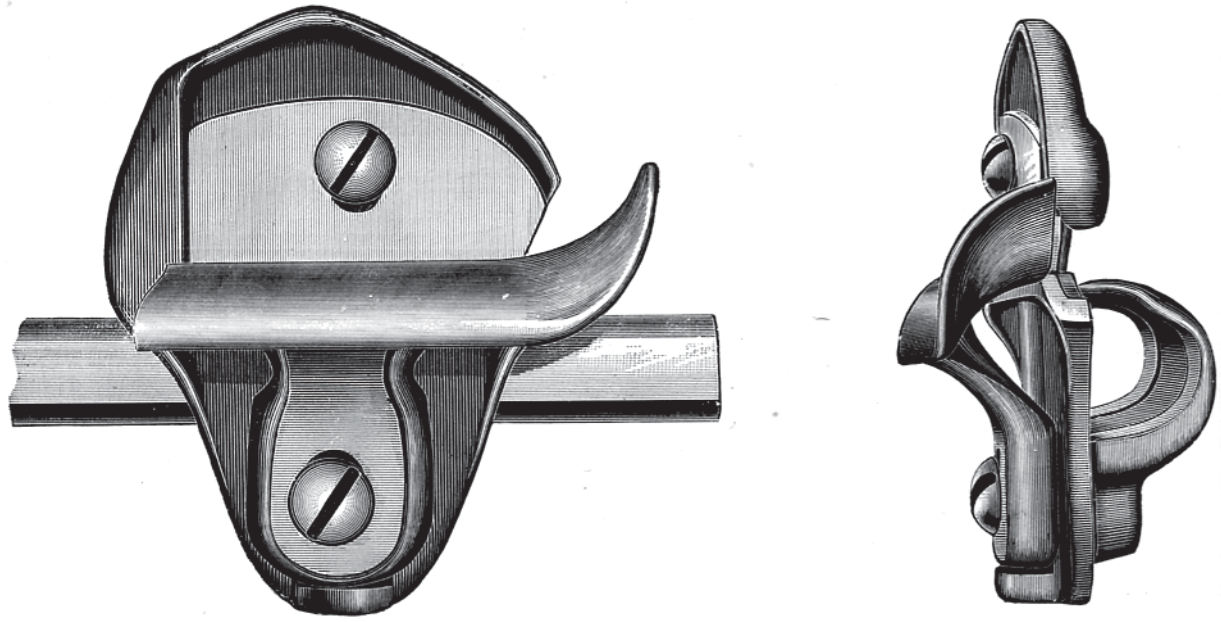
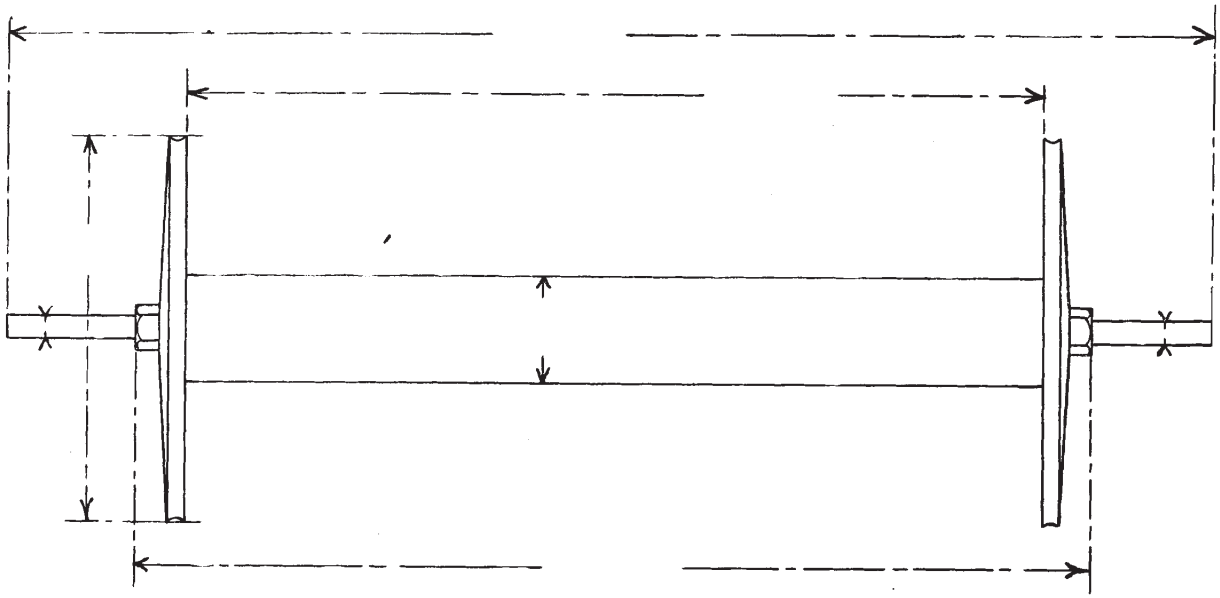




WARPER BEAM.

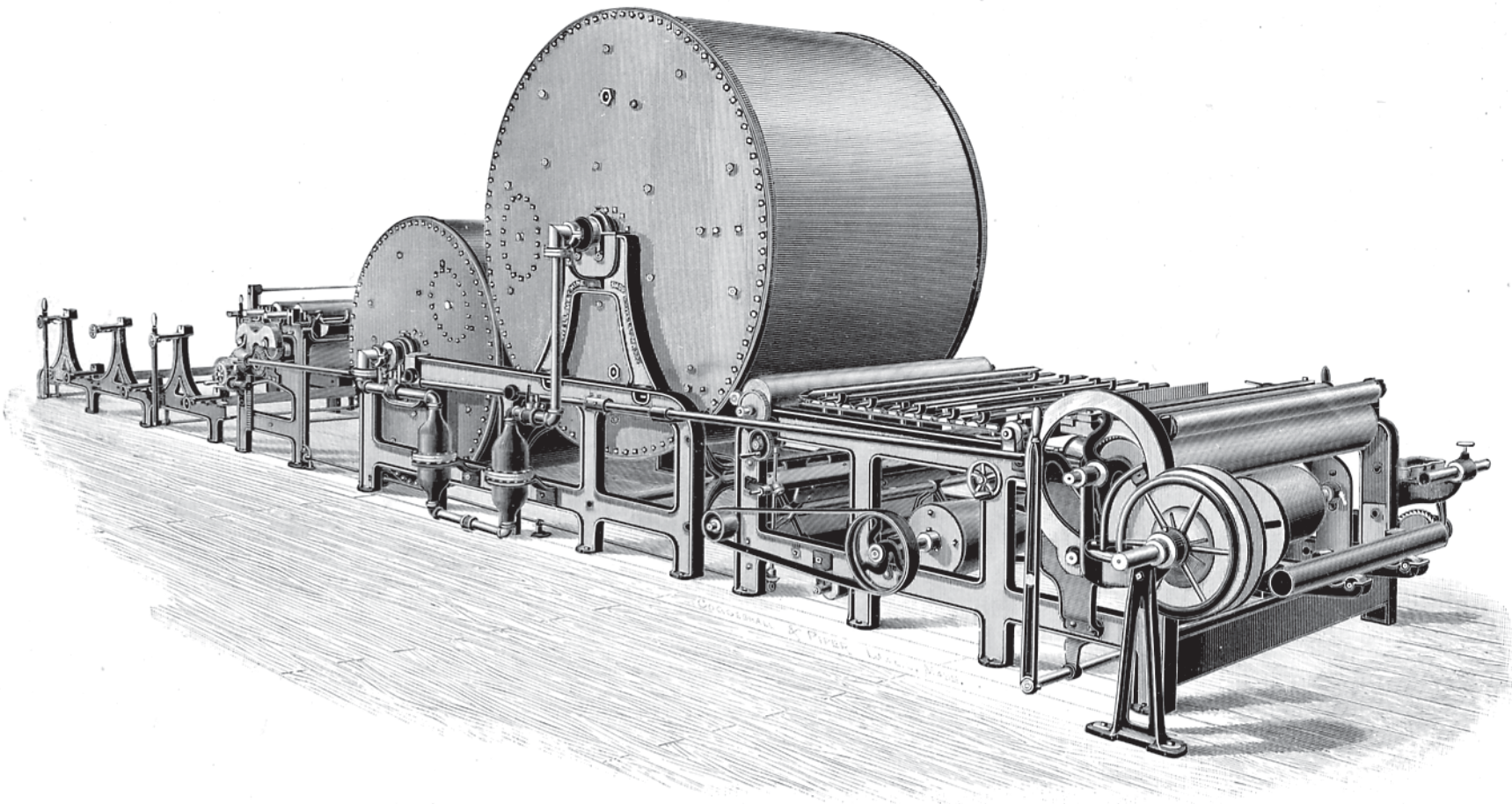
CURTICE PATENT THREAD GUIDE.

THIS invention has met with great success, a large number having been sold for new and old machines. It is extremely simple in construction, there being but few parts, and those not liable to wear out. The yarn enters the horizontal slot, and is prevented from being thrown out by a stop-gate, which is self-balancing, and well covered up to exclude dirt from interfering with its operation. Between the adjustable plate and the polished surface, over which the yarn passes, is a space of sufficient width to allow the dirt, etc., to drop through.

This Guide can be easily applied to any Spooler, and the little care which it requires has made it a leading Guide in the market.

WARPER BEAMS.

WE HAVE patterns for all the usual sizes, from 20 inch to 26 inch heads, and can supply them, at very reasonable cost, in any quantities. The heads are turned and faced up on inside, thus making a perfect beam. In ordering beams the distances between heads and diameter of barrel should be given; also the length and diameter of journals.



CYLINDER SLASHER.

THESE machines are well known as being the most satisfactory and best constructed of any in the market. Many improvements have been added, and several additional sizes have been made, so that we are now prepared to meet the various wants of our patrons.

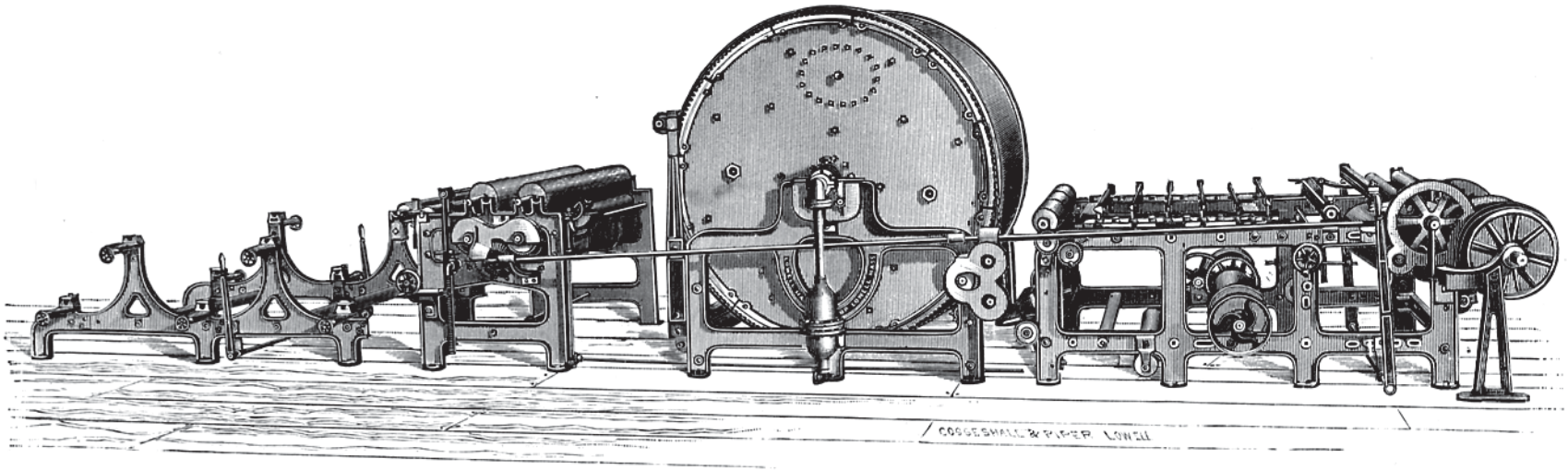
THE HEAD END — is from entire new patterns, much heavier and stronger than formerly made. It is arranged to wind upon any size loom beam, and is made with either the friction wind or the cone wind. It is also provided with the slow motion. We apply the press roll for loom beam and contractor motion, both very necessary improvements; also Rolf's patent cut marker.

CYLINDERS — We build two kinds of Cylinders — the cavity cylinder and the rim or annular. The former is preferable for durability, although the latter is claimed to be more economical in the use of steam. They are constructed from number 16 copper, weighing 3 pounds to the square foot, and are tested with 15 pounds pressure before leaving our yard. They are mounted sufficiently high upon the centre frame to dispense with the necessity of cutting away the floor.

A very valuable improvement has been added to these Cylinders in the shape of a driving arrangement to assist when few ends or fine yarns are being dressed, and we feel sure that this addition will be appreciated by all manufacturers.

We furnish with these Slashers our patent steam trap, Watts' patent steam pressure regulator, and Ashcroft's patent steam indicator, and the machines are piped for direct and exhaust steam.

Our Cylinder Slashers are made usually with a 4-foot and a 6-foot diameter cylinder, or a 5-foot and a 7-foot diameter cylinder. We also build them, as shown in the cut, with only one cylinder, which may be either 4-foot, 5-foot, 6-foot or 7-foot diameter, the usual size being 6-foot diameter. The usual width of these cylinders is 60 inches, but we make them wider if required.



Many sets of our Cylinders have been supplied to old slashers, and we have patterns for fitting them to most styles of English machines.

THE SIZE VAT—We have a large variety of styles and patterns, either single or double, besides many of special designs for special work. They are of iron, and contain two copper size rolls 9 inches in diameter, and one brass immersion roll 5 inches in diameter. The copper rolls are driven by bevel gears attached to a side shaft. The immersion roll is raised by a rack and pinion. For small mills we make a size vat containing one 9-inch copper size roll and one brass immersion roll.

We furnish any size and weight of iron squeeze roll desired, and where extra weight is required we weight them by a lever and weight.

The ordinary vat contains perforated brass pipe, through which steam is passed to keep the size at proper temperature. As is well known, much trouble has existed by the use of this method of steam heat, as the size is rapidly thinned and reduced in strength, while the holes in the pipe frequently become clogged up so that no steam can pass through. To overcome these objections we have designed a steam jacketed Size Vat. This vat is made in two parts, separated from each other by a sheet of copper. The lower part, or chamber, contains the steam. The upper chamber is made in the usual manner. The heat from the steam in the lower chamber is communicated to the size through the copper plate, and keeps it at a boiling point most of the time. It is also very easy to clean this vat, as there are no obstructions in the bottom.

We are prepared to supply manufacturers with this style of vat for their old machines, and many of the mills have replaced their old vats with the new.

The Creels are arranged to wind from four to twelve warper beams, and are provided with adjustable bearings for any size beam.

These machines are built either right or left hand, and can be belted from above or below.

