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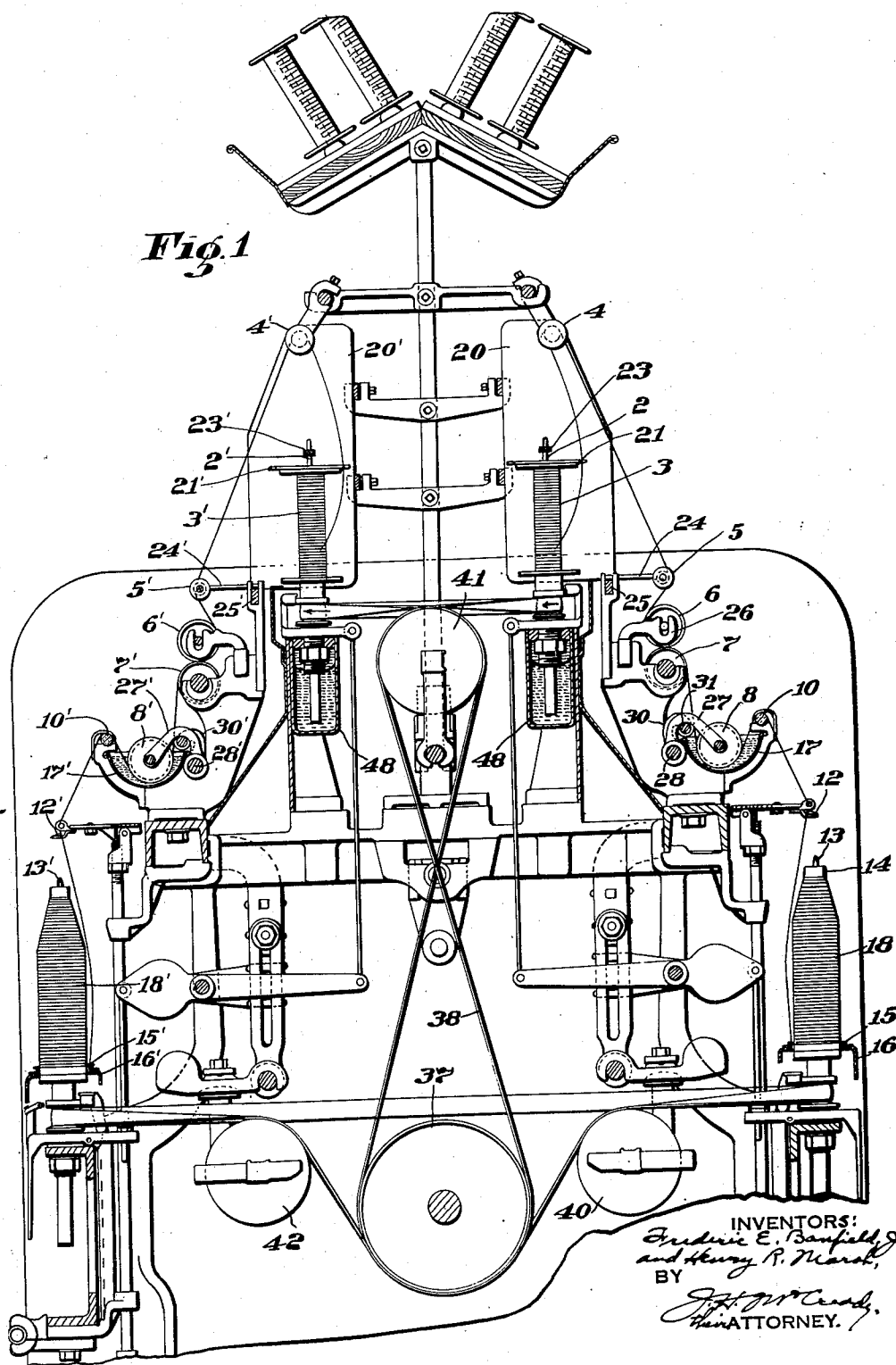
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MECHANISM FOR TWISTING FIBERS

