"	$1.66''$
$1\frac{3}{8}''$	"	"	"	$1.83''$
$1\frac{1}{2}''$	"	"	"	$2''$

Rolls with 32 pitch are figured the same as those with 24 pitch.

To find the weight of drawing sliver when the weight of card sliver doublings and draught are given:

Multiplying the weight of the card sliver by the doublings and dividing the product by the draught gives the weight of drawing sliver.

Example. — What is the weight of sliver produced on a drawing frame doubling 6×50-grain card slivers into one with a draught of 5?

$$\frac{50 \times 6}{5} = 60 \text{ grains.}$$

To find the draught when the doublings and weights of carding and drawing slivers are given:

Multiplying the weight of the card sliver by the doublings and dividing the product by the weight of the drawing sliver gives the draught.

Example. — What draught is required to produce a 60-grain drawing sliver from a 50-grain card sliver doubled 6 into 1?

$$\frac{50 \times 6}{60} = 5 \text{ draught.}$$

To find the change draught gear when changing from one weight to another:

Multiplying the required weight by the present draught gear and dividing the product by the present weight gives the change gear required.

Example. — What draught gear will be required to change from a 50-grain sliver, made with a 50-teeth draught gear, to a 60-grain sliver?

$$\frac{60 \times 50}{50} = \text{60-teeth change gear.}$$

To find change draught gear when changing from one hank to another:

Multiplying the hank by the present draught gear and dividing the product by the required hank gives the change gear required.

Example. — What draught gear will be required to change from .25 hank now made with a 40-teeth draught gear, to a .40 hank?

$.25 \times 40 = 10.0$; $10 \div .40 = $ 25-teeth gear required.

To find production of drawing per delivery in one day:

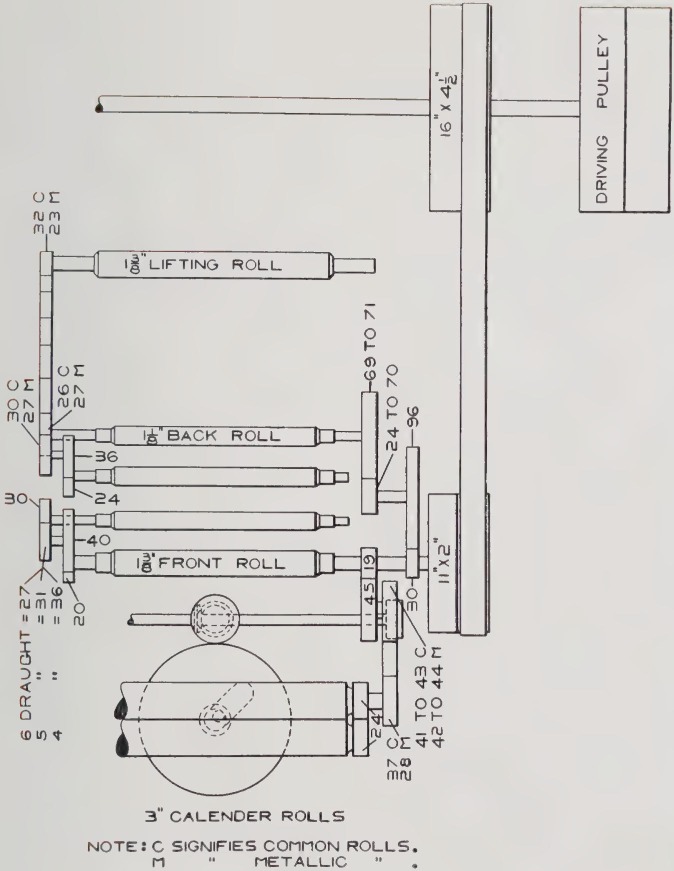
Multiply the revolutions of calender roll per minute, the number of hours per day, the number of minutes per hour, the circumference in inches of calender roll, the weight in grains of one yard of sliver, together, for a dividend, and multiply the number of inches in one yard by the number of grains in one pound for a divisor; dividing the dividend by the divisor equals the number of pounds per delivery in one day. An allowance of at least 20 per cent should be made from this result for stoppages, due to breakage of sliver, etc.

Example. —

Calender roll, 143 revolutions;
" " 3″ diameter;
Sliver, 60 grains per yard;
Allowance, 20 per cent.
Production per day of 10 hours?

Therefore:

$$\frac{143 \times 60 \times 10 \times 3 \times 3.1416 \times 60 \times .80}{36 \times 7000} = \text{154 pounds per delivery.}$$



Drawing Gearing Diagram. 1⅜ Front Roll

Draught Table of New Pattern Drawing Frame

1⅜-INCH FRONT ROLL

Table shows total draught between Back Roll and Calender Roll

Diameter of { Back Roll $1\frac{1}{8}$ in. / Calender Roll 3 in. — Compensating Gears { 43 teeth, Metallic Rolls / 42 teeth, Common Rolls

Back Roll Change Gear 69 Teeth			Back Roll Change Gear 70 Teeth			Back Roll Change Gear 71 Teeth		
Change Gear	Draught with Common Rolls	Draught with Metallic Rolls	Change Gear	Draught with Common Rolls	Draught with Metallic Rolls	Change Gear	Draught with Common Rolls	Draught with Metallic Rolls
30T	9.41	8.62	30T	9.54	8.75	30T	9.68	8.87
31	9.10	8.35	31	9.24	8.47	31	9.37	8.59
32	8.82	8.09	32	8.95	8.20	32	9.07	8.32
33	8.55	7.84	33	8.68	7.95	33	8.80	8.06
34	8.30	7.61	34	8.42	7.72	34	8.54	7.83
35	8.06	7.39	35	8.18	7.50	35	8.30	7.61
36	7.84	7.19	36	7.95	7.29	36	8.07	7.40
37	7.63	6.99	37	7.74	7.09	37	7.85	7.20
38	7.43	6.81	38	7.53	6.91	38	7.64	7.01
39	7.24	6.63	39	7.34	6.73	39	7.45	6.83
40	7.05	6.47	40	7.16	6.56	40	7.27	6.66
41	6.88	6.31	41	6.98	6.40	41	7.08	6.49
42	6.72	6.16	42	6.82	6.25	42	6.91	6.34
43	6.56	6.02	43	6.66	6.10	43	6.75	6.19
44	6.41	5.88	44	6.51	5.97	44	6.60	6.05
45	6.27	5.75	45	6.36	5.83	45	6.45	5.92
46	6.13	5.62	46	6.22	5.71	46	6.31	5.79
47	6.00	5.51	47	6.09	5.58	47	6.18	5.66
48	5.88	5.39	48	5.96	5.47	48	6.05	5.55
49	5.76	5.28	49	5.84	5.35	49	5.93	5.43
50	5.64	5.17	50	5.73	5.25	50	5.81	5.32
51	5.53	5.07	51	5.61	5.15	51	5.69	5.22
52	5.43	4.98	52	5.51	5.05	52	5.58	5.12
53	5.32	4.88	53	5.40	4.95	53	5.48	5.02
54	5.23	4.79	54	5.30	4.86	54	5.38	4.93
55	5.13	4.70	55	5.21	4.77	55	5.28	4.84
56	5.04	4.62	56	5.11	4.69	56	5.19	4.75
57	4.95	4.54	57	5.02	4.61	57	5.09	4.67
58	4.87	4.46	58	4.94	4.51	58	5.01	4.59
59	4.78	4.39	59	4.85	4.45	59	4.92	4.51
60	4.70	4.31	60	4.77	4.37	60	4.84	4.44
61	4.63	4.24	61	4.69	4.30	61	4.76	4.36
Const's	282.19	258.74	Const's	286.29	262.49	Const's	290.38	266.24

In the above table the draught with metallic rolls is only approximately correct and will generally vary with weight of sliver, etc.

Draught Table of New Pattern Drawing Frame

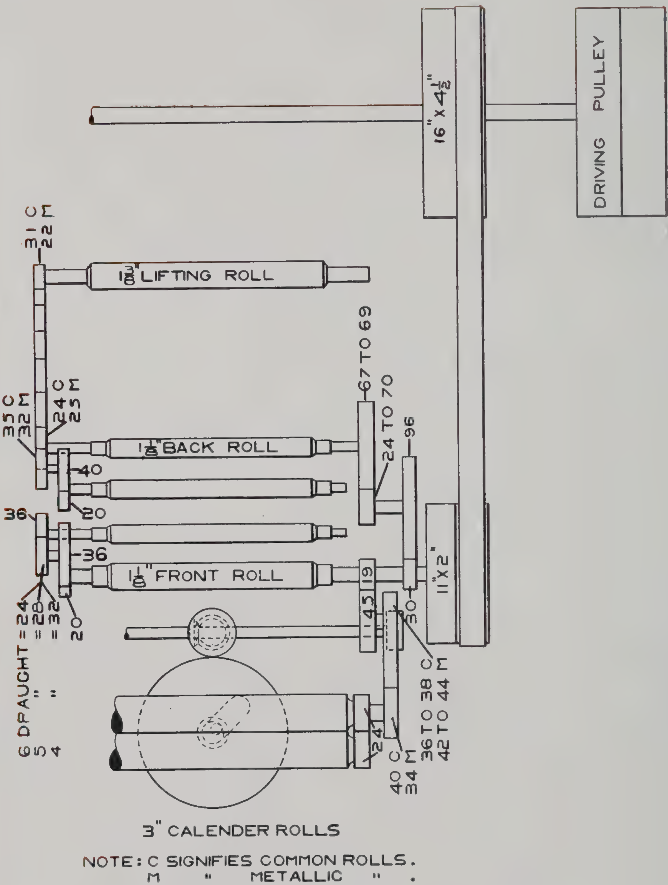
1⅜-INCH FRONT ROLL

Table shows total draught between Back Roll and Calender Roll

Diameter of	Back Roll $1\frac{1}{8}$ in. Calender Roll 3 in.	Compensating Gears	43 teeth, Metallic Rolls 42 teeth, Common Rolls

Back Roll Change Gear 69 Teeth			Back Roll Change Gear 70 Teeth			Back Roll Change Gear 71 Teeth		
Change Gear	Draught with Common Rolls	Draught with Metallic Rolls	Change Gear	Draught with Common Rolls	Draught with Metallic Rolls	Change Gear	Draught with Common Rolls	Draught with Metallic Rolls
62T	4.55	4.17	62T	4.62	4.23	62T	4.68	4.29
63	4.48	4.11	63	4.54	4.17	63	4.61	4.23
64	4.41	4.04	64	4.47	4.10	64	4.54	4.16
65	4.34	3.98	65	4.40	4.04	65	4.47	4.09
66	4.28	3.92	66	4.34	3.98	66	4.40	4.03
67	4.21	3.86	67	4.27	3.92	67	4.33	3.97
68	4.15	3.81	68	4.21	3.86	68	4.27	3.92
69	4.09	3.75	69	4.15	3.80	69	4.21	3.86
70	4.03	3.69	70	4.09	3.75	70	4.15	3.80
Const's	282.19	258.74	Const's	286.29	262.49	Const's	290.38	266.24

In the above table the draught with metallic rolls is only approximately correct and will generally vary with weight of sliver, etc.



Drawing Gearing Diagram. $1\frac{1}{8}$ Front Roll

Draught Table of New Pattern Drawing Frame

1⅛-INCH FRONT ROLL

Table shows total draught between Back Roll and Calender Roll

Diameter of { Back Roll 1⅛ in. / Calender Roll 3 in. } Compensating Gears { 43 teeth, Metallic Rolls / 37 teeth, Common Rolls }

Back Roll Change Gear 67 Teeth			Back Roll Change Gear 68 Teeth			Back Roll Change Gear 69 Teeth		
Change Gear	Draught with Common Rolls	Draught with Metallic Rolls	Change Gear	Draught with Common Rolls	Draught with Metallic Rolls	Change Gear	Draught with Common Rolls	Draught with Metallic Rolls
24T	9.30	8.62	24T	9.44	8.75	24T	9.58	8.88
25	8.93	8.27	25	9.07	8.40	25	9.20	8.52
26	8.59	7.96	26	8.72	8.08	26	8.84	8.20
27	8.27	7.66	27	8.39	7.78	27	8.52	7.89
28	7.97	7.39	28	8.09	7.50	28	8.21	7.61
29	7.70	7.13	29	7.81	7.24	29	7.93	7.35
30	7.44	6.90	30	7.55	7.00	30	7.67	7.10
31	7.20	6.67	31	7.31	6.77	31	7.42	6.87
32	6.98	6.47	32	7.08	6.56	32	7.19	6.66
33	6.77	6.27	33	6.87	6.36	33	6.97	6.46
34	6.57	6.09	34	6.67	6.18	34	6.76	6.27
35	6.38	5.91	35	6.47	6.00	35	6.57	6.09
36	6.20	5.75	36	6.29	5.83	36	6.39	5.92
37	6.04	5.59	37	6.13	5.68	37	6.21	5.76
38	5.88	5.44	38	5.96	5.53	38	6.05	5.61
39	5.73	5.31	39	5.81	5.38	39	5.90	5.46
40	5.58	5.17	40	5.67	5.25	40	5.75	5.33
41	5.45	5.05	41	5.53	5.12	41	5.61	5.20
42	5.32	4.93	42	5.40	5.00	42	5.48	5.07
43	5.19	4.81	43	5.27	4.88	43	5.35	4.96
44	5.08	4.70	44	5.15	4.77	44	5.23	4.84
45	4.96	4.60	45	5.04	4.67	45	5.11	4.74
46	4.85	4.50	46	4.03	4.57	46	5.00	4.63
47	4.75	4.40	47	4.82	4.47	47	4.89	4.53
48	4.65	4.31	48	4.72	4.37	48	4.79	4.44
49	4.56	4.22	49	4.63	4.29	49	4.69	4.35
50	4.47	4.14	50	4.53	4.20	50	4.60	4.26
51	4.38	4.06	51	4.44	4.12	51	4.51	4.18
52	4.30	3.98	52	4.36	4.04	52	4.42	4.10
53	4.21	3.90	53	4.28	3.96	53	4.34	4.02
54	4.14	3.83	54	4.20	3.89	54	4.26	3.95
55	4.06	3.76	55	4.12	3.82	55	4.18	3.87
Const's	223.29	206.90	Const's	226.63	209.99	Const's	229.96	213.08

In the above table the draught with metallic rolls is only approximately correct and will generally vary with weight of sliver, etc.