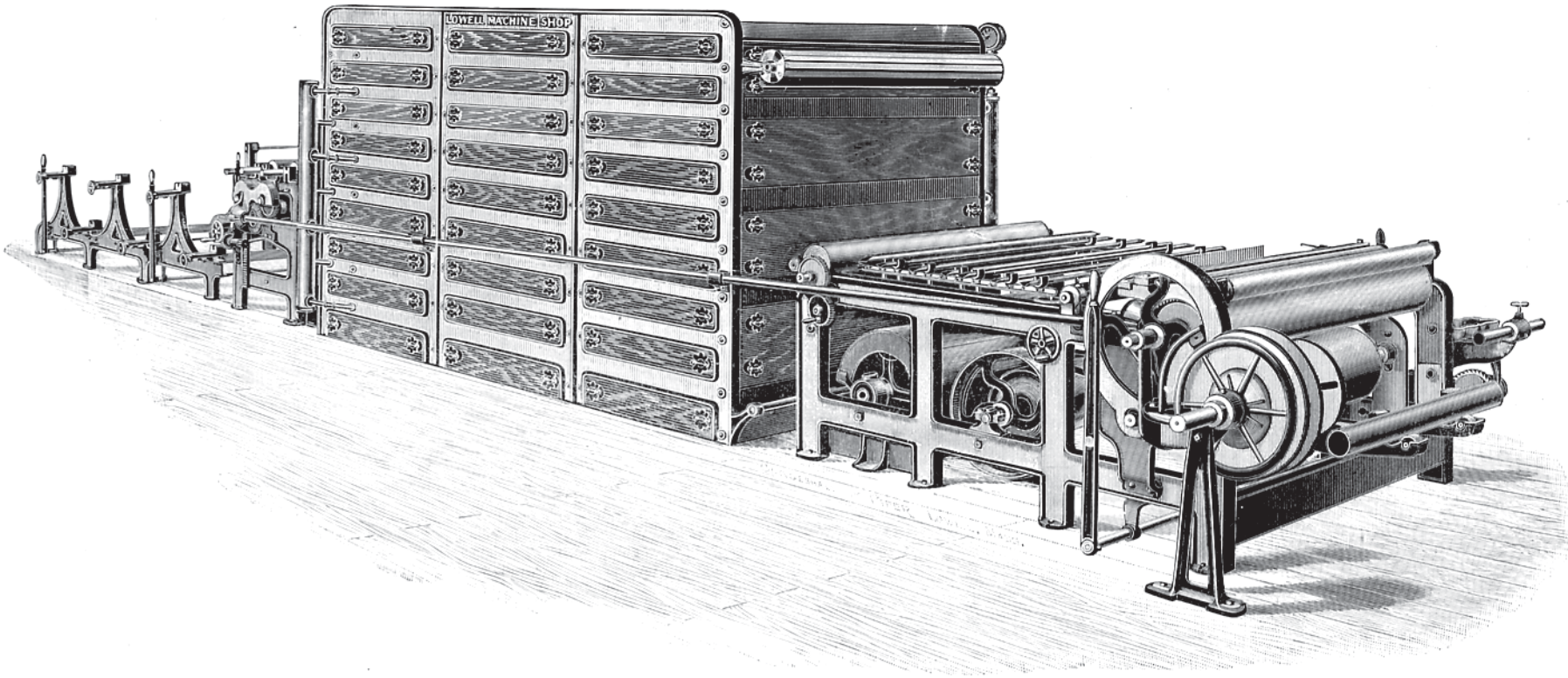
Driving Pulleys 12 inches in diameter, 3 inches face. Speed 400 revolutions per minute.

Width over all, 7 feet 10 inches.

Length, with 7-foot and 5-foot cylinders, and creel for 8 beams, 37 feet 10 inches.

Length, with 6-foot and 4-foot cylinders, and creel for 8 beams, 36 feet.

Length, with one 6-foot cylinder, and creel for 6 beams, 30 feet 9 inches.


LOWELL MACHINE SHOP

HOT AIR SLASHER.

MANY parties prefer drying their yarns by hot air rather than by contact with a hot surface, claiming that the yarn is not flattened, and weaves to better advantage. To meet their wants, we call attention to our Hot Air machine as being well adapted to their needs in this direction. The head end, size vat and creel end are made in the same manner as in the Cylinder Slasher.

The Centre, or Hot Air Chamber, is built with two, three or four sections long,—the cut represents one with three sections, seven coils high,—and these sections are so constructed that an additional one can be added to them at very little cost. Each section contains six, seven or eight coils of 1-inch pipe, as may be desired, and the nature of the work requires.

The yarn, after leaving the Size Vat, passes over three ribbed rolls; thence downward over several smooth rolls, between each coil of pipe, where it is thoroughly dried, and finally passes to the head end.

These machines are built of different sizes to accommodate large or small mills, and at the same time are made for different classes of goods. There are very few stoppages for repairs on the hot air chamber, and when they do get out of order they are easily repaired. The largest size of this machine will do fully as much work as the Cylinder Slasher, and some parties claim they can do more.

These machines must use steam at high pressure to obtain the best results, and are capable of standing a pressure of 70 pounds. This style of machine has been introduced into several Worsted Mills, and is giving good results on all classes of worsted yarns. In combination with the cylinder they are admirably adapted for carpet warps also.

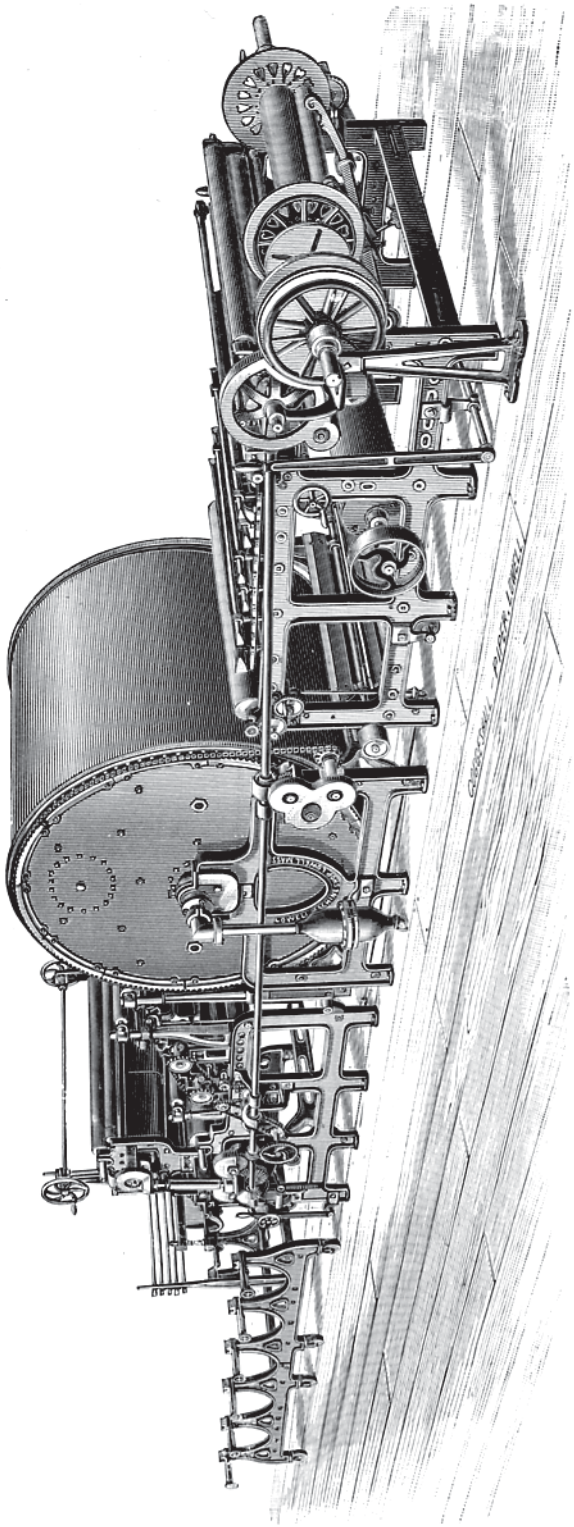
We have often put our hot air chambers in place of worn out cylinders, and in every case they are giving perfect satisfaction.

There is but little, if any, difference in the amount of steam or power required to run the Hot Air and the Cylinder Slasher.

Length of three-section machine, with creels for eight beams, 36 feet 10 inches. One section adds 3 feet 6 inches to length.

Width over all, 7 feet 10 inches.

Driving Pulleys 12 inches diameter, 3 inches face. Speed 350 revolutions per minute.



TAPE SLASHER.

THE machine illustrated by the cut has been designed for sizing colored yarns, the practice of long chain dyeing making this method of dressing yarns more economical than any heretofore in use. To do this work on the Slasher required some changes in the machine. These we have made, the principal alterations being in the Size Vats. The head end and cylinder are made as in the ordinary single Cylinder Slasher. The cylinder generally has the driving arrangement to assist it when few ends or fine yarns are being sized.

There are two Size Vats, of iron, one being placed over the other, the lower one containing two copper size rolls 9 inches in diameter, and one brass immersion roll, the upper vat having one copper size roll and one brass immersion roll. The copper rolls are driven by bevel gears attached to a side shaft, the immersion rolls being raised by a rack and pinion.

In front of the Size Vat, next to the Cylinder, are revolving brushes to lay the fibre of the yarn after it is sized, and before it reaches the Cylinder. These brushes are made in sections, so that they may be readily removed and cleaned, or we supply solid round brushes if preferred. They also have clearer brushes underneath to prevent their becoming clogged while running. This machine is frequently made without the brushes.

The Creels are arranged to wind from six beams, and are provided with adjustable bearings for any size beam. For greater convenience in drawing in the ends we have mounted the creels upon trucks. These creels differ from the ordinary creel in having the beams placed in line.

These machines are made right or left hand, and can be belted from above or below.

Driving Pulleys 12 inches in diameter, 3 inches face.

Speed 350 revolutions per minute.

Length when slashing from six beams, 37 feet 9 inches.

Width over all, 7 feet 10 inches.

Weight unboxed about 10,000 pounds.


LOWELL
MACHINE SHOP
LOWELL, MASS.


LOWELL
MACHINE SHOP
LOWELL, MASS.

SIZE KETTLE.

THE advantage of having good size is very important, and can only be obtained by having it properly mixed and thoroughly boiled. The vat on the Slasher is simply a receptacle for holding the size while being used, and the perforated steam pipe in the bottom is intended to keep it at a proper temperature only, and is not for boiling purposes. These Kettles are designed to supply the need for a clean and effectual apparatus for mixing and boiling size. They are made of cast iron, and each Kettle is provided with a stirrer, driving apparatus and faucets, complete. We sometimes make them steam jacketed.

The Driving Pulleys are 14 inches diameter and 2 inches face. Speed 100 revolutions per minute.

We make them of four different sizes, as follows:

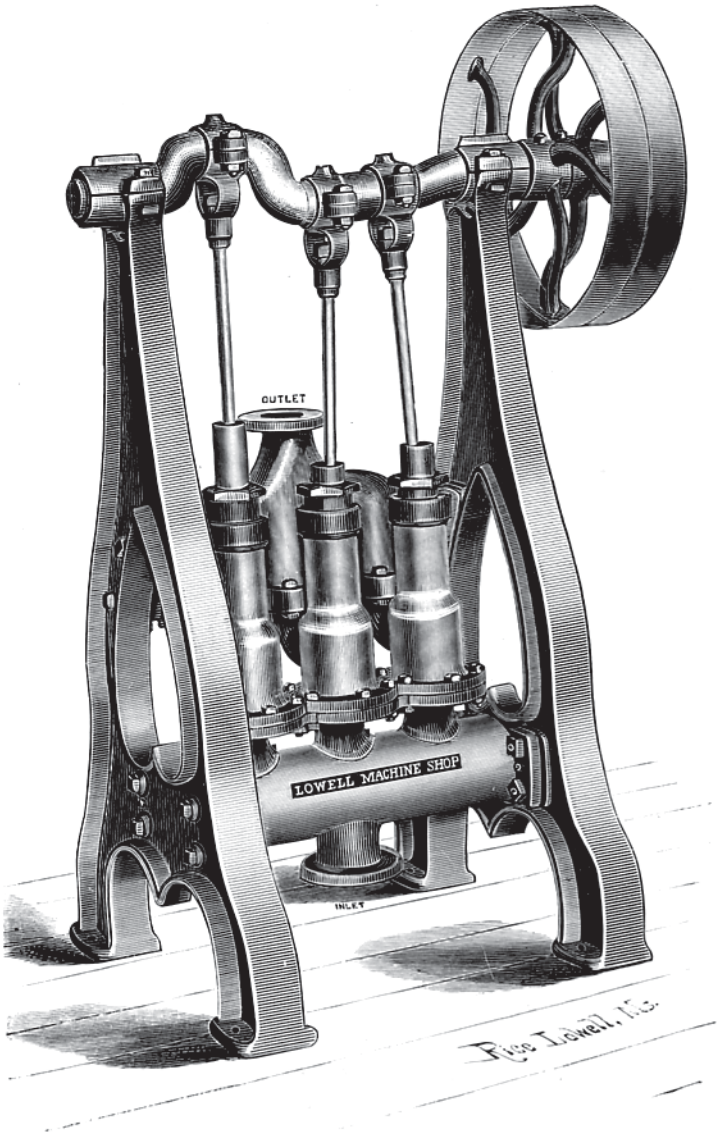
Size, 32 x 32 inches.
Holds 110 gallons.
Weight, 900 pounds.

Size, 36 x 36 inches.
Holds 158 gallons.
Weight, 1200 pounds.

Size, 42 x 42 inches.
Holds 250 gallons.
Weight, 1600 pounds.

Size, 48 x 48 inches.
Holds 360 gallons.
Weight, 1800 pounds.

We usually keep the three smaller sizes on hand.


OUTLET
LOWELL MACHINE SHOP
INLET
Pico Lowell, Mass.

SIZE PUMP.

IN large corporations, where many Size Kettles are used, it is convenient to place them all together in some detached building and pump the Size to the Slashers. For this purpose we have designed this Pump, which is of sufficient power to raise Size six stories high.

It is provided with three plungers, of gun metal, 2½ inches diameter.

The Valves, Valve Seats and Cylinders are also of gun metal.

Connecting rods are of steel.

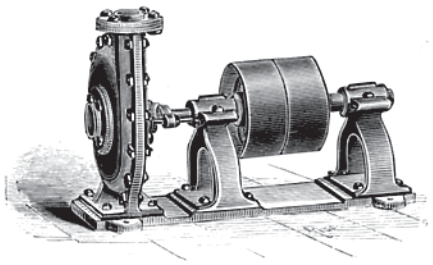
Length, including Pulleys, 44 inches.

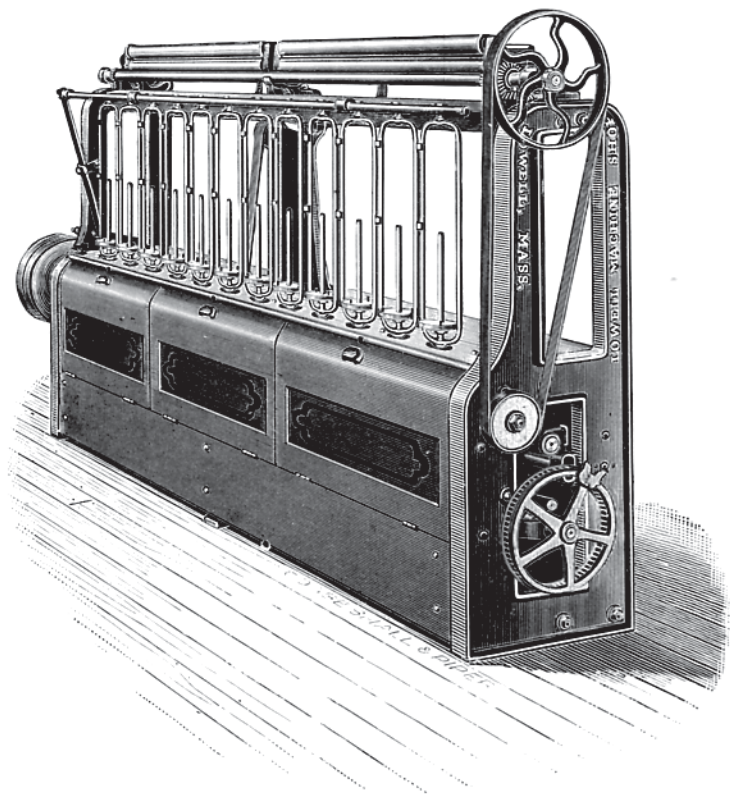
Width over all, 30 inches.

Weight about 1100 pounds.

Driving Pulleys 24 inches diameter, 3 inches face.

We also furnish a small brass Fan Pump, like the cut below, for parties who desire to pump the size only a short distance, particulars of which will be furnished on application.




LOWELL MACHINE SHOP
MASS.

FLYER TWISTER.