Filed March 28, 1931

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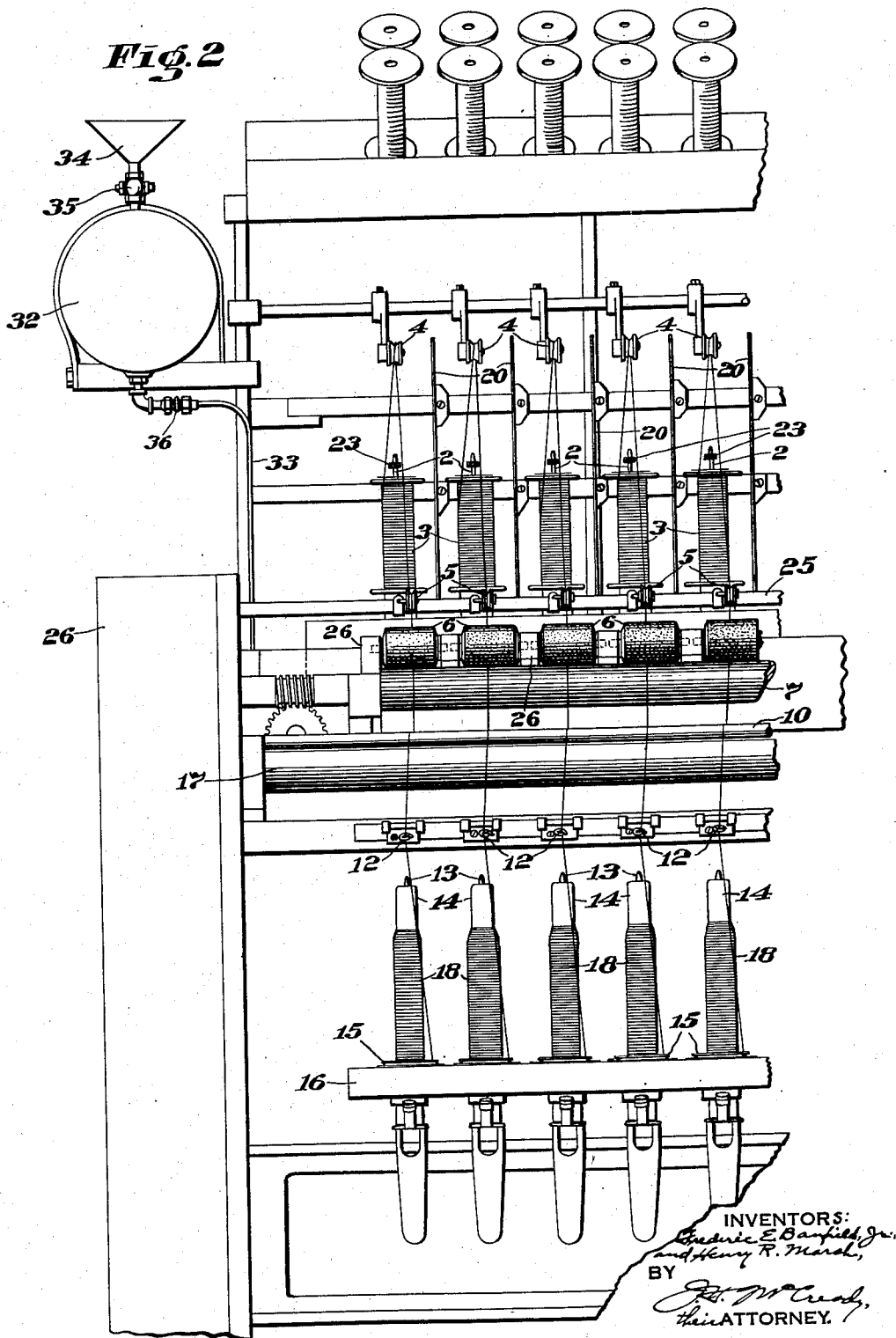
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Fig. 2