Draught Table of New Pattern Drawing Frame

1⅛-INCH FRONT ROLL

Table shows total draught between Back Roll and Calender Roll

Diameter of { Back Roll 1⅛ in. / Calender Roll 3 in. — Compensating Gears { 43 teeth, Metallic Rolls / 37 teeth, Common Rolls

Back Roll Change Gear 67 Teeth			Back Roll Change Gear 68 Teeth			Back Roll Change Gear 69 Teeth		
Change Gear	Draught with Common Rolls	Draught with Metallic Rolls	Change Gear	Draught with Common Rolls	Draught with Metallic Rolls	Change Gear	Draught with Common Rolls	Draught with Metallic Rolls
56T	3.99	3.69	56T	4.05	3.75	56T	4.11	3.81
57	3.96	3.63	57	3.98	3.68	57	4.03	3.74
58	3.85	3.57	58	3.91	3.62	58	3.96	3.67
59	3.78	3.51	59	3.84	3.56	59	3.90	3.61
60	3.72	3.45	60	3.78	3.50	60	3.83	3.55
61	3.66	3.39	61	3.72	3.44	61	3.77	3.49
62	3.60	3.34	62	3.66	3.39	62	3.71	3.44
63	3.54	3.28	63	3.60	3.33	63	3.65	3.38
64	3.49	3.23	64	3.54	3.28	64	3.59	3.33
65	3.44	3.18	65	3.49	3.23	65	3.54	3.28
66	3.38	3.13	66	3.43	3.18	66	3.48	3.23
67	3.33	3.09	67	3.38	3.13	67	3.43	3.18
68	3.28	3.04	68	3.33	3.09	68	3.38	3.13
69	3.24	3.00	69	3.28	3.04	69	3.33	3.09
70	3.19	2.96	70	3.24	3.00	70	3.29	3.04
Const's	223.29	206.90	Const's	226.63	209.99	Const's	229.96	213.08

In the above table the draught with metallic rolls is only approximately correct and will generally vary with weight of sliver, etc.

Production of Drawing Frame

1⅜-INCH FRONT ROLL

Table showing number of pounds Drawing Sliver produced in one day of 10 hours, allowing 20 per cent, for cleaning, oiling, etc.

Rev. of Front Roll Per. Min.	Number of Grains in one yard of Sliver.																	
	35		40		45		50		55		60		65		70		75	
	Com. Roll	Met. Roll	Com. Roll	Met. Roll	Com. Roll.	Met. Roll	Com. Roll	Met. Roll	Com. Roll	Met. Roll	Com. Roll	Met. Roll	Com. Roll	Met. Roll	Com. Roll	Met. Roll	Com. Roll	Met. Roll
250	74.6	97.7	85.3	111.7	96.0	125.7	106.6	139.6	117.3	153.6	127.9	167.5	138.6	181.5	149.3	195.5	159.9	209.4
260	77.6	101.6	88.7	116.2	99.8	130.7	110.9	145.2	122.0	159.7	133.1	174.2	144.1	188.8	155.2	203.3	166.3	217.8
270	80.6	105.5	92.1	120.6	103.6	135.7	115.1	150.8	126.7	165.9	138.2	180.9	149.7	196.1	161.2	211.1	172.8	226.2
280	83.6	109.5	95.5	125.1	107.5	140.7	119.4	156.4	131.4	172.0	143.3	187.6	155.2	203.3	167.2	219.0	179.1	234.6
290	86.6	113.4	98.9	129.6	111.3	145.8	123.7	162.0	136.1	178.1	148.4	194.4	160.8	210.5	173.2	226.7	185.5	242.9
300	89.6	117.3	102.4	134.0	115.1	150.8	127.9	167.5	140.7	184.3	153.5	201.1	166.3	217.8	179.1	234.6	191.9	251.3
310	92.5	121.2	105.8	138.5	119.0	155.8	132.2	173.1	145.4	190.4	158.7	207.8	171.9	225.1	185.1	242.4	198.3	259.7
320	95.5	125.1	109.2	143.0	122.8	160.8	136.5	178.7	150.1	196.6	163.8	214.5	177.4	232.3	191.1	250.2	204.7	268.1
330	98.5	129.0	112.6	147.4	126.7	165.9	140.7	184.3	154.8	202.7	168.9	221.2	183.0	239.6	197.0	258.0	211.1	276.4
340	101.5	132.9	116.0	151.9	130.5	170.9	145.0	189.9	159.5	208.9	174.0	227.9	188.5	246.9	203.0	265.8	217.5	284.8
350	104.5	136.8	119.4	156.4	134.3	175.9	149.3	195.5	164.2	215.0	179.1	234.6	194.1	254.1	209.0	273.7	223.9	293.2
360	107.5	140.7	122.8	160.8	138.2	180.9	153.5	201.1	168.9	221.2	184.2	241.3	199.6	261.4	214.9	281.5	230.3	301.6
370	110.5	144.6	126.2	165.3	142.0	186.0	157.8	206.6	173.6	227.3	189.4	248.0	205.1	268.6	220.9	289.3	236.7	310.0
380	113.4	148.6	129.6	169.8	145.9	191.0	162.1	212.2	178.3	233.4	194.5	254.7	210.7	275.9	226.9	297.1	243.1	318.3
390	116.4	152.5	133.0	174.2	149.7	196.0	166.3	217.8	183.0	239.6	199.6	261.4	216.2	283.2	232.9	304.9	249.5	326.7
400	119.4	156.4	136.5	178.7	153.5	201.1	170.6	223.4	187.7	245.7	204.7	268.1	221.8	290.4	238.8	312.8	255.9	335.1
410	122.4	160.3	139.9	183.2	157.4	206.1	174.9	229.0	192.3	251.9	209.8	274.8	227.3	297.7	244.8	320.6	262.3	343.5
420	125.4	164.2	143.3	187.7	161.2	211.1	179.1	234.6	197.0	258.0	215.0	281.5	232.9	304.9	250.8	328.4	268.7	351.9
430	128.4	168.1	146.7	192.1	165.1	216.1	183.4	240.1	201.7	264.2	220.1	288.2	238.4	312.2	256.7	336.2	275.1	360.2
440	131.4	172.0	150.1	196.6	168.9	221.2	187.7	245.7	206.5	270.3	225.2	294.9	243.9	319.5	262.7	344.0	281.5	368.6
450	134.3	175.9	153.5	201.1	172.7	226.2	191.9	251.3	211.1	276.5	230.3	301.6	249.5	326.7	268.7	351.8	287.9	377.0

NOTE:—Met. = Metallic. Com. = Common.

Production of Drawing Frame

1⅛-INCH FRONT ROLL

Table showing number pounds Drawing Sliver produced in one day of 10 hours, allowing 20 per cent for cleaning, oiling, etc.

Number of Grains in one Yard of Sliver

Rev. of Front Roll per Minute	35		40		45		50		55		60		65		70		75	
	Com. Roll	Met. Roll	Com. Roll	Met. Roll	Com. Roll	Met. Roll	Com. Roll	Met. Roll	Com. Roll	Met. Roll	Com. Roll	Met. Roll	Com. Roll	Met. Roll	Com. Roll	Met. Roll	Com. Roll	Met. Roll
250	61.3	83.9	70.1	95.8	78.9	107.8	87.6	119.8	96.4	131.8	105.2	143.8	113.9	155.8	122.7	167.8	131.4	179.7
260	63.8	87.2	72.9	99.7	82.0	112.2	91.1	124.6	100.3	137.1	109.4	149.5	118.5	162.0	127.6	174.5	136.7	187.9
270	66.3	90.6	75.7	103.5	85.2	116.5	94.7	129.4	104.1	142.4	113.6	155.3	123.0	168.2	132.8	181.2	142.0	194.1
280	68.7	93.9	78.5	107.4	88.4	120.9	98.2	134.2	108.0	147.6	117.8	161.0	127.6	174.5	137.4	187.9	147.2	201.3
290	71.2	97.3	81.3	111.2	91.5	125.1	101.7	139.0	111.8	152.9	122.0	166.8	132.2	180.7	142.3	194.6	152.5	208.5
300	73.6	101.0	84.1	115.0	94.6	129.4	105.2	143.8	115.7	158.2	126.2	172.6	136.7	186.9	147.2	201.3	157.7	215.7
310	76.1	104.0	86.9	118.9	97.8	133.7	108.7	149.0	119.5	163.4	130.4	178.3	141.3	193.2	152.1	208.0	163.0	222.9
320	78.5	107.4	89.7	122.8	101.0	138.0	112.2	153.4	123.4	168.7	134.6	184.0	145.6	199.4	157.1	214.7	168.3	230.1
330	81.0	110.7	92.5	126.3	104.1	142.3	115.7	158.2	127.2	174.0	138.8	189.1	150.4	205.6	162.0	221.4	173.5	237.2
340	83.4	114.0	95.4	130.4	107.3	146.7	119.2	162.9	131.1	179.3	143.0	195.6	154.9	211.9	166.9	228.1	178.8	244.4
350	85.9	117.4	98.2	134.2	110.4	151.0	122.7	167.8	135.0	184.5	147.2	210.3	159.5	218.1	171.9	234.9	184.0	251.6
360	88.3	120.8	101.0	138.0	113.6	155.3	126.2	172.6	138.8	189.8	151.4	207.1	164.1	224.3	176.7	241.6	189.3	258.8
370	90.8	124.1	103.8	141.9	116.7	159.6	129.5	177.3	142.7	195.1	155.6	212.8	168.6	230.5	181.9	248.3	194.6	266.0
380	93.2	127.5	106.6	145.7	119.9	163.9	133.2	182.1	146.5	200.3	159.9	218.6	173.2	236.8	186.5	257.0	199.8	273.2
390	95.7	130.8	109.4	149.6	123.0	168.2	136.7	186.9	150.4	205.6	164.1	224.5	177.7	249.2	191.4	261.7	205.1	280.4
400	98.2	134.2	112.2	153.4	126.2	172.5	140.2	191.7	154.2	210.9	168.3	230.1	182.3	243.0	196.3	268.4	210.3	287.6
410	100.6	137.6	115.0	157.2	129.3	176.9	143.7	196.5	158.1	216.2	172.5	235.8	196.8	255.5	201.2	275.1	215.6	294.8
420	103.1	140.9	117.8	161.4	132.3	180.1	147.2	201.7	162.0	221.9	176.7	242.1	191.4	262.2	206.1	282.4	220.8	302.6
430	105.5	144.3	120.6	164.9	135.7	185.5	150.7	206.1	165.8	225.7	180.9	247.3	196.0	267.9	211.0	288.5	226.1	309.1
440	108.0	147.6	123.4	168.7	138.8	189.8	154.2	210.9	169.7	232.0	185.1	253.1	200.5	274.2	215.9	295.2	231.4	316.3
450	110.3	150.1	126.2	172.5	142.0	194.1	161.8	215.7	173.5	237.3	189.3	258.8	205.1	280.4	220.9	302.0	236.6	323.5

Note: — Met. = Metallic Com. = Common

CARE OF DRAWING FRAMES

Although the mechanism of the drawing frame is of the simplest nature, it requires considerable attention to maintain it in perfect working order. The steel rolls should be scoured at least once a month. Leather top rolls should be examined weekly, uneven or soft rolls replaced by new ones, and a fresh coat of varnish applied to all that show wear. Metallic rolls should be frequently examined and the seed and dirt removed from the flutes. The sliver spoons should receive periodical attention, to be sure that they are properly balanced and working easily. The stop motions must be kept in perfect working condition at all times. Top-roll clearer waste should be removed hourly, thereby preventing unsatisfactory work. All bearings and swiftly moving parts should be oiled twice a day. Daily attention should be given to the gearing, to see that it is properly set up and running smoothly.

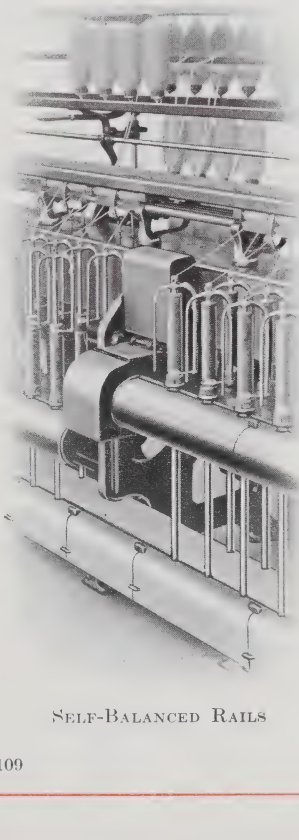
ROVING

Roving Frame

ROVING MACHINERY

As successors to the **Providence Machine Company**, of Providence, R. I., builders of roving machinery since 1847, we take pleasure in presenting their complete line, as incorporated successfully in the Whitin organization of textile machinery.

The Whitin-Providence Frame, perhaps, needs no introduction to the trade. Its long and continued use and popularity in hundreds of mills is a testimonial to the high reputation which it enjoys. With our excellent facilities, with the same men and most careful attention and specialization on our part, we expect to continue the enviable reputation of this frame in the future. Its old friends we hope to keep, and new friends to add.



Self-Balanced Rails

Our line of **Cotton Roving Machinery** includes Slubbers, Intermediates, Fine Roving, and Jack Frames. These frames are built either direct-weighted or with a patented self-balanced rail. In the weighted rail machine our method of balancing the bolster rail is by means of the customary direct weights, and insures an easy motion, with a minimum amount of dwell at the change of traverse.

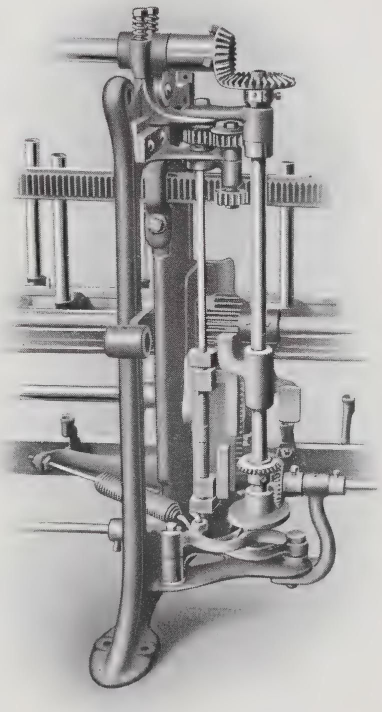
In comparison with the weighted rail style the **Patent**

Self-balanced Rail has many important advantages. The construction consists in dividing the bolster rail which carries the bobbins into two equal sections, the weight of one section counterbalancing the weight of the other, so that in the operation of the machine unequal balance is impossible, and no power is taken up in raising excess weight. In other words, it is evident that in a direct-weighted machine the weights do not balance the frame at its heaviest load. Only when the machine is started with empty bobbins is the rail balanced. As the bobbins commence to fill, the machine becomes more and more out of balance, and, accordingly, when the bobbins are full, the rail may be anywhere from one to two hundred pounds out of balance, according to the length of the frame and the size of the bobbins. It is therefore easy to appreciate that a great deal of extra power is consumed in a direct-weighted over and above that used on a self-balanced frame, as power must be continually used to raise this excess weight; hence a material saving in power bills at the end of the year. On the self-balanced rail frame the rails, being equally balanced, remain so as the bobbins are filled with cotton. The load on each rail increases in the same proportion, and the rails remain in constant balance. The many advantages of the self-balanced frame are apparent from a very casual examination of the operation of the machine. These are, briefly:

Great Saving in Power. Nearly one-half that of the direct-weighted machines is saved by the self-balanced rails, a $1\frac{1}{2}$-inch belt being amply sufficient to drive even the longest machine, although in connection with our new outboard bearing we recommend using a 2-inch belt on all frames.