THIS machine has been designed for twisting a greater number of ends than is possible with a Ring Twister. We have made quite a number of them in the past few years, and they are well adapted for makers of cords, rope or hose.

The spools containing the yarn to be twisted are placed in a creel at the back of the machine, and is not shown in the cut. This creel is arranged to double as high as 24 into 1; any greater number of ends can be used by stopping every other spindle on the machine.

The yarn passes from the spools to the rolls, where it is firmly held until the twist is put in by the flyer. These latter are made of wrought iron, and have a hook to guide the yarn upon the spool in place of the usual presser.

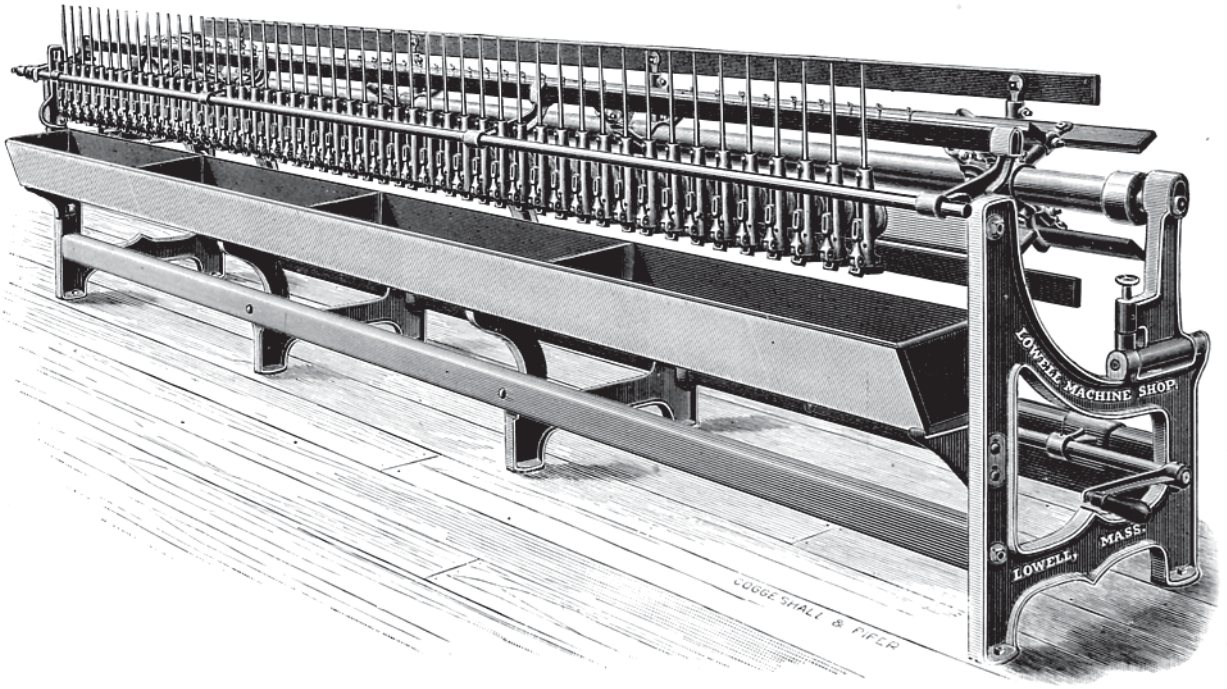
The gearing is heavier than is usually put into a Speeder, and the machine is provided with a three-step cone, compound, etc., and the twist is as uniform as it is possible to put in.

Changes in twist are made with different sizes of pulleys instead of gearing, and the traverse motion is operated by a mangle wheel.

The machine is made with 12 spindles only, and usually of the following sizes:

8½	inches	space.	Bobbin,	8 x 6	inches.
7	"	"	"	8 x 4½	"
5	"	"	"	7 x 3	"

Driving Pulleys 13 x 2¾ inches.


LOWELL MACHINE SHOP.
LOWELL, MASS.
COGGESHALL & PIPER

YARN REEL.

THIS YARN REEL is especially adapted for reeling heavy work. The reel is made adjustable for 54-inch, 72-inch and 90-inch skeins, and is arranged to drop two flats in doffing.

The Spindles have independent and adjustable friction for creating more or less tension, and can be made to suit any style bobbin or spool. We can also arrange it to reel from cops.

The Reel Shaft is made hollow, thus combining strength and lightness. The spiders are of malleable iron, and there are usually four to a machine, but on very heavy work we provide them with more.

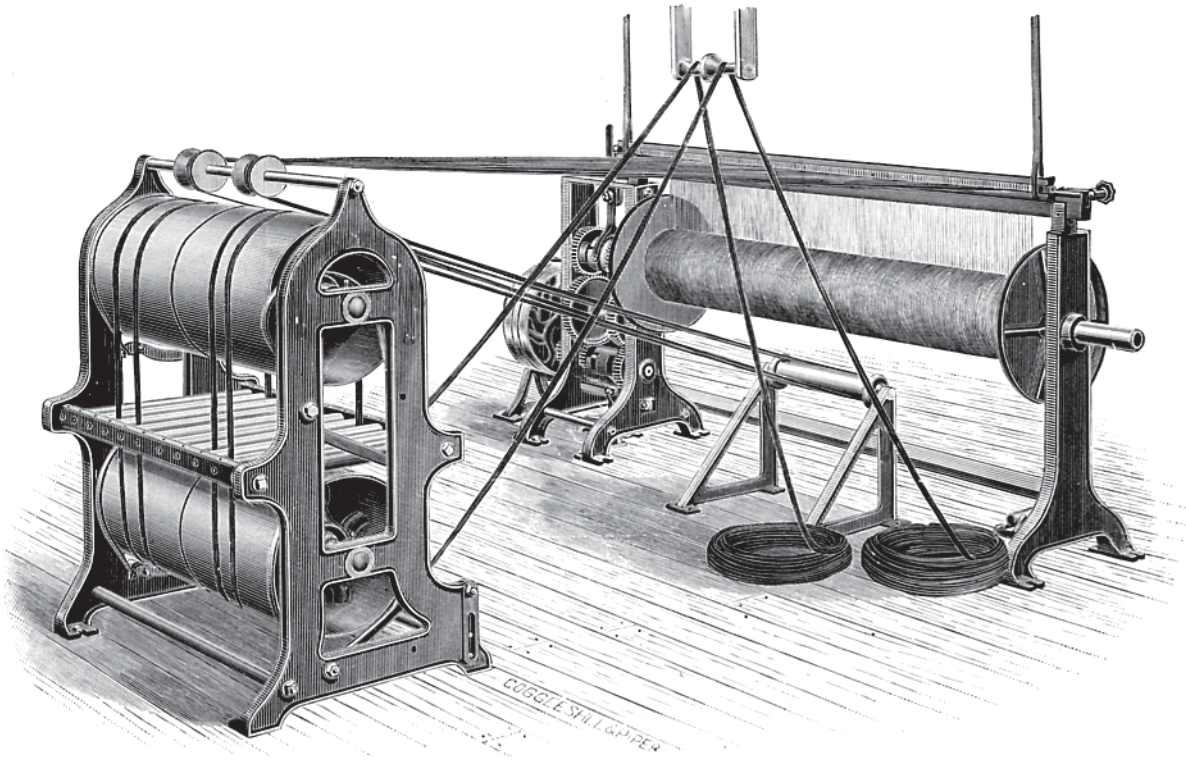
Each Reel is provided with a stop-clock, arranged to stop the machine at the completion of every hank wound. It can be very easily disconnected when not wanted.

Driving Pulleys are 12 inches diameter by 2 inches wide. Speed of driving pulleys 125 to 150 revolutions per minute.

Length of 50-spindle Reel, 3-inch space, 14 feet 7 inches, including pulleys.

Width when winding 90-inch skeins 3 feet 9 inches.

Weight of 50-spindle Reel unboxed 800 pounds.

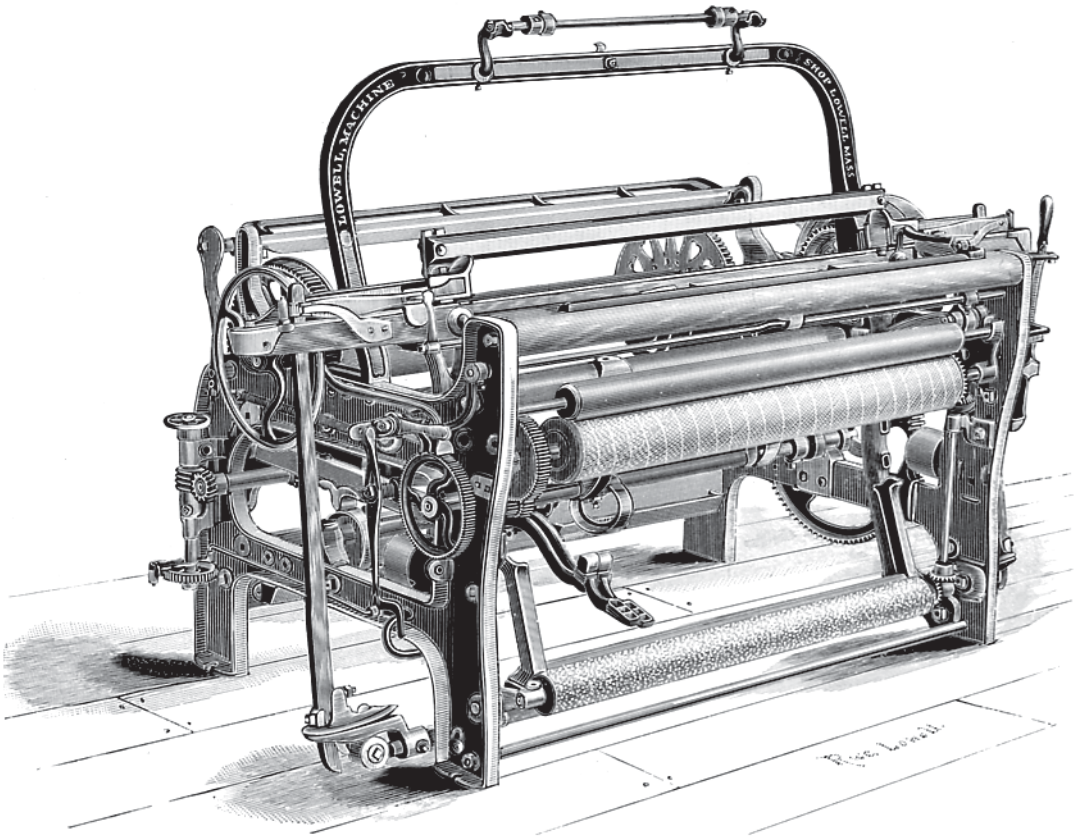


BEAMING MACHINE.

THE present method of long chain dyeing has introduced many new machines, and the cut illustrates one that is largely used in connection with the Slasher for beaming the yarn from chains upon Warper Beams before it is sized.

We have furnished quite a large number of these machines to our customers, and usually supply them with the adjustable reeds and the tail block.

The front of the machine is adjustable for different lengths of beams and the pulleys have three changes of speed.


LOWELL MACHINE SHOP LOWELL MASS.

LOWELL LOOMS.

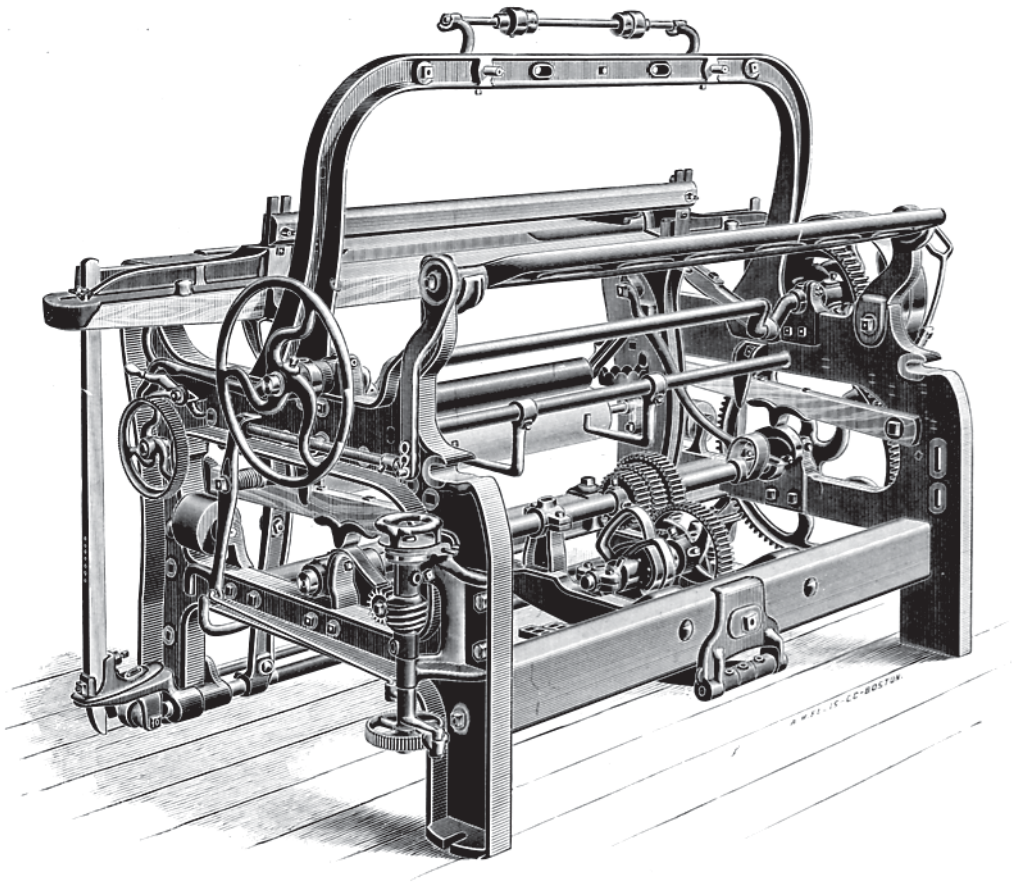
OUR Looms have secured an enviable reputation by the substantial manner in which they are constructed,—freedom from annoying and unexpected breakages, their easy and simple motions and the minimum wear on strapping and other parts,—so we have no hesitation in saying that they will produce more cloth at the same speed, in a year, than any other loom now in the market. These looms are running in every state where cotton manufacturing is carried on, and we shall be pleased to refer parties to mills having our looms near them.

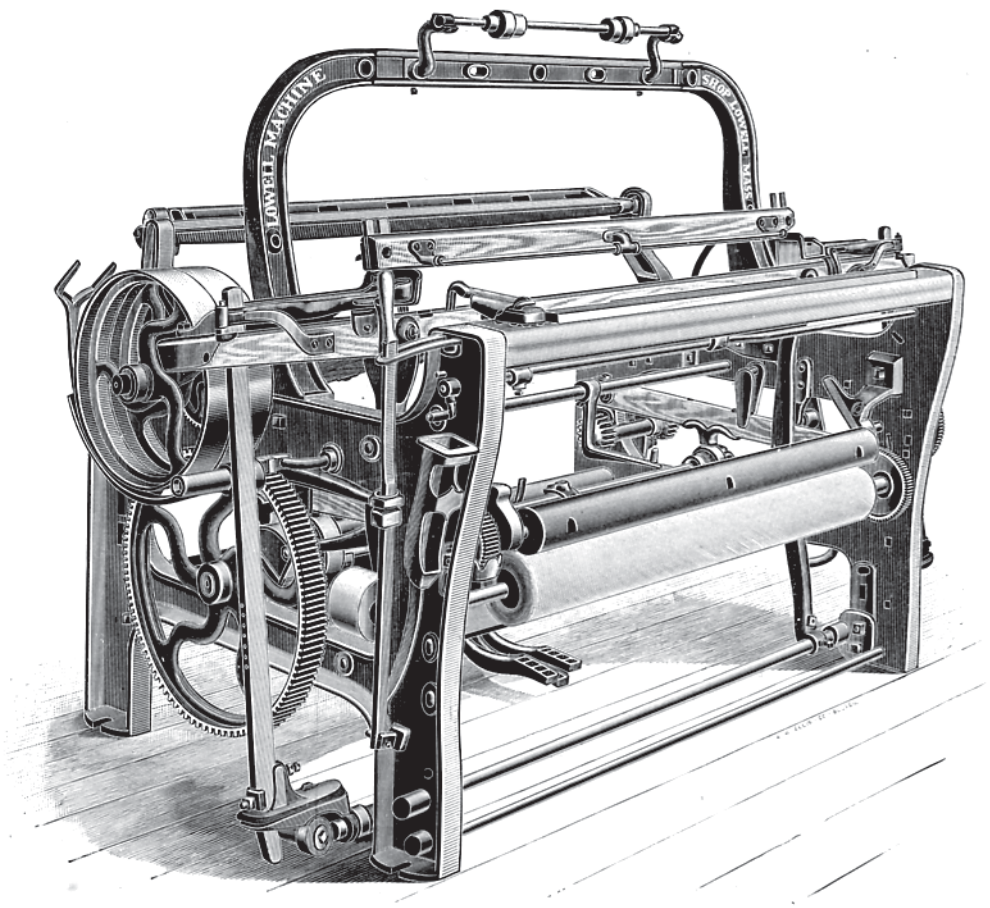
FRAME—is strongly made, the distribution of the metal is where it is most needed, and the entire frame is heavier than other looms made for weaving the same weight of cloth. We build this loom in **five** sizes—from the lightest cloths to medium weight duck. Parties ordering looms should give us the style of goods they intend to make.

