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STRAND FEEDING MECHANISM

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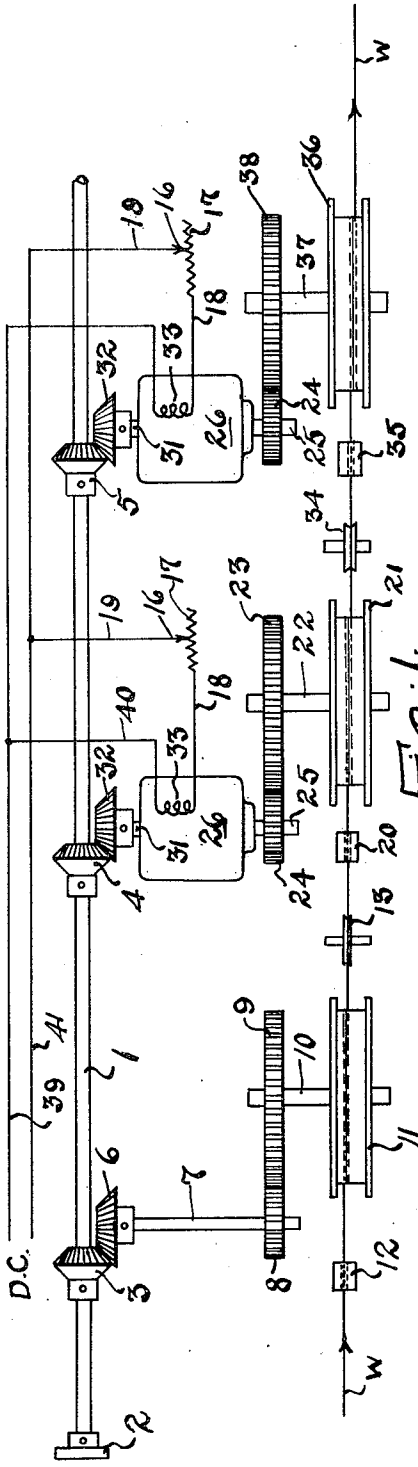


Fig. 1.

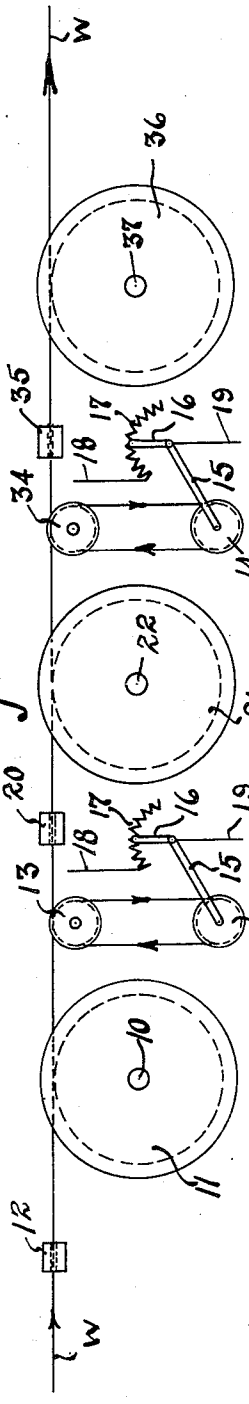


Fig. 2.

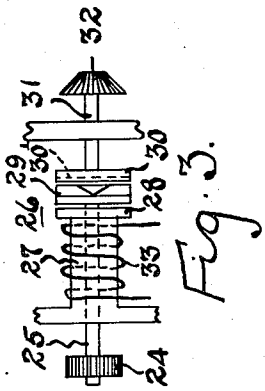


Fig. 3.

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STRAND FEEDING MECHANISM

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11 Claims. (Cl. 205—14)

This invention relates to improvements in strand feeding apparatus particularly of the type in which a plurality of power driven members operate simultaneously on a strand to effect movement thereof in the direction of its length.

