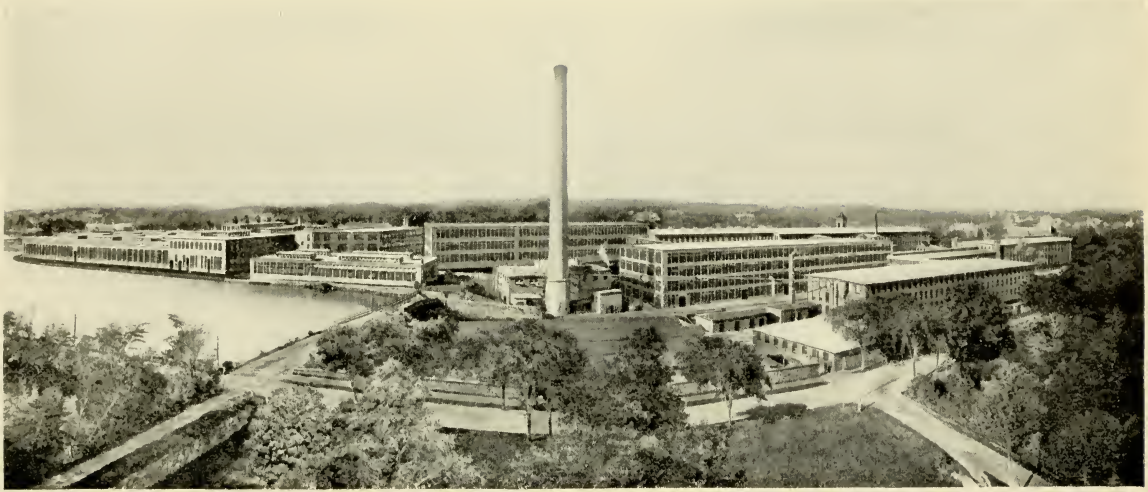
Cotton Yarn Machinery



THE WHITIN MACHINE WORKS

1911

1911

Illustrated and Descriptive Catalogue

OF

WHITIN COTTON YARN MACHINERY

AND

Handbook of Useful Information

FOR

OVERSEERS AND OPERATORS

WRITTEN AND COMPILED BY

OSCAR L. OWEN,

ISSUED BY

THE WHITIN MACHINE WORKS,

WHITINSVILLE, MASS., U. S. A.

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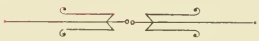


PRESS OF
EAGLE PRINTING COMPANY
WHITINSVILLE,
MASS.

INTRODUCTORY.

The favorable reception by cotton manufacturers of our 1908 general catalog, and the great demand for the same, owing to the information contained therein, has encouraged us to present this new catalog of Cotton Yarn Machinery to the consideration of all interested in cotton manufacturing; but more particularly to overseers and operators of cotton spinning departments using Whitin machinery, and we hope the various tables, formulae, etc., may prove of value to them for daily reference.

In the following pages we have given as concisely as possible descriptions of our Spinning, Spooling, Twisting, Reeling, and Quilling machinery, their productive abilities on different counts of yarn, with rules and tables for their proper operation. The name

WHITIN

on a textile machine is sufficient guarantee that it was made of the best material and by skilled workmen. As a proof of this we point with pride to the marked favor with which our machines have been received, and the phenomenal demand for them from all over the country convinces us that our efforts to improve and keep abreast of the times are fully appreciated by cotton manufacturing interests.

In addition to our improvements on yarn machinery, we will call your attention in later catalogs to improvements in our other lines of machinery, viz: Cards, Railway Heads, Drawing Frames, Combing Machinery, Roving Machinery, Looms, Dobbies and special Textile Machinery.

In conclusion, we respectfully invite manufacturers desiring to purchase new machinery to call or correspond with us, and they may rest assured of courteous treatment and reliable information upon any subject pertaining to our specialties.

THE WHITIN MACHINE WORKS.

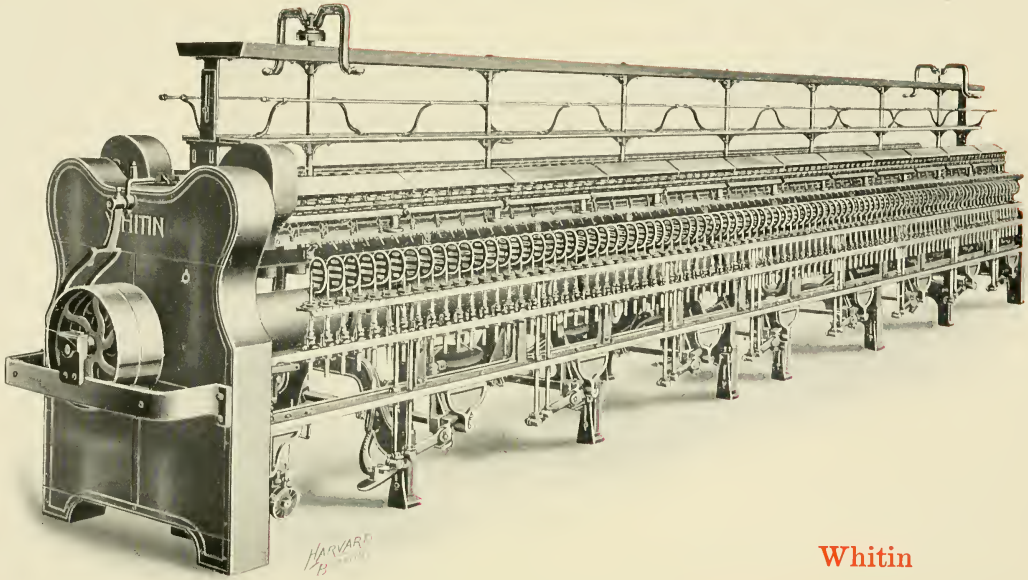
Whitinsville, Mass., May 1, 1911.

GENERAL

DIVISION OF CONTENTS.

INDEX.

SPINNING.



Whitin
Spinning Frame

RING SPINNING FRAME.

For Cotton Warp and Filling Yarns.

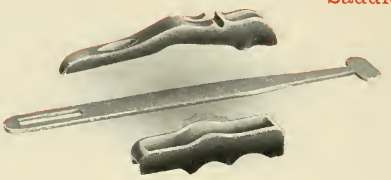
The **Whitin Spinning Frame** has been the subject of the most careful and constant study on our part. Although we have made no alteration in its general appearance, it has been improved upon from a mechanical standpoint until we are now putting on the market a spinning frame as nearly perfect as skilled workmen can make it. All details have been carefully designed to embody strength and rigidity, with neatness and accuracy.

The **Framing** is substantial, with extra wide roll beams and spindle bolster rails on the double web rail principle, with bridge connections between sampson supports. The foot end and sampsons are provided with loose feet for adjustment to suit uneven flooring.

The **Head End** is specially designed to facilitate the necessary twist gear changes. Cut gearing with wide faces is used. Convenience is provided for oiling, and all parts that are not readily accessible for oiling are provided with oil tubes, having their orifices placed in positions convenient to the operators. The ends of the frame are enclosed by removable panels which form guards against accident.

The **Fluted Rolls** are made of the best roller steel, and are irregularly fluted to avoid liability of cutting the covering of the top rolls. If desired, case-hardened rolls may be had ; either long or short-boss rolls as preferred.

Whitin Saddle

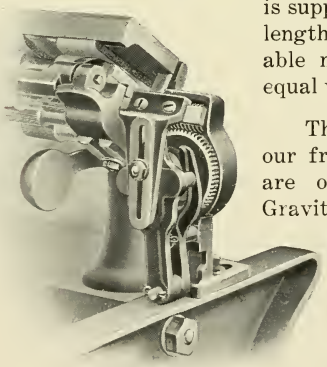


The **Top Rolls** are usually furnished covered, either shell or solid, and weighted with any saddle desired. Self-weighted top rolls are also furnished to mills preferring this system.

The **Top Roll Clearers** may be either stationary or revolving style as preferred.

The **Roll Stands** with their adjustable slides have milled bearings for steel rolls. The bearings are of such width as to insure long life to the neck of the rolls. The detachable cap-bars are arranged to work independently, the finger at each roll bearing being divided so that when the bar is thrown back, only its own particular set of rolls is affected. Ample space for oiling is left between the halves of cap-bar fingers over the roll bearings.

Our **Patented Variable Roving Traverse Motion** is supplied. It is adjustable as to length of traverse, and has a variable motion which prevents unequal wear of leather top-rolls.



Roving Traverse

The **Spindles** with which our frames are usually equipped are of the well-known Whitin Gravity type. They are made in three standard sizes; viz, Standard Gravity, Medium Gravity, and Large Gravity. They are all of the same general construction, but vary as to their weights and diameters of whirls.

For spinning warp yarns we recommend the Large Gravity Spindle for coarse yarns, from 4's to 12's; the Medium Gravity Spindle for all counts from 12's to 24's; and the Standard Gravity Spindle for all counts finer than 24's.

For spinning filling and hosiery yarns we recommend the Medium Spindle on coarse counts to 20's and the Standard Spindle on all finer counts.

We also recommend the use of large whirls on spindles, this assures regular speed, uniform twist, less breakage of bands, and a reduction in repairs in spindles and cylinders.

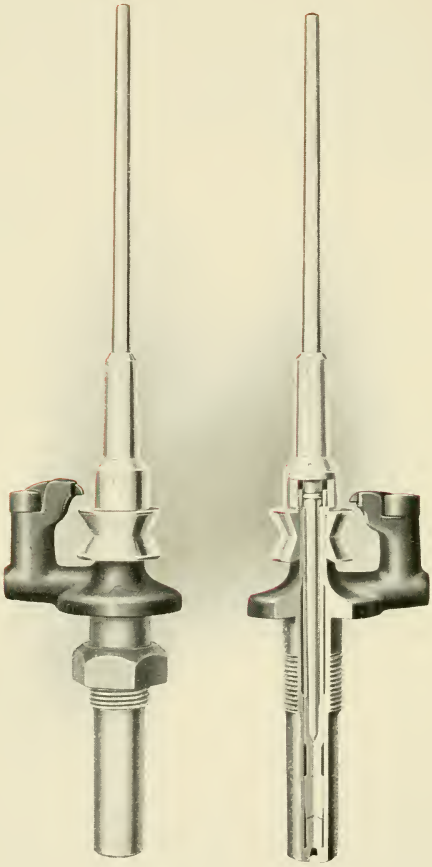
The following spindles are what might be called "Regular," as regards sizes of whirls:

Standard	No. 1	diameter of whirl	$\frac{3}{4}$	inch
"	" 2	"	" $\frac{15}{16}$	"
Medium	" 1	"	" $\frac{7}{8}$	"
"	" 2	"	" 1	"
Large		"	" $1\frac{1}{8}$	"

To suit special conditions the Standard Spindle may be fitted with $\frac{3}{4}$", $\frac{13}{16}$", $\frac{7}{8}$", $\frac{15}{16}$" or 1" diameter whirls; the Medium with $\frac{3}{4}$", $\frac{13}{16}$", $\frac{7}{8}$", $\frac{15}{16}$", 1", $1\frac{1}{16}$", or $1\frac{5}{16}$" diameter whirls, and the Large with $\frac{7}{8}$", $\frac{15}{16}$", 1", $1\frac{1}{8}$" or $1\frac{5}{16}$" diameter whirls; but as a general rule we would prefer not to fit any spindle with less than $\frac{7}{8}$" diameter whirl, with the possible exception of the Standard Spindle.

As to the construction of the **Whitin Gravity Spindle,** it hardly seems necessary to further describe it, inasmuch as it is so well known, there being over six millions now in use in this country. A good idea as to its construction may be obtained from the illustration. The principal advantages may be enumerated as simplicity of construction, steadiness in running, its self adjustment, and durability.

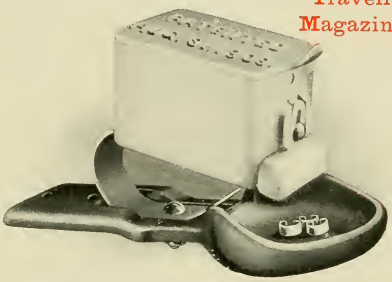
Gravity Spindles.



We furnish the **Whitin Spindle** with the centrifugal clutch, with or without spring, as desired. Also any of the following styles of spindles can be furnished in place of the Whitin Gravity:—Draper, Rabbeth, Sherman, or McMullen.

Adjustable Rings are supplied; cast-iron or plate ring holders as preferred. Efficient Traveller Cleaners can also be had if desired. The Ring Rails of rugged construction are made in short lengths, thus decreasing the liability of deflection. The rails are secured to milled heads of the lifting rods in such a manner as to prevent any undue vibration while working, and, at the same time, being easily removed when desired. The level of the rails is corrected by a novel construction of the lifting rod arms, as is best shown in the illustration on page 16.

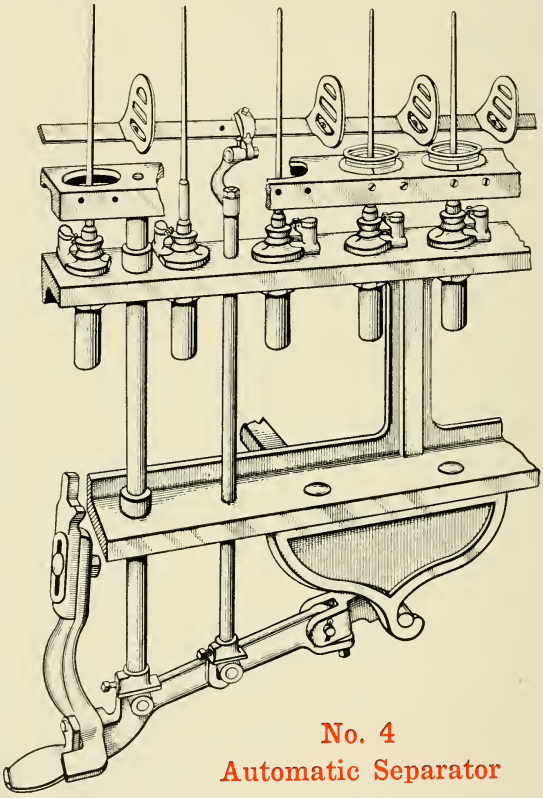
If desired our frames may be equipped with the **Whitin Traveller Magazine.** This little device, as shown in the illustration, fills a long-felt want among ring spinners. The travellers are usually put in packages, in which they are found more or less entangled in chains or bunches, although this is more noticeable in the smaller sizes than in the larger. The usual method of keeping the supply of travellers convenient for the operator is to place them in an open cup on the spinning frame, and it is frequently found difficult to disengage a single traveller from the bunch, without some of the others dropping on the floor, and being lost. The use of The Whitin Traveller Magazine prevents this loss, the vibratory motion imparted to the magazine effectually disengaging the travellers, and delivering them, a few at a time, into the receiving cup, convenient to the hand of the operator. The receptacle in the magazine is provided with an adjustable delivery to suit different sizes of travellers.



Traveller Magazine.

To anyone contemplating the purchase of new frames, we heartily advocate the adoption of wider gauges than has been customary heretofore to use, in order to dispense with the use of separators, which with narrow gauge frames are a necessary

evil. By the use of separators the yarn must receive some damage due to its whipping contact with the separator blades. To eliminate this evil, we recommend WIDE GAUGE FRAMES as, by eliminating the whip against the separator it can be readily appreciated that a higher spindle speed can be run and a better quality of yarn obtained. In the same floor space, wide gauge frames will give a yarn production equal to that produced on narrow gauge frames with more spindles, provided the gauge of the wide space frame is properly adapted to the number of the yarn. Also, a better quality of yarn is produced at a less cost. If narrow gauge frames are ordered, we can furnish our



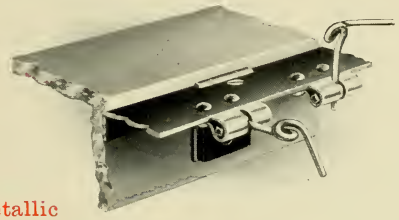
No. 4
Automatic Separator

No. 4 Automatic Separator, which is designed for use on frames having a long traverse. The blades of stamped steel are

fastened to a rod, hinged to brackets on top of auxiliary lifting rods which have a vertical reciprocating movement due to motion transmitted through the regular builder mechanism cross shaft, as will be readily understood by reference to the illustration. When doffing, the separator blades may be conveniently and quickly turned back out of the way.

The frames are equipped with **Thread Boards** of highly polished hard wood, unless metallic thread boards are ordered.

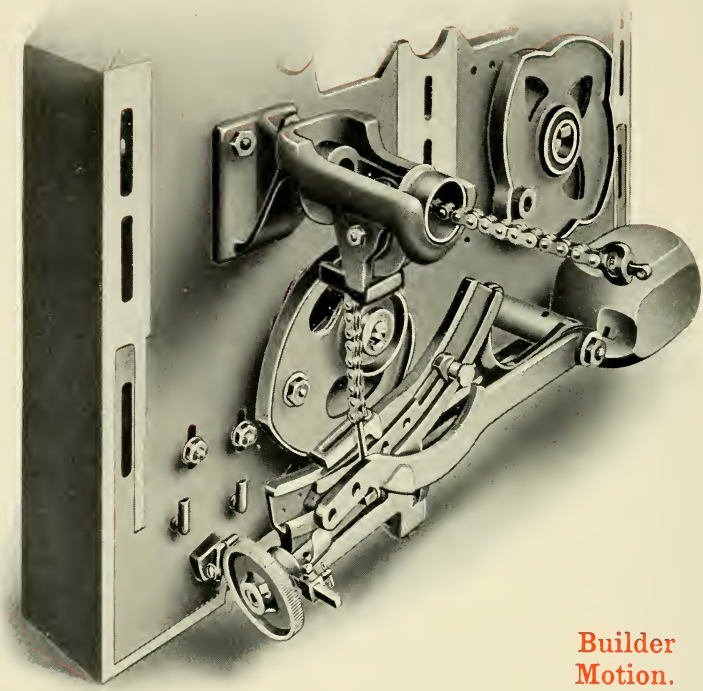
The **Whitin Patent Metallic Thread Board** is an important improvement to our frames. It consists of a sheet-metal back, to which are fastened the thread guide pintal holders. This construction readily allows for lifting up each individual guide, or all the guides at once, as is required.



Metallic Thread Board.

The thread guide can be accurately adjusted to the center of the spindle by moving its shank in or out of a hole in the pintal. When correctly adjusted, it is fastened in a permanent position by means of a set screw at one end of pintal. A simple and effective thread board lifter is also provided.

The **Builder Motion** is arranged for either warp or filling, or both, as desired. The change from warp to filling, or vice versa, is easily accomplished in a few minutes time. The traverses are from 4″ to 8″. Our PATENT LOCKING device is applied for locking the ring rail during the operation of doffing. It is located so as to be conveniently operated by the foot of the spinner before proceeding to doff. It consists of an arm pivoted to head cross shaft lifting arm in such a manner that when the lifting arm is depressed, the locking arm locks the ring rail at its lowest point automatically; a further slight depression disengages the arm which then drops back, and the ring rail is free to move.



Builder Motion.

The **Creels** are made either one or two stories for single or double roving, and are adjustable in height for any length of roving bobbin.

The **Driving Pulleys,** varying in size from 9″ diameter to 20″ diameter by 2″ to 4″ face, are placed on the head, or geared end of the frame, unless ordered to be fitted on the foot end. The loose pulley runs on a sleeve, which is integral with the yoke box supporting the pulley arbor. When the belt is on the tight pulley, the loose pulley does not revolve. The frame is equipped with a novel device (patent pending) that furnishes sufficient tension to the belt shipping mechanism to prevent the

belt from creeping from tight pulley on to loose pulley, or vice-versa, and thereby stopping or starting the frame when such change is not desired. Liability of accident to an operator while changing the gearing, by the unexpected starting of the frame, is avoided by the use of a locking device applied to the belt shipping mechanism.

If desired the frames may be built to be driven by an **Electric Motor,** either by direct connection with the cylinder or by gearing.

The **Cylinders** are substantially made, 7″ or 8″ diameter, in short lengths of the best grade of material, and are well balanced for high speeds. Where spindle whirls are larger than ⅞″ in diameter we would advise the use of an 8″ diameter cylinder provided, however, that the required spindle speed does not necessitate abnormal speed and sizes of counter shaft pulleys. The cylinder journals run in self-oiling bearings which require oiling but once a week. By our improved setting of the boxes, the cylinders may be taken from the frame for repairs and put back again without any re-adjustment. The support of the outside end of the pulley arbor serves also as a guard for the pulley and belt.

Horse Power. The power consumed by spinning frames depends on several varying factors, viz: the number of yarn, the weight and speed of the spindles, the length of the traverse, the diameter of the rings, the band pull, and the lubrication. Owing to these varying elements it is impossible to set up a standard that will answer all requirements. On pages 112 and 113 we have tabulated the results of some power tests taken in our Engineering Department in 1904. These results can be relied upon only where similar conditions exist.

Weights. Shipping Weight, 250 pounds per foot; net weight, 220 pounds per foot.

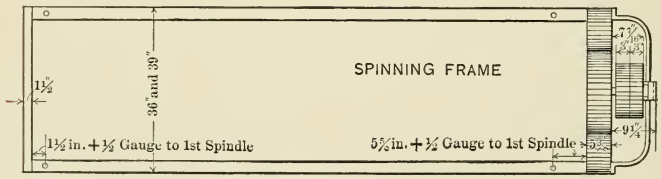
The **Frames** are built in two widths, 36 and 39 inches; gauges and lengths over all as per following table:

Whitin Spinning Frame.

Floor Space:—Widths 36 and 39 inches, and Lengths over all for Standard Frames as follows:—

Number of Spindles.	Space 4 in.		Space 3¾ in.		Space 3½ in.		Space 3¼ in.		Space 3 in.		Space 2¾ in.		Space 2⅝ in.		Space 2½ in.		Number of Spindles
	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.	
112											14	10	14	3	13	8	112
120	22	0	20	9	19	6	18	3	17	0							120
128											16	8	16	0	15	4	128
132	24	0	22	7	21	3	19	10	18	6							132
144	26	0	24	6	23	0	21	6	20	0	18	6	17	9	17	0	144
156	28	0	26	4	24	9	23	1	21	6							156
160											20	4	19	6	18	8	160
168	30	0	28	3	26	6	24	9	23	0							168
176											22	2	21	3	20	4	176
180	32	0	30	1	28	3	26	4	24	6							180
192	34	0	32	0	30	0	28	0	26	0	24	0	23	0	22	0	192
204	36	0	33	10	31	9	29	7	27	6							204
208											25	10	24	9	23	8	208
216	38	0	35	9	33	6	31	3	29	0							216
224											27	8	26	6	25	4	224
228	40	0	37	7	35	3	32	10	30	6							228
240	42	0	39	6	37	0	34	6	32	0	29	6	28	3	27	0	240
252			41	4	38	9	36	1	33	6							252
256											31	4	30	0	28	8	256
264					40	6	37	9	35	0							264
272											33	2	31	9	30	4	272
276					42	3	39	4	36	6							276
288							41	0	38	0	35	0	33	6	32	0	288
300							42	7	39	6							300
304											36	10	35	3	33	8	304
312									41	0							312
320											38	8	37	0	35	4	320
336											40	6	38	9	37	0	336
352											42	4	40	6	38	8	352

Above lengths are for 3″ Face Pulleys:- for 3½″ Face add 1″ – for 4″ Face add 2″.



FLOOR PLAN.

Speed Table

Giving Revolutions per Minute of 7 inch Cylinder Required to Produce Various Spindle Speeds.

R.P.M. OF SPINDLES	Revolutions per Minute of 7 inch Cylinder with							
	¾ inch Whirl Ratio 8.33	1 3/8 inch Whirl Ratio 7.68	⅞ inch Whirl Ratio 7.25	1 1/8 inch Whirl Ratio 6.62	1 inch Whirl Ratio 6.24	1 1/16 inch Whirl Ratio 5.86	1 1/4 inch Whirl Ratio 5.43	1 5/16 inch Whirl Ratio 4.80
4000						683	737	833
4100						700	755	854
4200						717	773	875
4300						734	792	896
4400						751	810	917
4500					721	768	829	938
4600					737	785	847	958
4700					753	802	866	979
4800					769	819	884	1000
4900					781	836	902	1021
5000				755	801	853	921	1042
5100				770	817	870	939	1063
5200				785	833	887	957	1083
5300				801	849	904	976	1104
5400				816	865	921	994	1125
5500			759	831	881	938	1013	1146
5600			772	846	897	956	1031	1167
5700			786	861	913	973	1050	1188
5800			800	876	929	990	1068	1208
5900			814	891	946	1007	1087	1224
6000		781	828	906	962	1024	1105	1250
6100		794	841	921	978	1041	1123	1271
6200		807	855	936	994	1058	1142	1292
6300		820	869	952	1010	1075	1160	1313
6400		833	883	967	1026	1092	1179	1333
6500	780	846	897	982	1042	1109	1197	1354
6600	792	859	910	997	1058	1126	1215	1375
6700	804	872	924	1012	1074	1143	1234	1396
6800	816	885	938	1027	1090	1160	1252	1417
6900	828	898	952	1042	1106	1177	1271	1438
7000	840	911	966	1057	1122	1195	1289	1459
7100	852	924	979	1072	1138	1212	1308	1470
7200	864	937	993	1088	1154	1229	1326	1491
7300	876	950	1007	1103	1170	1246	1344	1512
7400	888	963	1021	1118	1186	1263	1363	1533
7500	900	976	1034	1133	1202	1280	1381	
7600	912	989	1048	1148	1218	1297	1400	
7700	924	1002	1062	1163	1234	1314	1418	
7800	936	1015	1076	1178	1250	1331	1436	
7900	948	1028	1090	1193	1266	1348	1455	

Speed Table

Giving Revolutions per Minute of 7 inch Cylinder Required to Produce Various Spindle Speeds.

R.P.M. OF SPINDLES	Revolutions per Minute of 7 inch Cylinder with							
	$\frac{3}{4}$ inch Whirl Ratio 8.33	$\frac{13}{16}$ inch Whirl Ratio 7.68	$\frac{7}{8}$ inch Whirl Ratio 7.25	$\frac{15}{16}$ inch Whirl Ratio 6.62	1 inch Whirl Ratio 6.24	$1\frac{1}{16}$ inch Whirl Ratio 5.86	$1\frac{1}{8}$ inch Whirl Ratio 5.43	$1\frac{5}{16}$ inch Whirl Ratio 4.80
8000	960	1041	1103	1208	1282	1365	1473	
8100	972	1054	1117	1223	1298	1382	1491	
8200	984	1067	1131	1239	1314	1399	1509	
8300	996	1080	1145	1254	1330	1416	1527	
8400	1008	1093	1159	1269	1346	1433	1545	
8500	1020	1106	1172	1284	1362	1450		
8600	1032	1119	1186	1299	1378	1467		
8700	1044	1132	1200	1314	1394	1484		
8800	1056	1145	1214	1329	1410	1501		
8900	1068	1158	1228	1344	1426	1518		
9000	1080	1171	1241	1360	1442			
9100	1092	1184	1255	1375	1458			
9200	1104	1197	1269	1390	1474			
9300	1116	1210	1283	1405	1490			
9400	1128	1223	1297	1420	1506			
9500	1140	1236	1310	1435				
9600	1152	1249	1324	1450				
9700	1164	1262	1338	1465				
9800	1176	1275	1352	1480				
9900	1188	1288	1366	1495				
10000	1200	1301	1379					
10100	1212	1314	1393					
10200	1224	1327	1407					
10300	1236	1340	1421					
10400	1248	1353	1435					
10500	1260	1366	1449					
10600	1272	1379	1463					
10700	1284	1392	1477					
10800	1296	1405	1491					
10900	1308	1418	1505					
11000	1320	1431						
11100	1332	1444						
11200	1344	1457						
11300	1356	1470						
11400	1368	1483						
11500	1380							
11600	1392							
11700	1404							
11800	1416							
11900	1428							
12000	1440							

Speed Table

Giving Revolutions per Minute of 8 inch Cylinder Required to Produce Various Spindle Speeds.

R.P.M. OF SPINDLES	Revolutions per Minute of 8 inch Cylinder with							
	¾ inch Whirl Ratio 9.52	13/16 inch Whirl Ratio 8.91	⅞ inch Whirl Ratio 8.28	15/16 inch Whirl Ratio 7.67	1 inch Whirl Ratio 7.08	1 1/16 inch Whirl Ratio 6.80	1 ⅛ inch Whirl Ratio 6.22	1 5/16 inch Whirl Ratio 5.48
4000						588	643	730
4100						603	659	748
4200						618	675	766
4300						632	691	785
4400						647	707	803
4500					636	662	723	821
4600					650	676	740	840
4700					664	691	756	858
4800					678	706	772	876
4900					692	721	788	894
5000				652	706	735	804	912
5100				665	720	750	820	930
5200				678	734	765	836	949
5300				691	749	779	852	967
5400				704	761	794	868	985
5500			664	717	777	809	884	1004
5600			676	730	791	824	900	1022
5700			688	743	805	838	916	1040
5800			700	756	819	853	932	1058
5900			712	769	833	868	949	1077
6000		673	725	782	847	882	965	1095
6100		684	737	795	862	897	981	1113
6200		695	748	808	876	912	997	1131
6300		706	761	821	890	926	1013	1150
6400		717	773	834	904	941	1029	1168
6500	683	728	785	847	918	956	1045	1186
6600	693	739	797	860	932	971	1061	1205
6700	704	750	809	874	946	985	1077	1223
6800	714	761	821	887	961	1000	1093	1241
6900	724	772	833	900	975	1014	1109	1259
7000	734	783	845	913	989	1029	1125	1277
7100	744	794	857	926	1003	1044	1141	1296
7200	754	805	870	939	1017	1059	1158	1314
7300	764	816	882	952	1031	1074	1172	1332
7400	774	827	894	965	1045	1088	1190	1350
7500	784	838	906	978	1059	1103	1206	1369
7600	794	849	918	991	1073	1118	1222	1387
7700	804	860	930	1004	1088	1132	1238	1405
7800	814	871	942	1017	1102	1147	1254	1423
7900	824	882	954	1030	1116	1162	1270	1442

Speed Table

Giving Revolutions per Minute of 8 Inch Cylinder Required to Produce Various Spindle Speeds.

R.P.M. OF SPINDLES	Revolutions per Minute of 8 inch Cylinder with							
	$\frac{3}{4}$ inch Whirl Ratio 9.52	$\frac{13}{16}$ inch Whirl Ratio 8.91	$\frac{7}{8}$ inch Whirl Ratio 8.28	$\frac{15}{16}$ inch Whirl Ratio 7.67	1 inch Whirl Ratio 7.08	$1\frac{1}{16}$ inch Whirl Ratio 6.80	$1\frac{1}{4}$ inch Whirl Ratio 6.22	$1\frac{5}{16}$ inch Whirl Ratio 5.48
8000	840	898	966	1043	1130	1176	1286	
8100	851	909	978	1056	1144	1191	1302	
8200	862	921	990	1069	1158	1206	1318	
8300	872	932	1002	1082	1172	1221	1334	
8400	882	943	1014	1095	1186	1235	1350	
8500	893	954	1027	1108	1201	1250	1367	
8600	904	965	1039	1121	1215	1265	1383	
8700	915	976	1051	1134	1229	1279	1399	
8800	925	988	1063	1147	1243	1294	1415	
8900	935	999	1075	1160	1257	1309	1431	
9000	945	1010	1087	1173	1271	1324		
9100	956	1021	1099	1186	1285	1338		
9200	966	1032	1111	1199	1299	1353		
9300	977	1044	1123	1213	1314	1368		
9400	988	1055	1135	1226	1328	1382		
9500	998	1066	1147	1239	1342			
9600	1009	1077	1159	1252	1356			
9700	1019	1088	1171	1265	1370			
9800	1029	1100	1183	1278	1384			
9900	1040	1111	1195	1291	1398			
10000	1050	1122	1208	1304				
10100	1061	1133	1220	1317				
10200	1071	1144	1232	1330				
10300	1082	1156	1244	1343				
10400	1092	1167	1256	1356				
10500	1103	1178	1268					
10600	1113	1189	1280					
10700	1124	1200	1202					
10800	1134	1212	1304					
10900	1144	1223	1316					
11000	1155	1235						
11100	1166	1246						
11200	1176	1257						
11300	1187	1269						
11400	1197	1280						
11500	1208							
11600	1219							
11700	1229							
11800	1240							
11900	1250							
12000	1261							

Traveller Table

For Whitin Ring Spinning Frames with Separators.

Warp Yarn.					Filling Yarn.				
Number of Yarn.	Revolutions of Spindles.	Diameter of Ring.	Number of Traveller.	Weight of 10 Travellers in grains.	Number of Yarn.	Revolutions of Spindles.	Diameter of Ring.	Number of Traveller.	Weight of 10 Travellers in grains.
4	4950	2″	14	39	4	4000	1½″	16	44
6	5900		12	33	6	4800		13	36
8	6700		9	23	8	5450		10	26
10	7250		8	20	10	5950		8	20
11	7500		7	18	11	6150		7	18
12	7750		6	16	12	6350		6	16
13	7950		6	16	13	6500		5	14
14	8100		5	14	14	6700		4	13
15	8300		4	13	15	6850		3	12
16	8450		3	12	16	6950		2	11
17	8600		2	11	17	7100		1	10
18	8750		1	10	18	7200		1-0	9
19	8850		1-0	9	19	7300		3-0	8
20	8900		2-0	8½	20	7400		5-0	7
21	9050		3-0	8	21	7500		5-0	
22	9100		4-0	7½	22	7600		6-0	6½
23	9150		5-0	7	23	7700		6-0	
24	9200		6-0	6½	24	7800		7-0	6
28	9500	1¾″	7-0	6	28	7900	1⅜″	8-0	5½
32	9500		8-0	5½	32	7900		9-0	5
34	9600		9-0	5	34	7900		10-0	4½
36	9700		10-0	4½	36	7900		11-0	4
38	9800		11-0	4	38	7900		12-0	3¾
40	9700	1⅝″	12-0	3¾	40	7900	1¼″	13-0	3½
45	9700	1½″	13-0	3½	45	7900		14-0	3¼
50	9700		14-0	3¼	50	7900		15-0	3
55	9600		14-0		55	7900		15-0	
60	9600		15-0	3	60	7900		16-0	2¾
65	9600		15-0		65	7800		16-0	
70	9500		16-0	2¾	70	7800		17-0	2½
75	9500		16-0		75	7800		17-0	
80	9300		17-0	2½	80	7700		18-0	2¼
85	9100		17-0		85	7600		18-0	
90	9100	1⅜″	18-0	2¼	90	7400		19-0	2
95	9000		19-0	2	95	7400		20-0	1¾
100	8700		20-0	1¾	100	7200		21-0	1½
110	8500		21-0	1½	110	6900		22-0	1¼

Sizes of Travellers will vary from the above table according to variations in speed, quality of cotton, etc., but the table may serve as a basis to select from. The higher the speed the lighter the traveller and vice versa, varying in proportion of one or two grades of travellers to each 1000 revolutions of spindle. Without separators a few grades heavier traveller would be required.

RULES FOR SPINNERS.

One pound is 7000 grains.

One lea is 120 yards long.

One hank is 840 yards long.

The number of the yarn is the number of hanks in one pound.

The hank roving divided by the doublings, and multiplied by the draught equals the number of yarn.

To find hank roving from number of grains per yard:

Dividing 8.33 by the number of grains per yard, equals hank roving.

To find speed of front roll:

Divide revolutions per minute of spindle by the product of the twist per inch, multiplied by the circumference in inches of the front roll.

To find speed of spindles:

Multiply the revolutions of the cylinder by the ratio of speeds of the cylinder and spindle.

Method of finding the cylinder and spindle ratio:

On the foot end of the frame in which it is desired to find the speed ratio, mark with chalk coinciding points on both cylinder and frame. Also mark points in a like manner on the spindle whirl and frame adjacent thereto. Then slowly revolve the cylinder until the chalk marks on both the cylinder and spindle simultaneously coincide with their respective frame marks. With the aid of an assistant, the number of turns of both cylinder and spindle should be carefully taken. The turns

of the spindle divided by the turns of the cylinder gives the ratio desired. To render the result as accurate as possible, the spindle should be driven by a band of a size and tension the same as is used under ordinary working conditions.

To find the twist per inch:

Multiply the square root of the number of yarn by—

4.75 for Frame Warp Yarns
4. for Extra Mule Warp Yarns
3.50 for Frame Filling Yarns
3.25 for Mule Filling Yarns
2.75 for Doubling Yarns
2.50 for Mule Hosiery Yarns
3. for Frame " "

Example.—What is the twist per inch of 25s frame warp yarn?
Answer.—The square root of 25 is 5; therefore, $5 \times 4.75 = 23.75$ turns per inch.

To find the draught:

Counts divided by hank roving equals the draught.
Example.—24s ÷ 3 hank = 8 draught.

To find hank roving:

Counts divided by draught equals hank roving.
Example.—24s divided by 8 draught = 3 hank roving.

To find the counts:

Length of yarn in yards divided by weight in grains equals counts.

To find what per cent. yarn contracts in twisting:

Divide the number of yarn by the product of the draught and hank roving and subtract the quotient from 1.

Example.—No. 20s yarn is being spun from 3 hank roving with a draught of 6.87; then $6.87 \times 3 = 20.61$; $20 \div 20.61 = .97$; therefore, 1—.97 = .03 or 3%.

To find the draught in machine:

The product of the back roll gear, crown gear, and diameter in inches of the front roll, divided by the product of the front roll gear and diameter of the back roll equals the draught constant. Constant divided by change gear equals draught.

Example.—84 teeth back roll gear, 168 teeth crown gear, 1″ diameter of front roll, 30 teeth front roll gear, ⅞″ diameter back roll; what is the draught constant?

$$\frac{84 \times 168 \times 1}{30 \times \frac{7}{8}''} = 537.60 = \text{Draught constant.}$$

To find what change draught gear will be required when changing from one number of yarn to another, without changing the roving:

Multiply the number of teeth in the change draught gear in use by the number of yarn spun. Dividing this product by the number of yarn desired will give the required change draught gear.

Example.—What change draught gear will be required to change from 24s yarn, spun from 3 hank roving using a 32 teeth change draught gear to 20s yarn?

$32 \times 24 = 768$; $768 \div 20 = 38$ teeth change draught gear required.

To find what change draught gear will be required when changing from one number of yarn to another, the draught and roving both being changed:

Multiply the number of yarn being spun by the new hank roving and this product by the number of teeth in the change draught gear being used; divide this product by the number of yarn desired, multiplied by the hank roving being used. The quotient is the change draught gear required.

Example.—What change draught gear will be required to change from 24s yarn spun from 3 hank roving using a 32 teeth change draught gear to 20s yarn from 2.75 hank roving?

$24 \times 2.75 \times 32 = 2112$; $20 \times 3 = 60$; therefore, $2112 \div 60 = 35$ teeth change draught gear required.

To find the twist per inch in machine :

The product of the front roll gear, the stud gear, and the ratio of the spindle to the cylinder, divided by the product of the cylinder gear, and the circumference in inches of the front roll, equals the twist constant. Constant divided by change gear equals twist per inch.

Example.—108 teeth front roll gear, 88 teeth stud gear, 8.33 ratio of $\frac{3}{4}''$ whirl to 7″ cylinder, 22 teeth cylinder gear, $1'' \times 3.1416$ = circ. front roll ; twist constant required ?

$$\frac{108 \times 88 \times 8.33}{22 \times 1'' \times 3.1416} = 1144.99 = \text{Twist Constant}$$

To find what change twist gear will be required when changing from one number of yarn to another :

Square the number of teeth in the change twist gear being used, and multiply by the number of yarn being spun. Divide the product by the number of yarn desired ; the square root of the quotient will be the number of teeth in the change gear required.

Example.—What change twist gear will be required to change from 24s warp yarn, now using a 25 teeth change twist gear to 20s warp yarn ?

$25^2 = 625$; $625 \times 24 = 15000$; $15000 \div 20 = 750$; $\sqrt{750} = 27$ teeth, change twist gear required.

To find the hanks per spindle per day :

Divide the product of the circumference of the front roll, the number of revolutions per minute of the front roll, the number of minutes per hour and the hours per day by the product of the number of inches in one yard and the number of yards in one hank. The resulting quotient is the number of hanks per day per spindle without an allowance being made for stoppages, due to doffing, cleaning and oiling. The following table gives the usual allowances for the different numbers of yarn :

Warp % Allowance	Numbers of Yarn	Filling % Allowance
12	4s to 10s	14
10	10s " 20s	12
9	20s " 30s	10
8	30s " 40s	8
7	40s " 50s	7
6	50s " 60s	6
5	60s " 80s	5
2	80s " 100s	2

Example.—How many hanks of number 20s warp yarn per spindle per 10 hours will be produced by a frame with 1 inch front roll running 100 revolutions per minute?

$$\textit{Answer:}\quad \frac{1 \times 3.1416 \times 100 \times 60 \times 10 \times .90}{36 \times 840} = 5.61 \text{ hanks}$$

To find the pounds per spindle per day:

Divide the number of hanks produced per spindle per day by the number of yarn.

Example.—Taking the above problem,

5.61 hanks ÷ 20 = .28 pounds of 20s warp per day per spindle.

Sizes of Spinning Ring Flanges.

No. 1 flange is $\frac{4}{32}$ inch wide — No. 5 flange is $\frac{8}{32}$ inch wide

" 2 " " $\frac{5}{32}$ " " — " 6 " " $\frac{9}{32}$ " "

" $2\frac{1}{2}$ " " $\frac{11}{64}$ " " — " 7 " " $\frac{10}{32}$ " "

" 3 " " $\frac{6}{32}$ " " — " 8 " " $\frac{11}{32}$ " "

" 4 " " $\frac{7}{32}$ " " — " 9 " " $\frac{12}{32}$ " "

No. 10 flange is $\frac{13}{32}$ inch wide

Weight of yarn on bobbins:

$2\frac{1}{2}$" diameter ring,	7" traverse,	3.875 ozs. of cotton		
$2\frac{1}{4}$" "	"	7" "	3.325 "	"
2" "	"	6" "	2.8 "	"
$1\frac{3}{4}$" "	"	6" "	2.00 "	"
$1\frac{5}{8}$" "	"	5" "	1.30 "	"
$1\frac{1}{2}$" "	"	5" "	1.25 "	"

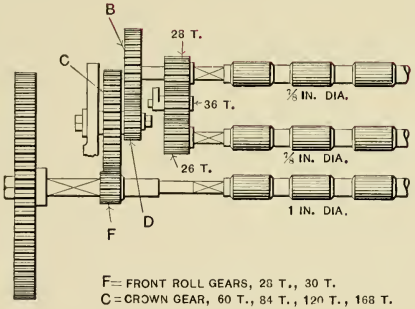
Table for Numbering Yarn by Grains.

No. of Yarn.	Grains per Hank.	No. of Yarn.	Grains per Hank.	No. of Yarn.	Grains per Hank.
9	777.77	20¼	344.44	31½	222.22
9¼	756.75	20½	341.46	31¾	220.47
9½	736.84	20¾	337.34	32	218.75
9¾	720.51	21	333.33	32¼	217.05
10	700.00	21¼	329.41	32½	215.38
10¼	682.92	21½	325.58	32¾	213.74
10½	666.66	21¾	321.83	33	212.12
10¾	651.16	22	318.18	33¼	210.52
11	636.36	22¼	314.60	33½	208.95
11¼	622.22	22½	311.11	33¾	207.40
11½	608.69	22¾	307.69	34	205.88
11¾	595.74	23	304.34	34¼	204.30
12	583.33	23¼	301.07	34½	202.89
12¼	571.42	23½	297.87	34¾	201.43
12½	560.00	23¾	294.73	35	200.00
12¾	549.01	24	291.66	35¼	198.58
13	546.15	24¼	288.65	35½	197.32
13¼	526.11	24½	285.71	35¾	195.80
13½	518.51	24¾	282.82	36	194.44
13¾	509.09	25	280.00	36¼	193.10
14	500.00	25¼	277.22	36½	191.78
14¼	491.22	25½	274.50	36¾	190.47
14½	482.75	25¾	271.84	37	189.18
14¾	474.57	26	269.23	37¼	187.91
15	466.66	26¼	266.66	37½	186.66
15¼	459.01	26½	264.15	37¾	185.42
15½	451.61	26¾	261.68	38	184.21
15¾	444.44	27	259.25	38¼	183.00
16	437.50	27¼	256.88	38½	181.81
16¼	430.76	27½	254.54	38¾	180.63
16½	424.24	27¾	252.52	39	179.48
16¾	417.91	28	250.00	39¼	178.34
17	411.76	28¼	247.78	39½	177.21
17¼	405.79	28½	245.61	39¾	176.10
17½	400.00	28¾	243.46	40	175.00
17¾	394.36	29	241.37	40¼	173.91
18	388.88	29¼	239.31	40½	172.83
18¼	383.56	29½	237.28	40¾	171.77
18½	378.37	29¾	235.29	41	170.73
18¾	373.33	30	233.33	41¼	169.69
19	368.42	30¼	231.40	41½	168.67
19¼	363.63	30½	229.50	41¾	167.66
19½	358.97	30¾	227.64	42	166.66
19¾	354.43	31	225.80	42¼	165.68
20	350.00	31¼	224.08	42½	164.70

Table for Numbering Yarn by Grains.

No. of Yarn.	Grains per Hank.	No. of Yarn.	Grains per Hank.	No. of Yarn.	Grains per Hank.
42¾	163.74	54	129.62	81	86.40
43	162.79	54¼	129.03	82	85.40
43¼	161.84	54½	128.44	83	84.30
43½	160.91	54¾	127.85	84	83.30
43¾	160.00	55	127.27	85	82.40
44	159.09	55¼	126.69	86	81.40
44¼	158.19	55½	126.12	87	80.40
44½	157.41	55¾	125.56	88	79.50
44¾	156.42	56	125.00	89	78.60
45	155.55	56¼	124.49	90	77.80
45¼	154.69	56½	123.89	91	76.90
45½	153.84	56¾	123.34	92	76.10
45¾	152.95	57	122.80	93	75.30
46	152.17	57¼	122.27	94	74.50
46¼	151.30	57½	121.73	95	73.70
46½	150.53	57¾	121.21	96	72.90
46¾	149.73	58	120.68	97	72.30
47	148.93	58¼	120.17	98	71.40
47¼	148.14	58½	119.65	99	70.70
47½	147.34	58¾	119.14	100	70.00
47¾	146.59	59	118.47	105	66.70
48	145.83	59¼	118.14	110	63.60
48¼	145.07	59½	117.64	115	60.90
48½	144.32	59¾	117.15	120	58.30
48¾	143.58	60	116.66	125	56.00
49	142.85	61	114.80	130	53.80
49¼	142.13	62	112.90	135	51.80
49½	141.41	63	111.10	140	50.00
49¾	140.70	64	109.30	145	48.30
50	140.00	65	107.70	150	46.70
50¼	139.30	66	106.10	155	45.20
50½	138.61	67	104.40	160	43.80
50¾	137.93	68	102.90	165	42.40
51	137.29	69	101.40	170	41.20
51¼	136.58	70	100.00	175	40.00
51½	135.92	71	98.60	180	38.90
51¾	135.26	72	97.20	185	37.80
52	134.61	73	95.90	190	36.80
52¼	133.97	74	94.60	195	35.90
52½	133.33	75	93.30	200	35.00
52¾	132.70	76	92.10		
53	132.07	77	90.90		
53¼	131.45	78	89.70		
53½	130.84	79	88.60		
53¾	130.23	80	87.50		

GEARING DIAGRAMS AND FORMULA FOR FIGURING DRAUGHT.



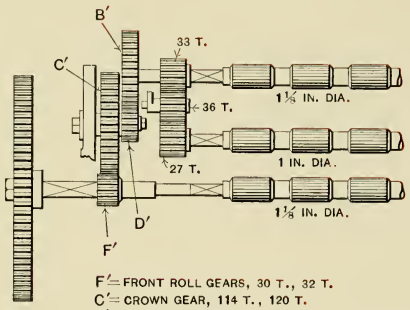
F = FRONT ROLL GEARS, 28 T., 30 T.
C = CROWN GEAR, 60 T., 84 T., 120 T., 168 T.
D = DRAUGHT GEAR, 26-60 T.
B = BACK ROLL GEAR 84 T.
1″ = DIA. OF FRONT ROLL
.875″ = DIA. OF BACK ROLL

$$\frac{C \times B \times 1}{F \times D \times .875} \text{ OR } \frac{C \times B \times 8}{F \times D \times 7} = \text{DRAUGHT}$$

$$\frac{C \times B \times 1}{F \times .875} \text{ OR } \frac{C \times B \times 8}{F \times 7} = \text{DRAUGHT CONSTANT}$$

$$\frac{\text{DRAUGHT CONSTANT}}{\text{DRAUGHT}} = \text{DRAUGHT GEAR}$$

$$\frac{\text{DRAUGHT CONSTANT}}{\text{DRAUGHT GEAR}} = \text{DRAUGHT}$$



F′ = FRONT ROLL GEARS, 30 T., 32 T.
C′ = CROWN GEAR, 114 T., 120 T.
D′ = DRAUGHT GEAR, 26 T.-60 T.
B′ = BACK ROLL GEAR 80 T., 84 T.
1.125″ = DIA. OF FRONT ROLL
1.125″ = DIA. OF BACK ROLL

$$\frac{C' \times B' \times 1.125}{F' \times D' \times 1.125} = \text{DRAUGHT}$$

$$\frac{C' \times B' \times 1.125}{F' \times 1.125} = \text{DRAUGHT CONSTANT}$$

$$\frac{\text{DRAUGHT CONSTANT}}{\text{DRAUGHT}} = \text{DRAUGHT GEAR}$$

$$\frac{\text{DRAUGHT CONSTANT}}{\text{DRAUGHT GEAR}} = \text{DRAUGHT}$$

Draught Gearing Constants.

Diameter of { Front Roll 1 in. / Back Roll ⅞ in.		Constant
Front Roll Gear,	28 T.	
Back Roll Gear,	84 T.	
Crown Gear,	84 T.	288.00
Front Roll Gear,	30 T.	
Back Roll Gear,	84 T.	
Crown Gear,	84 T.	268.80
Front Roll Gear,	30 T.	
Back Roll Gear,	84 T.	
Crown Gear,	168 T.	537.60
Front Roll Gear,	30 T.	
Back Roll Gear,	84 T.	
Crown Gear,	60 T.	192.00
Front Roll Gear,	30 T.	
Back Roll Gear,	84 T.	
Crown Gear,	120 T.	384.00

Diameter of { Front Roll 1⅛ in. / Back Roll 1⅛ in.		Constant
Front Roll Gear,	30 T.	
Back Roll Gear,	84 T.	
Crown Gear,	120 T.	336.00
Front Roll Gear,	32 T.	
Back Roll Gear,	80 T.	
Crown Gear,	114 T.	285.00

Rule:—To find Change Gear:—Divide Constant by Draught required.

Spinning Draught Gear Table.

Change Gears	Front Roll 1 in. Dia. Back Roll $\frac{7}{8}$ in. Dia. F.R.G 28T B.R.G 84T 84T Crown Gear	Front Roll Gear 30T. Back Roll Gear 84T. 60T Crown Gear	84T Crown Gear	120 T. Crown Gear	168 T. Crown Gear	F. R. $1\frac{1}{4}$ in. Dia. B. R. $1\frac{1}{8}$ in. Dia. F.R.G 30T B.R G 84T 120T Crown Gear	F.R.G 32T B.R.G 80T 114 T Crown Gear
	Draught.	Draught.	Draught.	Draught.	Draught.	Draught.	Draught.
26T	11.07	7.38	10.33	14.77		12.92	10.96
27		7.11		14.22		12.44	10.55
28	10.28	6.85	9.60	13.71		12.00	10.17
29		6.62		13.24		11.58	9.82
30	9.60	6.40	8.96	12.80	17.92	11.20	9.50
31		6.19		12.38		10.83	9.19
32	9.00	6.00	8.40	12.00	16.80	10.50	8.90
33		5.81		11.63		10.18	8.63
34	8.47	5.64	7.90	11.29	15.81	9.88	8.38
35		5.48		10.97		9.60	8.14
36	8.00	5.33	7.46	10.66	14.93	9.33	7.91
37		5.18		10.37		9.08	7.70
38	7.57	5.05	7.07	10.10	14.14	8.84	7.50
39		4.92		9.84		8.61	7.30
40	7.20	4.80	6.72	9.60		8.40	7.12
41		4.68		9.36	13.11	8.19	6.95
42	6.85	4.57	6.40	9.14		8.00	6.78
43				8.93		7.81	6.62
44	6.54		6.10		12.21		
45				8.53		7.46	6.33
46	6.26		5.84				
47					11.43		
48	6.00		5.60	8.00		7.00	5.93
50	5.76		5.37	7.68	10.75	6.72	5.70
52	5.53		5.16	7.38		6.46	5.48
53					10.14		
54	5.33		4.97	7.11		6.22	5.27
56	5.14		4.80	6.85	9.60	6.00	5.08
58	4.96		4.63	6.62		5.79	4.91
59					9.11		
60				6.40		5.60	4.75
62					8.67		
67					8.02		
72					7.46		
77					6.98		
82					6.55		
Const's	288.00	192.00	268.80	384.00	537.60	336.00	285.00

Twist Tables.

Counts or Numbers.	Square Root.	Frame Warp Twist.	Extra Mule Warp Twist.	Frame Filling Twist.	Mule Filling Twist.	Twist for Doubling.	Hosiery Yarn.
1	1.0000	4.75	4.00	3.50	3.25	2.75	2.50
2	1.4142	6.72	5.66	4.95	4.60	3.89	3.53
3	1.7320	8.23	6.93	6.06	5.63	4.76	4.33
4	2.0000	9.50	8.00	7.00	6.50	5.50	5.00
5	2.2360	10.62	8.94	7.83	7.27	6.15	5.59
6	2.4494	11.63	9.80	8.57	7.96	6.73	6.12
7	2.6457	12.56	10.58	9.26	8.60	7.27	6.61
8	2.8284	13.43	11.31	9.90	9.19	7.78	7.07
9	3.0000	14.25	12.00	10.50	9.75	8.25	7.50
10	3.1622	15.02	12.65	11.07	10.27	8.69	7.90
11	3.3166	15.75	13.26	11.61	10.78	9.12	8.29
12	3.4641	16.45	13.86	12.12	11.26	9.52	8.66
13	3.6055	17.12	14.42	12.62	11.72	9.91	9.01
14	3.7416	17.77	14.96	13.10	12.16	10.29	9.35
15	3.8729	18.39	15.49	13.56	12.59	10.65	9.68
16	4.0000	19.00	16.00	14.00	13.00	11.00	10.00
17	4.1231	19.58	16.49	14.43	13.40	11.34	10.31
18	4.2426	20.15	16.97	14.85	13.79	11.66	10.60
19	4.3588	20.70	17.43	15.26	14.17	11.98	10.89
20	4.4721	21.24	17.89	15.65	14.53	12.30	11.18
21	4.5825	21.76	18.33	16.04	14.89	12.60	11.46
22	4.6904	22.27	18.76	16.42	15.24	12.89	11.73
23	4.7958	22.78	19.80	16.79	15.59	13.19	11.99
24	4.8989	23.27	19.59	17.15	15.92	13.47	12.25
25	5.0000	23.75	20.00	17.50	16.25	13.75	12.50
26	5.0990	24.22	20.39	17.85	16.57	14.02	12.75
27	5.1961	24.68	20.78	18.19	16.89	14.29	12.99
28	5.2915	25.13	21.16	18.52	17.20	14.55	13.23
29	5.3851	25.58	21.54	18.85	17.50	14.81	13.46
30	5.4772	26.02	21.91	19.17	17.80	15.06	13.69
31	5.5677	26.44	22.27	19.49	18.10	15.31	13.92
32	5.6568	26.87	22.63	19.80	18.38	15.55	14.14
33	5.7445	27.28	22.98	20.11	18.67	15.80	14.36
34	5.8309	27.69	23.32	20.41	18.95	16.03	14.58
35	5.9160	28.10	23.66	20.71	19.23	16.27	14.79
36	6.0000	28.50	24.00	21.00	19.50	16.50	15.00
37	6.0827	28.89	24.33	21.29	19.77	16.72	15.21
38	6.1644	29.28	24.66	21.58	20.03	16.95	15.41
39	6.2449	29.66	24.98	21.86	20.30	17.17	15.61
40	6.3245	30.04	25.30	22.14	20.55	17.39	15.81
41	6.4031	30.42	25.61	22.41	20.81	17.61	16.01
42	6.4807	30.78	25.92	22.68	21.06	17.82	16.20
43	6.5574	31.14	26.23	22.95	21.31	18.03	16.39
44	6.6332	31.50	26.53	23.22	21.56	18.24	16.58
45	6.7082	31.86	26.83	23.48	21.80	18.45	16.77
46	6.7823	32.21	27.13	23.74	22.04	18.65	16.96
47	6.8556	32.56	27.42	23.99	22.28	18.85	17.14
48	6.9282	32.90	27.71	24.25	22.52	19.05	17.32
49	7.0000	33.25	28.00	24.50	22.75	19.25	17.50
50	7.0710	33.58	28.28	24.75	22.98	19.44	17.68

Twist Tables. Continued.

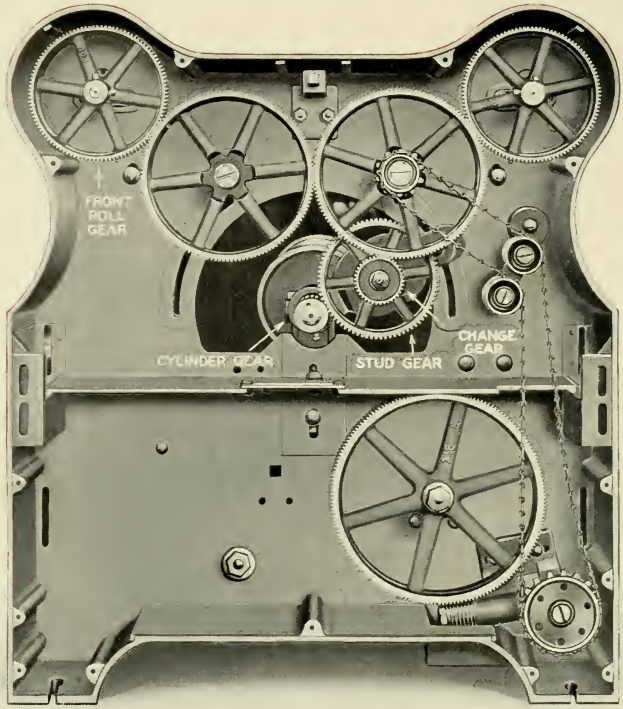
Counts or Numbers.	Square Root.	Frame Warp Twist.	Extra Mule Warp Twist.	Frame Filling Twist.	Mule Filling Twist.	Twist for Doubling.	Hosiery Yarn.
51	7.1414	33.92	28.56	24.99	23.21	19.64	17.85
52	7.2111	34.25	28.84	25.24	23.44	19.83	18.03
53	7.2801	34.58	29.12	25.48	23.66	20.02	18.20
54	7.3484	34.90	29.39	25.72	23.88	20.21	18.37
55	7.4161	35.22	29.66	25.96	24.10	20.39	18.54
56	7.4833	35.54	29.93	26.19	24.32	20.58	18.71
57	7.5498	35.86	30.20	26.42	24.53	20.76	18.87
58	7.6157	36.17	30.46	26.66	24.75	20.94	19.04
59	7.6811	36.48	30.72	26.88	24.96	21.12	19.20
60	7.7459	36.79	30.98	27.11	25.16	21.30	19.36
61	7.8102	37.10	31.24	27.34	25.38	21.48	
62	7.8740	37.40	31.49	27.56	25.59	21.65	
63	7.9372	37.70	31.74	27.78	25.79	21.83	
64	8.0000	38.00	32.00	28.00	26.00	22.00	
65	8.0622	38.29	32.25	28.22	26.20	22.17	
66	8.1240	38.59	32.49	28.43	26.40	22.34	
67	8.1853	38.88	32.74	28.65	26.60	22.51	
68	8.2462	39.16	32.98	28.86	26.80	22.68	
69	8.3066	39.46	33.22	29.07	26.99	22.84	
70	8.3666	39.74	33.46	29.28	27.19	23.01	
71	8.4261	40.02	33.70	29.49	27.38	23.17	
72	8.4852	40.30	33.94	29.70	27.58	23.33	
73	8.5440	40.58	34.17	29.90	27.77	23.50	
74	8.6023	40.86	34.41	30.11	27.96	23.65	
75	8.6602	41.14	34.64	30.31	28.14	23.81	
76	8.7177	41.41	34.87	30.51	28.33	23.97	
77	8.7749	41.68	35.09	30.71	28.51	24.13	
78	8.8317	41.95	35.32	30.91	28.70	24.28	
79	8.8881	42.22	35.55	31.11	28.89	24.44	
80	8.9442	42.48	35.77	31.30	29.07	24.60	
81	9.0000	42.75	36.00	31.50	29.25	24.75	
82	9.0553	43.01	36.22	31.69	29.43	24.90	
83	9.1104	43.27	36.44	31.89	29.61	25.05	
84	9.1651	43.53	36.66	32.08	29.79	25.20	
85	9.2195	43.79	36.88	32.27	29.96	25.35	
86	9.2736	44.05	37.09	32.46	30.14	25.50	
87	9.3273	44.30	37.31	32.65	30.31	25.65	
88	9.3808	44.56	37.52	32.83	30.48	25.79	
89	9.4339	44.81	37.73	33.02	30.66	25.94	
90	9.4868	45.06	37.95	33.20	30.83	26.09	
91	9.5393	45.31	38.16	33.39	31.00	26.23	
92	9.5916	45.56	38.36	33.57	31.17	26.37	
93	9.6436	45.80	38.57	33.75	31.34	26.52	
94	9.6953	46.05	38.78	33.93	31.51	26.66	
95	9.7467	46.30	38.98	34.11	31.67	26.80	
96	9.7979	46.54	39.19	34.29	31.84	26.94	
97	9.8488	46.78	39.39	34.47	32.01	27.08	
98	9.8994	47.02	39.60	34.65	32.17	27.22	
99	9.9498	47.26	39.80	34.82	32.33	27.36	
100	10.0000	47.50	40.00	35.00	32.50	27.50	

Twist Tables. Continued.

