Dec. 20, 1938. H. ZARAFU 2,140,728

WIRE SPOOLING APPARATUS AND TENSION VARYING ELEMENT

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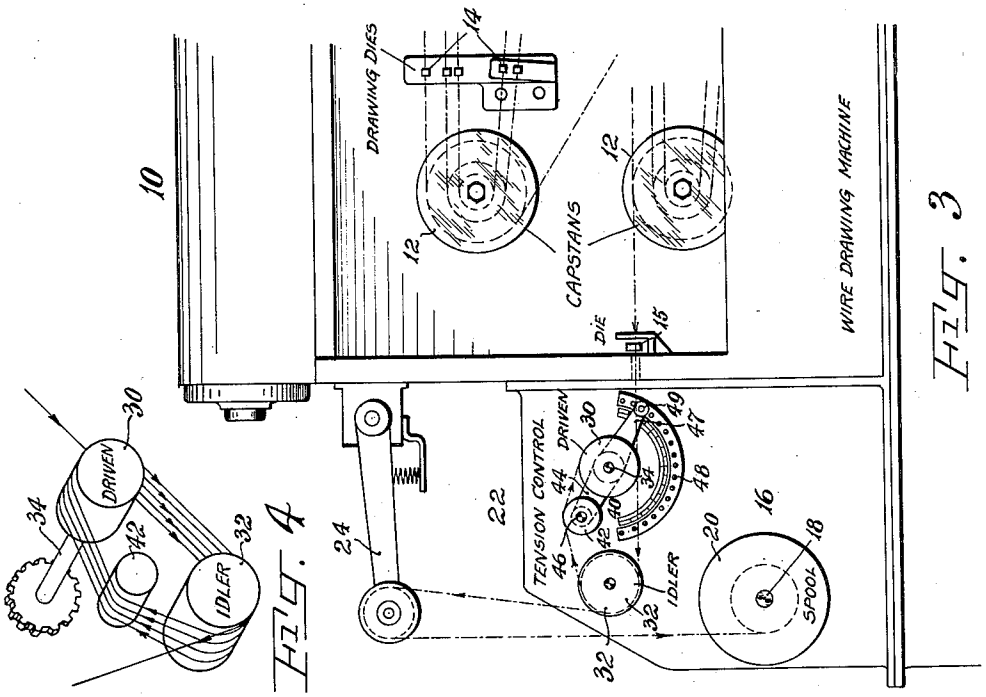



FIG. 3




FIG. 4

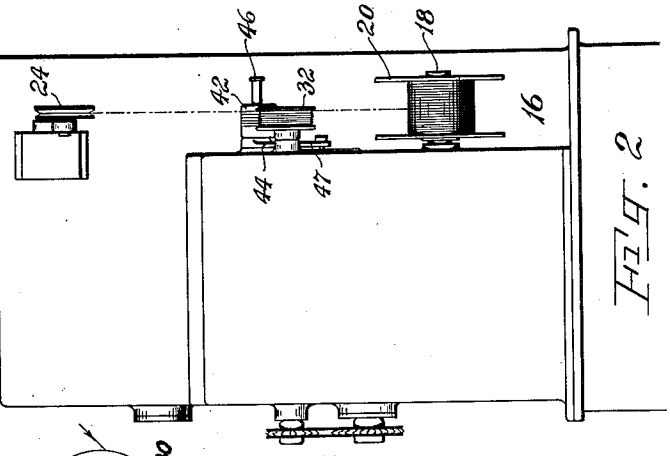


FIG. 2

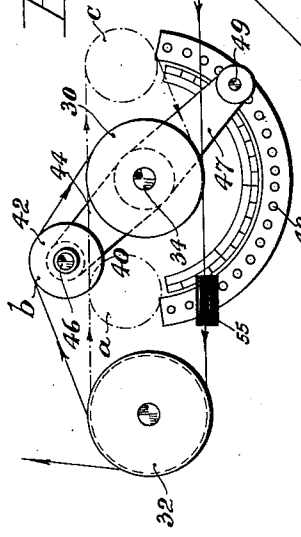


FIG. 1

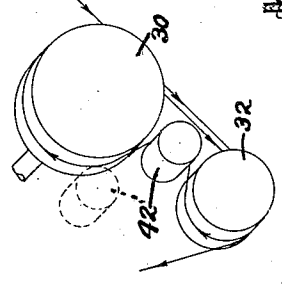


FIG. 5

INVENTOR
HERMAN ZARAFU
BY
ATTORNEY

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## WIRE SPOOLING APPARATUS AND TENSION VARYING ELEMENT

Herman Zarafu, West New York, N. J., assignor to Elevator Supplies Company, Incorporated, Hoboken, N. J., a corporation of New Jersey