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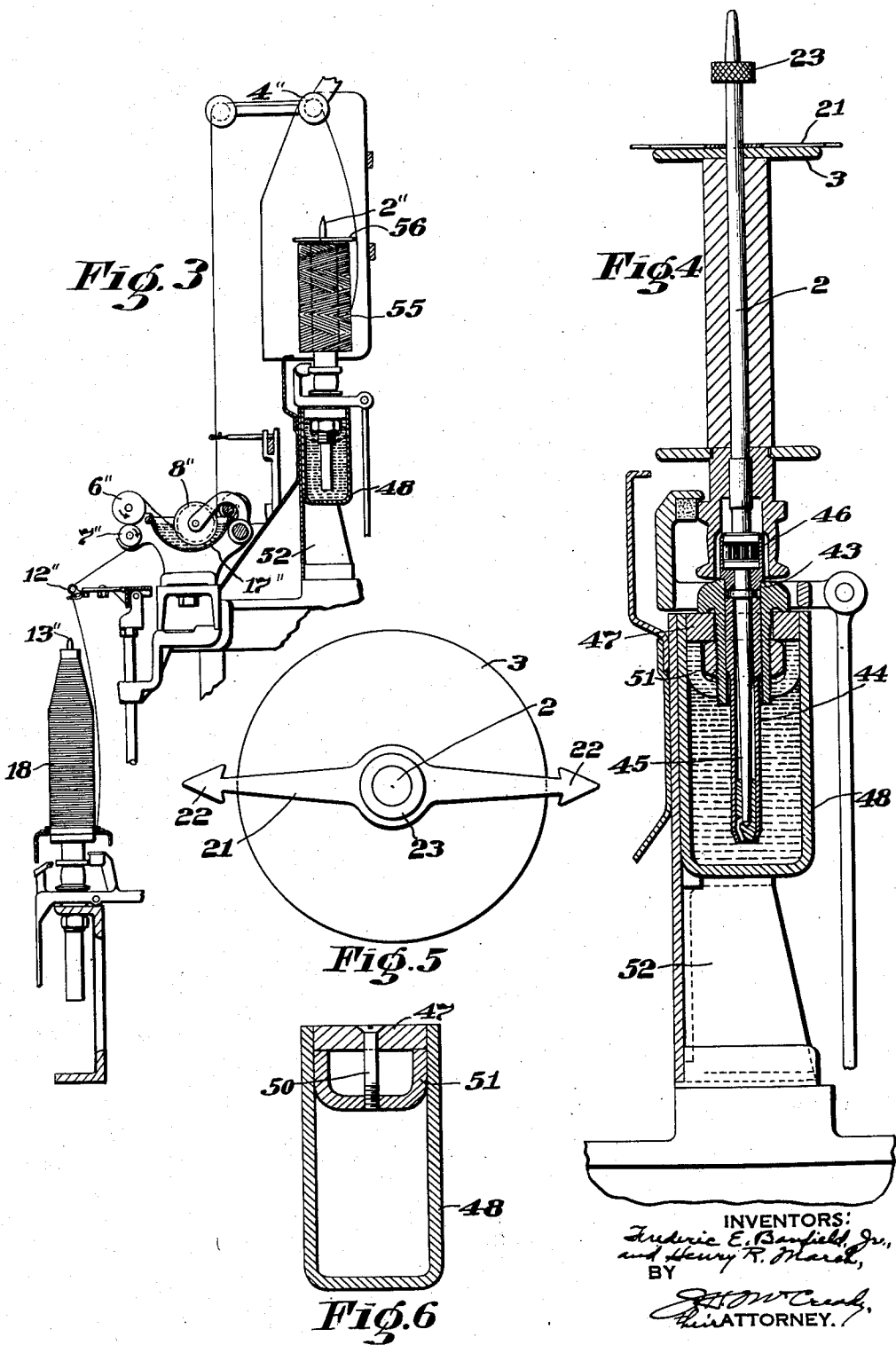
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UNITED STATES PATENT OFFICE