Counts or Numbers.	Square Root.	Frame Warp Twist.	Extra Mule Warp Twist.	Frame Filling Twist.	Mule Filling Twist.	Twist for Doubling.	Hosiery Yarn.
101	10.0499	47.74	40.20	35.17	32.66	27.64	
102	10.0995	47.97	40.40	35.35	32.82	27.77	
103	10.1489	48.21	40.60	35.52	32.98	27.91	
104	10.1980	48.44	40.79	35.69	33.14	28.04	
105	10.2470	48.67	40.99	35.86	33.30	28.18	
106	10.2956	48.90	41.18	36.03	33.46	28.31	
107	10.3441	49.13	41.38	36.20	33.62	28.44	
108	10.3923	49.36	41.57	36.37	33.78	28.58	
109	10.4403	49.59	41.76	36.54	33.93	28.71	
110	10.4881	49.82	41.95	36.71	34.09	28.84	
111	10.5357	50.04	42.14	36.87	34.24	28.97	
112	10.5830	50.27	42.33	37.04	34.39	29.10	
113	10.6301	50.49	42.52	37.21	34.55	29.23	
114	10.6771	50.72	42.71	37.37	34.70	29.36	
115	10.7238	50.94	42.90	37.53	34.85	29.49	
116	10.7703	51.16	43.08	37.70	35.00	29.62	
117	10.8167	51.38	43.27	37.86	35.15	29.75	
118	10.8628	51.60	43.45	38.02	35.30	29.87	
119	10.9087	51.82	43.63	38.18	35.45	30.00	
120	10.9545	52.03	43.82	38.34	35.60	30.12	
121	11.0000	52.25	44.00	38.50	35.75	30.25	
122	11.0454	52.47	44.18	38.66	35.90	30.27	
123	11.0905	52.68	44.36	38.82	36.04	30.50	
124	11.1355	52.89	44.54	38.97	36.19	30.62	
125	11.1803	53.11	44.72	39.13	36.34	30.75	
126	11.2250	53.32	44.90	39.29	36.48	30.87	
127	11.2694	53.53	45.08	39.44	36.63	30.99	
128	11.3137	53.74	45.25	39.60	36.77	31.11	
129	11.3578	53.95	45.43	39.75	36.91	31.23	
130	11.4018	54.16	45.61	39.91	37.06	31.35	
131	11.4455	54.37	45.78	40.06	37.20	31.48	
132	11.4891	54.57	45.96	40.21	37.34	31.60	
133	11.5326	54.78	46.13	40.36	37.48	31.71	
134	11.5758	54.99	46.30	40.52	37.62	31.83	
135	11.6190	55.19	46.48	40.67	37.76	31.95	
136	11.6619	55.39	46.65	40.82	37.90	32.07	
137	11.7047	55.60	46.82	40.97	38.04	32.19	
138	11.7473	55.80	46.99	41.12	38.18	32.31	
139	11.7898	56.00	47.16	41.26	38.32	32.42	
140	11.8322	56.20	47.33	41.41	38.45	32.54	
141	11.8743	56.40	47.50	41.56	38.59	32.65	
142	11.9164	56.60	47.67	41.71	38.73	32.77	
143	11.9583	56.80	47.83	41.85	38.86	32.89	
144	12.0000	57.00	48.00	42.00	39.00	33.00	
145	12.0416	57.20	48.17	42.15	39.14	33.11	
146	12.0830	57.39	48.33	42.29	39.27	33.23	
147	12.1244	57.59	48.50	42.44	39.40	33.34	
148	12.1655	57.79	48.66	42.58	39.54	33.46	
149	12.2066	57.98	48.83	42.72	39.67	33.57	
150	12.2474	58.18	48.99	42.87	39.80	33.68	

Twist Tables. Continued.

Counts or Numbers.	Square Root.	Frame Warp Twist.	Extra Mule Warp Twist.	Frame Filling Twist.	Mule Filling Twist.	Twist for Doubling.	Hosiery Yarn.
151	12.2882	58.37	49.15	43.01	39.94	33.79	
152	12.3288	58.56	49.32	43.15	40.07	33.90	
153	12.3693	58.75	49.48	43.29	40.20	34.02	
154	12.4097	58.95	49.64	43.43	40.33	34.13	
155	12.4499	59.14	49.80	43.57	40.46	34.24	
156	12.4900	59.33	49.96	43.72	40.59	34.35	
157	12.5300	59.52	50.12	43.86	40.72	34.46	
158	12.5698	59.71	50.28	43.99	40.85	34.57	
159	12.6095	59.90	50.44	44.13	40.98	34.68	
160	12.6491	60.08	50.60	44.27	41.11	34.79	
161	12.6886	60.27	50.75	44.41	41.24	34.89	
162	12.7279	60.46	50.91	44.55	41.37	35.00	
163	12.7671	60.64	51.07	44.68	41.49	35.11	
164	12.8062	60.83	51.22	44.82	41.62	35.22	
165	12.8452	61.01	51.38	44.96	41.75	35.32	
166	12.8841	61.20	51.54	45.09	41.87	35.43	
167	12.9228	61.38	51.69	45.23	42.00	35.54	
168	12.9615	61.57	51.85	45.37	42.12	35.64	
169	13.0000	61.75	52.00	45.50	42.25	35.75	
170	13.0384	61.93	52.15	45.63	42.37	35.86	
171	13.0767	62.11	52.31	45.77	42.50	35.96	
172	13.1149	62.30	52.46	45.90	42.62	36.07	
173	13.1529	62.48	52.61	46.04	42.75	36.17	
174	13.1909	62.66	52.76	46.17	42.87	36.27	
175	13.2288	62.84	52.92	46.30	42.99	36.38	
176	13.2665	63.02	53.07	46.43	43.12	36.48	
177	13.3041	63.19	53.22	46.56	43.24	36.59	
178	13.3417	63.37	53.37	46.70	43.36	36.69	
179	13.3791	63.55	53.52	46.83	43.48	36.79	
180	13.4164	63.73	53.67	46.96	43.60	36.90	
181	13.4536	63.90	53.81	47.09	43.72	37.00	
182	13.4907	64.08	53.96	47.22	43.84	37.10	
183	13.5277	64.26	54.11	47.35	43.97	37.20	
184	13.5647	64.43	54.26	47.48	44.09	37.30	
185	13.6015	64.61	54.41	47.61	44.20	37.40	
186	13.6382	64.78	54.55	47.73	44.32	37.51	
187	13.6748	64.96	54.70	47.86	44.44	37.61	
188	13.7113	65.13	54.85	47.99	44.56	37.71	
189	13.7477	65.30	54.99	48.12	44.68	37.81	
190	13.7840	65.47	55.14	48.24	44.80	37.91	
191	13.8203	65.65	55.28	48.37	44.92	38.01	
192	13.8564	65.82	55.43	48.50	45.03	38.11	
193	13.8924	65.99	55.57	48.62	45.15	38.20	
194	13.9284	66.16	55.71	48.75	45.27	38.30	
195	13.9642	66.33	55.86	48.87	45.38	38.40	
196	14.0000	66.50	56.00	49.00	45.50	38.50	
197	14.0357	66.67	56.14	49.12	45.62	38.60	
198	14.0712	66.84	56.28	49.25	45.73	38.70	
199	14.1067	67.01	56.43	49.37	45.85	38.79	
200	14.1421	67.17	56.57	49.50	45.96	38.89	



Spinning Frame Twist Gearing.

Formula for figuring twist :

C = Cylinder gear.
S = Stud Gear.
T = Change gear.
F = Front Roll gear.
R = Ratio cylinder to whirl.
D = Circumference of front roll.

$$\frac{F \times S \times R}{C \times T \times D} = \text{Twist per inch.}$$

$$\frac{F \times S \times R}{C \times D} = \text{Twist Constant.}$$

$$\frac{\text{Twist Constant}}{\text{Change gear}} = \text{Twist per inch.}$$

$$\frac{\text{Twist Constant}}{\text{Twist per inch}} = \text{Change gear.}$$

Twist Gearing Constants for Whitin Spinning Frame.

7 Inch Cylinder.

Front Roll 1 in. Dia. — Front Roll Gear 108 T

Diameter of Whirl	Ratio Whirl to Cylinder	Cyl. 20 T Stud 100 T Cons't	Cyl. 20 T Stud 90 T Cons't	Cyl. 22 T Stud 88 T Cons't	Cyl. 20 T Stud 80 T Cons't	Cyl. 40 T Stud 80 T Cons't	Cyl. 36 T Stud 74 T Cons't	Cyl. 55 T Stud 55 T Cons't
¾ in.	8.33	1431.81	1288.12	1144.99	1144.99	572.72	588.40	286.24
13/16 "	7.68	1320.09	1187.60	1055.65	1055.65	528.04	542.48	263.91
⅞ "	7.25	1246.18	1121.11	996.54	996.54	498.47	512.11	249.13
15/16 "	6 62	1137.89	1023.69	909.94	909 94	455.16	467.61	227.48
1 "	6 24	1072.57	964.93	857.71	857.71	429.03	440.77	214.42
1 1/16 "	5.86	1007.25	906.16	805.48	805.48	402.90	413.92	201.37
1⅛ "	5.43	933.34	839.67	746.37	746.37	373.33	383.55	186.59
1 5/16 "	4.80	825.05	742.25	659.78	659.78	330.02	339.05	164.94

Front Roll 1⅛ in. Dia. — Front Roll Gear 108 T.

¾ in.	8.33	1272.72	1144.99	1018.18	1018.18	509.09	523.32	254.54
13/16 "	7.68	1173.41	1055.65	938.73	938.73	469.36	482.40	234.62
⅞ "	7.25	1107.71	996.54	886.17	886.17	443.09	455.39	221.54
15/16 "	6.62	1011.46	909.94	809 17	809.17	404.58	415.82	202.29
1 "	6.24	953.39	857.71	762.71	762.71	381.36	391.95	190.68
1 1/16 "	5.86	895 34	805.48	716 27	716.27	358.14	368.09	179.07
1⅛ "	5.43	829.64	746.37	663.71	663.71	331.85	341.08	165.93
1 5/16 "	4.80	733.39	659.78	586.71	586.71	293.35	301 51	146.71

8 Inch Cylinder.

Front Roll 1 in. Dia. — Front Roll Gear 108 T

Diameter of Whirl	Ratio Whirl to Cylinder	Cyl. 20 T Stud 100 T Cons't	Cyl. 20 T Stud 90 T Cons't	Cyl. 22 T Stud 88 T Cons't	Cyl. 20 T Stud 80 T Cons't	Cyl. 40 T Stud 80 T Cons't	Cyl. 36 T Stud 74 T Cons't	Cyl. 55 T Stud 55 T Cons't
¾ in.	9.52	1636.36	1472.13	1308.56	1308.56	654.55	672.45	327.14
13/16 "	8.91	1531.32	1377.81	1224.72	1224.72	612.61	629.37	306.18
⅞ "	8.28	1423.22	1280.38	1138.12	1138.12	569.28	584.86	284 53
15/16 "	7.67	1318.37	1186.06	1054.27	1054.27	527.35	541.78	263 56
1 "	7.08	1216.95	1094.82	973.17	973.17	486.78	500.10	243.29
1 1/16 "	6 80	1168.83	1051.52	934.69	934.69	467.53	480.32	233.67
1⅛ "	6.22	1069.13	961.83	854.96	854.96	427.65	439.35	213.74
1 5/16 "	5.48	941.94	847.40	753.25	753.25	376.77	387.08	188.31

Front Roll 1⅛ in. Dia. — Front Roll Gear 108 T.

¾ in.	9.52	1454.55	1309.09	1163.64	1163.64	581.82	597.98	290.91
13/16 "	8.91	1361.34	1225.21	1089.07	1089.07	544.54	559.67	272.27
⅞ "	8 28	1265.09	1138.58	1012.07	1012.07	506.03	520.10	253.02
15/16 "	7.67	1171.89	1054.70	937.51	937.51	468.75	481.77	234.38
1 "	7.08	1081.74	973.57	865.39	865.39	432.69	444.71	216.35
1 1/16 "	6 80	1038.96	935.06	831.17	831.17	415.59	427.13	207.79
1⅛ "	6.22	950.34	855.31	760.27	760.27	380.14	390.70	190.07
1 5/16 "	5.48	837.28	753.55	669.82	669.82	334.91	344.21	167.46

Rule to find Change Gear:– Divide Constant by Twist per inch Required

Spinning Twist Gear Table.

FRONT ROLL 1 inch Diameter

Cylinder 7 inches Diameter. Ratio Cylinder to Whirl 1 to 8.33

Whirl $\frac{3}{4}$ inch Diameter. Front Roll Gear 108 Teeth

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
15T	95.45	85.87	76.33		38.18	39.23	19.08
16	89.48	80.50	71.56		35.79	36.77	17.89
17	84.22	75.77	67.35		33.68	34.61	16.84
18	79.54	71.56	63.61		31.81	32.69	15.90
19	75.35	67.79	60.26		30.14	30.97	15.07
20	71.59	64.40	57.25		28.63	29.42	14.31
21	68.18	61.33	54.52		27.27	28.02	13.63
22	65.08	58.55	52.04		26.03	26.74	13.01
23	63.12	56.00	49.78		24.90	25.58	12.45
24	59.65	53.67	47.71	47.71	23.86	24.52	11.93
25	57.27	51.52	45.80	45.80	22.90	23.54	11.45
26	55.06	49.54	44.04	44.04	22.02	22.63	11.01
27	53.03	47.70	42.41	42.41	21.21	21.79	10.60
28	51.13	46.00	40.89	40.89	20.45	21.01	10.22
29	49.37	44.41	39.48	39.48	19.74	20.29	9.87
30	47.72	42.93	38.17	38.17	19.09	19.61	9.54
31	46.18	41.55	36.93	36.93	18.47	18.98	9.23
32	44.74	40.25	35.78	35.78	17.89	18.39	8.95
33	43.38	39.03	34.70	34.70	17.35	17.83	8.67
34	42.11	37.88	33.68	33.68	16.84	17.30	8.42
35	40.90	36.80	32.71	32.71	16.36	16.81	8.18
36	39.77	35.78	31.80	31.80	15.90	16.34	7.95
37	38.69	34.81	30.94	30.94	15.47	15.90	7.74
38	37.67	33.89	30.13	30.13	15.07	15.48	7.54
39	36.71	33.02	29.36	29.36	14.68	15.08	7.34
40	35.79	32.20	28.62	28.62	14.31	14.71	7.16
41	34.92	31.41	27.93	27.93	13.96	14.35	6.98
42	34.09	30.66	27.26	27.26	13.63	14.00	6.82
43	33.29	29.95	26.63	26.63	13.31	13.68	6.66
44	32.54	29.27	26.02	26.02	13.01	13.37	6.51
45	31.81	28.62	25.44	25.44	12.72	13.07	6.36
46	31.12	28.00	24.89	24.89	12.42	12.79	6.22
47	30.46	27.40	24.36	24.36	12.10	12.52	6.09
48	29.82	26.83	23.85	23.85	11.93	12.26	5.97
49	29.22	26.28	23.37	23.37	11.68	12.01	5.84
50	28.63	25.76	22.90	22.90	11.45	11.77	5.72
51	28.07	25.25	22.45	22.45	11.22	11.54	5.61
52	27.53	24.77	22.02	22.02	11.01	11.31	5.50
53	27.01	24.30	21.60	21.60	10.80	11.10	5.40
54	26.51	23.85	21.20	21.20	10.60	10.90	5.30
55	26.03	23.42	20.82	20.82	10.41	10.70	5.20
56	25.56	23.00	20.45	20.45	10.22	10.51	5.11
57	25.11	22.59	20.09	20.09	10.04	10.32	5.02
58	24.68	22.20	19.74	19.74	9.87	10.14	4.93
Const's	1431.81	1288.12	1144.99	1144.99	572.72	588.40	286.24

Spinning Twist Gear Table.

FRONT ROLL 1 inch Diameter

Cylinder 7 inches Diameter. Ratio Cylinder to Whirl 1 to 8.33

Whirl ¾ inch Diameter Front Roll Gear 108 Teeth

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
59	24.26	21.83	19.41	19.41	9.70	9.97	4.85
60	23.86	21.46	19.08	19.08	9.54	9.81	4.77
61	23.47	21.11	18.77	18.77	9.38	9.65	4.69
62	23.09	20.77	18.47	18.47	9.23	9.49	4.62
63	22.72	20.44	18.17	18.17	9.09	9.34	4.54
64	22.37	20.19	17.89	17.89	8.94	9.19	4.47
65	22.02	19.81	17.62	17.62	8.80	9.05	4.40
66	21.69	19.51	17.35	17.35	8.67	8.92	4.34
67	21.37	19.07	17.09	17.09	8.54	8.78	4.27
68	21.05	18.79	16.84	16.84	8.42	8.65	4.21
69	20.75	18.66	16.59	16.59	8.30	8.53	4.15
70	20.45	18.40	16.36	16.36	8.18	8.41	4.09
71	20.16	18.14	16.13	16.13	8.06	8.29	4.03
72	19.88	17.89	15.90	15.90	7.95	8.17	3.98
73	19.61	17.64	15.68	15.68	7.84	8.06	3.92
74	19.35	17.40	15.47	15.47	7.73	7.95	3.87
75	19.10	17.17	15.27	15.27	7.63	7.85	3.82
76	18.85	16.94	15.07	15.07	7.53	7.74	3.76
77	18.60	16.73	14.87	14.87	7.43	7.64	3.72
78	18.35	16.52	14.68	14.68	7.34	7.54	3.67
79	18.12	16.31	14.49	14.49	7.24	7.45	3.62
80	17.90	16.11	14.31	14.31	7.15	7.35	3.58
81	17.68	15.90	14.14	14.14	7.07	7.26	3.53
82	17.46	15.70	13.96	13.96	6.98	7.18	3.49
83	17.25	15.52	13.79	13.79	6.90	7.09	3.45
84	17.05	15.34	13.63	13.63	6.81	7.00	3.41
85	16.85	15.16	13.47	13.47	6.73	6.92	3.37
86	16.65	14.98	13.31	13.31	6.65	6.84	3.33
87	16.47	14.81	13.16	13.16	6.58	6.76	3.29
88	16.29	14.65	13.01	13.01	6.50	6.69	3.25
89	16.10	14.49	12.87	12.87	6.43	6.61	3.22
90	15.92	14.32	12.72	12.72	6.36	6.54	3.18
91	15.75	14.16	12.58		6.29	6.47	3.15
92	15.58	14.00	12.45		6.22	6.40	3.11
93	15.42	13.85	12.31		6.15	6.33	3.08
94	15.26	13.70	12.18		6.09	6.26	3.04
	Change Gears 36″ Frame 24–94 T 39″ Frame 15–70 T	Change Gears 36″ Frame 30–94 T 39″ Frame 15–86 T	Change Gears 36″ Frame 30–94 T 39″ Frame 15–86 T	Change Gears 36″ Frame 40–88 T 39″ Frame 24–90 T	Change Gears 36″ Frame 15–94 T 39″ Frame 15–94 T	Change Gears 36″ Frame 28–94 T 39″ Frame 15–94 T	Change Gears 36″ Frame 30–94 T 39″ Frame 15–94 T
Const's	1431.81	1288.12	1144.99	1144.99	572.72	588.40	286.24

Spinning Twist Gear Table.

FRONT ROLL 1 inch Diameter.

Cylinder 7 inch Diameter. Ratio Cylinder to Whirl 1 to 7.68.

Whirl $\frac{13}{16}$ inch Diameter. Front Roll Gear 108 Teeth.

Change Gears	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 90 T Twist	Cyl. 22 T Stud 88 T Twist	Cyl. 20 T Stud 80 T Twist	Cyl. 40 T Stud 80 T Twist	Cyl. 36 T Stud 74 T Twist	Cyl. 55 T Stud 55 T Twist
15T	88.01	79.17	70.38		35.20	36 17	17.59
16	82.50	74.22	65.98		33.00	33.91	16.50
17	77.65	69.85	62.09		31.06	31.91	15.52
18	73.33	65.97	58.65		29.33	30.14	14.66
19	69.47	62.50	55.56		27.79	28.55	13 89
20	66.00	59.38	52.78		26.40	27.12	13.20
21	62 86	56.55	50.27		25.14	25.83	12.57
22	60.00	53.98	47.98		24.00	24.66	12.00
23	57.39	51.63	45.89		22.96	23.59	11.50
24	55.00	49.48	43.98	43.98	22.00	22.69	11.00
25	52.80	47.50	42.23	42.23	21.12	21.70	10.56
26	50.77	45.67	40.60	40.60	20.30	20.86	10.15
27	48.89	43.98	39.10	39.10	19.55	20.09	9.77
28	47.14	42.41	37.70	37.70	18 85	19.37	9.43
29	45 52	40.95	36.40	36.40	18.20	18.71	9.10
30	44.00	39.58	35.19	35.19	17.60	18.08	8.80
31	42.58	38.30	34.05	34.05	17.03	17.50	8.52
32	41.25	37.11	32.99	32.99	16.50	16.95	8.25
33	40.00	35.98	31.99	31.99	16.00	16.44	8.00
34	38.82	34 92	31.04	31.04	15.53	15.95	7.76
35	37.71	33.93	30.16	30.16	15.08	15.21	7.54
36	36 66	32.98	29.32	29.32	14.66	15.06	7.33
37	35.67	32.09	28.53	28.53	14.27	14.66	7.13
38	34.73	31.25	27.78	27.78	13.89	14.28	6.95
39	33.84	30.45	27.06	27.06	13.53	13.91	6.77
40	33.00	29.69	26.39	26.39	13.20	13.56	6.60
41	32.19	28.98	25.74	25.74	12.87	13.23	6.44
42	31.43	28.27	25.13	25.13	12.57	12.91	6.28
43	30 69	27.61	24.55	24.55	12.28	12.61	6.14
44	30.00	26.99	23.99	23.99	12.00	12.33	6.00
45	29.33	26.38	23.46	23.46	11.73	12.05	5 87
46	28.69	25.81	22.95	22.95	11.47	11.79	5.74
47	28 08	25.26	22.46	22.46	11.23	11.54	5.62
48	27.50	24.74	21.99	21.99	11.00	11.30	5.50
49	26.94	24.23	21.54	21.54	10.77	11.07	5.39
50	26.40	23.75	21.11	21.11	10.56	10.85	5.28
51	25.88	23.28	20.70	20.70	10.35	10.64	5.17
52	25.38	22.83	20.30	20.30	10.15	10.43	5.08
53	24.90	22.40	19.92	19.92	9.96	10.24	4.98
54	24.44	21.99	19.55	19.55	9.77	10.04	4.89
55	24.00	21.59	19.19	19.19	9.60	9.86	4.80
56	23.57	21.20	18.85	18.85	9.42	9.68	4.72
57	23.15	20.83	18.52	18.52	9.26	9.52	4.63
58	22.76	20.47	18.20	18 20	9.10	9.35	4.55
Const's	1320.09	1187.60	1055.65	1055.65	528.04	542.48	263.91

Spinning Twist Gear Table.

FRONT ROLL 1 inch Diameter.

Cylinder 7 inch Diameter. Ratio Cylinder to Whirl 1 to 7.68.

Whirl $\frac{13}{16}$ inch Diameter. Front Roll Gear 108 Teeth

Change Gears	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 90 T Twist	Cyl. 22 T Stub 88 T Twist	Cyl. 20 T Stud 80 T Twist	Cyl. 40 T Stud 80 T Twist	Cyl. 36 T Stud 74 T Twist	Cyl. 55 T Stud 55 T Twist
59T	22.37	20.12	17.89	17.89	8.94	9.19	4.47
60	22.00	19.79	17.59	17.59	8.80	9.04	4.40
61	21.64	19.46	17.31	17.31	8.66	8.89	4.33
62	21.29	19.15	17.03	17.03	8.51	8.75	4.26
63	20.95	18.85	16.76	16.76	8.38	8.61	4.19
64	20.62	18.55	16.49	16.49	8.25	8.48	4.12
65	20.30	18.27	16.24	16.24	8.12	8.35	4.06
66	20.00	17.99	15.99	15.99	8.00	8.22	4.00
67	19.70	17.72	15.76	15.76	7.88	8.10	3.94
68	19.41	17.46	15.52	15.52	7.76	7.98	3.88
69	19.13	17.20	15.30	15.30	7.65	7.86	3.82
70	18.85	16.96	15.08	15.08	7.54	7.75	3.77
71	18.59	16.71	14.87	14.87	7.43	7.64	3.72
72	18.33	16.49	14.66	14.66	7.33	7.53	3.67
73	18.09	16.26	14.46	14.46	7.23	7.43	3.62
74	17.84	16.04	14.27	14.27	7.13	7.33	3.57
75	17.60	15.83	14.08	14.08	7.04	7.23	3.52
76	17.38	15.63	13.89	13.89	6.94	7.14	3.47
77	17.16	15.43	13.71	13.71	6.85	7.04	3.43
78	16.93	15.23	13.53	13.53	6.76	6.95	3.38
79	16.71	15.03	13.36	13.36	6.68	6.87	3.34
80	16.51	14.85	13.20	13.20	6.60	6.78	3.30
81	16.30	14.67	13.03	13.03	6.51	6.70	3.26
82	16.10	14.49	12.87	12.87	6.43	6.62	3.22
83	15.90	14.31	12.72	12.72	6.36	6.54	3.18
84	15.72	14.14	12.57	12.57	6.28	6.46	3.14
85	15.53	13.97	12.42	12.42	6.21	6.38	3.10
86	15.35	13.81	12.28	12.28	6.14	6.31	3.07
87	15.17	13.65	12.13	12.13	6.06	6.24	3.03
88	15.00	13.50	12.00	12.00	6.00	6.16	3.00
89	14.83	13.35	11.86	11.86	5.93	6.10	2.97
90	14.67	13.20	11.73	11.73	5.86	6.03	2.93
91	14.51	13.05	11.60		5.80	5.96	2.90
92	14.35	12.91	11.47		5.73	5.90	2.87
93	14.19	12.77	11.35		5.67	5.83	2.84
94	14.04	12.63	11.23		5.61	5.77	2.81
	Change Gears 36″ Frame 24–94 T 39″ Frame 15–70 T	Change Gears 36″ Frame 30–94 T 39″ Frame 15–86 T	Change Gears 36″ Frame 30–94 T 39″ Frame 15–86 T	Change Gears 36″ Frame 40–88 T 39″ Frame 24–90 T	Change Gears 36″ Frame 15–94 T 39″ Frame 15–94 T	Change Gears 36″ Frame 28–94 T 39″ Frame 15–94 T	Change Gears 36″ Frame 30–94 T 39″ Frame 15–94 T
Const's	1320.09	1187.60	1055.65	1055.65	528.04	542.48	263.91

Spinning Twist Gear Table.

FRONT ROLL 1 Inch Diameter.

Cylinder 7 inches Diameter. Ratio Cylinder to Whirl 1 to 7.25

Whirl $\frac{7}{8}$ inch Diameter. Front Roll Gear 108 Teeth

Change Gears	Cyl. 20T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
15T	83.08	74.74	66.44		33.23	34.14	16.61
16	77.88	70.07	62.28		31.15	32.00	15.57
17	73.30	65.94	58.62		29.32	30.12	14.65
18	69.23	62.28	55.36		27.69	28.45	13.84
19	65.58	59.00	52.45		26.23	26.95	13.11
20	62.30	56.05	49.83		24.92	25.60	12.46
21	59.34	53.38	47.45		23.73	24.39	11.86
22	56.64	50.95	45.30		22.65	23.28	11.32
23	54.18	48.74	43.33		21.67	22.26	10.83
24	52.18	46.71	41.52	41.52	20.76	21.33	10.38
25	50.16	44.84	39.86	39.86	19.93	20.48	9.97
26	48.15	43.11	38.32	38.32	19.17	19.70	9.58
27	46.15	41.52	36.91	36.91	18.46	18.97	9.23
28	44.65	40.03	35.59	35.59	17.80	18.29	8.89
29	43.18	38.65	34.36	34.36	17.18	17.66	8.59
30	41.65	37.37	33.22	33.22	16.61	17.07	8.30
31	40.20	36.16	32.15	32.15	16.07	16.52	8.04
32	39.00	35.03	31.14	31.14	15.57	16.00	7.78
33	37.80	33 97	30.20	30.20	15.10	15.52	7.55
34	36.70	32.97	29.31	29.31	14.70	15.06	7.33
35	35.61	32.03	28.47	28.47	14.24	14 63	7.12
36	34.61	31.14	27.68	27.68	13.84	14.22	6.92
37	33.68	30.30	26.93	26.93	13.47	13.84	6.73
38	32.79	29.50	26.22	26.22	13.11	13.48	6.55
39	31.95	28.74	25 55	25.55	12.75	13.13	6.38
40	31.15	28.02	24.91	24.91	12.46	12.80	6.23
41	30.39	27.34	24.30	24.30	12.15	12.49	6.08
42	29.67	26.69	23.73	23.73	11.86	12.19	5.93
43	28.98	26.07	23.17	23.17	11.59	11.91	5.80
44	28.32	25.47	22.65	22.65	11.32	11.64	5.66
45	27.69	24.91	22.14	22.14	11.07	11.38	5.53
46	27.09	24.37	21.66	21.66	10.83	11,13	5.42
47	26.51	23.85	21.20	21.20	10.60	10.89	5.30
48	25.96	23.35	20.76	20.76	10.38	10.67	5 19
49	25.43	22.87	20.34	20.34	10.17	10.45	5 08
50	24.92	22.42	19.93	19.93	9.96	10.24	4.98
51	24.52	21.98	19.54	19.54	9.77	10.04	4.89
52	23.96	21.55	19.16	19.16	9.58	9.85	4.79
53	23.51	21.15	18.80	18.80	9.40	9.66	4.70
54	23.07	20.76	18.45	18.45	9.23	9.48	4.62
55	22.65	20.38	18.12	18.12	9.06	9.31	4.53
56	22.25	20.01	17.79	17.79	8.90	9.14	4.45
57	21.86	19.66	17.48	17.48	8.74	8.98	4.37
58	21.48	19.32	17.18	17.18	8.59	8.83	4.29
Const's	1246.18	1121.11	996.54	996.54	498.47	512.11	249.13

Spinning Twist Gear Table.

FRONT ROLL 1 inch Diameter

Cylinder 7 inches Diameter. Ratio Cylinder to Whirl 1 to 7.25

Whirl $\frac{7}{8}$ inch Diameter Front Roll Gear 108 Teeth

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
59T	21 12	19.00	16.89	16.89	8.44	8.68	4.22
60	20.76	18.68	16.61	16.61	8.30	8.53	4.15
61	20.42	18.37	16.34	16.34	8.17	8.39	4.08
62	20.09	18.08	16.07	16.07	8.03	8.26	4.02
63	19.78	17.79	15.82	15.82	7.91	8.13	3.95
64	19.49	17.51	15.57	15.57	7.78	8.00	3.89
65	19.17	17.24	15.33	15.33	7.66	7.88	3.83
66	18.88	16.98	15.10	15.10	7.55	7.76	3.77
67	18.59	16.73	14.87	14.87	7.43	7.64	3.72
68	18.32	16.48	14.65	14.65	7.33	7.53	3.66
69	18.06	16.24	14.44	14.44	7.22	7.42	3.61
70	17.80	16.00	14.24	14.24	7.12	7.32	3.56
71	17.55	15.79	14.04	14.04	7.02	7.21	3.51
72	17.30	15.57	13.84	13.84	6.92	7.11	3.46
73	17.07	15.35	13.65	13.65	6.82	7.02	3.41
74	16.84	15.15	13.47	13.47	6.73	6.92	3.37
75	16.62	14.95	13.29	13.29	6.64	6.83	3.32
76	16.40	14.76	13.11	13.11	6.55	6.74	3.28
77	16.19	14.57	12.94	12.94	6.47	6.65	3.24
78	16.98	14.38	12.78	12.78	6.39	6.57	3.19
79	15.77	14.19	12.61	12.61	6.30	6.48	3.15
80	15.58	14.02	12.46	12.46	6.23	6.40	3.11
81	15.39	13.85	12.30	12.30	6.15	6.32	3.08
82	15.20	13.68	12.15	12.15	6.07	6.25	3.04
83	15.01	13.51	12.01	12.01	6.00	6.17	3.00
84	14.83	13.35	11.86	11.86	5.93	6.10	2.97
85	14.66	13.19	11.72	11.72	5.88	6.02	2.93
86	14.49	14.04	11.59	11.59	5.79	5.95	2.90
87	14.32	12.89	11.45	11.45	5.72	5.89	2.86
88	14.16	12.74	11.32	11.32	5.66	5.82	2.83
89	14.00	12.60	11.20	11.20	5.60	5.75	2.80
90	14.84	12.46	11.07	11.07	5.53	5.69	2.77
91	13.69	12.32	10.95		5.47	5.63	2.74
92	13.54	12.19	10.83		5.41	5.57	2.71
93	13.40	12.06	10.72		5.35	5.51	2.68
94	13.26	11.93	10.60		5.30	5.45	2.65
	Change Gears 36″ Frame 24-94 T 39″ Frame 15-70 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 40-88 T 39″ Frame 24-90 T	Change Gears 36″ Frame 15-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 28-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-94 T
Const's	1246.18	1121.11	996.54	996.54	498.47	512.11	249.13

Spinning Twist Gear Table.

FRONT ROLL 1 inch Diameter

Cylinder 7 inches Diameter. Ratio Cylinder to Whirl 1 to 6.62

Whirl $\frac{15}{16}$ inch Diameter. Front Roll Gear 108 Teeth

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
15T	75.86	68.25	60.66		30.34	31.17	15.17
16	71.11	63.98	56.87		28.44	29.23	14.22
17	66.94	60.21	53.53		26.77	27 51	13.38
18	63.21	56.87	50.55		25.28	25.98	12.64
19	59.88	53.87	47.89		23.95	24.61	11.97
20	56.89	51.18	45.50		22.75	23.38	11.37
21	54.18	48.74	43.33		21.67	22.27	10.83
22	51.72	46.53	41.36		20.68	21.26	10.34
23	49.47	44.50	39.56		19.78	20.33	9.89
24	47.41	42.65	37.91	37.91	18.96	19.48	9.48
25	45.51	40.94	36.40	36.40	18.20	18.70	9.10
26	43.76	39.37	35.00	35.00	17.50	17.99	8.75
27	42.14	37.91	33.70	33.70	16.85	17.32	8.43
28	40.63	36.56	32.50	32.50	16.25	16.70	8.12
29	39.23	35.29	31.38	31.38	15.69	16.12	7.84
30	37.92	34.12	30.33	30.33	15.17	15.59	7.58
31	36.70	33.02	29.35	29.35	14.68	15.08	7.34
32	35.55	31.99	28.44	28.44	14.22	14.61	7.11
33	34.48	31.02	27.57	27.57	13.76	14.17	6.89
34	33.46	30.10	26.76	26.76	13.38	13.75	6.69
35	32.51	29.24	26.00	26.00	13.00	13.36	6.50
36	31.60	28.43	25.28	25.28	12.64	12.99	6.32
37	30.75	27.66	24.59	24.59	12.30	12.64	6.15
38	29.94	26.93	23.95	23.95	11.97	12.31	5.99
39	29.17	26.24	23.33	23.33	11.67	11.99	5.83
40	28.44	25.59	22.75	22.75	11.47	11.69	5.69
41	27.75	24.96	22.19	22.19	11.10	11.41	5.55
42	27.09	24.37	21.66	21.66	10.83	11.13	5.42
43	26.46	23.80	21.16	21.16	10.58	10.87	5.29
44	25.86	23.26	20.68	20.68	10.34	10.63	5.17
45	25.28	22.74	20.22	20.22	10.11	10.39	5.06
46	24.73	22.25	19.78	19.78	9.89	10.17	4.95
47	24.21	21.78	19.36	19.36	9.68	9.95	4.84
48	23.70	21.32	18.96	18.96	9.48	9.74	4.74
49	23.22	20.89	18.57	18.57	9.28	9.54	4.64
50	22.75	20.47	18.20	18.20	9.10	9.35	4.55
51	22.31	20.07	17.84	17.84	8.92	9.17	4.46
52	21.88	19.68	17.50	17.50	8.75	8.99	4.38
53	21.46	19.31	17.17	17.17	8.58	8.82	4.29
54	21.07	18.95	16.85	16.85	8.42	8.66	4.21
55	20.68	18.61	16.54	16.54	8.27	8.50	4.14
56	20.31	18.28	16.25	16.25	8.12	8.35	4.06
57	19.96	17.95	15.96	15.96	7.98	8.20	3.99
58	19.61	17.64	15.69	15.69	7.84	8.06	3.92
Const's	1137.89	1023.69	909.94	909.94	455.16	467.61	227.48

Spinning Twist Gear Table

FRONT ROLL 1 inch Diameter

Cylinder 7 inches diameter. Ratio Cylinder to Whirl 1 to 6.62

Whirl $\frac{15}{16}$ inch diameter. Front Roll gear 108 teeth

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
59T	19.28	17.35	15.42	15.42	7.71	7.93	3.86
60	18.96	17.06	15.17	15.17	7.58	7.79	3.79
61	18.65	16.78	14.92	14.92	7.46	7.67	3.73
62	18.35	16.51	14.68	14.68	7.34	7.54	3.67
63	18.06	16.24	14.44	14.44	7.22	7.42	3.61
64	17.77	15.99	14.22	14.22	7.11	7.31	3.55
65	17.50	15.74	14.00	14.00	7.00	7.19	3.50
66	17.24	15.51	13.79	13.79	6.89	7.09	3.45
67	16.98	15.27	13.58	13.58	6.79	6.98	3.40
68	16.73	15.05	13.38	13.38	6.69	6.88	3.35
69	16.49	14.83	13.19	13.19	6.59	6.78	3.29
70	16.25	14.62	13.00	13.00	6.50	6.68	3.25
71	16.02	14.41	12.82	12.82	6.41	6.59	3.21
72	15.80	14.21	12.63	12.63	6.32	6.49	3.16
73	15.58	14.02	12.46	12.46	6.23	6.41	3.12
74	15.37	13.83	12.30	12.30	6.15	6.32	3.07
75	15.17	13.65	12.13	12.13	6.06	6.23	3.03
76	14.97	13.47	11.97	11.97	5.98	6.15	2.99
77	14.78	13.30	11.82	11 82	5.91	6.07	2.95
78	14.59	13.13	11.67	11.67	5.83	6.00	2.92
79	14.40	12.96	11.52	11.52	5.76	5.92	2.89
80	14.22	12.80	11.37	11.37	5.68	5.84	2.84
81	14.05	12.64	11.23	11.23	5.61	5.77	2.81
82	13.88	12.48	11.10	11.10	5.55	5.70	2.77
83	13.71	12.33	10.96	10.96	5.48	5.63	2.74
84	13.55	12.19	10 83	10.83	5.41	5.57	2.71
85	13.39	12.05	10.71	10.71	5.35	5.50	2.68
86	13.23	11.81	10.58	10.58	5.29	5.44	2.65
87	13.08	11.77	10.46	10.46	5.23	5.37	2.61
88	12.93	11.64	10.34	10.34	5.17	5.31	2.58
89	12.78	11.51	10.22	10.22	5.11	5.25	2.56
90	12.64	11.38	10.11	10.11	5.05	5.20	2.53
91	12.50	11.25	10.00		5.00	5.14	2.50
92	12.37	11.13	9.89		4.94	5.08	2.47
93	12.24	11.01	9.78		4.89	5.03	2.45
94	12.11	10.89	9.68		4.84	4.97	2.42
	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears
	36″ Frame 24-94 T	36″ Frame 30-94 T	36″ Frame 30-94 T	36″ Frame 40-88 T	36″ Frame 15-94 T	36″ Frame 28-94 T	36″ Frame 30-94 T
	39″ Frame 15-70 T	39″ Frame 15-86 T	39″ Frame 15-86 T	39″ Frame 24-90 T	39″ Frame 15-94 T	39″ Frame 15-94 T	39″ Frame 15-94 T
Const's	1137.89	1023.69	909.94	909.94	455.16	467.61	227.48

Spinning Twist Gear Table.

FRONT ROLL 1 Inch Diameter.

Cylinder 7 inches Diameter. Ratio Cylinder to Whirl 1 to 6.24

Whirl 1 inch Diameter. Front Roll Gear 108 Teeth

Change Gears	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 90 T Twist	Cyl. 22 T Stud 88 T Twist	Cyl. 20 T Stud 80 T Twist	Cyl. 40 T Stud 80 T Twist	Cyl. 36 T Stud 74 T Twist	Cyl. 55 T Stud 55 T Twist
15T	71.51	64.33	57.18		28.60	29.38	14.29
16	67.03	60 30	53.61		26.81	27.55	13.40
17	63.09	56.76	50.45		25.23	25.93	12.61
18	59.58	53.60	47.65		23.83	24.48	11.91
19	56 45	50.79	45.14		22.58	23.20	11.28
20	53.62	48.24	42.88		21.45	22.04	10.72
21	51.07	45.94	40.84		20.43	20 99	10.21
22	48.75	43.86	38.99		19.50	20.04	9.75
23	46.63	41.95	37.29		18.65	19.16	9.32
24	44 69	40.20	35.74	35.74	17.87	18.37	8.93
25	42.90	38.59	34.31	34.31	17.16	17.63	8.58
26	41.25	37.11	32.99	32.99	16.50	16.95	8.25
27	39.72	35.73	31.77	31.77	15.89	16 32	7.94
28	38.30	34.46	30.63	30.63	15.32	15.74	7.66
29	36.98	33.27	29.58	29.58	14.79	15.20	7.39
30	35.75	32.16	28.59	28.59	14.30	14.69	7.15
31	34.59	31.12	27.67	27.67	13.83	14.22	6.92
32	33.55	30.15	26.80	26.80	13.40	13.77	6.70
33	32.50	29.24	25.99	25.99	13.00	13.36	6.50
34	31.54	28.38	25 23	25.23	12.61	12.97	6.31
35	30 64	27.56	24.51	24 51	12.25	12.59	6.13
36	29 79	26.80	23 82	23.82	11.91	12.24	5.96
37	28.98	26.07	23.18	23.18	11.59	11.91	5.80
38	28.22	25.39	22.57	22.57	11.29	11.60	5.64
39	27.50	24.74	21.99	21.99	11.00	11.30	5.50
40	26.81	24.12	21.44	21.44	10.72	11.02	5.36
41	26.16	23.53	20.92	20.92	10.46	10.75	5.23
42	25.53	22.97	20.42	20.42	10.21	10.49	5.11
43	24.94	22.44	19.95	19.95	9.97	10.25	4.99
44	24.37	21.93	19.49	19.49	9.75	10.02	4.87
45	23.83	21.44	19.06	19.06	9.53	9.79	4.77
46	23.31	20.97	18.65	18.65	9.32	9.58	4.66
47	22.82	20.53	18.25	18.25	9.12	9.38	4.56
48	22.34	20.10	17.87	17.87	8.93	9.18	4.47
49	21.88	19.69	17.50	17.50	8.75	9.00	4.38
50	21.45	19.29	17.15	17.15	8.58	8.82	4.29
51	21.03	18.92	16.82	16.82	8.41	8.64	4.20
52	20.62	18.55	16.49	16.49	8.25	8.48	4.12
53	20.23	18.20	16.18	16.18	8.09	8.32	4.05
54	19.86	17.86	15.88	15.88	7.94	8.16	3.97
55	19.50	17.54	15.59	15.59	7.80	8.01	3.90
56	19.15	17 23	15.32	15.32	7.66	7.87	3.83
57	18.81	16.92	15.05	15.05	7.52	7.73	3.76
58	18.49	16.63	14.79	14.79	7.39	7.60	3.70
Const's	1072.57	964.93	857.71	857.71	429.03	440.77	214.42

Spinning Twist Gear Table

FRONT ROLL 1 inch Diameter

Cylinder 7 inches diameter. Ratio Cylinder to Whirl 1 to 6.24.

Whirl 1 inch diameter. Front Roll gear 108 teeth

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
59	18.17	16.35	14.54	14.54	7.27	7.47	3.63
60	17.87	16.08	14.29	14.29	7.15	7.35	3.57
61	17.58	15.81	14.06	14.06	7.03	7.23	3.52
62	17.29	15.56	13.83	13.83	6.91	7.11	3.46
63	17.02	15.31	13.61	13.61	6.81	7.00	3.40
64	16.75	15.07	13.40	13.40	6.70	6.89	3.35
65	16.50	14.84	13.19	13.19	6.60	6.78	3.30
66	16.25	14.62	13.00	13.00	6.50	6.68	3.25
67	16.00	14.40	12.80	12.80	6.40	6.58	3.20
68	15.77	14.19	12.61	12.61	6.30	6.48	3.15
69	15.54	13.98	12.43	12.43	6.21	6.39	3.11
70	15.32	13.78	12.25	12.25	6.12	6.30	3.06
71	15.10	13.59	12.08	12.08	6.04	6.21	3.02
72	14.89	13.40	11.91	11.91	5.95	6.12	2.98
73	14.69	13.21	11.75	11.75	5.87	6.04	2.94
74	14.49	13.04	11.59	11.59	5.79	5.96	2.90
75	14.30	12.87	11.44	11.44	5.72	5.88	2.86
76	14.12	12.70	11.29	11.29	5.64	5.80	2.82
77	13.94	12.53	11.14	11.14	5.57	5.72	2.78
78	13.76	12.37	11.00	11.00	5.50	5.65	2.75
79	13.59	12.21	10.86	10.86	5.43	5.58	2.71
80	13.41	12.06	10.72	10.72	5.36	5.51	2.68
81	13.25	11.91	10.59	10.59	5.29	5.44	2.65
82	12.09	11.76	10.46	10.46	5.23	5.38	2.62
83	12.92	11.61	10.33	10.33	5.16	5.31	2.58
84	12.77	11.48	10.21	10.21	5.10	5.25	2.55
85	12.62	11.35	10.09	10.09	5.04	5.19	2.52
86	12.47	11.22	9.97	9.97	4.98	5.13	2.49
87	12.33	11.09	9.86	9.86	4.93	5.06	2.46
88	12.19	10.96	9.75	9.75	4.87	5.01	2.44
89	12.05	10.84	9.64	9.64	4.82	4.95	2.41
90	12.92	10.72	9.53	9.53	4.76	4.90	2.38
91	11.79	10.60	9.43		4.71	4.84	2.36
92	11.66	10.49	9.32		4.66	4.79	2.33
93	11.53	10.38	9.22		4.61	4.74	2.31
94	11.41	10.27	9.12		4.56	4.69	2.28
	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears
	36″ Frame 24-94 T	36″ Frame 30-94 T	36″ Frame 30-94 T	36″ Frame 40-88 T	36″ Frame 15-94 T	36″ Frame 28-94 T	36″ Frame 30-94 T
	39″ Frame 15-70 T	39″ Frame 15-86 T	39″ Frame 15-86 T	39″ Frame 24-90 T	39″ Frame 15-94 T	39″ Frame 15-94 T	39″ Frame 15-94 T
Const's	1072.57	964.93	857.71	857.71	429.03	440.77	214.42

Spinning Twist Gear Table.

FRONT ROLL 1 inch Diameter.

Cylinder 7 inch Diameter. Ratio Cylinder to Whirl 1 to 5.86.

Whirl $1\frac{1}{16}$ inch Diameter. Front Roll Gear 108 Teeth.

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
15T	67.15	60.41	53.70		26.86	27.59	13.42
16	62.95	56.63	50.34		25.18	25.87	12.59
17	59.25	53.30	47.38		23.70	24.35	11.84
18	55.95	50.34	44.75		22.38	22.99	11.19
19	53.01	47.69	43.29		21.20	21.79	10.60
20	50.36	45.30	40.27		20.14	20.70	10.07
21	47.96	43.15	38.36		19.18	19.71	9.59
22	45.78	41.18	36.61		18.31	18.81	9.15
23	43.79	39.39	35.02		17.52	18.00	8.76
24	41.96	37.75	33.56	33.56	16.78	17.25	8.39
25	40.29	36.24	32.22	32.22	16.11	16.56	8.06
26	38.74	34.85	30.98	30.98	15.49	15.92	7.75
27	37.30	33.56	29.83	29.83	14.84	15.33	7.47
28	35.97	32.36	28.77	28.77	14.38	14.78	7.19
29	34.73	31.24	27.77	27.77	13.88	14.27	6.94
30	33.57	30.20	26.85	26.85	13.43	13.80	6.71
31	32.49	29.23	25.98	25.98	12.99	13.35	6.50
32	31.47	28.31	25.17	25.17	12.59	12.94	6.29
33	30.52	27.45	24.41	24.41	12.20	12.54	6.10
34	29.62	26.65	23.69	23.69	11.85	12.17	5.92
35	28.77	25.89	23.01	23.01	11.51	11.82	5.75
36	27.97	25.17	22.37	22.37	11.19	11.50	5.59
37	27.22	24.49	21.77	21.77	10.88	11.19	5.44
38	26.50	23.84	21.20	21.20	10.60	10.89	5.30
39	25.82	23.23	20.65	20.65	10.33	10.61	5.16
40	25.18	22.65	20.14	20.14	10.07	10.35	5.04
41	24.56	22.10	19·65	19.65	9.82	10.09	4.91
42	23.98	21.57	19.18	19.18	9.59	9.86	4.80
43	23.42	21.07	18.73	18.73	9.36	9.63	4.68
44	22.88	20.59	18.31	18.31	9.15	9.41	4.58
45	22.38	20.13	17.90	17.90	8.95	9.20	4.48
46	21.89	19.69	17.51	17.51	8.75	9.00	4.38
47	21.43	19.28	17.14	17.14	8.57	8.81	4.29
48	20.98	18.87	16·78	16.78	8.39	8.62	4.20
49	20.55	18.49	16.44	16.44	8.22	8.45	4.11
50	20.14	18.12	16.11	16.11	8.05	8.28	4.03
51	19.75	17.76	15.79	15.79	7.90	8.12	3.95
52	19.37	17.42	15.49	15.49	7.74	7.96	3.87
53	19.00	17.09	15.20	15.20	7.60	7.81	3.80
54	18.65	16.78	14.92	14.92	7.46	7.67	3.73
55	18.31	16.47	14.64	14.64	7.32	7.53	3.66
56	17.98	16.18	14.38	14.38	7.19	7·39	3.60
57	17.67	15 89	14.13	14.13	7.06	7.26	3.53
58	17.36	15.62	13.89	13.89	6.94	7.14	3.47
Const's	1007.25	906.16	805.48	805.48	402.90	413.92	201.37

Spinning Twist Gear Table.

FRONT ROLL 1 inch Diameter.

Cylinder 7 inch Diameter. Ratio Cylinder to Whirl 1 to 5.86.

Whirl $1\frac{1}{16}$ inch Diameter. Front Roll Gear 108 Teeth.

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl . 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
59T	17.07	15.35	13.65	13.65	6.82	7.02	3.41
60	16.78	15.10	13.42	13.42	6.71	6.90	3.36
61	16.51	14.85	13 20	13.20	6.60	6.78	3.30
62	16.24	14.61	12 99	13.99	6.49	6.68	3.25
63	15.98	14.38	12.79	12.79	6.39	6.57	3.20
64	15.73	14.15	12.59	12.59	6.29	6.47	3.15
65	15.49	13.94	12.39	12 39	6.19	6.37	3.10
66	15.26	13.72	12.20	12.20	6.10	6.27	3.05
67	15.03	13.52	12.02	12.02	6.01	6.18	3.01
68	14.81	13.32	11 85	11.85	5.92	6.09	2.96
69	14.59	13.13	11.67	11 67	5.83	6.00	2.92
70	14.38	12.94	11.51	11.51	5.75	5.91	2.88
71	14.18	12.76	11.34	11.34	5.67	5.83	2.84
72	13.98	12.58	11.19	11.19	5.59	5.75	2.80
73	13.79	12.41	11.03	11.03	5.51	5.67	2.76
74	13.61	12.24	10.88	10.88	5.44	5.59	2.72
75	13.43	12.08	10.74	10.74	5.37	5.52	2.68
76	13.26	11.92	10.60	10.60	5.30	5.45	2.65
77	13.09	11.77	10.46	10.46	5·23	5.38	2.62
78	12.92	11.62	10.33	10.33	5.16	5.31	2.58
79	12.75	11.47	10.20	10.20	5.10	5.24	2.55
80	12.59	11.33	10.07	10.07	5.03	5.17	2.52
81	12.44	11.19	9.94	9.94	4.97	5.11	2.49
82	12.29	11.05	9.82	9.82	4.91	5.05	2.46
83	12.14	10.92	9.70	9.70	4.85	4.99	2.43
84	12.00	10.79	9.59	9.59	4.79	4.93	2.40
85	12.86	10.66	9.48	9.48	4.74	4.87	2.37
86	12.72	10.53	9.37	9.37	4.68	4.81	2.34
87	11.58	10.41	9.26	9.26	4.63	4.76	2.31
88	11.45	10.29	9.15	9.15	4.57	4.70	2.29
89	11.32	10.18	9.05	9.05	4.51	4.65	2.26
90	11.19	10.07	8.95	8.95	4.47	4.60	2.24
91	11·07	9.96	8.85		4.42	4.55	2.21
92	10.95	9.85	8.76		4.37	4.50	2.19
93	10.83	9.74	8.66		4.33	4.45	2.17
94	10.72	9.64	8.57		4.28	4.40	2.14
	Change Gears 36″ Frame 24-94 T 39″ Frame 15-70 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 40-88 T 39″ Frame 24-90 T	Change Gears 36″ Frame 15-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 28-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-94 T
Const's	1007.25	906.16	805.48	805.48	402.90	413.92	201.37

Spinning Twist Gear Table.

FRONT ROLL 1 inch Diameter.

Cylinder 7 inch Diameter. Ratio Cylinder to Whirl 1 to 5.43.

Whirl 1⅛ inch Diameter. Front Roll Gear 108 Teeth.

Change Gears	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 90 T Twist	Cyl. 22 T Stud 88 T Twist	Cyl. 20 T Stud 80 T Twist	Cyl. 40 T Stud 80 T Twist	Cyl. 36 T Stud 74 T Twist	Cyl. 55 T Stud 55 T Twist
15T	62.22	55.98	49.76		24.89	25.57	12.44
16	58.33	52.47	47.14		23.33	24.22	11.78
17	54.90	49.39	44.52		21.96	22.87	11.12
18	51.85	46.64	41.90		20.74	21.53	10.47
19	49.12	44.19	39.28		19.64	20.19	9.82
20	46.66	41.98	37.57		18.66	19.31	9.39
21	44.44	39.98	35.87		17.77	18.43	8.96
22	42.42	38.16	34.17		16.97	17.55	8.53
23	40.58	36.50	32.45		16.23	16.68	8.11
24	38.88	34.98	31.24	31.24	15.55	16.06	7.81
25	37.33	33.58	30.04	30.04	14.93	15.44	7.51
26	35.89	32.29	28.84	28.84	14.38	14.82	7.21
27	34.56	31.09	27.64	27.64	13.83	14.21	6.91
28	33.33	29.98	26.75	26.75	13.38	13.75	6.68
29	32.18	28.95	25.86	25.86	12.93	13.29	6.46
30	31.11	27.98	24.97	24.97	12.48	12.83	6.24
31	30.10	27.08	24.08	24.08	12.04	12.37	6.02
32	29.16	26.14	23.39	23.39	11.66	12.01	5.84
33	28.28	25.44	22.70	22.70	11.31	11.66	5.68
34	27.45	24.69	22.01	22.01	10.98	11.31	5.52
35	26.66	23.99	21.32	21.32	10.66	10.96	5.33
36	25.92	23.32	20.77	20.77	10.37	10.67	5.19
37	25.22	22.69	20.22	20.22	10.09	10.39	5.05
38	24.56	22.09	19.68	19.68	9.82	10.11	4.91
39	23.93	21.53	19.14	19.14	9.57	9.83	4.78
40	23.33	20.99	18.69	18.69	9.33	9.60	4.67
41	22.76	20.47	18.24	18.24	9.10	9.37	4.56
42	22.22	19.99	17.80	17.80	8.88	9.14	4.45
43	21.70	19.52	17.36	17.36	8.68	8.92	4.34
44	21.21	19.08	16.99	16.99	8.48	8.73	4.24
45	20.74	18.65	16.62	16.62	8.29	8.54	4.15
46	20.29	18.25	16.25	16.25	8.11	8.35	4.06
47	19.85	17.86	15.88	15.88	7.94	8.16	3.97
48	19.44	17.49	15.56	15.56	7.77	8.00	3.89
49	19.04	17.13	15.25	15.25	7.61	7.84	3.81
50	18.66	16.79	14.94	14.94	7.46	7.68	3.73
51	18.30	16.46	14.63	14.63	7.32	7.52	3.66
52	17.94	16.14	14.36	14.36	7.17	7.38	3.59
53	17.61	15.84	14.09	14.09	7.04	7.24	3.52
54	17.28	15.54	13.83	13.83	6.91	7.10	3.45
55	16.96	15.26	13.57	13.57	6.78	6.97	3.39
56	16.66	14.99	13.34	13.34	6.66	6.85	3.33
57	16.37	14.73	13.11	12.11	6.54	6.73	3.27
58	16.09	14.47	12.88	11.88	6.43	6.61	3.21
Const's	933.34	839.67	746.37	746.37	373.33	383.55	186.59

Spinning Twist Gear Table.

FRONT ROLL 1 inch Diameter.

Cylinder 7 inch Diameter. Ratio Cylinder to Whirl 1 to 5.43.

Whirl $1\frac{1}{8}$ inch Diameter. Front Roll Gear 108 Teeth

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
59T	15.81	14.23	12.65	12.65	6.32	6.50	3.16
60	15.55	13.99	12.45	12.45	6.22	6.39	3.11
61	15.30	13.76	12.25	12.25	6.12	6.29	3.06
62	15.05	13.54	12.05	12.05	6.02	6.19	3.01
63	14.81	13.32	11.85	11.85	5.92	6.09	2.96
64	14.58	13.11	11.67	11.67	5.83	5.99	2.91
65	14.35	12.90	11.49	11.49	5.74	5.90	2.86
66	14.14	12.72	11.31	11.31	5.65	5.81	2.82
67	13.93	12.53	11.14	11.14	5.57	5.72	2.78
68	13.72	12.34	10.98	10.98	5.49	5.64	2.74
69	13.52	12.16	10.82	10.82	5.41	5.56	2.70
70	13.33	11.99	10.66	10.66	5.33	5.48	2.66
71	13.14	11.82	10.51	10.51	5.25	5.40	2.63
72	12.96	11.66	10.37	10.37	5.18	5.32	2.59
73	12.78	11.50	10.23	10.23	5.11	5.25	2.56
74	12.61	11.35	10.09	10.09	5.04	5.18	2.52
75	12.44	11.20	9.95	9.95	4.97	5.11	2.49
76	12.28	11.05	9.82	9.82	4.90	5.04	2.45
77	12.12	10.91	9.69	9.69	4.84	4.98	2.42
78	11.96	10.77	9.57	9.57	4.78	4.92	2.39
79	11.81	10.63	9.45	9.45	4.72	4.86	2.36
80	11.66	10.50	9.33	9.33	4.66	4.80	2.33
81	11.52	10.37	9.21	9.21	4.60	4.74	2.30
82	11.38	10.24	9.10	9.10	4.55	4.68	2.27
83	11.24	10.12	8.99	8.99	4.49	4.62	2.25
84	11.11	10.00	8.88	8.88	4.44	4.56	2.22
85	10.98	9.88	8.78	8.78	4.39	4.51	2.19
86	10.85	9.76	8.68	8.68	4.34	4.46	2.16
87	10.73	9.65	8.58	8.58	4.29	4.41	2.14
88	10.61	9.54	8.48	8.48	4.24	4.36	2.11
89	10.49	9.43	8.38	8.38	4.19	4.31	2.09
90	10.37	9.33	8.29	8.29	4.14	4.26	2.07
91	10.26	9.23	8.20		4.10	4.21	2.05
92	10.15	9.13	8.11		4.05	4.16	2.02
93	10.04	9.03	8.02		4.01	4.12	1.99
94	9.93	8.93	7.94		3.97	4.08	1.97
	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears
	36″ Frame 24-94 T	36″ Frame 30-94 T	36.′ Frame 30-94 T	36″ Frame 40-88 T	36″ Frame 15-94 T	36″ Frame 28-94 T	36″ Frame 30-94 T
	39″ Frame 15-70 T	39″ Frame 15-86 T	39″ Frame 15-86 T	39″ Frame 24-90 T	39″ Frame 15-94 T	39″ Frame 15-94 T	39″ Frame 15-94 T
Const's	933.34	839.67	746.37	746.37	373.33	383.55	186.59

Spinning Twist Gear Table.

FRONT ROLL 1 Inch Diameter.