LET-OFF MOTION—is either Bartlett's or friction, but in addition to these we have several other patterns that are applied when ordered. We also apply both Bartlett's and friction combined when extra heavy goods are made, and arrange them so that they can be used independently or together. The whip rolls are made of various weights and styles; either stationary or to revolve.

TAKE-UP MOTIONS—are arranged to wind up from two to five cuts, and include a great variety of styles. We also apply our web motion, which will wind up from 300 to 500 yards. This is often desirable when cloth is sold in rolls and in the saving of short lengths. The take-up roll may be covered with quartz, sand paper, perforated tin or steel filleting.

PARALLEL MOTION—is Stearns' patent, and is acknowledged by all weavers to be the best ever applied to looms. The Lay or Lathe is made of the best of seasoned lumber and has iron swords; the shuttle boxes are of iron and the sides adjustable so that the throw of the shuttle can be varied slightly—this will be appreciated by all weavers; the race boards are usually of maple, though they can be made of iron if desired; the reed cap is of cherry and is supplied with a shuttle guard.




LOWELL MACHINE
SHOP LOWELL MASS

HARNESS MOTION—can be arranged for 2-shade, 3-shade, 4-shade and 5-shade motion, and the cams set so that any combinations can be made. We usually apply the cams to the picker cam shaft, and when so applied several of the motions can be put on, so that the change from one motion to the other can be made very quickly and with very little trouble. In addition to this mode of application, we also arrange the harness cams on a jack shaft by themselves, and this method has met with favor from weavers using them.

BEAMS—are furnished at the rate of one and one-half beams per loom. We have a large assortment of beam heads from 15 inches to 18 inches diameter for either gear or friction. We usually force all heads on, but joint bolt them if parties so desire.

ILLUSTRATIONS—Loom shown on page 76 is our regular 36-inch sheeting loom. Many thousands of this pattern are running today and giving good satisfaction. It has the Bartlett let-off and web motion, and for the class of work intended is a very superior machine.

The Looms shown on pages 78 and 79 represents them with the harness cams and gears on a jack shaft. These looms are also made with the selvage motion and friction let-off. They are largely used for weaving sateens, tickings and other goods.

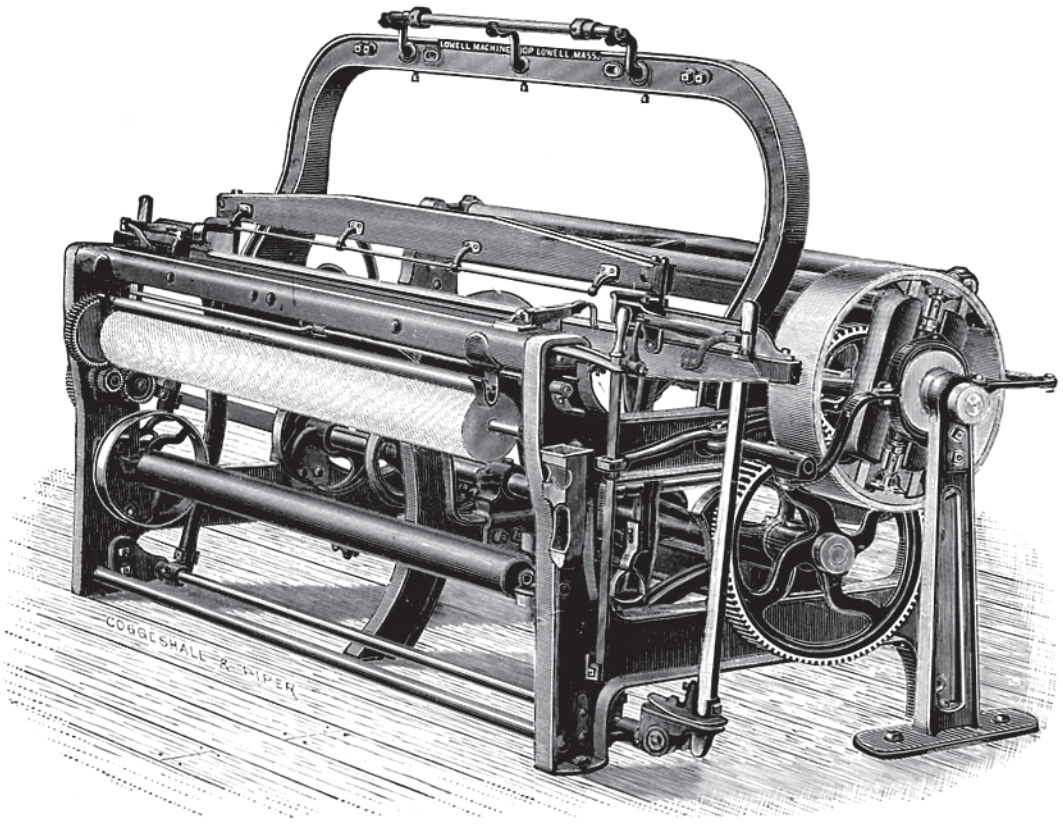
The Loom on page 81 illustrates a Duck Loom for weaving duck up to 66 inches wide. It is very heavy, and for all kinds of duck, except the very heaviest, it is admirably constructed. The pulley is a friction one, and is 20-inch diameter by 4-inch face, and the pick motion is different from that shown in the other looms. The take-up roll is dropped as low as possible so as to admit of as large a roll of cloth as can be wound up.

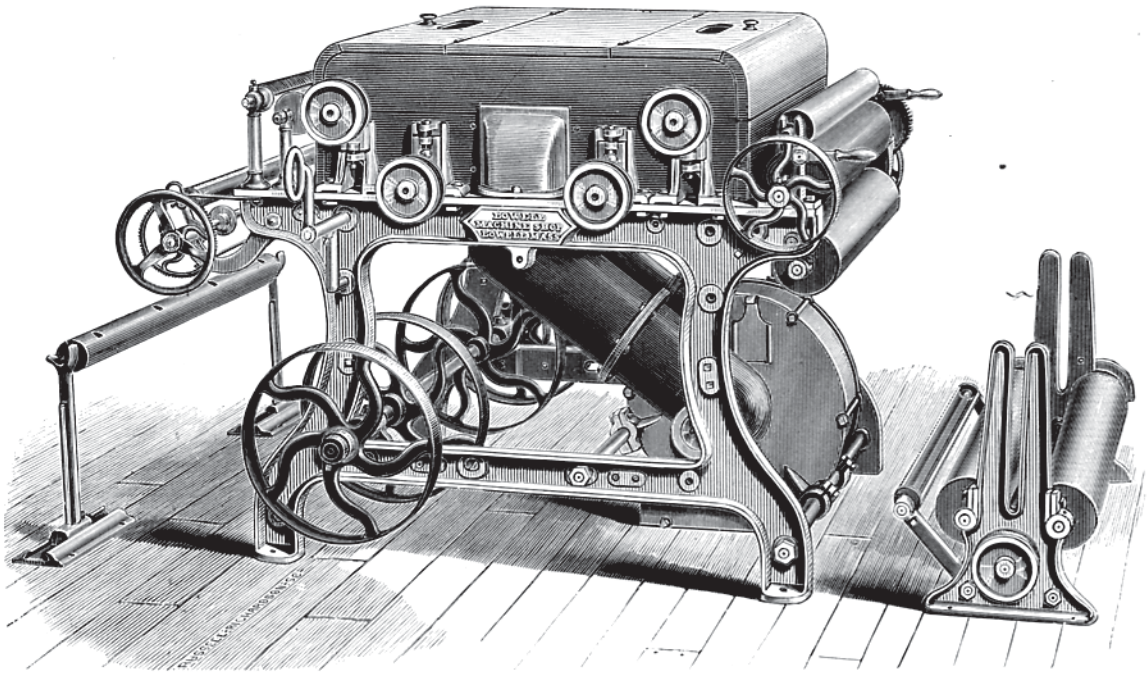
With each loom we supply harness jacks and leese rods, and if these articles are not wanted we make a deduction in price.

Pick gears are generally arranged to make two picks for each tooth in gear. We supply one gear with each loom.

Filling stop motions are furnished with all looms, and the forks may be the usual iron pattern or any of the patent steel or wire styles.

Parties in want of a strictly first-class loom in every particular will find that ours will meet their wants.


LOWELL MACHINE SHOP LOWELL MASS.



BRUSHING MACHINES.

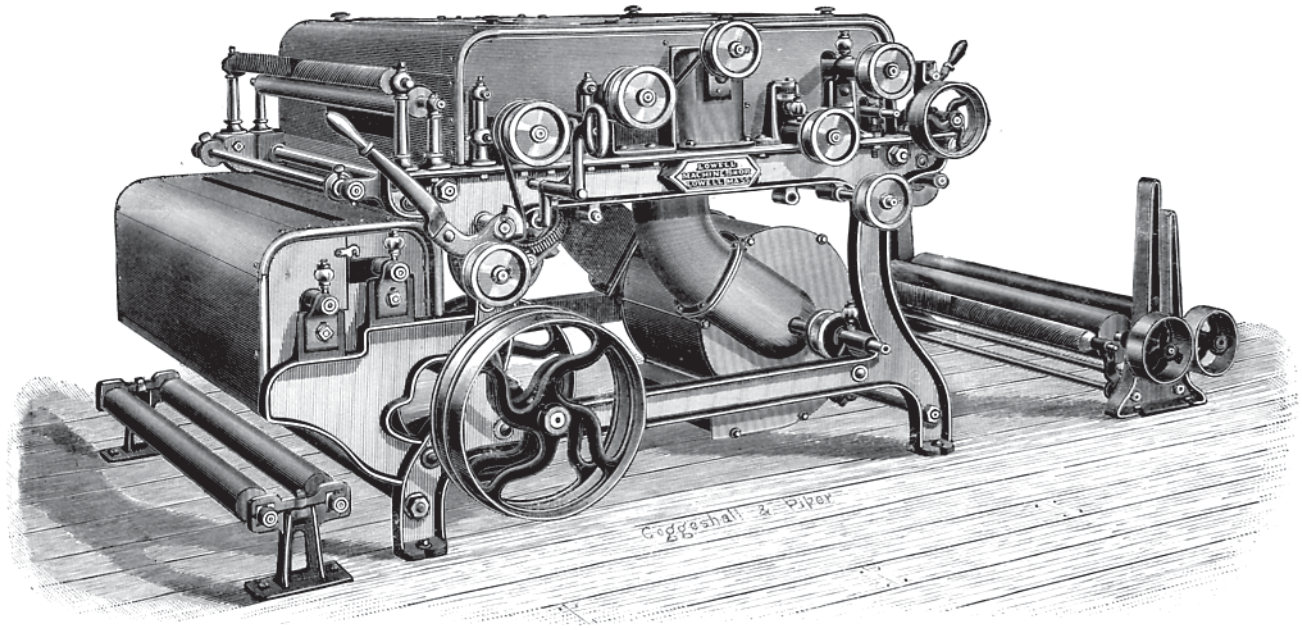
WHERE goods require but little brushing, and where smoothness is not essential, the machine illustrated on the opposite page will be found to be well adapted for the work, and has the advantage of requiring the very least of skill to run it. They are made of all widths up to 60 inches.

The cloth first passes between two fillet rolls, which brush from both sides all the threads and lint. It then passes between two emery rolls, where all rough projections are removed as far as possible. The fan removes all the dust from the machine, so that it does not accumulate.

With each machine is furnished calender head for winding up the cloth, and stands for holding cloth rolls.

Driving Pulleys 18 x 2 inches. Speed 400 revolutions per minute.

Capacity about 3500 yards of sheetings per hour.


LOWELL
MACHINE SHOP
LOWELL MASS.
Coggeshall & Piper

SHEARER AND BRUSHER.

FINISHING goods is a necessary part of the manufacturing, and to accomplish this in a satisfactory manner we have designed the machine shown on the opposite page. It includes the best features of the Shearing Machine and Brushing Machine in one. We have sold a large number of them, and their success on brown goods leads us to believe that their work has been well appreciated by manufacturers, and that the goods have been greatly improved in appearance.

SHEARS — are made of the best of steel, and can be arranged all on one side of goods, or a part on one side and a part on the other. We make them with 2, 3, 4 or 5 sets of shears, which cut from the cloth all projections and stray threads before passing to the brushes.

BRUSHES — can be covered with wire filleting or bristle brushes, as preferred. These brushes thoroughly clean all the dirt and lint from the cloth, leaving the same in a good condition to be wound up on the calender head. The dirt is carried from the machine by a suction fan, so that there is no accumulation in the machine.

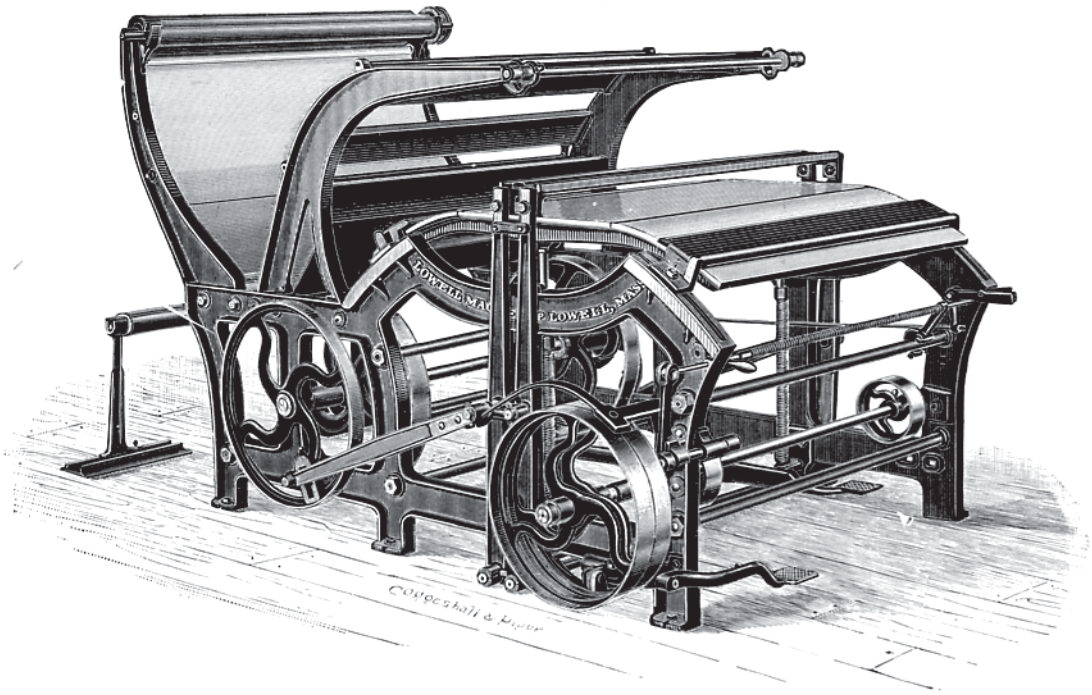
On some machines we place a pair of emery rolls, between which the cloth passes before going to the shears. This is preferred by some and no doubt gives good results. We also apply a perforated steam pipe on the calender head to moisten the cloth before being wound up.

