APPOINTUS FOR TWISTING WIRE

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Fig. 5

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Fig. 7

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The present invention relates to an apparatus for twisting wire and, more particularly, to an apparatus for twisting wire constituting an element in nail making machinery. In the making of nails of the type known as drive screws, i.e., those having a threaded shank, it has been necessary heretofore, first to form the nail and then to thread the shank of each individual nail after manufacture. It is obvious that such a method is costly and slow and the use of such nails, while desirable due to their great holding power, has been limited by the cost of manufacture. Also, it has not been possible to use certain hard and tough steels for these nails because the dies used to impart the thread to the nail are quickly worn out on the hard steel. For these reasons it is highly desirable to prepare nails of the type of drive screws from a twisted stock rather than from straight stock which must be rolled after the nail is formed. It is the aim of the present invention to provide a machine which will twist a long wire continuously and impart to such wire a twist of uniform pitch. This can be done only by pulling the wire at a constant rate of speed while rotating twisting means at a constant radial speed. Where twisted wire has been wound up on drums in previous machines, it has been attempted to surmount the difficulty presented by the gradually increasing size of the bundle and the consequent increasing speed at which the wire was pulled through the twisting head, by providing a friction drive which would permit slippage to compensate for the increased linear speed with which the wire was pulled through the apparatus as the size of the bundle of wire increased.

I have now discovered a means having a positive drive instead of a friction drive which is not satisfactory for accurate work, whereby wire, even of very hard and tough stock, such as steels containing manganese and carbon, may be uniformly twisted continuously in long pieces, lengths up to 1800 feet having been successfully twisted. It is, accordingly, an object of the invention to provide a means for continuously twisting a long wire. Another object of the invention is to provide a means for twisting wire of non-circular cross-section so as to impart to the same a twist of any desired pitch throughout its length. A further object of the invention is to provide a means for preparing a coil of twisted wire in condition to be immediately converted into nails in an ordinary nail-making machine. Still another object of the invention is to provide a combination of a wire-twisting apparatus with a nail-making machine which produces nails having threaded shanks at very slightly increased cost over ordinary nails. To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims.

The annexed drawings and the following description set forth in detail certain mechanism embodying the invention, such disclosed means constituting, however, but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawings:

Fig. 1 is a vertical elevation of the apparatus; Figs. 2 and 3 are perspective views of a piece of wire before and after twisting; Fig. 4 is a longitudinal elevation, partly in section, of the apparatus; Fig. 5 is a transverse section on the line 5—5 of Fig. 4; Fig. 6 is a transverse section on the line 6—6 of Fig. 4; Fig. 7 is an enlarged longitudinal section through the wire-guiding means shown in Fig. 4; Fig. 8 is a transverse section on the line 8—8 of Fig. 7; Fig. 9 is a top plan view of the wire-guide or stick; Fig. 10 is a transverse section taken on the line 10—10 of Fig. 9, together with a section through the surrounding spindle; Fig. 11 is a transverse section on the line 11—11 of Fig. 9; and Fig. 12 is an end elevation of a support for the wire-guide or stick.

The apparatus herein to be described takes wire of rectangular cross-section from a bundle and twists the wire evenly throughout its length, imparting a predetermined number of turns to the inch and rewinds the wire into a bundle for use on a nail machine. The wire is drawn through a holding means which permits forward travel but prevents turning of the wire before a certain point in the line of travel is reached. Revolving means then take the wire and cause a portion of it to revolve with the means while a winding device pulls the wire through the apparatus and winds it into a coil ready to be passed through a nail-making machine.

The apparatus as shown in Fig. 1 consists of a machine having a base 1, the machine carrying a winding drum 2 and a spider 3 together with a stick or wire-holding means. A drive shaft 4 is mounted in the base of the machine from which the drum and spider are positively driven at slightly varying speeds so as to pull...
the wire through the machine at the desired footage to obtain the twist required.

Referring now to Fig. 4, it will be seen that the machine is mounted on supporting legs 5, the drive being suitably journalined in the base and being driven from any suitable power source (not shown). On the base are mounted, at the right, a pair of hollow bearing supports 6 in which is mounted a hollow spindle 7. This spindle extends longitudinally of the base and has revolvably mounted thereon the winding drum 2 on the bearing 8, the drum and the spindle having a slight differential in rotating speeds. To the left of the machine is a second pair of bearing supports 9 in which is mounted a rotating shaft 10 which is the driving shaft for the drum 2.