Cylinder 7 inches Diameter. Ratio Cylinder to Whirl 1 to 4.80

Whirl $1\frac{5}{16}$ inch Diameter. Front Roll Gear 108 Teeth

Change Gears	Cyl. Stud 20T 100 T Twist	Cyl. Stud 20 T 90 T Twist	Cyl. Stud 22 T 88 T Twist	Cyl. Stud 20 T 80 T Twist	Cyl. Stud 40 T 80 T Twist	Cyl. Stud 36 T 74 T Twist	Cyl. Stud 55 T 55 T Twist
15T	55.00	49.48	43.98		22.00	22.60	11.00
16	51.56	46.39	41.66		20.62	21.41	10.42
17	48.53	43.66	39.35		19.41	20.22	9.84
18	45.83	41.23	37.04		18.33	19.03	9.26
19	43.42	39.06	34.73		17.36	17.84	8.68
20	41.25	37.11	33.22		16.50	17.06	8.30
21	39.28	35.34	31.71		15.71	16.28	7.92
22	37.50	33.73	30.20		15.00	15.51	7.54
23	35.87	32.27	28.69		14.34	14.74	7.17
24	34.37	30.92	27.62	27.62	13.75	14.19	6.90
25	33.00	29.69	26.56	26.56	13.20	13.64	6.63
26	31.73	28.54	25.50	25.50	12.69	13.10	6.37
27	30 57	27.49	24.44	24.40	12.22	12.56	6.11
28	29.46	26.50	23.65	23.65	11.78	12.15	5.91
29	28.45	25.59	22.86	22.86	11.38	11.74	5.71
30	27.50	24.74	22.07	22.07	11.00	11.34	5.51
31	26.61	23.94	21.28	21.28	10.64	10.94	5.32
32	25.78	23.19	20.67	20.67	10.31	10.62	5.16
33	25.00	22.48	20 06	20.06	10.00	10 31	5.01
34	24.26	21.83	19.45	19.45	9.70	10.00	4.86
35	23.57	21.20	18.85	18.85	9.42	9.69	4.71
36	22.91	20.61	18.36	18.36	9.16	9.44	4.59
37	22.29	20.06	17.88	17.88	8.91	9.19	4.47
38	21.71	19.53	17.40	17.40	8.68	8.94	4.35
39	21.15	19.03	16.92	16.92	8.46	8.69	4.23
40	20.62	18.55	16.52	16.52	8.25	8.48	4.13
41	20.12	18.10	16.12	16.12	8.04	8.28	4.03
42	19.64	17.67	15.73	15.73	7.85	8.08	3.93
43	19.18	17.26	15.34	15.34	7.67	7.88	3.84
44	18.75	16.86	15.01	15.01	7.50	7.71	3.75
45	18.33	16.49	14.68	14.68	7.33	7.54	3.67
46	17.93	16.13	14.36	14.36	7.17	7.37	3.59
47	17.55	15.79	14.04	14.04	7.02	7.21	3.51
48	17.18	15.46	13.76	13.76	6.87	7.07	3.44
49	16.83	15.14	13.48	13.48	6.73	6.93	3.37
50	16.50	14.84	13.21	13.21	6.60	6.79	3.30
51	16.17	14.55	12.94	12.94	6.47	6.65	3.23
52	15.86	14.27	12.70	12.70	6.34	6.52	3.17
53	15.56	14.00	12.46	12.46	6.22	6.40	3.11
54	15.27	13.78	12.23	12.23	6.11	6.28	3.05
55	15.00	13.49	12.00	12.00	6.00	6.16	3.00
56	14.73	13.25	11.79	11.79	5.89	6.05	2.95
57	14.47	13.02	11.58	11.58	5.78	5.95	2.90
58	14.22	12.79	11.38	11.38	5.69	5.85	2.85
Const's	825.05	742.25	659.78	659.78	330.02	339.05	164.94

Spinning Twist Gear Table.

FRONT ROLL 1 inch Diameter

Cylinder 7 inches Diameter. Ratio Cylinder to Whirl 1 to 4.80

Whirl $1\frac{5}{16}$ inch Diameter Front Roll Gear 108 Teeth

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
59T	13.98	12.57	11.18	11.18	5.59	5.75	2.80
60	13.75	12.37	11.00	11.00	5.50	5.65	2.75
61	13.52	12.16	10.82	10.82	5.41	5.56	2.70
62	13.30	11.97	10.64	10.64	5.32	5.47	2.66
63	13.09	11.78	10.47	10.47	5.23	5.38	2.62
64	12.89	11.59	10.31	10.31	5.15	5.30	2.58
65	12.69	11.42	10.15	10.15	5.07	5.22	2.54
66	12.50	11.24	10.00	10.00	5.00	5.14	2.50
67	12.31	11.07	9.85	9.85	4.92	5.06	2.46
68	12.13	10.91	9.71	9.71	4.85	4.99	2.42
69	11.95	10.75	9.57	9.57	4.79	4.92	2.38
70	11.78	10.60	9.43	9.43	4.71	4.85	2.35
71	11.62	10.45	9.29	9.29	4.64	4.78	2.32
72	11.45	10.30	9.16	9.16	4.58	4.71	2.29
73	11.30	10.16	9.04	9.04	4.52	4.65	2.26
74	11.15	10.03	8.92	8.92	4.45	4.58	2.23
75	11.00	9.90	8.80	8.80	4.40	4.52	2.20
76	10.86	9.77	8.68	8.68	4.34	4.46	2.17
77	10.72	9.64	8.57	8.57	4.28	4.40	2.14
78	10.58	9.52	8.46	8.46	4.23	4.34	2.11
79	10.44	9.40	8.35	8.35	4.17	4.29	2.09
80	10.31	9.28	8.25	8.25	4.12	4.23	2.06
81	10.18	9.16	8 15	8.15	4.07	4.18	2.03
82	10.06	9.05	8.05	8.05	4.02	4.13	2.01
83	9.94	8.94	7.95	7.95	3.97	4.08	1.99
84	9.82	8.83	7.85	7.85	3.92	4.03	1.96
85	9.70	8.73	7.76	7.76	3.88	3.98	1.94
86	9.59	8.63	7.67	7.67	3.83	3.94	1.92
87	9.48	8.53	7.58	7.58	3.79	3.90	1.90
88	9.37	8.43	7.49	7.49	3.75	3.85	1.87
89	9.27	8.34	7.41	7.41	3.70	3.81	1.85
90	9.17	8.25	7.33	7.33	3.66	3.77	1.83
91	9.07	8.16	7.25		3.62	3.73	1.81
92	8.97	8.06	7.17		3.58	3.69	1.79
93	8.87	7.98	7.09		3.54	3.65	1.77
94	8.78	7.90	7.02		3.51	3.61	1.75
	Change Gears 36″ Frame 24–94 T 39″ Frame 15–70 T	Change Gears 36″ Frame 30–94 T 39″ Frame 15–86 T	Change Gears 36″ Frame 30–94 T 39″ Frame 15–86 T	Change Gears 36″ Frame 40–88 T 39″ Frame 24–90 T	Change Gears 36″ Frame 15–94 T 39″ Frame 15–94 T	Change Gears 36″ Frame 28–94 T 39″ Frame 15–94 T	Change Gears 36″ Frame 30–94 T 39″ Frame 15–94 T
Const's	825.05	742.25	659.78	659.78	330.02	339.05	164.94

Spinning Twist Gear Table.

FRONT ROLL 1 inch Diameter

Cylinder 8 inches Diameter. Ratio Cylinder to Whirl 1 to 9.52

Whirl $\frac{3}{4}$ inch Diameter. Front Roll Gear 108 Teeth

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
15T	109.05	98.15	87.24		43.62	44.83	21.81
16	102.27	92.00	81.78		40.90	42.03	20.45
17	96.25	86.59	76.97		38.50	39.56	19.24
18	90.90	81.78	72.70		36.16	37.36	18.17
19	86.12	77.48	68.87		34.45	35.39	17.22
20	81.81	73.60	65.43		32.72	33.62	16.36
21	76.92	70.10	62.31		31.16	32.02	15.58
22	74.38	66.91	59.48		29.75	30.56	14.87
23	71.14	64.00	56.89		28.45	29.23	14.22
24	68.18	61.33	54.52	54.52	27.27	28.02	13.63
25	65.45	58.88	52.34	52.34	26.18	26.90	13.08
26	62.93	56.62	50.33	50.33	25.17	25.86	12.58
27	60.60	54.52	48.46	48.46	24.24	24.90	12.12
28	58.44	52.57	46.73	46.73	23.37	24.01	11.68
29	56.42	50.76	45.12	45.12	22.57	23.19	11.28
30	54.54	49.07	43.62	43.62	21.81	22.41	10.90
31	52.78	47.48	42.21	42.21	21.11	21.69	10.55
32	51.13	46.00	40.89	40.89	20.45	21.01	10.22
33	49.58	44.61	39.65	39.65	19.83	20.38	9.91
34	48.12	43.29	38.49	38.49	19.25	19.78	9.62
35	46.75	42.06	37.39	37.39	18.69	19.21	9.35
36	45.45	40.89	36.35	36.35	18.18	18.68	9.09
37	44.22	39.78	35.37	35.37	17.69	18.71	8.84
38	43.06	38.74	34.44	34.44	17.22	17.69	8.60
39	41.95	37.74	33.55	33.55	16.78	17.24	8.38
40	40.90	36.80	32.71	32.71	16.36	16.81	8.18
41	39.91	35.90	31.91	31.91	15.96	16.40	7.98
42	38.96	35.05	31.16	31.16	15.58	16.01	7.79
43	38.05	34.23	30.43	30.43	15.22	15.64	7.61
44	37.19	33.46	29.74	29.74	14.87	15.28	7.43
45	36.36	32.71	29.08	29.08	14.54	14.94	7.27
46	35.57	32.00	28.45	28.45	14.22	14.62	7.11
47	34.81	31.32	27.84	27.84	13.92	14.31	6.96
48	34.09	30.66	27.26	27.26	13.63	14.01	6.81
49	33.39	30.04	26.71	26.71	13.35	13.72	6.68
50	32.72	29.44	26.17	26.17	13.09	13.45	6.54
51	32.08	28.86	25.66	25.66	12.83	13.19	6.41
52	31.35	28.31	25.16	25.16	12.58	12.93	6.29
53	30.87	27.77	24.69	24.69	12.35	12.69	6.17
54	30.30	27.26	24.23	24.23	12.12	12.45	6.06
55	29.75	26.76	23.79	23.79	11.90	12.23	5.95
56	29.22	26.28	23.37	23.37	11.61	12.01	5.84
57	28.70	25.82	22.96	22.96	11.48	11.80	5.74
58	28.21	25.38	22.56	22.56	11.28	11.59	5.64
Const's	1636.36	1472.13	1308.56	1308.56	654.55	672.45	327.14

Spinning Twist Gear Table

FRONT ROLL 1 inch Diameter

Cylinder 8 inches diameter. Ratio Cylinder to Whirl 1 to 9.52

Whirl $\frac{3}{4}$ inch diameter. Front Roll gear 108 teeth

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
59T	27.73	24.95	22.18	22.18	11.09	11.40	5.54
60	27.27	24.54	21.81	21.81	10.90	11.21	5.45
61	26.82	24.13	21.45	21.45	10.73	11.02	5.36
62	26.39	23.74	21.11	21.11	10.55	10.85	5.28
63	25.97	23.36	20.77	20.77	10.38	10.67	5.19
64	25.56	23.00	20.45	20.45	10.22	10.51	5.11
65	25.17	22.64	20.13	20.13	10.07	10.35	5.03
66	24.79	22.30	19.83	19.83	9.92	10.19	4.96
67	24.42	21.97	19.53	19.53	9.76	10.04	4.88
68	24.06	21.61	19.24	19.24	9.62	9.89	4.81
69	23.71	21.33	18.97	18.97	9.48	9.75	4.74
70	23.37	21.03	18.69	18.69	9.35	9.61	4.67
71	23.04	20.73	18.43	18.43	9.21	9.47	4.61
72	22.72	20.44	18.17	18.17	9.09	9.34	4.54
73	22.41	20.16	17.93	17.93	8.96	9.21	4.48
74	22.11	19.89	17.68	17.68	8.84	9.09	4.42
75	21.81	19.62	17.45	17.45	8.72	8.97	4.36
76	21.53	19.37	17.22	17.22	8.61	8.85	4.30
77	21.25	19.11	16.99	16.99	8.50	8.73	4.25
78	20.98	18.87	16.80	16.80	8.39	8.62	4.19
79	20.71	18.63	16.56	16.56	8.28	8.51	4.14
80	20.45	18.40	16.36	16.36	8.18	8.41	4.09
81	20.20	18.17	16.15	16.15	8.08	8.30	4.04
82	19.95	17.95	15.96	15.96	7.98	8.20	3.99
83	19.71	17.73	15.75	15.75	7.88	8.10	3.94
84	19.48	17.52	15.58	15.58	7.79	8.01	3.89
85	19.25	17.31	15.39	15.39	7.70	7.91	3.85
86	19.02	17.11	15.22	15.22	7.61	7.82	3.80
87	18.80	16.92	15.04	15.04	7.52	7.73	3.76
88	18.59	16.72	14.87	14.87	7.43	7.64	3.72
89	18.38	16.54	14.70	14.70	7.35	7.56	3.68
90	18.18	16.35	14.54	14.54	7.27	7.47	3.63
91	17.98	16.17	14.38		7.19	7.39	3.59
92	17.78	16.00	14.22		7.11	7.31	3.56
93	17.59	15.83	14.07		7.03	7.23	3.52
94	17.40	15.66	13.92		6.96	7.15	3.48
	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears
	36″ Frame 24-94 T	36″ Frame 30-94 T	36″ Frame 30-94 T	36″ Frame 40-88 T	36″ Frame 15-94 T	36″ Frame 28-94 T	36″ Frame 30-94 T
	39″ Frame 15-70 T	39″ Frame 15-86 T	39″ Frame 15-86 T	39″ Frame 24-90 T	39″ Frame 15-94 T	39″ Frame 15-94 T	39″ Frame 15-94 T
Const's	1636.36	1472.13	1308.56	1308.56	654.55	672.45	327.14

Spinning Twist Gear Table.

FRONT ROLL 1 inch Diameter.

Cylinder 8 inch Diameter. Ratio Cylinder to Whirl 1 to 8.91.

Whirl $\frac{13}{16}$ inch Diameter. Front Roll Gear 108 Teeth.

Change Gears	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 90 T Twist	Cyl. 22 T Stud 88 T Twist	Cyl. 20 T Stud 80 T Twist	Cyl. 40 T Stud 80 T Twist	Cyl. 36 T Stud 74 T Twist	Cyl. 55 T Stud 55 T Twist
15T	102.05	91.85	81.65		40.82	41.96	20.41
16	95.70	86.11	76.55		38.28	39.93	19.13
17	90.07	81.04	72.04		36.03	37.02	18.01
18	85.07	76.54	68.04		34.03	34.96	17.01
19	80.59	72.51	64.46		32.24	33.12	16.11
20	76.56	68.89	61.24		30.63	31.46	15.31
21	72.92	65.61	58.31		29.17	29.97	14.58
22	69.60	62.62	55.67		27.84	28.61	13.92
23	66.57	59.90	53.25		26.63	27.36	13.31
24	63.80	57.40	51.03	51.03	25.52	26.22	12.76
25	61.25	55.11	48.99	48.99	24.50	25.17	12.25
26	58.88	52.99	47.10	47.10	23.56	24.21	11.77
27	56.71	51.03	45.36	45.36	22.68	23.31	11 34
28	54.69	49.20	43.74	43.74	21.87	22.48	10.93
29	52.80	47.51	42.23	42.23	21.12	21.70	10.55
30	51.04	45.92	40.82	40.82	20.42	20.98	10.21
31	49.39	44.44	39.51	39.51	19.76	20.30	9.88
32	47.85	43.05	38.28	38.28	19.14	19.67	9.57
33	46.40	41.75	37.12	37.12	18.56	19.07	9.28
34	45.03	40.52	36.02	36.02	18.01	18.51	9.01
35	43.75	39.36	35.14	35.14	17.50	17.98	8.75
36	42.53	38.21	34.02	34.02	17.01	17.48	8.51
37	41.38	37.23	33.10	33.10	16.55	17.01	8.27
38	40.29	36.25	32.23	32.23	16.12	16.55	8.05
39	39.26	35.32	31.40	31.40	15.70	16.13	7.85
40	38.28	34.44	30.62	30.62	15.31	15.73	7.65
41	37.34	33.60	29.88	29.88	14.94	15.35	7.47
42	36.46	32.80	29.16	29.16	14.58	14.98	7.29
43	35.61	32.04	28.48	28.48	14.24	14.64	7.12
44	34.80	31.31	27.84	27.84	13.92	14.30	6.96
45	34.03	30.61	27.21	27.21	13.61	13.98	6.80
46	33.28	29.95	26.62	26.62	13.31	13.68	6.65
47	32.58	29.31	26.06	26.06	13.03	13.39	6.51
48	31.90	28.70	25.52	25.52	12.76	13.11	6.38
49	31.25	28.11	24.99	24.99	12.50	12.84	6.25
50	30.62	27.55	24.49	24.49	12.25	12.59	6.12
51	30.02	27.01	24.01	24.01	12.01	12.34	6.00
52	29.44	26.49	23·56	23.56	11.78	12.10	5.89
53	28.88	25.99	23.11	23.11	11.55	11.88	5.78
54	28.35	25.51	22.68	22.68	11.34	11.66	5.67
55	27.84	25.05	22.27	22.27	11.17	11.45	5.57
56	27.34	24.60	21.87	21.87	10.93	11.24	5.46
57	26.86	24.17	21.49	21.49	10.74	11.04	5.37
58	26.40	23.75	21.12	21.12	10.56	10.85	5.28
Const's	1531.32	1377.81	1224.72	1224.72	612.61	629.37	306.18

Spinning Twist Gear Table.

FRONT ROLL 1 inch Diameter.

Cylinder 8 inch Diameter. Ratio Cylinder to Whirl 1 to 8.91.

Whirl $\frac{13}{16}$ inch Diameter. Front Roll Gear 108 Teeth.

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl . 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
59T	25.95	23.30	20.76	20.76	10.38	10.67	5.19
60	25.52	22 96	20.41	20.41	10.21	10.49	5.10
61	25.10	22.59	20.08	20.08	10.04	10.32	5.02
62	24.69	22.22	19.75	19.75	9.88	10.15	4.94
63	24.30	21.87	19.44	19.44	9.72	9.99	4.86
64	23.92	21.52	19.14	19.14	9.57	9.83	4.78
65	23.55	21.19	18.84	18.84	9.42	9.68	4.71
66	23.20	20.87	18.56	18.56	9.28	9.54	4.64
67	22.85	20.56	18.28	18.28	9.14	9.39	4.57
68	22.51	20.26	18.01	18.01	9.00	9.25	4.50
69	22.19	19.96	17.75	17.75	8.87	9.12	4.44
70	21.87	19.68	17.50	17.50	8.75	8.99	4.37
71	21.56	19.40	17.25	17.25	8.62	8.86	4.31
72	21.26	19.13	17.01	17.01	8.50	8.74	4.25
73	20.97	18.87	16.78	16.78	8.39	8.62	4.19
74	20.69	18.61	16.55	16.55	8.27	8.51	4.14
75	20.41	18.37	16.33	16.33	8.16	8.39	4.08
76	20.14	18.12	16.11	16.11	8.06	8.28	4.03
77	19.88	17.89	15.91	15.91	7.95	8.17	3.98
78	19.63	17.66	15.70	15.70	7.85	8.07	3.93
79	19.38	17.44	15.50	15.50	7.75	7.97	3.88
80	19.14	17.22	15.31	15.31	7.65	7.87	3.83
81	18.90	17.01	15.12	15.12	7.56	7.77	3.78
82	18.67	16.80	14.94	14.94	7.47	7.68	3.73
83	18.44	16.60	14.75	14.75	7.38	7.58	3.69
84	18.23	16.40	14.58	14.58	7.29	7.49	3.65
85	18.01	16.20	14.41	14.41	7.20	7.40	3.60
86	17.80	16.02	14.24	14.24	7.12	7.32	3.56
87	17.60	15.82	14.08	14.08	7.04	7.23	3.52
88	17.40	15.65	13.92	13.92	6.96	7.15	3.48
89	17.20	15.48	13.76	13.76	6.88	7.07	3.44
90	17.01	15.30	13.61	13.61	6.80	6.99	3.40
91	16.82	15.14	13.46		6.73	6.92	3.36
92	16.64	14.97	13.31		6.65	6.84	3.33
93	16.46	14.81	13.17		6.58	6.77	3.29
94	16.29	14.65	13.03		6.51	6.70	3.26
	Change Gears 36″ Frame 24–94 T 39″ Frame 15–70 T	Change Gears 36″ Frame 30–94 T 39″ Frame 15–86 T	Change Gears 36″ Frame 30–94 T 39″ Frame 15–86 T	Change Gears 36″ Frame 40–88 T 39″ Frame 24–90 T	Change Gears 36″ Frame 15–94 T 39″ Frame 15–94 T	Change Gears 36″ Frame 28–94 T 39″ Frame 15–94 T	Change Gears 36″ Frame 30–94 T 39″ Frame 15–94 T
Const's	1531.32	1377.81	1224.72	1224.72	612.61	629.37	306.18

Spinning Twist Gear Table.

FRONT ROLL 1 Inch Diameter.

Cylinder 8 inches Diameter. Ratio Cylinder to Whirl 1 to 8.28

Whirl $\frac{7}{8}$ inch Diameter. Front Roll Gear 108 Teeth

Change Gears	Cyl. 20T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
15T	94.85	85.37	75.87		37.94	38.99	18.97
16	88.95	80.02	71.13		35.58	36.55	17.78
17	83.71	75.31	66.95		33.48	34.40	16.74
18	79.06	71.13	63.23		31.62	32.49	15.81
19	74.90	67.38	59.90		29.96	30.78	14.97
20	71.16	64.01	56.91		28.46	29.24	14.22
21	67.77	60.97	54.20		27.10	27.85	13.55
22	64.69	58.19	51.73		25.87	26.58	12.93
23	61.87	55.66	49.48		24.75	25.42	12.37
24	59.30	53.34	47.42	47.42	23.72	24.37	11.86
25	56.92	51.21	45.52	45.52	22.77	23.39	11.38
26	54.73	49.24	43.77	43.77	21.89	22.49	10.94
27	52.71	47.42	42.15	42.15	21.08	21.66	10.54
28	50.82	45.72	40.65	40.65	20.33	20.89	10.16
29	48.04	44.15	39.24	39.24	19.63	20.17	9.81
30	47.44	42.67	37.94	37.94	18.97	19.49	9.48
31	45.91	41.30	36.71	36.71	18.36	18.87	9.18
32	44.47	40.01	35.57	35.57	17.79	18.28	8.89
33	43.12	38.79	34.49	34.49	17.25	17.72	8.62
34	41.85	37.65	33.47	33.47	16.74	17.20	8.37
35	40.66	36.58	32.52	32.52	16.26	16.71	8.13
36	39.53	35.56	31.61	31.61	15.81	16.24	7.90
37	38.46	34.60	30.76	30.76	15.38	15.81	7.69
38	37.45	33.69	29.95	29.95	14.98	15.39	7.49
39	36.49	32.83	29.18	29.18	14.59	15.00	7.29
40	35.58	32.00	28.45	28.48	14.23	14.62	7.11
41	34.71	31.22	27.76	27.76	13.88	14.26	6.94
42	33.88	30.48	27.10	27.10	13.55	13.92	6.77
43	33.09	29.77	26.47	26.47	13.23	13.60	6.62
44	32.36	29.10	25.87	25.87	12.93	13.29	6.47
45	31.62	28.45	25.29	25.29	12.65	13.00	6.32
46	30.93	27.83	24.74	24.74	12.37	12.71	6.18
47	30.28	27.24	24.21	24.21	12.11	12.44	6.05
48	29.65	26.67	23.71	23.71	11.86	12.18	5.93
49	29.04	26.10	23.23	23.23	11.61	11.94	5.81
50	28.46	25.60	22.76	22.76	11.38	11.70	5.69
51	27.90	25.10	22.32	22.32	11.16	11.47	5.58
52	27.36	24.62	21.89	21.89	10.94	11.25	5.47
53	26.85	24.15	21.49	21.49	10.74	11.04	5.37
54	26.35	23.71	21.08	21.08	10.54	10.83	5.27
55	25.87	23.27	20.69	20.69	10.35	10.63	5.17
56	25.41	22.86	20.32	20.32	10.16	10.44	5.08
57	24.96	22.46	19.97	19.97	9.98	10.26	4.99
58	24.53	22.07	19.62	19.62	9.81	10.08	4.91
Const's	1423.22	1280.38	1138.12	1138.12	569.28	584.86	284.53

Spinning Twist Gear Table.

FRONT ROLL 1 inch Diameter.

Cylinder 8 inch Diameter. Ratio Cylinder to Whirl 1 to 8.28.

Whirl $\frac{7}{8}$ inch Diameter. Front Roll Gear 108 Teeth

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
59T	24.12	21.70	19.29	19.29	9.64	9.91	4.82
60	23.72	21.33	18.97	18.97	9.48	9.75	4.74
61	23.33	20.98	18.66	18.66	9.33	9.59	4.66
62	22.95	20.65	18.36	18.36	9.18	9.43	4.59
63	22.59	20.32	18.07	18.07	9.03	9.28	4.52
64	22.23	20.00	17.78	17.78	8.89	9.14	4.45
65	21.89	19.69	17.51	17.51	8.75	9.00	4.38
66	21.56	19.39	17.24	17.24	8.62	8.86	4 31
67	21.24	19.11	16.99	16.99	8.49	8.73	4.25
68	20.92	18.83	16.74	16.74	8.37	8.60	4.18
69	20.62	18.55	16.49	16.49	8.25	8.48	4.12
70	20.33	18.29	16.26	16.26	8.13	8.36	4.06
71	20.04	18.03	16.03	16.03	8.01	8.24	4.01
72	19.76	17.78	15.81	15.81	7.90	8.12	3.95
73	19.49	17.53	15.59	15.59	7.79	8.01	3.90
74	19.23	17.30	15.38	15.38	7.69	7.90	3.84
75	18.97	17.07	15.17	15.17	7.59	7.80	3.79
76	18.72	16.84	14.98	14.98	7.49	7.70	3.74
77	18.48	16.62	14.78	14.78	7.39	7.60	3.70
78	18.24	16.41	14.59	14.59	7.29	7.50	3.65
79	18.01	16.20	14.41	14.41	7.20	7.40	3.60
80	17.79	16.00	14.23	14.23	7.11	7.31	3.56
81	17.57	15.80	14.05	14.05	7.02	7.22	3.51
82	17.35	15.61	13.88	13.88	6.94	7.13	3.47
83	17.14	15.42	13.71	13.71	6.85	7.05	3.43
84	16.94	15.24	13.55	13.55	6.77	6.96	3.39
85	16.74	15.06	13.39	13.39	6.69	6.88	3.35
86	16.54	14.88	13.23	13.23	6.61	6.80	3.31
87	16.35	14.71	13.08	13.08	6.54	6.72	3.27
88	16.17	14.54	12.93	12.93	6.46	6.65	3.23
89	15.99	14.38	12.79	12.79	6.39	6.57	3.20
90	15.81	14.22	12.65	12.65	6.32	6.50	3.16
91	15.53	14.07	12.51		6.25	6.43	3.13
92	15.46	13.91	12.37		6.18	6.36	3.09
93	15.30	13.76	12.24		6.12	6.29	3.06
94	15.14	13.62	12.11		6.05	6.22	3.03
	Change Gears 36″ Frame 24–94 T 39″ Frame 15–70 T	Change Gears 36″ Frame 30–94 T 39″ Frame 15–86 T	Change Gears 36″ Frame 30–94 T 39″ Frame 15–86 T	Change Gears 36″ Frame 40–88 T 39″ Frame 24–90 T	Change Gears 36″ Frame 15–94 T 39″ Frame 15–94 T	Change Gears 36″ Frame 28–94 T 39″ Frame 15–94 T	Change Gears 36″ Frame 30–94 T 39″ Frame 15–94 T
Const's	1423.22	1280.38	1138.12	1138.12	569.28	584.86	284.53

Spinning Twist Gear Table.

FRONT ROLL 1 inch Diameter.

Cylinder 8 inch Diameter. Ratio Cylinder to Whirl 1 to 7.67.

Whirl $\frac{15}{16}$ inch Diameter. Front Roll Gear 108 Teeth.

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
15T	87.85	79.06	70.28		35.14	36.12	17.57
16	82.39	74.12	65.89		32.95	33.86	16.48
17	77.55	69.76	62.02		31.02	31.87	15.50
18	73.24	65.89	58.57		29.29	30.10	14.64
19	69.38	62.42	55.49		27.75	28.52	13.87
20	65.91	59.30	52.78		26.36	27.12	13.20
21	62.77	56.47	50.27		25.11	25.83	12.57
22	59.92	53.91	47.98		23.96	24.66	12.00
23	57.32	51.56	45.89		22.92	23.59	11.50
24	54.93	49.41	43.98	43.98	21.97	22.60	11.00
25	52.73	47.44	42.23	42.23	21.09	21.70	10.56
26	50.70	45.62	40.60	40.60	20.28	20.86	10.15
27	48.82	43.92	39.10	39.10	19.53	20.09	9.77
28	47.08	42.35	37.70	37.70	18.83	19.37	9.43
29	45.46	40.89	36.40	36.40	18.17	18.71	9.10
30	43.94	39.53	35.19	35.19	17.57	18.08	8 80
31	42.52	38.26	34.05	34.05	17.01	17.50	8 52
32	41.19	37.06	32.99	32.99	16.47	16.95	8.25
33	39.95	35.94	31.99	31.99	15.98	16.44	8.00
34	38.77	34.88	31.04	31.04	15.51	15.95	7.76
35	37.66	33.88	30.16	30.16	15.09	15.21	7.54
36	36.62	32.94	29.32	29.32	14.64	15.06	7.33
37	35.63	32.05	28.53	28.53	14.25	14.66	7.13
38	34.69	31.21	27.78	27.78	13.87	14.28	6.95
39	33.80	30.41	27.07	27.07	13.52	13.91	6.77
40	32.95	29.65	26.39	26.39	13.18	13.56	6.60
41	32.15	28.92	25.75	25.75	12.86	13.23	6.44
42	31.38	28.23	25.13	25.13	12.55	12.91	6.28
43	30.65	27.58	24.55	24.55	12.26	12.61	6.14
44	29.96	27.86	23.99	23.99	11.98	12.33	6.00
45	29 29	26.35	23.46	23.46	11.71	12.05	5.87
46	28.66	25.78	22.95	22.95	11.46	11.79	5.74
47	28.05	25.23	22.46	22.46	11.21	11.54	5.62
48	27.46	24.70	21.99	21.99	10.98	11.30	5.50
49	26.90	24.20	21.52	21.52	10.76	11.06	5.38
50	26.36	23.72	21.11	21.11	10.54	10.85	5.28
51	25.85	23.25	20.67	20.67	10.34	10.62	5.17
52	25.35	22.80	20.30	20.30	10.14	10.43	5.08
53	24.87	22.37	19.89	19.89	9.95	10.22	4.97
54	24.41	21.96	19.55	19.55	9.76	10.04	4.89
55	23.97	21.56	19.17	19.17	9.58	9.85	4.79
56	23.54	21.17	18.85	18.85	9.41	9.68	4.72
57	23.12	20.80	18.50	18.50	9.25	9.50	4.62
58	22.73	20.44	18.20	18.20	9.09	9.35	4.55
Const's	1318.37	1186.06	1054.27	1054.27	527.35	541.78	263.56

Spinning Twist Gear Table.

FRONT ROLL 1 inch Diameter

Cylinder 8 inches Diameter. Ratio Cylinder to Whirl 1 to 7.67

Whirl $\frac{15}{16}$ inch Diameter Front Roll Gear 108 Teeth

Change Gears	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 90 T Twist	Cyl. 22 T Stud 88 T Twist	Cyl. 20 T Stud 80 T Twist	Cyl. 40 T Stud 80 T Twist	Cyl. 36 T Stud 74 T Twist	Cyl. 55 T Stud 55 T Twist
59T	22.34	20.10	17.87	17.87	8.93	9.18	4.47
60	21.97	19.76	17.59	17.59	8.78	9.04	4.40
61	21.61	19.44	17.28	17.28	8.64	8.88	4.32
62	21.26	19.13	17.03	17.03	8.50	8.75	4.26
63	20.92	18.82	16.73	16.73	8.37	8.60	4.18
64	20.59	18.53	16.47	16.47	8.23	8.47	4.12
65	20.28	18.24	16.22	16.22	8.11	8.34	4.06
66	19.97	17.97	15.99	15.99	7.99	8.22	4.00
67	19.67	17.70	15.74	15.74	7.87	8.09	3.93
68	19.38	17.44	15.50	15.50	7.75	7.97	3.88
69	19.10	17.18	15.27	15.27	7.64	7.85	3.82
70	18.83	16.94	15.08	15.08	7.53	7.75	3.77
71	18.56	16.70	14.85	14.85	7.42	7.63	3.71
72	18.31	16.47	14 64	14.64	7.32	7.52	3.66
73	18.05	16.24	14.46	14.46	7.22	7.42	3.61
74	17.81	16.02	14.26	14.26	7.12	7.32	3.57
75	17.57	15.81	14.06	14.06	7.03	7.22	3.51
76	17.34	15.60	13.87	13.87	6.93	7.13	3.47
77	17.12	15.40	13.69	13.69	6.84	7.04	3.42
78	16.90	15.20	13.53	13.53	6.76	6.95	3.38
79	16.68	15.01	13.35	13.35	6.65	6.86	3.34
80	16.47	14.82	13.18	13.18	6.56	6.77	3.29
81	16.27	14.64	13.02	13.02	6.48	6.69	3.25
82	16.07	14.46	12.87	12.87	6.40	6.62	3.20
83	15.88	14.38	12.70	12.70	6.32	6.53	3.16
84	15.69	14.11	12.55	12.55	6.27	6.45	3.14
85	15.51	13.95	12.40	12.40	6.20	6.37	3.10
86	15.32	13.79	12.27	12.27	6.13	6.31	3.07
87	15.15	13.63	12.12	12.12	6.06	6.23	3.03
88	14.98	13.47	11.98	11.98	5.99	6.16	3.00
89	14.81	13.32	11.85	11.85	5.92	6.09	2.96
90	14.64	13.17	11.71	11.71	5.85	6.03	2.93
91	14.48	13.03	11.58		5.79	5.95	2.89
92	14.33	12.89	11.47		5.73	5.89	2.87
93	14.17	12.75	11.34		5.66	5.83	2.82
94	14.02	12.61	11.22		5.61	5.76	2.79
	Change Gears 36″ Frame 24-94 T 39″ Frame 15-70 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 40-88 T 39″ Frame 24-90 T	Change Gears 36″ Frame 15-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 28-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-94 T
Const's	1318.37	1186.06	1054.27	1054.27	527.35	541.78	263.56

Spinning Twist Gear Table.

FRONT ROLL 1 Inch Diameter.

Cylinder 8 inches Diameter. Ratio Cylinder to Whirl 1 to 7.08

Whirl 1 inch Diameter. Front Roll Gear 108 Teeth

Change Gears	Cyl. 20T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
15T	81.10	72.99	64.88		32.45	33.24	16.22
16	76.05	68.42	60.82		30.42	31.26	15.21
17	71.58	64.40	57.25		28.63	29.42	14.31
18	67.60	60.82	54.07		27.04	27.78	13.52
19	64.05	57.62	51.22		25.62	26.32	12.80
20	60.84	54.74	48.66		24.33	25.05	12.16
21	57.95	52.13	46.34		23.18	23.81	11.59
22	55.31	49.76	44.23		22.12	22.73	11.06
23	52.91	47.60	42.31		21.16	21.74	10.58
24	50.70	45.61	40.55	40.55	20.28	20.84	10.14
25	48.67	43.79	38.93	38.93	19.47	20.00	9.73
26	46.80	42.10	37.43	37.43	18.72	19.23	9.36
27	45.07	40.54	36.04	36 04	18.02	18.52	9.01
28	43.46	39.10	34.76	34.76	17.38	17.86	8.69
29	41.96	37.75	33.56	33.56	16.78	17.24	8.39
30	40.56	36.49	32.44	32.44	16.22	16.67	8.11
31	39.25	35.31	31.39	31.39	15.70	16.13	7.85
32	38.02	34.21	30.41	30.41	15.21	15.63	7.60
33	36.87	33.17	29.49	29.49	14.75	15.15	7.37
34	35.79	32.20	28.62	28.62	14.31	14.71	7.16
35	34.77	31.28	27.80	27.80	13.90	14.29	6.95
36	33.80	30.41	27.03	27.03	13.52	13.89	6.76
37	32.89	29.58	26.30	26.30	13.15	13.52	6.58
38	32.02	28.81	25.61	25.61	12.81	13.16	6.40
39	31.20	28.07	24.95	24.95	12.48	12.82	6.24
40	30.42	27.37	24.33	24.33	12.16	12.50	6.08
41	29.68	26.70	23.74	23.74	11.87	12.20	5.93
42	28.97	26.06	23.17	23.17	11.59	11.90	5.79
43	28.30	25.46	22.63	22.63	11.32	11.63	5.66
44	27.65	24.88	22.12	22.12	11.06	11.37	5.53
45	27.04	24.33	21.63	21.63	10.81	11.11	5.41
46	26.45	23.80	21.16	21.16	10.58	10.87	5.29
47	25.89	23.29	20.71	20.71	10.35	10.64	5.18
48	25.35	22.80	20.27	20.27	10.14	10.42	5.07
49	24.83	22.34	19.86	19.86	9.93	10.22	4.97
50	24.33	21.89	19.46	19.46	9.73	10.00	4.87
51	23.86	21.46	19.08	19.08	9.54	9.81	4.77
52	23.40	21.05	18.71	18.71	9.36	9.62	4.68
53	22.96	20.65	18.36	18.36	9.18	9.44	4.59
54	22.46	20.27	18.02	18.02	9.01	9.22	4.51
55	22.12	19.90	17.68	17.68	8.85	9.09	4.42
56	21.73	19.55	17.38	17.38	8.69	8.93	4.34
57	21.35	19.20	17.05	17.05	8.54	8.77	4.27
58	20.98	18.87	16.78	16.78	8.39	8.62	4.19
Const's	1216.95	1094.82	973.17	973.17	486.78	500.10	243.29

Spinning Twist Gear Table.

FRONT ROLL 1 inch Diameter.

Cylinder 8 inch Diameter. Ratio Cylinder to Whirl 1 to 7.08.

Whirl 1 inch Diameter. Front Roll Gear 108 Teeth

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
59T	20.62	18.55	16.49	16.49	8.25	8.48	4.12
60	20.28	18.24	16.22	16.22	8.11	8.33	4.06
61	19.95	17.94	15.94	15.94	7.98	8.20	3.99
62	19.62	17.65	15.70	15.70	7.85	8.07	3.92
63	19.31	17.37	15.45	15.45	7.72	7.94	3.86
64	19.01	17.10	15.21	15.21	7.60	7.81	3.80
65	18.72	16.84	14.97	14.97	7.48	7.69	3.74
66	18.43	16.58	14.74	14.74	7.37	7.58	3.69
67	18.16	16.34	14.52	14.52	7.26	7.46	3.63
68	17.89	16.10	14.31	14.31	7.15	7.35	3.58
69	17.63	15.86	14.10	14.10	7.05	7.25	3.53
70	17.38	15.64	13.90	13.90	6.95	7.11	3.46
71	17.14	15.42	13.71	13.71	6.85	7.04	3.43
72	16.90	15.20	13.52	13.52	6.76	6.95	3.38
73	16.67	14.91	13.33	13.33	6.66	6.85	3.33
74	16.44	14.79	13.15	13.15	6.57	6.76	3.29
75	16.22	14.59	12.98	12.98	6.49	6.67	3.24
76	16.01	14.40	12.81	12.81	6.40	6.58	3.20
77	15.80	14.21	12.64	12.64	6.32	6.49	3.16
78	15.60	14.03	12.48	12.48	6.24	6.41	3.12
79	15.40	13.85	12.32	12.32	6.16	6.33	3.08
80	15.21	13.68	12 16	12.16	6.08	6.25	3.04
81	15.02	13.51	12.01	12.01	6.00	6.17	3.00
82	14.84	13.35	11.87	11.87	5.93	6.11	2.97
83	14.66	13.19	11.72	11.72	5.86	6.03	2.93
84	14.48	13.03	11.59	11.59	5.79	5.95	2.90
85	14.31	12.88	11.45	11.45	5.72	5.88	2.86
86	14.15	12.73	11.32	11.32	5.66	5.82	2.83
87	14.98	12.58	11.19	11.19	5.59	5.75	2.80
88	14.82	12.44	11.06	11.06	5.53	5.68	2.76
89	13.67	12.30	10.92	10.92	5.46	5.62	2.73
90	13.52	12.16	10.81	10.81	5.40	5.55	2.70
91	13.37	12.03	10.69		5.34	5.50	2.67
92	13.22	11.90	10.58		5.29	5.44	2.64
93	13.08	11.77	10.46		5.23	5.38	2.62
94	12.94	11.64	10.35		5.17	5.32	2.59
	Change Gears 36″ Frame 24–94 T 39″ Frame 15–70 T	Change Gears 36″ Frame 30–94 T 39″ Frame 15–86 T	Change Gears 36″ Frame 30–94 T 39″ Frame 15–86 T	Change Gears 36″ Frame 40–88 T 39″ Frame 24–90 T	Change Gears 36″ Frame 15–94 T 39″ Frame 15–94 T	Change Gears 36″ Frame 28–94 T 39″ Frame 15–94 T	Change Gears 36″ Frame 30–94 T 39″ Frame 15–94 T
Const's	1216.95	1094.82	973.17	973.17	486.78	500.10	243.29

Spinning Twist Gear Table.

FRONT ROLL 1 inch Diameter.

Cylinder 8 inch Diameter. Ratio Cylinder to Whirl 1 to 6.80.

Whirl $1\frac{1}{16}$ inch Diameter. Front Roll Gear 108 Teeth.

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
15T	77.92	70.10	62.31		31.16	32.02	15.58
16	73.05	65.78	58.42		29.22	30.02	14.60
17	68.75	61.85	54.98		27.50	28.25	13.75
18	64.93	58.41	57.93		25.97	28.68	12.98
19	61.51	55.34	49.19		24.60	25.28	12.30
20	58.44	52.57	46.73		23.38	24.01	11.68
21	55.65	50.07	44.51		22.26	22.87	11.13
22	53.12	47.79	42.48		21.25	21.83	10.62
23	50.81	45.71	40.64		20.32	20.88	10.16
24	48.70	43.81	38.94	38.94	19.48	20.01	9.74
25	46.75	42.06	37.39	37.39	18.70	19.21	9.35
26	44.95	40.44	35.95	35.95	17.98	18.47	8.99
27	43.29	38.94	34.62	34.62	17.31	17.79	8.65
28	41.74	37.55	33.38	33.38	16.69	17.15	8.34
29	40.30	36.25	32.23	32.23	16.12	16.56	8.06
30	38.96	35.05	31.15	31.15	15.58	16.01	7.79
31	37.70	33.92	30.15	30.15	15.08	15.49	7.54
32	36.52	32.86	29.21	29.21	14.61	15.01	7.30
33	35.41	31.86	28.32	28.32	14.16	14.55	7.08
34	34.37	30.92	27.49	27.49	13.75	14.13	6.87
35	33.39	30.04	26.70	26.70	13.35	13.72	6.68
36	32.46	29.20	25.96	25.96	12.98	13.34	6.49
37	31.59	28.41	25.26	25.26	12.63	12.98	6.32
38	30.75	27.67	24.60	24.60	12.30	12.64	6.15
39	29.97	26.96	23.97	23.97	11.98	12.32	5.99
40	29.22	26.28	23.37	23.37	11.68	12.00	5.84
41	28.50	25.64	22.80	22.80	11.40	11.71	5.70
42	27.82	25.03	22.25	22.25	11.13	11.44	5.56
43	27.18	24.45	21.74	21.74	10.87	11.17	5.43
44	26.56	23.89	21.24	21.24	10.62	10.91	5.31
45	25.97	23.36	20.77	20.77	10.38	10.67	5.19
46	25.40	22.85	20.32	20.32	10.16	10.44	5.08
47	24.86	22.37	19.89	19.89	9.94	10.22	4.97
48	24.35	21.90	19.47	19.47	9.74	10.01	4.87
49	23.85	21.45	19.08	19.08	9.54	9.80	4.77
50	23.37	21.03	18.69	18.69	9.35	9.61	4.67
51	22.91	20 61	18.33	18.33	9.16	9.42	4.58
52	22.47	20.22	17.97	17.97	8.99	9.23	4.49
53	22.05	19.84	17.64	17.64	8.82	9.06	4.41
54	21.64	19.47	17.31	17.31	8.65	8.90	4.33
55	21.25	19.11	16.99	16.99	8.50	8.73	4.25
56	20.87	18.77	16.69	16.69	8.34	8.58	4.17
57	20 50	18.44	16.40	16.40	8.20	8.42	4.10
58	20.15	18.12	16.11	16.11	8.06	8.28	4.03
Const's	1168.83	1051.52	934.09	934.69	467.53	480.32	233.67

Spinning Twist Gear Table.

FRONT ROLL 1 inch Diameter

Cylinder 8 inches Diameter. Ratio Cylinder to Whirl 1 to 6.80

Whirl $1\frac{1}{16}$ inch Diameter Front Roll Gear 108 Teeth

Change Gears	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 90 T Twist	Cyl. 22 T Stud 88 T Twist	Cyl. 20 T Stud 80 T Twist	Cyl. 40 T Stud 80 T Twist	Cyl. 36 T Stud 74 T Twist	Cyl. 55 T Stud 55 T Twist
59T	19.81	17.82	15.84	15.84	7.92	8.14	3.96
60	19.48	17.52	15.58	15.58	7.79	8.01	3.89
61	19.16	17.23	15.32	15.32	7.66	7.87	3.83
62	18.85	16.96	15.08	15.08	7.54	7.75	3.77
63	18.55	16.69	14.84	14.84	7.42	7.62	3.71
64	18.26	16.43	14.60	14.60	7.30	7.51	3.65
65	17.98	16.17	14.38	14.38	7.19	7.39	3.59
66	17.70	15.93	14.16	14.16	7.08	7.28	3.54
67	17.44	15.69	13.95	13.95	6.97	7.17	3.49
68	17.18	15.46	13.75	13.75	6.87	7.06	3.43
69	16.93	15.23	13.55	13.55	6.77	6.96	3.39
70	16.69	15.02	13.35	13.35	6.67	6.86	3.34
71	16.46	14.81	13.16	13.16	6.58	6.76	3.29
72	16.23	14.60	13.00	13.00	6.49	6.67	3.24
73	16.01	14.40	12.80	12.80	6.40	6.58	3.20
74	15.79	14.21	12.63	12.63	6.31	6.49	3.16
75	15.58	14.02	12.46	12.46	6.23	6.40	3.11
76	15.37	13.83	12.30	12.30	6.15	6.32	3.07
77	15.17	13.65	12.14	12.14	6.07	6.24	3.03
78	14.98	13.48	11.98	11.98	5.99	6.16	3.00
79	14.79	13.31	11.83	11.83	5.91	6.08	2.96
80	14.61	13.14	11.68	11.68	5.84	6.00	2.92
81	14.43	12.98	11.54	11.54	5.77	5.93	2 88
82	14.25	12.82	11.40	11.40	5.70	5.86	2.85
83	14.08	12.66	11.26	11.26	5.63	5.79	2.82
84	13.91	12.51	11.13	11.13	5.56	5.72	2.78
85	13.75	12.37	11.00	11.00	5.50	5.65	2.75
86	13.59	12.22	10.87	10.87	5.43	5.59	2.72
87	13.43	12.08	10.74	10.74	5.37	5.52	2.69
88	13.28	11.94	10.62	10.62	5.31	5.46	2.66
89	13.13	11.81	10 50	10.50	5.25	5.40	2.62
90	12.98	11.68	10.39	10.39	5.19	5.34	2.60
91	12.84	11.55	10.27		5.13	5.28	2 57
92	12.70	11.42	10.16		5.08	5.22	2 54
93	12.56	11.30	10.05		5,02	5.16	2 51
94	12.43	11.18	9.94		4.97	5.11	2.49
	Change Gears 36″ Frame 24-94 T 39″ Frame 15-70 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 40-88 T 39″ Frame 24-90 T	Change Gears 36″ Frame 15-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 28-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-94 T
Const's	1168.83	1051.52	934.69	934.69	467.53	480.32	233.67

Spinning Twist Gear Table.

FRONT ROLL 1 inch Diameter.

Cylinder 8 inch Diameter. Ratio Cylinder to Whirl 1 to 6.22.

Whirl 1⅛ inch Diameter. Front Roll Gear 108 Teeth.

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
15T	71.27	64.12	57.00		28.51	29.29	14.25
16	66.82	60.11	53.44		26.72	27.46	13.36
17	62.89	56.57	50.29		25.15	25.84	12.57
18	59.39	53.45	47.50		23.75	24.41	11.87
19	56.27	50.62	45.00		22.50	23.12	11.25
20	53.45	48.09	42.75		21.38	21.97	10.69
21	50.91	45.80	40.71		20.36	20.92	10.18
22	48.59	43.71	38.86		19.43	19.97	9.72
23	46.44	41.81	37.17		18.59	19.10	9.29
24	44.54	40.07	35.62	35.62	17.81	18.30	8.91
25	42.76	38.47	34.20	35.20	17.10	17.57	8.55
26	41.12	36.99	32.88	32.88	16.44	16.90	8.22
27	39.59	35.62	31.66	31.66	15.83	16.27	7.92
28	38.18	34.35	30.53	30.53	15.27	15.69	7.63
29	36.86	33.16	29.48	29.48	14.74	15.15	7.37
30	35.63	32.06	28.50	28.50	14.25	14.65	7.12
31	34.48	31.02	27.58	27.58	13.79	14.17	6.89
32	33.41	30.05	26.72	26.72	13.36	13.73	6.68
33	32.39	29.14	25.91	25.91	12.95	13.31	6.48
34	31.44	28.28	25.15	25.15	12.57	12.92	6.29
35	30.54	27.48	24.43	24.43	12.21	12.55	6.11
36	29.69	26.72	23.75	23.75	11.89	12.20	5.94
37	28.89	25.99	23.11	23.11	11.55	11.87	5.78
38	28.13	25.31	22.50	22.50	11.25	11.56	5.62
39	27.41	24.66	21.92	21.92	10.96	11.27	5.48
40	26.72	24.04	21.37	21.37	10.69	10.98	5.34
41	26.07	23.45	20.85	20.85	10.43	10.72	5.21
42	25.45	22.40	20.36	20.36	10.18	10.46	5.09
43	24.86	22.37	19.88	19.88	9.94	10.22	4.97
44	24.29	21.85	19.43	19.43	9.71	9.99	4.86
45	23.75	21.37	19.00	19.00	9.50	9.76	4.75
46	23.24	20.90	18.59	18.59	9.29	9.55	4.65
47	22.74	20.46	18.19	18.19	9.09	9.35	4.55
48	22.27	20.03	17.81	17.81	8.90	9.15	4.45
49	21.81	19.62	17.45	17.45	8.72	8.97	4.36
50	21.38	19.23	17.10	17.10	8.55	8.79	4.27
51	20.96	18.85	16.76	16.76	8.38	8.61	4.19
52	20.56	18.49	16.44	16.44	8.22	8.45	4.11
53	20.17	18.14	16.13	16.13	8.07	8.29	4.03
54	19.79	17.81	15.83	15.83	7.91	8.14	3.96
55	19.43	17.48	15.54	15.54	7.77	7.99	3.89
56	19.09	17.17	15.27	15.27	7.63	7.85	3.82
57	18.75	16.87	15.00	15.00	7.50	7.71	3.76
58	18.43	16.58	14.74	14.74	7.37	7.58	3.68
Const's	1069.13	961.83	854.96	854.96	427.65	439.35	213.74

Spinning Twist Gear Table.

FRONT ROLL 1 inch Diameter.

Cylinder 8 inch Diameter. Ratio Cylinder to Whirl 1 to 6.22.

Whirl 1⅛ inch Diameter. Front Roll Gear 108 Teeth.

Change Gears	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 90 T Twist	Cyl . 22 T Stud 88 T Twist	Cyl. 20 T Stud 80 T Twist	Cyl. 40 T Stud 80 T Twist	Cyl. 36 T Stud 74 T Twist	Cyl. 55 T Stud 55 T Twist
59T	18.12	16.30	14.49	14.49	7.24	7.45	3.62
60	17.81	16.03	14.25	14.25	7.12	7.32	3.57
61	17.52	15.76	14.01	14.01	7.01	7.20	3.50
62	17.24	15.51	13.79	13.79	6.90	7.09	3.45
63	16.97	15.26	13.57	13.57	6.78	6.97	3.39
64	16.70	15.02	13.36	13.36	6.68	6.86	3.34
65	16.44	14.79	13.15	13.15	6.58	6.76	3.29
66	16.19	14.57	12.95	12.95	6.48	6.66	3.24
67	15.95	14.35	12.76	12.76	6.38	6.56	3.19
68	15.72	14.14	12.57	12.57	6.28	6.46	3.14
69	15.49	13.93	12.39	12.39	6.20	6.37	3.10
70	15.27	13.74	12.21	12.21	6.10	6.28	3.05
71	15.05	13.54	12.04	12.04	6.02	6.19	3.01
72	14.88	13.35	11.87	11.87	5.94	6.10	2.97
73	14.64	13.17	11.71	11.71	5.84	6.02	2.92
74	14.44	12.99	11.55	11.55	5.78	5.94	2.89
75	14.25	12.82	11.40	11.40	5.70	5.86	2.85
76	14.06	12.65	11.25	11.25	5.62	5.78	2.81
77	13.88	12.49	11.10	11.10	5.55	5.71	2.78
78	13.70	12.33	10.96	10.96	5.48	5.63	2.74
79	13.53	12.17	10.82	10.82	5.41	5.56	2.71
80	13.36	12.02	10.69	10.69	5.34	5 49	2.67
81	13.19	11.87	10.56	10.56	5.27	5.42	2.64
82	13.03	11.72	10.43	10.43	5.21	5.36	2.61
83	12.88	11.58	10.30	10.30	5.15	5.29	2.58
84	12.72	11.45	10.18	10.18	5.09	5.23	2.54
85	12.57	11.31	10.06	10.06	5.03	5.17	2.51
86	12.43	11.18	9.94	9.94	4.97	5.11	2.49
87	12.28	11.05	9.83	9.83	4.91	5.05	2.46
88	12.14	10.92	9.72	9.72	4.85	4.99	2.43
89	12.01	10.80	9.61	9.61	4.80	4.94	2.40
90	11.87	10.68	9.50	9.50	4.75	4.88	2.37
91	11.74	10.56	9.40		4.69	4.83	2.34
92	11.62	10.45	9.29		4.64	4.78	2.32
93	11.49	10.34	9.19		4.59	4.72	2.30
94	11.37	10.23	9.10		4.54	4.67	2.27
	Change Gears 36″ Frame 24-94 T 39″ Frame 15-70 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 40-88 T 39″ Frame 24-90 T	Change Gears 36″ Frame 15-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 28-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-94 T
Const's	1069.13	961.83	854.96	854.96	427.65	439.35	213.74

Spinning Twist Gear Table.

FRONT ROLL 1 inch Diameter

Cylinder 8 inches Diameter. Ratio Cylinder to Whirl 1 to 5.48

Whirl 1 $\frac{5}{16}$ inch Diameter. Front Roll Gear 108 Teeth

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
15T	62.79	56.49	50.22		25.10	25.80	12.55
16	58.87	52.96	47.08		23.54	24.19	11.77
17	55.40	49.84	44.31		22.16	22.77	11.08
18	52.33	47.07	41.85		20.93	21.50	10.46
19	49.57	44.60	39.64		19.83	20.37	9.91
20	47.09	42.37	37.66		18.83	19.35	9.41
21	44·85	40.35	35.87		17.94	18.43	8.97
22	42.81	38.51	34.24		17.12	17.59	8.56
23	40.95	36.84	32.75		16.37	16.83	8.19
24	39.24	35.30	31.38	31.38	15.69	16.13	7.85
25	37.67	33.89	30.13	30.13	15.07	15.48	7.53
26	36.22	32.59	28.97	28.97	14.49	14.89	7.24
27	34.88	31.38	27.90	27.90	13.95	14.34	6.97
28	33.64	30.26	26.90	26.90	13.45	13.82	6.72
29	32.48	22.22	25.97	25.97	12.99	13.35	6.49
30	31.39	28.24	25.11	25.11	12.55	12.90	6.28
31	30.38	27.33	24.30	24.30	12.15	12.49	6.07
32	29.43	26.48	23.54	23.54	11.77	12.10	5.88
33	28.54	25.67	22.83	22.83	11.41	11.73	5.74
34	27.70	24.92	22.15	22.15	11.08	11.38	5.54
35	26.91	24.21	21.52	21.52	10.76	11.06	5.38
36	26.16	23.53	20.92	20.92	10.46	10.75	5.23
37	25.45	22.90	20.36	20.36	10·18	10.46	5.09
38	24.78	22.30	19.82	19.82	9.91	10.19	4.96
39	24.15	21.72	19.31	19.31	9·66	9.93	4.83
40	23.54	21.18	18.83	18.83	9.41	9.68	4.71
41	22.97	20.66	18.37	18.37	9.18	9.44	4.59
42	22.40	20.17	17.93	17.93	8.97	9.22	4.48
43	21.90	19.70	17.52	17.52	8.76	9.01	4.38
44	21.40	19.25	17.12	17.12	8.56	8.80	4.28
45	20.93	18.83	16.74	16.74	8.37	8.60	4.18
46	20.47	18.42	16.37	16.37	8.19	8.41	4.09
47	20·04	18.03	16.03	16.03	8.01	8.24	4.01
48	19.62	17.65	15.69	15.69	7.84	8.06	3.92
49	19.22	17.29	15.37	15.37	7.68	7.90	3.84
50	18.83	16.94	15.06	15.06	7.53	7.74	3.77
51	18 46	16.61	14.77	14.77	7.38	7.59	3.69
52	18.11	16.29	14.49	14.49	7.24	7.44	3.62
53	17.77	15.98	14.21	14.21	7.10	7.30	3.55
54	17.44	15.69	13.95	13.95	6.97	7.17	3.49
55	17.12	15.40	13.70	13.70	6.85	7.04	3.42
56	16.82	15.13	13.45	13.45	6.72	6.91	3.36
57	16.52	14.86	13.21	13.21	6.61	6.79	3.30
58	16.24	14.61	12.99	12.99	6.49	6.67	3.25
Const's	941.94	847 40	753.25	753.25	376.77	387.08	188.31

Spinning Twist Gear Table

FRONT ROLL 1 inch Diameter

Cylinder 8 inches diameter. Ratio Cylinder to Whirl 1 to 5.48

Whirl 1 $\frac{5}{16}$ inch diameter. Front Roll gear 108 teeth

Change Gears	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 90 T Twist	Cyl. 22 T Stud 88 T Twist	Cyl. 20 T Stud 80 T Twist	Cyl. 40 T Stud 80 T Twist	Cyl. 36 T Stud 74 T Twist	Cyl. 55 T Stud 55 T Twist
59T	15.96	14.36	12.77	12.77	6.38	6.56	3.19
60	15.69	14.12	12.55	12.55	6.27	6.45	3.14
61	15.44	13.89	12.35	12.35	6.17	6.35	3.09
62	15.19	13.66	12.15	12.15	6.07	6.24	3.04
63	14.94	13.45	11.96	11.96	5.98	6.14	2.99
64	14.71	13.24	11.77	11.77	5.88	6.05	2.94
65	14.49	13.03	11.59	11.59	5.79	5.96	2.90
66	14.27	12.84	11.41	11.41	5.70	5.86	2.85
67	14.05	12.64	11.24	11.24	5.62	5.78	2.81
68	13.85	12.46	11.08	11.08	5.54	5.69	2.77
69	13.65	12.28	10.92	10.92	5.46	5.61	2.73
70	13.45	12.10	10.76	10.76	5.38	5.53	2.69
71	13.26	11.93	10.61	10.61	5.30	5.45	2.65
72	13.08	11.77	10.46	10.46	5.23	5.38	2.62
73	12.90	11.60	10.32	10.32	5.16	5.30	2.58
74	12.72	11.45	10.18	10.18	5.09	5.23	2.54
75	12.55	11.29	10.04	10.04	5.02	5.16	2.51
76	12.39	11.15	9.91	9.91	4.95	5.09	2.48
77	12.23	11.00	9.78	9.78	4.89	5.03	2.45
78	12.07	10.86	9.66	9.66	4.82	4.96	2.41
79	11.92	10.72	9.53	9.53	4.76	4.90	2.38
80	11.77	10.59	9.42	9.42	4.70	4.84	2.35
81	11.62	10.46	9.30	9.30	4.65	4.78	2.32
82	11.48	10.33	9.19	9.19	4.59	4.72	2.30
83	11.34	10.20	9.08	9.08	4.53	4.66	2.27
84	11.21	10.08	8.97	8.97	4.48	4.61	2.24
85	11.08	9.96	8.86	8.86	4.43	4.55	2.22
86	10.95	9.85	8.76	8.76	4.38	4.50	2.19
87	10.82	9.74	8.66	8.66	4.33	4.45	2.16
88	10.70	9.62	8.56	8.56	4.28	4.40	2.14
89	10.58	9.52	8.46	8.46	4.23	4.35	2.12
90	10.46	9.41	8.37	8.37	4.18	4.30	2.09
91	10.35	9.31	8.28		4.14	4.25	2.07
92	10.23	9.21	8.19		4.09	4.21	2.05
93	10.12	9.11	8.10		4.05	4.16	2.02
94	10.02	9.01	8.01		4.00	4.12	2.00
	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears
	36″ Frame 24-94 T	36″Frame 30-94 T	36″ Frame 30-94 T	36″ Frame 40-88 T	36″ Frame 15-94 T	36″ Frame 28-94 T	36″ Frame 30-94 T
	39″ Frame 15-70 T	39″ Frame 15-86 T	39″Frame 15-86 T	39″ Frame 24-90 T	39″ Frame 15-94 T	39″ Frame 15-94 T	39″ Frame 15-94 T
Const's	941.94	847.40	753.25	753.25	376.77	387.08	188.31

Spinning Twist Gear Table.