In erecting these machines at the mill care should be taken that they are perfectly level, so that the shears touch equally their whole length. Carelessness in this respect can easily ruin a pair of shears before the machine has done any work.

We build this machine all widths up to 60 inches, and for all kinds of brown goods.

Driving Pulleys 18 x 2 inches. Speed 400 revolutions per minute.

Capacity about 3500 yards of cotton sheetings per hour.



FOLDER.

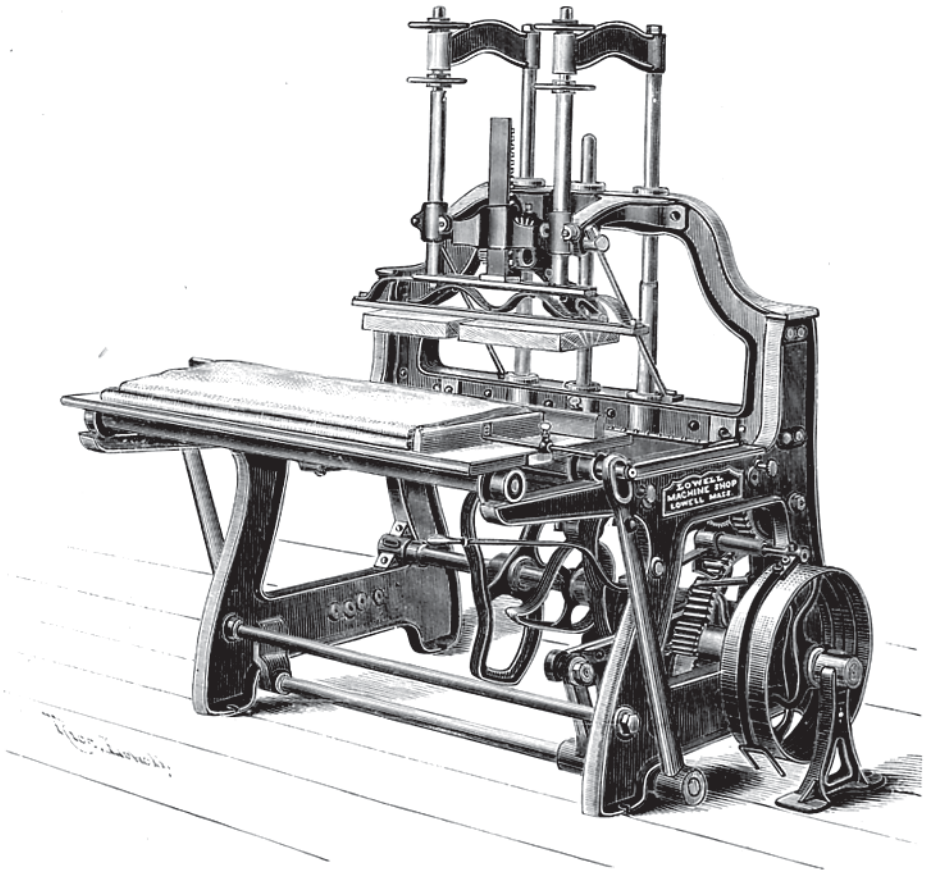
THIS cut represents our new and improved pattern of Folder, and is made for any width of cloth up to 50 inches. It is arranged to measure a yard, a yard and a quarter and one metre in length, and the table is so arranged that any of these lengths can be folded without trouble and the change from one to the other made quickly.

The average capacity of the Folder is about 70 yards per minute, but with superior skill and attention much more than this can be accomplished.

The Driving Pulleys are 18 inches in diameter by 2¼ inches wide. Speed usually 115 revolutions per minute.

Length of Folder 8 feet 9 inches, including cloth roll.

Width of 4-4 Folder over all 5 feet 7¾ inches.


LOWELL
MACHINE SHOP
LOWELL MASS.

STAMPING MACHINE.

PATENTED JANUARY 6, 1880.

THIS machine is designed to take the place of the old hand stamper. It is well arranged for the work and will do the stamping for about 3000 looms.

The frame is made very strong to withstand the heavy strain when the impression is made. The stamps are mounted upon a cross-bar of sufficient length to admit several stamps of different designs to be used at the same time. These stamps have brackets upon the backs, by which they slide easily on the cross-bar.

The cross-bar is adjustable by hand wheels at each end, so that the pressure can be regulated at either end, and also to overcome any inequality in the thickness of the stamps.

The arrangement for making the impression is operated by two cams, which raise and lower the cross-bar, and the pressure is given to the stamps by a third cam.

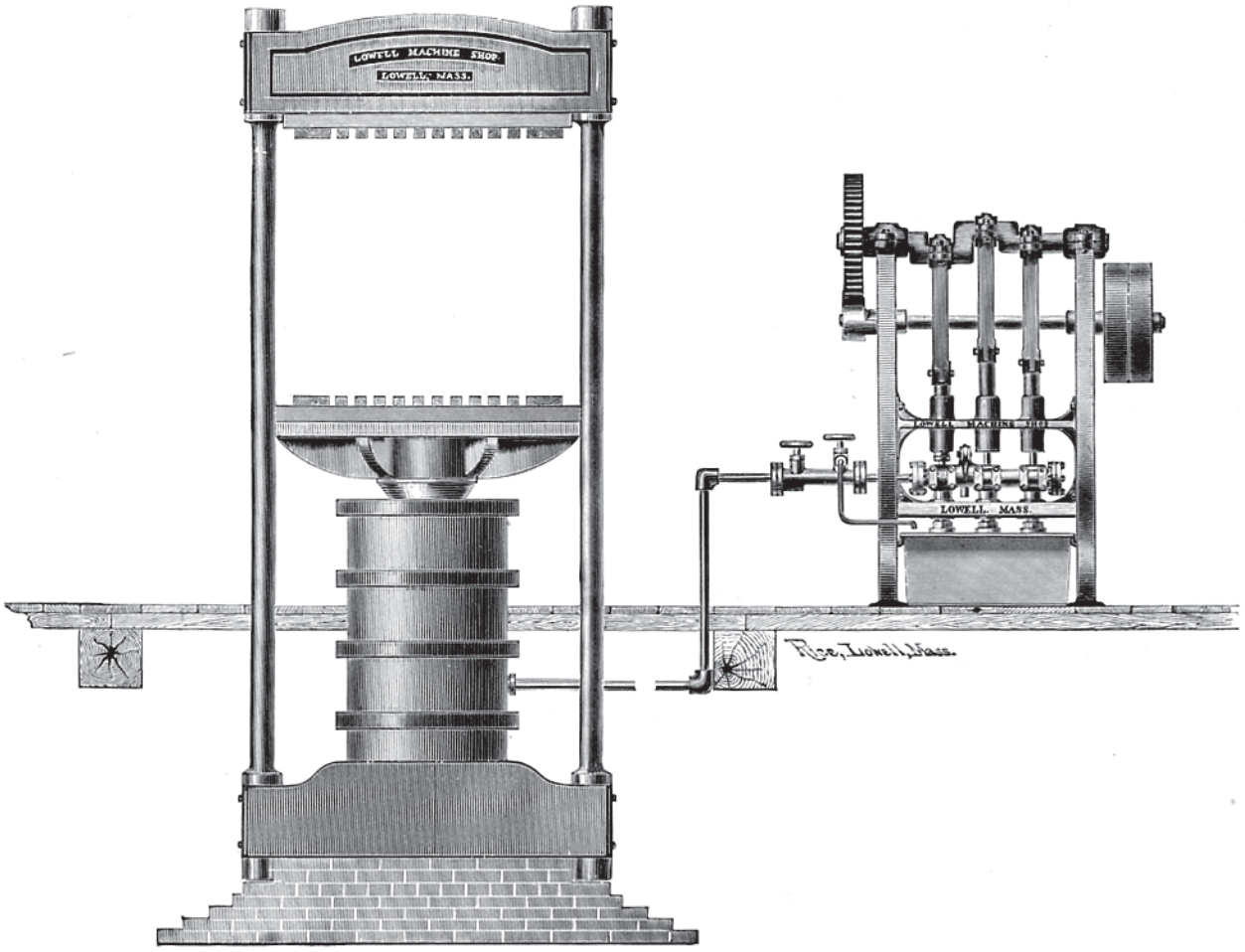
The inking apparatus consists of a copper vat, containing a water pad covered with rubber. Over this pad an endless apron passes, which carries the ink. The stamps are dipped into the ink upon this apron, while the pad gives elasticity to prevent their being injured.

The table is long enough to admit any width of cloth, and has adjustable sides, so that the impression can be made on each piece of cloth alike. It is carried in and out, automatically, by means of rocker arms working in a cam.

Driving Pulleys 18 inches diameter, 2¾ inches face. Speed 40 revolutions per minute.

Length 5 feet 1⅝ inches.

Width, including Driving Pulleys, 5 feet 9 inches.


LOWELL MACHINE SHOP
LOWELL, MASS.
LOWELL, MASS.
Rice, Lowell, Mass.

HYDRAULIC PRESS AND PUMP.

THIS cut represents one of our Four Hundred Ton Hydraulic Presses of the following description:

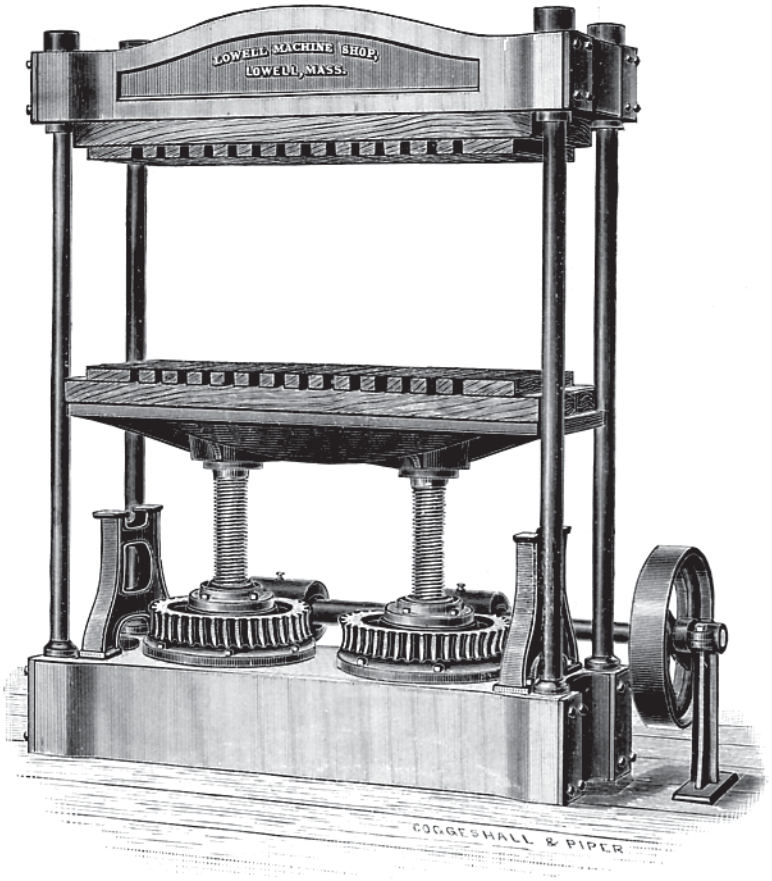
Diameter of Piston 12 inches.
Diameter of Post 3½ inches.
Traverse of Piston 24 inches.
Greatest distance between Posts 50 inches.
Least distance between Posts 14 inches.
Greatest distance between Cap and Follower 52 inches.
Follower 21 inches wide by 50 inches long.
Weight about 17,500 pounds.

We also make Presses of fifty to twelve hundred tons pressure.

This cut also represents our Three-Plunger Hydraulic Pump, with

Tempered Steel Piston ⅞ inch diameter.
5-inch stroke, Gun-metal Cylinder.
Driving Pulleys 20 x 4 inches.
Speed from 90 to 100 revolutions per minute.
Weight 2120 pounds.
Width over all 32 inches.
Length, including Pulleys, 54 inches.

This pump is also made with only two Plungers.

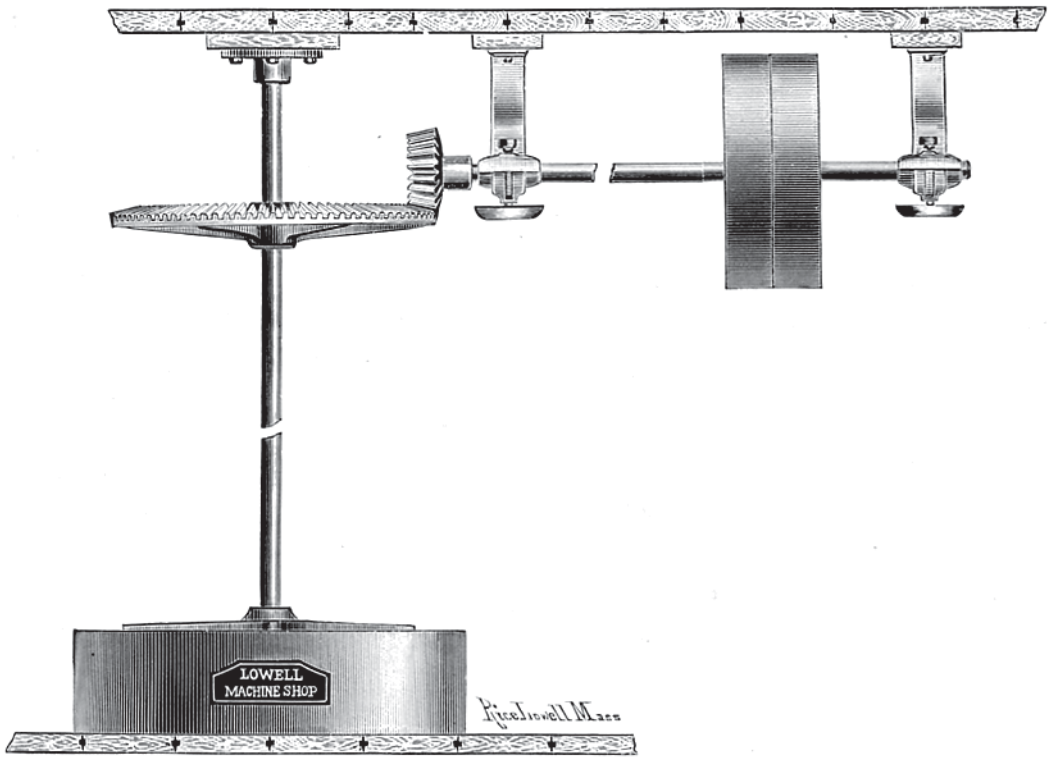

LOWELL MACHINE SHOP,
LOWELL, MASS.
COGGESHALL & PIPER

DOUBLE SCREW PRESS.

THIS press will be found as suitable and convenient as any of its kind. It is built unusually strong and substantial, and bears the following description:

Greatest distance between follower and Cap 46 inches.
Least distance between Follower and Cap 25 inches.
Traverse of Screws 21 inches.
Size of Follower 58 x 20 inches.
Greatest distance between Posts 58 inches.
Least distance between Posts 15¾ inches.
Two Steel Screws, 3½ inches diameter, two threads per inch.
Four Posts, 2¾ inches diameter.
Worm Shaft runs 200 revolutions per minute.
Driving Pulley on Worm Shaft 20 x 4 inches.
Finished Weight 6800 pounds.
Capacity 100 tons pressure.

We also have patterns for a Press similar in design, with platten 67 inches long and 30 inches wide, with a capacity for 200 tons pressure.