Saving in Repairs. The gearing is less liable to breakage, as the power is divided between the two sections, and each section has separate driving gears. Thus the gears have but one-half the work required of them in the older style of machine. Also, by the elimination of the weights, chains, studs, and pulleys necessary on direct-weighted machines, the frame is simplified, and, running in perfect balance, there is less strain on parts which are subject to wear.

Elimination of Backlash. Owing to the peculiar construction of the self-balanced rails, the dwell at the change of traverse is practically eliminated, the two rails being balanced, each by the other; and the direction of force being applied to the rails through the pinion gears, always tending to support the rails, there is no backlash, no matter how worn the shafts, boxes, or gears may become. The elimination of backlash causes the machine to build a more perfect nose or taper upon the bobbin and so produces a more even yarn, as it does away with the liability of strained or uneven roving, which comes from flushed-over or soft-nosed bobbins, all of which cause waste and bunches later on.



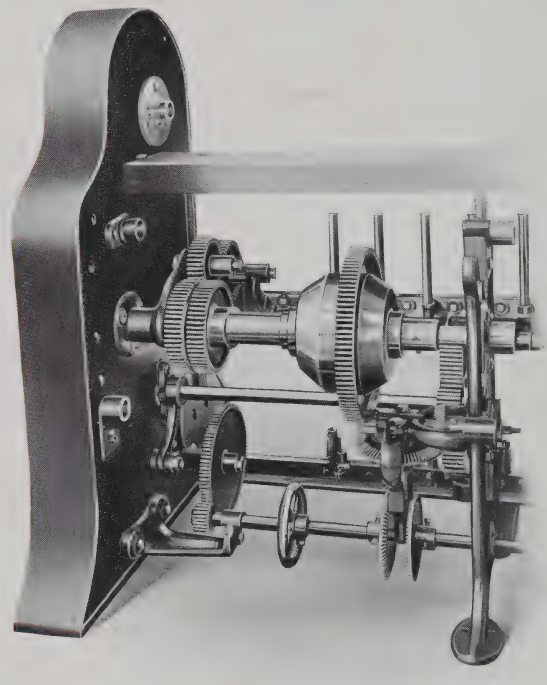
BUILDER MOTION

Accessibility of Parts and Cleanliness. By the elimination of the direct-weighting parts in the back the machine is cleaner, and weighs from eight hundred to twelve hundred pounds less. The cleaning is more easily done, as the underwork is more accessible, and the parts requiring oil are grouped at the head and centre, while on the direct-weighted type they extend the entire length of the back side of the machine.

On both our direct-weighted and self-balanced frames we would call attention to other special features of the construction, as follows:

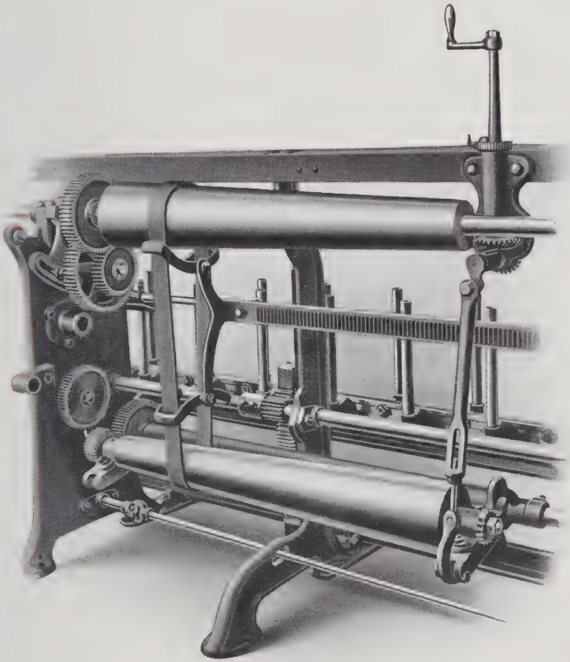
The **Frames** are built specially heavy. All parts which are fitted together are milled and machined on templates or jigs, so as to be interchangeable as regards repairs and securing an especially strong structure when fitted together.

Differential Motions. The differential motion is the well-known Holdsworth type, which, of all the many motions on the market, has best survived the hard service of the cotton mills. It is simple and effective, and always runs in perfect balance. Its reliability has been well proven by over forty years of continuous service.



Differential Motion

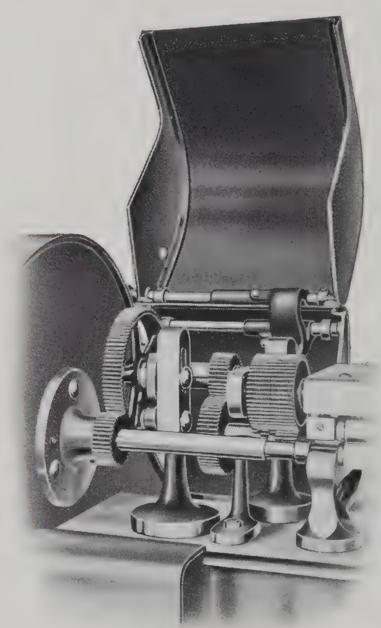
Cones. The outlines of the cones are determined by careful mathematical computations for all sizes of bobbins. The bottom cone is held in a swinging frame, maintaining an even tension on the belt.



Cone Belt Motion

This regulating device, as well as the means for winding back the cone belt when the bobbins are full, is readily operated from the front of he frame. The construction of the cone on its shaft is particularly substantial, and slippage is absolutely prevented by the pins and keys. It is always possible to remove the top cone and shaft from the frame quickly and readily, without disturbing the other parts of the machine. The cone is also so centred as to run perfectly true under all conditions of work.

Draught and Lay Gearing. The draught and lay gearing are machine cut and, while wide range of adjustment is secured, the weighting is arranged so that slight variations



Draught Gearing

in the twist and lay can be secured by one tooth of the large change gear.

Bottom Drawing Rolls. The bottom drawing rolls are made of the best roller steel, and are irregularly fluted to avoid cutting the covering of the top rolls.

Top Rolls. The top rolls are leather covered, the front being either shell or solid, the back and middle rolls solid. Metallic interlocking rolls may be furnished if desired.

Spindles. The spindles furnished are made from crucible steel, accurately ground to size and thoroughly tested, so as to insure perfect running without vibration. The bolsters are also so arranged as to sustain high speeds.

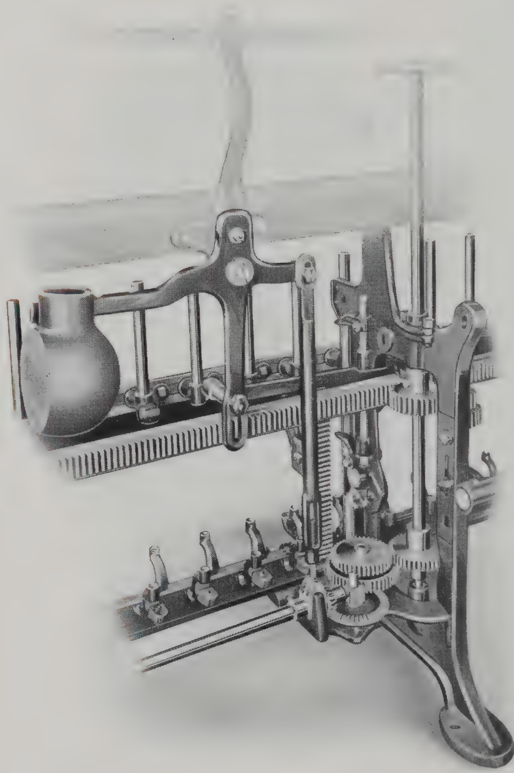
Flyers. The flyers are of the well-known solid nib type, and are made by special processes, with the best quality steel; they are evenly balanced at high speeds, are light in weight, and run free from vibration with their supporting spindles. By making and furnishing these flyers from our own works, we are always able to meet quick deliveries on odd sizes and special requirements, which are sometimes demanded by the mills.

FLYER

Casing and Clearer Covers, of stiff cold-rolled steel, highly polished, give a superior finish to the machine, and being unbreakable, no outlay for repairs is required.

A Full-bobbin Stop Motion is applied. It can be set to knock off at any diameter of bobbin, and when knocked off, the frames cannot be re-started without winding back the cone belt.

A Safety Stop Motion is also applied, which prevents breakage to the machine in case the reverse motion fails to work properly.

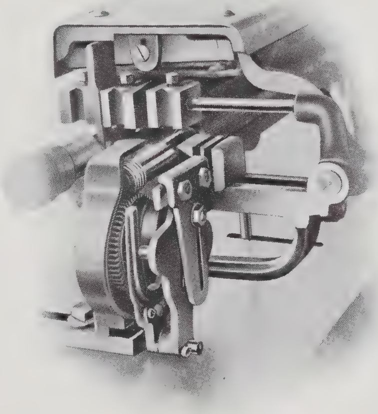


Stop-Motion

Creels for any size bobbin are made of wood, with porcelain steps arranged for single or double roving.

Our Patented Variable Roving Traverse Motion is supplied. It is adjustable as to length of traverse, and has a variable motion effectually preventing unequal wear of the leather top rolls.

A Hank Clock for registering the number of hanks delivered is applied at the foot end of each frame. It is driven by a worm on the end of the front roll, and protected by a cover, so that it cannot be tampered with by operatives.



ROVING TRAVERSE

The Driving Pulleys are 16 inches in diameter by $1\frac{5}{8}$ inches, 2 inches, $2\frac{1}{4}$ inches, or $2\frac{1}{2}$ inches, face. The loose pulley runs on a sleeve, which is integral with the yoke box supporting the driving shaft. When the belt is on the tight pulley, the loose pulley does not revolve, thus reducing the wear of pulley bearing. Liability of an accident to an operator while changing the gearing, through the unexpected starting of the frame, is avoided by the use of a locking device applied to the belt shipper rod.

Cone Belts:

Slubber,	11-inch and 12-inch traverse,	5 ft. 6 in. long
Intermediate,	9 " " 10 " "	4 " 10 " "
"	8 " "	4 " 8 " "
Roving,	7 " "	4 " 6 " "
Jack,	6 " "	4 " 6 " "
"	5 " "	4 " 6 " "

Weight of frames per foot in length:

	Weighted Rail.	Self-Balanced Rail.
Shipping weight	315 pounds,	290 pounds.
Net weight	280 pounds,	255 pounds.

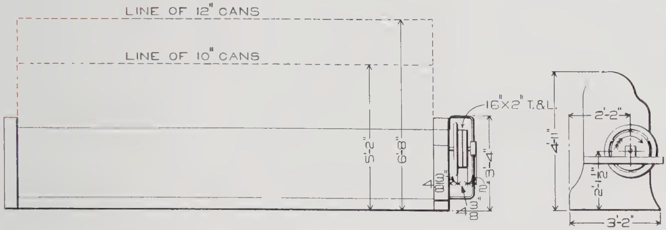
Car Load: Three frames, boxed.

On pages 120, 121, 122, 123 dimension tables of our standard fly frames are given. The space between spindles is not confined to that given in the tables; for instance, the roving frames, 7-inch traverse, $5\frac{1}{4}$-inch space, may be made 5-inch or $5\frac{1}{2}$-inch space, thereby shortening or lengthening the frame, as may be desired. Any size frame may be shortened or lengthened in that way, provided there is sufficient space for the flyers to run without interfering with each other. On all frames where there are four or eight spindles to a roll, rolls of half lengths, and when there are six spindles to a roll, one or two rolls of two-thirds length may be put in, to obtain a particular number of spindles or to make the length of the frame correspond with the space it is to occupy.

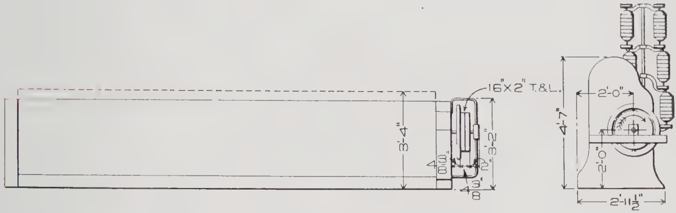
The **Lengths of Frames** tabulated in the tables are based on the following rule:

"To ascertain the length over all of our weighted-rail fly frame, multiply one-half the number of spindles by the space required, and to the product add 39 inches. Our self-balanced rail fly frame is 16 inches longer than the weighted-rail frame."

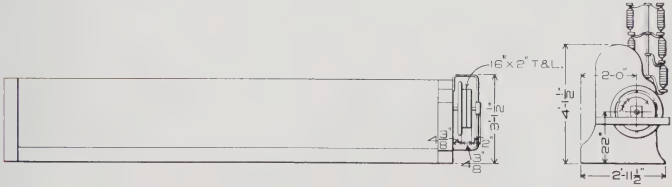
FLOOR PLANS OF WHITIN FLY FRAMES



SLUBBER.



INTERMEDIATE FRAME.



JACK OR ROVING FRAME.

Floor Spaces of Slubbing Frames

DIMENSIONS ARE OVER ALL

Full bobbin	12 in. by 6 in.				11 in. by $5\frac{1}{2}$ in.				10 in. by 5 in.				9 in. by $4\frac{1}{2}$ in.			
Space	10 in.				$9\frac{1}{2}$ in.				9 in.				$8\frac{1}{2}$ in.			
Gauge	4 Spindles to 20 in. Roll				4 Spindles to 19 in. Roll				4 Spindles to 18 in. Roll				4 Spindles to 17 in. Roll			
Rail	Weighted		Self-balanced		Weighted		Self-balanced		Weighted		Self-balanced		Weighted		Self-balanced	
Number of Spindles	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
40	19	11														
44	21	7			20	8										
48	23	3			22	3			21	3						
52	24	11	26	3	23	10	25	2	22	9			21	8		
56	26	7	27	11	25	5	26	9	24	3	25	7	23	1		
60	28	3	29	7	27	0	28	4	25	9	27	1	24	6	25	10
64	29	11	31	3	28	7	29	11	27	3	28	7	25	11	27	3
68	31	7	32	11	30	2	31	6	29	9	30	1	27	4	28	8
72	33	3	34	7	31	9	33	1	30	3	31	7	28	9	30	1
76	34	11	36	3	33	4	34	8	31	9	33	1	30	2	31	6
80					34	11	36	3	33	3	34	7	31	7	32	11
84					36	6	37	10	34	9	36	1	33	0	34	4
88									36	3	37	7	34	5	35	9
92									37	9	39	1	35	10	37	2
96													37	3	38	7
Widths	3 ft. 4 in.				3 ft. 4 in.				3 ft. 4 in.				3 ft. 4 in.			