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MECHANISM FOR TWISTING FIBERS

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5 Claims. (Cl. 117—2)

This invention relates to improvements in machines for twisting fibers. While not limited thereto, it is particularly concerned with the twisting of fibers to produce rayon yarn, sewing thread, and other yarns and threads which require a much higher twist than ordinary cotton yarn used in weaving.

When these high twist yarns and threads are twisted in the twister frame commonly used for ordinary cotton yarn, the necessity for putting in the higher twist requires a slowing down of the delivery rolls. This correspondingly reduces the rate of production even though the spindles be run at the usual speeds. In addition, it is often desirable to "wet twist" these materials, which fact introduces further difficulties, especially in the case of delicate threads, such as rayon, which is relatively weak prior to twisting and is further weakened by wetting.

The present invention aims to improve twisting mechanisms with a view to effecting economies in the production of yarns and threads and substantially increasing the rate of production, while still producing a finished product fully as satisfactory as that obtained by existing processes. To this end we have devised an improved mechanism to produce a twist on twist in a continuous operation, and to provide for wetting the yarn or thread between successive and continuous twisting operations.

The nature of the invention will be readily understood from the following description when read in connection with the accompanying drawings, and the novel features will be particularly pointed out in the appended claims.

In the drawings,

Figure 1 is a vertical sectional view, partly in elevation, showing a portion of a twister frame embodying features of this invention;

Fig. 2 is a front elevation of part of the machine shown in Fig. 1;

Fig. 3 is a vertical, sectional view showing a modification;

Fig. 4 is a vertical, sectional view of one of the spindles shown in Figs. 1 and 3;

Fig. 5 is a plan view illustrating a flyer; and

Fig. 6 is a sectional view showing a detail of construction.

Referring first to Fig. 2 and to the right-hand side of Fig. 1, we have illustrated a twister of our invention with provision for wet twisting. It will be seen that the machine there shown comprises a horizontal series or bank of spindles 2, each supporting a supply package 3 of thread or yarn, the supply package being shown in the form

of a spool of a usual kind. As the strands of yarn are unwound from the spools they are led, respectively, over guide rolls 4 located above and substantially in line with the spindles 2, and then travel downwardly at an angle over additional guide rolls 5, between upper and lower feed rolls 6 and 7, respectively, around additional guide rolls 8, over a guide rod 10 and through guide eyes 12 to a series of ring twisters which correspond in number and arrangement to the spindles 2. These ring twisters are of the usual construction, each including an upright spindle 13 on which a bobbin 14 or other thread body may be supported, each spindle having associated with it a ring 15 mounted in a ring rail 16 and each ring carrying the usual traveller. It will be noted that the guide 5 is so located with relation to the spindle 2 as to lead the yarn at a substantial angle from the guide 4 so that the yarn travelling from the spool to the guide 4 will not strike the yarn passing downwardly from guide 4 to guide 5. Also guide 5 is preferably so positioned with relation to roll 6 as to cause a substantial wrap of the yarn about roll 6 to avoid slippage of yarn between rolls 6 and 7.

It will be observed that the guide rolls 8 are supported in a pan or reservoir 17 adapted to contain water or other liquid for purposes such as wetting, dyeing, sizing, twist setting, etc.