LOWELL
MACHINE SHOP

INDIGO GRINDER.

THESE Grinders are furnished with a heavy cast-iron pan, and are made of two sizes:

Sixty inches in diameter, working about 80 gallons at a time, and weighing, without the counter, about 4000 pounds.

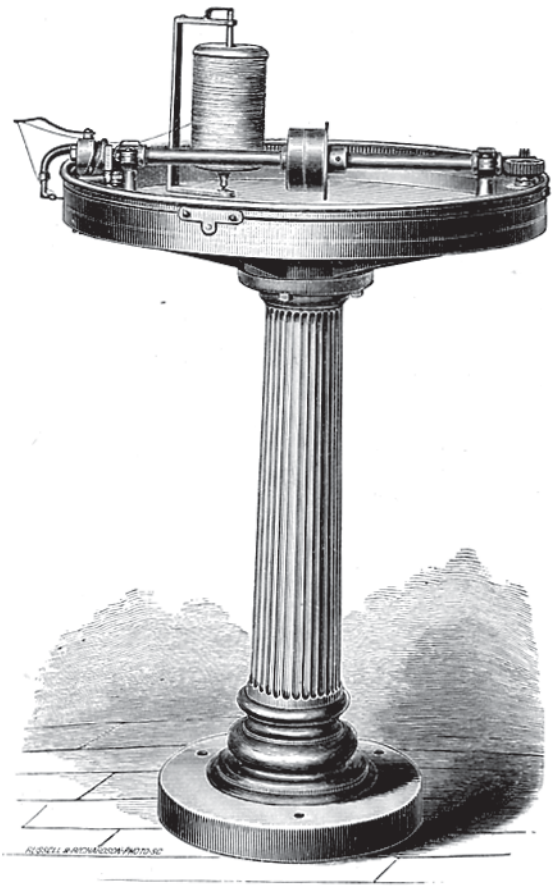
Fifty inches in diameter, working about 60 gallons at a time, and weighing, without the counter, about 2500 pounds.

The Indigo is ground by means of four heavy cast-iron cones, which are revolved about the pan by arms attached to the upright shaft.

The Upright Shaft is 9 feet long, 2 7-16 inches diameter, and should make 15 revolutions per minute.

Driving Pulleys 20 x 6 inches. Speed 60 revolutions per minute.

CIRCULAR SEWING MACHINE.



DRAWING-IN FRAME.

REPAIRS.

IN ordering parts for repairs we would thank our patrons if they would send us, whenever possible, a sample or sketch of what is wanted. In this way much delay in filling orders can be avoided. We have recently issued lithographs of the various pieces of some of our machines, and have numbered and named each piece, so that if parties order by the number they may be sure of having their orders correctly filled. Should this meet the notice of anyone using our machinery who has not been supplied with copies we shall be pleased to forward them upon application. We have now detailed illustrations of our Wellman Card, Foss & Pevey Card, Railway Head, Drawing Frame, Fine Speeder, Fly Frame, new pattern Warper and Loom, and others will be issued as rapidly as circumstances will permit.

SUPPLIES.

WE are prepared to furnish Mill Supplies of every description used with our machinery at the lowest market prices. Parties ordering from us may be sure of obtaining the best articles that are made.

FREIGHT — Being situated with the best of facilities for transportation, we shall be pleased to obtain for our patrons the best freight rates to their mills that can be secured, whenever it is inconvenient or impossible for them to make their own arrangements.

MILL PLANS.

WE would respectfully call the attention of Cotton Manufacturers to the fact that we are engaged in the business of Mill Engineering, as well as being the largest builders of cotton machinery in this country.

Carefully prepared plans, estimates, specifications and supervision furnished for the construction, equipment and organization of new mills for the manufacture of all kinds of cotton goods.

Old Mills reorganized, extended and improved.

Examinations and reports made as to the present condition of old mills, and of the practical methods of improving them; also attention given to all matters pertaining to the application of steam and water power.

Mill sites examined and reported upon. Mill Engineering in all its branches. All who propose building new mills or reorganizing old ones would do well to consult us in the matter.

LENGTH OF DRAWING FRAMES.

SHORT BOSS ROLL.						LONG BOSS ROLL.	
No. of Deliveries.	Double into one.	No. of Rolls Long.	16 Inch Rolls.	14½ Inch Rolls.	12½ Inch Rolls.	16 Inch Rolls.	No. of Deliveries.
9	2 or 4	9	13 ft. 1 in.	12 ft. 0 in.	10 ft. 7 in.	4 ft. 2½ in.	**2**
8	2 or 4	8	11 ft. 11 in.	10 ft. 10 in.	9 ft. 6 in.	5 ft. 6½ in.	**3**
6	3 or 6	9	13 ft. 1 in.	12 ft. 0 in.	10 ft. 7 in.	6 ft. 10½ in.	**4**
6	2 or 4	6	9 ft. 1 in.	8 ft. 5 in.	7 ft. 5 in.	8 ft. 2½ in.	**5**
4	3 or 6	6	9 ft. 1 in.	8 ft. 5 in.	7 ft. 5 in.	9 ft. 6½ in.	**6**
4	2 or 4	4	6 ft. 6 in.	6 ft. 0 in.	5 ft. 4 in.	10 ft. 10½ in.	**7**
2	3 or 6	3	5 ft. 3 in.	4 ft. 9 in.	4 ft. 3 in.		
Width, including 12-inch turn tables, 36 inches.						Width 38 inches from back stop motion to end of coiler.	

LENGTHS OF SPEEDERS, INCLUDING PULLEYS.

Number of Spindles.	8½ inches Space.	7½ inches Space.	7 inches Space.	6½ inches Space.	5¾ inches Space.	5 inches Space.	4½ inches Space.
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
20	16— 4.5						
22	17— 9.5	15—11.5					
24	19— 2.5	17— 2.5	16— 2.5				
26	20— 7.5	18— 5.5	17— 4.5	16— 3.5			
28	22— 0.5	19— 8.5	18— 6.5	17— 4.5			
30	23— 5.5	20—11.5	19— 8.5	18— 5.5			
32	24—10.5	22— 2.5	20—10.5	19— 6.5			
34	26— 3.5	23— 5.5	22— 0.5	20— 7.5			
36	27— 8.5	24— 8.5	23— 2.5	21— 8.5			
38	29— 1.5	25—11.5	24— 4.5	22— 9.5			
40	30— 6.5	27— 2.5	25— 6.5	23—10.5	21— 4.5		
42	31—11.5	28— 5.5	26— 8.5	24—11.5			
44	33— 4.5	29— 8.5	27—10.5	26— 0.5	23— 3.5	20— 6.5	
46	34— 9.5	30—11.5	29— 0.5	27— 1.5			
48	36— 2.5	32— 2.5	30— 2.5	28— 2.5	25— 2.5	22— 2.5	20— 2.5
50	.....	33— 5.5	31— 4.5	29— 3.5			
52	.....	34— 8.5	32— 6.5	30— 4.5	27— 1.5	23—10.5	21— 8.5
54	.....	.....	33— 8.5	31— 5.5			
56	.....	.....	34—10.5	32— 6.5	29— 0.5	25— 6.5	23— 2.5
58	.....	.....	.....	33— 7.5			
60	.....	.....	.....	34— 8.5	30—11.5	27— 2.5	24— 8.5
62	.....	.....	.....	35— 9.5			
64	.....	.....	.....	36—10.5	32—10.5	28—10.5	26— 2.5
66	.....	.....	.....	37—11.5			
68	.....	.....	.....	.....	34— 9.5	30— 6.5	27— 8.5
72	.....	.....	.....	.....	36— 8.5	32— 2.5	29— 2.5
76	.....	.....	.....	.....	.....	33—10.5	30— 8.5
80	.....	.....	.....	.....	.....	35— 6.5	32— 2.5
84	.....	.....	.....	.....	.....	.....	33— 8.5
88	.....	.....	.....	.....	.....	.....	35— 2.5
Speed of Flyer.	720	800	850	900	1100	1250	1400
Speed of Pulley.	355	394	419	443	415	471	528
Size of Bobbins.	12 x 6 in.	10½ x 5½ in.	10½ x 5 in.	9½x4½ in. 10½x4½ in.	8¼ x 3¾ in.	8¼ x 3½ in.	8¼ x 3 in.
Cotton on Full Bobbin.	56 oz.	34 oz.	30 oz.	25 oz.	15 oz.	13 oz.	10 oz.

Width of frame over all, 20 inches.
Driving Pulleys 13 inches diameter, 2¾ inches face.

LENGTH OF FLY FRAMES, INCLUDING DRIVING PULLEYS.

No. of Spindles.	10 Inch Space.	9½ Inch Space.	9 Inch Space.	8½ Inch Space.	7½ Inch Space.	7 Inch Space.	6 Inch Space.	5¼ Inch Space.	5 Inch Space.	4½ Inch Space.	4¼ Inch Space.	3¾ 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.	Ft. In.	Ft. In.	
40	19—10												**40**
42					16—3½	15— 5							**42**
44	21— 6	20— 7											**44**
48	23— 2	22— 2	21— 2										**48**
52	24—10	23— 9	22— 8	21— 7			16— 2						**52**
56	26— 6	25— 4	24— 2	23— 0				15— 5					**56**
60	28— 2	26—11	25— 8	24— 5	21—11				15— 8	14— 5			**60**
64	29—10	28— 6	27— 2	25—10									**64**
66					23—9½	22— 5							**66**
68	31— 6	30— 1	28— 8	27— 3									**68**
72	33— 2	31— 8	30— 2	28— 8	25— 8	24— 2	21— 2		18— 2		15—11		**72**
76	34—10	33— 3	31— 8	30— 1									**76**
78					27—6½	25—11							**78**
80	36— 6	34—10	33— 2	31— 6			23— 2		19—10				**80**
84	38— 2	36— 5	34— 8	32—11	29— 5	27— 8						16—3½	**84**
88		38— 0	36— 2	34— 4			25— 2		21— 6				**88**
90					31—3½	29— 5							**90**
92			37— 8	35— 9									**92**
96			39— 2	37— 2	33— 2	31— 2	27— 2	24— 2	23— 2				**96**
100				38— 7									**100**
102					35— ½	32—11							**102**
104							29— 2	25—11	24—10	22— 8			**104**
108					36—11	34— 8							**108**
112							31— 2	27— 8	26— 6	24— 2			**112**
114					38—9½	36— 5							**114**
120						38— 2	33— 2	29— 5	28— 2	25— 8		21—11	**120**
126													**126**
128							35— 2	31— 2	29—10	27— 2	25—10		**128**
132												23—9½	**132**
136							37— 2	32—11	31— 6	28— 8	27— 3		**136**
144							39— 2	34— 8	33— 2	30— 2	28— 8	25— 8	**144**
152								36— 5	34—10	31— 8	30— 1		**152**
156												27—6½	**156**
160								38— 2	36— 6	33— 2	31— 6		**160**
168								39—11	38— 2	34— 8	32—11	29— 5	**168**
176										36— 2	34— 4		**176**
180												31—3½	**180**
184										37— 8	35— 9		**184**
192										39— 2	37— 2	33— 2	**192**
200											38— 7		**200**
204												35— ½	**204**
216												36—11	**216**
228												38—9½	**228**
Size of Bobbin	12 x 16	11x5½	10 x 5	9 x 4½	10 x 5	9 x 4½	8 x 4	8x3½ / 7x3½	7 x 3½	6 x 3	5 x 2½	4½x2½	
Speed of Flyer	625	700	750	800	825	950	1100	1250	1250	1400	1600	1800	
Speed of Pulley	307	344	319	340	350	404	376	400	400	447	511	574	
Cotton on Full Bobbin	44 oz.	32 oz.	24 oz.	18 oz.	24 oz.	18 oz.	14 oz.	12 oz. / 10 oz.	10 oz.	7 oz.	4 oz.	3 oz.	

Frames of 9½ and 10-inch space are 3 feet 1¼ inches wide, not including cans.
Frames of 7, 7½, 8½ and 9-inch space are 3 feet 6 inches wide, outside bobbins in creel.
Frames of 5¼ and 6½-inch space are 3 feet 2 inches wide, outside bobbins in creel.
Frames of 3½, 3¾, 4¼ and 4½-inch space are 3 feet 1 inch wide, outside bobbins in creel.
Driving Pulleys 16 inches diameter, 1⅝-inch face.

LENGTHS OF MULES.

No. of Spindles.	1¼ in. Gauge.	1 5-16 in. Gauge.	1⅜ in. Gauge.	1¾ in. Gauge.	2 in. Gauge.
	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.
396	46— 5¾	48— 6½	50— 7¼	62—11¾	71— 2¾
408	47— 8¾	49—10¼	51—11¾	64— 8¾	73— 2¾
420	48—11¾	51— 2	53— 4¼	66— 5¾	75— 2¾
432	50— 2¾	52— 5¾	54— 8¾	68— 2¾	77— 2¾
444	51— 5¾	53— 9½	56— 1¼	69—11¾	79— 2¾
456	52— 8¾	55— 1¼	57— 5¾	71— 8¾	81— 2¾
460	53— 1¾	55— 6½	57—11¼	72— 3¾	81—10¾
472	54— 4¾	56—10¼	59— 3¾	74— ¾	83—10¾
480	55— 2¾	57— 8¾	60— 2¾	75— 2¾	85— 2¾
492	56— 5¾	59— ½	61— 7¼	76—11¾	87— 2¾
504	57— 8¾	60— 4¼	62—11¾	78— 8¾	89— 2¾
516	58—11¾	61— 8	64— 4¼	80— 5¾	91— 2¾
528	60— 2¾	62—11¾	65— 8¾	82— 2¾	93— 2¾
540	61— 5¾	64— 3½	67— 1¼	83—11¾	95— 2¾
552	62— 8¾	65— 7¼	68— 5¾	85— 8¾	97— 2¾
564	63—11¾	66—11	69—10¼	87— 5¾	99— 2¾
576	65— 2¾	68— 2¾	71— 2¾	89— 2¾	101— 2¾
588	66— 5¾	69— 6½	72— 7¼	90—11¾	103— 2¾
600	67— 8¾	70—10¼	73—11¾	92— 8¾	105— 2¾
612	68—11¾	72— 2	75— 4¼	94— 5¾	107— 2¾
624	70— 2¾	73— 5¾	76— 8¾	96— 2¾	109— 2¾
636	71— 5¾	74— 9½	78— 1¼	97—11¾	
648	72— 8¾	76— 1¼	79— 5¾	99— 8¾	
660	73—11¾	77— 5	80—10¼	101— 5¾	
672	75— 2¾	78— 8¾	82— 2¾	103— 2¾	
684	76— 5¾	80— ½	83— 7¼	104—11¾	
696	77— 8¾	81— 4¼	84—11¾	106— 8¾	
708	78—11¾	82— 8	86— 4¼	108— 5¾	
720	80— 2¾	83—11¾	87— 8¾	110— 2¾	
732	81— 5¾	85— 3½	89— 1¼		
744	82— 8¾	86— 7¼	90— 5¾		
756	83—11¾	87—11	91—10¼		
768	85— 2¾	89— 2¾	93— 2¾		
780	86— 5¾	90— 6½	94— 7¼		
792	87— 8¾	91—10¼	95—11¾		
804	88—11¾	93— 2	97— 4¼		
816	90— 2¾	94— 5¾	98— 8¾		
828	91— 5¾	95— 9½	100— 1¼		
840	92— 8¾	97— 1¼	101— 5¾		
852	93—11¾	98— 5	102—10¼		
864	95— 2¾	99— 8¾	104— 2¾		
876	96— 5¾	101— ½	105— 7¼		
888	97— 8¾	102— 4¼	106—11¾		
900	98—11¾	103— 8	108— 4¼		

Width of two Mules in working position—

= 20 feet 2 inches between outside of head;

= 19 feet 0 inches between outside of creels.

REELS.