NOTE. — Above lengths are for 2 in. face pulleys; for $2\frac{1}{2}$ in. face add 1 in.

Floor Spaces of Intermediate Frames. (Dimensions are over all)

Full bobbin	10 in. by 5 in.				9 in. by $4\frac{1}{2}$ in.				8 in. by 4 in.				8 in. by $3\frac{1}{2}$ in.			
Space	$7\frac{1}{2}$ in.				7 in.				6 in.				$5\frac{1}{2}$ in.			
Gauge	6 spindles to $22\frac{1}{2}$ in. roll				6 spindles to 21 in. roll				6 spindles to 18 in. roll				8 spindles to 22 in. roll			
Rail	Weighted		Self-balanced		Weighted		Self-balanced		Weighted		Self-balanced		Weighted		Self-balanced	
Number of Spindles	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
60	22	0														
66	23	11			22	6										
72	25	9	27	1	24	3	25	7								
78	27	8	29	0	26	0	27	4	22	9						
84	29	6	30	10	27	9	29	1	24	3	25	7				
88													23	5		
90	31	5	32	9	29	6	30	10	25	9	27	1				
96	33	3	34	7	31	3	32	7	27	3	28	7	25	3	26	7
100	34	6	35	10												
102					33	0	34	4	28	9	30	1				
104	35	9	37	1									27	1	28	5
108	37	0	38	4	34	9	36	1	30	3	31	7				
112	38	3	39	7									28	11	30	3
114					36	6	37	10	31	9	33	1				
116	39	6	40	10												
120	40	9	42	1	38	3	39	7	33	3	34	7	30	9	32	1
126					40	0	41	4	34	9	36	1				
128													32	7	33	10
132									36	3	37	7				
136													34	5	35	9
138									37	9	39	1				
144									39	3	40	7	36	3	37	7
150									40	9	42	1				
152													38	1	39	5
156													39	0	40	4
160													39	11	41	3
168													41	9	43	1
Widths		3 Ft.	4 in.			3 Ft.	4 in.			3 ft.	4 in.			3 ft.	$1\frac{1}{2}$ in.	

NOTE. — Above lengths are for 2-in. face pulleys; for $2\frac{1}{2}$-in. face add 1 in.

Floor Spaces of Roving Frames

DIMENSIONS ARE OVER ALL

Full Bobbin	7 in. by $3\frac{1}{2}$ in.				7 in. by 3 in.				6 in. by 3 in.			
Space	$5\frac{1}{4}$ in.				$4\frac{1}{2}$ in.				$4\frac{1}{2}$ in.			
Gauge	8 Spindles to 21 in. Roll				8 Spindles to 18 in. Roll				8 Spindles to 18 in. Roll			
Rail	Weighted		Self-Balanced		Weighted		Self-Balanced		Weighted		Self-Balanced	
Number of Spindles	Feet	Inches	Feet	Inches	Feet	Inches	Feet	Inches	Feet	Inches	Feet	Inches
96	24	3										
104	26	0			22	9			22	9		
112	27	9	29	1	24	3			24	3		
120	29	6	30	10	25	9	27	1	25	9	27	1
128	31	3	32	7	27	3	28	7	27	3	28	7
136	33	0	34	4	28	9	30	1	28	9	30	1
144	34	9	36	1	30	3	31	7	30	3	31	7
152	36	6	37	10	31	9	33	1	31	9	33	0
160	38	3	39	7	33	3	34	7	33	3	34	7
168	40	0	41	4	34	9	36	1	34	9	36	1
176	41	9	43	1	36	3	37	7	36	3	37	7
184	43	6	44	10	37	9	39	1	37	9	39	1
192	45	3	46	7	39	3	40	7	39	3	40	7
200					40	9	42	1	40	9	42	1
208									42	3	43	7
Widths	3 ft., $1\frac{1}{2}$ in.				3 ft., $1\frac{1}{2}$ in.				3 ft., $1\frac{1}{2}$ in.			

NOTE: — Above lengths are for 2 in. face pulleys; for $2\frac{1}{2}$ in. face add 1 in.

Floor Spaces of Jack Frames

DIMENSIONS ARE OVER ALL

Full Bobbin	6 in. by $2\frac{1}{2}$ in.				5 in. by $2\frac{1}{2}$ in.				$4\frac{1}{2}$ in. by $2\frac{1}{4}$ in.			
Space	$4\frac{1}{4}$ in.				$4\frac{1}{4}$ in.				4 in.			
Gauge	8 Spindles to 17 in. Roll				8 Spindles to 17 in. Roll				8 Spindles to 16 in. Roll			
Rail	Weighted		Self-Balanced		Weighted		Self-Balanced		Weighted		Self-Balanced	
Number of Spindles	Feet	Inches	Feet	Inches	Feet	Inches	Feet	Inches	Feet	Inches	Feet	Inches
120	24	6										
128	25	11										
136	27	4	28	8								
144	28	9	30	1	28	9	30	1	27	3	28	7
152	30	2	31	6	30	2	31	6	28	7	29	11
160	31	7	32	11	31	7	32	11	29	11	31	3
168	33	0	34	4	33	0	34	4	31	3	32	7
176	34	5	35	9	34	5	35	9	32	7	33	11
184	35	10	37	2	35	10	37	2	33	11	35	3
192	37	3	38	7	37	3	38	7	35	3	36	7
200	38	8	40	0	38	8	40	0	36	7	37	11
208	40	1	41	5	40	1	41	5	37	11	39	3
216	41	6	42	10	41	6	42	10	39	3	40	7
224									40	7	41	11
Widths	3 ft., $1\frac{1}{2}$ in.				3 ft., $1\frac{1}{2}$ in.				3 ft., $1\frac{1}{2}$ in.			

NOTE: — Above lengths are for 2 in. face pulleys; for $2\frac{1}{2}$ in. face add 1 in.

RULES FOR OPERATING FLY FRAMES

Number one hank is 840 yards long and weighs one pound, or 7000 grains.

The number of yards of cotton yarn that weigh 8.33 grains is the number or size of the yarn.

To find hank roving:

Divide 100 by the weight of 12 yards; the quotient is the number of hank roving.

To find the weight in grains of 1 yard of any hank:

Divide 8.33 by the number of hank; the quotient is the weight in grains of 1 yard.

To find the hank of any number of grains per yard:

Divide 8.33 by the grains per yard; the quotient is the number of hank.

To find the standard twist of roving per inch:

Multiply the square root of the number of roving by 1.20 and the product is the twist per inch.

To find draught required to give a required hank roving from a given hank roving:

Divide the required hank roving by the given hank and the quotient is the draught required.

Example. — What draught is required on an intermediate frame to produce 2.5 hank roving from .50 hank slubber roving?

$2.5 \div .50 = 5$, draught.

To find draught required to give a required hank roving from a given hank roving doubled:

Divide the required hank roving by the given hank, and multiplying the quotient by 2 gives the draught required.

Example. — What draught is required on a jack frame to produce 12 hank roving from 4 hank roving doubled?

$12 \div 4 = 3,\ 3 \times 2 = 6$, draught required.

NOTE. — On account of contraction due to twist, it is customary to increase the calculated draught about 3 per cent.

To find the revolutions of front roll on any hank roving, the spindle speed being given:

Divide the spindle speed by the circumference of the front roll in inches, and divide the quotient by the twist per inch of hank roving.

Example. — What are the revolutions per minute of a $1\frac{1}{4}$-inch diameter roll of a slubber with a spindle speed of 650 revolutions per minute, producing 1 hank roving?

$650 \div 3.927 = 165.6,\ 165.6 \div 1.2 = 138$ revolutions.

To find the draught constant:

Divide the product of the number of teeth in the driving gears and the diameter in inches of front roll by the product of the number of teeth in the driven gears and diameter of the back roll, omitting the change pinion; the quotient will be the draught constant.

Example. — What is the draught constant of $7'' \times 3\frac{1}{2}''$ frame?

$$\frac{56 \times 100 \times 1\frac{1}{8}}{37 \times \frac{8}{8}} = 170.27, \text{ draught constant.}$$

To find change draught gear:

Divide draught constant by draught required; the quotient is the number of teeth in draught gear.

To find change draught gear required when changing from one hank to another:

Multiply the number of teeth in the change draught gear in use by the hank being spun, and divide the product by the hank required; the quotient is the number of teeth in change draught gear required.

Example. — What change draught gear will be required to change from 4 hank made with a 40-teeth change draught gear to 5 hank?

$40 \times 4 = 160$; $160 \div 5 = 32$-teeth, change draught gear required.

To find the twist per inch:

Divide the revolutions per minute of the spindles by the length of roving, in inches, delivered by the front roll per minute.

Example. — What twist per inch is being put in roving if the spindles run 1200 revolutions per minute and the front roll delivers 1080 inches per minute?

$1200 \div 1080 = 1.11$ turns per inch.

To find the twist constant:

Divide the product of the number of teeth in the driving gears (between the spindle and front roll) by the product of the number of teeth in the driven gears, omitting the change twist gear, and divide the quotient by the circumference in inches of the front roll.

Example. — What is the twist constant of a $7'' \times 3\frac{1}{2}''$ frame?

$$\left(\frac{130 \times 46 \times 60 \times 46}{78 \times 40 \times 22}\right) \div 3.5343 = 68.03, \text{ twist constant.}$$

To find the change twist gear:

Divide twist constant by twist per inch required; the quotient is the number of teeth in twist gear.

To find the change twist gear required when changing from one hank to another:

Multiply the square root of the hank being spun by the twist gear in use, and divide by the square root of the hank required.

Example. — If .25 hank roving is being made with a 30-teeth twist gear, what twist gear is required for .36 hank roving?

$\sqrt{.25} = .5$; $.5 \times 30 = 15.0$; $15.0 \div \sqrt{.36} = 25$ teeth, twist gear required.

Traverse Motion

Excessive changes of twist, hard or soft, will affect the traverse gear required to produce best results. Judgment should be used in the selection of the correct gears for the various sized rovings.

Rule for Traverse

Number of layers to the inch in length of bobbin = $\sqrt{\text{hank roving}} \times 10$.

Square root of the hank roving times 10 = layers per inch in traverse $\sqrt{1\frac{1}{2}\text{ hank}} = 1.2247 \times 10 = 12+$ layers.

Refer to figures on cones as shown with a 46 twist gear; the movement of the 14 spur gear which turns the compound centre wheel is 8.60832 teeth, or $\frac{8.60832}{14}$ movement of the top spider shaft.

$\frac{2.1205}{4.3197}$ wind of empty bobbin to one turn of main shaft.

$\frac{2.1205}{4.3197} \times \frac{1}{12} = \frac{2.1205}{51.8364} = .039''$ movement of the bobbin rail.

Lifter rack is 8 pitch or .392″ circular pitch; $.039 \div .392 = .099$, teeth movement of the 16-tooth spur lifter shaft gear to traverse the rail .039″ required.

$\frac{.099}{16}$ of $\frac{84}{20}$ of $\frac{96}{}$ of $\frac{70}{16}$ of $\frac{76}{35}$ of $\frac{14}{8.60832} = 38$, traverse change for $1\frac{1}{2}$ hank roving, giving .039″ movement to the rail to each revolution of the bobbin and laying the roving 12 layers to the inch.

$12 \times 38 = 456$, constant number for any hank if standard twist is used, on a $7'' \times 3\frac{1}{2}''$ size roving frame. If 456 be divided by the layers per inch required by any hank roving, as shown by above rule, the result will be the number of teeth required in the traverse change gear to produce the correct traverse on a $7'' \times 3\frac{1}{2}''$ frame.

These rules can be applied to any size frame and worked out by substituting the correct working gears as applied to the various sizes of machines.

To find the traverse or lay constant of a frame:

Multiply the twist per inch of the number of roving being made by the number of teeth in the change traverse gear.

Example. — What is the traverse constant when 18-teeth change traverse gear is used for one hank roving?

Twist of one hank is 1.2; $1.2 \times 18 = 21.60$, traverse constant.

To find change traverse gear:

Divide traverse constant by the twist per inch in the number of roving required, and the quotient is the number of teeth in the change traverse gear.

To find change traverse gear required when changing from one hank to another:

Multiply the square root of the hank being made by the traverse gear, and divide the product by the square root of the hank required.

Example. — What traverse gear is required to change from .25 hank roving being made with a 36-teeth gear to .36 hank roving?

$\sqrt{.25} = .5$; $.5 \times 36 = 18.0$; $18 \div \sqrt{.36} = 30$ teeth, traverse gear.

Tension Gear

The tension gear, so called on account of the duty it performs of regulating the tension of the roving through the action of the cones and compound.

It is a change gear and regulates the exact movement of the cone belt carrier as each successive layer is wound upon the bobbin.

The size of this gear, *i. e.* number of teeth required, depends upon the number of layers required to fill the bobbin.

A good rule for the number of layers in the build of bobbin is as follows: (Square root of the hank roving multiplied by 40)

Time (the diameter of full bobbin less diameter of empty bobbin divided by 2)

$$(\sqrt{\text{hank}} \times 40) \times \left(\frac{\text{diameter full bobbin} - \text{diameter empty bobbin}}{2}\right) = \text{layers}$$

Example. — $\sqrt{1\frac{1}{2}\text{ hank}} = 1.2247 \times 40 = 48.988.$

$3\frac{9}{16}''$ diam. full bobbin less $1\frac{3}{8}''$ diam. empty bobbin $\div 2 = 1\frac{3}{32}$

$48.988 \times 1\frac{3}{32} = 53$ = layers.

53 layers equals 52 moves of the cone belt, as belt is already on the diameter for the first layer.

This movement is over a cone surface of $32\frac{1}{8}''$ long and equals $32.125 \div 52$, or $.6177''$ to each move.

Cone rack is 8 pitch or .392 circular pitch.

$.6177 \div .392 = 1\frac{58}{100}$ teeth movement of cone rack and of the 29 gear on the upright rack shaft.

$$\frac{1.58}{29} \text{ of } 40 \text{ of } \frac{50}{10} \text{ of } \frac{38}{9} = 46 \text{ tension change gear.}$$

52 movements $\times$ 46 = 2392, constant number, which, if divided by the layers required on bobbin of any hank roving as per rule given above, will give the correct tension gear.

In practical operation of machine other conditions influence the tension of roving: temperature, humidity, twist, open or close wind of the traverse motion.