FRONT ROLL 1⅛ inch Diameter

Cylinder 7 inches Diameter. Ratio Cylinder to Whirl 1 to 8.33

Whirl ⅝ inch Diameter. Front Roll Gear 108 Teeth

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
15T	84.85	76.33	67.88		33.94	34.88	16.96
16	79.54	71.56	63.64		31.81	32.70	15.90
17	74.86	67.35	59.89		29.94	40.77	14.97
18	70.70	63.61	56.57		28.28	29.06	14.14
19	66.98	60.21	53.59		26.79	27.53	13.39
20	63.63	57.24	50.91		25.45	26.16	12.72
21	60.60	54.52	48.48		24.24	24.91	12.12
22	57.85	52.04	46.28		23.14	23.78	11.57
23	55.33	49.78	44.27		22.13	22.74	11.06
24	53.03	47.70	42.42	42.42	21.21	21.80	10.60
25	50.90	45.79	40.73	40.73	20.39	20.92	10.18
26	48.95	44.03	39.16	39.16	19.57	20.12	9.79
27	47.13	42.40	37.71	37.71	18.85	19.37	9.42
28	45.45	40.89	36.36	36.36	18.18	18.68	9.09
29	43.88	39.48	35.11	35.11	17.55	18.04	8.77
30	42.42	38.16	33.94	33.94	16.96	17.44	8.48
31	41.05	36.93	32.84	32.84	16.42	16.87	8.21
32	39.77	35.78	31.82	31.82	15.90	16.35	7.95
33	38.56	34.69	30.85	30.85	15.42	15.85	7.71
34	37.43	33.67	29.95	29.95	14.97	15.38	7.48
35	36.36	32.71	29.09	29.09	14.54	14.94	7.27
36	35.35	31.80	28.28	28.28	14.14	14.53	7.07
37	34.39	30.94	27.52	27.52	13.75	14.14	6.87
38	33.49	30.13	26.79	26.79	13.39	13.76	6.69
39	32.63	29.35	26.11	26.11	13.05	13.41	6.52
40	31.81	28.62	25.45	25.45	12.72	13.08	6.36
41	31.04	27.92	24.83	24.83	12.41	12.76	6.20
42	30.30	27.26	24.24	24.24	12.12	12.45	6.06
43	29.59	26.62	23.68	23.68	11.83	12.16	5.91
44	28.92	26.02	23.14	23.14	11.57	11.89	5.78
45	28.28	25.44	22.63	22.63	11.31	11.62	5.65
46	27.66	24.89	22.13	22.13	11.06	11.37	5.53
47	27.07	24.36	21.66	21.66	10.83	11.13	5.41
48	26.51	23.85	21.21	21.21	10.60	10.90	5.30
49	25.97	23.36	20.78	20.78	10.38	10.67	5.19
50	23.45	22.89	20.36	20.36	10.18	10.46	5.09
51	24.95	22.45	19.96	19.96	9.98	10.25	4.99
52	24.47	22.01	19.58	19.58	9.79	10 06	4.89
53	24.01	21.60	19.21	19.21	9.62	9.87	4.80
54	23.56	21.20	18.86	18.86	9.42	9.68	4.71
55	23.14	20.81	18.51	18.51	9.25	9.51	4.62
56	22.72	20.44	18.18	18.18	9.09	9.34	4.54
57	22.32	20.08	17.86	17.86	8.93	9.17	4.46
58	21.94	19.74	17.55	17.55	8.77	9.02	4.38
Const's	1272.72	1144.99	1018.18	1018.18	509.09	523.22	254.54

Spinning Twist Gear Table.

FRONT ROLL 1⅛ inch Diameter.

Cylinder 7 inch Diameter. Ratio Cylinder to Whirl 1 to 8.33.

Whirl ¾ inch Diameter. Front Roll Gear 108 Teeth

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
59T	21 57	19.40	17.26	17.26	8.62	8.86	4.31
60	21.21	19.08	16.97	16.97	8.48	8.72	4.24
61	20.86	18.77	16.69	16.69	8.35	8.57	4.17
62	20.52	18.46	16.42	16.42	8.21	8.43	4.10
63	20.20	18.17	16.16	16.16	8.08	8.30	4.04
64	19.88	17.89	15.91	15.91	7.95	8.17	3.97
65	19.58	17.61	15.66	15 66	7.83	8.04	3.91
66	19.28	17.34	15.43	15.43	7.71	7.92	3.85
67	18.99	17.08	15.20	15.20	7.59	7.80	3.79
68	18.71	16.83	14.97	14.97	7.48	7.69	3.74
69	18.44	16.59	14.76	14.76	7.37	7.58	3.68
70	18.18	16.35	14.55	14.55	7.27	7.47	3.63
71	17.92	16.12	14.34	14.34	7.17	7.36	3.58
72	17.67	15.90	14.14	14.14	7.07	7.26	3.53
73	17.43	15.68	13.95	13.95	6.97	7.16	3.48
74	17.19	15.47	13.76	13.76	6.87	7.07	3.43
75	16.96	15.26	13.58	13.58	6.78	6.97	3.39
76	16.74	15.06	13.40	13.40	6.69	6.88	3.34
77	16.52	14.87	13.20	13.20	6.61	6.79	3.30
78	16.31	14.67	13.05	13.05	6.52	6.70	3.26
79	16.11	14.49	12.89	12.89	6.44	6.62	3.22
80	15.90	14.31	12.73	12.73	6.36	6.54	3.18
81	15.71	14.14	12.57	12.57	6.28	6.45	3.14
82	15.52	13.96	12.42	12.42	6.20	6.38	3.10
83	15.33	13.80	12.27	12.27	6.13	6.30	3.06
84	15.15	13.63	12.12	12.12	6.06	6.22	3.03
85	14.97	13.47	11.98	11.98	5.98	6.15	2.99
86	14.79	13.31	11.84	11.84	5.91	6.08	2.95
87	14.62	13.16	11.70	11.70	5.85	6.01	2.92
88	14.46	13.01	11.57	11.57	5.78	5.94	2.89
89	14.30	12.87	11.44	11.44	5.72	5.87	2.86
90	14.14	12.72	11.31	11.31	5.65	5.81	2.82
91	13.99	12.58	11.19		5.59	5.74	2.79
92	13.83	12.45	11.07		5.53	5.66	2.76
93	13.69	12 31	10.95		5.47	5.62	2.73
94	13.54	12.18	10.83		5.41	5.56	2.70
	Change Gears 36″ Frame 24-94 T 39″ Frame 15-70 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 40-88 T 39″ Frame 24-90 T	Change Gears 36″ Frame 15-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 28-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-94 T
Const's	1272.72	1144.99	1018.18	1018.18	509.09	523.22	254.54

Spinning Twist Gear Table.

FRONT ROLL 1⅛ inch Diameter.

Cylinder 7 inch Diameter. Ratio Cylinder to Whirl 1 to 7.68.

Whirl $\frac{13}{16}$ inch Diameter. Front Roll Gear 108 Teeth.

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
15T	78.23	70.38	62.58		31.29	32.16	15.64
16	73.33	65.97	58.67		29.33	30.46	14.66
17	69.02	62.09	55.22		27.61	28.77	13.80
18	65.18	58.64	52.15		26.07	27.08	13.03
19	61.75	55.56	49.41		24.70	25.39	12.35
20	58.67	52.75	46.94		23.46	24.28	11.73
21	55.87	50.25	44.70		22.35	23.17	11.17
22	53.33	47.98	42.67		21.33	22.07	10.66
23	51.01	45.89	40.81		20.40	20.97	10.20
24	48.89	43.98	39.11	39.11	19.55	20.19	9.77
25	46.93	42.22	37.55	37.55	18.77	19.41	9.38
26	45.13	40.60	36.11	36.11	18.05	18.64	9.02
27	43.45	39.09	34.77	34.77	17.38	17.87	8.69
28	41.90	37.70	33.53	33.53	16.76	17.29	8.38
29	40.46	36.40	32.37	32.37	16.18	16.71	8.09
30	39.11	35.18	31.29	31.29	15.64	16.13	7.82
31	37.85	34.05	30.28	30.28	15.14	15.56	7.57
32	36.66	32.98	29.33	29.33	14.66	15.11	7.33
33	35.55	31.98	28.45	28.45	14.22	14.66	7.11
34	34.51	31.04	27.61	27.61	13.80	14.22	6.90
35	33.52	30.16	26.82	26.82	13.41	13.78	6.70
36	32.59	29.32	26.04	26.04	13.03	13.42	6.51
37	31.71	28.53	25.37	25.37	12.68	13.07	6.34
38	30.87	27.78	24.70	24.70	12.35	12.72	6.17
39	30.08	27.06	24.07	24.07	12.03	12.37	6.01
40	29.33	26.39	23.47	23.47	11.73	12 08	5.86
41	28.61	25.74	22.90	22.90	11.44	11.79	5.72
42	27.93	25.13	22.35	22.35	11.17	11.50	5.58
43	27.28	24.55	21.83	21.83	10.91	11.22	5.45
44	26.66	23.99	21 33	21.33	10.66	10.98	5.33
45	26.07	23.45	20.86	20.86	10.43	10.74	5.21
46	25.50	22.94	20.41	20.41	10.20	10.50	5.10
47	24.96	22.46	19.97	19.97	9.98	10.26	4.99
48	24.44	21.99	19.56	19.56	9.77	10.06	4.88
49	23.94	21.54	19.16	19.16	9.57	9.86	4.78
50	23.46	21.11	18.77	18.77	9.38	9.66	4.69
51	23.00	20.69	18.41	18.41	9.20	9.46	4.60
52	22.56	20.30	18.05	18.05	9.02	9.28	4.51
53	22.15	19.91	17.71	17.71	8.85	9.11	4.42
54	21.72	19.54	17.38	17.38	8.69	8.94	4.34
55	21.33	19.19	17.07	17.07	8.53	8.77	4.26
56	20.95	18.85	16.76	16.76	8.38	8.62	4.19
57	20.58	18.52	16.47	16.47	8.23	8.47	4.11
58	20.23	18.20	16.19	16.19	8.09	8.32	4.04
Const's	1173.41	1055.65	938.73	938.73	469.36	482.40	234.68

Spinning Twist Gear Table.

FRONT ROLL 1⅛ inch Diameter.

Cylinder 7 inch Diameter. Ratio Cylinder to Whirl 1 to 7.68.

Whirl $\frac{13}{16}$ inch Diameter. Front Roll Gear 108 Teeth.

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
59T	19.88	17.90	15.91	15.91	7.95	8.18	3.97
60	19.55	17.59	15.65	15.65	7.82	8.05	3.91
61	19.23	17.30	15.39	15.39	7.69	7.92	3.84
62	18.92	17.02	15.14	15.14	7.57	7.79	3.78
63	18.62	16.75	14.90	14.90	7.45	7.66	3.72
64	18.33	16.49	14.67	14.67	7.33	7.54	3.66
65	18.05	16.24	14.44	14.44	7.22	7.42	3.61
66	17.77	15.99	14.22	14.22	7.11	7.31	3.55
67	17.51	15.75	14.01	14.01	7.00	7.20	3.50
68	17.25	15 52	13.80	13.80	6.90	7.09	3.45
69	17.00	15.29	13.60	13.60	6.80	6.99	3.40
70	16.76	15.08	13.41	13.41	6.70	6.89	3.35
71	16.52	14.86	13.22	13.22	6.61	6.79	3 30
72	16.29	14.66	13.04	13.04	6.51	6.70	3 25
73	16.07	14.46	12.86	12.86	6.42	6.61	3.21
74	15.85	14.26	12.69	12.69	6.34	6.52	3.17
75	15.64	14.07	12.52	12.52	6.25	6.43	3.12
76	15.43	13.87	12.35	12.35	6.17	6.35	3.08
77	15.24	13.71	12.19	12.19	6.09	6.27	3.04
78	15.04	13.53	12.04	12.04	6.01	6.19	3.00
79	14.85	13.36	11.88	11.88	5.94	6.11	2.97
80	14.67	13.20	11.73	11.73	5.86	6.03	2.93
81	14.49	13.03	11.59	11.59	5.79	5.95	2.89
82	14.31	12.87	11.45	11.45	5.72	5.88	2.86
83	14.14	12.73	11.31	11.31	5.65	5.81	2.82
84	13.97	12.57	11.18	11.18	5.58	5.74	2.79
85	13.80	12.42	11.04	11.04	5.52	5.67	2.76
86	13.64	12.28	10.92	10.92	5.45	5.60	2.72
87	13.49	12.13	10.79	10.79	5.39	5.54	2.69
88	13.33	12.00	10.67	10.67	5.33	5.48	2.66
89	13.18	11.86	10.55	10.55	5.27	5.42	2.63
90	13.04	11.73	10.43	10.43	5.21	5.36	2.60
91	12.89	11.60	10.32		5.15	5.30	2.57
92	12.75	11.47	10.20		5.10	5.24	2.55
93	12.62	11.35	10.09		5.04	5.18	2.52
94	12.48	11.23	9.99		4.99	5.13	2.49
	Change Gears 36″ Frame 24–94 T 39″ Frame 15–70 T	Change Gears 36″ Frame 30–94 T 39″ Frame 15–86 T	Change Gears 36″ Frame 30–94 T 39″ Frame 15–86 T	Change Gears 36″ Frame 40–88 T 39″ Frame 24–90 T	Change Gears 36″ Frame 15–94 T 39″ Frame 15–94 T	Change Gears 36″ Frame 28–94 T 39″ Frame 15–94 T	Change Gears 36″ Frame 30–94 T 39″ Frame 15–94 T
Const's	1173.41	1055.65	938.73	938.73	469.36	482.40	234.68

Spinning Twist Gear Table.

FRONT ROLL 1⅛ inch Diameter

Cylinder 7 inches Diameter. Ratio Cylinder to Whirl 1 to 7.25

Whirl ⅞ inch Diameter. Front Roll Gear 108 Teeth

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
15T	73.85	66.44	59.08		29.54	30.35	14.76
16	69.23	62.25	55.39		27.69	28.46	13.84
17	65.15	58.62	52.13		26.18	26.78	13.03
18	61.53	55.36	49.23		24.61	25.29	12.30
19	58.30	52.44	46.64		23.32	23.96	11.66
20	55 38	49.82	44.31		22.15	22.76	11.07
21	52.74	47.45	42.20		21.09	21.68	10.54
22	50.35	45.29	40.28		20.14	20.69	10.07
23	48.16	43.32	38.53		19.26	19.79	9.63
24	46.15	41.52	36.92	36.92	18.46	18.97	9.23
25	44.30	39.86	35.45	35.45	17.72	18.21	8.86
26	42.60	38.32	34.08	34.08	17.04	17.51	8.52
27	41.02	36.91	32.82	32.82	16.41	16.86	8.20
28	39.20	35.59	31.65	31.65	15.82	16.26	7.91
29	38.19	34.36	30.56	30.56	15.27	15.70	7.63
30	36.92	33.21	29.54	29.54	14.76	15.17	7.38
31	35.73	32.14	28.59	28.59	14.29	14.69	7.14
32	34.61	31·14	27.69	27.69	13.84	14.23	6.92
33	33.56	30.19	26.85	26.85	13.42	13.79	6.71
34	32.55	29.31	26.06	26.06	13.03	13.39	6.51
35	31.64	28.50	25.32	25.32	12.65	13.01	6.32
36	30.76	27.68	24.62	24.62	12.30	12.64	6.15
37	29.93	26.93	23.95	23.95	11.97	12.30	5.98
38	29.15	26.22	23.32	23.32	11.66	11.98	5.83
39	28.40	25.55	22.72	22.72	11.36	11.67	5.68
40	27.69	24.91	22.15	22.15	11.07	11.38	5.53
41	27.01	24.30	21.61	21.61	10.80	11.10	5.40
42	26.37	23.72	21.10	21.10	10.54	10.84	5.27
43	25.76	23.17	20.61	20.61	10.31	10.59	5.15
44	25.17	22.64	20.14	20.14	10.07	10.34	5.03
45	24.61	22.14	19.69	19.69	9.84	10.11	4.92
46	24.08	21.66	19.26	19.26	9.63	9.89	4.81
47	23.56	21.20	18.85	18.85	9.44	9.68	4.71
48	23.07	20·76	18.46	18.46	9.23	9.48	4.61
49	22.60	20.33	18.09	18.09	9.04	9.29	4.52
50	22.15	19.93	17.72	17.72	8.86	9.10	4.43
51	21.72	19.54	17.38	17.38	8.68	8.92	4.34
52	21.30	19.16	17.04	17.04	8.52	8.75	4.26
53	20.90	18.80	16.72	16.72	8.36	8.59	4.18
54	20.51	18.45	16.41	16.41	8.20	8.43	4.10
55	20.14	18.11	16.11	16.11	8.05	8.27	4.02
56	19.78	17.79	15.82	15.82	7.91	8.13	3.95
57	19.43	17.48	15.55	15.55	7.77	7.98	3.88
58	19.09	17.18	15.28	15.28	7.63	7.85	3.81
Const's	1107.71	996.54	886.17	886.17	443.09	455.39	221.54

Spinning Twist Gear Table.

FRONT ROLL 1⅛ inch Diameter.

Cylinder 7 inch Diameter. Ratio Cylinder to Whirl 1 to 7.25.

Whirl ⅞ inch Diameter. Front Roll Gear 108 Teeth

Change Gears	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 90 T Twist	Cyl. 22 T Stud 88 T Twist	Cyl. 20 T Stud 80 T Twist	Cyl. 40 T Stud 80 T Twist	Cyl. 36 T Stud 74 T Twist	Cyl. 55 T Stud 55 T Twist
59T	18.77	16.89	15.02	15.02	7.50	7.71	3.75
60	18.46	16.60	14.77	14.77	7.38	7.58	3.69
61	18.15	16.33	14.53	14.53	7.26	7.46	3.63
62	17.86	16.07	14.29	14.29	7.14	7.34	3.57
63	17.58	15.81	14.07	14.07	7.03	7.22	3.51
64	17.31	15.72	13.85	13.85	6.92	7.11	3.46
65	17.04	15.33	13.63	13.63	6.81	7.00	3.40
66	16.78	15.09	13.43	13.43	6.71	6.89	3.35
67	16.53	14.87	13.23	13.23	6.61	6.79	3.30
68	16.28	14.65	13.03	13.03	6.51	6.69	3.25
69	16.05	14.44	12.84	12.84	6.42	6.59	3.21
70	15.82	14.23	12.66	12.66	6.32	6.50	3.16
71	15.60	14.03	12.48	12.48	6.24	6.41	3.12
72	15.37	13.84	12.31	12.31	6.15	6.32	3.07
73	15.17	13.65	12.14	12.14	6.06	6.23	3.03
74	14.96	13.46	11.98	11.98	5.98	6.15	2.99
75	14.76	13.28	11.82	11.82	5.90	6.07	2.95
76	14.57	13.11	11.66	11.66	5.83	5.99	2.91
77	14.39	12.94	11.51	11.51	5.75	5.91	2.87
78	14.20	12.78	11.36	11.36	5.68	5.83	2.84
79	14.02	12.61	11.22	11.22	5.60	5.76	2.80
80	13.85	12.46	11.08	11.08	5.53	5.69	2.76
81	13.68	12.30	10.94	10.94	5.47	5.62	2.73
82	13.51	12.15	10.81	10.81	5.40	5.55	2.70
83	13.35	12.01	10.68	10.68	5.33	5.48	2.66
84	13.19	11.86	10.55	10.55	5.27	5.42	2.63
85	13.03	11.72	10.43	10.43	5.20	5.35	2.60
86	12.88	11.59	10.30	10.30	5.15	5.29	2.57
87	12.73	11.45	10.19	10.19	5.09	5.23	2.54
88	12.59	11.32	10.07	10.07	5.03	5.17	2.51
89	12.45	11.20	9.96	9.96	4.97	5.11	2.48
90	12.31	11.07	9.85	9.85	4.92	5.05	2.46
91	12.17	10.95	9.74		4.86	5.00	2.43
92	12.04	10.83	9.63		4.81	4.94	2.40
93	11.91	10.72	9.53		4.76	4.89	2.38
94	11.78	10.60	9.43		4.71	4.84	2.35
	Change Gears 36″ Frame 24-94 T 39″ Frame 15-70 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 40-88 T 39″ Frame 24-90 T	Change Gears 36″ Frame 15-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 28-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-94 T
Const's	1107.71	996.54	886.17	886.17	443.09	455.39	221.54

Spinning Twist Gear Table.

FRONT ROLL $1\frac{1}{8}$ inch Diameter.

Cylinder 7 inch Diameter. Ratio Cylinder to Whirl 1 to 6.62.

Whirl $\frac{15}{16}$ inch Diameter. Front Roll Gear 108 Teeth.

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
15T	67.43	60.66	53.94		26.97	27.72	13.48
16	63.21	56.87	50.57		25.28	25.98	12.64
17	59.49	53.52	47.59		23.79	24.46	11.89
18	56.19	50.55	44.95		22.47	23.10	11.23
19	53.23	47.89	42.58		21.29	21.88	10.64
20	50.57	45.49	40.45		20.22	20.79	10.11
21	48.16	43.33	38.53		19.26	19.80	9.63
22	45.97	41.36	36.78		18.39	18.90	9.19
23	43.97	39.56	35.18		17.59	18.07	8.79
24	42.14	37.99	33.71	33.71	16.85	17.32	8.42
25	40.45	36.39	32.36	32.36	16.18	16.63	8.09
26	38.90	34.99	31.12	31.12	15.56	15.99	7.78
27	37.46	33.70	29.96	29.96	14.98	15.40	7.49
28	36.12	32.49	28.89	28.89	14.44	14.85	7.22
29	34.87	31.37	27.90	27.90	13.95	14.33	6.97
30	33.71	30.33	26.97	26.97	13.48	13.86	6.74
31	32.62	29.35	26.10	26.10	13.05	13.41	6.52
32	31.60	28.43	25.22	25.22	12.64	12.99	6.32
33	30.65	27.57	24.52	24.52	12.26	12.60	6.13
34	29.74	26.76	23.79	23.79	11.89	12.23	5.94
35	28.89	25.99	23.11	23.11	11.55	11.88	5.77
36	28.09	25.27	22.47	22.47	11.23	11.55	5.61
37	27.33	24.59	21.86	21.86	10.93	11.23	5.46
38	26.61	23.94	21.29	21.29	10.64	10.94	5.32
39	25.93	23.33	20.74	20.74	10.37	10.66	5.18
40	25.28	22.74	20.22	20.22	10.11	10.39	5.05
41	24.66	22.19	19.73	19.73	9.86	10.14	4.93
42	24.08	21.66	19.26	19.26	9.63	9.90	4.81
43	23.52	21.16	18.81	18.81	9.40	9.67	4.70
44	22.96	20.68	18.39	18.39	9.19	9.45	4.59
45	22.47	20.22	17.98	17.98	8.99	9.24	4.49
46	21.98	19.78	17.59	17.59	8.79	9.03	4.39
47	21.52	19.36	17.21	17.21	8.60	8.84	4.30
48	21.07	18.95	16.85	16.85	8.42	8.66	4.21
49	20.64	18.57	16.51	16.51	8.25	8.48	4.12
50	20.22	18.19	16.18	16.18	8.09	8.31	4 04
51	19.83	17.84	15.86	15.86	7.93	8.15	3.96
52	19.45	17.49	15.56	15.56	7.78	7.99	3.89
53	19.08	17.16	15.26	15.26	7.63	7.84	3.81
54	18.73	16.85	14.98	14.98	7.49	7.70	3.74
55	18.39	16.54	14.71	14.71	7.35	7.56	3.67
56	18.06	16.25	14.44	14.44	7.22	7.42	3 61
57	17.74	15.96	14.19	14.19	7.09	7.29	3.54
58	17.43	15.68	13 95	13.95	6.97	7.16	3.48
Const's	1011.46	909.94	809.17	809.17	404.58	415.82	202.29

Spinning Twist Gear Table.

FRONT ROLL 1⅛ inch Diameter.

Cylinder 7 inch Diameter. Ratio Cylinder to Whirl 1 to 6.62.

Whirl $\frac{15}{16}$ inch Diameter. Front Roll Gear 108 Teeth.

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl . 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
59T	17.14	15.42	13.71	13.71	6.85	7.04	3.42
60	16.85	15.16	13.48	13.48	6.74	6.93	3.37
61	16.58	14.91	13.26	13.26	6.63	6.81	3.31
62	16.31	14.67	13.05	13.05	6.54	6.70	3.26
63	16.05	14.44	12.84	12.84	6.42	6.60	3.21
64	15.80	14.21	12.64	12.64	6.32	6.49	3.16
65	15.56	13.99	12.44	12.44	6.22	6.39	3.11
66	15.31	13.78	12.26	12 26	6.13	6 30	3.06
67	15.09	13.58	12.07	12.07	6.03	6.20	3.01
68	14.87	13.38	11.89	11.89	5 94	6.11	2.97
69	14.65	13.18	11.72	11.72	5.86	6.02	2.93
70	14.44	12.99	11.55	11.55	5.77	5.94	2.88
71	14 24	12.81	11.39	11.39	5.69	5.85	2.84
72	14 04	12.63	11.23	11.23	5.61	5.77	2.80
73	13.85	12.46	11.08	11.08	5 54	5.69	2.77
74	13.66	12.29	10.93	10.93	5.46	5.61	2.73
75	13.48	12.13	10.78	10.78	5.39	5 54	2.69
76	13.30	11 97	10.64	10.64	5.32	5.47	2.66
77	13.14	11.82	10.50	10.50	5.25	5.40	2.62
78	12.97	11.67	10.37	10.37	5.18	5.33	2.59
79	12.80	11.52	10.24	10.24	5.12	5.26	2.56
80	12.64	11.37	10.11	10.11	5.05	5.19	2.52
81	12.49	11.23	9.98	9.98	4.99	5.13	2.49
82	12.33	11.10	9.86	9.86	4.93	5.07	2.46
83	12.19	10.96	9.74	9.74	4 87	5.00	2.43
84	12.04	10 83	9.63	9.63	4.81	4 95	2.40
85	11.90	10.72	9.51	9.51	4.75	4.89	2.37
86	11.76	10.58	9.40	9.40	4.70	4 83	2.35
87	11.63	10.46	9.30	9.30	4.65	4.77	2.32
88	11.49	10.34	9.19	9.19	4.59	4.72	2.29
89	11.36	10.22	9.09	9.09	4 54	4.67	2.27
90	11.24	10.11	8.99	8.99	4.49	4.62	2.24
91	11.11	10.00	8.89		4.44	4.56	2.22
92	11.00	9.89	8.79		4 39	4.51	2.19
93	10.88	9.78	8.70		4.36	4.47	2.17
94	10.76	9.68	8.60		4.31	4.42	2.15
	Change Gears 36″ Frame 24-94 T 39″ Frame 15-70 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 40-88 T 39″ Frame 24-90 T	Change Gears 36″ Frame 15-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 28-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-94 T
Const's	1011.46	909.94	809.17	809.17	404 58	415 82	202 29

Spinning Twist Gear Table.

FRONT ROLL 1⅛ Inch Diameter.

Cylinder 7 inches Diameter. Ratio Cylinder to Whirl 1 to 6.24

Whirl 1 inch Diameter. Front Roll Gear 108 Teeth

Change Gears	Cyl. 20T Stud 100 T Twist	Cyl. 20 T Stud 90 T Twist	Cyl. 22 T Stud 88 T Twist	Cyl. 20 T Stud 80 T Twist	Cyl. 40 T Stud 80 T Twist	Cyl. 36 T Stud 74 T Twist	Cyl. 55 T Stud 55 T Twist
15T	63.56	57.18	50.84		25.42	26.13	12.71
16	59.58	53.60	47.66		23.83	24.49	11.91
17	56.19	50.45	44.86		22.43	23.05	11.21
18	52.96	47.65	42.37		21.18	21.77	10.59
19	50.17	45.14	40.14		20.07	20.62	10.03
20	47.66	42.88	38.13		19.06	19.59	9.53
21	45.39	40.84	36.31		18.16	18.66	9.08
22	43.33	38.98	34.66		17.33	17.81	8.66
23	41.45	37.29	33.16		16.58	17.04	8.29
24	39.72	35.73	31.77	31.77	15.89	16.33	7.94
25	38.13	34.30	30.50	30.50	15.25	15.67	7.62
26	36.66	32.91	29.33	29.33	14.66	15.07	7.33
27	35.31	31.76	28.24	28.24	14.12	14.51	7.06
28	34.04	30.63	27.23	27.23	13.62	13.99	6.81
29	32.87	29.57	26.20	26.20	13.15	13.51	6.57
30	31.77	28.59	25.42	25.42	12.71	13.06	6.35
31	30.75	27.66	24.60	24.60	12.30	12.64	6.15
32	29.79	26.80	23.83	23.83	11.91	12.24	5.95
33	28.89	25.99	23.11	23.11	11.55	11.87	5.77
34	28.04	25.22	22.43	22.43	11.21	11.52	5.60
35	27.23	24.50	21.79	21.79	10.89	11.19	5.44
36	26.48	23.82	21.18	21.18	10.59	10.88	5.29
37	25.76	23.18	20.61	20.61	10.30	10.59	5.15
38	25.09	22.57	20.07	20.07	10.03	10.31	5.01
39	24.44	21.99	19.55	19.55	9.77	10.05	4.88
40	23.83	21.44	19.06	19.06	9.53	9.79	4.76
41	23.25	20.91	18.60	18.60	9.30	9.55	4.65
42	22.69	20.42	18.15	18.15	9.08	9.33	4.54
43	22.17	19.94	17.73	17.73	8.86	9.11	4.43
44	21.66	19.49	17.33	17.33	8.66	8.90	4.33
45	21.18	19.06	16.94	16.94	8.47	8.71	4.23
46	20.72	18.64	16.58	16.58	8.29	8.52	4.14
47	20.28	18.24	16.22	16.22	8.11	8.33	4.05
48	19.86	17.86	15.88	15.88	7.94	8.16	3.97
49	19.45	17.50	15.56	15.56	7.74	7.99	3.89
50	19.06	17.15	15.25	15.25	7.62	7.83	3.81
51	18.69	16.81	14.95	14.95	7.47	7.68	3.73
52	18.33	16.49	14.66	14.66	7.33	7.53	3.66
53	17.99	16.18	14.37	14.37	7.19	7.39	3.59
54	17.65	15.88	14.12	14.12	7.06	7.25	3.53
55	17.33	15.59	13.86	13.86	6.93	7.12	3.46
56	17.02	15.31	13.61	13.61	6.81	6.99	3.40
57	16.72	15.04	13.38	13.38	6.69	6.87	3.34
58	16.43	14.78	13.15	13.15	6.57	6.75	3.28
Const's	953.39	857.71	762.71	762.71	381.36	391.95	190.68

Spinning Twist Gear Table

FRONT ROLL 1⅛ inch Diameter

Cylinder 7 inches diameter. Ratio Cylinder to Whirl 1 to 6.24

Whirl 1 inch diameter. Front Roll gear 108 teeth

Change Gears	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 90 T Twist	Cyl. 22 T Stud 88 T Twist	Cyl. 20 T Stud 80 T Twist	Cyl. 40 T Stud 80 T Twist	Cyl. 36 T Stud 74 T Twist	Cyl. 55 T Stud 55 T Twist
59T	16.15	14.53	12.92	12.92	6.46	6.64	3.23
60	15.88	14.29	12.71	12.71	6.35	6.53	3.17
61	15.62	14.06	12.50	12.50	6.25	6.42	3.12
62	15.37	13.83	12.30	12.30	6.15	6.32	3.07
63	15.13	13.61	12.10	12.10	6.05	6.22	3.02
64	14.89	13.40	11.91	11.91	5.95	6.12	2.97
65	14.66	13.21	11.73	11.73	5.86	6.03	2.93
66	14.44	12.98	11.55	11.55	5.77	5.93	2.88
67	14.22	12.80	11.38	11.38	5.66	5.85	2.84
68	14.02	12.61	11.21	11.21	5.60	5.76	2.80
69	13.81	12.43	11.05	11.05	5.52	5.68	2.76
70	13.61	12.25	10.89	10.89	5.44	5.59	2.72
71	13.42	12.08	10.74	10.74	5.37	5.52	2.68
72	13.24	11.91	10.59	10.59	5.29	5.44	2.64
73	13.06	11.74	10.44	10.44	5.22	5.36	2.61
74	12.88	11.59	10.30	10.30	5.15	5.29	2.57
75	12.71	11.43	10.16	10.16	5.08	5.22	2.54
76	12.54	11.28	10.03	10.03	5.01	5.15	2.50
77	12.38	11.14	9.90	9.90	4.95	5.09	2.47
78	12.22	11.00	9.77	9.77	4.88	5.02	2.44
79	12.07	10.86	9.65	9.65	4.82	4.96	2.41
80	11.92	10.73	9.53	9.53	4.76	4.89	2.38
81	11.77	10.60	9.41	9.41	4.70	4.83	2.35
82	11.63	10.47	9.30	9.30	4.65	4.77	2.32
83	11.49	10.33	9.18	9.18	4.59	4.72	2.29
84	11.35	10.21	9.07	9.07	4.54	4.66	2.27
85	11.22	10.09	8.97	8.97	4.48	4.61	2.24
86	11.09	9.97	8.86	8.86	4.43	4.55	2.21
87	10.96	9.86	8.76	8.76	4.38	4.50	2.19
88	10.83	9.75	8.66	8.66	4.33	4.45	2.16
89	10.71	9.64	8.56	8.56	4.28	4.40	2.14
90	10.59	9.53	8.47	8.47	4.23	4.35	2.11
91	10.48	9.43	8.38		4.19	4.30	2.09
92	10.36	9.32	8.29		4.14	4.26	2.07
93	10.25	9.22	8.20		4.10	4.21	2.05
94	10.14	9.12	8.11		4.05	4.16	2.03
	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears
	36″ Frame 24-94 T	36″ Frame 30-94 T	36″ Frame 30-94 T	36″ Frame 40-88 T	36″ Frame 15-94 T	36″ Frame 28-94 T	36″ Frame 30-94 T
	39″ Frame 15-70 T	39″ Frame 15-86 T	39″ Frame 15-86 T	39″ Frame 24-90 T	39″ Frame 15-94 T	39″ Frame 15-94 T	39″ Frame 15-94 T
Const's	953.39	857.71	762.71	762.71	381.36	391.95	190.68

Spinning Twist Gear Table.

FRONT ROLL 1¾ inch Diameter.

Cylinder 7 inch Diameter. Ratio Cylinder to Whirl 1 to 5.86.

Whirl $1\frac{1}{16}$ inch Diameter. Front Roll Gear 108 Teeth.

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
15T	59.69	53.70	47.75		23.88	24.53	11.93
16	55.95	50.30	44.76		22.37	23.00	11.19
17	52.66	47.38	42.13		21.06	21.65	10.53
18	49.74	44.74	39.79		19.89	20.44	9.94
19	47.12	42.39	37.69		18.84	19.37	9.42
20	44.76	40.27	35.81		17.90	18.40	8.95
21	42.63	38 35	34.10		17.05	17.52	8.52
22	40.69	36.61	32.55		16.27	16.73	8.13
23	38 92	35.02	31.14		15.57	16.00	7.78
24	37.30	33.56	29.84	29.84	14.92	15.33	7.46
25	35.81	32.21	28.65	28.65	14.32	14.72	7.16
26	34.43	30.98	27.54	27.54	13.77	14.15	6.88
27	33.16	29.83	26.52	26.52	13.26	13.63	6.63
28	31.97	28.77	25.58	25.58	12.79	13.14	6.39
29	30.87	27.77	24.69	24.69	12.34	12.69	6.17
30	29.84	26.84	23.87	23.87	11.93	12.26	5.96
31	28.88	25.98	23.10	23.10	11.55	11.87	5.77
32	27.97	25.17	22.38	22.38	11.19	11.50	5.59
33	27.13	24.40	21.70	21.70	10.85	11.15	5.42
34	26.33	23.69	21.06	21.06	10.53	10.82	5.26
35	25.58	23.01	20.46	20.46	10.23	10.51	5.11
36	24.92	22.37	19.89	19 89	9.94	10.22	4.97
37	24.19	21.76	19.35	19.35	9.67	9.94	4.83
38	23.56	21.19	18.84	18.84	9.42	9.68	4.71
39	22.95	20.65	18.36	18.36	9.18	9.43	4.59
40	22.38	20.13	17.90	17.90	8.95	9.20	4.47
41	21.83	19.64	17.47	17.47	8.73	8.97	4.36
42	21.31	19.17	17.05	17.05	8.52	8.76	4.26
43	20.82	18.73	16.65	16.65	8.32	8.56	4.16
44	20.34	18.30	16.27	16.27	8.13	8.36	4.06
45	19.89	17.89	15.91	15.91	7.95	8.17	3.97
46	19.46	17.51	15.57	15.57	7.78	8.00	3.89
47	19.04	17.11	15.23	15.23	7.62	7.83	3.81
48	18.65	16.78	14.92	14.92	7.46	7.66	3.73
49	18.27	16.43	14.61	14.61	7.31	7.51	3.65
50	17.90	16.10	14.32	14.32	7.16	7.36	3.58
51	17.55	15.79	14.04	14.04	7.02	7.21	3.51
52	17.21	15.49	13.77	13.77	6.88	7.07	3.44
53	16.89	15.19	13.51	13.51	6.75	6.94	3.37
54	16.58	14.91	13.26	13.26	6.63	6.81	3 31
55	16.27	14.64	13.02	13.02	6.51	6.69	3.25
56	15.98	14.38	12.79	12.79	6.39	6.57	3.19
57	15.70	14.13	12.56	12.56	6.28	6.45	3 14
58	15.43	13.88	12.34	12.34	6.17	6 34	3.08
Const's	895 34	895.48	716.27	716.27	358.14	368.09	179.07

Spinning Twist Gear Table.

FRONT ROLL 1⅛ inch Diameter

Cylinder 7 inches Diameter. Ratio Cylinder to Whirl 1 to 5.86

Whirl 1 $\frac{1}{16}$ inch Diameter Front Roll Gear 108 Teeth

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
59T	15.17	13.65	12.14	12.14	6.07	6.23	3.03
60	14.92	13.42	11.93	11.93	5.96	6.13	2.98
61	14.67	13.20	11.74	11.74	5.87	6.03	2.93
62	14.44	12.99	11.55	11.55	5.77	5.93	2.88
63	14 21	12.78	11.36	11.36	5.68	5.84	2.84
64	13.98	12.58	11.19	11.19	5.59	5.75	2.79
65	13.77	12.39	11.01	11.01	5.50	5.66	2.75
66	13.56	12.20	10.85	10.85	5.42	5.57	2.71
67	13.36	12.02	10.69	10.69	5.34	5.49	2.67
68	13.16	11.84	10.53	10.53	5.26	5.41	2.63
69	12.97	11.67	10.38	10.38	5.19	5.33	2.59
70	12.79	11.50	10.23	10.23	5.11	5.25	2.55
71	12.61	11.34	10.08	10.08	5.04	5.18	2.52
72	12.43	11.18	9.94	9.94	4.97	5.11	2.48
73	12.25	11.03	9.81	9.81	4.90	5.04	2.45
74	12.09	10 87	9.67	9.67	4.83	4.97	2.41
75	11.93	10.73	9.55	9.55	4.77	4.90	2 38
76	11.77	10.59	9.42	9.42	4.70	4.84	2.35
77	11.63	10.46	9.30	9.30	4.65	4.78	2 32
78	11.48	10.33	9.18	9.18	4.57	4.71	2.29
79	11.33	10.20	9.06	9.06	4.53	4.65	2.26
80	11.19	10.07	8.95	8.95	4.47	4.60	2.23
81	11.05	9.94	8.84	8.84	4.42	4.54	2.21
82	10.92	9.82	8.73	8.73	4.36	4.48	2.18
83	10.79	9.70	8.62	8.62	4 31	4.43	2.15
84	10.66	9.59	8 52	8.52	4.26	4.38	2.13
85	10.53	9.48	8.42	8.42	4 21	4.33	2.10
86	10.41	9.37	8.32	8.32	4.16	4.28	2.08
87	10.29	9.26	8.23	8.23	4 11	4.23	2.05
88	10.17	9.15	8.13	8.13	4 06	4.18	2.03
89	10.06	9.05	8.04	8.04	4.02	4.13	2.01
90	9.95	8.95	7.95	7.95	3.97	4.08	1.98
91	9 84	8.85	7.87		3.93	4.04	1.96
92	9.73	8.76	7.78		3.89	4.00	1.94
93	9.63	8.66	7.70		3 85	3.95	1.92
94	9.52	8.57	7.61		3.81	3.91	1.90
	Change Gears 36″ Frame 24–94 T 39″ Frame 15–70 T	Change Gears 36″ Frame 30–94 T 39″ Frame 15–86 T	Change Gears 36″ Frame 30–94 T 39″ Frame 15–86 T	Change Gears 36″ Frame 40–88 T 39″ Frame 24–90 T	Change Gears 36″ Frame 15–94 T 39″ Frame 15–94 T	Change Gears 36″ Frame 28–94 T 39″ Frame 15–94 T	Change Gears 36″ Frame 30–94 T 39″ Frame 15–94 T
Const's	895.34	805.48	716.27	716.27	358.14	368.09	179.07

Spinning Twist Gear Table.

FRONT ROLL 1⅛ inch Diameter.

Cylinder 7 inch Diameter. Ratio Cylinder to Whirl 1 to 5.43.

Whirl 1 ⅛ inch Diameter. Front Roll Gear 108 Teeth.

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
15T	55.31	49.76	44.24		22.12	22.73	11.06
16	51.85	46.64	41.48		20.74	21.31	10.37
17	48.80	43.90	39.04		19.52	20.06	9.76
18	46.09	41.46	36.89		18.43	18.94	9.21
19	43.66	39.28	34.93		17.46	17.95	8.73
20	41.48	37.31	33.18		16.59	17.05	8.29
21	39.50	35.54	31.60		15.80	16.24	7.90
22	37.71	33.92	30.16		15.08	15.50	7.54
23	36.07	32.45	28.85		14.42	14.82	7.21
24	34.56	31.09	27.65	27.65	13.82	14.21	6.91
25	33.18	29.85	26.54	26.54	13.27	13.61	6.63
26	31.90	28.70	25.52	25.52	12.76	13.11	6.38
27	30.72	27.64	24.58	24.58	12.29	12.63	6.14
28	29.63	26.65	23.70	23.70	11.85	12.18	5.92
29	28.60	25.73	22.88	22.88	11.44	11.76	5.72
30	27.65	24.87	22.12	22.12	11.06	11.36	5.53
31	26.76	24.08	21.41	21.41	10.70	11.00	5.35
32	25.92	23.35	20.74	20.74	10.37	10.65	5.18
33	25.14	22.61	20.11	20.11	10.05	10.33	5.02
34	21.46	21.95	19.52	19.52	9.76	10.03	4.88
35	23.70	21.32	18.96	18.96	9.48	9.74	4.74
36	23.04	20.73	18.43	18.43	9.21	9.47	4.60
37	22.42	20.17	17.93	17.93	8.96	9.21	4.48
38	21.83	19.64	17.46	17.46	8.73	8.97	4.36
39	21.27	19.13	17.01	17.01	8.50	8.74	4.25
40	20.74	18.65	16.59	16.59	8.29	8.52	4.14
41	20.23	18.20	16.18	16.18	8.09	8.31	4.04
42	19.75	17.77	15.80	15.80	7.90	8.12	3.95
43	19.29	17.35	15.43	15.43	7.71	7.93	3.85
44	18.85	16.96	15.08	15.08	7.54	7.75	3.77
45	18.43	16.58	14.74	14.74	7.37	7.57	3.68
46	18.03	16.22	14.42	14.42	7.21	7.41	3.60
47	17.65	15.88	14.12	14.12	7.06	7.25	3.53
48	17.28	15.54	13.82	13.82	6.91	7.10	3.45
49	16.93	15.23	13.54	13.54	6.77	6.96	3.38
50	16.59	14.92	13.27	13.27	6.63	6.82	3.31
51	16.27	14.63	13.01	13.01	6.50	6.68	3.25
52	15.95	14.35	12.76	12.76	6.38	6.55	3.19
53	15.65	14.08	12.52	12.52	6.26	6.43	3.13
54	15.36	13.82	12.29	12.29	6.14	6.31	3.07
55	15.08	13.57	12.06	12.06	6.03	6.20	3.01
56	14.81	13.32	11.85	11.85	5.92	6.09	2.96
57	14.55	13.09	11.64	11.64	5.82	5.98	2.91
58	14.30	12.86	11.44	11.44	5.72	5.88	2.86
Const's	829.64	746.37	663.71	663.71	331.85	341.08	165.93

Spinning Twist Gear Table.

FRONT ROLL 1⅛ inch Diameter.

Cylinder 7 inch Diameter. Ratio Cylinder to Whirl 1 to 5.43.

Whirl 1⅛ inch Diameter. Front Roll Gear 108 Teeth.

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl . 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
59T	14.06	12.65	11.24	11.24	5.62	5.78	2.81
60	13.82	12.43	11.06	11.06	5.53	5.68	2.76
61	13.60	12.23	10.88	10.88	5.42	5.59	2.72
62	13.38	12.03	10.70	10.70	5.35	5.50	2.67
63	13.16	11 84	10.53	10.53	5.26	5.41	2.63
64	12.96	11.66	10.37	10.37	5.18	5.32	2.59
65	12.76	11.48	10.21	10.21	5.10	5.24	2.55
66	12.57	11.30	10.05	10.05	5.02	5.16	2.51
67	12.38	11.12	9.90	9.90	4.95	5.09	2.47
68	12.20	10.97	9.76	9.76	4.88	5.01	2 44
69	12.02	10.81	9.61	9.61	4.80	4.94	2 40
70	11.85	10.66	9.48	9.48	4.74	4.87	2.37
71	11.68	10.51	9.34	9.34	4 67	4.80	2.33
72	11.52	10.36	9.21	9.21	4.60	4.73	2.30
73	11.36	10.22	9.09	9.09	4.54	4.67	2.27
74	11.21	10.08	8.96	8.96	4.48	4.60	2.24
75	11.06	9.95	8.84	8.84	4.42	4.54	2.21
76	10.91	9.82	8.73	8.73	4.36	4.48	2.18
77	10.77	9.69	8.61	8.61	4.30	4.42	2.15
78	10.64	9.56	8.50	8.50	4.25	4.37	2.12
79	10.50	9.44	8.40	8.40	4.20	4.31	2.10
80	10.37	9.32	8.29	8.29	4.14	4.26	2.07
81	10.24	9.21	8.19	8.19	4.09	4.21	2.04
82	10.12	9.10	8.09	8.09	4.04	4.15	2.02
83	10.00	8.99	7.99	7.99	3.99	4.10	1.99
84	9.88	8.89	7.90	7.90	3.95	4.06	1.97
85	9.76	8.78	7.80	7.80	3.90	4.01	1.95
86	9.65	8.68	7.71	7.71	3.85	3.96	1.92
87	9.54	8.58	7.62	7.62	3.81	3.92	1.90
88	9.43	8.48	7.54	7.54	3.77	3.87	1.88
89	9.32	8.39	7.45	7.45	3.72	3.83	1.86
90	9.22	8.29	7.37	7.37	3.68	3.78	1.84
91	9.12	8.20	7.29		3.64	3.74	1.82
92	9.02	8.11	7.21		3.60	3.70	1.80
93	8.92	8.03	7.13		3.56	3.66	1.78
94	8.83	7.94	7.06		3.53	3.62	1.76
	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears
	36″ Frame 24-94 T	36″ Frame 30-94 T	36″ Frame 30-94 T	36″ Frame 40-88 T	36″ Frame 15-94 T	36″ Frame 28-94 T	36″ Frame 30-94 T
	39″ Frame 15-70 T	39″ Frame 15-86 T	39″ Frame 15-86 T	39″ Frame 24-90 T	39″ Frame 15-94 T	39″ Frame 15-94 T	39″ Frame 15-94 T
Const's	829.64	746.37	663.71	663.71	331.85	341.08	165.93

Spinning Twist Gear Table.

FRONT ROLL 1⅛ inch Diameter.

Cylinder 7 inch Diameter. Ratio Cylinder to Whirl 1 to 4.80

Whirl 1 $\frac{5}{16}$ inch Diameter. Front Roll Gear 108 Teeth.

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
15T	48.89	43.99	39.11		19.56	20.10	9.78
16	45.83	41.23	36.66		18.33	18.84	9.17
17	43.14	38.81	34.51		17.25	17.73	8.63
18	40.70	36.65	32.59		16.29	16.75	8.15
19	38.59	34.72	30.87		15.43	15 86	7.73
20	36.66	32.98	29.33		14.66	15.07	7.34
21	34.92	31.41	27.93		13.96	14.35	6.99
22	33.33	29.99	26.66		13.33	13.70	6.67
23	33.88	28.68	25.50		12.75	13.10	6.38
24	30.55	27.49	24.44	24.44	12.22	12.56	6.12
25	29.33	26.39	23.46	23.46	11.73	12.06	5.87
26	28.20	25.37	22.56	22.56	11.28	11.59	5.65
27	27.16	24.43	21.73	21.73	10.86	11.16	5.44
28	26.19	23.56	20.95	20.95	10.47	10.76	5.24
29	25.28	22.75	20.23	20.23	10.11	10.39	5.06
30	24.44	21.99	19.55	19.55	9.77	10.05	4.89
31	23.65	21.28	18.92	18.92	9.46	9.72	4.74
32	22.91	20.61	18.33	18.33	9.16	9.42	4.59
33	22.22	19.99	17.77	17.77	8.88	9.13	4.45
34	21.57	19.40	17.25	17.25	8.62	8.86	4.32
35	20.95	18.85	16.76	16.76	8.38	8.61	4.20
36	20.37	18.32	16.29	16.29	8.14	8.37	4.08
37	19.82	17.83	15.85	15.85	7.92	8.14	3.97
38	19.29	17.36	15.43	15.43	7.71	7.93	3.87
39	18.80	16.91	15.04	15.04	7.52	7.73	3.77
40	18.33	16.49	14.66	14.66	7.33	7.53	3.67
41	17.88	16.09	14.31	14.31	7.15	7.35	3.58
42	17.46	15.70	13.96	13.96	6.98	7.17	3.50
43	17.05	15.34	13.64	13.64	6.82	7.01	3.42
44	16.66	14.99	13.33	13.33	6.66	6.85	3.34
45	16.29	14.66	13.03	13.03	6.51	6 70	3.26
46	15.94	14.34	12.75	12.75	6.37	6.55	3.19
47	15.60	14.03	12.48	12.48	6.24	6.41	3.13
48	15.27	13.74	12.22	12.22	6.11	6.28	3.06
49	14.96	13.46	11.97	11.97	5.98	6.15	3.00
50	14.66	13.19	11.73	11.73	5.86	6.03	2.94
51	14.38	12.93	11.50	11.50	5.75	5.91	2.88
52	14.10	12.68	11.28	11.28	5.64	5.79	2.83
53	13.83	12.44	11.07	11.07	5.53	5.68	2.77
54	13.58	12.22	10.86	10.86	5.43	5.58	2.72
55	13.33	11.99	10.66	10.66	5.33	5.48	2.67
56	13.09	11.78	10.47	10.47	5.23	5.38	2.62
57	12.86	11.57	10.29	10.29	5.14	5.29	2.58
58	12.64	11.37	10.11	10.11	5.05	5.19	2.53
Const's	733.39	659.78	586.71	586.71	293.35	301 51	146.71

Spinning Twist Gear Table.

FRONT ROLL 1⅛ inch Diameter

Cylinder 7 inches Diameter. Ratio Cylinder to Whirl 1 to 4.80

Whirl 1 $\frac{5}{16}$ inch Diameter Front Roll Gear 108 Teeth

Change Gears	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 90 T Twist	Cyl. 22 T Stud 88 T Twist	Cyl. 20 T Stud 80 T Twist	Cyl. 40 T Stud 80 T Twist	Cyl. 36 T Stud 74 T Twist	Cyl. 55 T Stud 55 T Twist
59T	12.43	11.18	9.94	9.94	4.97	5.11	2.49
60	12.22	10.99	9.77	9.77	4.89	5.02	2.45
61	12.02	10.81	9.61	9.61	4.80	4.94	2.41
62	11.82	10.64	9.46	9.46	4.73	4.86	2.37
63	11.64	10.47	9.31	9.31	4.65	4.78	2.33
64	11.45	10.30	9.16	9.16	4.58	4.71	2.30
65	11.28	10.15	9.02	9.02	4.51	4.63	2.26
66	11.11	9.99	8.88	8.88	4.44	4.56	2.23
67	10.94	9.84	8.75	8.75	4.37	4.50	2.19
68	10.78	9.70	8.62	8.62	4.31	4.43	2.16
69	10.62	9.56	8.50	8.50	4.25	4.36	2.13
70	10.47	9.42	8.38	8.38	4.19	4.30	2.10
71	10.32	9.29	8.26	8.26	4.13	4.24	2.07
72	10.18	9.16	8.14	8.14	4.07	4.18	2.04
73	10.04	9.03	8.03	8.03	4.01	4.13	2.00
74	9.91	8.91	7.92	7.92	3.96	4.07	1.98
75	9.77	8.79	7.82	7.82	3.91	4.02	1.95
76	9.64	8.68	7.71	7.71	3.85	3.96	1.93
77	9.52	8.57	7.61	7.61	3.80	3.91	1.90
78	9.40	8.46	7.52	7.52	3.76	3.86	1.88
79	9.28	8.35	7.42	7.42	3.71	3.81	1.85
80	9.17	8.25	7.33	7.33	3.66	3.76	1.83
81	9.05	8.15	7.24	7.24	3.62	3.72	1.81
82	8.94	8.05	7.15	7.15	3.57	3.67	1.78
83	8.84	7.95	7.06	7.06	3.53	3.63	1.76
84	8.73	7.85	6.98	6.98	3.49	3.58	1.74
85	8.63	7.76	6.90	6.90	3.45	3.54	1.72
86	8.53	7.67	6.82	6.82	3.41	3.50	1.70
87	8.43	7.58	6.74	6.74	3.37	3.46	1.68
88	8.33	7.50	6.66	6.66	3.33	3.42	1.66
89	8.24	7.41	6.59	6.59	3.29	3.38	1.64
90	8.15	7.33	6.51	6.51	3.25	3.35	1.62
91	8.06	7.25	6.44		3.22	3.31	1.61
92	7.97	7.17	6.37		3.18	3.27	1.59
93	7.89	7.09	6.30		3.15	3.24	1.57
94	7.80	7.02	6.24		3.12	3.20	1.56
	Change Gears 36″ Frame 24-94 T 39″ Frame 15-70 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 40-88 T 39″ Frame 24-90 T	Change Gears 36″ Frame 15-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 28-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-94 T
Const's	733.39	659.78	586.71	586.71	293.35	301.51	146.71

Spinning Twist Gear Table.

FRONT ROLL 1⅛ inch Diameter

Cylinder 8 inches Diameter. Ratio Cylinder to Whirl 1 to 9.52

Whirl ⅝ inch Diameter. Front Roll Gear 108 Teeth

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
15T	96.96	87.27	77.57		38.78	39.86	19.39
16	90.90	81.81	72.72		36.36	37.37	18.18
17	85.56	77.00	68.44		34.22	35.17	17.11
18	80.80	72.72	64.64		32.32	33.22	16.16
19	76.55	68.89	61.24		30.62	31.47	15.31
20	72.72	65.45	58.18		29.09	29.89	14.54
21	69.26	62.33	55.41		27.70	28.47	13.85
22	66.11	59.50	52.89		26.44	27.18	13.22
23	63.24	56.91	50.59		25.29	25.99	12.64
24	60.60	54.54	48.48	48.48	24.24	24.91	12.12
25	58.18	52.36	46.54	46.54	23.27	23.91	11.63
26	55.94	50.34	44.75	44.75	22.37	22.99	11.18
27	53.87	48.48	43.09	43.09	21.54	22.14	10.77
28	51.94	46.75	41.55	41.55	20.77	21.35	10.38
29	50.15	45.14	40.12	40.12	20.06	20.62	10.03
30	48.48	43.63	38.78	38.78	19.39	19.93	9.69
31	46.92	42.22	37.73	37.73	18.76	19.28	9.38
32	45.45	40.90	36.36	36.36	18.18	18.68	9.09
33	44.07	39.66	35.25	35.25	17.63	18.12	8.81
34	42.78	38.50	34.22	34.22	17.11	17.58	8.55
35	41.55	37.40	33.24	33.24	16.62	17.08	8.31
36	40.40	36.36	32.32	32.32	16.16	16.61	8.08
37	39.31	35.38	31.44	31.44	15.72	16.16	7.86
38	38.27	34.44	30.62	30.62	15.31	15.73	7.65
39	37.29	33.56	29.83	29.83	14.91	15.33	7.45
40	36.36	32.72	29.09	29.09	14.54	14.94	7.27
41	35.47	31.92	28.38	28.38	14.19	14.58	7.09
42	34.63	31.16	27.70	27.70	13.85	14.23	6.92
43	33.82	30.44	27.06	27.06	13.53	13.90	6.76
44	33.05	29.75	26.44	26.44	13.22	13.59	6.61
45	32.32	29.09	25.85	25.85	12.92	13.28	6.46
46	31.62	28.45	25.29	25.29	12.64	12.99	6.32
47	30.94	27.85	24.75	24.75	12.37	12.72	6.18
48	30.30	27.27	24.24	24.24	12.12	12.45	6.06
49	29.68	26.71	23.74	23.74	11.87	12.20	5.93
50	29.09	26.18	23.27	23.27	11.63	11.95	5.81
51	28.52	25.66	22.81	22.81	11.40	11.72	5.70
52	27.97	25.17	22.37	22.37	11.18	11.49	5.59
53	27.44	24.69	21.95	21.95	10.97	11.28	5.48
54	26.93	24.24	21.54	21.54	10.77	11.07	5.38
55	26.44	23.80	21.15	21.15	10.57	10.87	5.28
56	25.97	23.37	20.77	20.77	10.38	10.67	5.19
57	25.51	22.96	20.41	20.41	10.20	10.49	5.10
58	25.07	22.57	20.06	20.06	10.03	10.31	5.01
Const's	1454.55	1309.09	1163.64	1163.64	581.82	597.98	290.91

Spinning Twist Gear Table.

FRONT ROLL 1⅛ inch Diameter.

Cylinder 8 inch Diameter. Ratio Cylinder to Whirl 1 to 9.52.

Whirl ¾ inch Diameter. Front Roll Gear 108 Teeth

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
59T	24.65	22.18	19.72	19.72	9.86	10.13	4.93
60	24.24	21.81	19.39	19.39	9.69	9.96	4.84
61	23.84	21.46	19.07	19.07	9.53	9.80	4.76
62	23.46	21.11	18.76	18.76	9.38	9.64	4.69
63	23.08	20.77	18.47	18.47	9.23	9.49	4.61
64	22.72	20.45	18.18	18.18	9.09	9.34	4.54
65	22.37	20.13	17.90	17.90	8.95	9.19	4.47
66	22.03	19.83	17.63	17.63	8.81	9.06	4.40
67	21.70	19.53	17.36	17.36	8.68	8.92	4.34
68	21.39	19.25	17.11	17.11	8.55	8.79	4.27
69	21.08	18.97	16.86	16.86	8.43	8.66	4.21
70	20.77	18.70	16.62	16.62	8.31	8.54	4.15
71	20.48	18.43	16.38	16.38	8.19	8.42	4.09
72	20.20	18.18	16.16	16.16	8.08	8.30	4.04
73	19.92	17.93	15.94	15.94	7.97	8.19	3.98
74	19.65	17.69	15.72	15.72	7.86	8.08	3.93
75	19.39	17.45	15.51	15.51	7.75	7.97	3.87
76	19.13	17.22	15.31	15.31	7.65	7.86	3.82
77	18.89	17.00	15.11	15.11	7.55	7.76	3.77
78	18.64	16.78	14.91	14.91	7.45	7.66	3.72
79	18.41	16.57	14.72	14.72	7.36	7.56	3.68
80	18.18	16.36	14.54	14.54	7.27	7.47	3.63
81	17.95	16.16	14.36	14.36	7.18	7.38	3.59
82	17.73	15.96	14.19	14.19	7.09	7.29	3.54
83	17.52	15.77	14.01	14.01	7.00	7.20	3.50
84	17.31	15.58	13.85	13.85	6.92	7.11	3.46
85	17.11	15.40	13.68	13.68	6.84	7.03	3.42
86	16.91	15.22	13.53	13.53	6.76	6.95	3.38
87	16.71	15.04	13.37	13.37	6.68	6.87	3.34
88	16.52	14.87	13.22	13.22	6.61	6.79	3.30
89	16.34	14.70	13 07	13.07	6.53	6.71	3.26
90	16.16	14.54	12.92	12.92	6.46	6.64	3.23
91	15.98	14.38	12.78		6.39	6.57	3.19
92	15.81	14.22	12.64		6.32	6.49	3.16
93	15.64	14.07	12.51		6.25	6.42	3.12
94	15.47	13.92	12.37		6.18	6.36	3.09
	Change Gears 36″ Frame 24-94 T 39″ Frame 15-70 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 40-88 T 39″ Frame 24-90 T	Change Gears 36″ Frame 15-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 28-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-94 T
Const's	1454.55	1309.09	1163.64	1163.64	581.82	597.98	290.91

Spinning Twist Gear Table.

FRONT ROLL 1⅛ inch Diameter.

Cylinder 8 inch Diameter. Ratio Cylinder to Whirl 1 to 8.91.

Whirl $\frac{13}{16}$ inch Diameter. Front Roll Gear 108 Teeth.