Reels are 14 feet 7 inches long, including pulleys, and will contain the following number of spindles:

3-inch space	50 spindles
3¼-inch space	45 spindles
3½-inch space	42 spindles
3¾-inch space	39 spindles
4-inch space	37 spindles
4¼-inch space	34 spindles
4½-inch space	32 spindles

Width 3 feet 9 inches.

DIMENSIONS OF A 36-INCH LOOM.

Length of Reed	41¼ inches
Length of Frame	55½ inches
Length outside of Pulley	68½ inches
Length of Lay	6 feet 10½ inches
Width of Frame, front to back	39¼ inches
Width outside of 17-inch Beam	43 inches
Size of Shuttle Box, ordinary size, 1⅞ inches wide, 17 inches long.	
Weight	about 800 pounds

POWER REQUIRED TO DRIVE VARIOUS MACHINES.

Pickers	6 to 8 horse power
Cards	3 to 5 cards per horse power
Railway Head	¾ to 1½ horse power
Drawing Frame	4 to 6 deliveries per horse power
Coarse Speeder	27 to 33 spindles per horse power
Intermediate Speeder	37 to 50 spindles per horse power
Fine Speeder	42 to 51 spindles per horse power
Slubber Fly Frame	40 to 50 spindles per horse power
Intermediate Fly Frame	70 to 80 spindles per horse power
Fine Fly Frame	100 to 120 spindles per horse power
Ring Spindles, Common	70 to 120 spindles per horse power
Ring Spindles, Sawyer	90 to 130 spindles per horse power
Ring Spindles, Rabbeth	70 to 90 spindles per horse power
Spooler	250 to 400 spindles per horse power
Warper	4 to 6 per horse power
Slasher	1½ to 1¾ horse power
Loom	4 to 6 looms per horse power

SPEED OF VARIOUS MACHINES.

	Revs. per Min.
Picker, Beater	1300 to 1600
Picker, Fan	1400 to 1700
Card, Cylinder	120 to 150
Railway Head, Front Roll	400 to 500
Drawing Frame, Front Roll	300 to 400
Coarse Speeder, Flyer	720
Intermediate Speeder, Flyer	900
Fine Speeder, Flyer	1250
Slubber Fly Frame, Flyers	600
Intermediate Fly Frame, Flyers	900
Fine Fly Frame, Flyers	1100
Ring Spindle, Common	6000 to 7000
Ring Spindle, Sawyer	7000 to 7800
Ring Spindle, New Rabbeth	7000 to 10,000
Mule Spindles	5000 to 10,000
Spooler Spindles	700 to 900
Warper, Drum	30 to 40
Slasher, Pulley	350 to 400
Looms on Prints	170 to 190
Looms on Sheetings	150 to 170

LENGTH OF RING FRAMES AND TWISTERS OVER ALL.

RING SPINNING FRAMES.						TWISTERS.				
No. of Spindles.	2½ in. Space.	2¼ in. Space.	2⅞ in. Space.	3 in. Space.	3¼ in. Space.	3½ in Space.	3¾ in. Space.	4 in. Space.	4½ in. Space.	5 in. Space.
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft in.	ft. in.	ft. in.	ft. in.
64	8— 7	9— 3	.....	.....	.....	....	.....	.....	.....	.....
80	.....	.....	.....	.....	12— 9	13—5⅜	14— 3⅜	15—1⅜	16—9⅜	18—5⅜
84	.....	.....	.....	.....	13— 3½	14—0⅜	14—10⅞	15—9⅜	17—6⅜	19—3⅜
96	.....	.....	.....	13—11	14—11	15—9⅜	16— 9⅜	17—9⅜	19—9⅜	21—9⅜
112	13— 7	14— 9	15— 4	15—11	17— 1	18—1⅜	19— 3⅜	20—5⅜	22—9⅜	25—1⅜
120	14— 5	15— 8	16— 3½	16—11	18— 2	19—3⅜	20— 6⅜	21—9⅜	24—3⅜	26—9⅜
128	15— 3	16— 7	17— 3	17—11	19— 3	20—5⅜	21— 9⅜	23—1⅜	25—9⅜	28—5⅜
132	.....	.....	.....	.....	.....	21—0⅜	22— 4⅞	23—9⅜	26—6⅜	29—2⅜
144	16—11	18— 5	19— 2	19—11	21— 5	22—9⅜	24— 3⅜	25—9⅜	28—9⅜	.....
160	18— 7	20— 3	21— 1	21—11	23— 7	25—1⅜	26— 9⅜	28—5⅜	.....	.....
176	20— 3	22— 1	23— 0	23—11	25— 9	27—5⅜	.....	.....	.....	.....
192	21—11	23—11	24—11	25—11	27—11	.....	.....	.....	.....	.....
208	23— 7	25— 9	26—10	27—11	.....	.....	.....	.....	.....	.....
224	25— 3	27— 7	28— 9	.....	.....	.....	....	.....	.....	.....
240	26—11	29— 5	.....	.....	.....	.....	.....	.....	.....	.....
256	28— 7	31— 3	.....	.....	.....	.....	.....	.....	.....	.....
272	30— 3	33— 1	.....	.....	.....	.....	.....	.....	.....	.....
288	31—11	.....	.....	.....	.....	.....	.....	.....	.....	.....

Frames geared at both ends are three inches shorter than above.
Width outside 39 in., 36 in. or 32. Frames 32 in. wide have two lines of drums.

LENGTH OF SPOOLERS, INCLUDING PULLEYS.

Number of Spindles.	3¼ Inch Space.	4½ Inch Space.	4¾ Inch Space.	5 Inch Space.
	ft. in.	ft. in.	ft. in.	ft. in.
60	10 — 10¾	12 — 8½	13 — 3¾	13 — 9
68	12 — 1¾	14 — 2½	14 — 10¾	15 — 5
76	13 — 4¾	15 — 8½	16 — 5¾	17 — 1
80	14 — ¼	16 — 5½	17 — 3¼	17 — 11
88	15 — 3¼	17 — 11½	18 — 10¼	19 — 7
96	16 — 6¼	19 — 5½	20 — 5¼	21 — 3
100	17 — 1¾	20 — 2½	21 — 2¾	22 — 1
108	18 — 4¾	21 — 8½	22 — 9¾	23 — 9
116	19 — 7¾	23 — 2½	24 — 4¾	25 — 5
120	20 — 3¼	23 — 11½	25 — 2¼	26 — 3

Width, including boxes, 42 inches.

PRODUCTION OF SPEEDER.

Number of Roving.	Grains per Yard.	Twist per Inch.	POUNDS PER DAY PER SPINDLE.					
			8½ Inch Space.	7½ Inch Space.	7 Inch Space.	6½ Inch Space.	5¾ Inch Space.	5 Inch Space.
.30	27.77	.701	45.76	48.91				
.35	23.81	.758	37.68	39.97				
.40	20.83	.809	32.42	33.39	33.32			
.45	18.52	.859	28.08	28.78	28.49			
.50	16.66	.905	24.86	25.05	24.74	25.88		
.55	15.15	.950	22.36	22.33	21.89	22.80		
.60	13.88	.992	20.16	19.94	19.53	20.40		
.65	12.82	1.03	.....	18.13	17.69	18.44		
.70	11.90	1.07	.....	16.55	16.05	16.80		
.75	11.11	1.10	.....	15.28	14.74	15.39		
.80	10.42	1.14	.....	14.15	13.46	14.22		
.85	9.80	1.18	.....	13.15	12.63	13.21		
.90	9.26	1.21	.....	12.36	11.79	12.35		
.95	8.77	1.24	.....	.....	11.05	11.58		
1.00	8.33	1.28	.....	.....	10.41	10.88	12.78	11.66
1.25	6.66	1.43	.....	.....	.....	7.892	9.46	10.47
1.50	5.55	1.56	.....	.....	.....	6.226	7.29	8.06
1.75	4.76	1.69	.....	.....	....	5.123	5.87	6.52
2.00	4.16	1.80	.....	.....	.....	.....	4.93	5.45
2.25	3.70	1.92	.....	.....	.....	.....	4.21	4.61
2.50	3.33	2.02	.....	.....	.....	.....	3.67	3.99
2.75	3.03	2.12	.....	.....	.....	.....	3.25	3.51
3.00	2.77	2.21	.....	.....	.....	.....	2.91	3.13
3.25	2.56	2.30	.....	.....	.....	.....	.....	2.82
3.50	2.38	2.39	.....	.....	.....	.....	.....	2.56
4.00	2.08	2.56	.....	.....	.....	.....	.....	2.15
Speed of Flyer			720	800	850	900	1100	1250
Speed of Pulley.....			355	394	419	443	415	471
Size of Bobbins.....			12 x 6 in.	10½x5½ in.	10½ x 5 in.	$9\frac{1}{2}$ x $4\frac{1}{2}$ in. $10\frac{1}{2}$ x $4\frac{1}{2}$ in.	$8\frac{1}{4}$ x $3\frac{3}{4}$ in.	$8\frac{1}{4}$ x $3\frac{1}{2}$ in.
Cotton on Full Bobbin			56 oz.	34 oz.	30 oz.	25 oz.	15 oz.	13 oz.

PRODUCTION OF FLY FRAMES.

Number of Roving.	Grains per Yard.	Twist per Inch.	POUNDS PER DAY PER SPINDLE.									
			Slubber. 10″ space.	Slubber. 9½″ space	Slubber. 9″ space	Intermediate. 7½″ space	Intermediate. 7″ space.	Fine. 6″ space.	Fine. 5¼″ space	Jack. 4½″ space	Jack. 4¼″ space	Jack. 3¾″ space
.30	27.77	.66	40.07									
.35	23.81	.71	32.40									
.40	20.83	.76	27.14	30.41								
.45	18.52	.80	23.76	26.63								
.50	16.66	.85	20.40	23.34	25.38							
.55	15.15	.89	18.40	20.86	22.23							
.60	13.88	.93	16.84	18.89	20.12							
.65	12.81	.97	15.04	16.88	17.85							
.70	11.90	1.00	13.96	15.55	16.39							
.75	11.12	1.04	12.87	14.38	15.01							
.80	10.42	1.07	11.88	13.41	14.04	13.30						
.85	9.80	1.11	11.13	12.57	13.22	12.14						
.90	9.26	1.14	10.31	11.59	11.79	11.23	10.78					
.95	8.77	1.17	9.78	10.98	11.16	10.42	9.65					
1.00	8.33	1.20	9.09	10.27	10.39	9.73	9.47	11.61				
1.10	7.58	1.26	8.09	9.10	9.25	8.53	8.44	10.15				
1.20	6.94	1.31	7.20	8.09	8.23	7.60	7.61	9.14				
1.30	6.41	1.37	6.45	7.22	7.50	6.78	6.68	8.04				
1.40	5 95	1.42		6.50	6.77	6.15	6.06	7.26				
1.50	5.55	1.47			6.31	5.61	5.65	6.51				
2.00	4.16	1.70				3.84	4.04	4.48	5.00			
2.50	3.33	1.90					2.95	3.30	3.65			
3.00	2.78	2.08						2.57	2.84			
3.50	2.38	2.24						2.18	2.30			
4.00	2.08	2.40							1.92	2.25		
4.50	1.85	2.55							1.63	1.90		
5.00	1.67	2.68							1.42	1.63		
6.00	1.38	2.92							1.11	1.26		
7.00	1.19	3.18								1.03		
8.00	1.04	3.40								.84		
9.00	.92	3.60								.71		
10.00	.83	3.79								.62	.70	
11.00	.76	3.97								.54	.62	
12.00	.69	4.15									.55	.62
14.00											.45	.50
16.00											.38	.42
18.00											.32	.36
20.00											.27	.31
25.00											.20	.23
30.00											.15	.17
Size of Bobbin.			6″x 12″	5½″ x 11″	5″x 10″	5″x 10″	4½″ x 9″	4″x8″	{3½″x7″ 3½″x8″	3″x6″	2½″ x 5″	2½″x 4½″
Speed of Flyer.			625	700	750	825	950	1100	1250	1400	1600	1800
Speed of Pulley.			307	344	319	350	404	376	400	447	511	574
Cotton on Full Bobbin.			44 oz.	32 oz.	24 oz.	24 oz.	18 oz.	14 oz.	{10 oz.-7″ 12 oz.-8″	7 oz.	4 oz.	3 oz.

SPINNING.

No. of Yarn.	RING WARP YARN.			RING FILLING YARN.			MULE FILLING YARN.			No. of Yarn.
	Revs. per min. of Front Roll.	Revs. per min. of Spindle.	Pounds per Spindle per day.	Revs. per min. of Front Roll	Revs. per min. of Spindle.	Pounds per Spindle per day.	Stretches per min. 65 in. each	Hanks per day per Spindle.	Pounds per day per Spindle.	
4	155.0	4600	2.160	169.1	3400	2.305	4.610	5.322	1.330	**4**
5	153.5	5100	1.716	168.0	3775	1.835	4.575	5.291	1.058	**5**
6	152.0	5600	1.418	166.6	4100	1.520	4.540	5.260	.876	**6**
7	150.4	5900	1.205	165.5	4400	1.297	4.505	5.229	.747	**7**
8	148.9	6300	1.043	163.6	4650	1.124	4.470	5.198	.650	**8**
9	147.4	6600	.921	162.5	4900	.994	4.435	5.166	.574	**9**
10	145.9	6900	.822	160.5	5100	.885	4.400	5.134	.513	**10**
11	144.3	7100	.741	159.0	5300	.799	4.365	5.102	.464	**11**
12	142.8	7400	.673	158.0	5500	.729	4.330	5.071	.423	**12**
13	141.3	7600	.616	157.3	5700	.671	4.295	5.038	.388	**13**
14	139.7	7800	.566	155.6	5850	.618	4.260	5.006	.358	**14**
15	138.2	8000	.524	154.2	6000	.573	4.225	4.974	.332	**15**
16	136.7	8200	.486	151.7	6100	.529	4.190	4.941	.309	**16**
17	135.1	8300	.453	149.6	6200	.492	4.155	4.908	.289	**17**
18	133.6	8500	.424	147.8	6300	.460	4.120	4.876	.271	**18**
19	132.1	8600	.398	146.1	6400	.432	4.085	4.843	.255	**19**
20	130.6	8700	.374	144.6	6500	.407	4.050	4.810	.241	**20**
21	129.0	8800	.353	143.3	6600	.385	4.015	4.776	.227	**21**
22	127.5	8900	.333	142.1	6700	.365	3.980	4.743	.216	**22**
23	126.0	9000	.315	139.0	6700	.342	3.945	4.709	.205	**23**
24	124.4	9100	.299	136.1	6700	.321	3.910	4.676	.195	**24**
25	122.9	9200	.284	135.3	6800	.307	3.875	4.642	.186	**25**
26	121.4	9200	.270	134.6	6900	.295	3.840	4.608	.178	**26**
27	119.8	9300	.257	132.1	6900	.279	3.805	4.574	.169	**27**
28	118.3	9300	.245	130.7	6950	.266	3.770	4.539	.162	**28**
29	116.8	9400	.234	128.4	6950	.253	3.735	4.505	.155	**29**
30	115.3	9400	.224	126.2	6950	.241	3.700	4.470	.149	**30**
31	113.7	9400	.214	125.1	7000	.232	3.665	4.435	.143	**31**
32	112.2	9500	.205	123.1	7000	.221	3.630	4.401	.138	**32**
33	110.7	9500	.196	121.2	7000	.212	3.595	4.366	.132	**33**
34	109.1	9500	.188	119.4	7000	.203	3.560	4.331	.127	**34**
35	107.6	9500	.181	117.7	7000	.195	3.525	4.295	.123	**35**
36	106.1	9500	.173	116.1	7000	.187	3.490	4.260	.118	**36**
37	104 5	9500	.166	115.3	7050	.181	3.455	4.224	.114	**37**
38	103.0	9500	.160	114.6	7100	.175	3.420	4.188	.110	**38**
39	101.5	9500	.154	113.1	7100	.169	3.385	4.152	.107	**39**
40	100.0	9500	.148	112.5	7150	.164	3.350	4.116	.103	**40**
42	98.0	9500	.138	110.5	7200	.154	3.280	4.044	.096	**42**
44	96.0	9500	.130	108.0	7200	.144	3.210	3.971	.090	**44**
46	94.0	9500	.122	105.6	7200	.135	3.140	3.897	.085	**46**
48	92.0	9500	.115	103.4	7200	.128	3.070	3.823	.080	**48**
50	90.0	9600	.108	101.3	7200	.120	3.000	3.748	.075	**50**
52	89.0	9600	.103	100.7	7300	.115	2.930	3.672	.070	**52**
54	88.0	9600	.099	98.8	7300	.110	2.860	3.597	.066	**54**
56	87.0	9600	.094	97.0	7300	.104	2.790	3.520	.062	**56**
58	86.0	9800	.090	95.4	7300	.099	2.720	3.421	.059	**58**
60	85.0	9800	.086	93.8	7300	.094	2.650	3.364	.056	**60**

RELATION OF DRUM TO WHIRL.