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6 Claims. (Cl. 205—16)

This invention relates to spooling apparatus, and particularly in combination with a wire drawing device in which the winding tension is variable, and to elements thereof, and provides improvements therein:

The general construction and operating characteristics of wire drawing and spooling machines may be summarized as follows:—The machine comprises a plurality of dies of progressively smaller size and a capstan after each die, the capstans being so driven as to have progressively higher peripheral speeds occasioned by the elongation of the wire in passing through each die. For the purpose of avoiding breakage of the wire, the machines are so designed that the peripheral speed of each capstan-drum is somewhat less than the peripheral speed of the preceding capstan-drum plus the elongation of the wire in passing through the preceding die, so that there is a continual "slip" of the wire on the capstan-drums through the machine. That is, while the wire is pulled forward all the time, its speed is less than the peripheral speed of the capstan-drums by the amount of slip which occurs. The amount of slip is governed by the difference between the actual, or designed, peripheral speed of each capstan-drum, and the required peripheral-speed to correspond to the speed of the wire on leaving the preceding capstan-drum plus the elongation in passing through the preceding die, and also by the pull on the wire after it leaves the last capstan-drum.

In some wire drawing apparatus the duty of the last capstan is performed by the reel or spooling device.

In many cases it is desirable to wind the wire on the spool under a uniform tension, and it has heretofore been proposed to provide means for controlling or varying the tension of the wire while being wound on a spool.

The present invention provides improved apparatus of the character described. The invention provides a purely mechanical apparatus for the purpose described; the apparatus is of great simplicity, and provides for a wide variation being made in the tension at which the wire is wound on the spool, and further provides for such changes in the tension, within said wide variation, during the normal running of the combined apparatus. The invention furthermore provides apparatus in which there is less liability of the wire being broken than heretofore, particularly at the high speeds at which wire drawing apparatus are being operated at the present time, such apparatus now being operated at wire speeds as high as ten thousand feet per minute.

The invention further provides apparatus of the character described in which means for cleaning the wire previous to spooling, is advantageously combined, it being desirable, and often necessary to remove from the wire, before spooling, the cooling and lubricating solution which is used in the wire drawing apparatus.

An embodiment of the invention is illustrated in the accompanying drawing, wherein:

Fig. 1 is a view in side elevation of the tension control apparatus.

Fig. 2 is a view in end elevation of a wire drawing and spooling machine incorporating my improved tension control.

Fig. 3 is a view in elevation of the front side of the apparatus shown in Fig. 2.

Fig. 4 is a diagrammatic view of the apparatus shown in Fig. 1.

Fig. 5 is a diagrammatic view similar to Fig. 4, illustrating another arrangement of the loops of wire with respect to the drums of the tension control apparatus.

Referring to said drawing, numeral 10 designates a wire drawing machine of any well-known construction and comprising power driven capstans 12, and wire drawing dies 14 and 15.

Numeral 16 designates a power driven spooling or reeling device of any suitable or well-known construction, and comprising a driven spindle 18 on which the spools are mounted for winding the wire. Numeral 22 designates my improved tension control apparatus. This apparatus functions as a traction device, and as here shown and embodied, takes the wire from the wire drawing machine 10 and performs the function of a capstan after the last drawing die 15. From the tension control apparatus 22, the wire is wound under tension on the spool 20 on the driven spindle 18 of the spooling device 16, the wire preferably passing over a roller on a buffer device 24, as shown.