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
15T	90.75	81.68	72.60		36.30	37.31	18.15
16	85.08	76.57	68.06		34.03	34.97	17.01
17	80.07	72.07	64.06		32.03	32.92	16.01
18	75.63	68.06	60.50		30.25	31.09	15.12
19	71.64	64.48	57.31		28.66	29.45	14.33
20	68.06	61.26	54.45		27.22	27.98	13.61
21	64.82	58.34	51.86		25.93	26.65	12.96
22	61.87	55.69	49.50		24.75	25.43	12.37
23	59.18	53.27	47.35		23.67	24.33	11.83
24	56.72	51.05	45.37	45.37	22.68	23.31	11.34
25	54.45	49.00	43.56	43.56	21.78	22.38	10.89
26	52.35	47.12	41.88	41.88	20.94	21.52	10.47
27	50.42	45.37	40.33	40.33	20.16	20.72	10.08
28	48.61	43.75	38.89	38.89	19.44	19.98	9.72
29	46.94	42.24	37.55	37.55	18.77	19.29	9.38
30	45.37	40.84	36.30	36.30	18.15	18.65	9.07
31	43.91	39.52	35.13	35.13	17.56	18.05	8.78
32	42.54	38.28	34.03	34.03	17.01	17.48	8.50
33	41.25	37.12	33.00	33.00	16.50	16.95	8.25
34	40.05	36.03	32.03	32.03	16.01	16.46	8.00
35	38.89	35.00	31.11	31.11	15.55	15.99	7.77
36	37.81	34 03	30.25	30.25	15.12	15.54	7.56
37	36.79	33.11	29.43	29.43	14.71	15.12	7.35
38	35.82	32.24	28.65	28.65	14.33	14.72	7.16
39	34.90	31.41	27.92	27.92	13.96	14.35	6.98
40	34 03	30.63	27.22	27.22	13.61	13.99	6.80
41	33.20	29.88	26.56	26.56	13.28	13.65	6.64
42	32.41	29.17	25.93	25.93	12.96	13.32	6.48
43	31.65	28.49	25.32	25.32	12.66	13.01	6.33
44	30.93	27 84	24.75	24.75	12.37	12.71	6.18
45	30.25	27.22	24.20	24.20	12.10	12.43	6.05
46	29.59	26.63	23.67	23.67	11.83	12.16	5.91
47	28.96	26.06	23.17	23.17	11.58	11.90	5.79
48	28.36	25.52	22.68	22.68	11.34	11.65	5.67
49	27.78	25.00	22.22	22.22	11.11	11.42	5.55
50	27.22	24.50	21.78	21.78	10.89	11.19	5.44
51	26.69	24.02	21.35	21.35	10.67	10 97	5.33
52	26.17	23.56	20 94	20.94	10.47	10.76	5.23
53	25.68	23.11	20.54	20.54	10.27	10.55	5.13
54	25.21	22.68	20.16	20.16	10.08	10.36	5.04
55	24.75	22 27	19.80	19.80	9.90	10.17	4.95
56	24.30	21.87	19.44	19.44	9.72	9.99	4.86
57	23.88	21.49	19.10	19.10	9.55	9.81	4.77
58	23.47	21.12	18.77	18.77	9.38	9.64	4.69
Const's	1361.34	1225.21	1089.07	1089.07	544.54	559.67	272.27

Spinning Twist Gear Table.

FRONT ROLL 1⅛ inch Diameter.

Cylinder 8 inch Diameter. Ratio Cylinder to Whirl 1 to 8.91.

Whirl $\frac{3}{16}$ inch Diameter. Front Roll Gear 108 Teeth.

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
59T	23.07	20.76	18.45	18.45	9.22	9.48	4.61
60	22.68	20.42	18.15	18.15	9.07	9 32	4.53
61	22.31	20.08	17.85	17.85	8.92	9.17	4.46
62	21.95	19.76	17.56	17.56	8.78	9.02	4.39
63	21.60	19.44	17.28	17.28	8.64	8.88	4.32
64	21.27	19.14	17.01	17.01	8.50	8.74	4.25
65	20.94	18.84	16.75	16.75	8.37	8.61	4.18
66	20.62	18.56	16.50	16.50	8.25	8.47	4.12
67	20.31	18.28	16.25	16.25	8.12	8.35	4.06
68	20.01	18.01	16.01	16.01	8.00	8.23	4.00
69	19.72	17.75	15.78	15.78	7.89	8.11	3.94
70	19.44	17.50	15.55	15.55	7.77	7.99	3.88
71	19.17	17.25	15.33	15.33	7.66	7.88	3.83
72	18.90	17.01	15.12	15.12	7.56	7.77	3.78
73	18.64	17.78	14.91	14.91	7.45	7.66	3.72
74	18.39	16.55	14.71	14.71	7.35	7.56	3.67
75	18.15	16.33	14.52	14.52	7.26	7.46	3.63
76	17.91	16.12	14.32	14.32	7.16	7.36	3.58
77	17.67	15.91	14.14	14.14	7.07	7.26	3.53
78	17.45	15.70	13.96	13.96	6.98	7.17	3.49
79	17.23	15.50	13.78	13.78	6.89	7.08	3.44
80	17.01	15.31	13.61	13.61	6.80	6.99	3.40
81	16.80	15.12	13.44	13.44	6.72	6.90	3.36
82	16.60	14.94	13.28	13.28	6.64	6.82	3.32
83	16.40	14.76	13.12	13.12	6.56	6.74	3.28
84	16.20	14.58	12.96	12.96	6.48	6.66	3.24
85	16.01	14.41	12.81	12.81	6.40	6.58	3.20
86	15.82	14.24	12.66	12.66	6.33	6.50	3.16
87	15.64	14.08	12.51	12.51	6.25	6.43	3.12
88	15.46	13.92	12.37	12.37	6.18	6.35	3.09
89	15.29	13.76	12.23	12.23	6.11	6.28	3.05
90	15.12	13.61	12.10	12.10	6.05	6.21	3.02
91	14.95	13.46	11.96		5 98	6.15	2.99
92	14.79	13.31	11.83		5.91	6.08	2.95
93	14.63	13.17	11.71		5.85	6.01	2.92
94	14.48	13.03	11.58		5.79	5.95	2.89
	Change Gears 36″ Frame 24-94 T 39″ Frame 15-70 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 40-88 T 39″ Frame 24-90 T	Change Gears 36″ Frame 15-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 28-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-94 T
Const's	1361.34	1225.21	1089.07	1089.07	544.54	559.67	272.27

Spinning Twist Gear Table.

FRONT ROLL 1⅛ Inch Diameter.

Cylinder 8 inches Diameter. Ratio Cylinder to Whirl 1 to 8.28

Whirl ⅝ inch Diameter. Front Roll Gear 108 Teeth

Change Gears	Cyl. 20T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
15T	84.33	75.90	67.47		33.73	34.67	16.86
16	79.06	71.16	63.25		31.62	32.50	15.81
17	74.40	66.97	59.53		29.76	30.59	14.88
18	70.28	63.25	56.22		28.11	28.89	14.05
19	66.58	59.92	53.26		26.63	27.37	13.31
20	63.25	56.92	50.60		25.30	26.00	12.65
21	60.24	54.21	48.19		24.09	24.76	12.04
22	57.50	51.75	46.00		23.00	23.64	11.50
23	55.00	49.50	44.00		22.00	22.61	11.00
24	52.71	47.44	42.16	42.16	21.08	21.67	10.54
25	50.60	45.54	40.48	40.48	20.24	20.80	10.12
26	48.65	43.79	38.92	38.92	19.46	20.00	9.73
27	46.85	42.16	37.48	37.48	18.74	19.26	9.37
28	45.17	40.66	36.14	36.14	18.07	18.57	9.03
29	43.62	39.26	34.89	34.89	17.44	17.93	8.72
30	42.16	37.95	33.73	33.73	16.86	17.33	8.43
31	40.80	36.72	32.64	32.64	16.32	16.77	8.16
32	39.53	35.58	31.62	31.62	15.81	16.25	7.90
33	38.33	34.50	30.66	30.66	15.33	15.76	7.66
34	37.20	33.48	29.76	29.76	14.88	15.29	7.44
35	36.14	32.53	28.91	28.91	14.45	14.86	7.22
36	35.14	31 62	28.11	28.11	14.05	14.44	7.02
37	34.19	30.77	27.35	27.35	13.67	14.05	6.83
38	33.29	29.96	26.63	26.63	13.31	13.68	6.65
39	32.43	29.19	25.95	25.95	12.97	13.33	6.48
40	31.62	28.46	25.30	25.30	12.65	13.00	6.32
41	30.85	27.77	24.68	24.68	12.34	12.68	6.17
42	30.12	27.10	24.09	24.09	12.04	12.38	6.02
43	29.42	26.47	23.53	23.53	11.76	12.09	5.88
44	28.75	25.87	23.00	23.00	11.50	11.82	5.75
45	28.11	25.30	22.49	22.49	11.24	11.55	5.62
46	27.50	24.75	22.00	22.00	11.00	11.30	5.50
47	26.91	24.22	21.53	21.53	10.76	11.06	5.38
48	26.35	23.72	21.08	21.08	10.54	10.83	5.27
49	25.81	23.23	20.65	20.65	10.32	10.61	5.16
50	25.30	22.77	20.24	20.24	10.12	10.40	5.06
51	24.80	22.32	19.84	19.84	9.92	10.19	4.96
52	24.32	21.89	19.46	19.46	9.73	10.00	4.86
53	23.86	21.48	19.09	19.09	9.54	9.81	4.77
54	23.42	21.08	18.74	18.74	9.37	9.63	4.68
55	23.00	20.70	18.40	18.40	9.20	9.45	4.60
56	22.59	20.33	18.07	18.07	9.03	9.28	4.51
57	22.19	19.97	17.75	17.75	8.87	9.12	4.43
58	21.81	19.63	17.44	17.44	8.72	8.96	4.36
Const's	1265.09	1138.58	1012.07	1012.07	506.03	520.10	253.02

Spinning Twist Gear Table

FRONT ROLL 1⅛ inch Diameter

Cylinder 8 inches diameter. Ratio Cylinder to Whirl 1 to 8.28

Whirl ⅞ inch diameter. Front Roll gear 108 teeth

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
59T	21.44	19.29	17.15	17.15	8.57	8.81	4.28
60	21.08	18.97	16.86	16.86	8.43	8.66	4.21
61	20.73	18.66	16.59	16.59	8.29	8.52	4.14
62	20.40	18.36	16.32	16.32	8.16	8.38	4.08
63	20.08	18.07	16.06	16.06	8.03	8.25	4.01
64	19.76	17.79	15.81	15.81	7.90	8.12	3.95
65	19.46	17.51	15.57	15.57	7.78	8.00	3.89
66	19.16	17.25	15.33	15.33	7.66	7.88	3.83
67	18.88	16.99	15.10	15.10	7.55	7.76	3.77
68	18.60	16.74	14.88	14.88	7.44	7.64	3.72
69	18.33	16.50	14.66	14.66	7.33	7.53	3.66
70	18.07	16.26	14.45	14.45	7.22	7.43	3.61
71	17.81	16.03	14.25	14.25	7.12	7.32	3.56
72	17.57	15.81	14.05	14.05	7.02	7.22	3.51
73	17.33	15.59	13.86	13.86	6.93	7.12	3.46
74	17.09	15.38	13.67	13.67	6.83	7.02	3.41
75	16.86	15.18	13.49	13.49	6.74	6.93	3.37
76	16.64	14.98	13.31	13.31	6.65	6.84	3.32
77	16.42	14.78	13.14	13.14	6.57	6.75	3.28
78	16.21	14.59	12.97	12.97	6.48	6.66	3.24
79	16.01	14.41	12.81	12.81	6.40	6.58	3.20
80	15.81	14.23	12.65	12.65	6.32	6.50	3.16
81	15.61	14.05	12.49	12.49	6.24	6.42	3.12
82	15.42	13.88	12.34	12.34	6.17	6.34	3.08
83	15.24	13.71	12.19	12.19	6.09	6.26	3.04
84	15.06	13.55	12.04	12.04	6.02	6.19	3.01
85	14.88	13.39	11.90	11.90	5.95	6.11	2.97
86	14.71	13.23	11.76	11.76	5.88	6.04	2.94
87	14.54	13.08	11.63	11.63	5.81	5.97	2.90
88	14.37	12.93	11.50	11.50	5.75	5.91	2.87
89	14.21	12.79	11.37	11.37	5.68	5.84	2.84
90	14.05	12.65	11.24	11.24	5.62	5.77	2.81
91	13.90	12.51	11.12		5.56	5.71	2.78
92	13.75	12.37	11.00		5.50	5.65	2.75
93	13.60	12.24	10.88		5.44	5.59	2.72
94	13.45	12.11	10.76		5.38	5.53	2.69
	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears
	36″ Frame 24-94 T	36″ Frame 30-94 T	36″ Frame 30-94 T	36″ Frame 40-88 T	36″ Frame 15-94 T	36″ Frame 28-94 T	36″ Frame 30-94 T
	39″ Frame 15-70 T	39″ Frame 15-86 T	39″ Frame 15-86 T	39″ Frame 24-90 T	39″ Frame 15-94 T	39″ Frame 15-94 T	39″ Frame 15-94 T
Const's	1265.09	1138.58	1012.07	1012.07	506.03	520.10	253.02

Spinning Twist Gear Table.

FRONT ROLL 1¼ inch Diameter.

Cylinder 8 inch Diameter — Ratio Cylinder to Whirl 1 to 7.67.

Whirl $\frac{15}{16}$ inch Diameter — Front Roll Gear 108 teeth.

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
15T	78.12	70.31	62.50		31.25	32.11	15.62
16	73.24	65.91	58.59		29.29	30.11	14.64
17	68.93	62.04	55.14		27.57	28.33	13.78
18	65.10	58.59	52.08		26.04	26.76	13.02
19	61.67	55.51	49.34		24.67	25.35	12.33
20	58.59	52.73	46.87		23.43	24.08	11.71
21	55.80	50.22	44.64		22.32	22.94	11.16
22	53.26	47.94	42.61		21.30	21.89	10.65
23	50.95	45.85	40.76		20.38	20.94	10.19
24	48.82	43.94	39.06	39.06	19.53	20.07	9.76
25	46.87	42.18	37.50	37.50	18.75	19.27	9.37
26	45.07	40.56	36.05	36.05	18.02	18.52	9.01
27	43.40	39.06	34.72	34.72	17.36	17.84	8.68
28	41.85	37.66	33.48	33.48	16.74	17.20	8.37
29	40.41	36.36	32.32	32.32	16.16	16.61	8.08
30	39.06	35.15	31.25	31.25	15.62	16.05	7.81
31	37.80	34.02	30.24	30.24	15.12	15.54	7.56
32	36.62	32.95	29.29	29 29	14.64	15.05	7.32
33	35.51	31.96	28.40	28.40	14.20	14.59	7.10
34	34.46	31.02	27.57	27.57	13.78	14.16	6.89
35	33.48	30.13	26.78	26.78	13.39	13.76	6.69
36	32.55	29.29	26.04	26.04	13.02	13.38	6.51
37	31.67	28.50	25.33	25.33	12.66	13.02	6.33
38	30.83	27.75	24.67	24.67	12.33	12.67	6.16
39	30.04	27.04	24.03	24.03	12.01	12.35	6.00
40	29.29	26.36	23.43	23.43	12.71	12.04	5.85
41	28.58	25.72	22.86	22.86	11.43	11.75	5.71
42	27.90	25.11	22.32	22.32	11.16	11.47	5.58
43	27.25	24.52	21.80	21.80	10.90	11.20	5.45
44	26.63	23.97	21.30	21.30	10.65	10.94	5.32
45	26.04	23.43	20.83	20.83	10.41	10.70	5.20
46	25.47	22.92	20.38	20.38	10.19	10.47	5.09
47	24.93	22.44	19.94	19.94	9.97	10.25	4.98
48	24.41	21.97	19.53	19.53	9.76	10.03	4.88
49	23.91	21.52	19.13	19.13	9.56	9.83	4.78
50	23.43	21.09	18.75	18.75	9.37	9.63	4.68
51	22.97	20.68	18.38	18.38	9.19	9.44	4.59
52	22.53	20.28	18.02	18.02	9.01	9.26	4.50
53	22.11	19.90	17.68	17.68	8.84	9.09	4.42
54	21.70	19.53	17.36	17.36	8.67	8.92	4.34
55	21.30	19.17	17.04	17.04	8.52	8.75	4.26
56	20.92	18.83	16.74	16.74	8.37	8 60	4.18
57	20.55	18.50	16.44	16.44	8.22	8.45	4.11
58	20.20	18.18	16.16	16.16	8.08	8.30	4.04
Const's	1171.89	1054.70	937.51	937.51	468 75	481.77	234.38

Spinning Twist Gear Table.

FRONT ROLL 1⅛ inch Diameter.

Cylinder 8 inch Diameter — Ratio Cylinder to Whirl 1 to 7.67

Whirl $\frac{15}{16}$ inch Diameter — Front Roll Gear 108 teeth.

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
59T	19.86	17.87	15.89	15.89	7.94	8.16	3.97
60	19.53	17.57	15.62	15.62	7.81	8.02	3.90
61	19.21	17.29	15.36	15.36	7.68	7.89	3.84
62	18.90	17.01	15.12	15.12	7.56	7.77	3.74
63	18.60	16.74	14.88	14.88	7.44	7.64	3.72
64	18.31	16.47	14.64	14.64	7.32	7.52	3.66
65	18.02	16.22	14.42	14.42	7.21	7.41	3.60
66	17.75	15.98	14.20	14.20	7.10	7.29	3.55
67	17.49	15.74	13.99	13.99	6.99	7.19	3.49
68	17.23	15.51	13.78	13.78	6.89	7.08	3.44
69	16.98	15 28	13.58	13.58	6.79	6.98	3.39
70	16.74	15.06	13.39	13.39	6.69	6.88	3.34
71	16.50	14.85	13.20	13.20	6.60	6.78	3.30
72	16.27	14.64	13.02	13.02	6.51	6.69	3.25
73	16.05	14.44	12.84	12.84	6.42	6.59	3.21
74	15.83	14.25	12.66	12.66	6.33	6.51	3.16
75	15.62	14.06	12.50	12.50	6.25	6.42	3.12
76	15.41	13.87	12.33	12.33	6.16	6.33	3.08
77	15.21	13.69	12.17	12.17	6 08	6.25	3.04
78	15.02	13.52	12.01	12.01	6.00	6.17	3.00
79	14 83	13.35	11.86	11.86	5.93	6.09	2.96
80	14.64	13.18	11.71	11.71	5.85	6.02	2.92
81	14.46	13 02	11.57	11.57	5.78	5.94	2.89
82	14.29	12.86	11.43	11.43	5.71	5.87	2.85
83	14.11	12.70	11.29	11.29	5.64	5.80	2.82
84	13.95	12.55	11.16	11.16	5.58	5.73	2.79
85	13.78	12.40	11.02	11.02	5.51	5.66	2.75
86	13.62	12.26	10.90	10.90	5.45	5.60	2.72
87	13.47	12.12	10.77	10.77	5.38	5.53	2.69
88	13.31	11.98	10.65	10.65	5.32	5.47	2.66
89	13.16	11.85	10.53	10.53	5.26	5.41	2.63
90	13.02	11.71	10.41	10.41	5.20	5.35	2.60
91	12.87	11.59	10.30		5.15	5.29	2.57
92	12.73	11.46	10.19		5.09	5.23	2.54
93	12.60	11.34	10.08		5.04	5.18	2.52
94	12.46	11.22	9.97		4.98	5.12	2.49
	Change Gears 36″ Frame 24-94 T 39″ Frame 15-70 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 40-88 T 39″ Frame 24-90 T	Change Gears 36″ Frame 15-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 28-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-94 T
Const's	1171.89	1054.70	937.51	937.51	468.75	481.77	234.38

Spinning Twist Gear Table.

FRONT ROLL 1⅛ Inch Diameter.

Cylinder 8 inches Diameter. Ratio Cylinder to Whirl 1 to 7.08

Whirl 1 inch Diameter. Front Roll Gear 108 Teeth

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
15T	72.11	64.90	57.69		28.84	29.64	14.42
16	67.60	60.84	54.08		27.04	27.79	13.52
17	63.63	57.26	50.90		25.45	26.15	12.72
18	60.09	54.08	48.07		24.03	24.70	12.01
19	56.93	51.24	45.54		22.77	23.40	11.38
20	54.08	48.67	43.26		21.63	22.23	10.81
21	51.51	46.36	41.20		20.60	21.17	10.30
22	49.17	44.25	39.33		19.66	20.21	9.83
23	47.03	42.32	37.62		18.81	19.33	9.40
24	45.07	40.56	36.05	36.05	18.02	18.52	9.01
25	43.26	38.94	34.61	34.61	17.30	17.78	8.65
26	41.60	37.44	33.28	33.28	16.64	17.10	8.32
27	40.06	36.05	32.05	32.05	16.02	16.47	8.01
28	38.63	34.77	30.90	30.90	15.45	15.88	7.72
29	37.30	33.57	29.84	29.84	14.92	15.33	7.46
30	36.05	32.45	28.84	28.84	14.42	14.82	7.21
31	34.89	31.40	27.91	27.91	13.95	14.34	6.97
32	33.80	30.42	27.04	27.04	13.52	13.89	6.76
33	32.78	29.50	26.22	26.22	13.11	13.47	6.55
34	31.81	28.63	25.45	25.45	12.72	13 07	6.36
35	30.90	27.81	24.72	24.72	12.36	12.70	6.18
36	30.04	27.04	24.03	24.03	12.01	12.35	6.00
37	29.23	26.31	23.38	23.38	11.69	12.01	5.84
38	28.46	25.62	22.77	22.77	11.38	11.70	5.69
39	27.73	24.96	22.18	22.18	11.09	11.40	5.54
40	27.04	24.33	21.63	21.63	10.81	11.11	5.40
41	26.38	23.74	21.10	21.10	10.55	10.84	5.27
42	25.75	23.18	20.60	20.60	10.30	10.58	5.15
43	25.15	22.64	20.12	20.12	10.06	10.34	5.03
44	24.58	22.12	19.66	19.66	9.83	10.10	4.91
45	24.03	21.63	19.23	19.23	9.61	9.88	4.80
46	23.51	21.16	18.81	18.81	9.40	9.66	4.70
47	23.01	20.71	18.41	18.41	9.20	9.46	4.60
48	22.53	20 28	18.02	18.02	9.01	9.26	4.50
49	22.07	19.86	17.66	17.66	8.83	9.07	4.41
50	21.63	19.47	17.30	17.30	8.65	8.89	4.32
51	21.21	19.08	16.96	16.96	8.48	8.71	4.24
52	20.80	18.72	16.64	16.64	8.32	8.55	4.16
53	20.41	18.36	16.32	16.32	8.16	8.39	4.08
54	20.03	18.02	16.02	16.02	8.01	8.23	4.00
55	19.66	17.70	15.73	15.73	7.86	8.08	3.93
56	19.31	17.38	15.45	15.45	7.72	7.94	3.86
57	18.97	17.08	15.18	15.18	7.59	7.80	3.79
58	18 65	16.78	14.92	14.92	7.46	7.66	3.73
Const's	1081.74	973.57	865.39	865.39	432.69	444.71	216.35

Spinning Twist Gear Table

FRONT ROLL 1¼ inch Diameter

Cylinder 8 inches diameter. Ratio Cylinder to Whirl 1 to 7.08

Whirl 1 inch diameter. Front Roll gear 108 teeth

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
59T	18.33	16.50	14.66	14.66	7.33	7.53	3.66
60	18.02	16.22	14.42	14.42	7.21	7.41	3.60
61	17.73	15.96	14.18	14.18	7.09	7.29	3 54
62	17.44	15.70	13.95	13.95	6.97	7.17	3.48
63	17.17	15.45	13.73	13.73	6.86	7.05	3.43
64	16.90	15.21	13.52	13.52	6.76	6.94	3.38
65	16.64	14.97	13.31	13.31	6.65	6.84	3.32
66	16.39	14.75	13.11	13.11	6.55	6.73	3.27
67	16.14	14.53	12.91	12.91	6.45	6.63	3.22
68	15.90	14.31	12.72	12.72	6.36	6.53	3.18
69	15.67	14.10	12.54	12.54	6.27	6.44	3.13
70	15.45	13.90	12.36	12.36	6.18	6.35	3.09
71	15.23	13.71	12.18	12.18	6.09	6.26	3.04
72	15.02	13.52	12.01	12 01	6.00	6.17	3.00
73	14.81	13.33	11.85	11.85	5.92	6.09	2.96
74	14.61	13.15	11.69	11.69	5.84	6.00	2.92
75	14.42	12.98	11.53	11.53	5.76	5.92	2.88
76	14.23	12.78	11.38	11.38	5.69	5.85	2.84
77	14.04	12.64	11.23	11.23	5.61	5.77	2.80
78	13.86	12.48	11.09	11.09	5.54	5.70	2.77
79	13.69	12.32	10.95	10.95	5.47	5.62	2.73
80	13.52	12.16	10.81	10.81	5.40	5.55	2.70
81	13.35	12.01	10.68	10.68	5.34	5.49	2.67
82	13.19	11.87	10.55	10.55	5.27	5.42	2.63
83	13.03	11.72	10.42	10.42	5.21	5.35	2.60
84	12.87	11.59	10.30	10.30	5.15	5.29	2.57
85	12.72	11.45	10.18	10.18	5.09	5.23	2.54
86	12.57	11.32	10.06	10.06	5.03	5.17	2.51
87	12.43	11.19	9.94	9.94	4.97	5.11	2.48
88	12 29	11.06	9.83	9.83	4.91	5.05	2.45
89	12.15	10.93	9.72	9.72	4.86	4.99	2.43
90	12.01	10.81	9.61	9.61	4.80	4.94	2.40
91	11.88	10.69	9.50		4.75	4.88	2.37
92	11.75	10.58	9.40		4.70	4.83	2.35
93	11.63	10.46	9.30		4.65	4.78	2.32
94	11.50	10.35	9.20		4.60	4.73	2.30
	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears
	36″ Frame 24-94 T	36″ Frame 30-94 T	36″ Frame 30-94 T	36″ Frame 40-88 T	36″ Frame 15-94 T	36″ Frame 28-94 T	36″ Frame 30-94 T
	39″ Frame 15-70 T	39″ Frame 15-86 T	39″ Frame 15-86 T	39″ Frame 24-90 T	39″ Frame 15-94 T	39″ Frame 15-94 T	39″ Frame 15-94 T
Const's	1081.74	973.57	865.39	865.39	432.69	444.71	216 35

Spinning Twist Gear Table.

FRONT ROLL 1½ inch Diameter.

Cylinder 8 inch Diameter — Ratio Cylinder to Whirl 1 to 6.80.

Whirl 1 $\frac{1}{16}$ inch Diameter — Front Roll Gear 108 teeth.

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
15T	69.26	62.33	55.40		27.70	28.47	13.85
16	64.93	58.44	51.94		25.97	26.69	12.98
17	61.11	55.00	48.89		24.44	25.12	12.22
18	57.72	51.94	46.17		23.08	23.72	11.54
19	54.68	49.21	43.74		21.87	22.48	10.93
20	51.94	46.75	41.55		20.77	21.35	10.38
21	49.47	44.52	39.51		19.79	20.33	9.89
22	47.22	42.50	37.78		18.89	19.41	9.44
23	45.17	40.65	36.13		18.06	18.57	9.03
24	43.29	38.96	34.63	34.63	17.31	17.79	8.65
25	41.55	37.40	33.24	33.24	16.62	17.08	8 31
26	39.96	35.96	31.96	31.96	15.98	16.42	7.99
27	38.48	34.63	30.78	30.78	15.39	15.81	7.69
28	37.10	33.39	29.68	29.68	14.84	15.25	7.42
29	35.82	32.24	28.66	28.66	14.33	14.72	7.16
30	34.63	31.16	27.70	27.70	13.85	14.23	6.92
31	33.51	30.16	26.81	26.81	13.40	13.77	6.70
32	32.46	29.22	25.97	25.97	12.98	13.34	6.49
33	31.48	28.33	25.18	25.18	12.59	12.94	6.29
34	30.55	27.50	24.44	24.44	12.22	12.56	6.11
35	29.68	26.71	23 74	23.74	11.87	12.20	5.93
36	28.86	25.97	23.08	23.08	11.54	11.86	5.77
37	28.08	25.27	22.46	22.46	11.23	11.54	5.61
38	27.34	24.60	21.87	21.87	10.93	11.24	5.46
39	26.64	23.97	21.31	21.31	10.65	10.95	5.32
40	25.97	23.37	20.77	20.77	10.38	10.67	5.19
41	25.34	22.80	20.27	20.27	10.13	10.41	5.06
42	24.73	22.26	19.78	19.78	9.89	10.16	4.94
43	24.16	21.74	19.32	19.32	9.66	9.93	4.83
44	23.61	21.25	18.89	18.89	9.44	9.70	4.72
45	23.08	20.77	18.47	18.47	9.23	9.49	4.61
46	22.58	20.32	18.06	18.06	9.03	9.28	4.51
47	22.10	19 89	17.68	17.68	8.84	9.08	4.42
48	21.64	19.48	17.31	17.31	8.65	8.89	4.32
49	21.20	19 08	16.96	16.96	8.48	8.71	4.24
50	20.77	18.70	16.62	16.62	8.31	8.54	4.15
51	20.37	18.33	16.29	16.29	8.14	8.37	4.07
52	19.98	17.98	15.98	15.98	7.99	8.21	3.99
53	19.60	17.64	15.68	15.68	7.84	8.05	3.92
54	19.24	17.31	15.39	15.39	7.69	7.90	3.84
55	18.89	17.00	15.11	15.11	7.55	7.76	3.77
56	18.55	16.69	14.84	14.84	7.42	7.62	3.71
57	18.22	16.40	14.58	14.58	7 29	7.49	3.64
58	17.91	16.12	14.33	14.33	7.16	7.36	3.58
Const's	1038.96	935.06	831.17	831.17	415.59	427.13	207.79

Spinning Twist Gear Table.

FRONT ROLL 1½ inch Diameter.

Cylinder 8 inch Diameter — Ratio Cylinder to Whirl 1 to 6.80

Whirl 1 $\frac{1}{16}$ inch Diameter — Front Roll Gear 108 teeth.

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
59T	17.60	15.84	14.08	14 08	7.04	7.23	3.52
60	17.31	15.58	13.85	13.85	6.92	7.11	3.46
61	17.03	15.32	13.62	13.62	6.81	7.00	3.40
62	16.75	15.08	13.40	13.40	6.70	6.88	3.35
63	16.49	14.84	13.19	13.19	6.59	6.77	3 29
64	16.23	14.61	12.98	12.98	6.49	6.67	3.24
65	15.98	14.38	12 78	12.78	6.39	6.57	3.19
66	15.74	14.16	12.59	12.59	6.29	6.47	3.14
67	15.50	13.95	12.40	12.40	6.20	6.37	3.10
68	15.27	13.75	12.22	12.22	6.11	6.28	3.05
69	15.05	13.55	12.04	12.04	6 02	6.19	3.01
70	14.84	13.35	11.87	11.87	5.93	6.10	2.96
71	14.63	13.16	11.70	11.70	5.85	6.01	2.92
72	14.43	12.98	11.54	11.54	5.77	5.93	2.88
73	14 23	12.80	11.38	11.38	5.69	5.85	2.84
74	14.04	12.63	11.23	11.23	5.61	5.77	2.80
75	13 85	12.46	11.08	11.08	5.54	5.69	2.77
76	13.67	12.30	10.93	10.93	5.46	5.62	2.73
77	13.49	12.14	10.79	10.79	5.39	5.54	2 69
78	13.32	11.98	10.65	10.65	5.32	5.47	2.66
79	13.15	11.83	10.52	10.52	5.26	5.40	2.63
80	12.98	11.68	10.38	10.38	5.19	5.33	2.59
81	12.82	11.54	10.26	10.26	5.13	5.27	2.56
82	12.67	11.40	10.13	10.13	5.06	5.20	2.53
83	12.51	11.26	10.01	10.01	5.00	5.14	2.50
84	12.36	11.13	9.89	9.89	4.94	5.08	2.47
85	12.22	11.00	9.77	9.77	4.88	5.02	2.44
86	12.08	10.87	9.66	9.66	4.83	4.96	2.41
87	11.94	10.74	9.55	9.55	4.77	4.90	2.38
88	11.80	10.62	9.44	9.44	4.72	4.85	2.36
89	11.67	10.50	9.33	9 33	4.66	4.79	2.33
90	11.54	10.38	9.23	9.23	4.61	4.74	2.30
91	11.41	10.27	9.14		4.56	4.69	2.28
92	11.29	10.16	9.03		4.51	4.64	2.25
93	11.17	10.05	8.93		4.46	4.59	2.23
94	11.05	9.94	8.84		4.42	4.54	2.21
	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears	Change Gears
	36″ Frame 24-94 T 39″ Frame 15-70 T	36″ Frame 30-94 T 39″ Frame 15-86 T	36″ Frame 30-94 T 39″ Frame 15-86 T	36″ Frame 40-88 T 39″ Frame 24-90 T	36″ Frame 15-94 T 39″ Frame 15-94 T	36″ Frame 28-94 T 39″ Frame 15-94 T	36″ Frame 30-94 T 39″ Frame 15-94 T
Const's	1038.96	935.06	831.17	831.17	415.59	427.13	207.79

Spinning Twist Gear Table.

FRONT ROLL 1⅛ inch Diameter.

Cylinder 8 inch Diameter. Ratio Cylinder to Whirl 1 to 6.22

Whirl 1⅛ inch Diameter. Front Roll Gear 108 Teeth.

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
15T	63.35	57.02	50.68		25.34	26.04	12.67
16	59.39	53.45	47.51		23.75	24.41	11.87
17	55.90	50.31	44.72		22.36	22.98	11 18
18	52.79	47.51	42.23		21.11	21.70	10.55
19	50.01	45.01	40.01		20.00	20.56	10.00
20	47.51	42.76	38.01		19.00	19.53	9.50
21	45.25	40.72	36.20		18.10	18.60	9.05
22	43.19	38.87	34.55		17.27	17.75	8.63
23	41.31	37.18	33.05		16.52	16.98	8.26
24	39.59	35.63	31.67	31.67	15.83	16.27	7.91
25	38.01	34.21	30.41	30.41	15.20	15.62	7.60
26	36.55	32.89	29.24	29.24	14.62	15.02	7.31
27	35.19	31.67	28.15	28.15	14.07	14.47	7.03
28	33.94	30.54	27.15	27.15	13.57	13.95	6.78
29	32.77	29.49	26.21	26.21	13.10	13.47	6 55
30	31.67	28.51	25.34	25.34	12.67	13.02	6.33
31	30.65	27.59	24.52	24.52	12.26	12.60	6.13
32	29.69	26.72	23.75	23.75	11.87	12.20	5.92
33	28.79	25.91	23.03	23.03	11.51	11.83	5 75
34	27.95	25 15	22.36	22.36	11.18	11 49	5.59
35	27.15	24.43	21.72	21.72	10.86	11.16	5.43
36	26.39	23.75	21.11	21.11	10.55	10.85	5.27
37	25.68	23.11	20.54	20.54	10.27	10.55	5.13
38	25.00	22.50	20.00	20.00	10.00	10.28	5.00
39	24.36	21.95	19.49	19.49	9.74	10.01	4 87
40	23.75	21.38	19.00	19.00	9.50	9.76	4.75
41	23.17	20.86	18.54	18.54	9.27	9.52	4.63
42	22.62	20.36	18.10	18.10	9.05	9.30	4.52
43	22.10	19.89	17.68	17.68	8.84	9.08	4.42
44	21.59	19 43	17.27	17.27	8.63	8.87	4.31
45	21.11	19.00	16.89	16.89	8 44	8.68	4.22
46	20.65	18.59	16.52	16.52	8.26	8.49	4.13
47	20.22	18.19	16.17	16.17	8.08	8.31	4.04
48	19.79	17.81	15.83	15.83	7.91	8.13	3.95
49	19.39	17.45	15.51	15.51	7.75	7.97	3.87
50	19.00	17.10	15.20	15.20	7.60	7.81	3.80
51	18.63	16.77	14.90	14.90	7.45	7.66	3.72
52	18.27	16.44	14.62	14 62	7.31	7.51	3.65
53	17.93	16.13	14.34	14.34	7.17	7.37	3.58
54	17.59	15.83	14.07	14.07	7 03	7.23	3.51
55	17.27	15.55	13.82	13.82	6.91	7.10	3.45
56	16.96	15.27	13 57	13.57	6.78	6.97	3.39
57	16.67	15.00	13.33	13.33	6.66	6.85	3.33
58	16.38	14.74	13.10	13.10	6.55	6.73	3.27
Const's	950.34	855.31	760.27	760.27	380.14	390.70	190.07

Spinning Twist Gear Table.

FRONT ROLL 1⅛ inch Diameter

Cylinder 8 inch Diameter. Ratio Cylinder to Whirl 1 to 6.22

Whirl 1 ⅛ inch Diameter Front Roll Gear 108 Teeth

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
59T	16.10	14.49	12.88	12.88	6.44	6.62	3.22
60	15.83	14.25	12.67	12.67	6.33	6.51	3.16
61	15.57	14.02	12.46	12.46	6.23	6.40	3.11
62	15.32	13.79	12.26	12.26	6.13	6.30	3.06
63	15.08	13.57	12.06	12.06	6 03	6.20	3.01
64	14.84	13.36	11.87	11.87	5.93	6.10	2.96
65	14.62	15.15	11.66	11.69	5 84	6.01	2.92
66	14.39	12.95	11.51	11.51	5.75	5.91	2.87
67	14.18	12.76	11.34	11.34	5.67	5.83	2 83
68	13.97	12 57	11.18	11.18	5.59	5.74	2.79
69	13.77	12.39	11.01	11.01	5.50	5.66	2 75
70	13.57	12.21	10.86	10.86	5.43	5.58	2.71
71	13.38	12.04	10.70	10.70	5.35	5.50	2.67
72	13.19	11.87	10.55	10.55	5.27	5.42	2.63
73	13.01	11.71	10.41	10.41	5.20	5.35	2.60
74	12.84	11.55	10.27	10.27	5.13	5.27	2.56
75	12.67	11.40	10.13	10.13	5.06	5.20	2.53
76	12.50	11.25	10 00	10.00	5.00	5.14	2.50
77	12.34	11.10	9.87	9.87	4.93	5.07	2.46
78	12.18	10.96	9.74	9.74	4.87	5.00	2.43
79	12.02	10.82	9.62	9.62	4.81	4.94	2.40
80	11.87	10.69	9.50	9.50	4.75	4.88	2.37
81	11.73	10.55	9.38	9.38	4.69	4.82	2.34
82	11.58	10.43	9.27	9.27	4.63	4.76	2.31
83	11.44	10.30	9.15	9.15	4.58	4.70	2.29
84	11.31	10.18	9.05	9.05	4.52	4.65	2.26
85	11.18	10.06	8.94	8.94	4.47	4 59	2 23
86	11.05	9.94	8.84	8.84	4.42	4.54	2.21
87	10.92	9.83	8.73	8.73	4.36	4.49	2.18
88	10.79	9.71	8.63	8.63	4.31	4.43	2.15
89	10.67	9.61	8.54	8.54	4.27	4.38	2.13
90	10.55	9.50	8.44	8.44	4.22	4.34	2.11
91	10.44	9.39	8.35		4.17	4.29	2.08
92	10.32	9.29	8.26		4.13	4.24	2 06
93	10.21	9.19	8.17		4.08	4.20	2.04
94	10.11	9.09	8.08		4.04	4.15	2.02
	Change Gears 36″ Frame 24-94 T 39″ Frame 15-70 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 40-88 T 39″ Frame 24-90 T	Change Gears 36″ Frame 15-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 28-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-94 T
Const's	950.34	855.31	760.27	760.27	380.14	390.70	190.07

Spinning Twist Gear Table.

FRONT ROLL 1⅛ inch Diameter.

Cylinder 8 inch Diameter. Ratio Cylinder to Whirl 1 to 5.48.

Whirl $1\frac{5}{16}$ inch Diameter. Front Roll Gear 108 Teeth.

Change Gears	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 22 T Stud 88 T	Cyl. 20 T Stud 80 T	Cyl. 40 T Stud 80 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
	Twist	Twist	Twist	Twist	Twist	Twist	Twist
15T	55.80	50.23	44.65		22.32	22.94	11.16
16	52.33	47.09	41.86		20.93	21.51	10.46
17	49.25	44.32	39.40		19.70	20.24	9.85
18	46.51	41.86	37.21		18.60	19.12	9.30
19	44.06	39.66	35.25		17.62	18.11	8.81
20	41.86	37.67	33.49		16.74	17.21	8.37
21	39.87	35.88	31.89		15.94	16 39	7.97
22	38.05	34.25	30.44		15.22	15.64	7.61
23	36.40	32.76	29.12		14.56	14 96	7.28
24	34.88	31.39	27.90	27.90	13.95	14.34	6.97
25	33.48	30.14	26.79	26.79	13.39	13.76	6 69
26	32.20	28.98	25.76	25.76	12.88	13.23	6.44
27	31.01	27.90	24.80	24.80	12.40	12.74	6 20
28	29.90	26.91	23 92	23.92	11.96	12.29	5.98
29	28.87	25.98	23.09	23.09	11.54	11.86	5.77
30	27.90	25.11	22.32	22.32	11.16	11.47	5.58
31	27.00	24.30	21.60	21.60	10.80	11.10	5.40
32	26.16	23.54	20.93	20.93	10.46	10.75	5.23
33	25.37	22.83	20.29	20.29	10.14	10.43	5.07
34	24.62	22.16	19.70	19.70	9.85	10.12	4.92
35	23.92	21.53	19.13	19.13	9.56	9.83	4.78
36	23.25	20.93	18.60	18.60	9.30	9.56	4 65
37	22.62	20.36	18.10	18.10	9.05	9.30	4.52
38	22.03	19.83	17.62	17.62	8.81	9.05	4.40
39	21.46	19.32	17.17	17.17	8.58	8.82	4.29
40	20.93	18 83	16.74	16.74	8.37	8.60	4.18
41	20.42	18.37	16.33	16.33	8.16	8.39	4 08
42	19.93	17.94	15.94	15.94	7.97	8.19	3.98
43	19.47	17.52	15.57	15.57	7 78	8.00	3.89
44	19.02	17.12	15.22	15.22	7.61	7.82	3.80
45	18.60	16.74	14.88	14.88	7.44	7.64	3.72
46	18.20	16.38	14.56	14.56	7.28	7.48	3.64
47	17.81	16.03	14.25	14.25	7.12	7.32	3.56
48	17.44	15.69	13.95	13.95	6.97	7.17	3.48
49	17.08	15.37	13.66	13.66	6.83	7.02	3.41
50	16.74	15.07	13.39	13.39	6.69	6.88	3.34
51	16.41	14.77	13.13	13.13	6.56	6.74	3.28
52	16.10	14.49	12.88	12.88	6.44	6.61	3.22
53	15.79	14.21	12.63	12.63	6.31	6.49	3.15
54	15.50	13.95	12.40	12.40	6.20	6.37	3 10
55	15.22	13.70	12.17	12.17	6.08	6.25	3.04
56	14.95	13.45	11.96	11.96	5.98	6.14	2.99
57	14.68	13.22	11.75	11.75	5.87	6.03	2.93
58	14.43	12.99	11.54	11.54	5.77	5.93	2.88
Const's	837.28	753.55	669.82	669.82	334.91	344.21	167.46

Spinning Twist Gear Table.

FRONT ROLL 1⅛ inch Diameter

Cylinder 8 inch Diameter. Ratio Cylinder to Whirl 1 to 5.48

Whirl 1 $\frac{5}{16}$ inch Diameter Front Roll Gear 108 Teeth

Change Gears	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 90 T Twist	Cyl. 22 T Stud 88 T Twist	Cyl. 20 T Stud 80 T Twist	Cyl. 40 T Stud 80 T Twist	Cyl. 36 T Stud 74 T Twist	Cyl. 55 T Stud 55 T Twist
59T	14.19	12.77	11.35	11.35	5.67	5.83	2.83
60	13.95	12.55	11.16	11.16	5.58	5.73	2.79
61	13.72	12.35	10.97	10.97	5.49	5.64	2.74
62	13.50	12.15	10.80	10.80	5.40	5.55	2.70
63	13.29	11.96	10.63	10.63	5.31	5.46	2.65
64	13.08	11.77	10.46	10.46	5.23	5.37	2.61
65	12.88	11.59	10.30	10 30	5.15	5.29	2.57
66	12.68	11.41	10.14	10.14	5.07	5.21	2.53
67	12.49	11.24	9.99	9.99	4.99	5.13	2.49
68	12.31	11.08	9.85	9.85	4.92	5.06	2.46
69	12.13	10.92	9.70	9.70	4.85	4.98	2.42
70	11.96	10.76	9.56	9.56	4.78	4.91	2.39
71	11.79	10.61	9.43	9.43	4.71	4.84	2.35
72	11.62	10.46	9.30	9.30	4 65	4.78	2.32
73	11.46	10.32	9.17	9.17	4.58	4.71	2.29
74	11.31	10.18	9.05	9.05	4 52	4 65	2.26
75	11.16	10.04	8.93	8.93	4.46	4.58	2.23
76	11.01	9.91	8.81	8.81	4 40	4.52	2.20
77	10.87	9.78	8.69	8.69	4 34	4 47	2.17
78	10.73	9.66	8.58	8.58	4.29	4.41	2.14
79	10.59	9.53	8.47	8.47	4.23	4.35	2.11
80	10.46	9.41	8.37	8.37	4.18	4.30	2.09
81	10.33	9.30	8.26	8.26	4.13	4.24	2.06
82	10.21	9.18	8.16	8.16	4.08	4.19	2.04
83	10.08	9.07	8.07	8.07	4.03	4.14	2.01
84	9.96	8.97	7.97	7.97	3.98	4.09	1.99
85	9.85	8.86	7.88	7.88	3.94	4.04	1.97
86	9.73	8.76	7.78	7.78	3.89	4.00	1.94
87	9.62	8.66	7.69	7.69	3.84	3.95	1.92
88	9.51	8.56	7.61	7.61	3.80	3.91	1 90
89	9.40	8.46	7.52	7.52	3.76	3.86	1.88
90	9.30	8.37	7.44	7.44	3.72	3.82	1.86
91	9.20	8.28	7.36		3 68	3.78	1.84
92	9.10	8.19	7.28		3.64	3.74	1.82
93	9.00	8.10	7.20		3.60	3.70	1.80
94	8.90	8.01	7.12		3.56	3.66	1.78
	Change Gears 36″ Frame 24-94 T 39″ Frame 15-70 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-86 T	Change Gears 36″ Frame 40-88 T 39″ Frame 24-90 T	Change Gears 36″ Frame 15-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 28-94 T 39″ Frame 15-94 T	Change Gears 36″ Frame 30-94 T 39″ Frame 15-94 T
Const's	837.28	753.55	669.82	669.82	334.91	344 21	167 46

Production Table of Ring Warp Yarn.

Front Roll 1 in. Diameter.

Number of Yarn.	Twist per Inch.	Rev. of Front Roll per Minute.	Rev. of Spindles per Minute.	Hanks per Day per Spindle.	Pounds per day per Spindle.	Number of Yarn.
4	9.50	166.0	4950	9.115	2.279	4
5	10.62	163.2	5450	8.962	1.792	5
6	11.63	161.4	5900	8.863	1.477	6
7	12.56	159.6	6300	8.764	1.252	7
8	13.43	157.6	6650	8.654	1.082	8
9	14.25	156.3	7000	8.583	.954	9
10	15.02	153.6	7250	8.530	.853	10
11	15.75	151.5	7500	8.413	.765	11
12	16.45	150.0	7750	8.330	.694	12
13	17.12	147.8	7950	8.208	.631	13
14	17.77	145.9	8150	8.103	.579	14
15	18.39	143.6	8300	7.975	.532	15
16	19.00	141.5	8450	7.858	.497	16
17	19.58	139.7	8600	7.758	.468	17
18	20.15	138.1	8750	7.670	.429	18
19	20.70	136.0	8850	7.553	.398	19
20	21.24	134.0	8950	7.525	.376	20
21	21.76	132.3	9050	7.430	.354	21
22	22.27	130.0	9100	7.301	.332	22
23	22.78	127.8	9150	7.177	.312	23
24	23.27	125.8	9200	7.065	.294	24
25	23.75	124.6	9300	6.998	.280	25
26	24.22	123.7	9400	7.024	.270	26
27	24.68	121.9	9450	6.922	.256	27
28	25.13	120.2	9500	6.825	.244	28
29	25.58	118.2	9500	6.712	.231	29
30	26.02	116.2	9500	6.598	.220	30
31	26.44	114.4	9500	6.496	.210	31
32	26.87	112.5	9500	6.388	.200	32
33	27.28	111.4	9550	6.326	.192	33
34	27.69	110.3	9600	6.263	.184	34
35	28.10	108.7	9600	6.240	.178	35

Allowance has been made for cleaning, oiling and doffing.

Production Table of Ring Warp Yarn.

Front Roll 1 in. Diameter.

Number of Yarn.	Twist per Inch.	Rev. of Front Roll per Minute.	Rev. of Spindles per Minute.	Hanks per Day per Spindle.	Pounds per day per Spindle.	Number of Yarn.
36	28.50	108.3	9700	6.217	.173	36
37	28.89	106.8	9700	6.131	.166	37
38	29.28	106.5	9800	6.114	.161	38
39	29.66	105.2	9800	6.039	.155	39
40	29.07	106.2	9700	6.097	.152	40
41	29.44	104.9	9700	6.022	.147	41
42	29.80	103.6	9700	5.947	.142	42
43	30.13	102.5	9700	5.884	.137	43
44	30.49	101.2	9700	5.810	.132	44
45	30.82	100.2	9700	5.815	.129	45
46	31.18	99.0	9700	5.745	.125	46
47	31.51	98.0	9700	5.687	.121	47
48	31.83	97.0	9700	5.629	.117	48
49	32.20	95.9	9700	5.535	.114	49
50	32.52	94.9	9700	5.508	.110	50
55	33.34	91.6	9600	5.373	.098	55
60	34.83	87.7	9600	5.199	.087	60
65	36.27	84.2	9600	4.991	.077	65
70	37.62	81.2	9600	4.814	.069	70
75	38.10	79.4	9500	4.707	.063	75
80	39.33	76.9	9500	4.606	.058	80
85	39.64	74.0	9100	4.433	.052	85
90	40.76	71.0	9100	4.297	.048	90
95	41.88	68.5	9000	4.146	.044	95
100	42.00	65.9	8700	4.030	.040	100
110	44.01	61.5	8500	3.761	.034	110
120	44.89	58.1	8200	3.553	.030	120
130	46.74	53.1	7800	3.281	.025	130
140	47.32	47.1	7000	2.910	.021	140
150	48.96	42.9	6600	2.650	.018	150
160	50.56	37.8	6000	2.335	.015	160
170	52.12	33.6	5500	2.076	.012	170

Allowance has been made for cleaning, oiling and doffing.

Production Table of Ring Filling Yarn.

Front Roll 1 in. Diameter.

Number of Yarn.	Twist per Inch.	Rev. of Front Roll per Minute.	Rev. of Spindles per Minute.	Hanks per Day per Spindle.	Pounds per day per Spindle.	Number of Yarn.
4	7.00	182.0	4000	9.656	2.414	4
5	7.83	178.8	4400	9.483	1.897	5
6	8.57	178.3	4800	9.568	1.594	6
7	9.26	176.9	5150	9.494	1.356	7
8	9.90	175.3	5450	9.407	1.176	8
9	10.50	172.7	5700	9.267	1.030	9
10	11.07	171.0	5950	9.283	.928	10
11	11.61	168.6	6150	9.153	.832	11
12	12.12	166.7	6350	9.154	.763	12
13	12.62	164.0	6500	9.005	.693	13
14	13.10	162.7	6700	8.934	.638	14
15	13.56	160.7	6850	8.825	.588	15
16	14.00	158.0	6950	8.676	.542	16
17	14.43	156.6	7100	8.599	.506	17
18	14.85	154.3	7200	8.473	.471	18
19	15.26	152.5	7300	8.374	.441	19
20	15.65	150.4	7400	8.352	.418	20
21	16.04	148.8	7500	8.264	.394	21
22	16.42	147.3	7600	8.181	.372	22
23	16.79	145.9	7700	8.103	.352	23
24	17.15	144.7	7800	8.034	.335	24
25	17.50	142.8	7850	7.930	.317	25
26	17.85	140.0	7850	7.862	.302	26
27	17.64	141.6	7850	7.952	.295	27
28	17.99	139.7	7900	7.845	.280	28
29	18.29	137.4	7900	7.717	.266	29
30	18.35	136.9	7900	7.774	.259	30
31	18.62	135.0	7900	7.666	.248	31
32	18.64	134.9	7900	7.660	.239	32
33	18.94	133.3	7900	7.569	.229	33
34	18.95	132.7	7900	7.535	.222	34
35	19.23	130.7	7900	7.503	.214	35

Allowance has been made for cleaning, oiling and doffing.

Production Table of Ring Filling Yarn.

Front Roll 1 in. Diameter.

Number of Yarn.	Twist per Inch.	Rev. of Front Roll per Minute.	Rev. of Spindles per Minute.	Hanks per Day per Spindle.	Pounds per day per Spindle.	Number of Yarn.
36	19.50	128.9	7900	7.400	.206	36
37	19.77	127.2	7900	7.302	.195	37
38	20.03	125.5	7900	7.205	.190	38
39	20.30	123.8	7900	7.107	.182	39
40	20.55	122.3	7900	7.098	.177	40
41	20.81	120.8	7900	7.010	.171	41
42	21.06	119.4	7900	6.929	.165	42
43	21.31	117.9	7900	6.842	.159	43
44	21.56	116.6	7900	6.767	.154	44
45	21.80	115.3	7900	6.691	.149	45
46	22.04	114.1	7900	6.622	.144	46
47	22.28	112.8	7900	6.546	.139	47
48	22.52	111.6	7900	6.477	.135	48
49	22.75	110.5	7900	6.412	.131	49
50	22.98	109.4	7900	6.417	.128	50
55	24.10	104.3	7900	6.183	.112	55
60	25.16	99.9	7900	5.985	.100	60
65	25.79	96.2	7800	5.760	.088	65
70	26.75	92.8	7800	5.559	.079	70
75	27.71	89.6	7800	5.367	.072	75
80	28.16	87.0	7700	5.266	.066	80
85	29.04	83.3	7600	5.042	.059	85
90	29.39	80.1	7400	4.899	.054	90
95	30.19	78.0	7400	4.770	.050	95
100	30.50	75.1	7200	4.639	.046	100
110	31.44	69.8	6900	4.312	.039	110
120	32.85	63.0	6500	3.892	.032	120
130	34.20	57.7	6200	3.564	.027	130
140	35.49	52.9	5900	3.248	.023	140
150	36.72	48.6	5600	3.002	.020	150
160	37.92	44.5	5300	2.750	.017	160
170	39.09	40.8	5000	2.520	.015	170

Allowance has been made for cleaning, oiling and doffing.

Production Table of Ring Hosiery Yarns.

Front Roll 1 in. Diameter.

Number of Yarn	Twist per Inch	Rev. of Front Roll per Minute	Rev. of Spindles per Minute	Hanks per day per Spindle	Pounds per day per Spindle	Number of Yarn
2	4.24	210.0	2800	10.989	5.495	2
3	5.20	189.7	3100	9.927	3.309	3
4	6.00	180.3	3400	9.435	2.359	4
5	6.71	175.4	3700	9.179	1.836	5
6	7.35	173.2	4000	9.063	1.511	6
7	7.94	168.3	4200	8.807	1.258	7
8	8.49	164.9	4400	8.733	1.092	8
9	9.00	162.6	4600	8.611	.957	9
10	9.49	161.0	4800	8.526	.853	10
11	9.95	159.9	5000	8.468	.770	11
12	10.39	157.7	5150	8.449	.704	12
13	10.82	157.4	5350	8.433	.649	13
14	11.22	156.3	5500	8.374	.598	14
15	11.62	154.7	5650	8.289	.553	15
16	12.00	153.8	5800	8.241	.515	16
17	12.37	151.7	5900	8.222	.484	17
18	12.73	150.0	6000	8.130	.446	18
19	13.08	148.4	6100	8.043	.423	19
20	13.42	144.6	6100	7.927	.396	20
21	13.75	141.2	6100	7.741	.369	21
22	14.07	140.2	6200	7.686	.349	22
23	14.39	137.1	6200	7.516	.327	23
24	14.70	134.2	6200	7.441	.310	24
25	15.00	133.7	6300	7.414	.297	25
26	15.30	131.0	6300	7.349	.283	26
27	15.59	128 6	6300	7.214	.267	27
28	15.87	126.3	6300	7.085	.253	28
29	16.16	124.0	6300	6.956	.240	29
30	16.43	123.9	6400	6.950	.232	30

Allowance has been made for cleaning, oiling and doffing.

Draper's Table

of Breaking Weight of American Warp Yarns, per Skein, weight given in Pounds.

Number.	Breaking Weight.	Number.	Breaking Weight.	Number.	Breaking Weight.	Number.	Breaking Weight.
1		26	66.3	51	36.6	76	25.8
2		27	63.6	52	36.1	77	25.5
3	530.0	28	61.3	53	35.5	78	25.3
4	410.0	29	59.2	54	34.9	79	24.9
5	330.0	30	57.3	55	34.4	80	24.6
6	275.0	31	55.6	56	33.8	81	24.3
7	237.6	32	54.0	57	33.4	82	24.0
8	209.0	33	52.6	58	32.8	83	23.7
9	186.5	34	51.2	59	32.3	84	23.4
10	168.7	35	50.0	60	31.7	85	23.2
11	154.1	36	48.7	61	31.3	86	22.8
12	142.0	37	47.6	62	30.8	87	22.6
13	131.5	38	46.5	63	30.4	88	22.4
14	122.8	39	45.5	64	30.0	89	22.2
15	115.1	40	44.6	65	29.6	90	22.0
16	108.4	41	43.8	66	29.2	91	21.7
17	102.5	42	43.0	67	28.8	92	21.5
18	97.3	43	42.2	68	28.5	93	21.3
19	92.6	44	41.4	69	28.2	94	21.2
20	88.3	45	40.7	70	27.8	95	21.0
21	83.8	46	40.0	71	27.4	96	20.7
22	79.7	47	39.3	72	27.1	97	20.5
23	75.9	48	38.6	73	26.8	98	20.4
24	72.4	49	37.9	74	26.5	99	20.2
25	69.2	50	37.3	75	26.2	100	20.0

Horse Power of Whitin Ring Spinning.

Warp Yarn.

Number of Yarn.	Space of Frame.	Size of Spindle.	Diameter of Ring.	Length of Traverse.	Twist per inch.	Revolutions Front Roll per min.	Revolutions Spindle per min.	Revolutions Cylinder per min.	Avg. Number of Spindles per Horse Power.	Number of Spls per Horse Power Full Bobbin.
6	3″	Large	2″	7¼″	11.63	161	5900	814	85	75
8					13.43	158	6700	920	74	67
10					15.02	154	7250	1000	68	66
12		Medi-		7″	16.45	150	7750	1069	76	70
14		um.			17.77	146	8100	1124	72	64
16					19.00	141	8450	1166	70	63
18					20.15	138	8750	1207	72	63
20					21.24	134	8950	1280	74	64
24				6½″	23.27	125	9200	1280	76	66
28	2¾″	Stand-	1¾″		25.13	120	9500	1140	76	69
32		ard.			26.87	114	9500	1140	78	71
36					28.50	108	9700	1164	78	72
40			1⅝″	6″	29.07	106	9700	1164	80	75
45			1½″		30.82	100	9700	1164	83	78
50					32.52	94	9700	1164	86	82
60					34.83	86	9500	1140	90	86
70					37.62	80	9500	1140	94	93
80					39.33	76	9300	1130	100	96
90			1⅜″	5½″	40.76	72	9100	1090	108	102
100					42.00	66	8700	1044	114	110
110					44.00	64	8500	1020	127	120

The tables of Horse Power of Whitin Ring Spinning are the results of tests made on two Whitin Spinning Frames, one of 256 spindles, 2¾ inch space, the other 240 spindles, 3 inch space. The frames were run under conditions that prevail in the average cotton mill. The average temperature of the room was 76°; average humidity 50%; band pull 2 pounds; bands 120 to the pound; and size of travellers as stated in Traveller Table on page 25.

Observations were made on both empty and full bobbins, the average of which showed the power required to drive the average bobbin on each number of yarn tested.

Horse Power of Whitin Ring Spinning.

Filling Yarn.

Number Yarn.	Space of Frame.	Size of Spindle.	Diameter of Ring.	Length of Traverse.	Twist per inch.	Revolutions Front Roll per min.	Revolutions Spindle per min.	Revolutions Cylinder per min.	Avg. Number of Spindles per Horse Power.	Number of Spls per Horse Power Full Bobbin.
6	2¾″	Medium.	1½″	7½″	8.57	178	4800	662	142	135
8					9.90	175	5450	752	140	133
10					11.07	171	5950	821	125	120
12				7″	12.12	166	6350	876	122	112
14					13.10	162	6700	924	120	109
16					14.00	158	6950	959	116	106
18					14.85	154	7200	992	110	104
20					15.65	150	7400	1021	98	93
24					17.15	144	7800	1070	87	83
28		Standard.	1⅜″	6½″	17.99	140	7900	949	86	85
32					18.64	135	7900	949	88	86
36					19.50	129	7900	949	90	88
40			1¼″	6″	20.55	122	7900	949	90	88
45					21.80	115	7900	949	91	89
50					22.98	109	7900	949	93	91
60				5½″	25.16	100	7900	949	97	95
70					26.75	92	7800	936	100	98
80					28.16	87	7700	924	104	106
90					29.39	80	7400	888	110	100
100					30.50	75	7200	864	117	110
110					31.44	70	6900	830	132	125

The Tests were made with Emerson Power Scale, Huddleston's Hygrophant and Taylor Bros'. Thermometer.

NOTE:—In estimating the power required to drive a spinning room where several frames are to be driven from one shaft by belts, it will be advisable to use the data in the column of "Average number of spindles per horse power;" but in case of individual motor driven frames the "full bobbin column" data should be used.