The upper spindles 2 are mounted to revolve at high speeds, and as the yarn is fed upwardly from the spools, it should be unwound from them in the same direction in which the spindles are revolving. The yarn is drawn from these spools by the feed rolls 6 and 7, the lower of these rolls being positively driven at a uniform speed while the upper roll or rolls 6 are revolved simply by their contact with the lower roll. Consequently, these upper spindles and the guides associated with them form twisters or twister units. The amount of twist put into the yarn in this first twisting step or operation will depend upon the ratio of the speed of revolution of the spindles 2 to the rate at which the yarn is delivered by the feed rolls 6 and 7. Similarly at the lower spindles 13 the amount of twist put into the yarn depends upon the ratio between the speed of these spindles and the feeding rate of the rolls 6 and 7.

The spindles in both the upper and lower banks may be driven at speeds at least as high as those used in the common commercial twister frames so that at least double the production obtained in the ordinary twister frame can be produced in this machine. Furthermore, with this ar-

rangement the yarn receives one-half, or at least a substantial fraction, of its final twist before it enters the water pan so that it is thereby strengthened very materially before the wetting operation. The second half or remaining fraction of the twist is then put into the yarn, but before this occurs the first twist has been "set" by the wetting step, the second twist being superposed on the first.

10 If desired, a small percentage of starch or other sizing or of some dye for tinting the yarn can be introduced into the liquid in the reservoir 17. The yarn can be wound on the bobbins 14 to produce either warp wound or filling wound packages. This arrangement also permits the use of somewhat heavier travellers on the rings 15, than is usually customary so as to make large hard yarn or thread packages 18 suitable for delivery directly to the loom and thus avoid the necessity for rewinding.

20 As the yarn is drawn from each spool 3 in the upper bank of twistlers it revolves around its respective spool at a higher speed than the speed of the spindles 2. This is commonly accompanied by a ballooning of the yarn. The ballooning may be controlled by the use of separators 20 which permit a moderate but controlled degree of ballooning. The use of a flyer, as hereinafter described, will also aid in avoiding excessive ballooning. When the machine is stopped, however, and the spools 3 slow down, there is a tendency for some slack to accumulate. With some yarns, if such slack is permitted it is very likely to cause the yarn to kink, and this kink may feed through to the package 18 and produce a flaw in the final product.

30 In order to prevent the formation of the kinks which otherwise might occur, a flyer 21, best shown in Fig. 5, is loosely supported on the upper end of each spool 3 where it can rotate freely about the spindle 2. The flyer should be relatively light in weight and for this reason may conveniently be made of aluminum, or other relatively light material. It is preferably given the symmetrical bar shape shown in Fig. 5 so that it will balance and run smoothly, and it is preferably provided with a head 22 at each end and with shoulders at the junction of the head and body, these shoulders serving to limit the outward movement radially of the yarn relatively to the flyer, and thus also aid in controlling the ballooning while permitting the thread to be freely engaged by and disengaged from the flyer.

40 This form of flyer is of convenience in threading up since it is not necessary to pay any attention to the flyer but simply to carry the yarn from the spool up over the guide roll 4 and then to the other feeding and guiding devices. When the spindle starts up, the yarn will strike one side or the other of the flyer 21 and will compel the flyer to rotate with the yarn. Due to the fact that the flyer is very light in weight, it exerts only a slight drag on the yarn and permits the yarn to feed freely and to form an approximately normal though limited balloon. Before the spindle gets up to speed the flyer usually will be lifted off the spool head 3 and thereafter it will "float" just above the spool head so long as the spindle is running at high speeds. When the machine is shut down and the spindle slows up, the flyer will drop on to the top of the spool and will exert an increased drag on the yarn, thereby effectually preventing the formation of slack with the consequences above described.

A small knurled collar 23 may be placed on the upper end of the spindle 2 to prevent the flyer from being lifted off the end of the spindle accidentally, the collar having a tapered hole to fit the taper of the spindle. This collar preferably is so positioned that it does not interfere with the normal floating movement of the flyer.