These bearing supports are mounted on a slidable plate 11 carried in suitable guideways 12, the guideways being formed in suitable members 13 at the sides of the base and having overlapping bars 14 secured by cap screws 15 so as to allow the plate 11 to be removed as desired. Longitudinal movement of the plate 11 with its bearing supports 9 and shaft 10 is accomplished by rack 16 and pinion 17 operated by the hand wheel 18.

The shaft 10 is provided between the bearings with sprockets 19 and 19' which are keyed to the shaft. The sprocket 19 is connected by a chain 20 to a sprocket 21 slidably but non-rotatably mounted on the drive shaft 4, there being an arm 22 depending from the sliding plate 11 and having engagement with a hub 23 of the sprocket 21 to move it laterally along the drive shaft with the plate 11. The sprocket 19' may be connected to a corresponding sprocket 21' by a chain to change the speed of rotation of the drum 2, the chain 20 being removed at the same time.

The winding drum is slightly tapered and is provided at its forward or right hand end with a flange 25 connected to the conical portion of the drum by a curved area 26, which is of hardened steel, to allow the wire to slide slowly down onto the smaller portion of the drum. At the rear end, the drum is closed and is provided with a bearing hub 27, the end having a series of apertures 28. The end of the drum has a cover plate or disc 29 which is non-rotatably mounted on the shaft 10 and which is larger than the drum to provide a flange 30, the disc 29 also having a series of drive pins 31 extending into the apertures 28 in the drum end so that the drum 2 may be driven by the shaft 10. The shaft 10 extends within the spindle 7 and is supported therein by an inserted journal hub 32.

By means of this mechanism the disc may be withdrawn from the end of the drum along with the shaft 10 and plate 11, leaving the drum end clear for the removal of the collared twisted wire in a bundle, and then the disc may be moved forwardly by the rack and pinion mechanism, above mentioned, again to close and engage the drum for the next bundle.

At the forward end of the machine, the spindle 7 is provided, between the bearings 6, with a sprocket wheel 33 through which the spindle is driven by means of a chain 34 from a sprocket 35 mounted on the drive shaft 4. This sprocket, as previously described, is hollow and between the rear bearing 6 and the drum, is cut away as at 38 to permit the attachment thereto of the spider 3 with its associated hub 39. This hub in turn is cut away at 41 to provide, together with the opening 38 in the spindle, a space for a grooved wheel 42 having its axis at right angles to that of the spindle. The spider itself has a plurality of legs 43, preferably two to eight as shown in the drawings, but the number of legs is not important provided there is a giving balance. At their outer extremities, the legs 43 are bent rearwardly and support grooved pulley wheels 44 over which the wire passes to the drum. As best shown in Fig. 4, 45, the pulleys on the spider legs extend beyond and substantially overlie the forward end of the winding drum so as to allow the wire to drop down and be wound upon the curved area 26 between the flange 25 and the conical part of the drum proper.

Inside the spindle and ahead of the spider pulley wheel 42, as shown in Fig. 7, is mounted a wire-guide or stick 45 which is slidably mounted in a supporting bracket 46 positioned on the forward end of the base, the stick being adjustable therein and being clamped in place by a cap plate 47 secured by cap screws 48. The spider is, in effect, longitudinally displaced from the stick 45 forwardly with relation to the direction of travel of the wire. The stick consists of a metal bar having a slot 49 extending longitudinally, the slot being wide enough to receive the rectangular wire. At its rear end, the stick is provided with a recess 51 in which, preferably, is mounted two grooved wheels 52 and 53, the grooves being shaped to provide a rectangular opening for the wire. The lower wheel 52 is mounted on a pin 54 carried in the stick and the upper wheel 53 is carried in a pivotally mounted plate 55 which is held in place by means of set screws 56, there being adjusting screws 57 to space the plate and wheel from the lower wheel.

The stick is, of course, longitudinally adjustable and the twisting action on the wire takes place between the end wheels 52 and 53 in the stick and the pulley wheel 42 in the spider hub, the number of twists per inch varying with the rate of rotation of the spider and 125 the speed with which the wire is drawn through the stick means of the winding drum, which is the driving means for the drum, is fastened to the drum by being passed through an aperture 58 in the forward flange and secured around a pin or bolt 59.