To find tension constant:

Multiply the twist per inch of the number of roving being made by the number of teeth in the change tension gear.

Example. — What is the tension constant when 19-teeth change tension gear is used for one hank roving?

Twist of one hank is 1.2; $1.2 \times 19 = 22.80$, tension constant.

To find change tension gear:

Divide tension constant by the twist per inch in the number of roving required, and the quotient is the number of teeth in change tension gear.

To find change tension gear required when changing from one hank to another:

Multiply the square root of the hank being made by the tension gear, and divide the product by the square root of the hank required.

Example. — What tension gear is required to change from .25 hank roving being made with a 36-teeth gear to .64 hank roving?

$\sqrt{.25} = .5$; $.5 \times 36 = 18.0$; $\sqrt{.64} = .8$; $18 \div .8 = 22$, teeth tension gear.

To calculate the production of a fly frame:

Multiply 840 (yards in 1 hank) by 36 (inches in 1 yard) by twist per inch by number of hank roving by weight of full bobbin in pounds; and dividing the product by the revolutions per minute of spindle results in minutes required for one set. To this result add 15 minutes allowance per set for doffing; then dividing the number of minutes in a day of ten hours by the number of minutes to doff, the quotient is the sets in ten hours. The sets in the ten hours multiplied by the weight of the bobbin in pounds gives the pounds per spindle in ten hours. Pounds per day multiplied by the number of hank roving equals hanks per day per spindle.

Example. — What is the production in ten hours of a spindle of a 12″ × 6″ frame on 1 hank roving at a spindle speed of 660 revolutions per minute, weight of full bobbin 44 ounces?

$$\frac{840 \times 36 \times 1.20 \times 1 \times 44}{660 \times 16} = 151.2 \text{ minutes for one set,}$$

$151.2 + 15 = 166.2$ minutes for doffing,

$600 \div 166.2 = 3.60$ sets in 10 hours,

$$\frac{3.60 \times 44}{16} = 9.9 \text{ pounds per spindle in 10 hours,}$$

$9.9 \times 1 = 9.9$ hanks per day per spindle.

To find production of a frame by means of a hank clock:

Multiply the hanks per spindle, as indicated on clock, by the number of spindles in frame; and dividing by the hank roving gives the production in pounds.

Example. — What is the production of a 60-spindle slubber on .60 hank roving, the hank clock registering 70 hanks per week?

$$\frac{70 \times 60}{.6} = 7000 \text{ pounds per week.}$$

Table of Constants

For finding the weight of hank or decimal part of a hank.

RULE :—Dividing 7000 grains by 840 yards gives constants for one yard.

Yards	Constant	Yards	Constant
1	8.333	12	99.996
2	16.666	15	124.995
3	24.999	20	166.660
4	33.332	30	249.990
5	41.665	40	333.320
6	49.998	60	499.980
7	58.331	80	666.640
8	66.664	100	833.330
9	74.997	120	999.960
10	83.333		

Examples:

If 3 yards card sliver weigh 120 grains, what hank is it?

Divide the constant for 3 yards by 120 gives .208 hank.

If 20 yards of fine roving frame roving weigh 50 grains, what hank is it?

Divide the constant for 20 yards by 50 gives 3.33 hank roving.

What should 60 yards of 4 hank roving weigh? Divide the constant for 60 yards by 4 gives 125 grains.

Roving Table

For Numbering by the Weight, in Grains, of 12 Yards; and showing Twist per Inch.

Grains Weight.	Hank Roving.	Square Root.	Twist per Inch	Grains Weight.	Hank Roving.	Square Root.	Twist per Inch
400.00	.25	.500	.60	147.06	.68	.825	.99
384.61	.26	.510	.61	144.93	.69	.831	1.00
370.37	.27	.520	.62	142.86	.70	.837	1.00
357.14	.28	.529	.63	140.85	.71	.843	1.01
344.83	.29	.539	.65	138.89	.72	.849	1.02
333.33	.30	.548	.66	135.99	.73	.854	1.02
322.58	.31	.557	.67	135.14	.74	.860	1·03
312.50	.32	.566	.68	133.33	.75	.866	1.04
303.03	.33	.574	.69	131.58	.76	.872	1.05
294.12	.34	.583	.70	129.87	.77	.874	1.05
285.71	.35	.592	.71	128.21	.78	.883	1.06
277.78	.36	.600	.72	126.58	.79	.889	1.07
270.27	.37	.608	.73	125.00	.80	.894	1.07
263.16	.38	.616	.74	123.46	.81	.900	1.08
256.41	.39	.624	.75	121.95	.82	.906	1.09
250.00	.40	.632	.76	120.48	.83	.911	1.09
243.90	.41	.640	.77	119.05	.84	.917	1.10
238.10	.42	.648	.78	117.65	.85	.922	1.11
232.56	.43	.656	.79	116.28	.86	.927	1.11
227.27	.44	.663	.80	114.94	.87	.933	1.12
222.22	.45	.671	.80	113.64	.88	.938	1.13
217.39	.46	.678	.81	112.36	.89	.943	1.13
212.77	.47	.686	.82	111.11	.90	.949	1.14
208.33	.48	.693	.83	109.89	.91	.954	1.14
204.08	.49	.700	.84	108.70	.92	.959	1.15
200.00	.50	.707	.85	107.53	.93	.964	1.16
196.08	.51	.714	.86	106.38	.94	.970	1.16
192.31	.52	.721	.87	105.26	.95	.975	1.17
188.68	.53	.728	.87	104.17	.96	.980	1.18
185.19	.54	.735	.88	103.09	.97	.985	1.18
181.82	.55	.742	.89	102.04	.98	.990	1.19
178.57	.56	.748	.90	101.01	.99	.995	1.19
175.44	.57	.755	.91	100.00	1.00	1.000	1.20
172.41	.58	.762	.91	98.04	1.02	1.010	1.21
169.49	.59	.768	.92	96.15	1.04	1.020	1.22
166.67	.60	.775	.93	94.34	1.06	1.030	1.24
163.93	.61	.781	.94	92.59	1.08	1.039	1.25
161.29	.62	.787	.94	90.91	1.10	1.049	1.26
158.73	.63	.794	.95	89.29	1.12	1.058	1.27
156.25	.64	.800	.96	87.72	1.14	1.068	1.28
153.85	.65	.806	.97	86.21	1.16	1.077	1.29
151.52	.66	.812	.97	84.75	1.18	1.086	1.30
149.25	.67	.819	.98	83.33	1.20	1.095	1.31

Roving Table. Continued

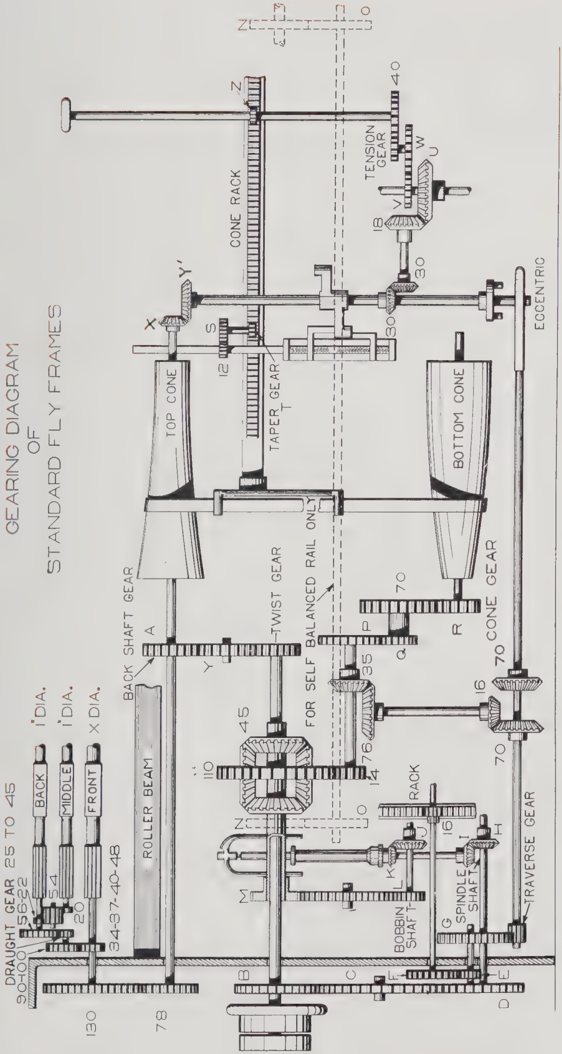
For Numbering by the Weight, in Grains, of 12 Yards; and showing Twist per Inch.

Grains Weight.	Hank Roving.	Square Root.	Twist per Inch	Grains Weight.	Hank Roving.	Square Root.	Twist per Inch
81.97	1.22	1.105	1.33	48.08	2.08	1.442	1.73
80.65	1.24	1.114	1.34	47.62	2.10	1.449	1.74
79.37	1.26	1.122	1.35	47.17	2.12	1.456	1.75
78.12	1.28	1.131	1.36	46.73	2.14	1.463	1.76
76.92	1.30	1.140	1.37	46.30	2.16	1.470	1.76
75.76	1.32	1.149	1.38	45.87	2.18	1.476	1.77
74.63	1.34	1.158	1.39	45.45	2.20	1.483	1.78
73.53	1.36	1.166	1.40	45.05	2.22	1.490	1.79
72.46	1.38	1.175	1.41	44.64	2.24	1.497	1.80
71.43	1.40	1.183	1.42	44.25	2.26	1.503	1.80
70.42	1.42	1.192	1.43	43.86	2.28	1.510	1.81
69.44	1.44	1.200	1.44	43.48	2.30	1.517	1.82
68.49	1.46	1.208	1.45	43.10	2.32	1.523	1.83
67.57	1.48	1.217	1.46	42.74	2.34	1.530	1.84
66.67	1.50	1.225	1.47	42.37	2.36	1.536	1.84
65.79	1.52	1.233	1.48	42.02	2.38	1.543	1.85
64.94	1.54	1.241	1.49	41.67	2.40	1.549	1.86
64.10	1.56	1.249	1.50	41.32	2.42	1.556	1.87
63.29	1.58	1.257	1.51	40.98	2.44	1.562	1.87
62.50	1.60	1.265	1.52	40.65	2.46	1.568	1.88
61.73	1.62	1.273	1.53	40.32	2.48	1.575	1.89
60.98	1.64	1.281	1.54	40.00	2.50	1.581	1.90
60.24	1.66	1.288	1.55	39.68	2.52	1.587	1.90
59.52	1.68	1.296	1.56	39.37	2.54	1.594	1.91
58.82	1.70	1.304	1.56	39.06	2.56	1.600	1.92
58.14	1.72	1.311	1.57	38.76	2.58	1.606	1.93
57.47	1.74	1.319	1.58	38.46	2.60	1.612	1.93
56.82	1.76	1.327	1.59	38.17	2.62	1.619	1.94
56.18	1·78	1.334	1.60	37.88	2.64	1.625	1.95
55.56	1.80	1.342	1.61	37.59	2.66	1.631	1.96
54.95	1.82	1.349	1.62	37.31	2.68	1.637	1.96
54.35	1.84	1.356	1.63	37.04	2.70	1.643	1.97
53.76	1.86	1.364	1.64	36.76	2.72	1.649	1.98
53.19	1.88	1.371	1.65	36.50	2.74	1.655	1.99
52.63	1.90	1.378	1.65	36.23	2.76	1.661	1.99
52.08	1.92	1.386	1.66	35.97	2.78	1.667	2.00
51.55	1.94	1.393	1.67	35.71	2.80	1.673	2.01
51.02	1.96	1.400	1.68	35.46	2.82	1.679	2.01
50.51	1.98	1.407	1.69	35.21	2.84	1.685	2.02
50.00	2.00	1.414	1.70	34.97	2.86	1.691	2.03
49.50	2.02	1·421	1.71	34.72	2.88	1.697	2.04
49.02	2.04	1.428	1.71	34.48	2.90	1.703	2.04
48.54	2.06	1.435	1.72	34.25	2.92	1.709	2.05

Roving Table. Continued

For Numbering by the Weight, in Grains, of 12 Yards; and showing Twist per Inch.

Grains Weight.	Hank Roving.	Square Root.	Twist per Inch	Grains Weight.	Hank Roving.	Square Root.	Twist per Inch
34.01	2.94	1.715	2.06	14.29	7.00	2.646	3.17
33.78	2.96	1.721	2.07	14.08	7.10	2.665	3.20
33.56	2.98	1.726	2.07	13.89	7.20	2.683	3.22
33.33	3.00	1.732	2.08	13.70	7.30	2.702	3.24
32.26	3.10	1.761	2.11	13.51	7.40	2.720	3.26
31.25	3.20	1.789	2.15	13.33	7.50	2.739	3.29
30.30	3.30	1.817	2.18	13.16	7.60	2.757	3.31
29.41	3.40	1.844	2.21	12.99	7.70	2.775	3.33
28.57	3.50	1.871	2.24	12.82	7.80	2.793	3.35
27.78	3.60	1.897	2.28	12.66	7.90	2.811	3.37
27.03	3.70	1.924	2.31	12.50	8.00	2.828	3.39
26.32	3.80	1.949	2.34	12.35	8.10	2.846	3.42
25.64	3.90	1.975	2.37	12.20	8.20	2.864	3.44
25.00	4.00	2.000	2.40	12.05	8.30	2.881	3.46
24.39	4.10	2.025	2.43	11.90	8.40	2.898	3.48
23.81	4.20	2.049	2.46	11.76	8.50	2.915	3.50
23.26	4.30	2.074	2.49	11.63	8.60	2.933	3.52
22.73	4.40	2.098	2.52	11.49	8.70	2.950	3.54
22.22	4.50	2.121	2.55	11.36	8.80	2.966	3.56
21.74	4.60	2.145	2.57	11.24	8.90	2.983	3.58
21.28	4.70	2.168	2.60	11.11	9.00	3.000	3.60
20.83	4.80	2.191	2.63	10.99	9.10	3.017	3.62
20.41	4.90	2.214	2.66	10.87	9.20	3.033	3.64
20.00	5.00	2.236	2.68	10.75	9.30	3.050	3.66
19.61	5.10	2.258	2.71	10.64	9.40	3.066	3.68
19.23	5.20	2.280	2.74	10.53	9.50	3.082	3.70
18.87	5.30	2.302	2.76	10.42	9.60	3.098	3.72
18.52	5.40	2.324	2.79	10.31	9.70	3.114	3.74
18.18	5.50	2.345	2.81	10.20	9.80	3.130	3.76
17.86	5.60	2.366	2.84	10.10	9.90	3.146	3.78
17.54	5.70	2.387	2.86	10.00	10.00	3.162	3.79
17.24	5.80	2.408	2.89	9.09	11.00	3.317	3.98
16.95	5.90	2.429	2.91	8.33	12.00	3.464	4.16
16.67	6.00	2.449	2.94	7.69	13.00	3.606	4.33
16.39	6.10	2.470	2.96	7.14	14.00	3.742	4.49
16.13	6.20	2.490	2.99	6.67	15.00	3.873	4.65
15.87	6.30	2.510	3.01	6.25	16.00	4.000	4.80
15.62	6.40	2.530	3.04	5.88	17.00	4.123	4.95
15.38	6.50	2.550	3.06	5.56	18.00	4.243	5.09
15.15	6.60	2.569	3.08	5.26	19.00	4.359	5.23
14.93	6.70	2.588	3.11	5.00	20.00	4.472	5.37
14.71	6.80	2.608	3.13	4.76	21.00	4.582	5.50
14.49	6.90	2.627	3.15	4.27	22.00	4.690	5.63