5 In order to avoid any liability of injuring delicate yarn, such as rayon, it is preferable to use a yielding covering on the upper feed roll 6. Such a covering may consist, for example, of leather or cork. When such rolls are used it is desirable to traverse the yarn across the faces of the rolls and for this purpose each of the guide rolls 5 is mounted on the end of an arm 24 which is secured to a traverse bar 25. The bar is given a longitudinal traversing movement of suitable amplitude by means of mechanism enclosed in the casing 26, Fig. 2, such mechanism not being shown since it is common in twister frames. If a traverse is not to be utilized the guides 5 may be fixed.

10 It should be observed that the upper roll 6 consists of a series of independent sections, as clearly shown in Fig. 2. Each section has short stub shafts projecting from its opposite ends which are supported in slotted brackets 26 so that any roll section can be removed freely from the machine to permit threading up or piecing up a broken end. The lower roll 7 is mounted to revolve in fixed bearings.

20 To facilitate the threading up and piecing up operations in wet twisting, each of the guide rolls 8 which runs in the liquid pan 17 is mounted on an arm 27, Fig. 1, which is pivoted to swing on a rock shaft 28 that extends longitudinally of the machine and is located just behind the pan. This arrangement permits the operator to swing any roll 8 out of the liquid pan simply by placing her finger under the arm 27 and lifting it. Located immediately beside each arm 27 is another arm 30 carrying a pin 31 which projects laterally under the arm 27. These arms 30 are secured rigidly to the rock shaft 28 and a handle (not shown) is secured to the end of this rock shaft at one end of the frame. Consequently, by operating the handle to rock the shaft 28, all of the arms 27 with their guide rolls 8 may be swung simultaneously out of the pan into inactive positions where they may be held so long as desired. Each pin 31 also performs the function of acting as a stop for the arm 27 to sustain the arm and its roll 8 in their normal or active positions in the pan.

30 The liquid in the reservoir 17 should be maintained at an approximately uniform level and this is conveniently accomplished by mounting a supply tank 32, Fig. 2, for the liquid at one end of the frame and connecting this tank with the pan or reservoir 17 by a supply tube 33. Normally the top of the tank 32 is closed tightly so that liquid can feed from it barometrically into the reservoir 17 and thus replenish the supply of liquid in this reservoir automatically and maintain a substantially constant liquid level in the reservoir. The tank 32 may be filled through a funnel 34 which is connected to the tank through a valve 35, a valve 36 also being connected into the feed tube 33 so that this tube can be closed during the filling of the tank.

40 The foregoing description, so far as it relates to Fig. 1, has referred particularly to the units at the right hand side of the frame, but these units customarily are duplicated at the left-hand side of the frame and such an arrangement is il-

illustrated in this figure, the left-hand units being designated by corresponding but primed reference numerals.

It is desirable that each spindle should be directly driven from a source of power. In the particular arrangement shown four spindles are directly driven by a single tape, two of these spindles being located at one side of the machine and twisting the same strand of yarn, and the other two being the corresponding spindles at the opposite side of the machine. In the particular arrangement shown a main driving drum 37 extends longitudinally of the machine between the lower pair of spindles 13—13' and drives the tape or band 38. Starting from the whirl on the spindle 13, the band runs over a takeup roll 40, around the drum 37, then upwardly over a guide roll 41, around the whirl of the spindle 2', then across the machine and around the whirl of the spindle 2, back over the guide roll 41 and around the driving drum 37, over a second take-up roll 42 to the whirl of the spindle 13'. From this whirl the tape extends directly across the machine frame to the first spindle 13. With this arrangement the stopping of any pair of spindles to piece up involves stopping that pair only, such pair consisting of the upper and corresponding lower spindles.