More specifically, the invention is concerned with improvements in the wire pulling mechanism of a wire drawing machine in which the wire passes through several drawing dies in succession.

An object of the invention is to provide an improved form of multiple power transmission device for the wire pulling members to ensure that the portion of the wire at any instant being acted upon by the machine will be under substantially uniform tension in all parts.

Other and more detailed objects of this invention will be apparent from the following description when taken in connection with the attached drawing.

This invention resides substantially in the combination, construction, arrangement, and relative location of parts, all in accordance with this disclosure.

In the accompanying drawing,

Figure 1 is a diagrammatic top plan view of one embodiment of the invention;

Figure 2 is a side elevational view of a portion thereof, parts having been omitted for simplicity; and

Figure 3 is a diagrammatic view of the magnetic slip clutch employed in the complete combination.

In the handling of strands which are moved in the direction of their length in various treating machines, such as wire drawing, coating and annealing machines, the problem of maintaining a uniform tension in the strand so as not to stretch or break it or have it pile up at a particular point is frequently encountered. It is difficult, particularly in the steel wire drawing art where the wire being drawn is passed successively through several drawing dies, to maintain the desired uniform tension throughout the length of the wire being treated. The general object of this invention is the provision of a simple and yet particularly effective machine for overcoming these difficulties.

In the accompanying drawing, one embodiment of the principles of this invention has been diagrammatically illustrated. As illustrated, the machine is shown as including a shaft 1 suitably journalled for rotation and provided at one end with a coupling device 2 by means of which it is connected to a suitable power source, such as an electric motor. Distributed along the shaft and secured thereto at suitably spaced points are the bevel gears 3, 4 and 5. Mounted on the shaft 7, journalled for rotation on an axis at right angles to shaft 1, is a shaft 7, to one end of which is secured a bevel gear 6 positioned to mesh with the gear 3. On the other end of shaft 7 is a gear 8 meshing with a larger gear 9 secured to a shaft 10 journalled for rotation on an axis parallel to the shaft 7. Mounted on the shaft 10 for rotation therewith is a capstan wheel 11. At 12 is diagrammatically illustrated the first drawing die through which the wire W passes on its way through the machine. From the die the wire passes to the capstan wheel 11 and therearound one and a half or more times in order to have a driving engagement therewith. It then passes to a small idler wheel 13 journalled for rotation on a suitable axis and from there in a direction at right angles to the main path of movement of the strand W to and around an idler pulley 14 which is journalled for free rotation on the end of a lever 15. The wire then passes back to the idler 13 and into the path from which it was diverted thereby. Lever 15 is pivotally mounted on a shaft to which a switch or contact arm is secured for rotation therewith. This arm is arranged to move over a resistor 17 provided with the current lead 18. The other lead for this circuit is connected to the contact finger 16. It will be seen that with this arrangement as the tension in the wire W changes, the loop formed by the wheels 13 and 14 changes, becoming larger or smaller and as a result causing rotary movement of arm 15 and switch arm 16 which is proportionate to the change in size of the loop.

The wire then passes through the next drawing die 20, where it suffers a further reduction in diameter, and thence one and a half or more times around the capstan wheel 21. This capstan wheel is secured to a shaft 22, journalled for rotation, to which is also secured the large gear wheel 23. This gear wheel meshes with a smaller gear 24 mounted on a shaft 25. The shaft 25 is part of a magnetic slip clutch 26, the details of which are generally illustrated in Figure 3.

As shown in Figure 3, the shaft 25 passes axially through a magnetizable pole 27, on which is mounted a magnetizing winding 33. The pole 27 is provided with a circular pole piece 28. Secured to the inner end of shaft 25 is a magnetizable disc 29 provided with poles on the other face thereof. The disc 29 is adapted to be rotated in close proximity to the pole face 28 to minimize the air gap losses. Journalled for rotation in axial alignment with shaft 25 is a shaft 31, on the inner end of which is a magnetizable disc 30 upon which there is preferably mounted a squirrel cage winding of any suitable form, as indicated diagrammatically at 30'. The outer end of shaft 31 is provided with a bevel gear 32. At this point it may be noted that the magnetic slip clutch of the induced current type as shown in Figure 3 is fully disclosed in the co-pending application of Edward G. Parvin, Serial No. 280,768,

filed June 23, 1939, and entitled "Magnetic slip clutch."