GEARING DIAGRAM
OF
STANDARD FLY FRAMES
DRAUGHT GEAR 25 TO 45
BACK
MIDDLE
FRONT
1" DIA.
1" DIA.
X DIA.
56-22
54
20
34-37-40-48
90-100
130
78
ROLLER BEAM
BACK SHAFT GEAR
A
Y
TWIST GEAR
TOP CONE
BOTTOM CONE
CONE RACK
TAPER GEAR
T
X
Y'
S
12
30
30
18
V
W
U
TENSION GEAR
40
Z
O
ECCENTRIC
FOR SELF BALANCED RAIL ONLY
70
P
Q
R
CONE GEAR
70
35
16
70
45
110
76
14
RACK
16
J
H
I
K
L
M
BOBBIN SHAFT
SPINDLE SHAFT
G
TRAVERSE GEAR
B
C
F
E
D

Reference Table of Gearing Diagram of Whitin Standard Fly Frames

Frames	Slubbers				Intermediates				Rovings			Jacks		
Size of Frames	12 in. by 6 in.	11 in. by $5\frac{1}{2}$ in.	10 in. by 5 in.	9 in. by $4\frac{1}{2}$ in.	10 in. by 5 in.	9 in. by $4\frac{1}{2}$ in.	8 in. by 4 in.	8 in. by $3\frac{1}{2}$ in.	7 in. by $3\frac{1}{2}$ in.	7 in. by 3 in.	6 in. by 3 in.	6 in. by $2\frac{1}{2}$ in.	5 in. by $2\frac{1}{2}$ in.	$4\frac{1}{2}$ in. by $2\frac{1}{4}$ in.
Gears	Teeth	Teeth	Teeth	Teeth	Teeth	Teeth	Teeth	Teeth	Teeth	Teeth	Teeth	Teeth	Teeth	Teeth
A	38	38	38	38	46	46	38	46	46	56	56	60	64	64
B	56	56	48	60	48	60	56	56	60	60	60	60	60	60
C	154	154	154	148	154	148	154	154	134	134	134	134	134	134
D	56	56	48	48	48	48	40	40	40	40	40	40	40	40
E	38	38	38	34	38	34	24	24	14	14	12	12	12	12
F	90	90	90	94	90	94	80	80	90	90	92	92	92	92
G	96	96	96	96	104	104	96	104	104	104	104	104	104	104
H	55	55	55	55	55	55	46	46	46	46	46	46	46	46
I	27	27	27	27	27	27	22	22	22	22	22	22	22	22
J	55	55	55	55	55	55	46	46	46	46	46	46	46	46
K	27	27	27	27	27	27	22	22	22	22	22	22	22	22
L	73	73	65	48	65	48	40	40	40	40	40	40	40	40
M	73	73	65	60	65	60	56	56	60	60	60	60	60	60
N	73	73	65	60	65	60	56	56	60	60	60	60	60	60
O	56	56	64	64	64	64	73	73	64	64	64	64	64	64
P	56	56	64	64	64	64	64	64	64	64	64	64	64	64
Q	64	64	56	56	56	56	56	56	56	56	56	56	56	56
R	29	29	38	29	38	29	29	29	34	34	32	34	36	36
S	19	19	18	18	18	18	18	18	18	18	18	18	18	18
T	19	19	17	17	17	17	18	18	14	14	13	13	13	13
U	38	38	38	38	38	38	38	46	38	46	46	46	46	46
V	12	12	12	12	10	10	10	10	10	10	10	10	10	10
W	48	48	48	48	50	50	50	50	50	50	50	50	50	50
Y	80	80	61	56	61	56	46	46	46	46	46	46	38	38
Z	32	32	32	32	32	32	29	29	29	29	29	29	29	29
X′	21	21	21	21	21	21	21	21	21	21	27	27	27	27
Y′	22	22	22	22	22	22	22	22	22	22	18	18	18	18
X	$1\frac{1}{4}$ in.	$1\frac{1}{4}$ in.	$1\frac{1}{4}$ in.	$1\frac{1}{4}$ in.	$1\frac{1}{4}$ in.	$1\frac{1}{4}$ in.	$1\frac{1}{8}$ in.	$1\frac{1}{8}$ in.	$1\frac{1}{8}$ in.	$1\frac{1}{8}$ in.	$1\frac{1}{8}$ in.	$1\frac{1}{8}$ in.	$1\frac{1}{8}$ in.	$1\frac{1}{8}$ in.

Table of Constants for Whitin Fly Frames with Standard Gearing

Frame	Size of Full Bobbin	Space	Twist Constant	Draught Constant	Traverse Constant	Tension Constant	Roll Constant	Frame Constant
Slubber	12″ × 6″	10″	32.85	157.50	21.60	22.80	165.	.8646
"	11″ × 5½″	9½″	32.85	157.50	21.60	22.80	178.	.8646
"	10″ × 5″	9″	32.85	157.50	24.50	28.80	191.	.8646
"	9″ × 4½″	8½″	41.06	157.50	32.88	34.25	204.	1.08064
Intermediate	10″ × 5″	7½″	39.77	157.50	26.20	35.28	216.5	.8646
"	9″ × 4½″	7″	49.71	157.50	34.50	42.80	241.91	1.08064
"	8″ × 4″	6″	52.46	170.27	45.57	52.80	297.	1.38041
"	8″ × 3½″	5½″	63.50	170.27	48.51	64.80	311.23	1.38041
Roving	7″ × 3½″	5¼″	68.03	170.27	88.87	68.03	325.38	1.479
"	7″ × 3″	4½″	82.82	170.27	98.22	76.30	339.52	1.479
"	6″ × 3″	4½″	82.82	170.27	116.84	96.30	353.67	1.479
Jack	6″ × 2½″	4¼″	88.74	170.27	108.29	84.00	381.97	1.479
"	5″ × 2½″	4¼″	94.66	170.27	95.20	132.00	424.41	1.479
"	4½″ × 2¼″	4″	94.66	170.27	86.12	132.00	452.70	1.479

RULES TO FIND CHANGE GEARS:

Twist constant divided by twist equals change twist gear.
Draught constant divided by draught equals change draught gear.
Traverse constant divided by twist equals change traverse gear.
Tension constant divided by twist equals change tension gear
Roll constant divided by twist equals revolutions of roll.
Frame constant multiplied by top cone gear equals twist constant.

NOTE. — For standard gearing in each frame see diagram on page 135.

Attachments for compounding the twist, tension, or traverse gearing may be had if it is desired to use a larger change gear than the above constants will give.

Draught Table for Whitin Fly Frames

Front Roll	$1\frac{1}{4}$ in. Diameter				$1\frac{1}{8}$ in. Diameter	
Back Roll	1 in. Diameter				1 in. Diameter	
F. R. Gear	48 T	40 T	40 T	34 T	34 T	37 T
B. R. Gear	56 T	56 T	56 T	56 T	56 T	56 T
Crown Gear	90 T	90 T	100 T	100 T	100 T	100 T
Change Gear	Draught	Draught	Draught	Draught	Draught	Draught
25 T	5.25	6.30	7.00	8.23	7.40	6.81
26	5.04	6.05	6.72	7.91	7.12	6.55
27	4.85	5.83	6.48	7.62	6.86	6.30
28	4.68	5.62	6.25	7.35	6.61	6.08
29	4.52	5.43	6.03	7.09	6.37	5.87
30	4.34	5.25	5.83	6.86	6.17	5.67
31	4.23	5.08	5.64	6.64	5.98	5.49
32	4.10	4.92	5.46	6.43	5.79	5.31
33	3.97	4.77	5.30	6.23	5.61	5.16
34	3.86	4.63	5.14	6.05	5.44	5.00
35	3.75	4.50	5.00	5.88	5.29	4.86
36	3.64	4.37	4.86	5.72	5.14	4.73
37	3.54	4.25	4.73	5.56	5.00	4.60
38	3.45	4.14	4.60	5.41	4.87	4.48
39	3.36	4.03	4.48	5.27	4.75	4.36
40	3.28	3.93	4.37	5.14	4.63	4.25
41	3.20	3.84	4.26	5.02	4.52	4.15
42	3.12	3.75	4.16	4.90	4.41	4.05
43	3.05	3.66	4.06	4.78	4.30	3.96
44	2.98	3.57	3.97	4.67	4.21	3.87
45	2.91	3.50	3.88	4.57	4.11	3.78
Constants	131.25	157.50	175.00	205.88	185.29	170.27

Change Gear Table for Slubbers

Full Bobbin		12 in. by 6 in.			11 in. by $5\frac{1}{2}$ in.			10 in. by 5 in.			9 in. by $4\frac{1}{2}$ in.		
Back Shaft Gear		38 teeth			38 teeth			38 teeth			38 teeth		
Bottom Cone Gear		29 teeth			29 teeth			38 teeth			29 teeth		
Taper Gear		19 teeth			19 teeth			17 teeth			17 teeth		
Hank Roving	Twist per inch	Gears Required			Gears Required			Gears Required			Gears Required		
		Twist	Tension	Traverse	Twist	Tension	Traverse	Twist	Tension	Traverse	Twist	Tension	Traverse
.20	.54	60	42	43									
.25	.60	55	38	39									
.30	.66	50	35	35	50	35	35						
.35	.71	47	33	33	47	33	33						
.40	.76	43	30	31	43	30	31	42	38	33			
.45	.80	41	29	29	41	29	29	40	36	31			
.50	.84	39	27	26	39	27	26	39	34	29	48	42	40
.55	.89	37	26	25	37	26	25	37	33	28	46	39	38
.60	.92	35	24	23	35	24	23	35	32	27	44	37	35
.65	.97	34	23	22	34	24	22	34	31	26	43	36	34
.70	1.00	33	22	21	33	23	21	33	30	25	41	35	33
.75	1.04	32	22	21	32	23	21	32	29	24	39	34	32
.80	1.07	31	21	20	31	22	20	31	28	23	38	32	31
.85	1.11	30	21	20	30	22	20	30	27	23	37	31	30
.90	1.14	29	20	19	29	21	19	29	26	22	36	30	29
.95	1.17	28	20	19	28	21	19	28	25	21	35	29	28
1.00	1.20	27	19	18	27	20	18	27	24	20	34	28	27
1.05	1.23				27	20	18	27	24	20	33	28	27
1.10	1.26				26	19	17	26	23	19	32	27	26
1.15	1.29				25	18	17	26	22	19	32	27	26
1.20	1.31				25	17	16	25	22	19	31	26	25
1.25	1.34							25	21	18	31	26	25
1.30	1.37							24	21	18	30	25	24

Change Gear Table for Intermediate Frames

Full Bobbin		10 in. by 5 in.			9 in. by $4\frac{1}{2}$ in.			8 in. by 4 in.			8 in. by $3\frac{1}{2}$ in.		
Back Shaft Gear		46 teeth			46 teeth			38 teeth			46 teeth		
Bottom Cone Gear		38 teeth			29 teeth			29 teeth			29 teeth		
Taper Gear		17 teeth			17 teeth			18 teeth			18 teeth		
Hank Roving	Twist per inch	Gears Required			Gears Required			Gears Required			Gears Required		
		Twist	Tension	Traverse	Twist	Tension	Traverse	Twist	Tension	Traverse	Twist	Tension	Traverse
.80	1.07	37	33	26									
.85	1.11	36	32	25									
.90	1.14	35	31	24	43	38	32						
.95	1.17	34	30	23	42	37	31						
1.00	1.20	33	30	22	41	36	30	44	44	38			
1.05	1.23	33	29	22	40	35	29	43	43	37			
1.10	1.26	32	28	21	39	34	28	42	42	36			
1.15	1.29	31	28	21	39	33	27	41	41	35			
1.20	1.31	30	27	20	38	32	26	40	40	35			
1.25	1.34	30	26	20	37	32	26	39	39	34			
1.30	1.37	29	25	19	36	31	25	38	39	33			
1.35	1.39	29	25	19	36	31	25	37	28	33			
1.40	1.42	28	24	18	35	30	24	37	37	32			
1.50	1.47	27	23	18	34	29	23	36	36	31			
1.60	1.52	26	23	17	33	28	22	35	35	30			
1.75	1.59	25	22	17	31	27	21	33	33	29			
2.00	1.70	23	21	15	29	25	20	31	31	27	37	38	29
2.25	1.80				28	24	19	29	29	25	35	36	27
2.50	1.90				26	23	18	27	27	24	33	34	25
2.75	1.99							26	26	23	31	32	24
3.00	2.07							25	26	22	30	31	23
3.50	2.24							23	24	21	28	29	22
4.00	2.40										26	27	20
4.50	2.55										24	25	19
5.00	2.68										23	24	18

Change Gear Table for Roving Frames

Full Bobbin		7 in. by $3\frac{1}{2}$ in.			7 in. by 3 in.			6 in. by 3 in.		
Back Shaft Gear		46 teeth			56 teeth			56 teeth		
Bottom Cone Gear		34 teeth			34 teeth			32 teeth		
Taper Gear		14 teeth			14 teeth			13 teeth		
Hank Roving	Twist per inch	Gears Required			Gears Required			Gears Required		
		Twist	Tension	Traverse	Twist	Tension	Traverse	Twist	Tension	Traverse
2.00	1.69	40	40	53						
2.50	1.90	35	35	47						
3.00	2.07	32	32	43	40	38	47			
3.25	2.16	31	31	41	39	37	45			
3.50	2.24	30	30	40	38	36	44			
3.75	2.32	29	29	38	37	35	42			
4.00	2.40	28	28	37	35	33	41	35	40	49
4.25	2.47	27	27	36	34	32	40	34	39	47
4.50	2.54	26	26	35	33	31	39	33	38	46
4.75	2.60	26	26	34	32	30	38	32	37	45
5.00	2.67	25	25	33	31	29	37	31	36	44
5.25	2.75	25	25	32	31	29	36	30	35	43
5.50	2.80	24	24	32	30	28	35	29	34	42
5.75	2.88	24	24	31	29	27	34	29	33	41
6.00	2.92	23	23	30	28	26	33	28	33	40
6.50	3.06	22	22	29	27	25	32	27	32	38
7.00	3.17	21	21	28	26	24	31	26	30	37
7.50	3.29	21	21	27	25	23	30	25	29	36
8.00	3.40	20	20	26	24	22	29	24	28	34
9.00	3.60				23	21	27	23	27	32
10.00	3.79				22	20	26	22	25	31
11.00	3.97							21	24	29
12.00	4.16							20	23	28
13.00	4.33							19	22	27
14.00	4.49							18	21	26