In this machine the spindles of the ringtwisters can be run at fully as high speeds as those used heretofore in ring twister frames. For instance, with 2 or 2½ inch rings, common spindle speeds are from 6,000 to 8,000 R. P. M. High speed self-centering spindles preferably are used in these lower banks. The operating speed of a ring twister, however, is limited by the speed at which the traveller can run rather than the speed of operation of the spindle. Since no traveller is used with the upper spindles, a spindle construction can be employed in these upper banks which will permit a substantially higher operating speed than that of the ring twisters. For this purpose we prefer to use a ball or roller bearing self-centering spindle, one form of which is shown in Fig. 4. This spindle is of a known form and includes a spindle base 43 supporting a bolster 44 in which the bearing blade 45 of the spindle is mounted. The roller bearing for the spindle is indicated at 46.

There is danger that the machine attendant in oiling the spindles of the upper bank will spill oil on the yarn and we have therefore devised a common lubricating system for all of the spindles in each of the upper banks. For this purpose the spindle bases of one bank are all mounted in a spindle rail 47, Fig. 4, and all of these bases project into a trough 48 which extends the entire length of the rail. The bases are secured to the rail in the usual manner, but each base is cut off a short distance below the usual clamping nut so that the entire lower end portion of the bolster is left bare and extends down into the trough 48. This trough is kept approximately filled with oil or other lubricant, and since the same trough supplies lubricant to all the spindles, the level of the lubricant at each spindle is the same. The spindle rail 47 may conveniently be set into the upper end of the trough 48 and be secured in place by a series of screws, one of which is shown at 50 in Fig. 6, these screws taking into U-shaped braces 51 which are located in the trough and are spot welded to the opposite side walls of the trough. Brackets 52, Figs. 3 and 4, support the trough and the spindle rail in their operative positions in the

machine. Lubricant is supplied to this trough through a filling cup (not shown) located at one end of the machine frame, or by means of a barometric feed, such as that above described for replenishing the supply of liquid in the water pan 17. This arrangement has the added advantage that replenishment of oil is necessary only infrequently.

With our machine we are enabled to produce high twist threads and yarns at more than twice the rate of production heretofore obtainable.

We have found that a further reduction in manufacturing expense can be effected in making some threads by winding the yarn on tubes instead of on spools preparatory to bringing it to the twister frame. These tubes can be either straight or tapered. Since they are devoid of heads, the winding operation must be performed in such a manner as to produce a self-sustaining thread or yarn body, and for this purpose we prefer to use the Foster or Universal winding machines which crosses the thread upon itself in such a manner as to build up an inherently stable yarn package from which the yarn will unwind freely. The yarn can be prepared for twisting more economically in this manner than by the spooling method.

A self-sustaining yarn supply package of this character is shown at 55 in the upper spindle 2' in Fig. 3. Held on the spindle immediately above this package is a disk 56 which revolves with the spindle. This disk assists in leading the yarn outwardly as it is unwound, thereby effectively controlling the ballooning and maintaining a uniform and harmless balloon.

In substantially all respects the arrangement shown in Fig. 3 is like that illustrated at the left-hand side of Fig. 1 except for the fact that the water pan is located between the feed rolls and the upper twister unit. It will be noted that the roll 8'' serves as an additional guide to increase the wrap of the yarn about the feed roll 6''.

This is a suitable arrangement and for most yarns may be used interchangeably with the arrangement shown in Fig. 1. In the arrangement shown in Fig. 1 there is less tendency to exert a definite pull on the yarn while it is wet and therefore the arrangement of Fig. 1 may be preferable for some of the more delicate yarns or threads such as rayon. In both arrangements there is the novel and useful result of giving the yarn a twist, then wetting it, and then again twisting by a single, continuous operation.

It is contemplated that the yarn may be twice wetted. That is, both before and after passage through the feed rolls. In this arrangement, as in the others, there will be a wetting of a previously twisted thread and a subsequent twisting of the wet thread in a single, continuous operation.

So far as we are aware, no practical high speed twisting mechanism has ever been devised or used which will commercially produce a twist on twist by a single continuous operation. And so far as we are aware, no one has heretofore twisted the yarn, then wet it and then again twisted the wet twisted yarn by a single, continuous operation.