	6¼ Inches Diam. of Drum.	7 Inches Diam. of Drum.	8 Inches Diam. of Drum.	9 Inches Diam. of Drum.
¾ inch whirl	7.30	8.12	9.20	10.72
13-16 inch whirl	6.83	7.58	8.64	9.94
⅞ inch whirl	6.40	7.05	8.10	9.45
1 inch whirl	5.83	6.48	7.18	8.25
1⅛ inch whirl	5.17	5.80	6.62	
1¼ inch whirl	4.70	5.20	5.94	
1½ inch whirl	3.92	4.32	4.91	
1¾ inch whirl	3.30	3.70	4.22	
2 inch whirl	3.03	3.40	3.88	
2¼ inch whirl	2.69	3.00	3.44	

TWIST TABLE.

Showing the Twist per inch for different kinds of Twisted Yarns.

Number of Yarn to be Twisted.	2 Ply.	3 Ply.	4 Ply.	5 Ply.	6 Ply.	Number of Yarn to be Twisted.	2 Ply.	3 Ply.	4 Ply.	5 Ply.	6 Ply.
1	2.83	2.30	2.00	1.79	1.65	**37**	17.20	14.04	12.16	10 88	9 94
2	4.00	3.28	2.83	2.53	2.30	**38**	17.43	14.24	12 33	11.03	10.06
3	4.90	4.00	3 46	3.10	2.83	**39**	17 66	14.42	12.49	11.17	10.20
4	5 66	4.61	4.00	3.58	3.28	**40**	17.89	14.60	12.65	11.31	10.33
5	6.32	5 17	4.47	4 00	3.64	**41**	18.11	14.79	12.81	11.46	10.45
6	6 93	5.66	4.90	4 38	4.00	**42**	18.33	14.96	12 96	11.59	10.58
7	7.48	6.10	5 29	4.73	4.33	**43**	18.55	15.14	13.12	11.73	10.71
8	8.00	6.54	5.66	5.06	4.61	**44**	18.76	15.32	13.26	11.87	10.83
9	8.48	6.93	6.00	5.37	4.90	**45**	18.97	15.49	13.42	12.00	10.96
10	8.94	7.30	6 32	5.66	5.17	**46**	19.18	15.66	13.56	12.13	11.08
11	9 38	7.66	6.63	5.93	5.41	**47**	19.39	15.84	13.71	12.26	11.19
12	9.80	8.00	6.93	6 20	5.66	**48**	19 59	16 00	13.86	12.39	11.31
13	10.20	8.32	7.21	6 45	5 89	**49**	19.80	16 16	14.00	12.52	11.43
14	10 58	8.64	7.48	6.69	6.10	**50**	20.00	16.33	14.14	12.65	11.54
15	10 96	8.94	7.75	6.93	6.32	**51**	20.20	16.49	14.28	12.78	11.66
16	11.31	9.24	8.00	7.16	6.54	**52**	20.40	16.65	14.42	12 90	11.78
17	11.66	9.52	8.25	7.38	6.73	**53**	20.59	16.82	14.56	13 02	11 89
18	12.00	9.80	8.48	7.59	6.93	**54**	20.78	16 97	14.70	13.14	12.00
19	12.33	10.06	8.72	7 80	7.12	**55**	20.98	17.12	14.83	13.26	12.11
20	12.65	10.33	8 94	8.00	7.30	**56**	21.16	17.28	14.96	13.39	12.22
21	12.96	10.58	9.16	8.20	7.48	**57**	21.36	17.43	15.10	13.50	12.33
22	13 26	10.83	9.38	8.39	7.66	**58**	21 54	17 59	15.23	13.62	12.44
23	13.56	11.08	9.59	8.58	7 83	**59**	21.72	17.74	15.36	13.74	12.54
24	13.86	11.31	9.80	8.76	8.00	**60**	21.91	17.89	15.49	13.86	12.65
25	14.14	11.54	10.00	8.94	8.17	**61**	22.09	18.04	15.62	13.97	12.76
26	14 42	11.78	10.20	9.12	8.32	**62**	22 27	18.18	15.75	14 08	12.86
27	14.70	12.00	10.39	9.30	8 48	**63**	22.45	18.33	15 88	14.20	12 96
28	14.96	12.22	10 58	9 46	8.64	**64**	22.62	18.47	16 00	14.31	13.06
29	15.23	12.44	10.77	9.63	8 79	**65**	22 80	18.62	16.12	14.42	13.16
30	15.49	12 65	10 96	9 80	8.94	**66**	22.98	18.76	16.25	14.53	13.26
31	15.75	12.86	11.14	9.96	9.10	**67**	23.15	18.90	16.37	14.64	13.37
32	16.00	13.06	11.31	10 12	9.24	**68**	23 32	19.04	16.49	14.75	13.46
33	16 25	13.26	11.49	10 28	9.38	**69**	23.50	19.18	16.61	14.86	13.56
34	16.49	13.46	11.66	10.43	9.52	**70**	23.66	19.32	16 73	14.96	13.66
35	16.73	13.66	11.83	10.58	9 66	**71**	23.83	19.46	16.85	15 07	13.76
36	16 97	13 86	12.00	10 73	9.80	**72**	24.00	19.59	16.97	15.18	13.86

The above table is the one generally adopted by builders of machinery, although it is frequently varied to meet individual requirements.

TWIST TABLE.

Showing the Twist per Inch for different kinds of Yarn.

No. of Yarn.	Frame Warp Twist.	Frame Filling Twist.	Mule Filling Twist.	No. of Yarn.	Frame Warp Twist.	Frame Filling Twist.	Mule Filling Twist.
1	4.75	3.20	3.50	**29**	25.57	17.23	18.84
2	6.71	4.52	4.94	**30**	26.01	17.52	19.16
3	8.21	5.54	6.06	**31**	26.44	17.81	19.48
4	9.50	6.40	7.00	**32**	26.86	18.09	19.79
5	10.62	7.15	7.82	**33**	27.28	18.38	20.10
6	11.63	7.83	8.57	**34**	27.69	18.65	20.40
7	12.56	8.46	9.25	**35**	28.10	18.93	20.70
8	13.43	9.04	9.89	**36**	28.50	19.20	21.00
9	14.25	9.60	10.50	**37**	28.88	19.46	21.28
10	15.01	10.11	11.06	**38**	29.27	19.72	21.57
11	15.75	10.61	11.60	**39**	29.65	19.98	21.85
12	16.45	11.08	12.12	**40**	30.03	20.23	22.13
13	17.12	11.53	12.61	**41**	30.41	20.48	22.41
14	17.76	11.97	13.09	**42**	30.78	20.73	22.68
15	18.39	12.39	13.55	**43**	31.14	20.98	22.94
16	19.00	12.80	14.00	**44**	31.55	21.22	23.21
17	19.58	13.19	14.43	**45**	31.86	21.46	23.47
18	20.14	13.57	14.84	**46**	32.21	21.70	23.73
19	20.70	13.94	15.25	**47**	32.56	21.93	23.99
20	21.24	14.31	15.65	**48**	32.95	22.16	24.24
21	21.76	14.66	16.03	**49**	33.25	22.40	24.50
22	22.27	15.00	16.41	**50**	33.58	22.62	24.74
23	22.77	15.34	16.78	**52**	34.25	23.07	25.23
24	23.26	15.67	17.14	**54**	34.90	23.51	25.71
25	23.75	16.00	17.50	**56**	35.54	23.94	26.19
26	24.22	16.31	17.84	**58**	36.17	24.36	26.65
27	24.68	16 62	18.18	**60**	36.78	24.78	27.10
28	25.13	16.93	18.51				

We have printed lists of draft and twist gearing used on our Ring Frames and Twisters, which we shall be pleased to send to all users of our Frames. It will be found convenient and useful in making changes.

TABLE SHOWING BREAKING WEIGHT OF WARP YARN PER SKEIN.

Weight given in pounds and tenths.

Number of Yarn.	BREAKING WEIGHT.					
	Ordinary.	Fair.	Good.	Extra.	Super Extra.	Draper's Standard
10	115.6	120.5	125.4	130.2	135.2	168.7
11	102.2	104.4	106.6	108.9	111.1	154.1
12	96.2	99.1	100.3	103.5	105.7	142.0
13	91.9	93.9	96.0	98.1	100.2	131.5
14	89.7	91.7	93.8	95.9	97.9	122.8
15	83.7	85.6	87.5	89.4	91.4	115.1
16	81.7	83.5	85.4	87.2	89.1	108.4
17	76.9	78.6	80.4	82.1	83.9	102.5
18	72.6	74.2	75.9	77.5	79.2	97.3
20	67.9	69.4	70.9	72.4	74.0	88.3
22	61.7	63.1	64.4	65.9	67.3	79.7
24	58.6	59.9	61.2	62.6	63.9	72.4
26	54.6	55.8	57.1	58.3	59.6	66.3
28	50.2	51.4	52.5	53.6	54.8	61.3
30	48.7	49.7	50.8	51.9	53.0	57.3
32	45.6	46.4	47.3	48.2	49.1	54.0
34	44.4	45.4	46.4	47.4	48.4	51.2
36	41.9	42.8	43.7	44.7	45.7	48.7
38	39.7	40.6	41.4	42.4	43.3	46.5
40	38.9	39.8	40.7	41.6	42.5	44.6
42	37.8	38.6	39.5	40.4	41.2	43.0
44	35.4	36.2	37.0	37.8	38.6	41.4
46	33.8	34.6	35.3	36.1	36.9	40.0
48	32.2	32.9	34.6	34.3	35.1	38.6
50	32.1	32.8	33.5	34.2	35.0	37.3
55	30.5	31.2	31.9	32.6	33.3	34.4
60	27.6	28.2	28.9	29.5	30.1	31.7
65	25.5	26.1	26.6	27.2	27.8	29.6
70	24.4	24.9	25.5	26.1	26.6	27.8
75	22.7	23.2	23.7	24.2	24.8	26.2
80	22.0	22.5	23.0	23.5	24.0	24.6
85	20.2	20.8	21.4	21.9	22.5	23.2
90	19.5	19.2	19.9	20.6	21.3	22.0
95	18.5	18.9	19.3	19.7	20.2	21.0
100	18.2	18.6	19.0	19.4	19.7	20.0

LIST OF SPINNING PULLEYS.

No. of Pattern.	Diameter.	Face.		No. of Pattern.	Diameter.	Face.		No. of Pattern.	Diameter.	Face.		No. of Pattern.	Diameter.	Face.	
26697	15	3	Tight.	28030	12½	3	Tight.	24724	10½	2¼	Tight.	24718	9	2¼	Loose.
26698	15	3	Loose.	28031	12½	3	Loose.	24725	10½	2¼	Loose.	24719	9	2¼	Tight.
25288	14½	2¼	Tight.	24728	12	2¼	Tight.	26226	10½	2¾	Tight.	26260	9	3	Tight.
25289	14½	2¼	Loose.	24729	12	2¼	Loose.	26227	10½	2¾	Loose.	26261	9	3	Loose.
24736	14	2	Tight.	26176	12	2¾	Tight.	25038	10¼	2¼	Tight.	26699	8¾	3	Tight.
24737	14	2	Loose.	26177	12	2¾	Loose.	25039	10¼	2¼	Loose.	26700	8¾	3	Loose.
26270	14	3	Tight.	26266	12	3	Tight.	24722	10	2	Tight.	24716	8½	2½	Tight.
26271	14	3	Loose.	26267	12	3	Loose.	24723	10	2	Loose.	24717	8½	2½	Loose.
29075	13¾	2¼	Tight.	24726	11½	2	Tight.	24758	10	2½	Tight.	27212	8¼	2½	Tight.
29076	13¾	2¼	Loose.	24727	11½	2	Loose.	24759	10	2½	Loose.	27213	8¼	2½	Loose.
28689	13½	2½	Tight.	26274	11¼	3	Tight.	25282	10	2¾	Tight.	24424	8	2½	Tight.
28690	13½	2½	Loose.	26275	11¼	3	Loose.	25283	10	2¾	Loose.	24425	8	2½	Loose.
24734	13½	2	Tight.	26224	11¼	2½	Tight.	26262	10	3	Tight.	26942	8	3	Tight.
24735	13½	2	Loose.	26225	11¼	2½	Loose.	26263	10	3	Loose.	26943	8	3	Loose.
24732	13	2	Tight.	24426	11	2¼	Tight.	25962	9¾	3	Tight.	28537	12	1½	Tight, with flange.
24733	13	2	Loose.	24427	11	2¼	Loose.	25963	9¾	3	Loose.	28538	11¾	1½	Loose.
26268	13	3	Tight.	25954	11	2¾	Tight.	24720	9½	2¼	Tight.	30328	14	1½	Tight, with flange.
26269	13	3	Loose.	25955	11	2¾	Loose.	24721	9½	2¼	Loose.	30329	13¾	1½	Loose.
24730	12½	2	Tight.	26264	11	3	Tight.	27198	9½	3	Tight.				
24731	12½	2	Loose.	26265	11	3	Loose.	27199	9½	3	Loose.				

LIST OF LOOM PULLEYS.

No. of Pattern.	Diameter.	Face.		No. of Pattern.	Diameter.	Face.		No. of Pattern.	Diameter.	Face.		No. of Pattern.	Diameter.	Face.	
28651	20	4	Loose.	24908	15	2½	Loose.	26047	13½	2½	Loose.	29044	12½	2⅛	Tight.
28652	18	3½	Tight, flange on one edge.	24568	15	2⅛	Tight.	26048	13½	2½	Tight.	29045	12½	2⅛	Loose.
				24569	15	2⅛	Loose.	28279	13½	2⅛	Tight.	24998	12	2½	Tight.
25300	20	3¼	Tight.	24810	14	2½	Tight.	28280	13½	2⅛	Loose.	24999	12	2½	Loose.
25301	20	3¼	Loose.	24811	14	2½	Loose.	31667	13¼	2½	Tight.	24570	12	2	Tight.
24334	17¾	2½	Tight.	28156	14	2¼	Tight.	31668	13¼	2½	Loose.	24571	12	2	Loose.
24335	17¾	2½	Loose.	28157	14	2¼	Loose.	26053	13	2½	Tight.	26251	11½	2¼	Tight.
26049	16	3	Tight.	25179	14	2⅛	Tight, offset arms.	26054	13	2½	Loose.	26252	11½	2¼	Loose.
26050	16	3	Loose.	25180	14	2⅛	Loose, offset arms.	24921	13	2¼	Tight.	28940	11	2½	Tight.
24919	16	2⅛	Tight.					24922	13	2¼	Loose.	28941	11	2½	Loose.
24920	16	2⅛	Loose.	24282	14	2⅛	Tight.	24296	13	1¾	Tight.	24923	11	2¼	Tight.
26395	15½	2½	Tight.	24283	14	2⅛	Loose.	24297	13	1¾	Loose.	24924	11	2¼	Loose.
26396	15½	2½	Loose.	24182	14	1¾	Tight.	26249	12½	2½	Tight.	24925	10½	2¼	Tight.
24907	15	2½	Tight.	24183	14	1¾	Loose.	26250	12½	2½	Loose.	24926	10½	2¼	Loose.