Change Gear Table for Jack Frames

Full Bobbin		6 in. by $2\frac{1}{2}$ in.			5 in. by $2\frac{1}{2}$ in.			$4\frac{1}{2}$ in. by $2\frac{1}{4}$ in.		
Back Shaft Gear		60 teeth			64 teeth			64 teeth		
Bottom Cone Gear		33 teeth			36 teeth			36 teeth		
Taper Gear		13 teeth			13 teeth			13 teeth		
Hank Roving	Twist per inch	Gears Required			Gears Required			Gears Required		
		Twist	Tension	Traverse	Twist	Tension	Traverse	Twist	Tension	Traverse
5.00	2.67	34	32	41						
5.50	2.81	32	31	39						
6.00	2.92	30	29	37						
6.50	3.06	29	28	35						
7.00	3.18	28	27	34						
7.50	3.29	27	26	33						
8.00	3.40	26	25	32						
8.50	3.50	26	25	31						
9.00	3.60	25	24	30						
9.50	3.70	24	23	29						
10.00	3.79	23	22	28	25	35	25			
10.50	3.89	23	22	27	24	34	24			
11.00	3.97	22	21	27	23	33	24			
12.00	4.15	21	20	26	23	32	23			
13.00	4.33	20	19	25	22	31	22			
14.00	4.49	19	18	24	21	30	21			
16.00	4.80	18	17	23	20	28	20	20	28	18
18.00	5.08	17	16	22	19	26	19	19	26	17
20.00	5.36	16	15	20	18	24	18	18	24	16
22.00	5.62	16	15	20	17	23	17	17	23	15
24.00	5.87	15	14	19	16	22	16	16	22	15
26.00	6.10				15	21	15	15	21	14
28.00	6.33				15	21	15	14	20	14
30.00	6.56				14	20	14	13	19	13

PRODUCTION OF FLY FRAMES

On the following pages will be found tables of production which we consider reasonable under average conditions of work. These tables are purposely made conservative, but in many mills greater results are being obtained.

In these tables the twist per inch, viz., 1.20 times the square root of the hank roving, is that usually given to cotton of ordinary length of staple, but when Sea Island, or other long staple cotton, is used, less twist will be required, and the production will be increased from ten to twenty per cent.

The tables are calculated for ten hours per day running time, and fifteen minutes are allowed for one tender for doffing each set.

The weight of cotton on full bobbins will vary with different kinds of cotton; that given in the tables is about the average of ordinary cotton.

HANK CLOCK

Slubbers

PRODUCTION PER DAY OF TEN HOURS

Full Bobbin		12 in. by 6 in.				11 in. by 5½ in.				10 in. by 5 in.				9 in. by 4½ in.			
Cotton on Full Bobbin		44 ounces				32 ounces				24 ounces				18 ounces			
Flyer Revolu.		650 per Minute				700 per Minute				750 per Minute				800 per Minute			
Pulley Revolu.		320 per Minute				344 per Minute				368 per Minute				314 per Minute			
Front Roll Diam.		1¼ in.				1¼ in.				1¼ in.				1¼ in.			
Hank Roving	Twist per inch	R.P.M F. Roll	Sets per day	Hanks per day	Pounds per day	R.P.M. F.Roll	Sets per day	Hanks per day	Pounds per day	R.P.M. F.Roll	Sets per day	Hanks per day	Pounds per day	R.P.M. F.Roll	Sets per day	Hanks per day	Pounds per day
.20	.54	306	20.82	11.45	57.25												
.25	.60	276	17.54	12.06	48.23												
.30	.66	251	14.87	12.27	40.89	270	18.68	11.21	37.36								
.35	.71	233	12.81	12.31	35.21	251	16.43	11.50	32.86								
.40	.76	218	11.12	12.23	30.58	234	14.53	11.62	29.06	251	17.96	10.78	26.94				
.45	.80	207	9.83	12.16	27.03	223	13.02	11.72	26.04	239	16.32	11.02	24.48				
.50	.84	197	8.73	12.00	24.00	212	11.70	11.70	23.40	227	14.85	11.14	22.27	243	18.26	10.27	20.54
.55	.89	186	7.72	11.68	21.23	200	10.46	11.51	20.92	214	13.44	11.09	20.16	229	16.74	10.35	18.83
.60	.92	177	7.00	11.55	19.25	194	9.57	11.48	19.14	208	12.40	11.16	18.60	222	15.63	10.54	17.58
.65	.97	170	6.27	11.21	17.24	184	8.63	11.22	17.26	197	11.30	11.02	16.95	210	14.35	10.49	16.14
.70	1.00	165	5.74	11.05	15.78	178	7.95	11.13	15.90	191	10.46	10.98	15.69	204	13.40	10.55	15.08
.75	1.04	160	5.23	10.78	14.38	171	7.28	10.92	14.56	184	9.65	10.86	14.48	196	12.46	10.51	14.02
.80	1.07	154	4.82	10.55	13.19	166	6.74	10.78	13.48	178	8.98	10.78	13.47	190	11.67	10.50	13.13
.85	1.11	150	4.42	10.33	12.15	160	6.21	10.56	12.42	172	8.32	10.61	12.48	183	10.88	10.40	12.24
.90	1.14	145	4.10	10.14	11.27	156	5.79	10.42	11.58	168	7.78	10.50	11.67	179	10.24	10.37	11.52
.95	1.17	141	3.81	9.96	10.48	152	5.40	10.26	10.80	163	7.30	10.40	10.95	174	9.63	10.29	10.83
1.00	1.20	138	3.56	9.79	9.79	148	5.07	10.14	10.14	159	6.85	10.27	10.27	170	9.09	10.23	10.23
1.05	1.23					145	4.74	9.95	9.48	155	6.45	10.15	9.67	166	8.59	10.14	9.66
1.10	1.26					141	4.46	9.81	8.92	152	6.07	10.01	9.10	162	8.12	10.05	9.14
1.15	1.29					138	4.19	9.65	8.39	148	5.74	9.90	8.61	159	7.69	9.95	8.65
1.20	1.31					136	3.98	9.56	7.97	146	5.45	9.80	8.17	156	7.34	9.91	8.26
1.25	1.34									143	5.18	9.71	7.77	153	6.94	9.76	7.81
1.30	1.37									140	4.67	9.10	7.00	149	6.54	9.57	7.36

Intermediate Frames — PRODUCTION PER DAY OF TEN HOURS

Full Bobbin		10 in. by 5 in.				9 in. by 4½ in.				8 in. by 4 in.				8 in. by 3½ in.			
Cotton on Full Bobbin		24 ounces				18 ounces				14 ounces				12 ounces			
Flyer Revolu.		850 per Minute				950 per Minute				1050 per Minute				1100 per Minute			
Pulley Revolu.		418 per Minute				374 per Minute				359 per Minute				376 per Minute			
Front Roll Diam.		1¼ in.				1¼ in.				1⅛ in.				1⅛ in.			
Hank Roving	Twist per inch	R.P.M. F. Roll	Sets per day	Hanks per day	Pounds per day	R.P.M. F. Roll	Sets per day	Hanks per day	Pounds per day	R.P.M. F. Roll	Sets per day	Hanks per day	Pounds per day	R.P.M. F. Roll	Sets per day	Hanks per day	Pounds per day
.80	1.07	202	9.89	11.86	14.83												
.85	1.11	196	9.18	11.70	13.77												
.90	1.14	190	8.57	11.56	12.85	212	11.59	11.74	13.04								
.95	1.17	185	8.07	11.50	12.10	207	10.95	11.70	12.32								
1.00	1.20	180	7.59	11.38	11.38	202	10.35	11.64	11.64	247	13.26	11.60	11.60				
1.05	1.23	176	7.16	11.27	10.74	197	9.80	11.57	11.02	241	12.63	11.60	11.05				
1.10	1.26	172	6.72	11.08	10.08	192	9.27	11.47	10.43	236	11.99	11.54	10.49				
1.15	1.29	168	6.38	11.00	9.57	189	8.82	11.41	9.92	230	11.47	11.53	10.03				
1.20	1.31	165	6.07	10.93	9.11	185	8.42	11.36	9.47	227	11.00	11.54	9.62				
1.25	1.34	161	5.74	10.76	8.61	181	7.98	11.22	8.98	222	10.47	11.45	9.16				
1.30	1.37	158	5.46	10.64	8.19	177	7.62	11.14	8.57	217	10.02	11.40	8.77				
1.35	1.39	154	5.20	10.53	7.80	174	7.30	11.08	8.21	214	9.62	11.36	8.42				
1.40	1.42	150	4.95	10.39	7.42	170	6.95	10.94	7.82	209	9.21	11.28	8.06				
1.50	1.47	147	4.53	10.18	6.79	165	6.40	10.80	7.20	202	8.51	11.16	7.44				
1.60	1.52	142	4.14	9.94	6.21	159	5.88	10.59	6.62	196	7.87	11.02	6.89				
1.75	1.59	136	3.67	9.62	5.50	152	5.24	10.31	5.89	188	7.10	10.87	6.21				
2.00	1.69	128	3.07	9.20	4.60	142	4.39	9.88	4.94	176	5.99	10.48	5.24	184	7.08	10.62	5.31
2.25	1.80					134	3.75	9.50	4.22	165	5.12	10.08	4.48	173	6.10	10.30	4.58
2.50	1.90					127	3.24	9.13	3.65	156	4.45	9.72	3.89	164	5.32	9.98	3.99
2.75	1.99									149	3.92	9.43	3.43	156	4.68	9.65	3.51
3.00	2.07									143	3.49	9.15	3.05	150	4.19	9.42	3.14
3.50	2.24									133	2.82	8.65	2.47	139	3.40	8.92	2.55
4.00	2.40													130	2.82	8.48	2.12
4.50	2.54													123	2.35	7.92	1.76
5.00	2.67													117	2.07	7.75	1.55

Roving Frames

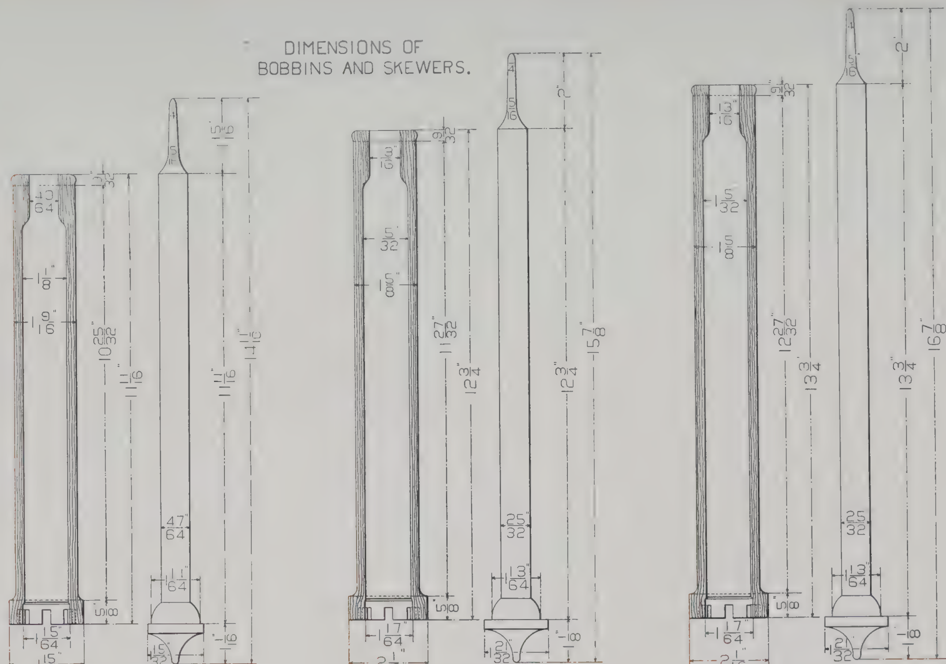
PRODUCTION PER DAY OF TEN HOURS

Full Bobbin		7 in. by $3\frac{1}{2}$ in.				7 in. by 3 in.				6 in. by 3 in.			
Cotton on Full Bobbin		10 ounces				$8\frac{1}{2}$ ounces				7 ounces			
Flyer Revolutions		1150 per minute				1200 per minute				1250 per minute			
Pulley Revolutions		367 per minute				383 per minute				399 per minute			
Front Roll diameter		$1\frac{1}{8}$ inch				$1\frac{1}{8}$ inch				$1\frac{1}{8}$ inch			
Hank Roving	Twist per inch	R.P.M. F. Roll	Sets per day	Hanks per day	Pounds per day	R.P.M. F. Roll	Sets per day	Hanks per day	Pounds per day	R.P.M. F. Roll	Sets per day	Hanks per day	Pounds per day
2.00	1.69	193	8.51	10.65	5.32								
2.50	1.90	171	6.44	10.06	4.02								
3.00	2.07	157	5.12	9.60	3.20	164	6.12	9.75	3.25				
3.25	2.16	151	4.60	9.33	2.87	156	5.51	9.52	2.93				
3.50	2.24	145	4.17	9.14	2.61	152	5.00	9.31	2.66				
3.75	2.32	140	3.80	8.89	2.37	146	4.57	9.11	2.43				
4.00	2.40	136	3.48	8.72	2.18	141	4.19	8.92	2.23	147	5.14	9.00	2.25
4.25	2.47	132	3.20	8.50	2.00	137	3.86	8.76	2.05	143	4.76	8.88	2.09
4.50	2.54	128	2.96	8.33	1.85	134	3.68	8.57	1.91	139	4.42	8.73	1.94
4.75	2.60	125	2.75	8.17	1.72	131	3.33	8.41	1.77	136	4.12	8.55	1.80
5.00	2.67	122	2.56	8.00	1.60	127	3.10	8.20	1.64	132	3.82	8.40	1.68
5.25	2.75	119	2.38	7.82	1.49	123	2.88	8.03	1.53	129	3.58	8.19	1.56
5.50	2.80	116	2.24	7.70	1.40	121	2.72	7.93	1.45	126	3.37	8.14	1.48
5.75	2.88	113	2.09	7.53	1.31	118	2.54	7.76	1.35	224	3.15	7.93	1.38
6.00	2.92	111	1.97	7.38	1.23	116	2.41	7.68	1.28	121	2.99	7.86	1.31
6.50	3.06	106	1.76	7.15	1.10	111	2.14	7.41	1.14	116	2.67	7.60	1.17
7.00	3.17	103	1.58	6.93	.99	107	1.93	7.21	1.03	111	2.39	7.35	1.05
7.50	3.29	99	1.43	6.68	.89	103	1.74	6.98	.93	107	2.17	7.13	.95
8.00	3.40	96	1.30	6.48	.81	100	1.58	6.72	.84	104	1.98	6.96	.87
9.00	3.60					94	1.34	6.39	.71	98	1.67	6.57	.73
10.00	3.79					90	1.15	6.11	.61	93	1.44	6.30	.63
11.00	3.97									89	1.26	6.05	.55
12.00	4.16									85	1.14	6.00	.50
13.00	4.33									82	.98	5.59	.43
14.00	4.49									79	.88	5.39	.39