The use of tubes (cylindrical or conical) effects a saving since the tubes are very cheap and can be thrown away when they are empty. The annoyance and expense of handling and returning the spools or bobbins thus is avoided.

While we have herein shown and described

preferred embodiments of our invention, it will be evident that the invention may be embodied in other forms without departing from the spirit or scope thereof. It is contemplated that the invention herein disclosed can be used in plying and cabling.

Having thus described our invention, what we desire to claim as new is:

1. In a machine of the character described, the combination of two twisting mechanisms arranged in series, feed rolls for drawing the yarn from the first of said mechanisms and feeding it toward the second, a reservoir for holding a body of liquid, means for guiding the yarn through said reservoir in its travel from the first to the second of said twisting mechanisms, and barometric means for feeding liquid to said reservoir automatically and maintaining an approximately constant level of liquid therein.
2. In a machine of the character described, the combination of a bank of spindles each adapted to support a yarn body, a device associated with each spindle for so guiding the yarn as it unwinds from the yarn body on the spindle as to cause the rotation of the spindle to twist the yarn, a bank of twisters corresponding in number to said spindles, mechanism for continuously feeding the strands of yarn from said yarn bodies to said respective twisters, a reservoir for holding a liquid, means for guiding the strands of yarn through said reservoir as they travel from the first of said twisting mechanisms to the second, said means including a guide in said reservoir for each strand of yarn, and means for supporting said guides for individual and collective removal from said reservoir.
3. In a machine of the character described, the combination of a bank of spindles each adapted to support a yarn body, a device associated with each spindle for so guiding the yarn while it unwinds from the yarn body on the spindle as to cause the rotation of the spindle to twist the yarn, a bank of twisters, mechanism for continuously feeding the strands of yarn from said yarn bodies to said twisters, a reservoir for holding a liquid, means for guiding the strands of yarn through said reservoir as they travel from the first of said twisting mechanisms to the second, said means including a guide in said reservoir for each strand of yarn, a supporting arm for each of said guides, a common shaft on which said arms are pivotally mounted whereby any arm may be swung on said shaft to move

its guide out of said reservoir, and connections between said shaft and said arm for causing a rocking movement of said shaft to swing all of said guides simultaneously out of said reservoir.

4. In a high speed twisting mechanism, the combination of an upper bank of upright high speed spindles each adapted to support a yarn body, a device associated with each spindle in said bank and located axially above it for so guiding the yarn while it unwinds from the yarn body on the spindle as to twist the yarn while the spindle rotates, mechanism for feeding the yarn from said bodies, said mechanism including a lower feed roll mounted in fixed bearings and upper roll sections, one for each strand of yarn, resting on said lower roll and driven thereby but freely removable therefrom, a bank of ring twisters located below said upper bank, each of said ring twisters including an upright high speed spindle, said yarn feeding mechanism being located at an intermediate level between said upper and lower banks of spindles, a single mechanism for driving all of said spindles and means for guiding the strands of yarn from said yarn bodies continuously through said yarn feeding mechanism to said ring twisters to subject each strand of yarn to two twisting operations and to cause each strand to be fed continuously from the first of said operations to the second.
5. In a twisting mechanism, the combination of a spindle for supporting a supply package of yarn for rotation, means for revolving said spindle, mechanism for drawing yarn in a substantially axial direction from said package, and a flyer mounted to revolve about the axis of said spindle immediately above said package and arranged to be engaged and rotated by the yarn as the yarn is drawn from said package, said flyer having enlarged end portions located at opposite sides of said package and joined to the main body of the flyer by thread guiding shoulders lying beyond the sides of the package where they will be automatically engaged by the normal feeding movement of the thread and from said package and will limit the ballooning of the yarn while being self-threading in either direction of rotation of the yarn, said flyer being free to rise and fall with the yarn as the yarn is drawn from the package and being freely engageable with and disengageable from said yarn without threading or unthreading.

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