The tension control apparatus 22 comprises a pair of spaced drums 30 and 32, one of which, as the drum 30 is driven as by means of a shaft 34. The shaft 34 may be driven in any suitable manner, being here shown as geared to the spooling apparatus as indicated at 36, Fig. 2. The wire is wound or passed around said drums 30, 32 in a plurality of loops, in such manner that the loops span the two drums 30, 32. A means 40 is provided for varying the arc or arcs of contact of the loops of wire with the driven drum 30. The means 40 comprises a third drum or roller

42 which is arranged to occupy a position in contact with the looped wire and preferably within the loops of wire which pass around the drums 30, 32, and is movable transversely of a line joining the axes of the drums 30, 32. An arrangement in which the drum 42 makes contact with the wire at the outside of the loops, is illustrated in Fig. 5. For this purpose the drum 42 is conveniently mounted on an arm 44 pivoted so that it can be turned around the drum 30, the arm 44 being preferably pivoted on the shaft 34 of the drum 30. A handle 46 is provided for moving the arm 44 around its pivot, which handle may be on the arm 44. Means are preferably provided for holding the arm 44 in a variety of positions around its pivot. Such means may comprise an arc shaped rack 48 provided with a number of recesses or holes, and an arm carrying a pin 49 which can be slid into and out of the holes in the rack 48.

When the third drum 42 is in the position *a*, Fig. 1, the wire in each loop is in contact with the surface of the driven drum 30 through an arc of 180°. By moving the drum 42 transversely of a line joining the axes of the drums 30, 32 the arcs of contact of the loops of wire with the driven drum 30 are changed or varied. One such position of the drum 42 is illustrated at *b*, Fig. 1. In this position the arcs of contact of the loops of wire with the drum 30 are less than they are with the drum 42 in the position at *a*, the arcs of contact in position *b* being about 145°. Another position of the drum 42 is illustrated at *c*, Fig. 1. In this position the arcs of contact of the loops of wire with the driven drum 30 are about 30°.

As an example, from four to six loops of wire would be arranged on the drums 30, 32. If the last drawing die 15 should be one having a #30 Browne and Sharpe gauge opening (for drawing wire to a diameter of .010 inch), and the wire before reaching the die 15 be of a #29 Browne and Sharpe gauge, the pull required to draw the wire through die 15 under the conditions given, would be 3½ pounds. The effort to exert such pull would be apportioned between the spooling device 16 and the tension control apparatus 22 as may be desired to obtain a desired tension of the wire in winding on the spool. If, for example, it be desired to wind the wire onto the spool with a tension of one pound, the tension control apparatus 22, would be adjusted by so positioning the drum 42 (in the manner hereinbefore described) so that the drum 30 of the tension control apparatus would exert a pull or tractive effort on the wire of 2½ pounds, the remaining 1 pound of pull or tractive effort (to supplement the 2½ pounds pull of the tension-control apparatus to provide the 3½ pounds required to pull the wire through the die 15) being exerted by the spooling device 16.

With the apparatus illustrated it will be seen that a wide variation can be obtained of the arcs of contact of the loops of wire with the driven drum 30. As the arcs of contact of the loops of wire on the driven roll 30 are less, the tractive effect of the driven roll 30 on the wire will be less. As the tractive effect of the element 22 is less, the pull of the spooling device 16 will be greater, and hence the tension at which the wire is wound onto the spool 20 will be greater, and by varying the tractive effect of the element 22, as hereinbefore explained, the tension at which the wire winds onto the spool 20 can be varied through a wide range.

For example, supposing the drums 30, 32 to have five loops of the wire thereon; with the drum 42 positioned as indicated at *a* Fig. 1, there would be the equivalent of 2½ full wraps of the wire around the drum 30, and much of the pulling on the wire would be done by the drum 30, and the wire would wind onto the spool 20 under relatively small tension. If the drum 42, at the other extreme, be positioned as indicated at *c* Fig. 1, there would be the equivalent of about ½ a wrap of the wire around the drum 30, and considerably more of the pulling on the wire would be done by the spooling device 16, and the wire would wind onto the spool 20 under considerably greater tension, than in the previous instance. Between the extremes of adjustment in the example just given (between positions *a* and *c* of drum 42, Fig. 1) there can be obtained the difference between the equivalent of 2½ full wraps and ½ of a wrap, or a difference of 2 full wraps, of the wire on the drum 30, with corresponding changes in the proportion of the pull or tractive effect exerted on the wire by the tension control apparatus 22.

By arranging the peripheral speed of the drum 30 so that it is slightly less than the speed of the wire advancing to the die 15 plus its elongation in passing through the die 15, the slip characteristic of the operation in wire drawing machines may be provided for.

In practice the spooling apparatus usually comprises a means (not shown) for decreasing the speed of rotation of the spindle on which the spool 20 is mounted as the coils of wire build up on the spool, and hence increase the effective diameter of the spool.