CARE OF SPINNING FRAMES.

The **proper care of machinery** in the spinning department of a cotton mill is an important consideration, and the smallest details should not be overlooked, if good quality and maximum production is desired. Systematic care in keeping the frames clean and in proper working order will repay the spinner, as good results cannot be had if the frames are neglected and allowed to get out of repair. Periodical attention should be given to the oiling and cleaning of the rolls, both top and bottom, the spindles, lifting rods and all bearings. The frames when first installed should be accurately levelled, and this condition should be maintained by frequent inspections and relevelled whenever found necessary.

CLEANING.

For medium and fine work the deck boards and creels should be dusted at least once a day ; the accumulation of lint and dust about the skewer steps and top holes should be removed every other day ; the thread boards blocked off every hour, and also thoroughly wiped with waste twice a day. The separators and ring rails should be brushed off every other day; the bolster rails wiped with waste twice daily. The bottom rolls should be wiped with waste twice a week. The front top rolls should be cleaned daily while the frame is running, if desired, by wiping the leather covers with waste dipped in a half and half mixture of alcohol and water. The back and middle rolls should be treated in the

same manner, but only once a week. The top clearers should be picked four times daily, and scavenger rolls as often as necessary. The spindles should be taken from the frame twice a year, the dirty oil removed and all parts of the spindle thoroughly cleaned before refitting in frame. All remaining parts of frame should have daily brushings, excepting the back weights where one brushing a week would be sufficient.

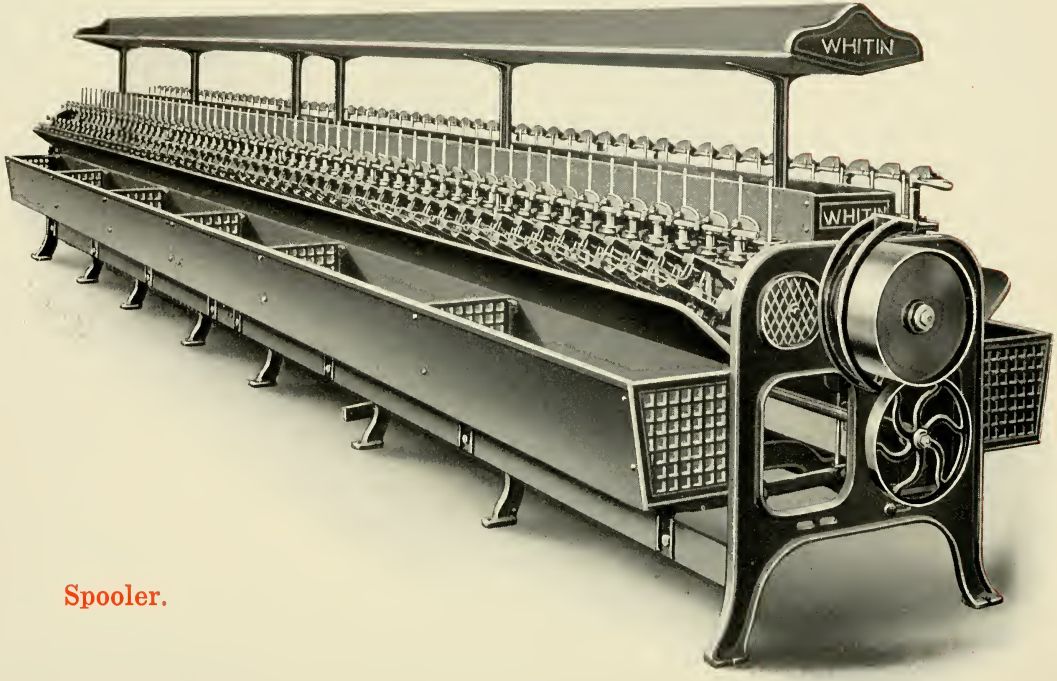
OILING.

The loose pulley, cylinder bearings, head end gearing and top front rolls should be oiled daily ; the steel roll bearings twice a day ; for the back and middle top roll end bearings and builder motion weekly oiling will be sufficient; saddle bearings twice a week. The spindles should be oiled every two weeks, although it would not be amiss to put in a little fresh oil every week.

Bobbins.

Badly fitting bobbins and poor oil are the causes of considerable trouble, therefore the greatest care should be exercised in the selection of both, otherwise good and satisfactory results cannot be obtained.

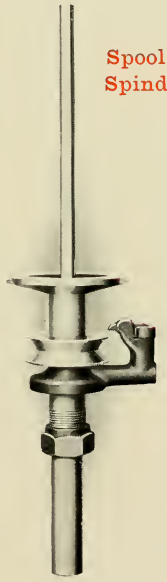
SPOOLING.



Spooler.

IMPROVED SPOOLER.

The accompanying cut shows clearly the general features of construction of our **Improved Spooler.** The frame is of a substantial and pleasing design, the end legs being connected together by four rigid iron bars, or girts, supported at frequent intervals by heavy sampsons. The two top bars serve to hold the spindle bolsters, thus furnishing a solid foundation, with a minimum amount of vibration for the spindles at any economical speed.



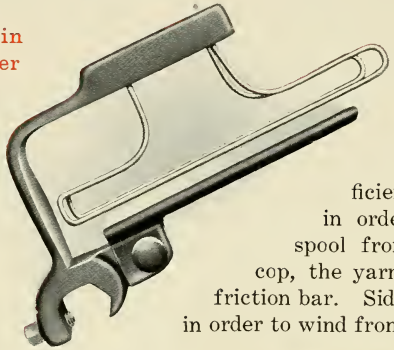
The **spindles** are as light as is consistent with the work demanded of them. The bolster case is constructed with a chamber holding a generous supply of oil, so that oiling is required not more than once a month. The bolsters are provided with the well-known Woodmancy oil hole cap and spindle retainer.

In **banding the spindles,** one band drives two spindles, one on each side of the frame. To avoid cross banding at the end of the cylinder, two spindles, one on each side of the frame, have double whirls and use two bands.

The frames are built to wind from warp, filling or twister bobbins as ordered. When warp bobbins are used, the frame is equipped with the well-known Wade type of

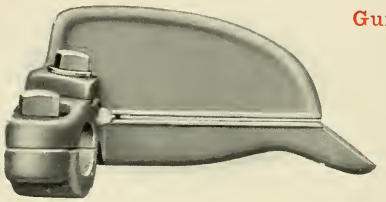
bobbin holder, which has given universal satisfaction for years in many mills. For filling bobbins or cops, the frame is fitted with skewers, fastened to rods on each side of the frame. To give sufficient tension to the yarn, in order to wind a compact spool from a filling bobbin or cop, the yarn is run over a flannel friction bar. Side spindles are provided in order to wind from twister bobbins.

Bobbin Holder



Our patented **Thread Guide** is easily adjusted and firmly held in position for the different numbers of yarn by means of an inclined adjusting foot and holding screw.

Guide



The **Traverse Motion** is governed by a mangle wheel, and on long frames is driven from both ends, thus ensuring a very positive and steady motion to the guides the entire length of the frame, thereby ensuring perfectly wound spools. The wave of traverse shaft is so placed that the levers operating the lifting rods are well up from the floor, thus preventing any possibility of breakage of the mangle wheel, owing to the levers striking a spool that may have fallen under the frame.

The frame is fitted with a **locking belt shipper** for both overhead and underneath belts.

Floor space: width, 4 feet over all; lengths and spaces, as per table on following page. Driving pulleys are 8 to 14 inches diameter, 2½ in. face, and run from 160 to 200 revs. per minute.

Horse power: 200 spindles per horse-power.

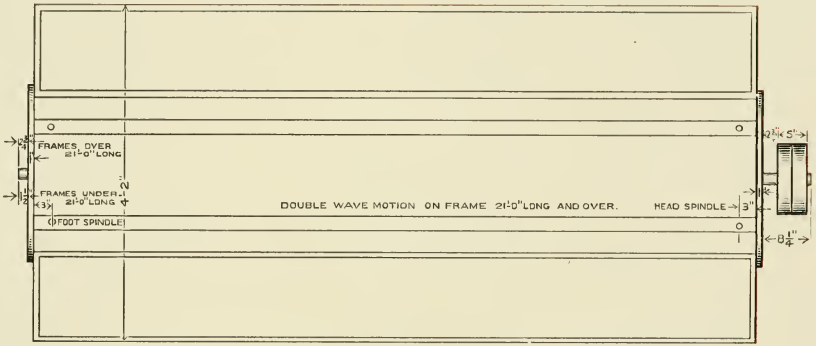
Weights: shipping weight, 160 pound per foot; net weight, 135 pounds per foot.

SPOOLER.

Floor Space.

No. of Spindles	3½ in. Space.		3¾ in. Space.		4 in. Space.		4¼ in. Space.		4½ in. Space.		4¾ in. Space.		5 in. Space.		5¼ in. Space.		5½ in. Space.		5¾ in. Space.		6 in. Space.	
	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
40	7	¼	7	5	7	9¾	8	2½	8	7¼	9	0	9	4¾	9	9½	10	2¼	10	7	10	11¾
50	8	5¾	8	11¾	9	5¾	9	11¾	10	5¾	10	11¾	11	5¾	11	11¾	12	5¾	12	11¾	13	5¾
60	9	11¼	10	6½	11	1¾	11	9	12	4¼	12	11½	13	6¾	14	2	14	9¼	15	4½	15	11¾
70	11	4¾	12	1¼	12	9¾	13	6¼	14	2¾	14	11¼	15	7¾	16	4¼	17	¾	17	9¼	18	5¾
80	12	10¼	13	8	14	5¾	15	3½	16	1¼	16	11	17	8¾	18	6½	19	4¼	20	2	20	11¾
90	14	3¾	15	2¾	16	1¾	17	¾	17	11¾	18	10¾	19	9¾	20	8¾	21	9	22	8	23	7
100	15	9¼	16	9½	17	9¾	18	10	19	10¼	20	10½	22	0	23	¼	24	½	25	¾	26	1
110	17	2¾	18	4¼	19	5¾	20	7¼	21	10	22	11½	24	1	25	2½	26	4	27	5½	28	7
120	18	8½	19	11	21	3	22	5¾	23	8½	24	11¼	26	2	27	4¾	28	7½	29	10¼	31	1
130	20	1¾	21	7	22	11	24	3	25	7	26	11	28	3	29	7	30	11	32	3	33	7
140	21	7¼	23	1¾	24	7	26	¼	27	5½	28	10¾	30	4	31	9¼	33	2½	34	7¾	36	1
150	23	2	24	8½	26	3	27	9½	29	4	30	10½	32	5	33	11½	35	6	37	½	38	7
160	24	7½	26	3¼	27	11	29	6¾	31	2½	32	10¼	34	6	36	1¾	37	9½	39	5¼	41	1
170	26	1	27	10	29	7	31	4	33	1	34	10	36	7	38	4	40	1	41	10	43	7
180	27	6½	29	4¾	31	3	33	1¼	34	11½	36	9¾	38	8	40	6¼	42	4½	44	2¾	46	1
190	29	0	30	11½	32	11	34	10½	36	10	38	9½	40	9	42	8½	44	8	46	7½	48	7
200	30	5½	32	6¼	34	7	36	7¾	38	8½	40	9¼	42	10	44	10¾	46	11½	49	¼	51	1

Double Wave Motion used on Frames 21", 0" and over.

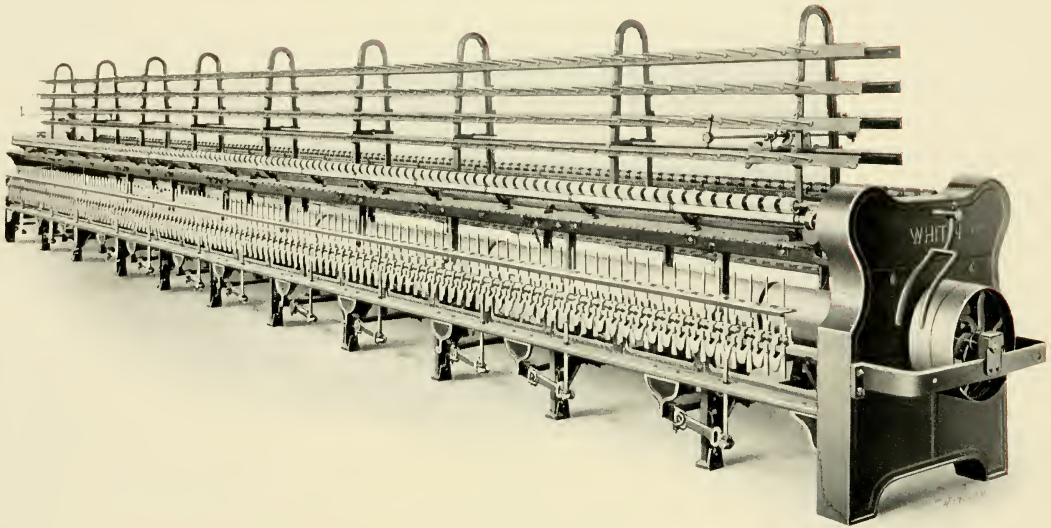


FLOOR PLAN OF SPOOLER.

Production Table of Spooler.

Dimensions of Spools.		Number of Yarn.	Revolutions per Minute of			No. Whitin Gravity Spindles to one Spooler Spindle at 825 Rev.
Length between Heads.	Diameter of Heads.		Cyl. 167, Spindle 750	Cyl. 184, Spindle 825	Cyl. 200. Spindle 900	
			Pounds per Day per Spindle.			
		8	10.8	11.8	12.9	
		10	8.6	9.5	10.3	12
6 in.	5 in.	12	7.2	7.9	8.6	
		14	6.2	6.8	7.4	
		16	5.4	5.9	6.5	13
		18	4.8	5.3	5.8	
		20	4.3	4.8	5.2	
		22	3.9	4.3	4.7	14
		24	3.6	4.0	4.3	
5 in.	4 in.	26	3.3	3.7	4 0	
		28	3.1	3.4	3.7	15
		30	2.9	3.2	3.5	
		32	2.7	3.0	3.3	16
		34	2.6	2.8	3.1	
		36	2.4	2.7	2.9	17
		38	2.3	2.5	2.7	
4½ in.	3½ in.	40	2.2	2.4	2·6	18
		44	2.0	2.2	2.4	19
		50	1.8	1.9	2.1	20
		60	1.5	1.6	1.8	21
3½ in.	3¼ in.	70	1.3	1.4	1.5	23
		80	1.1	1.2	1.3	25
		90	1.0	1.1	1.2	27
3 in.	2¾ in.	100	.9	1.0	1.1	30

TWISTING.



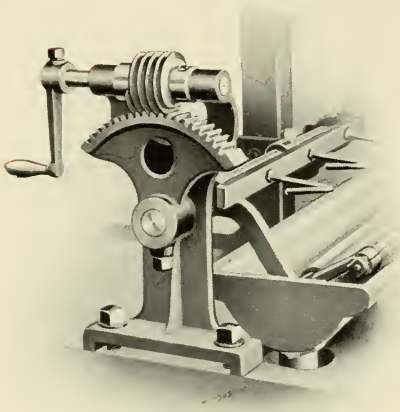
Twisting Machine.

TWISTING MACHINES.

This machine, in its general design, is similar to our Spinning Frame, but of much heavier construction. The most noticeable differences are the heavier ring and bolster rails. The machine is also so designed that vibrations are practically eliminated, thus ensuring better quality of work and a larger productive capacity. The machines are built either 36 or 39 inches wide, and equipped for either dry or wet twisting; the number of spindles and the spaces are as per table on page 132. The boxed end is used, enclosing the twist and builder motion gearing. Ready access to the gearing is obtained by removable panels, held in position by efficient locking devices. **All gearing** is machine cut, and teeth have wide faces, which features ensure quiet running and freedom from expensive repairs. The twist gearing is so designed that a wide range in different twist combinations is afforded, as can readily be seen and appreciated by reference to the appended change twist gear tables. At the option of the purchaser the gearing may be arranged to drive each side of the frame independent of the other, thereby producing two different twists at the same time.

Adjustable feet are provided for the sampsons and foot end in order to facilitate the levelling of the frame.

The rolls, $1\frac{1}{2}$″ in diameter are furnished in two styles, viz: two lines of bottom rolls, with single line of heavy top rolls, generally used in heavy dry twisting; and single line of bottom rolls with single line of top rolls, which are used for both dry and wet twisting. For dry twisting the bottom rolls are of steel and the top rolls of polished cast iron. For wet twisting the rolls are brass or brass covered and the yarn is held under water contained in a trough, by glass rods or revolving brass rolls, supported by lifting arms at frequent intervals on a lifter shaft. In order to free the yarn from the water, or to clean the trough, a simple and effective lifting device is provided at the foot end of the frame.



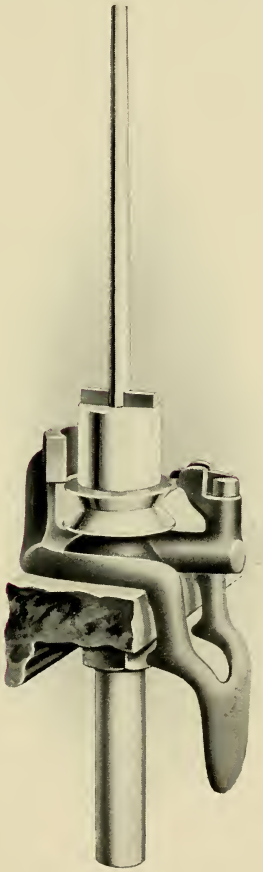
Trough Roll Lifter

The water troughs are so arranged that they can be connected with the water and drain system of the mill, so that a continuous circulation of clean water may be maintained, thus ensuring the cleanliness of the yarn in its passage through the water. The troughs are made of sheet brass with rolled over sides to give them sufficient strength to withstand rough usage. They are made in sections corresponding to the length of the frame, these sections being so bolted together as to prevent all leakage.

The traverse motion consists of a worm and gear driving a traverse cam, which gives a uniform motion to the guide rods.

The creels, arranged for any number of ply desired, are of our improved "all iron" style, consisting of cast-iron uprights supporting skewer rails of angle iron, rigidly held in proper position, and easily adjusted or removed.

The spindles furnished on this machine are of the Whitin Gravity type, and are made in the following regular sizes :



Spindle and Brake.

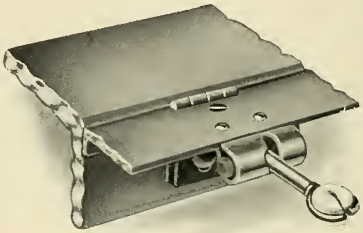
Light Twisting Spindle,	.	.	.	.	diam. of whirl,		$1\frac{1}{16}$	in.
Heavy " "	.	.	.	.	"	"	$1\frac{5}{16}$	"
Extra Heavy Twisting Spindle, No.				1,	"	"	$1\frac{5}{16}$	"
" " "	"	"		2,	"	"	$1\frac{5}{8}$	"
" " "	"	"		3,	"	"	2	"
" " "	"	"		4,	"	"	$2\frac{1}{8}$	"

To suit special conditions the Light Twisting Spindle may be fitted with $\frac{7}{8}''$, 1″, or $1\frac{1}{8}''$ diameter whirls, and $1\frac{1}{4}''$ whirl may be had on the Extra Heavy Twisting Spindle.

A simple and effective **knee brake** is provided for each spindle by means of which the motion of the spindle may be stopped for the purpose of piecing up.

Any of the various styles and sizes of **rings** may be had as preferred.

The thread boards of highly polished wood, using any of the usual forms of wire or porcelain guides are furnished unless metallic thread boards are ordered.



Wet Twister Metallic Thread Board.

The metallic thread board, applied to dry twisters, is the same as that used on spinning frames, described on page 17. The metallic thread boards for wet twisters follow the same general construction, with the exception that the guides, hinges and screws are of brass instead of iron thus preventing the formation of rust that might otherwise stain the yarn. A simple and effective thread board lifter is applied.

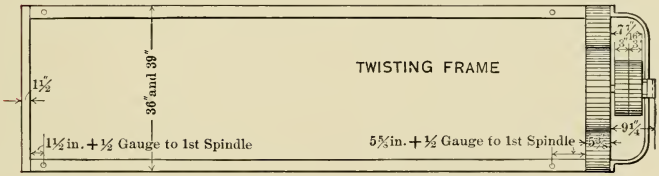
The builder motion is arranged to build bobbins with straight, taper top, warp or filling winds, with traverses from 4″ to 7″. The change from one wind to another is quickly and easily accomplished. Our **patent locking** device is used for locking the ring rail during the operation of doffing. The ring rails are conveniently levelled by the same device used on our Spinning Frames, as illustrated on page 16.

The cylinders may be of 7″ or 8″ diameter, as desired. Self-oiling cylinder boxes requiring oiling but once a week, are used. The settings of the boxes are so arranged that the cylinders can be readily taken out and returned without any readjustments being required.

The driving pulleys range from 6″ to 20″ diameter, with 2″ to 4″ face. They may be placed on the geared or foot end of the frame, as preferred. The loose pulley runs on a sleeve, which is integral with the yoke box supporting the driving arbor. By this construction excessive wear is prevented in the bearing of the loose pulley, for the reason that the loose pulley does not revolve when the belt is on the tight pulley. The tight pulley and cylinder heads are prevented from slipping by set-screws and Woodruff keys. The support for the pulley arbor bearing serves as a guard for the pulley and belt.

The belt shipping mechanism is so designed that the operator can stop the frame anywhere in its length. A locking device is furnished that prevents accidental starting of the frame, thus avoiding possible injury to the operative when in the act of changing twist gears.

Weights: shipping weight, 250 pounds per foot; net weight, 220 pounds per foot.



FLOOR PLAN.

New Model Twister.

Floor Space:—Widths 36 and 39 inches and lengths over all for Standard Frames, as follows:

No. of Spindles	6 inch Space		5½ inch Space		5 inch Space		4½ inch Space		4 inch Space		3¾ inch Space		3½ inch Space		3¼ inch Space		3 inch Space		2¾ inch Space		No. of Spindles
	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.	
60	17	0	15	9	14	6	13	3	12	0	11	5	10	9	10	2	9	6	8	11	60
64	18	0	16	8	15	4	14	0	12	8	12	0	11	4	10	8	20	0	9	4	64
72	20	0	18	6	17	0	15	6	14	0	13	3	12	6	11	9	11	0	10	3	72
80	22	0	20	4	18	8	17	0	15	4	14	6	13	8	12	10	12	0	11	2	80
84	23	0	21	3	19	6	17	9	16	0	15	2	14	3	13	5	12	6	11	8	84
88	24	0	22	2	20	4	18	6	16	8	15	11	14	10	13	11	13	0	12	1	88
96	26	0	24	0	22	0	20	0	18	0	17	0	16	0	15	0	14	0	13	0	96
104	28	0	25	10	23	8	21	6	19	4	18	3	17	2	16	1	15	0	13	11	104
108	29	0	26	9	24	6	22	3	20	0	18	11	17	9	16	8	15	6	14	5	108
112	30	0	27	8	25	4	23	0	20	8	19	6	18	4	17	2	16	0	14	10	112
120	32	0	29	6	27	0	24	6	22	0	20	9	19	6	18	3	17	0	15	9	120
128	34	0	31	4	28	8	26	0	23	4	22	0	20	8	19	4	18	0	16	8	128
132	35	0	32	8	29	6	26	9	24	0	22	8	21	3	19	11	18	6	17	2	132
144	38	0	35	0	32	0	29	0	26	0	24	6	23	0	21	6	20	0	18	6	144
160	42	0	38	8	35	4	32	0	28	8	27	0	25	4	23	8	22	0	20	4	160
168			40	6	37	0	33	6	30	0	28	3	26	6	24	9	23	0	21	3	168
176					38	8	35	0	31	4	29	6	27	8	25	10	24	0	22	2	176
192					42	0	38	0	34	0	32	0	30	0	28	0	26	0	24	0	192
208							41	0	36	8	34	6	32	4	30	2	28	0	25	10	208
216									38	0	35	9	33	6	31	3	29	0	26	9	216
224									39	4	37	0	34	8	32	4	30	0	27	8	224
240									42	0	39	6	37	0	34	6	32	0	29	6	240
256											42	0	39	4	36	8	34	0	31	3½	256
272													41	8	38	10	36	0	33	2	272
280															39	11	37	0	34	1	280
288																	38	0	35	0	288
292																	38	6	35	6	292

Twister Speed Table.

Giving Revolutions per Minute of 7 Inch Cylinder Required to Produce Various Spindle Speeds.

R.P.M. OF SPINDLES	Revolutions per Minute of 7 inch Cylinder with									
	$\frac{7}{8}$ inch Whirl Ratio 7.25	$1\frac{5}{16}$ inch Whirl Ratio 6.62	1 inch Whirl Ratio 6.24	$1\frac{1}{16}$ inch Whirl Ratio 5.86	$1\frac{1}{4}$ inch Whirl Ratio 5.43	$1\frac{5}{16}$ inch Whirl Ratio 4.80	$1\frac{3}{8}$ inch Whirl Ratio 3.80	$1\frac{3}{4}$ inch Whirl Ratio 3.70	2 inch Whirl Ratio 3.41	$2\frac{1}{4}$ inch Whirl Ratio 2.66
3000						625	789	811	880	1128
3100						646	816	838	909	1165
3200						667	842	865	938	1203
3300						688	868	892	968	1241
3400						708	895	919	997	1278
3500					645	729	921	946	1026	1316
3600					663	750	947	973	1056	1353
3700					681	771	974	1000	1085	1391
3800					700	792	1000	1027	1114	1428
3900					718	813	1026	1054	1144	1466
4000				683	737	833	1053	1081	1173	
4100				700	755	854	1079	1108	1202	
4200				717	773	875	1105	1135	1232	
4300				734	792	896	1132	1162	1261	
4400				751	810	917	1158	1189	1290	
4500			721	768	829	938	1184	1216	1319	
4600			737	785	847	958	1211	1243	1349	
4700			753	802	866	979	1237	1270	1378	
4800			769	819	884	1000	1263	1297	1408	
4900			781	836	902	1021	1289	1324	1436	
5000		755	801	853	921	1042	1316	1351		
5100		770	817	870	939	1063	1342	1378		
5200		785	833	887	957	1083	1368	1405		
5300		801	849	904	976	1104	1395	1432		
5400		816	865	921	994	1125	1421	1459		
5500	759	831	881	938	1013	1146				
5600	772	846	897	956	1031	1167				
5700	786	861	913	973	1050	1188				
5800	800	876	929	990	1068	1208				
5900	814	891	946	1007	1087	1224				
6000	828	906	962	1024	1105	1250				
6100	841	921	978	1041	1123	1271				
6200	855	936	994	1058	1142	1292				
6300	869	952	1010	1075	1160	1313				
6400	883	967	1026	1092	1179	1333				

Twister Speed Table.

Giving Revolutions per Minute of 7 Inch Cylinder Required to Produce Various Spindle Speeds.

R.P.M. OF SPINDLES	Revolutions per Minute of 7 inch Cylinder with									
	$\frac{5}{8}$ inch Whirl Ratio 7.25	$\frac{15}{16}$ inch Whirl Ratio 6.62	1 inch Whirl Ratio 6.24	1 $\frac{1}{16}$ inch Whirl Ratio 5.86	1$\frac{1}{4}$ inch Whirl Ratio 5.43	1 $\frac{5}{16}$ inch Whirl Ratio 4.80	1$\frac{1}{2}$ inch Whirl Ratio 3.80	1$\frac{3}{4}$ inch Whirl Ratio 3.70	2 inch Whirl Ratio 3.41	2$\frac{1}{2}$ inch Whirl Ratio 2.66
6500	897	982	1042	1109	1197	1354				
6600	910	997	1058	1126	1215	1375				
6700	924	1012	1074	1143	1234	1396				
6800	938	1027	1090	1160	1252	1417				
6900	952	1042	1106	1177	1271	1438				
7000	966	1057	1122	1195	1289					
7100	979	1072	1138	1212	1308					
7200	993	1088	1154	1229	1326					
7300	1007	1103	1170	1246	1344					
7400	1021	1118	1186	1263	1363					
7500	1034	1133	1202	1280	1381					
7600	1048	1148	1218	1297	1400					
7700	1062	1163	1234	1314	1418					
7800	1076	1178	1250	1331	1436					
7900	1090	1193	1266	1348	1455					
8000	1103	1208	1282	1365						
8100	1117	1223	1298	1382						
8200	1131	1239	1314	1399						
8300	1145	1254	1330	1416						
8400	1159	1269	1346	1433						
8500	1172	1284	1362							
8600	1186	1299	1378							
8700	1200	1314	1394							
8800	1214	1329	1410							
8900	1228	1344	1426							
9000	1241	1360								
9100	1255	1375								
9200	1269	1390								
9300	1283	1405								
9400	1297	1420								
9500	1310									
9600	1324									
9700	1338									
9800	1352									
9900	1366									
10000	1379									

Twister Speed Table.

Giving Revolutions per Minute of 8 Inch Cylinder Required to Produce Various Spindle Speeds.

R.P.M. OF SPINDLES	Revolutions per Minute of 8 inch Cylinder with									
	$\frac{7}{8}$ inch Whirl Ratio 8.28	$1\frac{5}{16}$ inch Whirl Ratio 7.67	1 inch Whirl Ratio 7.08	$1\frac{1}{16}$ inch Whirl Ratio 6.80	$1\frac{1}{4}$ inch Whirl Ratio 6.62	$1\frac{5}{16}$ inch Whirl Ratio 5.48	$1\frac{5}{8}$ inch Whirl Ratio 4.37	$1\frac{3}{4}$ inch Whirl Ratio 4.12	2 inch Whirl Ratio 3.88	$2\frac{1}{4}$ inch Whirl Ratio 3.03
3000						547	686	728	773	990
3100						566	709	752	799	1023
3200						584	732	776	825	1056
3300						602	755	800	851	1089
3400						620	778	825	876	1121
3500					563	639	800	849	902	1155
3600					579	657	824	874	928	1188
3700					595	675	847	898	954	1221
3800					611	693	870	922	979	1254
3900					627	712	892	947	1005	1287
4000				588	643	730	915	971	1031	1320
4100				603	659	748	938	995	1057	1353
4200				618	675	766	960	1019	1082	1386
4300				632	691	785	983	1044	1108	1419
4400				647	707	803	1007	1068	1134	1452
4500			636	662	723	821	1030	1092	1160	
4600			650	676	740	840	1053	1117	1186	
4700			664	691	756	858	1076	1141	1211	
4800			678	706	772	876	1098	1165	1237	
4900			692	721	788	894	1121	1189	1263	
5000		652	706	735	804	912	1144	1214	1289	
5100		665	720	750	820	930	1167	1238	1314	
5200		678	734	765	836	949	1190	1262	1340	
5300		691	749	779	852	967	1213	1286	1366	
5400		704	761	794	868	985	1236	1311	1392	
5500	664	717	777	809	884	1004	1259	1335		
5600	676	730	791	824	900	1022	1281	1359		
5700	688	743	805	838	916	1040	1304	1383		
5800	700	756	819	853	932	1058	1327	1408		
5900	712	768	833	868	949	1077	1350	1432		
6000	725	782	847	882	965	1095	1373			
6100	737	795	862	897	981	1113	1396			
6200	748	808	876	912	997	1131	1419			
6300	761	821	890	926	1013	1150	1442			
6400	773	834	904	941	1029	1168	1465			

Twister Speed Table.

Giving Revolutions per Minute of 8 Inch Cylinder Required to Produce Various Spindle Speeds.

R.P.M. OF SPINDLES	Revolutions per Minute of 8 inch Cylinder with									
	¾ inch Whirl Ratio 8.28	15/16 inch Whirl Ratio 7.67	1 inch Whirl Ratio 7.08	1 1/16 inch Whirl Ratio 6.80	1¼ inch Whirl Ratio 6.22	1 7/16 inch Whirl Ratio 5.48	1⅝ inch Whirl Ratio 4.37	1¾ inch Whirl Ratio 4.12	2 inch Whirl Ratio 3.88	2¼ inch Whirl Ratio 3.03
6500	785	847	918	956	1045	1186				
6600	797	860	932	971	1061	1205				
6700	809	874	946	985	1077	1223				
6800	821	887	961	1000	1093	1241				
6900	833	900	985	1014	1109	1259				
7000	845	913	989	1029	1125	1277				
7100	857	926	1003	1044	1141	1296				
7200	870	939	1017	1059	1158	1314				
7300	882	952	1031	1074	1172	1332				
7400	894	965	1045	1088	1190	1350				
7500	906	978	1059	1103	1206	1369				
7600	918	991	1073	1118	1222	1387				
7700	930	1004	1088	1132	1238	1405				
7800	942	1017	1102	1147	1254	1423				
7900	954	1030	1116	1162	1270	1442				
8000	966	1043	1130	1176	1286					
8100	978	1056	1144	1191	1302					
8200	990	1069	1158	1206	1318					
8300	1002	1082	1172	1221	1334					
8400	1014	1095	1186	1235	1350					
8500	1027	1108	1201	1250	1367					
8600	1039	1121	1215	1265	1383					
8700	1051	1134	1229	1279	1399					
8800	1063	1147	1243	1294	1415					
8900	1075	1160	1257	1309	1431					
9000	1087	1173	1271	1324						
9100	1099	1186	1285	1338						
9200	1111	1199	1299	1353						
9300	1123	1213	1314	1368						
9400	1135	1226	1328	1382						
9500	1147	1239	1342	1397						
9600	1159	1252	1356	1412						
9700	1171	1265	1370	1426						
9800	1183	1278	1384	1441						
9900	1195	1291	1398	1456						
10000	1208	1304	1412	1471						

RULES FOR TWISTERS.

To calculate the resulting counts of ply yarn, made of two strands of different sizes:

Divide the product of the single counts by their sum.

Example.—40sx10s=400÷(40+10)=8s.

To calculate the single count that must be combined with another single strand of known size, in order to make a two ply of given size:

Divide the product of the known counts by their difference.

Example.—10sx8s=80. 80÷(10–8)=40s.

To find the twist per inch of ply yarn:

Divide the number of yarn to be twisted by the ply required. Multiply the square root of this quotient by 4, 5 or 6 according to whether soft, medium or hard twist is required.

Example.—What is the medium twist per inch of 12s 3-ply?

12÷3=4. $\sqrt{4}$=2. 2x5=10 turns per inch.

To find the twist per inch in machine:

The product of the front roll gear, the stud gear, and the ratio of the spindle to the cylinder, divided by the product of the cylinder gear, and the circumference in inches of the front roll, equals the twist constant. Twist constant divided by change gear equals twist per inch.

Example.—What is the twist constant with the following gearing? Front roll gear 112 teeth, stud gear 88 teeth, $1\frac{5}{16}$ inch whirl, 7 inch cylinder, ratio whirl to cylinder 4.80, front roll $1\frac{1}{2}$ inch diameter, cylinder gear 22 teeth.

$$\frac{112\text{x}88\text{x}2\text{x}4.80}{22\text{x}3\text{x}3.1416}=456.33 \text{ constant.}$$

Twist Tables for Twisting Yarns.

Two Ply.

No. of Yarn to be Twisted.	No. of Twisted Yarn.	Sq. root of No. Twisted Yarn.	Square root multiplied by			No. of Yarn to be Twisted.	No. of Twisted Yarn.	Sq. root of No. Twisted Yarn.	Square root multiplied by		
			4	5	6				4	5	6
1	.5	.7071	2.83	3.54	4.24	51	25.5	5.0498	20.20	25.25	30.30
2	1.	1.	4.	5.	6.	52	26.	5.0990	20.40	25.50	30.59
3	1.5	1.2247	4.90	6.12	7.35	53	26.5	5.1478	20.59	25.74	30.89
4	2.	1.4142	5.66	7.07	8.49	54	27.	5.1962	20.78	25.98	31.18
5	2.5	1.5811	6.32	7.91	9.49	55	27.5	5.2440	20.98	26.22	31.46
6	3.	1.7321	6.93	8.66	10.39	56	28.	5.2915	21.17	26.46	31.75
7	3.5	1.8708	7.48	9.35	11.22	57	28.5	5.3385	21.35	26.69	32.03
8	4.	2.	8.	10.	12.	58	29.	5.3852	21.54	26.93	32.31
9	4.5	2.1213	8.49	10.61	12.73	59	29.5	5.4314	21.73	27.16	32.59
10	5.	2.2361	8.94	11.18	13.42	60	30.	5.4772	21.91	27.39	32.86
11	5.5	2.3452	9.38	11.73	14.07	61	30.5	5.5227	22.09	27.61	33.14
12	6.	2.4495	9.80	12.25	14.70	62	31.	5.5678	22.27	27.84	33.41
13	6.5	2.5495	10.20	12.75	15.30	63	31.5	5.6125	22.45	28.06	33.67
14	7.	2.6458	10.58	13.23	15.87	64	32.	5.6569	22.63	28.28	33.94
15	7.5	2.7386	10.95	13.69	16.43	65	32.5	5.7009	22.80	28.50	34.21
16	8.	2.8284	11.31	14.14	16.97	66	33.	5.7446	22.98	28.72	34.47
17	8.5	2.9155	11.66	14.58	17.49	67	33.5	5.7879	23.15	28.94	34.73
18	9.	3.	12.	15.	18.	68	34.	5.8310	23.32	29.15	34.99
19	9.5	3.0822	12.33	15.41	18.49	69	34.5	5.8737	23.49	29.37	35.24
20	10.	3.1623	12.65	15.81	18.97	70	35.	5.9161	23.66	29.58	35.50
21	10.5	3.2404	12.96	16.20	19.44	71	35.5	5.9582	23.83	29.79	35.75
22	11.	3.3166	13.27	16.58	19.90	72	36.	6.	24.	30.	36.
23	11.5	3.3912	13.56	16.96	20.35	73	36.5	6.0415	24.17	30.21	36.25
24	12.	3.4641	13.86	17.32	20.78	74	37.	6.0828	24.33	30.41	36.50
25	12.5	3.5355	14.14	17.68	21.21	75	37.5	6.1237	24.49	30.62	36.74
26	13.	3.6056	14.42	18.03	21.63	76	38.	6.1644		30.82	36.99
27	13.5	3.6742	14.70	18.37	22.05	77	38.5	6.2049		31.02	37.23
28	14.	3.7417	14.97	18.71	22.45	78	39.	6.2450		31.22	37.47
29	14.5	3.8079	15.23	19.04	22.85	79	39.5	6.2849		31.42	37.71
30	15.	3.8730	15.49	19.37	23.24	80	40.	6.3246		31.62	37.95
31	15.5	3.9370	15.75	19.69	23.62	81	40.5	6.3640		31.82	38.18
32	16.	4.	16.	20.	24.	82	41.	6.4031		32.02	38.42
33	16.5	4.0620	16.25	20.31	24.37	83	41.5	6.4420		32.21	38.65
34	17.	4.1231	16.49	20.62	24.74	84	42.	6.4807		32.40	38.88
35	17.5	4.1833	16.73	20.92	25.10	85	42.5	6.5192		32.60	39.12
36	18.	4.2426	16.97	21.21	25.46	86	43.	6.5574		32.79	39.34
37	18.5	4.3012	17.20	21.51	25.81	87	43.5	6.5955		32.98	39.57
38	19.	4.3589	17.44	21.79	26.15	88	44.	6.6332		33.17	39.80
39	19.5	4.4159	17.66	22.08	26.50	89	44.5	6.6708		33.35	40.02
40	20.	4.4721	17.89	22.36	26.83	90	45.	6.7082		33.54	40.25
41	20.5	4.5277	18.11	22.64	27.17	91	45.5	6.7454		33.73	40.47
42	21.	4.5826	18.33	22.91	27.50	92	46.	6.7823		33.91	40.69
43	21.5	4.6368	18.55	23.18	27.82	93	46.5	6.8191		34.10	40.91
44	22.	4.6904	18.76	23.45	28.14	94	47.	6.8557		34.28	41.13
45	22.5	4.7434	18.97	23.72	28.46	95	47.5	6.8920		34.46	41.35
46	23.	4.7958	19.18	23.98	28.77	96	48.	6.9282		34.64	41.57
47	23.5	4.8477	19.39	24.24	29.09	97	48.5	6.9642		34.82	41.79
48	24.	4.8990	19.60	24.49	29.39	98	49.	7.		35.	42.
49	24.5	4.9497	19.80	24.75	29.70	99	49.5	7.0356		35.18	42.21
50	25.	5.	20.	25.	30.	100	50.	7.0711		35.36	42.43

Twist Tables for Twisting Yarns.

Three Ply.

No. of Yarn to be Twisted.	No. of Twisted Yarn.	Sq. root of No. Twisted Yarn.	Square root multiplied by			No. of Yarn to be Twisted.	No. of Twisted Yarn.	Sq. root of No. Twisted Yarn.	Square root multiplied by		
			4	5	6				4	5	6
1	.33	.5774	2.31	2.89	3.46	51	17.	4.1231	16.49	20.62	24.74
2	.67	.8165	3.27	4.08	4.90	52	17.33	4.1633	16.65	20.82	24.98
3	1.	1.	4.	5.	6.	53	17.67	4.2032	16.81	21.02	25.22
4	1.33	1.1547	4.62	5.77	6.93	54	18.	4.2426	16.97	21.21	25.46
5	1.67	1.2910	5.16	6.45	7.75	55	18.33	4.2817	17.13	21.41	25.69
6	2.	1.4142	5.66	7.07	8.49	56	18.67	4.3205	17.28	21.60	25.92
7	2.33	1.5275	6.11	7.64	9.17	57	19.	4.3589	17.44	21.79	26.15
8	2.67	1.6330	6.53	8.16	9.80	58	19.33	4.3970	17.59	21.98	26.38
9	3.	1.7321	6.93	8.66	10.39	59	19.67	4.4347	17.74	22.17	26.61
10	3.33	1.8257	7.30	9.13	10.95	60	20.	4.4721	17.89	22.36	26.83
11	3.67	1.9149	7.66	9.57	11.49	61	20.33	4.5092	18.04	22.55	27.06
12	4.	2.	8.	10.	12.	62	20.67	4.5461	18.18	22.73	27.28
13	4.33	2.0817	8.33	10.41	12.49	63	21.	4.5826	18.33	22.91	27.50
14	4.67	2.1602	8.64	10.80	12.96	64	21.33	4.6188	18.48	23.09	27.71
15	5.	2.2361	8.94	11.18	13.42	65	21.67	4.6547	18.62	23.27	27.93
16	5.33	2.3094	9.24	11.55	13.86	66	22.	4.6904	18.76	23.45	28.14
17	5.67	2.3805	9.52	11.90	14.28	67	22.33	4.7258	18.90	23.63	28.35
18	6.	2.4495	9.80	12.25	14.70	68	22.67	4.7610	19.04	23.80	28.57
19	6.33	2.5166	10.07	12.58	15.10	69	23.	4.7958	19.18	23.98	28.77
20	6.67	2.5820	10.33	12.91	15.49	70	23.33	4.8305	19.32	24.15	28.98
21	7.	2.6458	10.58	13.23	15.87	71	23.67	4.8648	19.46	24.32	29.19
22	7.33	2.7080	10.83	13.54	16.25	72	24.	4.8990	19.60	24.49	29.39
23	7.67	2.7689	11.08	13.84	16.61	73	24.33	4.9329	19.73	24.66	29.60
24	8.	2.8284	11.31	14.14	16.97	74	24.67	4.9666	19.87	24.83	29.80
25	8.33	2.8868	11.55	14.43	17.32	75	25.	5.	20.	25.	30.
26	8.67	2.9439	11.76	14.72	17.66	76	25.33	5.0332		25.17	30.20
27	9.	3.	12.	15.	18.	77	25.67	5.0662		25.33	30.40
28	9.33	3.0551	12.22	15.28	18.33	78	26.	5.0990		25.50	30.59
29	9.67	3.1091	12.44	15.55	18.65	79	26.33	5.1316		25.66	30.79
30	10.	3.1623	12.65	15.81	18.97	80	26.67	5.1640		25.82	30.98
31	10.33	3.2145	12.86	16.07	19.29	81	27.	5.1962		25.98	31.18
32	10.67	3.2659	13.06	16.33	19.60	82	27.33	5.2281		26.14	31.37
33	11.	3.3166	13.27	16.58	19.90	83	27.67	5.2599		26.30	31.56
34	11.33	3.3665	13.47	16.83	20.20	84	28.	5.2915		26.46	31.75
35	11.67	3.4157	13.66	17.08	20.49	85	28.33	5.3229		26.61	31.94
36	12.	3.4641	13.86	17.32	20.78	86	28.67	5.3541		26.77	32.12
37	12.33	3.5119	14.05	17.56	21.07	87	29.	5.3852		26.93	32.31
38	12.67	3.5590	14.24	17.80	21.35	88	29.33	5.4160		27.08	32.50
39	13.	3.6056	14.42	18.03	21.63	89	29.67	5.4467		27.23	32.68
40	13.33	3.6515	14.61	18.26	21.91	90	30.	5.4772		27.39	32.86
41	13.67	3.6969	14.79	18.48	22.18	91	30.33	5.5076		27.54	33.05
42	14.	3.7417	14.97	18.71	22.45	92	30.67	5.5377		27.69	33.23
43	14.33	3.7859	15.14	18.93	22.72	93	31.	5.5678		27.84	33.41
44	14.67	3.8297	15.32	19.15	22.98	94	31.33	5.5976		27.99	33.59
45	15.	3.8730	15.49	19.36	23.24	95	31.67	5.6273		28.14	33.76
46	15.33	3.9158	15.66	19.58	23.49	96	32.	5.6569		28.28	33.94
47	15.67	3.9582	15.83	19.79	23.75	97	32.33	5.6862		28.43	34.12
48	16.	4.	16.	20.	24.	98	32.67	5.7155		28.58	34.29
49	16.33	4.0415	16.17	20.21	24.25	99	33.	5.7446		28.72	34.47
50	16.67	4.0825	16.33	20.41	24.49	100	33.33	5.7735		28.87	34.64

Twist Tables for Twisting Yarns.

Four Ply.

No. of Yarn to be Twisted.	No. of Twisted Yarn.	Sq. root of No. Twisted Yarn.	Square root multiplied by			No. of Yarn to be Twisted.	No. of Twisted Yarn.	Sq. root of No. Twisted Yarn.	Square root multiplied by		
			4	5	6				4	5	6
1	.25	.5	2.	2.5	3.	51	12.75	3.5707	14.28	17.85	21.42
2	.50	.7071	2.83	3.54	4.24	52	13.	3.6056	14.42	18.03	21.63
3	.75	.8660	3.46	4.33	5.20	53	13.25	3.6401	14.56	18.20	21.84
4	1.	1.	4.	5.	6.	54	13.50	3.6742	14.70	18.37	22.05
5	1.25	1.1180	4.47	5.59	6.71	55	13.75	3.7081	14.83	18.54	22.25
6	1.50	1.2247	4.90	6.12	7.35	56	14.	3.7417	14.97	18.71	22.45
7	1.75	1.3229	5.29	6.61	7.94	57	14.25	3.7749	15.10	18.87	22.65
8	2.	1.4142	5.66	7.07	8.49	58	14.50	3.8079	15.23	19.04	22.85
9	2.25	1.5	6.	7.5	9.	59	14.75	3.8406	15.36	19.20	23.04
10	2.50	1.5811	6.32	7.91	9.49	60	15.	3.8730	15.49	19.37	23.24
11	2.75	1.6583	6.63	8.29	9.95	61	15.25	3.9051	15.62	19.53	23.43
12	3.	1.7321	6.93	8.66	10.39	62	15.50	3.9370	15.75	19.69	23.62
13	3.25	1.8028	7.21	9.01	10.82	63	15.75	3.9686	15.88	19.84	23.81
14	3.50	1.8708	7.48	9.35	11.22	64	16.	4.	16.	20.	24.
15	3.75	1.9365	7.75	9.68	11.62	65	16.25	4.0311	16.12	20.16	24.19
16	4.	2.	8.	10.	12.	66	16.50	4.0620	16.25	20.31	24.37
17	4.25	2.0616	8.25	10.31	12.37	67	16.75	4.0927	16.37	20.46	24.56
18	4.50	2.1213	8.49	10.61	12.73	68	17.	4.1231	16.49	20.62	24.74
19	4.75	2.1794	8.72	10.90	13.08	69	17.25	4.1533	16.61	20.77	24.92
20	5.	2.2361	8.94	11.18	13.42	70	17.50	4.1833	16.73	20.92	25.10
21	5.25	2.2913	9.17	11.46	13.75	71	17.75	4.2130	16.85	21.07	25.28
22	5.50	2.3452	9.38	11.73	14.07	72	18.	4.2426	16.97	21.21	25.46
23	5.75	2.3979	9.59	11.99	14.39	73	18.25	4.2720	17.09	21.36	25.63
24	6.	2.4495	9.80	12.25	14.70	74	18.50	4.3012	17.20	21.51	25.81
25	6.25	2.5	10.	12.5	15.	75	18.75	4.3301	17.32	21.65	25.98
26	6.50	2.5495	10.20	12.75	15.30	76	19.	4.3589		21.79	26.15
27	6.75	2.5981	10.39	12.99	15.59	77	19.25	4.3875		21.94	26.32
28	7.	2.6458	10.58	13.23	15.87	78	19.50	4.4159		22.08	26.50
29	7.25	2.6926	10.77	13.46	16.16	79	19.75	4.4441		22.22	26.66
30	7.50	2.7386	10.95	13.69	16.43	80	20.	4.4721		22.36	26.83
31	7.75	2.7839	11.14	13.92	16.70	81	20.25	4.5		22.5	27.
32	8.	2.8284	11.31	14.14	16.97	82	20.50	4.5277		22.64	27.17
33	8.25	2.8723	11.49	14.36	17.23	83	20.75	4.5552		22.78	27.33
34	8.50	2.9155	11.66	14.58	17.49	84	21.	4.5826		22.91	27.50
35	8.75	2.9580	11.83	14.79	17.75	85	21.25	4.6098		23.05	27.66
36	9.	3.	12.	15.	18.	86	21.50	4.6368		23.18	27.82
37	9.25	3.0414	12.17	15.21	18.25	87	21.75	4.6637		23.32	27.98
38	9.50	3.0822	12.33	15.41	18.49	88	22.	4.6904		23.45	28.14
39	9.75	3.1225	12.49	15.61	18.73	89	22.25	4.7170		23.58	28.30
40	10.	3.1623	12.65	15.81	18.97	90	22.50	4.7434		23.72	28.46
41	10.25	3.2016	12.81	16.01	19.21	91	22.75	4.7697		23.85	28.62
42	10.50	3.2404	12.96	16.20	19.44	92	23.	4.7958		23.98	28.77
43	10.75	3.2787	13.11	16.39	19.67	93	23.25	4.8218		24.11	28.93
44	11.	3.3166	13.27	16.58	19.90	94	23.50	4.8477		24.24	29.09
45	11.25	3.3541	13.42	16.77	20.12	95	23.75	4.8734		24.37	29.24
46	11.50	3.3912	13.56	16.96	20.35	96	24.	4.8990		24.49	29.39
47	11.75	3.4278	13.71	17.14	20.57	97	24.25	4.9244		24.62	29.55
48	12.	3.4641	13.86	17.32	20.78	98	24.50	4.9497		24.75	29.70
49	12.25	3.5	14.	17.5	21.	99	24.75	4.9749		24.87	29.85
50	12.50	3.5355	14.14	17.68	21.21	100	25.	5.		25.	30.

Twist Tables for Twisting Yarns

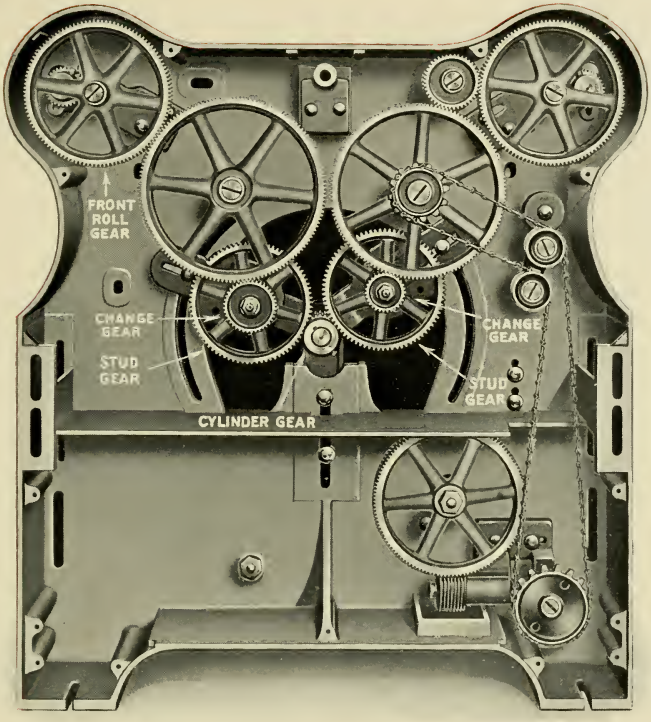
Five Ply.

No. of Yarn to be Twisted.	No. of Twisted Yarn.	Sq. root of No. Twisted Yarn.	Square root multiplied by			No. of Yarn to be Twisted.	No. of Twisted Yarn.	Sq. root of No. Twisted Yarn.	Square root multiplied by		
			4	5	6				4	5	6
1	.2	.4472	1.79	2.24	2.68	51	10.2	3.1937	12.77	15.97	19.16
2	.4	.6325	2.53	3.16	3.79	52	10.4	3.2249	12.90	16.12	19.35
3	.6	.7746	3.10	3.87	4.65	53	10.6	3.2558	13.02	16.28	19.53
4	.8	.8944	3.58	4.47	5.37	54	10.8	3.2863	13.15	16.43	19.72
5	1.	1.	4.	5.	6.	55	11.	3.3166	13.27	16.58	19.90
6	1.2	1.0954	4.38	5.48	6.57	56	11.2	3.3466	13.39	16.73	20.08
7	1.4	1.1832	4.73	5.92	7.10	57	11.4	3.3764	13.51	16.88	20.26
8	1.6	1.2649	5.06	6.32	7.59	58	11.6	3.4059	13.62	17.03	20.44
9	1.8	1.3416	5.37	6.71	8.05	59	11.8	3.4351	13.74	17.18	20.61
10	2.	1.4142	5.66	7.07	8.49	60	12.	3.4641	13.86	17.32	20.78
11	2.2	1.4832	5.93	7.42	8.90	61	12.2	3.4928	13.97	17.46	20.96
12	2.4	1.5492	6.20	7.75	9.30	62	12.4	3.5214	14.09	17.61	21.13
13	2.6	1.6125	6.45	8.06	9.67	63	12.6	3.5496	14.20	17.75	21.30
14	2.8	1.6733	6.69	8.37	10.04	64	12.8	3.5777	14.31	17.89	21.47
15	3.	1.7321	6.93	8.66	10.39	65	13.	3.6056	14.42	18.03	21.63
16	3.2	1.7889	7.16	8.95	10.73	66	13.2	3.6332	14.53	18.17	21.80
17	3.4	1.8439	7.38	9.22	11.06	67	13.4	3.6606	14.64	18.30	21.96
18	3.6	1.8974	7.59	9.49	11.38	68	13.6	3.6878	14.75	18.44	22.13
19	3.8	1.9494	7.80	9.75	11.70	69	13.8	3.7148	14.86	18.56	22.29
20	4.	2.	8.	10.	12.	70	14.	3.7417	14.97	18.71	22.45
21	4.2	2.0494	8.20	10.25	12.30	71	14.2	3.6783	15.07	18.84	22.61
22	4.4	2.0976	8.39	10.49	12.59	72	14.4	3.7948	15.18	18.97	22.77
23	4.6	2.1448	8.58	10.72	12.87	73	14.6	3.8210	15.28	19.10	22.93
24	4.8	2.1909	8.76	10.95	13.15	74	14.8	3.8471	15.38	19.24	23.08
25	5.	2.2361	8.94	11.18	13.42	75	15.	3.8730	15.49	19.37	23.24
26	5.2	2.2804	9.12	11.40	13.68	76	15.2	3.8987		19.49	23.39
27	5.4	2.3238	9.30	11.62	13.94	77	15.4	3.9243		19.62	23.55
28	5.6	2.3664	9.47	11.83	14.20	78	15.6	3.9497		19.75	23.70
29	5.8	2.4083	9.63	12.04	14.45	79	15.8	3.9749		19.87	23.85
30	6.	2.4495	9.80	12.25	14.70	80	16.	4.		20.	24.
31	6.2	2.4900	9.96	12.45	14.94	81	16.2	4.0249		20.12	24.15
32	6.4	2.5298	10.12	12.65	15.18	82	16.4	4.0497		20.25	24.30
33	6.6	2.5690	10.28	12.85	15.41	83	16.6	4.0743		20.37	24.45
34	6.8	2.6077	10.43	13.04	15.65	84	16.8	4.0988		20.49	24.59
35	7.	2.6458	10.58	13.23	15.87	85	17.	4.1231		20.62	24.74
36	7.2	2.6833	10.73	13.42	16.10	86	17.2	4.1473		20.74	24.88
37	7.4	2.7203	10.88	13.60	16.32	87	17.4	4.1713		20.86	25.03
38	7.6	2.7568	11.03	13.78	16.54	88	17.6	4.1952		20.98	25.17
39	7.8	2.7928	11.17	13.96	16.76	89	17.8	4.2190		21.10	25.31
40	8.	2.8284	11.31	14.14	16.97	90	18.	4.2426		21.21	25.46
41	8.2	2.8636	11.45	14.32	17.18	91	18.2	4.2661		21.33	25.60
42	8.4	2.8983	11.59	14.49	17.39	92	18.4	4.2895		21.45	25.74
43	8.6	2.9326	11.73	14.66	17.60	93	18.6	4.3128		21.56	25.88
44	8.8	2.9665	11.87	14.83	17.80	94	18.8	4.3359		21.68	26.02
45	9.	3.	12.	15.	18.	95	19.	4.3589		21.79	26.15
46	9.2	3.0332	12.13	15.17	18.20	96	19.2	4.3818		21.91	26.29
47	9.4	3.0659	12.26	15.33	18.40	97	19.4	4.4045		22.02	26.43
48	9.6	3.0984	12.39	15.49	18.59	98	19.6	4.4272		22.14	26.50
49	9.8	3.1305	12.52	15.65	18.78	99	19.8	4.4497		22.25	26.70
50	10.	3.1623	12.65	15.81	18.97	100	20.	4.4721		22.36	26.83

Twist Tables for Twisting Yarns.

Six Ply.

No. of Yarn to be Twisted.	No. of Twisted Yarn.	Sq. root of No. Twisted Yarn.	Square root multiplied by		
			4	5	6
1	.17	.4082	1.63	2.04	2.45
2	.33	.5774	2.31	2.89	3.46
3	.50	.7071	2.83	3.54	4.24
4	.67	.8165	3.27	4.08	4.90
5	.83	.9129	3.65	4.56	5.48
6	1.	1.	4.	5.	6.
7	1.17	1.0801	4.32	5.40	6.48
8	1.33	1.1547	4.62	5.77	6.93
9	1.50	1.2247	4.90	6.12	7.35
10	1.67	1.2910	5.16	6.45	7.75
11	1.83	1.3540	5.42	6.77	8.12
12	2.	1.4142	5.66	7.07	8.49
13	2.17	1.4720	5.89	7.36	8.83
14	2.33	1.5275	6.11	7.64	9.17
15	2.50	1.5811	6.32	7.91	9.49
16	2.67	1.6330	6.53	8.16	9.80
17	2.83	1.6833	6.73	8.42	10.10
18	3.	1.7321	6.93	8.66	10.39
19	3.17	1.7795	7.12	8.90	10.68
20	3.33	1.8257	7.30	9.13	10.95
21	3.50	1.8708	7.48	9.35	11.22
22	3.67	1.9149	7.66	9.57	11.49
23	3.83	1.9579	7.83	9.79	11.75
24	4.	2.	8.	10.	12.
25	4.17	2.0412	8.16	10.21	12.25
26	4.33	2.0817	8.33	10.41	12.49
27	4.50	2.1213	8.49	10.61	12.73
28	4.67	2.1602	8.64	10.80	12.96
29	4.83	2.1985	8.79	10.99	13.19
30	5.	2.2361	8.94	11.18	13.42
31	5.17	2.2730	9.09	11.37	13.64
32	5.33	2.3094	9.24	11.55	13.86
33	5.50	2.3452	9.38	11.73	14.07
34	5.67	2.3805	9.52	11.90	14.28
35	5.83	2.4152	9.66	12.08	14.49
36	6.	2.4495	9.80	12.25	14.70
37	6.17	2.4833	9.93	12.42	14.90
38	6.33	2.5166	10.07	12.58	15.10
39	6.50	2.5495	10.20	12.75	15.30
40	6.67	2.5820	10.53	12.91	15.49
41	6.83	2.6141	10.46	13.07	15.68
42	7.	2.6458	10.58	13.23	15.87
43	7.17	2.6771	10.71	13.39	16.06
44	7.33	2.7080	10.83	13.54	16.25
45	7.50	2.7386	10.95	13.69	16.43
46	7.67	2.7689	11.08	13.84	16.61
47	7.83	2.7988	11.20	13.99	16.79
48	8.	2.8284	11.31	14.14	16.97
49	8.17	2.8577	11.43	14.29	17.15
50	8.33	2.8868	11.55	14.43	17.32
51	8.50	2.9155	11.66	14.58	17.49
52	8.67	2.9439	11.78	14.72	17.66
53	8.83	2.9721	11.89	14.86	17.83
54	9.	3.	12.	15.	18.
55	9.17	3.0277	12.11	15.14	18.17
56	9.33	3.0551	12.22	15.28	18.33
57	9.50	3.0822	12.33	15.41	18.49
58	9.67	3.1091	12.44	15.55	18.65
59	9.83	3.1358	12.54	15.68	18.81
60	10.	3.1623	12.65	15.81	18.97
61	10.17	3.1885	12.75	15.94	19.13
62	10.33	3.2415	12.86	16.07	19.29
63	10.50	3.2404	12.96	16.20	19.44
64	10.67	3.2659	13.06	16.33	19.60
65	10.83	3.2914	13.17	16.46	19.75
66	11.	3.3166	13.27	16.58	19.90
67	11.17	3.3417	13.37	16.71	20.05
68	11.33	3.3665	13.47	16.83	20.20
69	11.50	3.3912	13.56	16.96	20.35
70	11.67	3.4157	13.66	17.08	20.49
71	11.83	3.4400	13.76	17.20	20.64
72	12.	3.4641	13.86	17.32	20.78
73	12.17	3.4881	13.95	17.44	20.93
74	12.33	3.5119	14.05	17.56	21.07
75	12.50	3.5355	14.14	17.68	21.21
76	12.67	3.5590		17.80	21.35
77	12.83	3.5824		17.91	21.49
78	13.	3.6056		18.03	21.63
79	13.17	3.6286		18.14	21.77
80	13.33	3.6515		18.26	21.91
81	13.50	3.6742		18.37	22.05
82	13.67	3.6969		18.48	22.18
83	13.83	3.7192		18.60	22.32
84	14.	3.7417		18.71	22.45
85	14.17	3.7639		18.82	22.58
86	14.33	3.7859		18.93	22.72
87	14.50	3.8079		19.04	22.85
88	14.67	3.8297		19.15	22.98
89	14.83	3.8514		19.26	23.11
90	15.	3.8730		19.36	23.24
91	15.17	3.8944		19.47	23.37
92	15.33	3.9158		19.58	23.49
93	15.50	3.9370		19.69	23.62
94	15.67	3.9582		19.79	23.75
95	15.83	3.9791		19.90	23.87
96	16.	4.		20.	24.
97	16.17	4.0208		20.10	24.12
98	16.33	4.0415		20.21	24.25
99	16.50	4.0620		20.31	24.37
100	16.67	4.0825		20.41	24.49



Twisting Frame Twist Gearing.