The operation of the mechanism is as follows: A wire 60 which may be of rectangular cross section, as shown in Fig. 2, is fed from a reel 61 mounted on a table 62 and passes through 126 the hollow spindle 7 to the wire-guide or stick 45 where the rollers 52 and 53 permit the wire to travel forward, but hold its rotation due to the shape of the opening between these grooved rollers. The wire passes past 131 others to the pulley 42 where its direction of travel is changed and the wire brought out to be engaged by a pulley 44 on an extremity of the spider 3. The spider revolves together with the pulleys and twists the wire between the 140 rollers 52 and 53, beyond which it may take place, and the pulley 42. The drum 2, while it revolves about the spindle 7, is driven independently thereof by means of the sprocket 19 or 19' and is given a speed which causes it to creep slightly ahead of the revolving spider 3, thus drawing the wire through the apparatus as well as coiling it on the drum. By adjusting the speed of the drum so that it slightly exceeds the speed of the spider rotating in the same di-
The twisted wire has its forward end attached to the pin 59 and is progressively coiled on the surface 26 adjacent to the flange 25. As a coil is completed on this surface it tends to slip away from the flange due to the fact that the drum is tapered toward the opposite flange 30. Thus, each succeeding coil is wound on the same surface 26, of constant diameter, and the preceding coil may be shifted to the narrow end of the drum. In operation, the wire passes from the pin 59 over to the leading coil of the bundle, as the advances along the drum, by passing under the bundle in a spiral, the successive coils of wire being wound over this attached end. The coiled wire hangs more or less loosely in the bundle on the tapered drum, demonstrating that the tension on the prevailing wire does not take up the slack in the bundle. This follows from the fact that the tension pulling the wire through the twisting apparatus is applied at the surface 26 only. It should be noted that the surface 26 of the drum is always free to receive the oncoming twisted wire and, as a consequence, one layer of wire is not wound over another and no compensation in radial speed of the drum is necessary to accommodate a gradually increasing effective winding diameter which would otherwise result.

Stock is fed to the apparatus from a reel of steel wire and stock is taken from the apparatus in the form of a reel of wire twisted uniformly throughout its length at any desired pitch. The coiled wire may be removed from the machine by detaching the end from the pin 59 and sliding the cover plate or disc 29 away from the drum by means of the handle 18 operating through the ratchet 16. Since the drum is made slightly tapering, the roll of wire comes off easily and may be fed through an ordinary nail-making machine of the usual type wherever the nail blanks may be cut off, headed, and pointed in the same manner as is done with untwisted wire.

While the invention has been described with particular reference to a wire of rectangular or square cross-section, a wire of any cross-section other than circular may be twisted in the new apparatus by making minor changes and adjustments not affecting the principle of operation of the invention. Square, oblong and triangular wires may be so twisted and particularly by this twisting apparatus in the form of a square with concave sides, the latter giving a nail with particularly good holding power.

It is also within the purview of my invention to operate upon round wires, i.e., those having a circular cross-section, by passing the same through wire twisting apparatus having the usual type incorporated in the stick mechanism without departing from the scope of the invention.

The present apparatus is particularly useful in twisting wire made from hard and tough steel, such as steels having a manganese and carbon content. Such steels are very desirable as stock for making nails but it has not been possible, by any apparatus heretofore devised, to form a thread on such material economically since the hardness of the steel causes dies to wear out rapidly. In my apparatus manganese steels may be twisted readily with no increased wear on parts and the twisted wire, so prepared, may be converted into nails in a nail making machine at a low cost. The nails produced may be driven through steel having a thickness one-half the diameter of the nail and may be driven through lignum vitae, fiber and other materials without bending. Due to the threaded shape, the nail has great holding power and will break before it can be withdrawn by a direct pull. Other materials, such as various steels, bronze, etc., may also be used.

The above described apparatus is thus adapted to twist a long wire uniformly throughout its length and, in such apparatus, a reel of straight wire may be converted into a reel of twisted wire suitable to be immediately passed through a nail-making machine and formed into nails.

Other modes of applying the principle of my invention may be employed instead of the same as regards the mechanism herein disclosed, provided the means pointed out by any of the following claims or having the equivalent of such stated means be employed.