A cleaning device 55 for removing the cooling and lubricating solution used in the wire drawing machine is advantageously combined with the tension control apparatus 22. The cleaning device 55 operates on the wire from two sides. The space within the loops of wire around the rolls 32, 32 provides ample access to the wire at the inside of the loops. Moreover the cleaning device in the location described has the advantage of operating on the wire at a plurality of adjacent portions, and thereby the wire is subjected to a multiple cleaning action. The cleaning device 55 may be of any suitable or desired character or construction; as here shown it is of the squeegee type, and comprises two felt pads which press against the wire from opposite sides, as shown.

By passing the wire around the drums 30, 32 in a plurality of loops, strain on the wire incident to variation in the speed of rotation of one of the drums, such as might be occasioned by a dust particle lodging in a ball bearing of one of the drums, is distributed among the plurality of loops, and the liability of the wire breaking, particularly in machines operating at very high speeds, is minimized.

The handle 46 may be operated while the machine is operating, and thereby the tension at which the wire winds on the spool may be varied during the operation of the apparatus, the tension variations being effected in the manner hereinbefore described.

The invention may receive other embodiments than that herein specifically illustrated and described.

What is claimed is:

1. Apparatus for pulling wire with variable tractive effect, comprising a pair of spaced drums around which wire after it has been drawn is wound in a plurality of loops spanning said pair of drums, means for driving one drum, said driven drum acting by less than its full arc of circum-

ference on the loops of wire in contact therewith, and displacement means for simultaneously varying the arcs of contact of a plurality of the loops of wire with said driven drum, and a wiper contacting with passes of the plurality of wire-loops between the drums which are spanned by said loops.

2. In combination, a driven spooling or reeling device operating to wind wire thereon under tension, and a traction-device for pulling wire from a wire drawing apparatus, constructed and operating so that a predetermined part of the tension or pull on the wire for pulling it through the wire drawing apparatus is imparted by the aforesaid traction-device, and that the traction-device may be deliberately adjusted by the operator from one predetermined position of adjustment to another to vary the predetermined part of the tension or pull to be imparted by said traction-device, said traction-device comprising a pair of spaced drums, between the wire-drawing apparatus and the spooling or reeling device, around which wire, after it has been drawn, is looped in a plurality of loops spanning the drums, the wire in each loop making less than 360° of contact with each drum, means for driving one drum to impart a tractive effort from the drum to the wire, the other of said drums being free to turn under the tractive effect of the wire in contact therewith, and means adjustable by an operator to vary at determinate times the arcs of contact of a plurality of said loops of wire with said driven drum to thereby increase or decrease in a predetermined manner the part of the tension or pull on the wire to be imparted by said traction-device.

3. A combination according to claim 2, wherein said adjustable means for varying the arcs of contact of the loops of wire with said drum comprises a third drum arranged to make contact with the loops of wire, and means for holding said third drum in any one of a number of positions transversely of a line joining the axes of said pair of drums.

4. Apparatus for pulling wire adjustable to pull the wire with different predetermined tractive efforts, comprising a pair of spaced drums, around which the wire is looped in a plurality of unimpeded loops spanning the drums, the wire in each loop making less than 360° of contact with each drum, means for driving one drum to impart a tractive effort from the drum to the wire, the other of said drums being free to turn under the tractive effect of the wire in contact therewith, and means adjustable by an operator to vary at determinate times the arcs of contact of a plurality of said loops of wire with said driven drum to thereby increase or decrease in a predetermined manner the amount of the tension or pull on the wire to be imparted by said wire-pulling apparatus.

5. Apparatus according to claim 4, wherein said adjustable means for varying the arcs of contact of the loops of wire with said drum, comprises a third drum arranged to make contact with the loops of wire, and means for holding said third drum in any one of a number of positions transversely of a line joining the axes of said pair of drums.

6. Apparatus according to claim 4, wherein said adjustable means for varying the arcs of contact of the loops of wire with said drum, comprises a third drum arranged to make contact with the loops of wire, an arm for supporting said third drum arranged so that it may be turned on an axis adjacent the axis of one of said pair of spaced drums, and means for holding said arm and the third drum carried thereby in any one of a number of positions around the axis on which the arm may be turned.

HERMAN ZARAFU.