Formula for figuring twist:

C = Cylinder gear.
S = Stud gear.
T = Change gear.
F = Front Roll gear.
R = Ratio cylinder to whirl.
D = Circumference of front roll.

$$\frac{F \times S \times R}{T \times C \times D} = \text{Twist per inch.}$$

$$\frac{F \times S \times R}{C \times D} = \text{Twist Constant}$$

$$\frac{\text{Twist Constant}}{\text{Change gear}} = \text{Twist per inch.}$$

$$\frac{\text{Twist Constant}}{\text{Twist per inch}} = \text{Change gear.}$$

Twist Gearing Constants for Whitin Twisting Frame.

7 inch Cylinder.

Front Roll 1⅜ in. Dia. Front Roll Gear 108 T

Diameter of Whirl	Ratio Whirl to Cylinder	Cyl. 20 T Stud 120 T	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 20 T Stud 80 T	Cyl. 22 T Stud 88 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
		Cons't	Cons't	Cons't	Cons't	Cons't	Cons't	Cons't
¾ in.	7.25			815.35		724.76	372.44	181.19
15/16 "	6.62			744.50		661.78	340.08	165.44
1 "	6.24			701.77		623.79	320.56	155.95
1 1/16 "	5.86			659.03		585.80	301.04	146.45
1 1/8 "	5.43			610.67		542.82	278.95	135.70
1 5/16 "	4.80			539.82		479.84	246.58	119.96
1 3/8 "	3.80			427.36		379.87	195.21	94.96
1 3/4 "	3.70			416.11		369.88	190.08	92.47
2 "	3.41			383.50		340.89	175.17	85.22
2 1/2 "	2.66			299.15		260.91	136.65	66.48

Front Roll 1½ in. Dia. Front Roll Gear 112 T.

¾ in.	7.25	1033.87	861.56	775.09	689.24	689.24	354.05	172.24
15/16 "	6.62	944.03	786.69	707.73	629.35	629.35	323.28	157.27
1 "	6.24	889.84	760.91	667.11	593.23	593.23	304.73	148.24
1 1/16 "	5.86	835.65	696.37	626.48	557.10	557.10	286.17	139.22
1 1/8 "	5.43	774.33	645.28	580.52	516.22	516.22	265.17	129.00
1 5/16 "	4.80	684.49	570.41	513.16	456.33	456.33	234.40	114.03
1 3/8 "	3.80	541.89	451.57	406.25	361.85	361.85	185.51	90.28
1 3/4 "	3.70	527.63	439.69	395.56	351.75	351.75	180.69	87.90
2 "	3.41	486.27	405.23	364.56	324.18	324.18	166.52	81.10
2 1/2 "	2.66	379.32	316.10	284.37	252.88	252.88	129.90	63.19

8 inch Cylinder

Front Roll 1⅜ in. Dia. Front Roll Gear 108 T.

Diameter of Whirl	Ratio Whirl to Cylinder	Cyl. 20 T Stud 120 T	Cyl. 20 T Stud 100 T	Cyl. 20 T Stud 90 T	Cyl. 20 T Stud 80 T	Cyl. 22 T Stud 88 T	Cyl. 36 T Stud 74 T	Cyl. 55 T Stud 55 T
		Cons't	Cons't	Cons't	Cons't	Cons't	Cons't	Cons't
¾ in.	8.28			931.19		827.72	425.35	206.93
15/16 "	7.67			862.59		766.74	394.02	191.68
1 "	7.08			796.23		707.77	363.71	176.94
1 1/16 "	6.80			764.74		679.77	349.33	169.94
1 1/8 "	6.22			699.51		621.79	319.53	155.44
1 5/16 "	5.48			616.29		547.82	281.52	136.95
1 3/8 "	4.37			491.46		436.85	224.49	109.21
1 3/4 "	4.12			463.34		411.86	211.65	102.96
2 "	3.88			436.35		387.87	199.32	96 96
2 1/2 "	3.03			340.76		302.89	155.65	75.72

Front Roll 1½ in. Dia. Front Roll Gear 112 T.

¾ in.	8 28	1180.75	983.95	885.20	787.17	787.17	404.35	196.71
15/16 "	7.67	1093.76	911.47	819.99	729.17	729.17	374.56	182.22
1 "	7.08	1009.63	841.35	756.91	673.08	673.08	345.71	168.20
1 1/16 "	6.80	969.70	808.08	726.98	646.46	646.46	332.08	161.55
1 1/8 "	6.22	886.99	739.16	664.97	591.33	591.33	303.75	147.77
1 5/16 "	5.48	781.46	651.22	585.86	520.97	520.97	267.61	130.19
1 3/8 "	4.37	623.17	519.31	467.19	416.04	416.04	213.41	103.82
1 3/4 "	4.12	587.52	489.60	440.46	391.68	391.68	201.20	97.88
2 "	3.88	553.30	461.08	414.81	368.87	368.87	189.48	92.18
2 1/2 "	3.03	432.09	360.07	323.93	288.06	288.06	147.98	71.99

Rule to find Change Gear:– Divide Constant by Twist per inch Required.

Twister Twist Gear Table.

FRONT ROLL 1½ Inch Diameter.

Cylinder 7 inches Diameter. Ratio Cylinder to Whirl 1 to 7.25

Whirl ⅞ inch Diameter. Front Roll Gear 112 Teeth

Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist	Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist
21T			49.23	65T	10.60	13.25	15.90
22			46.99	66	10.44	13.05	15.66
23			44.95	67	10.29	12.86	15.43
24		35.90	43.07	68	10.14	12.67	15.20
25		34.46	41.35	69	9.99	12.49	14.98
26		33.44	39.76	70	9.85	12.31	14.77
27		31.91	38.29	71	9.71	12.13	14.56
28		30.77	36.92	72	9.57	11.97	14.36
29		29.71	35.65	73	9.44	11.80	
30		28.72	34.46	74	9.31	11.64	
31		27.79	33.35	75	9.19	11.49	
32		26.92	32.31	76	9.07	11.34	
33		26.11	31.33	77	8.94	11.19	
34		25 34	30.40	78	8.84	11.04	
35		24.62	29.54	79	8.72	10.90	
36		23.93	28.72	80	8.61	10.77	
37		23.28	27.94	81	8.51	10.64	
38		22.67	27.21	82	8.40	10.51	
39		22.09	26.51	83	8.30	10.38	
40		21.54	25.85	84	8.20	10.26	
41		21.01	25.22	85	8.11	10.14	
42		20 51	24.61	86	8.01	10.02	
43		20.04	24.04	87	7.92	9.90	
44		19.58	23.50	88	7.83	9.79	
45	15.31	19.14	22.97	89	7.74	9.68	
46	14.98	18.73	22.47	90	7.66	9.57	
47	14.66	18.33	22.00	91	7.57	9.47	
48	14.36	17.95	21.54	92	7.49	9.36	
49	14.07	17.58	21.10	93	7.41	9.26	
50	13.78	17.23	20.68	94		9.16	
51	13.51	16.89	20.27	95		9.07	
52	13.25	16.57	19.88	96		8.97	
53	13.00	16.26	19.51				
54	12.76	15.95	19.14				
55	12.53	15.66	18.80				
56	12.30	15.38	18.46				
57	12.09	15.11	18.14				
58	11.88	14.85	17.82				
59	11.68	14.60	17.52				
60	11.49	14.36	17.23				
61	11.30	14.12	16 95				
62	11.12	13.89	16.67				
63	10.94	13.67	16.41				
64	10.77	13.46	16.15				
Const's	689.24	861.56	1033.87	Const's	689.24	861.56	1033.87

Twister Twist Gear Table

FRONT ROLL 1½ inch Diameter

Cylinder 7 inches diameter. Ratio Cylinder to Whirl 1 to 6.62

Whirl $\frac{15}{16}$ inch diameter. Front Roll Gear 112 teeth

Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist	Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist
21T			44.95	65T	9.68	12.10	14.52
22			42.91	66	9.53	11.92	14.30
23			41.04	67	9.39	11.74	14.09
24		32.78	39.33	68	9.25	11.57	13.88
25		31.47	37.76	69	9.12	11.40	13.68
26		30.26	36.31	70	8.99	11.24	13.49
27		29 14	34.96	71	8.86	11.08	13.30
28		28.10	33.71	72	8.74	10.93	13.11
29		27.13	32.55	73	8.62	10.78	
30		26.22	31.47	74	8.50	10.63	
31		25.38	30.45	75	8.39	10.49	
32		24.58	29.50	76	8.28	10.35	
33		23.84	28 61	77	8.17	10.22	
34		23.14	27.76	78	8.07	10.08	
35		22.48	26.97	79	7.97	9.96	
36		21.85	26.22	80	7.87	9.83	
37		21.26	25.51	81	7.77	9.71	
38		20.70	24.84	82	7.67	9.59	
39		20.17	24.20	83	7.58	9.48	
40		19.66	23.60	84	7.49	9.36	
41		19.19	23.02	85	7.40	9.25	
42		18.73	22.48	86	7.32	9.15	
43		18.29	21.95	87	7.23	9.04	
44		17.88	21.45	88	7.15	8.94	
45	13.98	17.48	20.98	89	7.07	8.84	
46	13.68	17.10	20.52	90	6.99	8.74	
47	13.39	16.74	20.08	91	6.91	8.64	
48	13.11	16.39	19.67	92	6.84	8.55	
49	12.84	16.05	19.26	93	6.76	8.46	
50	12.59	15.73	18.88	94		8.37	
51	12.34	15.42	18.51	95		8.28	
52	12.10	15.13	18.15	96		8.19	
53	11 87	14.84	17.81				
54	11.65	14.57	17.48				
55	11.44	14.30	17.16				
56	11.24	14.05	16.86				
57	11.04	13.80	16.56				
58	10.85	13.56	16.28				
59	10.67	13.33	16.00				
60	10.49	13.11	15.73				
61	10.32	12.90	15.47				
62	10.15	12.69	15.23				
63	9.99	12.49	14.98				
64	9.83	12.29	14.75				
Const's	629.35	786.69	944.03	Const's	629.35	786.69	944.03

Twister Twist Gear Table.

FRONT ROLL 1½ inch Diameter

Cylinder 7 inches Diameter. Ratio Cylinder to Whirl 1 to 6.24

Whirl 1 inch Diameter. Front Roll Gear 112 Teeth

Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist	Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist
21T			42.37	65T	9.13	11.71	13.69
22			40.45	66	8.99	11.53	13.48
23			38.69	67	8.85	11.36	13.28
24		31.70	37.07	68	8.72	11.19	13.08
25		30.44	35.59	69	8.60	11.03	12.89
26		29.26	34.23	70	8.47	10.87	12.71
27		28.18	32.96	71	8.35	10.72	12.53
28		27.17	31.78	72	8.24	10.57	12.36
29		26.24	30.68	73	8.13	10.42	
30		25.36	29.66	74	8.02	10.28	
31		24.54	28.70	75	7.91	10.14	
32		23.78	27.81	76	7.80	10.01	
33		23.06	26.96	77	7.70	9.88	
34		22.38	26.17	78	7.60	9.75	
35		21.74	25.42	79	7.51	9.63	
36		21.14	24.72	80	7.41	9.51	
37		20.56	24.05	81	7.32	9.39	
38		20.02	23.42	82	7.23	9.28	
39		19.51	22.81	83	7.15	9.17	
40		19.02	22.24	84	7.06	9.06	
41		18.56	21.70	85	6.98	8.95	
42		18.12	21.18	86	6.90	8.85	
43		17.69	20.69	87	6.82	8.75	
44		17.29	20.22	88	6.74	8.65	
45	13.18	16.91	19.77	89	6.66	8.55	
46	12.90	16.54	19.34	90	6.59	8.45	
47	12.62	16.19	18.93	91	6.52	8.36	
48	12.36	15.85	18.54	92	6.45	8.27	
49	12.11	15.53	18.16	93	6.38	8.18	
50	11.86	15.22	17.79	94		8.09	
51	11.63	14.92	17.45	95		8.01	
52	11.41	14.63	17.11	96		7.93	
53	11.19	14.36	16.79				
54	10.98	14.09	16.48				
55	10.78	13.83	16.17				
56	10.59	13.59	15.89				
57	10.41	13.35	15.61				
58	10.23	13.12	15.34				
59	10.05	12.90	15.08				
60	9.89	12.68	14.83				
61	9.72	12.47	14.58				
62	9.57	12.27	14.35				
63	9.42	12.08	14.12				
64	9.27	11.89	13.90				
Const's	593.23	760.91	889.84	Const's	593.23	760.91	889.84

Twister Twist Gear Table.

FRONT ROLL 1½ inch Diameter.

Cylinder 7 inch Diameter. Ratio Cylinder to Whirl 1 to 5.86.

Whirl 1 $\frac{1}{16}$ inch Diameter. Front Roll Gear 112 Teeth

Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist	Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist
21T			39.79	65T	8.57	10.71	12.86
22			37.98	66	8.44	10.55	12.66
23			36.33	67	8.31	10.39	12.47
24		29.01	34.82	68	8.19	10.24	12.29
25		27.85	33.43	69	8.07	10.09	12.11
26		26.78	32.14	70	7.96	9.95	11.94
27		25.79	30.95	71	7.85	9.81	11.77
28		24.87	29.84	72	7.74	9.67	11.61
29		24.01	28.82	73	7.63	9.54	
30		23.21	27.85	74	7.53	9.41	
31		22.46	26.96	75	7.43	9.29	
32		21.76	26.11	76	7.33	9.16	
33		21.10	25.32	77	7.23	9.04	
34		20.48	24.58	78	7.14	8.93	
35		19.89	23.88	79	7.05	8.81	
36		19.34	23 21	80	6.96	8.70	
37		18.82	22.58	81	6.88	8.60	
38		18.32	21.99	82	6.79	8.49	
39		17.85	21.43	83	6.71	8.39	
40		17.41	20.89	84	6.63	8.29	
41		16.98	20.38	85	6.55	8.19	
42		16.58	19.89	86	6.48	8.10	
43		16.19	19.43	87	6.40	8.00	
44		15.83	18.99	88	6.33	7.91	
45	12 38	15.47	18.57	89	6.26	7.82	
46	12.11	15.13	18.17	90	6.19	7.74	
47	11.85	14.82	17.78	91	6.12	7.65	
48	11.61	14.51	17.41	92	6.05	7.57	
49	11.37	14.21	17.05	93	5.99	7.49	
50	11.14	13.93	16.71	94		7.41	
51	10.92	13.65	16.38	95		7.33	
52	10.71	13.39	16.07	96		7.25	
53	10.51	13.14	15.77				
54	10.31	12.90	15.47				
55	10.13	12.66	15.19				
56	9.95	12.43	14.92				
57	9.77	12.22	14.66				
58	9.61	12.01	14.41				
59	9.44	11.80	14.16				
60	9.28	11.61	13.93				
61	9.13	11.42	13.70				
62	8.98	11.23	13.48				
63	8.84	11.05	13.26				
64	8.70	10.88	13.06				
Const's	557.10	696.37	835.65	Const's	557.10	696.37	835.65

Twister Twist Gear Table.

FRONT ROLL 1½ inch Diameter.

Cylinder 7 inch Diameter — Ratio Cylinder to Whirl 1 to 5.43.

Whirl 1⅛ inch Diameter — Front Roll Gear 112 Teeth.

Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist	Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist
21T			36.87	65T	7.94	9.93	11.91
22			35.20	66	7.82	9.78	11.73
23			33.67	67	7.70	9.63	11.56
24		26.89	32.26	68	7.59	9.49	11.39
25		25.81	30.97	69	7.48	9.35	11.22
26		24.82	29.78	70	7.37	9.22	11.06
27		23.90	28.68	71	7.27	9.09	10.91
28		23.05	27.65	72	7.17	8.96	10.75
29		22.25	26.70	73	7.07	8.84	
30		21.51	25.81	74	6.98	8.72	
31		20.82	24.98	75	6.88	8.61	
32		20.17	24.19	76	6.79	8.49	
33		19.55	23.46	77	6.70	8.38	
34		18.98	22.77	78	6.62	8.27	
35		18.44	22.12	79	6.53	8.17	
36		17.92	21.51	80	6.45	8.07	
37		17.44	20.93	81	6.37	7.97	
38		16.98	20.38	82	6.30	7.87	
39		16.55	19.85	83	6.22	7.77	
40		16.13	19.36	84	6.15	7.68	
41		15.74	18.89	85	6.07	7.59	
42		15.36	18.44	86	6.00	7.50	
43		15.01	18.01	87	5.93	7.42	
44		14.67	17.60	88	5.87	7.33	
45	11.47	14.34	17.21	89	5.80	7.25	
46	11.22	14.03	16.83	90	5.74	7.17	
47	10.98	13.73	16.47	91	5.67	7.09	
48	10.75	13.44	16.13	92	5.61	7.01	
49	10.53	13.17	15.80	93	5.55	6.94	
50	10.33	12.91	15.49	94		6.86	
51	10.12	12.65	15.18	95		6.79	
52	9.93	12.41	14.89	96		6.72	
53	9.74	12.18	14.61				
54	9.56	11.95	14.34				
55	9.39	11.73	14.08				
56	9.22	11.52	13.83				
57	9.06	11.32	13.58				
58	8.90	11.13	13.35				
59	8.75	10.94	13.12				
60	8.60	10.75	12.91				
61	8.46	10.58	12.69				
62	8.33	10.41	12.49				
63	8.19	10.24	12.29				
64	8.07	10.08	12.10				
Const's	516.22	645.28	774.33	Const's	516.22	645.28	774.33

Twister Twist Gear Table.

FRONT ROLL 1½ inch Diameter.

Cylinder 7 inch Diameter. Ratio Cylinder to Whirl 1 to 4.80.

Whirl 1 $\frac{5}{16}$ inch Diameter. Front Roll Gear 112 Teeth.

Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist	Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist
21T			32.59	65T	7.02	8.78	10.53
22			31.11	66	6.91	8.64	10.37
23			29.76	67	6.81	8.51	10.22
24		23.77	28.52	68	6.71	8.39	10.07
25		22.82	27.38	69	6.61	8.27	9.92
26		21.94	26.32	70	6.52	8.15	9.78
27		21.13	25.35	71	6.43	8.03	9.64
28		20.37	24.45	72	6.34	7.92	9.51
29		19.67	23.60	73	6.25	7.81	
30		19.01	22.82	74	6.17	7.71	
31		18.40	22.08	75	6.08	7.61	
32		17.83	21.39	76	6.00	7.51	
33		17.29	20.74	77	5.93	7.41	
34		16.78	20.13	78	5.85	7.31	
35		16.30	19.56	79	5.78	7.22	
36		15.84	19.01	80	5.70	7.13	
37		15.42	18.50	81	5.63	7.04	
38		15.01	18.01	82	5.57	6.96	
39		14.62	17.55	83	5.50	6.87	
40		14.26	17.11	84	5.43	6.79	
41		13.91	16.69	85	5.37	6.71	
42		13.58	16.30	86	5.31	6.63	
43		13.27	15.92	87	5.25	6.56	
44		12.96	15.56	88	5.19	6.48	
45	10.14	12.68	15.21	89	5.13	6.41	
46	9.92	12.40	14.88	90	5.07	6.34	
47	9.71	12.14	14.56	91	5 01	6.27	
48	9.51	11.88	14.26	92	4.96	6.20	
49	9.31	11.64	13.97	93	4.91	6.13	
50	9.13	11.41	13.69	94		6.07	
51	8.95	11.18	13.42	95		6.00	
52	8.78	10.97	13.16	96		5.94	
53	8.61	10.76	12.91				
54	8.45	10.56	12.68				
55	8.30	10.37	12.45				
56	8.15	10.19	12.22				
57	8.01	10.01	12.01				
58	7.87	9.83	11.80				
59	7.73	9.66	11.60				
60	7.61	9.51	11.41				
61	7.48	9.35	11.22				
62	7.36	9.20	11.04				
63	7.24	9.05	10.86				
64	7.13	8.91	10.70				
Const's	456.33	570.41	684.49	Const's	456.33	570.41	684.49

Twister Twist Gear Table.

FRONT ROLL 1½ inch Diameter.

Cylinder 7 inch Diameter. Ratio Cylinder to Whirl 1 to 3.80.

Whirl 1⅝ inch Diameter. Front Roll Gear 112 Teeth.

Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist	Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist
21T			25.80	65T	5.57	6.95	8.34
22			24.63	66	5.48	6.84	8.21
23			23.56	67	5.40	6.74	8.09
24		18.82	22.58	68	5.32	6.64	7.97
25		18.06	21.68	69	5.24	6.54	7.85
26		17.37	20.84	70	5.17	6.45	7.74
27		16.72	20.07	71	5.10	6.36	7.63
28		16.13	19.35	72	5.03	6.27	7.53
29		15.57	18.69	73	4.96	6.19	
30		15.05	18.06	74	4.89	6.10	
31		14.57	17.48	75	4.82	6.02	
32		14.11	16.93	76	4.76	5.94	
33		13.68	16.42	77	4.70	5.86	
34		13.28	15.94	78	4.64	5.79	
35		12.90	15.48	79	4.58	5.72	
36		12.54	15.05	80	4.52	5.64	
37		12.20	14.65	81	4.47	5.57	
38		11.88	14.26	82	4.41	5.51	
39		11.58	13.89	83	4.36	5.44	
40		11.29	13 55	84	4.31	5.38	
41		11.01	13.22	85	4.26	5.31	
42		10.75	12.90	86	4.21	5.25	
43		10.50	12.60	87	4.16	5.19	
44		10.26	12.32	88	4.11	5.13	
45	8.04	10.03	12.04	89	4.07	5.07	
46	7.87	9.82	11.78	90	4.02	5.02	
47	7.70	9.61	11.53	91	3.98	4.96	
48	7.54	9.41	11.29	92	3.93	4.91	
49	7.38	9.22	11.06	93	3.89	4.86	
50	7.24	9.03	10.84	94		4.80	
51	7.10	8.85	10.63	95		4.75	
52	6.96	8.68	10.42	96		4.70	
53	6.83	8.52	10.22				
54	6.70	8.36	10.04				
55	6.58	8.21	9.85				
56	6.46	8.06	9.68				
57	6.35	7.92	9.51				
58	6.24	7.79	9.34				
59	6.13	7.65	9.18				
60	6.03	7.52	9.03				
61	5.93	7.40	8.88				
62	5.84	7.28	8.74				
63	5.74	7.17	8.60				
64	5.65	7.05	8.47				
Const's	361.85	451.57	541.89	Const's	361.85	451.57	541.89

Twister Twist Gear Table.

FRONT ROLL 1½ inch Diameter.

Cylinder 7 inch Diameter. Ratio Cylinder to Whirl 1 to 3.70.

Whirl 1⅜ inch Diameter. Front Roll Gear 112 Teeth.

Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist	Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist
21T			25.13	65T	5.41	6.76	8.12
22			23.98	66	5.33	6.66	7.99
23			22.94	67	5.25	6.56	7.88
24		18.32	21.98	68	5.17	6.47	7.76
25		17.59	21.12	69	5.10	6.37	7.65
26		16.91	20.29	70	5.03	6.28	7.54
27		16.28	19.54	71	4.95	6.19	7.43
28		15.70	18.84	72	4.89	6.11	7.33
29		15 16	18.19	73	4.82	6.02	
30		14.66	17.59	74	4.75	5.94	
31		14.18	17.02	75	4.69	5.86	
32		13.74	16.49	76	4.63	5.79	
33		13.32	15.99	77	4.57	5.71	
34		12.93	15.52	78	4.51	5.64	
35		12.56	15.08	79	4.45	5.57	
36		12.21	14.66	80	4.40	5.50	
37		11.88	14.26	81	4.34	5.43	
38		11.57	13.89	82	4.29	5.36	
39		11.27	13.53	83	4.24	5.30	
40		10.98	13.19	84	4.19	5.23	
41		10.72	12.87	85	4.14	5.17	
42		10.47	12.56	86	4.09	5.11	
43		10.23	12.27	87	4 04	5.05	
44		9.99	11.99	88	4.00	5.00	
45	7.82	9.77	11.73	89	3.95	4.94	
46	7.65	9.56	11.47	90	3.91	4 89	
47	7.48	9.36	11.23	91	3.87	4.83	
48	7.33	9.16	10.99	92	3.82	4.78	
49	7.18	8.97	10.77	93	3.78	4.73	
50	7.03	8.79	10.55	94		4.68	
51	6.90	8.62	10.35	95		4.63	
52	6.76	8.46	10.15	96		4.58	
53	6.64	8 30	9.96				
54	6 51	8.14	9.77				
55	6.40	7.99	9.59				
56	6.28	7.85	9.42				
57	6.17	7.71	9.26				
58	6.06	7.58	9.10				
59	5.96	7.45	8.94				
60	5.86	7.33	8.79				
61	5.77	7.21	8.65				
62	5.67	7.09	8.51				
63	5.58	6.97	8.38				
64	5.50	6.87	8.24				
Const's	351.75	439.69	527.63	Const's	351.75	439.69	527.63

Twister Twist Gear Table.

FRONT ROLL 1½ inch Diameter

Cylinder 7 inch Diameter. Ratio Cylinder to Whirl 1 to 3.41

Whirl 2 inch Diameter Front Roll Gear 112 Teeth

Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist	Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist
21T			23.16	65T	4.99	6.23	7.48
22			22.10	66	4.91	6.14	7.37
23			21.14	67	4.83	6 05	7.26
24		16.88	20.26	68	4.77	5.96	7.15
25		16 21	19.45	69	4.70	5.87	7.05
26		15.59	18.70	70	4.63	5.79	6.95
27		15.01	18.01	71	4.57	5.71	6.85
28		14.47	17.37	72	4.50	5.63	6.75
29		13.97	16.77	73	4.44	5.55	
30		13.51	16.21	74	4.38	5.48	
31		13.07	15.69	75	4.32	5.40	
32		12.66	15.20	76	4.27	5.33	
33		12.28	14.74	77	4.21	5.26	
34		11.92	14.30	78	4.16	5.20	
35		11.59	13.89	79	4.11	5.13	
36		11.26	13·51	80	4.05	5.07	
37		10.95	13.14	81	4.00	5.00	
38		10.66	12.80	82	3.95	4.94	
39		10.39	12.47	83	3.91	4.88	
40		10.13	12.16	84	3.86	4.82	
41		9.88	11.86	85	3.81	4.77	
42		9.65	11.58	86	3.77	4.71	
43		9.42	11.31	87	3.73	4.66	
44		9.21	11.05	88	3.68	4.60	
45	7.20	9.01	10.81	89	3.64	4.55	
46	7.05	8.81	10.57	90	3.60	4.50	
47	6.90	8.62	10.35	91	3.56	4.45	
48	6.75	8.44	10.13	92	3.52	4.40	
49	6.62	8.27	9.92	93	3.49	4.36	
50	6.48	8.10	9.73	94		4.31	
51	6.36	7.95	9.53	95		4.27	
52	6.24	7.79	9.35	96		4.22	
53	6.12	7.65	9.17				
54	6.00	7.50	9.01				
55	5.89	7.37	8.84				
56	5.79	7.24	8.68				
57	5.69	7.11	8.53				
58	5.59	6.99	8.38				
59	5.49	6.87	8.24				
60	5.40	6.75	8.10				
61	5.31	6.64	7.97				
62	5.23	6.56	7.84				
63	5.15	6.43	7.72				
64	5.07	6.33	7.60				
Const's	324.18	405.23	486.27	Const's	324.18	405.23	486.27

Twister Twist Gear Table.

FRONT ROLL 1½ inch Diameter.

Cylinder 7 inch Diameter — Ratio Cylinder to Whirl 1 to 2.66.

Whirl 2½ inch Diameter — Front Roll Gear 112 teeth.

Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist	Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist
21T			18.06	65T	3.89	4 86	5.84
22			17.24	66	3.83	4.79	5.75
23			16.49	67	3.77	4.72	5.66
24		13.17	15.81	68	3.72	4.65	5,58
25		12.64	15.17	69	3.66	4.58	5.50
26		12.16	14.59	70	3.61	4.52	5.42
27		11.71	14.05	71	3.56	4.45	5.34
28		11.29	13.55	72	3.51	4.39	5.27
29		10.90	13.08	73	3.46	4.33	
30		10.54	12.64	74	3.42	4.27	
31		10.20	12.24	75	3.37	4.21	
32		9.88	11.85	76	3.33	4.16	
33		9.58	11.49	77	3.28	4.11	
34		9.30	11.16	78	3.24	4.05	
35		9.03	10.84	79	3.20	4.00	
36		8.78	10.54	80	3.16	3.95	
37		8.54	10.25	81	3.12	3.90	
38		8.32	9.98	82	3.08	3.85	
39		8.11	9.73	83	3.05	3.81	
40		7.90	9.48	84	3.01	3.76	
41		7.71	9.25	85	2.98	3.72	
42		7.53	9.03	86	2.94	3.68	
43		7.35	8.82	87	2.91	3.63	
44		7.18	8.62	88	2.87	3.59	
45	5.62	7.02	8.43	89	2.84	3.55	
46	5.49	6.87	8.25	90	2.81	3.51	
47	5.38	6.73	8.07	91	2.78	3.47	
48	5.27	6.59	7.90	92	2.75	3.44	
49	5.16	6.45	7.74	93	2.72	3.40	
50	5.06	6.32	7.59	94		3.36	
51	4.96	6.20	7.44	95		3.33	
52	4.86	6.08	7.29	96		3.29	
53	4.77	5.96	7.16				
54	4.68	5.85	7.02				
55	4.60	5.75	6.90				
56	4.52	5.64	6.77				
57	4.44	5.55	6.65				
58	4.36	5.45	6.54				
59	4.29	5.36	6.43				
60	4.21	5.27	6.32				
61	4.15	5 18	6.22				
62	4.08	5.10	6.12				
63	4.01	5.02	6.02				
64	3.95	4.94	5.93				
Const's	252.88	316.10	379.32	Const's	252.88	316.10	379.32

Twister Twist Gear Table.

FRONT ROLL 1½ inch Diameter.

Cylinder 8 inch Diameter — Ratio Cylinder to Whirl 1 to 8.28

Whirl ⅞ inch Diameter — Front Roll Gear 112 teeth.

Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist	Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist
21T			56.23	65T	12.11	15.14	18.17
22			53.67	66	11.93	14.91	17.89
23			51.34	67	11.75	14.69	17.62
24		41.00	49.20	68	11.58	14.47	17.36
25		39.36	47.23	69	11.41	14.26	17.11
26		37.84	45.41	70	11.25	14.06	16.87
27		36.44	43.73	71	11.09	13.86	16.63
28		35.14	42.17	72	10.93	13.67	16.40
29		33.93	40.72	73	10.78	13.48	
30		32.80	39.36	74	10.64	13.30	
31		31.74	38.09	75	10.50	13.12	
32		30.75	36.90	76	10.36	12.95	
33		29.82	35.78	77	10.22	12.78	
34		28.94	34.73	78	10.09	12.61	
35		28.11	33.74	79	9.96	12.46	
36		27.33	32.80	80	9.84	12.30	
37		26.59	31.91	81	9.72	12.15	
38		25.89	31.07	82	9.60	12.00	
39		25.23	30.28	83	9.48	11.85	
40		24.60	29.52	84	9.37	11.71	
41		24.00	28.80	85	9.26	11.58	
42		23.43	28.11	86	9.15	11.44	
43		22.88	27.45	87	9.05	11.31	
44		22.36	26.84	88	8.95	11.18	
45	17.49	21.87	26.24	89	8.84	11.06	
46	17.11	21.39	25.67	90	8.75	10.93	
47	16.75	20.94	25.12	91	8.65	10.81	
48	16.40	20.50	24.60	92	8.56	10.70	
49	16.06	20.08	24.10	93	8.46	10.58	
50	15.74	19.68	23.62	94		10.47	
51	15.43	19.29	23.15	95		10.36	
52	15.14	18.92	22.71	96		10.25	
53	14.85	18.57	22.28				
54	14.58	18.22	21.87				
55	14.31	17.89	21.47				
56	14.06	17.57	21.08				
57	13.81	17.26	20.71				
58	13.57	16.96	20.36				
59	13.34	16.68	20.01				
60	13.12	16.40	19.68				
61	12.90	16.13	19.36				
62	12.70	15.87	19.04				
63	12.49	15.62	18.74				
64	12.30	15.37	18.45				
Const's	787.17	983.95	1180.75	Const's	787.17	983.95	1180.75

Twister Twist Gear Table.

FRONT ROLL 1½ inch Diameter.

Cylinder 8 inch Diameter — Ratio Cylinder to Whirl 1 to 7.67.

Whirl $\frac{15}{16}$ inch Diameter — Front Roll Gear 112 Teeth.

Change Gears	Cyl. Stud 20 T 80 T Twist	Cyl. Stud 20 T 100 T Twist	Cyl. Stud 20 T 120 T Twist	Change Gears	Cyl. Stud 20 T 80 T Twist	Cyl. Stud 20 T 100 T Twist	Cyl. Stud 20 T 120 T Twist
21T			52.08	65T	11 22	14.02	16.83
22			49.72	66	11.05	13.81	16.57
23			47.55	67	10.88	13 60	16.32
24		37.97	45.57	68	10.72	13.40	16.08
25		36.46	43.75	69	10.57	13.21	15.85
26		35.06	42.07	70	10.42	13.02	15.63
27		33.76	40.51	71	10.27	12.84	15.42
28		32.55	39.06	72	10.13	12.66	15.19
29		31.43	37.72	73	9.99	12.49	
30		30.37	36.46	74	9.85	12.32	
31		29.40	35.28	75	9.72	12.15	
32		28.48	34.18	76	9.59	11.99	
33		27.62	33.14	77	9.47	11.84	
34		26.81	32.17	78	9.35	11.70	
35		26.04	31.25	79	9.23	11.54	
36		25.32	30.38	80	9.11	11.39	
37		24.63	29.56	81	9.00	11.25	
38		23.99	28.78	82	8.89	11.12	
39		23.37	28.05	83	8.79	10.98	
40		22.79	27.34	84	8.68	10.85	
41		22.23	26.68	85	8.58	10.72	
42		21.70	26.04	86	8.48	10.60	
43		21.20	25.44	87	8.38	10.48	
44		20.72	24.86	88	8.29	10.36	
45	16.20	20.25	24.31	89	8.19	10.24	
46	15 85	19.81	23.78	90	8.10	10.13	
47	15.51	19.39	23.27	91	8.01	10.02	
48	15.19	18.99	22.79	92	7.93	9.91	
49	14.88	18.60	22.32	93	7.84	9.80	
50	14.58	18.23	21.88	94		9.70	
51	14.30	17.87	21.45	95		9.59	
52	14.02	17.53	21.03	96		9.49	
53	13.76	17.20	20.64				
54	13.50	16.88	20.25				
55	13.26	16.57	19.89				
56	13.02	16.27	19.53				
57	12.79	15.99	19.19				
58	12.57	15.71	18.86				
59	12.36	15.45	18.54				
60	12.15	15.19	18.23				
61	11.95	14.94	17.93				
62	11.76	14.70	17.64				
63	11.57	14.47	17.36				
64	11.39	14.24	17.09				
Const's	729.17	911.47	1093.76	Const's	729.17	911.47	1093.76

Twister Twist Gear Table.

FRONT ROLL 1½ inch Diameter

Cylinder 8 inches Diameter. Ratio Cylinder to Whirl 1 to 7.08

Whirl 1 inch Diameter. Front Roll Gear 112 Teeth

Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist	Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist
21T			48.08	65T	10.36	12.93	15.53
22			45.89	66	10.20	12.75	15.30
23			43.85	67	10.05	12.56	15.07
24		35.06	42.07	68	9.90	12.37	14.85
25		33.65	40.38	69	9.75	12.19	14.63
26		32.40	38.83	70	9.61	12.02	14.42
27		31.16	37.39	71	9.48	11.85	14.22
28		30.05	36.06	72	9.35	11.69	14.03
29		29.01	34.81	73	9.22	11.53	
30		28.04	33.65	74	9.10	11.37	
31		27.14	32.57	75	8.97	11 22	
32		26.29	31.55	76	8.86	11.07	
33		25.49	30.59	77	8 74	10.93	
34		24.74	29.69	78	8.63	10.79	
35		24.04	28.85	79	8.52	10.65	
36		23.37	28.04	80	8.41	10.52	
37		22.74	27.29	81	8.31	10.39	
38		22.14	26.57	82	8.21	10.26	
39		21.57	25.89	83	8.11	10.14	
40		21.01	25.24	84	8.01	10.02	
41		20.52	24.63	85	7.92	9.89	
42		20.03	24.04	86	7.83	9.78	
43		19.57	23.48	87	7.74	9.67	
44		19.12	22.95	88	7.65	9.56	
45	14.96	18.69	22.44	89	7.56	9.45	
46	14.63	18.29	21.95	90	7.48	9.35	
47	14.32	17.90	21.48	91	7.40	9.25	
48	14.02	17.52	21.03	92	7.32	9.15	
49	13.74	17.17	20.60	93	7.24	9.05	
50	13.46	16.82	20.19	94		8.95	
51	13.19	16.50	19.80	95		8.86	
52	12.94	16.18	19.42	96		8.76	
53	12.70	15.87	19.05				
54	12.46	15.58	18.70				
55	12.24	15.30	18.36				
56	12.02	15.02	18.02				
57	11.81	14.76	17.71				
58	11.61	14.51	17.41				
59	11.41	14.26	17.11				
60	11.22	14.02	16.83				
61	11.03	13.79	16.55				
62	10.86	13.57	16.28				
63	10.68	13.35	16.03				
64	10.52	13.15	15.78				
Const's	673.08	841.35	1009.63	Const's	673.08	841.35	1009.63

Twister Twist Gear Table.

FRONT ROLL 1½ Inch Diameter.

Cylinder 8 inches Diameter. Ratio Cylinder to Whirl 1 to 6.80

Whirl 1 $\frac{1}{16}$ inch Diameter. Front Roll Gear 112 Teeth

Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist	Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist
21T			46.18	65T	9.95	12.43	14.92
22			44.08	66	9.79	12.24	14.69
23			42.16	67	9.65	12.06	14.47
24		33.67	40.40	68	9.51	11.88	14.26
25		32.32	38.79	69	9.37	11.71	14.05
26		31.08	37.30	70	9.24	11.54	13.85
27		29.93	35.91	71	9.11	11.38	13.66
28		28.86	34.63	72	8.98	11.22	13.47
29		27.86	33.44	73	8.86	11.07	
30		26.94	32.32	74	8.74	10.92	
31		26.07	31.28	75	8.62	10.77	
32		25.25	30.30	76	8.51	10.63	
33		24.49	29.38	77	8.40	10.49	
34		23.77	28.52	78	8.29	10.36	
35		23.09	27.71	79	8.18	10.23	
36		22.45	26.94	80	8.08	10.10	
37		21.84	26.21	81	7.98	9.98	
38		21.27	25.52	82	7.88	9.85	
39		20.72	24.86	83	7.79	9.74	
40		20.20	24.24	84	7.70	9.62	
41		19.71	23.65	85	7.61	9.51	
42		19.24	23 09	86	7.52	9.40	
43		18.79	22.55	87	7.43	9.29	
44		18.37	22.04	88	7.35	9.18	
45	14.37	17.96	21.55	89	7.26	9.08	
46	14.05	17.57	21.08	90	7.18	8.97	
47	13.75	17.19	20.63	91	7.10	8.88	
48	13.47	16.84	20.20	92	7.03	8.78	
49	13.19	16.49	19.79	93	6.95	8.69	
50	12.93	16.16	19.39	94		8.60	
51	12.68	15.84	19.01	95		8.51	
52	12.43	15.54	18.65	96		8.42	
53	12.20	15.25	18.30				
54	11.97	14.96	17.96				
55	11.75	14.69	17.63				
56	11.54	14.43	17.32				
57	11.34	14.18	17.01				
58	11.15	13.93	16.72				
59	10.96	13.70	16.44				
60	10.77	13.46	16.16				
61	10.60	13.25	15.90				
62	10.43	13.03	15.64				
63	10.26	12.83	15.39				
64	10.10	12.63	15.15				
Const's	646.46	808.08	969.70	Const's	646.46	808.08	969.70

Twister Twist Gear Table.

FRONT ROLL 1½ inch Diameter.

Cylinder 8 inch Diameter. Ratio Cylinder to Whirl 1 to 6.22.

Whirl 1 ⅛ inch Diameter. Front Roll Gear 112 Teeth

Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist	Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist
21T			42.24	65T	9.10	11.38	13.65
22			40.32	66	8.96	11.20	13.44
23			38.56	67	8.82	11.03	13.24
24		30.80	36.96	68	8.70	10.87	13.04
25		29.57	35.48	69	8.57	10.72	12.86
26		28.43	34.12	70	8.45	10 56	12.67
27		27.38	32.85	71	8.31	10.41	12.49
28		26.40	31.68	72	8.21	10.27	12.32
29		25.49	30.59	73	8.10	10.13	
30		24.64	29.57	74	7.99	9.99	
31		23.84	28.61	75	7.88	9.87	
32		23.10	27.72	76	7.78	9.75	
33		22.40	26.88	77	7.68	9.61	
34		21.74	26.09	78	7.58	9.47	
35		21.12	25.34	79	7.49	9.36	
36		20.53	24.64	80	7.39	9.24	
37		19.98	23.97	81	7.30	9.12	
38		19.45	23.34	82	7.21	9.01	
39		18.95	22.74	83	7.12	8.91	
40		18.48	22.17	84	7.04	8.80	
41		18.03	21.63	85	6.96	8.69	
42		17.60	21.12	86	6.88	8.59	
43		17.19	20.64	87	6.80	8.49	
44		16.80	20.16	88	6.72	8.40	
45	13.14	16.43	19.72	89	6.64	8.31	
46	12.85	16.07	19.28	90	6.57	8.22	
47	12.58	15.73	18.88	91	6.50	8.13	
48	12.32	15.40	18.48	92	6.43	8.04	
49	12.07	15.08	18.11	93	6.36	7.95	
50	11.83	14.78	17.74	94		7.87	
51	11.60	14.49	17.40	95		7.78	
52	11.37	14.21	17.06	96		7.70	
53	11.16	13.95	16.74				
54	10.95	13.69	16.42				
55	10.75	13.45	16.13				
56	10.56	13.20	15.84				
57	10.37	12.97	15.57				
58	10.20	12.74	15.29				
59	10.02	12.53	15.03				
60	9.86	12.32	14.78				
61	9.69	12.12	14.54				
62	9.54	11.92	14.31				
63	9.39	11.73	14.09				
64	9.26	11.55	13.86				
Const's	591.33	739.16	886.99	Const's	591.33	739.16	886.99

Twister Twist Gear Table

FRONT ROLL 1½ inch Diameter

Cylinder 8 inches diameter. Ratio Cylinder to Whirl 1 to 5.48

Whirl 1 $\frac{5}{16}$ inch diameter. Front Roll Gear 112 teeth

Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist	Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist
21 T			37.21	65T	8.01	10.02	12.02
22			35.52	66	7.89	9.87	11.84
23			33.98	67	7.78	9.72	11.66
24		27.13	32.56	68	7.66	9.57	11.49
25		26.05	31.26	69	7.55	9.44	11.33
26		25.05	30.06	70	7.44	9.31	11.16
27		24.12	28.95	71	7.34	9.17	11.01
28		23.26	27.91	72	7.24	9.04	10.85
29		22.46	26.94	73	7.14	8.92	
30		21.71	26.05	74	7.04	8.80	
31		21.01	25.21	75	6.95	8.69	
32		20.35	24.42	76	6.85	8.57	
33		19.74	23.68	77	6 77	8.46	
34		19.15	22.98	78	6.68	8.35	
35		18.61	22.33	79	6.59	8.25	
36		18.09	21.71	80	6.51	8.14	
37		17.60	21.12	81	6.43	8.04	
38		17.14	20.56	82	6.35	7.94	
39		16.70	20.04	83	6.28	7.84	
40		16.28	19.54	84	6.20	7.75	
41		15.88	19.06	85	6.13	7.66	
42		15.51	18.61	86	6.06	7.57	
43		15.14	18.17	87	5.99	7.48	
44		14.80	17.76	88	5.92	7.40	
45	11 58	14.47	17.37	89	5.85	7.32	
46	11.33	14.16	16.99	90	5.79	7.23	
47	11.08	13.86	16.63	91	5.73	7.15	
48	10.85	13.57	16.28	92	5.66	7.08	
49	10.63	13.29	15.95	93	5.60	7.00	
50	10.42	13.02	15.63	94		6.93	
51	10.22	12.78	15.32	95		6·86	
52	10.02	12.53	15.03	96		6.78	
53	9.83	12.30	14.74				
54	9.65	12.06	14.47				
55	9.47	11.85	14.21				
56	9.30	11.63	13.95				
57	9.14	11.43	13.71				
58	8.98	11.23	13.47				
59	8.83	11.04	13.25				
60	8.68	10.85	13.02				
61	8.54	10.68	12.81				
62	8.40	10.51	12.60				
63	8.27	10.34	12.40				
64	8 14	10.17	12.21				
Const's	520.97	651.22	781.46	Const's	520.97	651.22	781.46

Twister Twist Gear Table.

FRONT ROLL 1½ inch Diameter.

Cylinder 8 inch Diameter. Ratio Cylinder to Whirl 1 to 4.37.

Whirl 1 ⅝ inch Diameter. Front Roll Gear 112 Teeth.

Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist	Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist
21T			29.67	65T	6 40	7.99	9.59
22			28.32	66	6.30	7.87	9.44
23			27.09	67	6.21	7.75	9.30
24		21.64	25.96	68	6.12	7.64	9.16
25		20.77	24.93	69	6.02	7.53	9.03
26		19.97	23.96	70	5.94	7.42	8.90
27		19.23	23 08	71	5.86	7.31	8.78
28		18.54	22.26	72	5.78	7.21	8.66
29		17.90	21.49	73	5.70	7.11	
30		17 31	20.77	74	5.62	7.02	
31		16.75	20.10	75	5.55	6.92	
32		16 23	19.47	76	5.47	6.83	
33		15.74	18.88	77	5.40	6.74	
34		15.28	18.33	78	5.33	6.66	
35		14.84	17.80	79	5.27	6.57	
36		14.43	17.31	80	5.20	6.49	
37		14.04	16.84	81	5.14	6.41	
38		13.67	16 40	82	5.07	6 33	
39		13.32	15.98	83	5.01	6.26	
40		12.98	15.58	84	4.95	6.18	
41		12.67	15.20	85	4.89	6.11	
42		12.36	14.83	86	4.84	6.04	
43		12.08	14.49	87	4.78	5.97	
44		11.80	14.16	88	4.73	5.90	
45	9.25	11.54	13 85	89	4.67	5.83	
46	9.04	11.29	13.55	90	4.62	5.77	
47	8.85	11.05	13.26	91	4.57	5.71	
48	8.67	10.82	12.98	92	4.52	5.64	
49	8.49	10.60	12.72	93	4.47	5.58	
50	8.32	10.39	12.46	94		5.52	
51	8.16	10.18	12.22	95		5.47	
52	8.00	9.99	11.98	96		5.41	
53	7.85	9.80	11.76				
54	7.70	9.62	11.54				
55	7.56	9.44	11.33				
56	7.43	9.27	11.13				
57	7.30	9.11	10.93				
58	7.17	8.95	10.74				
59	7.05	8.80	10.56				
60	6.93	8.66	10.39				
61	6.82	8.51	10.22				
62	6.71	8.37	10.05				
63	6.60	8.24	9.89				
64	6.50	8.11	9.74				
Const's	416.04	519.31	623.17	Const's	416.04	519.31	623.17

Twister Twist Gear Table.

FRONT ROLL 1½ inch Diameter.

Cylinder 8 inch Diameter. Ratio Cylinder to Whirl 1 to 4.12.

Whirl 1⅜ inch Diameter. Front Roll Gear 112 Teeth.

Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist	Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist
21 T			27.98	65T	6.03	7.53	9.04
22			26.71	66	5.93	7.42	8.90
23			25.54	67	5.85	7.31	8.77
24		20.40	24.48	68	5.76	7.20	8.64
25		19.58	23.50	69	5.68	7.10	8 51
26		18.83	22.60	70	5.60	6.99	8 39
27		18.13	21.76	71	5.52	6.90	8 27
28		17.49	20.98	72	5.44	6.80	8.16
29		16.88	20.26	73	5.37	6.71	
30		16.32	19.58	74	5.29	6.62	
31		15.79	18.95	75	5.22	6.53	
32		15.30	18.36	76	5.15	6.44	
33		14.84	17.80	77	5.09	6.36	
34		14.40	17.28	78	5.02	6.28	
35		13.99	16.79	79	4.96	6.20	
36		13.60	16.32	80	4.90	6.12	
37		13.23	15.88	81	4.83	6.04	
38		12 88	15.46	82	4.78	5.97	
39		12.55	15.06	83	4.72	5.90	
40		12.24	14 69	84	4.66	5.83	
41		11.94	14.33	85	4.61	5.76	
42		11.66	13 99	86	4.55	5.69	
43		11.39	13.66	87	4.50	5.63	
44		11.12	13.35	88	4.45	5.56	
45	8.70	10.88	13.06	89	4 40	5.50	
46	8.51	10.64	12.77	90	4.35	5.44	
47	8.33	10.42	12.50	91	4.30	5.38	
48	8.16	10.20	12.24	92	4.26	5.32	
49	7.99	9.99	11.99	93	4.21	5.26	
50	7.83	9.79	11.75	94		5.21	
51	7.68	9.60	11.52	95		5.15	
52	7.53	9.42	11.30	96		5.10	
53	7.39	9.24	11.09				
54	7.25	9.07	10.87				
55	7.12	8.90	10.68				
56	6.99	8.74	10.49				
57	6.87	8.59	10.31				
58	6.75	8.44	10.13				
59	6.64	8.30	9.96				
60	6.53	8.16	9.79				
61	6.42	8.03	9.63				
62	6.32	7.90	9.48				
63	6 22	7.77	9.33				
64	6.12	7.65	9.18				
Const's	391.68	489.60	587.52	Const's	391.68	489.60	587.52

Twister Twist Gear Table.

FRONT ROLL 1½ inch Diameter

Cylinder 8 inch Diameter. Ratio Cylinder to Whirl 1 to 3.88

Whirl 2 inch Diameter Front Roll Gear 112 Teeth

Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist	Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist
21T			26.35	65T	5.67	7.09	8.51
22			25.15	66	5.59	6.99	8.38
23			24.06	67	5.51	6.88	8.26
24		19.21	23.05	68	5.42	6.78	8.14
25		18.44	22.13	69	5.35	6.68	8.02
26		17.73	21.28	70	5.27	6.58	8.90
27		17.08	20.49	71	5.19	6.49	7.79
28		16.47	19.76	72	5.12	6.40	7.68
29		15.90	19.08	73	5.05	6.32	
30		15.37	18.44	74	4.99	6.23	
31		14.87	17.85	75	4 92	6.15	
32		14.40	17.29	76	4.85	6.07	
33		13.97	16.77	77	4.79	5.99	
34		13.56	16.27	78	4.73	5.91	
35		13.17	15.81	79	4 67	5.84	
36		12.81	15.37	80	4.61	5.76	
37		12.46	14.95	81	4.55	5.69	
38		12.13	14.56	82	4.50	5.62	
39		11.82	14.19	83	4.44	5.56	
40		11.53	13.83	84	4.39	5.49	
41		11.25	13.50	85	4.34	5.42	
42		10.98	13.17	86	4.29	5.36	
43		10.72	12.87	87	4.24	5.30	
44		10.48	12.58	88	4.19	5.24	
45	8.20	10 25	12.30	89	4 14	5.18	
46	8.02	10.02	12.03	90	4.10	5 12	
47	7.85	9.81	11.77	91	4.05	5.07	
48	7.69	9.61	11.53	92	4.01	5.01	
49	7.53	9.41	11.29	93	3.97	4.96	
50	7.38	9.22	11.07	94		4.91	
51	7.23	9.04	10.85	95		4.85	
52	7.09	8.87	10.64	96		4.80	
53	6.96	8.70	10.44				
54	6.83	8.54	10.25				
55	6.71	8.38	10.06				
56	6.59	8.23	9.88				
57	6.47	8.08	9.71				
58	6.36	7 95	9.54				
59	6.25	7.81	9.38				
60	6.15	7.68	9.22				
61	6.05	7.56	9.07				
62	5.95	7.44	8.92				
63	5 86	7.32	8.78				
64	5.76	7.20	8.65				
Const's	368.87	461 08	553.30	Const's	368.87	461.08	553.30

Twister Twist Gear Table.

FRONT ROLL 1½ inch Diameter.

Cylinder 8 inch Diameter. Ratio Cylinder to Whirl 1 to 3.03.

Whirl 2½ inch Diameter. Front Roll Gear 112 Teeth.

Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist	Change Gears	Cyl. 20 T Stud 80 T Twist	Cyl. 20 T Stud 100 T Twist	Cyl. 20 T Stud 120 T Twist
21T			20.58	65T	4 43	5.54	6.65
22			19.64	66	4.36	5.46	6.55
23			18.79	67	4.30	5.37	6.45
24		15.00	18.00	68	4.24	5.30	6.35
25		14.40	17.28	69	4.17	5.22	6.26
26		13.85	16.62	70	4.12	5.14	6.17
27		13.34	16.00	71	4.06	5.07	6.09
28		12.86	15.43	72	4.00	5.00	6.00
29		12.41	14.90	73	3.95	4.93	
30		12.00	14.40	74	3.89	4.87	
31		11.62	13.94	75	3.84	4.80	
32		11.25	13.50	76	3.79	4.74	
33		10.91	13.09	77	3.74	4.68	
34		10.59	12.71	78	3.69	4.62	
35		10.29	12.34	79	3.65	4.56	
36		10.00	12.00	80	3.60	4.50	
37		9.73	11.68	81	3.56	4.45	
38		9.48	11.37	82	3.51	4.39	
39		9.23	11.08	83	3.47	4.34	
40		9.00	10.80	84	3.43	4.29	
41		8.78	10.54	85	3.39	4.24	
42		8.57	10.29	86	3 35	4.19	
43		8 37	10.05	87	3.31	4.13	
44		8.18	9.82	88	3.27	4.09	
45	6.40	8.00	9.60	89	3.24	4.05	
46	6.26	7.83	9.39	90	3.20	4.00	
47	6.13	7.66	9.19	91	3.17	3.96	
48	6.00	7.50	9.00	92	3.13	3.91	
49	5.88	7.35	8.82	93	3.10	3.87	
50	5.76	7.20	8.64	94		3.83	
51	5.65	7.06	8.47	95		3.79	
52	5.54	6.92	8.31	96		3.75	
53	5.44	6.79	8.15				
54	5.33	6 67	8.00				
55	5.24	6.54	7.86				
56	5.14	6.43	7.72				
57	5.05	6.32	7.58				
58	4 97	6.21	7.45				
59	4.88	6.10	7.32				
60	4.80	6.00	7.20				
61	4.72	5.90	7.08				
62	4.65	5.81	6.97				
63	4.57	5.72	6.86				
64	4.50	5.63	6.75				
Const's	288.06	360.07	432.09	Const's	288.06	360.07	432.09

Twister Change Twist Gear Tables.

Cylinder 7 in. Diameter. Whirl $\frac{7}{8}$ in. Diameter.
Speed Ratio of Cylinder to Whirl 1 to 7.25.

Change Gear.	Cyl. 22T. Stud 88T.		Cyl. 36T. Stud 74T.		Cyl. 55T. Stud 55T.	
	$1\frac{3}{8}$ in. Roll 108T. Gear	$1\frac{1}{2}$ in. Roll 112T. Gear	$1\frac{3}{8}$ in. Roll 108T. Gear	$1\frac{1}{2}$ in. Roll 112T. Gear	$1\frac{3}{8}$ in. Roll 108T. Gear	$1\frac{1}{2}$ in. Roll 112T. Gear
	Twist.	Twist.	Twist.	Twist.	Twist.	Twist.
15	48.32	45.93	24.83	23.60	12.08	11.48
16	45.30	43.06	23.28	22.14	11.02	10.76
17	42.63	40.53	21.91	20.83	10.66	10.13
18	40.27	38.28	20.69	19.67	10.07	9.57
19	38.15	36.26	19.60	18.63	9.54	9.06
20	36.24	34.44	18.62	17.70	9.06	8.61
21	34.51	32.81	17.74	16.86	8.63	8.20
22	32.95	31.32	16.93	16.08	8.24	7.83
23	31.51	29.96	16.19	15.35	7.88	7.49
24	30.20	28.71	15.52	14.75	7.55	7.18
25	28.99	27.56	14.90	14.16	7.25	6.89
26	27.88	26.50	14.33	13.62	6.97	6.62
27	26.84	25.52	13.79	13.11	6.71	6.38
28	25.89	24.61	13.30	12.66	6.47	6.15
29	24.99	23.75	12.84	12.21	6.25	5.94
30	24.16	22.96	12.41	11.80	6.04	5.74
31	23.38	22.22	12.01	11.42	5.84	5.55
32	22.65	21.53	11.64	11.06	5.66	5.38
33	21.96	20.88	11.28	10.73	5.49	5.22
34	21.32	20.26	10.95	10.41	5.33	5.06
35	20.71	19.68	10.64	10.11	5.18	4.92
36	20.13	19.13	10.34	9.84	5.03	4.78
37	19.59	18.62	10.06	9.57	4.90	4.65
38	19.07	18.13	9.80	9.32	4.77	4.53
39	18.58	17.69	9.55	9.08	4.64	4.42
40	18.12	17.22	9.31	8.85	4.53	4.30
41	17.68	16.80	9.08	8.63	4.42	4.20
42	17.26	16.40	8.87	8.43	4.31	4.10
43	16.85	16.02	8.66	8.23	4.21	4.00
44	16.47	15.66	8.46	8.04	4.12	3.91
45	16.11	15.33	8.27	7.86	4.03	3.83
46	15.76	14.98	8.09	7.69	3.94	3.74
47	15.42	14.66	7.92	7.53	3.85	3.66
48	15.10	14.35	7.76	7.37	3.77	3.59
49	14.79	14.06	7.60	7.22	3.70	3.51
50	14.49	13.78	7.45	7.08	3.62	3.44
51	14.21	13.51	7.30	6.94	3.55	3.38
52	13.94	13.25	7.16	6.81	3.48	3.31
53	13.67	13.00	7.03	6.68	3.42	3.25
54	13.42	12.76	6.90	6.55	3.35	3.19
55	13.18	12 54	6.77	6.44	3.29	3.13
56	12.94	12.30	6.65	6.32	3.23	3.07
57	12.72	12.10	6.53	6.21	3.18	3.02
58	12.50	11.88	6.42	6.10	3.12	2.97
59	12.28	11.69	6.31	6.00	3.07	2.92
60	12.08	11.48	6.21	5.90	3.02	2.87

Twister Change Twist Gear Tables.

Cylinder 7 in. Diameter. Whirl $1\frac{5}{16}$ in. Diameter.
Speed Ratio of Cylinder to Whirl 1 to 4.80.