I therefore particularly point out and distinctly claim as my invention:

1. An apparatus for twisting wire which comprises means for holding a traveling wire against rotation, means displaced longitudinally from said holding means adapted to rotate said wire, and winding means for said wire operating at a constant rate of speed and adapted to wind the wire on a surface of constant effective diameter.

2. An apparatus for twisting wire which comprises means for holding a traveling wire against rotation, means displaced longitudinally from said holding means adapted to rotate said wire, and winding means for simultaneously pulling said wire through the apparatus and winding the same on a surface of constant effective winding diameter.

3. An apparatus for twisting wire which comprises means for holding a traveling wire against rotation, means displaced forwardly of said holding means in the direction of travel of said wire adapted to rotate said wire, and winding means for simultaneously pulling said wire through the apparatus and winding the same on a surface of constant effective winding diameter.

4. An apparatus for twist wire which comprises means for holding a traveling wire against rotation, means placed forwardly of said holding means in the direction of travel of said wire adapted to rotate said wire, and winding means having a constant effective winding diameter for drawing said wire through said apparatus and winding the same.

5. In an apparatus for twisting wire, the combination which comprises a stationary wire guide, a revolving spider, and a coiling drum adapted to revolve at a different constant rate.
of speed from the spider and having a constant effective winding diameter.

7. In an apparatus for twisting wire, the combination which comprises a stick adapted to hold a traveling wire against rotation, a revoluble spider adapted to rotate said wire, and a drum adapted to revolve at a constant different speed from said stick, and having a constant effective winding diameter.

8. In an apparatus for twisting wire, the combination which comprises a stick adapted to feed a squared wire and to hold said wire against rotation, a revoluble spider displaced longitudinally from said stick, and a drum adapted to revolve at a higher rate of speed than said spider and having a constant effective winding circumference.

9. In an apparatus for making twisted wire, the combination which comprises a stick adapted to feed a squared wire and to hold said wire against rotation, a revoluble spider positioned forwardly of said stick in the direction of travel of said wire, a pulley located adjacent the axis of said spider and a pulley on an outer extremity of said spider, said pulleys being revoluble as a unit with said spider, and a revoluble drum adapted to creep ahead of said spider.

10. In an apparatus for making twisted wire, the combination which comprises a stick adapted to feed a squared wire and to hold said wire against rotation, a revoluble spider positioned forwardly of said stick in the direction of travel of said wire, a pulley located adjacent the axis of said spider and a pulley on an outer extremity of said spider, said pulleys being revoluble as a unit with said spider, a revoluble drum adapted to creep ahead of said spider, and detachable means retaining said wire on said drum.

11. In an apparatus for making twisted wire, the combination which comprises a wire guide having rolls adapted to hold a traveling wire against rotation, a revoluble spider positioned forwardly of said rolls in the direction of travel of said wire, and a winding drum adapted to be revolved at a greater constant rate of speed than said spider.

12. An apparatus for making twisted wire which comprises a stick having rolls adapted to hold a traveling wire against rotation, a revoluble spider positioned forwardly of said rolls in the direction of travel of said wire on said spider engaging said wire, a winding drum adapted to be revolved at a greater constant speed than said spider, and means for revolving said spider and said drum at different speeds.

13. An apparatus for making drive screws, which comprises a hollow spindle, a stick in said spindle adapted to hold a traveling wire against rotation, a spider mounted on said spindle forwardly of said stick in the direction of travel of said wire and revoluble with said spindle, wire-engaging means on said spider, and a winding drum positioned on said spindle and revoluble thereto.

14. An apparatus for making twisted wire which comprises a hollow spindle, a wire guide in said spindle having rollers adapted to hold a traveling wire against rotation, a spider mounted on said spindle and revoluble therewith, pulleys on said spider guiding and engaging said wire, a winding drum on said spindle revoluble relatively thereto, and means for revolving said spider and said drum at differential speeds.

15. An apparatus for making twisted wire which comprises a hollow spindle, a wire guide in said spindle having rollers adapted to hold a traveling wire against rotation, a spider mounted on said spindle and revoluble therewith, pulleys on said spider guiding and engaging said wire, a winding drum on said spindle revoluble relatively thereto, means for revolving said spider and said drum at differential speeds, and detachable means for retaining said wire on said drum.

16. An apparatus for twisting wire which comprises means for holding a traveling wire against rotation, means displaced longitudinally from said holding means for twisting said wire, and a tapered drum for winding said wire.

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