Jack Frames — Production Per Day of Ten Hours

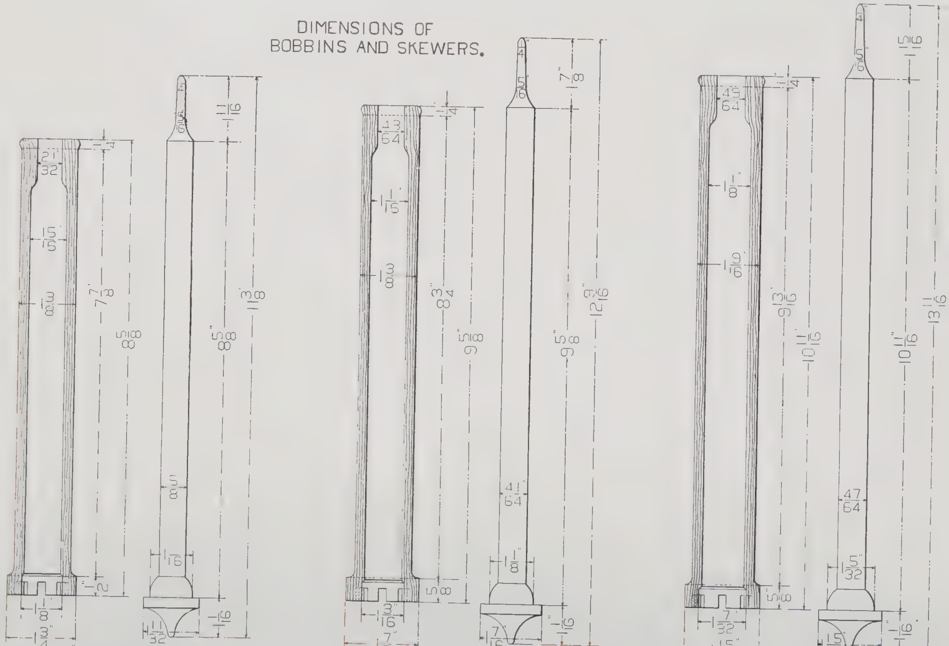
Full Bobbin		6 in. by $2\frac{1}{2}$ in.				5 in. by $2\frac{1}{2}$ in.				$4\frac{1}{2}$ in. by $2\frac{1}{4}$ in.			
Cotton on Full Bobbin		$5\frac{1}{2}$ ounces				4 ounces				3 ounces			
Flyer Revolutions		1350 per minute				1500 per minute				1600 per minute			
Pulley Revolutions		431 per minute				479 per minute				510 per minute			
Front Roll diameter		$1\frac{1}{8}$ inch				$1\frac{1}{8}$ inch				$1\frac{1}{8}$ inch			
Hank Roving	Twist per inch	R.P.M. F. Roll	Sets per day	Hanks per day	Pounds per day	R.P.M. F. Roll	Sets per day	Hanks per day	Pounds per day	R.P.M. F. Roll	Sets per day	Hanks per day	Pounds per day
5.00	2.67	143	5.09	8.75	1.75								
5.50	2.81	138	4.49	8.52	1.55								
6.00	2.92	131	4.01	8.28	1.38								
6.50	3.06	126	3.57	7.99	1.23								
7.00	3.18	120	3.22	7.77	1.11								
7.50	3.29	116	2.93	7.50	1.00								
8.00	3.40	112	2.67	7.36	.92								
8.50	3.50	109	2.46	7.22	.85								
9.00	3.60	106	2.27	7.02	.78								
9.50	3.70	104	2.10	6.86	.72								
10.00	3.79	101	1.96	6.70	.67	112	2.91	7.30	.73				
10.50	3.89	99	1.82	6.62	.63	109	2.72	7.14	.68				
11.00	3.97	96	1.71	6.49	.59	105	2.55	7.00	.64				
12.00	4.15	92	1.51	6.24	.52	102	2.25	6.72	.56				
13.00	4.33	88	1.34	5.98	.46	98	2.01	6.50	.50				
14.00	4.49	85	1.20	5.74	.41	95	1.82	6.44	.46				
16.00	4.80	79	.99	5.44	.34	88	1.49	5.92	.37	94	2.08	6.24	.39
18.00	5.08	75	.83	5.13	.29	84	1.27	5.76	.32	89	1.77	5.94	.33
20.00	5.36	71	.71	4.80	.24	79	1.08	5.40	.27	84	1.51	5.60	.28
22.00	5.62	68	.62	4.62	.21	76	.95	5.28	.24	81	1.33	5.50	.25
24.00	5.87	65	.55	4.33	.18	72	.82	5.04	.21	77	1.17	5.28	.22
26.00	6.10					70	.74	4.78	.18	74	1.04	4.94	.19
28.00	6.33					67	.66	4.48	.16	72	.92	4.76	.17
30.00	6.56					65	.60	4.47	.15	68	.83	4.50	.15

DIMENSIONS OF BOBBINS AND SKEWERS.

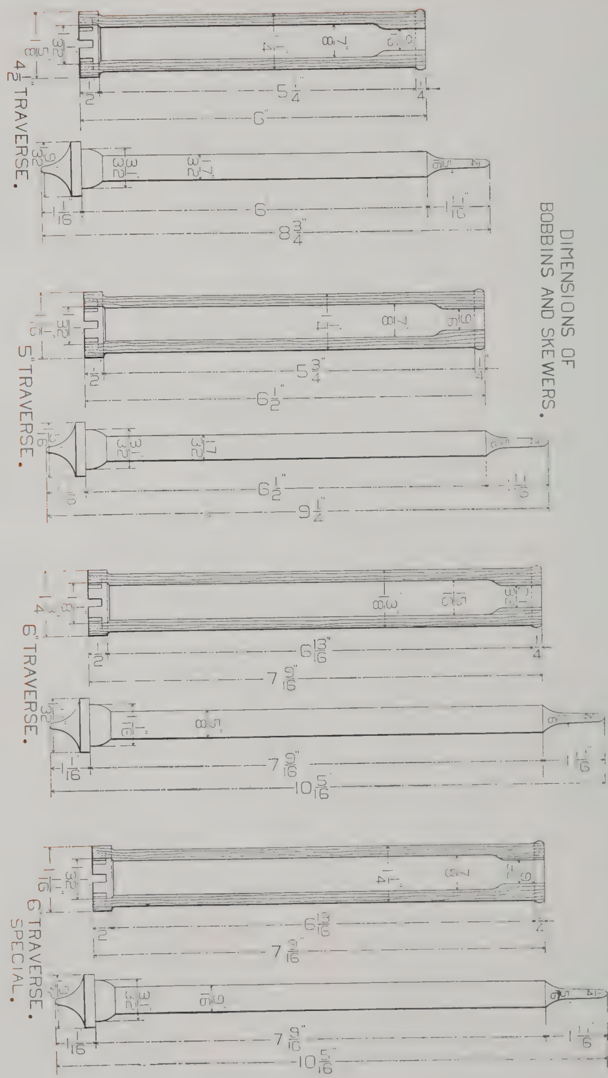


10" TRAVERSE. 11" TRAVERSE. 12" TRAVERSE.

DIMENSIONS OF BOBBINS AND SKEWERS.



7" TRAVERSE. 8" TRAVERSE. 9" TRAVERSE.


DIMENSIONS OF
BOBBINS AND SKEWERS.
4 1/2" TRAVERSE.
5" TRAVERSE.
6" TRAVERSE.
6" TRAVERSE.
SPECIAL.

CARE OF FLY FRAMES

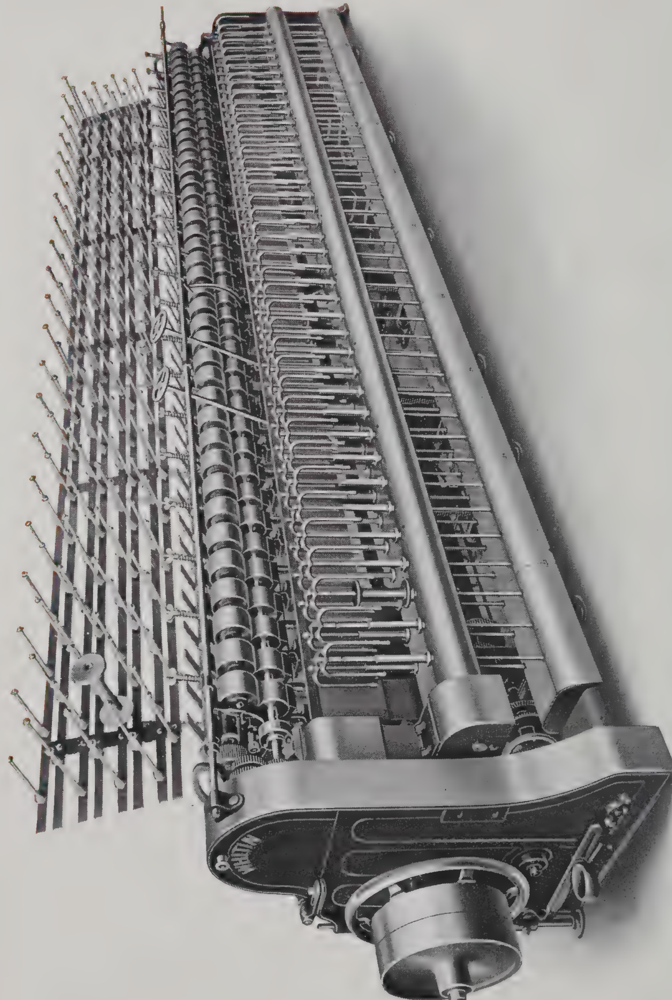
Fly Frames, like all other cotton mill machinery, require careful attention in order to obtain the best results in quality and quantity of production. They should be accurately levelled when first installed and maintained in this condition by frequent inspections, and re-levelled whenever found necessary. It is also of the greatest importance that all oiling and cleaning should be done at regular stated intervals.

Oiling

The bearings of the differential and horse head gearing, main, cone, and jack shafts should be oiled twice a day; the loose pulley, the front roll, bobbin and spindle shaft bearings, once a day. Once a month the differential motion should be taken apart, cleaned, and oiled, the bevel gears being packed with tallow. The spindle bolsters and bearings should be oiled daily and the spindle steps once a month. Once a week the arbors of the shell top rolls should be taken out, cleaned, and oiled, and at the same time the middle and back roll bearings should be oiled. Extreme care should be used that no oil gets on the roving when oiling the rolls.

Cleaning

The creels should be brushed off twice a day; head end, and centre gearing cleaned twice a week, and the spindle and bobbin gears, with their shafts, once a month. On medium counts the flyers should be wiped off every doff and more frequently in finer counts. Extreme care should be taken that the flyer heads and slots in top of spindles are entirely free from obstructions, so that the pins in flyer heads perfectly fit the slots. The steel rolls should be taken out several times in each year, cleaned, and polished with pumice stone. The top clearers must be picked frequently or bad work will result. The clearer cloth should rest firmly and evenly on the top rolls. The weights of the under clearers should be so hung that the clearers are always in contact with the steel rolls. It is very important that the bobbins used on our frames be made according to dimensions as shown on pages 148, 149, and 150, otherwise irregular winding will result.



Worsted Roving Frame

WORSTED ROVING FRAMES

The illustration on the preceding page shows a front view of our improved worsted roving frame for making roving from domestic and fine merino worsted wools.

As the scope of this catalog is not intended to cover worsted machinery, it is our idea in showing this illustration to merely call the attention of the manufacturers of worsted goods to the fact that we make a full line of worsted roving frames, complete details of which will be furnished on application, and full descriptions will be given in a future catalog.

MISCELLANEOUS

REPAIRS

We have issued, for the convenience of users of our machinery, **Illustrated Circulars of the Component Parts** of each machine which we build. The various pieces are illustrated in a clear manner, numbered, and named, so that if the directions for ordering repairs, as stated in circulars, are followed there will be no doubt but that the orders will be correctly filled, with the least possible delay. Copies of these circulars have been sent to all our customers, and extra copies will be sent on application.

THE HANDS OF MACHINES

To determine the **Hands of our Machines,** face the delivery and note which hand side the driving pulleys are.

SHIPPING DIRECTIONS

We prefer our customers to furnish directions for shipping their orders, but if not given and the package is small, we send by express, if large by freight, selecting the most reliable routes and the lowest freight rates that can be secured.

RECIPES FOR TOP ROLL VARNISH

No. 1. Dissolve 1 pint of acetic acid in a glass jar, with $\frac{1}{4}$ pound of the best carpenter's glue, to which is added 1 tablespoonful of the oil origanum and a piece of American isinglass the size of a walnut. Shake until liquefied and add chrome green to give a body.

No. 2. Dissolve 2 ounces of Lepage's glue in 3 ounces of good vinegar, then add 400 grains of dry green, 12 drops of oil origanum, and 5 drops of alcohol.

No. 3. Dissolve 1 pound of glue in 4 pints of acetic acid, then add $\frac{3}{4}$ pound of burnt sienna, 4 ounces of red lead, and 1 ounce of oil origanum.

No. 4. Dissolve 1 ounce of glue, 2 ounces of borax, and 1 ounce of gum arabic in 48 ounces of acetic acid, then add 8 ounces of dry green, 3 ounces of lampblack, and 1 ounce of oil origanum.

Decimal Equivalents

Ounces		Grains	Ounces		Grains
1	=	437.5	11	=	4812.5
2	=	875.	11½	=	5031.25
3	=	1312.5	12	=	5250.
4	=	1750.	12½	=	5468.75
5	=	2187.5	13	=	5687.5
6	=	2625.	13½	=	5906.25
7	=	3062.5	14	=	6125.
8	=	3500.	14½	=	6343.75
9	=	3937.5	15	=	6562.5
10	=	4375.	15½	=	6781.25
10½	=	4593.75	16	=	7000.