Change Gear.	Cyl. 22T. Stud 88T.		Cyl. 36T. Stud 74T.		Cyl. 55T. Stud 55T.	
	$1\frac{3}{8}$ in. Roll 108T. Gear	$1\frac{1}{2}$ in. Roll 112T. Gear	$1\frac{3}{8}$ in. Roll 108T. Gear	$1\frac{1}{2}$ in. Roll 112T. Gear	$1\frac{3}{8}$ in. Roll 108T. Gear	$1\frac{1}{2}$ in. Roll 112T. Gear
	Twist.	Twist.	Twist.	Twist.	Twist.	Twist.
15	32.00	30.41	16.44	15.63	8.00	7.60
16	30.00	28.51	15.41	14.65	7.50	7.13
17	28.23	26.83	14.50	13.79	7.06	6.71
18	26.66	25.34	13.70	13.02	6.67	6.33
19	25.26	24.01	12.98	12.34	6.32	6.00
20	24.00	22.80	12.33	11.72	6.00	5.70
21	22.85	21.72	11.74	11.16	5.71	5.43
22	21.81	20.73	11.21	10.66	5.45	5.18
23	20.86	19.83	10.72	10.19	5.22	4.96
24	20.00	19.01	10.28	9.77	5.00	4.75
25	19.20	18.24	9.86	9.38	4.80	4.56
26	18.46	17.54	9.49	9.02	4.61	4.38
27	17.77	16.89	9.13	8.68	4.44	4.22
28	17.14	16.29	8.81	8.37	4.29	4.07
29	16.55	15.73	8.50	8.08	4.14	3.93
30	16.00	15.20	8.22	7.81	4.00	3.80
31	15.48	14.71	7.96	7.56	3.87	3.68
32	15.00	14.27	7.70	7.33	3.75	3.57
33	14.54	13.82	7.47	7.10	3.64	3.45
34	14.11	13.41	7.25	6.89	3.53	3.35
35	13.71	13.03	7.05	6.70	3.43	3.26
36	13.33	12.67	6.85	6.51	3.33	3.17
37	12.97	12.33	6.67	6.33	3.24	3.08
38	12.63	12.00	6.49	6.17	3.16	3.00
39	12.30	11.68	6.32	6.01	3.08	2.92
40	12.00	11.40	6.16	5.86	3.00	2.85
41	11.70	11.13	6.01	5.72	2.93	2.78
42	11.42	10.87	5.87	5.58	2.86	2.72
43	11.16	10.61	5.73	5.45	2.79	2.65
44	10.90	10.34	5.60	5.33	2.73	2.58
45	10.66	10.13	5.48	5.21	2.67	2.53
46	10.43	9.92	5.36	5.09	2.61	2.48
47	10.21	9.71	5.25	4.99	2.55	2.43
48	10.00	9.50	5.14	4.88	2.50	2.37
49	9.79	9.31	5.03	4.78	2.45	2.33
50	9.60	9.12	4.93	4.69	2.40	2.28
51	9.41	8.95	4.83	4.60	2.35	2.24
52	9.23	8.77	4.74	4.51	2.31	2.19
53	9.05	8.61	4.65	4.43	2.26	2.15
54	8.88	8.45	4.57	4.34	2.22	2.11
55	8.72	8.30	4.48	4.27	2.18	2.08
56	8.57	8.14	4.40	4.19	2.14	2.03
57	8.42	8.01	4.33	4.12	2.11	2.00
58	8.27	7.86	4.25	4.04	2.07	1.96
59	8.13	7.74	4.18	3.98	2.03	1.93
60	8.00	7.60	4.11	3.91	2.00	1.90

Twister Change Twist Gear Tables.

Cylinder 8 in. Diameter. Whirl $\frac{7}{8}$ in. Diameter.
Speed Ratio of Cylinder to Whirl 1 to 8.28.

Change Gear.	Cyl. 22T. $1\frac{3}{8}$ in. Roll 108T. Gear Twist.	Stud 88T. $1\frac{1}{2}$ in. Roll 112T. Gear Twist.	Cyl. 36T. $1\frac{3}{8}$ in. Roll 108T. Gear Twist.	Stud 74T. $1\frac{1}{2}$ in. Roll 112T. Gear Twist.	Cyl. 55T. $1\frac{3}{8}$ in. Roll 108T. Gear Twist.	Stud 55T. $1\frac{1}{2}$ in. Roll 112T. Gear Twist.
15	55.18	52.46	28.36	26.96	13.79	13.11
16	51.73	49.18	26.58	25.27	12.93	12.29
17	48.70	46.28	25.02	23.78	12.17	11.57
18	45.98	43.71	23.63	22.46	11.49	10.93
19	43.56	41.41	22.38	21.28	10.89	10.35
20	41.38	39.34	21.27	20.21	10.34	9.83
21	39.41	37.47	20.25	19.25	9.85	9.37
22	37.62	35.77	19.34	18.38	9.41	8.94
23	35.99	34.21	18.49	17.58	9.00	8 55
24	34.49	32.78	17.72	16.85	8.62	8.19
25	33.11	31.47	17.01	16.17	8.28	7.87
26	31.84	30.26	16.36	15.55	7.96	7.56
27	30.66	29.14	15.75	14.98	7.66	7.28
28	29.56	28.10	15.19	14.44	7.39	7.02
29	28.54	27.13	14.67	13.94	7.13	6.78
30	27.59	26.23	14.18	13.47	6.90	6.56
31	26.70	25.38	13.72	13.04	6.68	6.34
32	25.87	24.59	13.29	12.64	6.47	6.15
33	25.08	23.84	12.89	12.25	6.27	5.96
34	24.34	23.14	12.51	11.89	6.08	5.78
35	23.65	22.48	12.15	11.55	5.91	5.62
36	22.99	21.86	11.81	11.23	5.75	5.46
37	22.37	21.26	11.49	10.93	5.59	5.31
38	21.78	20.71	11.19	10.64	5.44	5.18
39	21.22	20.17	10.91	10.36	5.30	5.04
40	20.69	19.67	10.63	10.11	5.17	4.92
41	20.19	19.19	10.37	9.86	5.05	4.80
42	19.71	18.73	10.12	9.63	4.93	4.68
43	19.25	18.34	9.89	9.40	4.81	4.58
44	18.81	17.88	9.67	9.19	4.70	4.47
45	18.39	17.48	9.45	8.98	4.60	4.37
46	17.99	17.11	9.25	8.79	4.50	4.28
47	17.61	16.74	9.05	8.60	4.40	4.18
48	17.24	16.39	8.86	8.42	4.31	4.10
49	16.89	16.06	8.68	8.25	4.22	4.01
50	16.55	15.73	8.51	8.09	4.14	3.93
51	16.23	15.44	8.34	7.93	4.06	3.86
52	15.92	15.13	8.18	7.77	3.98	3.78
53	15.62	14.86	8.02	7.64	3.90	3.71
54	15.31	14.57	7.88	7.49	3.83	3.64
55	15.05	14.32	7.73	7.36	3.76	3.58
56	14.78	14.05	7.59	7.22	3.69	3.51
57	14.52	13.82	7.46	7.10	3.63	3.45
58	14.27	13.56	7.33	6.97	3.57	3.39
59	14.03	13.35	7.21	6.86	3.51	3.34
60	13.80	13.11	7.09	6.74	3.45	3.28

Twister Change Twist Gear Tables.

Cylinder 8 in. Diameter. Whirl $1\frac{5}{16}$ in. Diameter.
Speed Ratio of Cylinder to Whirl 1 to 5.48.

Change Gear.	Cyl. 22T.	Stud 88T.	Cyl. 36T.	Stud 74T.	Cyl. 55T.	Stud 55T.
	$1\frac{3}{8}$ in. Roll 108T. Gear	$1\frac{1}{2}$ in. Roll 112T. Gear	$1\frac{3}{8}$ in. Roll 108T. Gear	$1\frac{1}{2}$ in. Roll 112T. Gear	$1\frac{3}{8}$ in. Roll 108T. Gear	$1\frac{1}{2}$ in. Roll 112T. Gear
	Twist.	Twist.	Twist.	Twist.	Twist.	Twist.
15	36.53	34.72	18.77	17.84	9.13	8.68
16	34.25	32.55	17.60	16.73	8.56	8.14
17	32.23	30.63	16.56	15.74	8.06	7.66
18	30.44	28.93	15.64	14.86	7.61	7.24
19	28.84	27.41	14.82	14.08	7.21	6.85
20	27.40	26.04	14.08	13.38	6.85	6.51
21	26.09	24.79	13.41	12.74	6.52	6.20
22	24.90	23.67	12.80	12.16	6.22	5.92
23	23.82	22.64	12.24	11.64	5.95	5.66
24	22.83	21.69	11.73	11.15	5.71	5.42
25	21.92	20.83	11.26	10.71	5.48	5.21
26	21.07	20.03	10.83	10.29	5.27	5.01
27	20.29	19.29	10.43	9.91	5.06	4.82
28	19.57	18.60	10.06	9.56	4.89	4.65
29	18.89	17.95	9.71	9.21	4.72	4.49
30	18.26	17.35	9.38	8.92	4.56	4.34
31	17.67	16.80	9.08	8.63	4.42	4.20
32	17.12	16.28	8.80	8.36	4.28	4.07
33	16.60	15.78	8.53	8.11	4.15	3.94
34	16.11	15.31	8.28	7.86	4.03	3.83
35	15.65	14.88	8.04	7.65	3.91	3.72
36	15.22	14.46	7.82	7.43	3.80	3.61
37	14.81	14.07	7.61	7.23	3.70	3.52
38	14.42	13.70	7.41	7 04	3.60	3.42
39	14.05	13.35	7.22	6.86	3.51	3.34
40	13.70	13.02	7.04	6.69	3.42	3.25
41	13.36	12.70	6.87	6.53	3.34	3.17
42	13.04	12.40	6.70	6.37	3.26	3.10
43	12.74	12.11	6.55	6.22	3.18	3.03
44	12.45	11.83	6.40	6.08	3.11	2.96
45	12.17	11.57	6.25	5.95	3.04	2.89
46	11.91	11.32	6.12	5.82	2.98	2.83
47	11.65	11.08	5.99	5.69	2.91	2.77
48	11.41	10.85	5.86	5.57	2.85	2.71
49	11.18	10.63	5.74	5.46	2.79	2.66
50	10.96	10.41	5.63	5.35	2.74	2.60
51	10.74	10.22	5.52	5.25	2.68	2.56
52	10.53	10.01	5.41	5.15	2.63	2.50
53	10.34	9.83	5.31	5.05	2.58	2.46
54	10.14	9.65	5.21	4.96	2.53	2.41
55	9.96	9.48	5.12	4.87	2.49	2.37
56	9.78	9.30	5.03	4.78	2.44	2.32
57	9.61	9.14	4.94	4.70	2.40	2.29
58	9.44	8.98	4.85	4.62	2.36	2.24
59	9.28	8.83	4.77	4.54	2.32	2.21
60	9.13	8.66	4.69	4.46	2.28	2.16

Twister Change Twist Gear Table.

Whirl 2 inches diameter.

Front Roll 1½ inch diameter. Front Roll Gear 112 teeth.

Change Gear	Cylinder 7 in. diam. Cyl. : Whirl : : 1 : 3.41.			Cylinder 8 in. diam. Cyl. : Whirl : : 1 : 3.88		
	Cyl. 22T. Stud 88T.	Cyl. 36T. Stud 74T.	Cyl. 55T. Stud. 55T.	Cyl. 22T. Stud 88T.	Cyl. 36T. Stud 74T.	Cyl. 55T. Stud 55T.
	Twist.	Twist.	Twist.	Twist.	Twist.	Twist
20T	16.20	8.32	4.05	18.43	9.47	4.61
21	15.43	7.93	3.86	17.56	9.02	4.39
22	14.73	7.57	3.68	16.76	8.61	4.19
23	14.09	7.24	3.52	16.03	8.24	4.01
24	13.50	6.94	3.38	15.37	7.90	3.84
25	12.96	6 66	3.24	14.75	7.58	3.69
26	12.46	6 41	3.12	14.18	7.29	3.55
27	12 00	6 17	3 00	13.66	7.02	3.41
28	11.57	5 95	2.89	13.17	6.77	3.29
29	11.17	5.74	2.79	12.71	6.53	3.18
30	10.80	5.55	2.70	12.29	6.32	3.07
31	10.45	5.37	2.61	11.89	6.11	2.97
32	10.12	5.20	2.53	11.52	5.92	2.88
33	9.82	5 05	2.45	11.17	5.74	2.79
34	9.53	4 90	2.38	10.84	5.57	2.71
35	9.26	4.76	2.31	10 53	5.41	2.63
36	9.00	4.63	2.25	10.24	5.26	2.56
37	8.76	4.50	2.19	9.97	5.12	2.49
38	8.53	4 38	2.13	9.70	4.99	2.43
39	8.31	4.27	2.08	9.45	4.86	2.36
40	8 10	4 16	2 03	9.22	4.74	2.30
41	7.90	4 06	1.98	8.99	4.62	2.25
42	7.72	3.96	1.93	8 78	4.51	2.19
43	7.54	3 87	1.89	8 57	4.41	2.14
44	7.36	3.78	1 84	8.38	4.31	2.10
45	7.20	3.70	1.80	8.19	4.21	2.05
46	7.04	3.62	1.78	8.02	4.12	2.00
48	6.75	3.47	1.69	7.68	3.95	1.92
50	6.48	3.33	1.62	7 37	3.79	1 84
52	6 23	3.20	1.56	7.09	3.64	1.77
54	6 00	3.08	1.50	6 83	3.61	1.71
56	5.79	2.97	1.45	6 58	3.38	1.65
58	5.59	2.87	1.40	6.36	3.27	1.59
60	5.40	2.78	1.35	6 15	3.16	1.54
64	5 06	2 60	1.27	5.76	2.96	1 44
68	4.77	2 45	1.19	5.42	2.79	1 36
72	4.50	2 31	1.13	5.12	2.63	1.28
76	4.26	2 19	1.07	4.85	2 49	1.21
80	4.05	2 08	1.01	4.61	2.37	1.15
84	3.86	1.98	.96	4 39	2 26	1.10
88	3 68	1.89	.92	4.19	2.15	1.05

Table Showing Number Pounds Twisted Yarn Produced in Ten Hours.—2 Ply.

No of Yarn to be Twisted.	Rev. of Spindle per Minute.	Multiplier 4.			Multiplier 5.			Multiplier 6.			Space of Frame in Inches	Dia. of Ring in Inches
		Rev. per Min.		Pounds per Spindle.	Rev. per Min.		Pounds per Spindle.	Rev. per Min.		Pounds per Spindle.		
		1⅜″Roll	1½″Roll		1⅜″Roll	1½″Roll		1⅜″Roll	1½″Roll			
6	4500	150.3	137.8	3.97	120.3	110.3	3.18	100.3	91.9	2.65	4	3
7	4750	147.0	134.8	3.33	117.6	107.8	2.67	98.0	89.8	2.22		
8	5000	144.7	132.6	2.87	115.7	106.1	2.29	96.4	88.4	1.91		
9	5200	141.8	130.0	2.50	113.4	104.0	2.01	94.6	86.7	1.67		
10	5300	137.2	125.8	2.18	109.7	100.6	1.75	91.4	83.8	1.46		
11	5500	135.8	124.5	1.96	108.5	99.5	1.57	90.5	83.0	1.30		
12	5500	130.0	119.1	1.71	103.9	95.2	1.38	86.6	79.4	1.15		
13	5650	128.2	117.5	1.57	102.6	94.1	1.25	85.5	78.4	1.05	3½	2½
14	5750	125.8	115.3	1.43	100.6	92.2	1.14	83.9	76.9	0.96		
15	5900	124.7	114.3	1.31	99.8	91.5	1.06	83.0	76.1	0.88		
16	6000	122.8	112.6	1.22	98.2	90.0	0.98	81.8	75.0	0.81		
17	6000	119.1	109.2	1.12	95.2	87.3	0.89	79.4	72.8	0.74	3¼	2¼
18	6050	116.6	106.9	1.03	93.5	85.7	0.82	77.8	71.3	0.69		
19	6100	114.5	105.0	0.96	91.6	84.0	0.77	76.4	70.0	0.64		
20	6150	112.5	103.1	0.91	90.0	82.5	0.73	75.0	68.8	0.60		
22	6300	109.9	100.7	0.80	87.9	80.6	0.64	73.3	67.2	0.54		
24	6500	108.5	99.5	0.73	86.8	79.6	0.58	72.4	66.4	0.49		
26	6650	106.7	97.8	0.66	85.4	78.3	0.53	71.2	65.3	0.44		
28	6800	105.1	96.3	0.60	84.1	77.1	0.48	70.1	64.3	0.40		
30	6900	103.0	94.4	0.55	82.4	75.5	0.44	68.7	63.0	0.37	3	2
32	7000	101.3	92.9	0.51	81.0	74.3	0.41	67.6	62.0	0.34		
34	7000	98.2	90.0	0.46	78.5	72.0	0.37	65.5	60.0	0.31		
36	7000	95.5	87.5	0.42	76.4	70.0	0.34	63.6	58.3	0.29		
38	7000	92.9	85.2	0.39	74.3	68.1	0.32	61.9	56.7	0.26		
40	7000	90.6	83.1	0.37	72.5	66.5	0.30	60.4	55.4	0.24		
50	7500	86.8	79.6	0.28	69.4	63.6	0.22	57.9	53.1	0.19		
60	7500	79.2	72.6	0.22	63.4	58.1	0.17	52.8	48.4	0.15	2¾	1¾
70	7500	73.4	67.3	0.18	58.7	53.8	0.14	48.9	44.8	0.12		

Allowance has been made for waste, cleaning, oiling and doffing.

Table Showing Number Pounds Twisted Yarn Produced in Ten Hours.—3 Ply.

No of Yarn to be Twisted.	Rev. of Spindle per Minute.	Multiplier 4.			Multiplier 5.			Multiplier 6.			Space of Frame in Inches	Dia. of Ring in Inches
		Rev. per Min.		Pounds per Spindle.	Rev. per Min.		Pounds per Spindle.	Rev. per Min.		Pounds per Spindle.		
		1⅜"Roll	1½"Roll		1⅜"Roll	1½"Roll		1⅜"Roll	1½"Roll			
6	4000	163.6	150.0	6.48	130.9	120.0	5.18	109.1	100.0	4.33	4½	3½
7	4300	162.9	149.3	5.54	130.3	119.4	4.43	108.6	99.6	3.69		
8	4550	161.2	147.8	4.80	129.1	118.3	3.83	107.5	98.5	3.20		
9	4800	160.4	147.0	4.23	128.3	117.6	3.38	106.9	98.0	2.82		
10	5000	158.6	145.4	3.77	126.7	116.2	3.02	105.7	96.9	2.51		
11	5200	157.1	144.0	3.39	125.8	115.3	2.71	104.8	96.1	2.26		
12	5350	154.8	141.9	3.07	123.8	113.5	2.46	103.2	94.6	2.05		
13	5500	152.8	140.1	2.80	122.3	112.1	2.24	101.9	93.4	1.87	4	3
14	5600	150.0	137.5	2.54	120.0	110.0	2.03	100.0	91.7	1.69		
15	5750	148.8	136.4	2.36	119.0	109.1	1.89	99.2	90.9	1.57		
16	5850	146.6	134.4	2.18	117.2	107.4	1.74	97.7	89.6	1.45		
17	5850	142.2	130.4	1.99	113.8	104.3	1.59	94.8	86.9	1.33		
18	5950	140.5	128.8	1.86	112.4	103.0	1.49	93.7	85.9	1.24		
19	6000	137.9	126.4	1.72	110.4	101.2	1.38	92.0	84.3	1.15		
20	6000	134.5	123.3	1.60	107.6	98.6	1.28	89.7	82.2	1.07	3½	2½
22	6000	128.2	117.5	1.39	102.5	94.0	1.12	85.5	78.4	0.93		
24	6000	122.8	112.6	1.22	98.2	90.0	0.98	81.9	75.1	0.81		
26	6100	120.1	110.1	1.09	95.9	87.9	0.87	80.0	73.3	0.73		
28	6250	118.4	108.5	1.01	94.7	86.8	0.81	78.9	72.3	0.67		
30	6400	117.1	107.3	0.94	93.7	85.9	0.75	78.1	71.6	0.63	3¼	2¼
32	6500	115.2	105.6	0.86	92.1	84.4	0.69	76.8	70.4	0.57		
34	6500	111.8	102.5	0.79	89.4	82.0	0.63	74.5	68.3	0.53		
36	6500	108.5	99.5	0.73	86.9	79.7	0.58	72.4	66.4	0.49		
38	6500	105.6	96.8	0.67	84.5	77.5	0.54	70.5	64.6	0.45		
40	6500	102.9	94.3	0.62	82.4	75.5	0.50	68.7	63.0	0.41	3	2
50	7000	99.2	90.9	0.47	79.3	72.8	0.38	66.2	60.7	0.31	2¾	1¾
60	7000	90.5	83.0	0.37	72.5	66.5	0.30	60.4	55.4	0.25		
70	7000	83.8	76.8	0.30	67.1	61.5	0.24	55.9	51.2	0.20		

Allowance has been made for waste, cleaning, oiling and doffing.

Table Showing Number Pounds Twisted Yarn Produced in Ten Hours.—4 Ply.

No. of Yarn to be Twisted.	Rev. of Spindle per Minute.	Multiplier 4.			Multiplier 5.			Multiplier 6.			Space of Frame in Inches	Dia. of Ring in Inches
		Rev. per Min.		Pounds per Spindle.	Rev. per Min.		Pounds per Spindle.	Rev. per Min.		Pounds per Spindle		
		1⅜"Roll	1½"Roll		1⅜"Roll	1½"Roll		1⅜"Roll	1½"Roll			
6	3500	165.3	151.5	8.73	132.3	121.3	6.98	110.2	101.0	5.82	5	4
7	3750	163.2	149.6	7.39	131.3	120.4	5.95	109.3	100.2	4.95		
8	3950	161.5	148.0	6.40	129.3	118.5	5.13	107.7	98.7	4.27		
9	4100	158.2	145.0	5.57	126.5	116.0	4.46	105.5	96.7	3.72		
10	4300	157.5	144.4	4.99	125.8	115.3	3.99	104.9	96.2	3.33		
11	4450	155.4	142.5	4.48	124.3	113.9	3.58	103.5	94.9	2.98		
12	4600	153.7	140.9	4.07	123.0	112.8	3.25	102.5	94.0	2.71		
13	4700	151.0	138.4	3.69	120.8	110.7	2.94	100.6	92.2	2.46	4½	3½
14	4800	148.5	136.1	3.36	118.8	108.9	2.69	99.0	90.8	2.24		
15	4900	146.3	134.1	3.09	117.2	107.4	2.48	97.6	89.5	2.06		
16	5000	144.7	132.6	2.87	115.7	106.1	2.29	96.4	88.4	1.91		
17	5100	143.1	131.2	2.67	114.5	105.0	2.13	95.4	87.5	1.78		
18	5200	141.7	129.9	2.50	113.4	104.0	2.00	94.5	86.6	1.67	4	3
19	5250	139.3	127.7	2.32	111.5	102.2	1.86	92.9	85.2	1.55		
20	5300	137.2	125.8	2.18	109.7	100.6	1.75	91.4	83.8	1.45		
22	5450	134.5	123.3	1.94	107.6	98.6	1.55	89.7	82.2	1.29		
24	5600	132.2	121.2	1.75	105.8	97.0	1.40	88.2	80.9	1.17		
26	5700	129.4	118.6	1.58	103.5	94.9	1.26	86.2	79.0	1.05	3½	2½
28	5800	127.0	116.4	1.44	161.5	93.0	1.15	84.6	77.6	0.96		
30	5900	124.7	114.3	1.31	99.8	91.5	1.05	83.1	76.2	0.87		
32	5950	121.8	111.7	1.21	97.4	89.3	0.97	81.2	74.4	0.81		
34	6000	119.1	109.2	1.12	95.2	87.3	0.90	79.4	72.8	0.75		
36	6050	116.7	107.0	1.03	93.4	85.6	0.82	77.8	71.3	0.69	3	2
38	6100	114.5	105.0	0.96	91.6	84.0	0.77	76.4	70.0	0.64		
40	6100	111.6	102.3	0.89	89.3	81.9	0.71	74.4	68.2	0.60		
50	6450	105.6	96.8	0.67	84.5	77.5	0.54	70.4	64.5	0.45	2¾	1¾
60	6750	100.9	92.5	0.54	80.7	74.0	0.43	67.2	61.6	0.36		
70	6900	95.4	87.5	0.44	76.4	70.0	0.35	63.6	58.3	0.29		

Allowance has been made for waste, cleaning, oiling and doffing.

Table Showing Number Pounds Twisted Yarn Produced in Ten Hours.—5 Ply.

No. of Yarn to be Twisted.	Rev. of Spindle per Minute.	Multiplier 4.			Multiplier 5.			Multiplier 6.			Space of Frame in Inches	Dia. of Ring in Inches
		Rev. per Min.		Pounds per Spindle.	Rev. per Min.		Pounds per Spindle.	Rev. per Min.		Pounds per Spindle		
		1⅜"Roll	1½"Roll		1⅜"Roll	1½"Roll		1⅜"Roll	1½"Roll			
6	2800	148.0	135.7	9.77	118.3	108.4	7.81	98.7	90.5	6.52	5½	4½
7	3000	146.8	134.6	8.31	117.3	107.5	6.64	97.8	89.7	5.54		
8	3150	144.1	132.1	7.13	115.4	105.8	5.71	96.1	88.1	4.75		
9	3300	142.2	130.4	6.26	113.8	104.3	5.01	94.9	87.0	4.17		
10	3400	139.1	127.5	5.51	111.3	102.0	4.41	92.7	85.0	3.67	5	4
11	3550	138.6	127.1	4.99	110.8	101.6	3.99	92.4	84.7	3.33		
12	3650	136.3	124.9	4.50	109.0	99.9	3.60	90.8	83.2	3.00		
13	3750	134.6	123.4	4.10	107.7	98.7	3.29	89.8	82.3	2.73		
14	3800	131.5	120.5	3.72	105.1	96.3	2.98	87.6	80.3	2.48		
15	3900	130.3	119.4	3.44	104.3	95.6	2.75	86.8	79.6	2.29		
16	3950	127.7	117.1	3.16	102.2	93.7	2.53	85.2	78.1	2.11		
17	4000	125.5	115.0	2.93	100.4	92.0	2.34	83.7	76.7	1.95		
18	4050	123.5	113.2	2.72	98.8	90.6	2.18	82.4	75.5	1.81		
19	4100	121.7	111.6	2.54	97.3	89.2	2.03	81.1	74.3	1.70		
20	4150	120.1	110.1	2.38	96.1	88.1	1.90	80.1	73.4	1.59	4½	3½
22	4200	116.2	106.5	2.09	92.7	85.0	1.67	77.2	70.8	1.39		
24	4300	113.6	104.1	1.88	90.9	83.3	1.50	75.7	69.4	1.25		
26	4350	110.4	101.2	1.68	88.3	80.9	1.34	73.6	67.5	1.12		
28	4100	107.6	98.6	1.52	86.1	78.9	1.22	71.7	65.6	1.01		
30	4500	106.3	97.4	1.41	85.1	78.0	1.13	70.9	65.0	0.94		
32	4550	104.1	95.4	1.29	83.3	76.4	1.03	69.4	63.6	0.86		
34	4600	102.1	93.6	1.19	81.7	74.9	0.95	68.0	62.3	0.79		
36	4600	99.2	90.9	1.09	79.4	72.8	0.87	66.1	60.6	0.73	4	3
38	4600	96.6	88.7	1.01	77.3	70.9	0.81	64.4	59.0	0.67		
40	4600	94.1	86.3	0.93	75.3	69.0	0.74	62.7	57.5	0.62		
50	4900	89.7	82.2	0.72	71.7	65.7	0.58	59.8	54.8	0.48		
60	5200	86.8	79.6	0.58	69.5	63.7	0.46	57.9	53.1	0.39	3½	2½
70	5450	84.3	77.3	0.48	67.4	61.8	0.38	56.2	51.5	0.32		

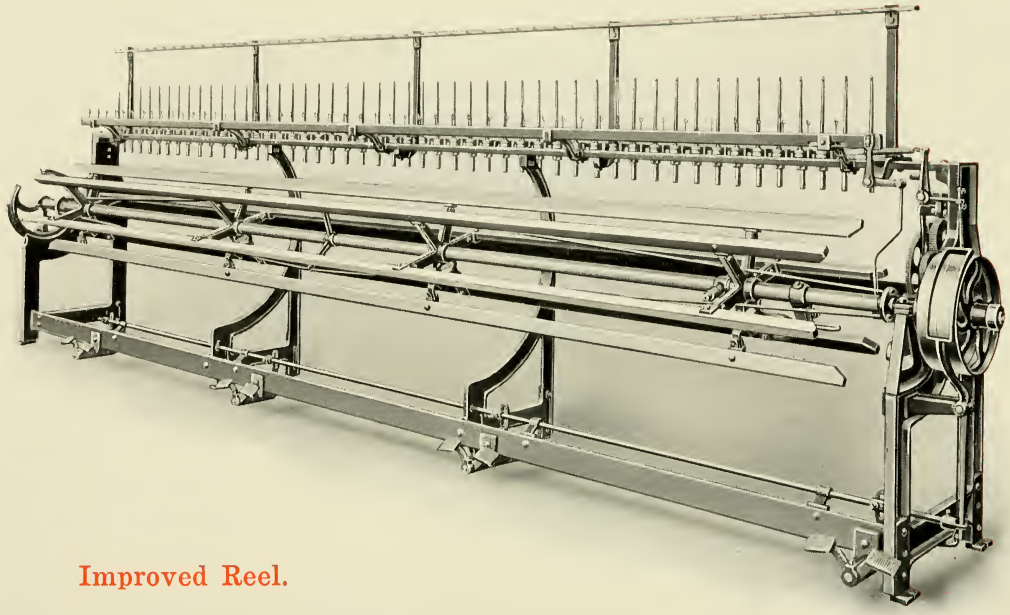
Allowance has been made for waste, cleaning, oiling and doffing.

Table Showing Number Pounds Twisted Yarn Produced in Ten Hours.—6 Ply.

No of Yarn to be Twisted.	Rev. of Spindle per Minute.	Multiplier 4.			Multiplier 5.			Multiplier 6.			Space of Frame in Inches	Dia. of Ring in Inches
		Rev. per Min.		Pounds per Spindle.	Rev. per Min.		Pounds per Spindle.	Rev. per Min.		Pounds per Spindle.		
		1⅜"Roll	1½"Roll		1⅜"Roll	1½"Roll		1⅜"Roll	1½"Roll			
6	2400	138.9	127.3	11.00	111.1	101.8	8.80	92.6	84.9	7.34	5½	4½
7	2550	136.7	125.3	9.28	109.3	100.2	7.42	91.1	83.5	6.19		
8	2700	135.3	124.0	8.04	108.4	99.4	6.44	90.2	82.7	5.36		
9	2850	134.6	123.4	7.13	107.8	98.8	5.70	89.8	82.3	4.75		
10	2950	132.3	121.3	6.29	105.9	97.1	5.03	88.1	80.8	4.19	5	4
11	3050	130.3	119.4	5.64	104.3	95.6	4.51	86.9	79.7	3.76		
12	3150	128.8	118.1	5.10	103.1	94.5	4.08	85.9	78.7	3.40		
13	3250	127.7	117.6	4.68	102.2	93.7	3.74	85.2	78.1	3.12		
14	3350	126.9	116.3	4.31	101.5	93.0	3.45	84.6	77.6	2.88		
15	3450	126.4	115.9	4.00	101.0	92.6	3.20	84.2	77.2	2.67		
16	3550	125.8	115.3	3.74	100.7	92.3	2.99	83.9	76.9	2.49		
17	3600	123.8	113.5	3.46	99.0	90.8	2.77	82.5	75.6	2.31		
18	3650	121.9	111.7	3.23	97.6	89.5	2.58	81.3	74.5	2.15		
19	3700	120.3	110.3	3.01	96.2	88.2	2.41	80.2	73.5	2.01		
20	3750	118.9	109.0	2.83	95.1	87.2	2.26	79.3	72.7	1.88	4½	3½
22	3850	116.3	106.6	2.51	93.1	85.3	2.01	77.6	71.1	1.68		
24	4000	115.7	106.1	2.30	92.6	84.9	1.84	77.2	70.8	1.53		
26	4050	112.5	103.1	2.06	90.1	82.6	1.05	75.1	68.8	1.38		
28	4100	109.8	100.6	1.86	87.9	80.6	1.49	73.2	67.1	1.24		
30	4150	107.4	98.5	1.70	85.9	78.7	1.36	71.6	65.6	1.13	4	3
32	4200	105.2	96.4	1.56	84.2	77.2	1.25	70.1	64.3	1.04		
34	4200	102.1	93.6	1.43	81.7	74.9	1.14	68.1	62.4	0.95		
36	4250	100.4	92.0	1.32	80.3	73.6	1.06	66.9	61.3	0.88		
38	4250	97.7	89.6	1.23	78.2	71.7	0.98	65.2	59.8	0 82	3½	2½
40	4250	93.4	85.6	1.14	76.2	69.9	0.91	63.5	58.2	0.76		
50	4550	91.2	83.6	0.87	73.0	66.9	0.70	60.8	55.7	0.58		
60	4750	86.9	79.7	0.70	69.5	63.7	0.56	58.0	53.2	0.47		
70	4950	83.9	76.9	0.58	67.1	61.5	0.46	55.9	51.2	0.38	3	2

Allowance has been made for waste, cleaning, oiling and doffing.

REELING.



Improved Reel.

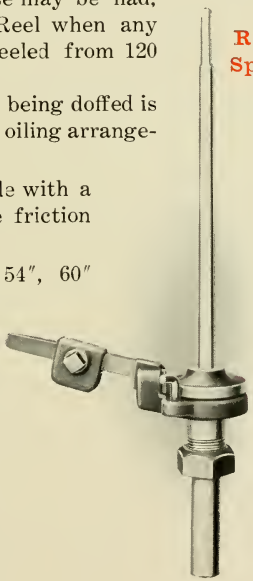
THE IMPROVED REEL.

This machine is simple in design, well built and light running. The heaviest yarns can be reeled with practically no vibrations to the machine, owing to its rigid construction, and the perfect balancing of the swift. The wheel method of doffing is used, either plain or cross traverse may be had, also stop mechanism to stop the Reel when any desired length of skein has been reeled from 120 yards to 840 yards.

All risk of soiling the yarn while being doffed is eliminated by the use of our patented oiling arrangement, applied to doffing wheel.

The spindles are usually made with a uniform friction, but an adjustable friction spindle may be had, if preferred.

The swift is adjustable for 54″, 60″ and 72″ skeins, and can be arranged to wind 90″ skeins also.



Driving Pulleys: 12 inches diameter by 2 inch face, running from 100 to 150 revolutions per minute, according to the size of skein and strength of yarn.

Horse Power: 300 spindles per horse power.

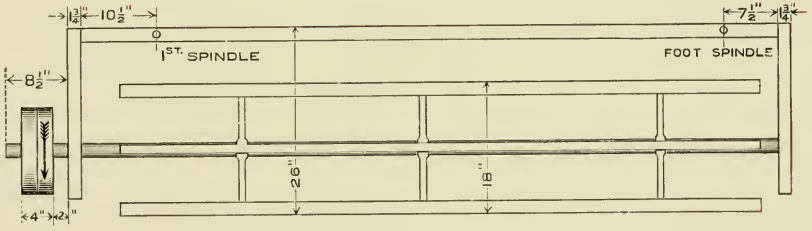
Floor space: width, 2 feet, 2 inches; length, according to the number of spindles and space as per table of floor space.

Weights: shipping weight, 90 pounds per foot; net weight, 60 pounds per foot.

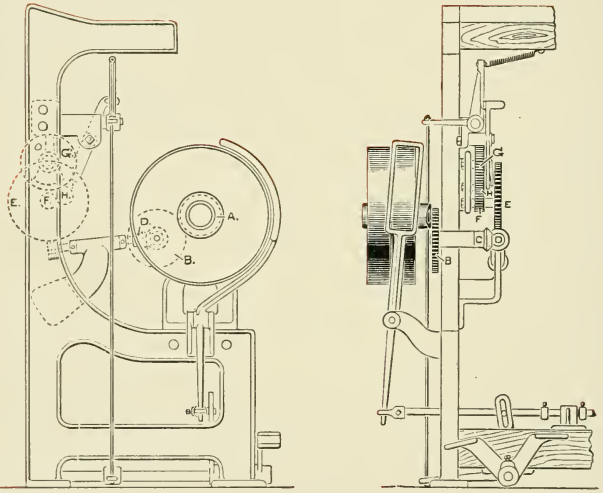
Reel.

FLOOR SPACE.

No. of Spindles	2¾ in. Space.		3 in. Space.		3¼ in. Space.		3½ in. Space.		3¾ in. Space.		4 in. Space.		No. of Spindles
	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in	ft.	in.	
30									11	6¾	12	2	30
32							11	6½	12	2¼	12	10	32
34					11	5¼	12	1½	12	9¾	13	6	34
36			11	3	11	11¾	12	8½	13	5¼	14	2	36
38			11	9	12	6¼	13	3½	14	0¾	14	10	38
40	11	5¼	12	3	13	0¾	13	10½	14	8¼	15	6	40
42	11	10¾	12	9	13	7¼	14	5½	15	3¾	16	2	42
44	12	4¼	13	3	14	1¾	15	0½	15	11¼			44
46	12	9¾	13	9	14	8¼	15	7½					46
48	13	3¼	14	3	15	2¾	16	2½					48
50	13	8¾	14	9	15	9¼							50
52	14	2¼	15	3	16	3¾							52
54	14	7¾	15	9									54
56	15	1¼	16	3									56
58	15	6¾											58
60	16	0¼											60



FLOOR PLAN OF REEL.



REEL STOP-MOTION DIAGRAM.

Change Gear Tables.

Reel Stop Motions.

Plain Traverse.

Yds.	A	B	D	F	G	H	54″ Reel.		62″ Reel.		72″ Reel.		90″ Reel.	
							C	E	C	E	C	E	C	E
120	38	63	20	42	16	21	21	133	20	114	20	95	20	76
240	38	63	20	21	16	42	21	133	20	114	20	95	20	76
360	38	63	20	21	24	42	21	133	20	114	20	95	20	76
480	38	63	20	21	32	42	21	133	20	114	20	95	20	76
600	38	63	20	21	40	42	21	133	20	114	20	95	20	76
720	38	63	20	21	48	42	21	133	20	114	20	95	20	76
840	38	63	20	21	56	42	21	133	20	114	20	95	20	76

Gears F and H are interchangeable.

This Motion cannot be used on Cross Traverse.

Cross Traverse.

Yds	A	B	F	G	H	54″ Reel.			60″ Reel.			72″ Reel.			90″ Reel.		
						C	D	E	C	D	E	C	D	E	C	D	E
120	42	91	42	16	21	26	20	126	26	21	108	39	21	135	39	21	108
240	42	91	21	16	42	26	20	126	26	21	108	39	21	135	39	21	108
360	42	91	21	24	42	26	20	126	26	21	108	39	21	135	39	21	108
480	42	91	21	32	42	26	20	126	26	21	108	39	21	135	39	21	108
600	42	91	21	40	42	26	20	126	26	21	108	39	21	135	39	21	108
720	42	91	21	48	42	26	20	126	26	21	108	39	21	135	39	21	108
840	42	91	21	56	42	26	20	126	26	21	108	39	21	135	39	21	108

Gears F and H are interchangeable.

This Motion cannot be used on Plain Traverse.

Reel Production Tables.

No. Yarn.	54 IN. REEL. Revolutions per Minute. 125	130	135	140	145	150	60 IN. REEL. Revolutions per Minute. 120	125	130	135	140	145	No. Yarn.
1	50.22	52.24	54.24	56.25	58.26	60.27	53.57	55.81	58.04	60.27	62.50	64.74	1
2	25.11	26.12	27.12	28.12	29.13	30.14	26.79	27.91	29.02	30.14	31.25	32.37	2
3	16.74	17.41	18.08	18.75	19.42	20.09	17.86	18.60	19.35	20.09	20.84	21.58	3
4	12.55	13.06	13.56	14.07	14.57	15.07	13.40	13.95	14.51	15.07	15.62	16.18	4
5	10.04	10.45	10.85	11.25	11.65	12.06	10.72	11.16	11.61	12.06	12.50	12.95	5
6	8.37	8.71	9.03	9.38	9.71	10.05	8.93	9.30	9.67	10.05	10.42	10.79	6
7	7.17	7.46	7.75	8.04	8.33	8.61	7.66	7.97	8.29	8.61	8.93	9.25	7
8	6.28	6.53	6.78	7.04	7.28	7.54	6.70	6.98	7.26	7.54	7.82	8.09	8
9	5.58	5.81	6.03	6.25	6.48	6.70	5.95	6.20	6.45	6.70	6.95	7.20	9
10	5.02	5.23	5.43	5.63	5.83	6.03	5.36	5.58	5.81	6.03	6.25	6.48	10
11	4.56	4.75	4.93	5.12	5.30	5.48	4.87	5.08	5.28	5.48	5.64	5.89	11
12	4.18	4.36	4.52	4.69	4.86	5.02	4.46	4.65	4.84	5.02	5.21	5.40	12
13	3.86	4.02	4.17	4.33	4.48	4.64	4.12	4.29	4.47	4 64	4.81	4.98	13
14	3.58	3.73	3.88	4.02	4.16	4.30	3.83	3.99	4.15	4.31	4.47	4.63	14
15	3.34	3.48	3.62	3.75	3.89	4.02	3.57	3.72	3.87	4.02	4.17	4.32	15
16	3.14	3.27	3.39	3.52	3.64	3.77	3.35	3.49	3.63	3.77	3.91	4.05	16
17	2.95	3.08	3.20	3.31	3.43	3.55	3.15	3.29	3.42	3.55	3.68	3.81	17
18	2.79	2.90	3.02	3.13	3.24	3.35	2.98	3.10	3.23	3.35	3.47	3.59	18
19	2.65	2.75	2.85	2.96	3.07	3.17	2.82	2.99	3.06	3.17	3.29	3.41	19
20	2.51	2.61	2.70	2.82	2.92	3.02	2.68	2.79	2.90	3.02	3.13	3.24	20
21	2.40	2.49	2.58	2.68	2.78	2.87	2.55	2.66	2.77	2.87	2.98	3.08	21
22	2.28	2.38	2.47	2.56	2.65	2.74	2.44	2.54	2.64	2.74	2.84	2.95	22
23	2.19	2.27	2.36	2.45	2.54	2.62	2.33	2.43	2.53	2.62	2.72	2.82	23
24	2.10	2.18	2.26	2.35	2.43	2.51	2.24	2.33	2.42	2.51	2.61	2.69	24
25	2.01	2.09	2.17	2.25	2.33	2.41	2.15	2.23	2.32	2.41	2.50	2.59	25
26	1.93	2.01	2.09	2.17	2.24	2.32	2.06	2.15	2.23	2.32	2.41	2.49	26
27	1.86	1.94	2.01	2.09	2.16	2.23	1.99	2.07	2.15	2.23	2.32	2.40	27
28	1.80	1.87	1.94	2.01	2.08	2.15	1.92	2.00	2.08	2.15	2.23	2.31	28
29	1.73	1.80	1.87	1.94	2.01	2.08	1.85	1.93	2.00	2.08	2.16	2.23	29
30	1.68	1.74	1.81	1.88	1.94	2.01	1.79	1.86	1.94	2.01	2.09	2.16	30

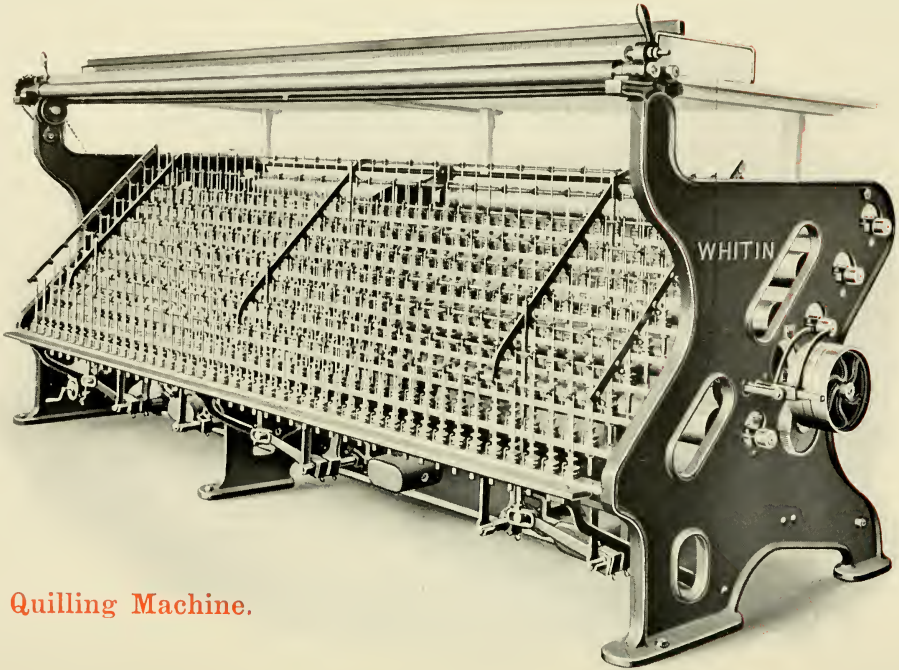
NOTE:—Result in pounds per spindle per day. Allowance is made in above table for doffing, etc.

Reel Production Tables. Continued.

72 IN. REEL. Revolutions per Minute.							90 IN. REEL. Revolutions per Minute.						
No. Yarn.	110	115	120	125	130	135	100	105	110	115	120	125	No. Yarn.
1	58.93	61.61	64.29	66.97	69.65	72.33	66.97	70.31	73.66	77.01	80.36	83.71	1
2	29.47	30.81	32.15	33.49	34.83	36.16	33.49	35.16	36.83	38.51	40.18	41.86	2
3	19.65	20.54	21.43	22.33	23.22	24.11	22.32	23.44	24.56	25.67	26.78	27.90	3
4	14.74	15.40	16.07	16.74	17.41	18.08	16.74	17.58	18.42	19.26	20.09	20.93	4
5	11.79	12.32	12.86	13.40	13.93	14.47	13.40	14.06	14.73	15.40	16.07	16.74	5
6	9.82	10.27	10.72	11.16	11.61	12.05	11.16	11.72	12.33	12.84	13.40	13.95	6
7	8.42	8.73	9.19	9.57	9.95	10.33	9.57	10.05	10.53	11.00	11.48	11.96	7
8	7.37	7.70	8.04	8.37	8.71	9.04	8.37	8.79	9.21	9.63	10.05	10.47	8
9	6.55	6.85	7.15	7.44	7.74	8.04	7.44	7.81	8.19	8.56	8.93	9.30	9
10	5.90	6.16	6.43	6.70	6.97	7.23	6.70	7.03	7.37	7.70	8.04	8.37	10
11	5.36	5.60	5.85	6.09	6.33	6.58	6.09	6.39	6.70	7.00	7.31	7.61	11
12	4.91	5.14	5.36	5.58	5.81	6.03	5.58	5.86	6.14	6.42	6.70	6.98	12
13	4.54	4.74	4.95	5.15	5.36	5.57	5.15	5.41	5.66	5.93	6.18	6.44	13
14	4.21	4.40	4.59	4.79	4.97	5.17	4.79	5.03	5.26	5.50	5.74	5.98	14
15	3.93	4.11	4.29	4.47	4.64	4.82	4.47	4.69	4.91	5.14	5.36	5.58	15
16	3.69	3.85	4.02	4.19	4.36	4.52	4.19	4.40	4.61	4.82	5.02	5.23	16
17	3.47	3.63	3.78	3.94	4.20	4.26	3.94	4.14	4.34	4.53	4.73	4.93	17
18	3.28	3.43	3.57	3.72	3.87	4.02	3.72	3.91	4.09	4.28	4.47	4.65	18
19	3.10	3.24	3.39	3.53	3.67	3.81	3.53	3.70	3.88	4.05	4.23	4.41	19
20	2.95	3.08	3.22	3.35	3.49	3.62	3.35	3.52	3.69	3.85	4.02	4.19	20
21	2.81	2.94	3.06	3.19	3.32	3.45	3.19	3.35	3.51	3.67	3.83	3.99	21
22	2.68	2.80	2.92	3.05	3.17	3.29	3.05	3.20	3.35	3.50	3.66	3.81	22
23	2.56	2.68	2.80	2.91	3.03	3.15	2.91	3.06	3.21	3.35	3.50	3.64	23
24	2.46	2.57	2.68	2.79	2.90	3.02	2.79	2.93	3.07	3.21	3.35	3.49	24
25	2.36	2.47	2.57	2.68	2.79	2.90	2.68	2.81	2.95	3.08	3.22	3.35	25
26	2.27	2.37	2.47	2.58	2.68	2.78	2.58	2.71	2.84	2.96	3.09	3.22	26
27	2.19	2.28	2.38	2.48	2.58	2.68	2.48	2.61	2.73	2.85	2.98	3.10	27
28	2.11	2.20	2.30	2.39	2.49	2.58	2.39	2.51	2.63	2.75	2.87	2.99	28
29	2.03	2.13	2.22	2.31	2.40	2.50	2.31	2.43	2.54	2.66	2.77	2.89	29
30	1.97	2.06	2.15	2.23	2.32	2.41	2.23	2.35	2.46	2.57	2.68	2.79	30

NOTE:—Result in pounds per spindle per day. Allowance is made in above table for doffing, etc.

QUILLING.



Quilling Machine.

LONG CHAIN QUILLING MACHINE.

Since the introduction of our **Quilling Machine** to the trade, the long chain process of finishing yarns has come into almost universal use in velvet, plush, mercerized yarn and colored mills. This process, in comparison to the old style skein process, has several points in its favor, among which may be mentioned :

FIRST. —The labor expense of preparing the yarn for bleaching, dyeing or mercerizing is greatly reduced.

SECOND.—The long chain yarn dyes a more even shade than the skein, and the colors show more lustre and bloom.

THIRD. —The yarn is wound direct from the chain onto bobbin or quill, ready for weaving without any intermediate process.

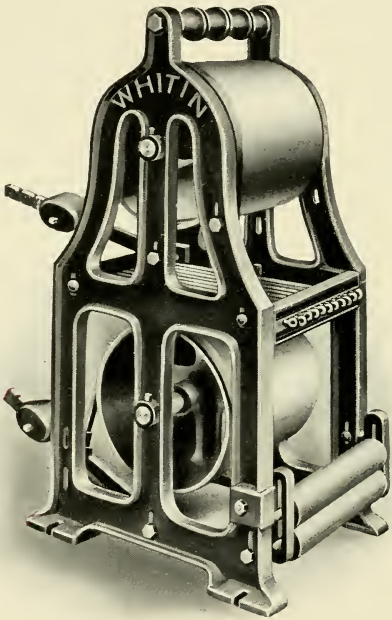
FOURTH.—The avoidance of burnt or burnished yarn, whereby the strength as well as the original brightness and clearness of the yarn is fully maintained.

FIFTH.—There is practically no waste in winding and great savings are made in the cost of production, floor space used, and power consumed.

By the use of our **Quilling Machine,** the trouble with "double filling" is, to a great extent, eliminated. When a "double" occurs on our machine, the quill or bobbin builds correspondingly larger diameter, rendering it impossible to place in shuttle. Whereas in the skein winder a "double" does not alter the appearance or diameter of the bobbin, and the weaver, not noticing the defect, puts the bobbin in the shuttle, with a result of a "pick-out" in the cloth, and the consequent loss in the weaver's time and quality of cloth.

Our **Long Chain Quilling Machine** is a rigidly constructed frame, consisting of two end standards connected together by bolster rails, supported by intermediate sampsons. The machine is easily operated, and will successfully and economically handle any count of yarn. The chain of yarn to be

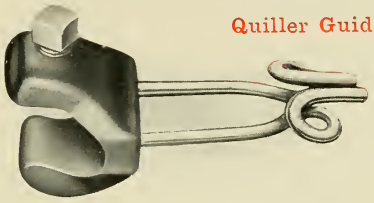
Yarn Friction Drums



quilled is drawn through **friction drums,** placed about 30 feet from the frame to allow sufficient spread to the yarn, and also to give the operator an opportunity to stop the machine when

leases or broken ends are coming up. The yarn then passes through a suspended reed that the operator occasionally moves backward and forward to properly separate the ends, thus preventing breakage. From the reed the yarn is drawn under a cloth covered friction roll, which also serves to catch loose ends. Thence the yarn passes through the guide wires, and is wound on the bobbins.

Quiller Guide



Quiller Spindle

The spindles are positively driven by bands from the cylinders revolving at about 320 revolutions per minute. The bobbins are frictionally driven from the spindles by means of a friction washer of flannel interposed between the bobbin collar and top of spindle whirl. The bobbin is prevented from slipping on its collar by a small pin projecting from the collar into a slot in the base of the bobbin. By this method of driving the bobbins, breakage of yarn on account of excessive tension is avoided, and the speed of the bobbin is sufficient to wind up all the yarn as it comes from the rolls.

The **builder motion** has a quick return, which securely binds the yarn on the quill, forming a hard bobbin suitable for weaving or rewinding.

The **shipper motion** is operated by the foot of the operator, leaving both hands free.

Pulleys: 10 inches in diameter by 2 in. face, speed, 300 to 380 revolutions per minute.

Horse Power: 378 spindle; 2½ inch space machine consumes 1½ horse power.

To suit the varied requirements of the trade in the matter of sizes and styles of bobbins to be quilled, our machines are made in **six models,** as follows :

Model	Space	Number of Spindles	Length Overall
A	2½ in.	378	10 ft., 10 in.
F	3 in.	378	12 ft., 7 in.
E	3⅝ in.	192	11 ft., 8½ in.
B	4½ in.	125	10 ft., 10 in.
C	4¾ in.	190	17 ft., 1½ in.
D	5 in.	150	14 ft., 9 in.

In regard to the PRODUCTION table, given herewith, we have been governed entirely by the results reported by the various mills using these machines. We have found more or less divergence in the results obtained owing to the particular conditions and processes under which each mill works up its product. However, for purposes of comparison, we have averaged all the results together for the reason that in the same mill we have found little difference in production on the same actual number, whether the yarn was in the gray, mercerized, colored, bleached or in ply.

In the last column we have given a proportionate list of productions which would seem fair under the best conditions. We would caution mills, however, in making comparison with these estimated figures, as a number of conditions arise which would limit their production, among which we might mention :—

1. Expertness of help.
2. The condition, length and strength of the warps as delivered to the Quilling Machine.
3. If dyed, the color of the warp.
4. The size and traverse of the quill.

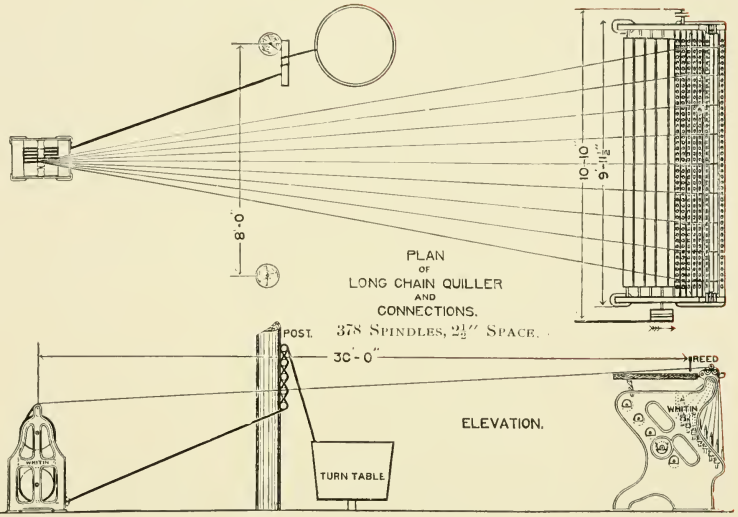
In brief, this table is only approximate, but as such we believe has value if taken and considered in reference to the particular conditions of each mill. We believe, however, it will give a fair indication of what is being accomplished by different mills.

Production Table.

NUMBER OF POUNDS QUILLING PER DAY OF TEN HOURS,

378 SPINDLE MACHINE.

Number of Yarn	Highest Lbs.	Lowest. Lbs.	Averages obtained Lbs.	A Fair Average. Lbs.
5's	370	275	305	400
6's	400	400	400	400
7's	300	300	300	400
8's	450	300	375	400
9's	391	391	394	400
10's	550	225	398	400
11's	409	344	377	375
12's	410	273	317	350
13's	333	180	260	325
14's	400	225	300	300
15's	425	170	286	280
16's	360	165	263	270
17's	260	246	253	260
18's	300	225	255	255
20's	330	110	236	250
22's	230	210	220	230
24's	200	125	163	210
25's	280	216	249	200
26's	190	138	169	190
27's	140	140	140	180
28's	120	112	116	170
30's	240	110	158	155
32's	150	150	150	150
33's	155	155	155	145
35's	180	118	149	140
36's	140	115	126	135
38's	130	120	125	125
40's	120	112	116	115
45's	110	100	105	105
50's	100	76	88	90
60's	80	80	80	80
65's	75	70	72	75
70's	70	50	60	60
80's	60	40	50	50


8'-0"
10'-10"
9'-11½"
PLAN
OF
LONG CHAIN QUILLER
AND
CONNECTIONS.
378 SPINDLES, 2½" SPACE.
POST.
30'-0"
REED
WHITIN
TURN TABLE
ELEVATION.

CARE OF QUILLING MACHINES.

In order to obtain the best results, both in the quality and quantity of quilled work, it is absolutely necessary that all parts of the machine be kept as clean as possible. The cleaning of the machines should be carefully attended to, especially in removing lint and oil that collects around the parts with which the yarn comes in contact. Waste must be kept away from the spindle and friction washer, as a soft quill would be formed if a small piece of waste should catch under the spindle cap.

At regular intervals the old oil should be pumped out of the spindle bolsters and refilled with a good light oil. Care should be taken not to get too much oil in the bolsters, or the yarn will be stained by the oil thrown by the spindle.

Bands should be made of good strong roving about 100 to the pound and not put on too tightly.

Guide wires should be carefully examined and renewed when badly worn.

Badly fitted quills or bobbins are the cause of considerable trouble, therefore the greatest care should be exercised in their selection. Whenever an end breaks and runs in double, the operator should pull it back for if this is not done faulty cloth will result.

In piecing up the operator should be careful to hold the ends tightly until all slack is taken up, otherwise the yarn is wound on slack and will slub off in the loom, resulting in poor cloth.

REPAIRS.

We have issued for 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 what 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.

MISCELLANEOUS RULES.

MISCELLANEOUS RULES.

To find the diameter of driving pulley:

Multiply the diameter of the driven in inches by the number of revolutions per minute it should make, and divide the product by the revolutions per minute of the driver. The quotient will be the diameter in inches of the driving pulley.

Example.—Spinning frame pulley 12″ diameter at 800 revolutions per minute, counter shaft 300 revolutions per minute, what size counter pulley required?

Answer.—12x800=9600÷300=32 inch diam. counter pulley.

To find the diameter of the driven pulley:

Multiply the diameter of the driver by its revolutions, and divide the product by the revolutions of the driven. The quotient will be the diameter of the driven pulley.

Example.—The speed of a spinning frame cylinder is 800 revolutions, what is the pulley diameter of this frame if driven from a 32″ diameter counter shaft pulley at 300 revolutions?

Answer.—32x300=9600÷800=12 inch diameter.

To find number of revolutions of the driven pulley:

Multiply the diameter of the driver by its revolutions and divide the product by the diameter of the driven. The quotient will be the number of revolutions of the driven pulley.

Example.—A 32″ diameter counter shaft pulley at 300 revolutions drives a frame with a 12″ pulley. What speed will the pulley run?

Answer.—32x300=9600÷12=800 revolutions.

To find the width of belt and diameter of shaft to transmit a stated horse power at a given speed, the following Harpers' short formulæ are convenient:

LEATHER BELTS.

Single belting—1″-2″-3″-4″-5″-6″-7″-8″-9″-10″-12″-15″-18″ wide will transmit $\frac{1}{8}$ - $\frac{1}{4}$ - $\frac{3}{8}$ - $\frac{1}{2}$ - $\frac{5}{8}$ - $\frac{3}{4}$ - $\frac{7}{8}$ - 1 - $1\frac{1}{8}$-$1\frac{1}{4}$ - $1\frac{1}{2}$ - $1\frac{7}{8}$ - $2\frac{1}{4}$ H. P. for every 100 feet of velocity per minute. Double belts transmit $1\frac{1}{2}$ times as much as single belts.

ROPE DRIVING.

One rope— $\frac{3}{4}$″-1″-$1\frac{1}{4}$″-$1\frac{1}{2}$″-$1\frac{3}{4}$″-2″ diameter
will transmit $\frac{1}{8}$ - $\frac{1}{4}$ - $\frac{2}{3}$ - $\frac{3}{3}$ - $\frac{4}{3}$ - 1 horse power
for every 100 feet of velocity per minute.

SHAFTING.

Steel Shafting—$1\frac{1}{2}$″-2″-$2\frac{1}{2}$″-3″-$3\frac{1}{2}$″-4″-$4\frac{1}{2}$″-5″-$5\frac{1}{2}$″-6″ diameter
will transmit $\frac{1}{2}$ - $1\frac{1}{8}$-$2\frac{1}{4}$ - $3\frac{7}{8}$-6 - 9 - 13 - 18-24-31 horse power
for every ten revolutions per minute.

To ascertain any length of belt required :

Take twice the distance from centre to centre of shafting and add half the circumference of each pulley.

To determine the length of belt when changing the size of one of the pulleys :

Take the difference between the diameters of the two pulleys, and one-half the difference, and add to length if the change is to a larger pulley, and subtract from length if the change is to a smaller pulley.

NOTES ON BELTING.

In the location of shafts that are to be connected with each other by belts, care should be taken to have a proper distance between them. This distance should be such as to allow of a gentle sag to the belt when in motion.

A general rule for this distance is as follows: 15 feet is a good average where narrow belts are to run over small pulleys, the belt having a sag of 1½ to 2 inches.

For larger belts working on larger pulleys, a distance of 20 to 25 feet is proper.

For main belts working on very large pulleys, the distance should be 25 to 30 feet, the belts working well with a sag of 4 or 5 inches.

If too great a distance is attempted, the weight of the belt will produce a very heavy sag, drawing so hard on the shaft as to produce great friction in the bearings, while at the same time the belt will have an unsteady flapping motion which will in a short time destroy both belt and machinery.

Connected shafts should never be placed one directly over the other if possible to avoid it, as in such case the belt must be kept very tight to do the work.

The diameter of pulleys should be as large as possible, provided they do not produce a belt speed exceeding 3000 feet per minute

Never add to the work of a belt so much as to overload it.