As is clear from Figure 1, bevel gear 32 meshes with bevel gear 4.

The wire W, after leaving the capstan wheel 21, passes around an idler pulley 34 journalled for rotation in suitable bearings, thence down to and around an idler wheel 14 and back around wheel 34 into the path from which that wheel diverted it. As before, the idler 14 is mounted on a rotatable arm 15 integral with a switch arm 16 operating over a resistor 17. The wire after returning to its main path of movement passes through another drawing die 35 where its diameter is further reduced, and thence one and a half or more times around the capstan wheel 36 mounted on the shaft 37 journalled for rotation in suitable bearings. A large gear 38 is secured to this shaft and meshes with a gear 24, as before, secured to the shaft 27 in the magnetic slip clutch 26. The gear 32 on the shaft 31 of this clutch meshes with the bevel gear 5 on the shaft 1. The wire W after leaving the capstan wheel 31 passes to any suitable mechanism, depending upon its further treatment, which may include further duplications of the apparatus illustrated or may be simply a spooler by means of which it is wound into coils.

The circuit for this arrangement is also illustrated in Figure 1. The wire 39 extends from a suitable direct current source to one terminal of the right hand winding 33. It is also connected by branch 40 to one terminal of the left hand winding 33. The other terminal of each of these windings is connected by wire 18 to one terminal of the resistors 17 respectively. From there the circuit returns through the contact arm 16 and branch 19 in each case to the wire 41 to be connected to the other side of the direct current source.

At this point it may be noted that whereas resistors are employed for varying the strength of the current supplied to the windings 13, other equivalent arrangements may be employed, such as those disclosed in the co-pending application of Edward G. Parvin, Serial No. 307,203, filed December 2, 1939, for "Reeling mechanism."

In the operation of this apparatus, the wire W is pulled through the dies 12, 20 and 35 by the capstan wheels 11, 21 and 36, respectively. In this respect the device of this invention is similar to types of steel wire drawing machines and the like already in use in this art. With these arrangements, however, notwithstanding many efforts to prevent it, it frequently happens that the tension in the lengths of wire between the capstans does not remain uniform. This results in part from the fact that the types of drives now used for machines of this nature are not such as to be individually capable of maintaining the desired tension in these strand sections.

By the arrangement disclosed it will be seen that any change in tension in a strand section will affect the length of the loops between the respective idlers 13 and 14 in accordance with those changes in tension. Advantage is taken of this fact in the machine of this invention to vary the strength of the current supplied to the magnetizing windings 33 of the magnetic slip clutches. The driving shafts 31 of the slip clutches are rotated at a uniform angular velocity through the common drive shaft 1. The driving shafts 25 of these clutches are, however, free to have relative movement with respect thereto through magnetic slippage in the clutch. This magnetic slippage is proportional to the strength of the magnetic field created by the winding 33, and thus as the tension in the wire increases between capstans the amount of resistance in the circuit to these windings is varied in proportion thereto to weaken the field and thereby allow greater slippage in the clutch whereupon the associated capstan wheel exerts a lessened pull on the wire, proportionately reducing the tension therein to the desired value. In case the reverse condition results, namely, that the tension in the wire falls off, the loop for that section enlarges, cutting out some of the resistance 17, thereby strengthening the magnetic field of the clutch and increasing the pull of the associated capstan on the wire.

Upon consideration of the arrangement herein disclosed, it will be apparent, as is intended and desired, that it is possible to adjust the apparatus so that the tension on the wire between a pair of capstan wheels and on both sides of the die positioned between those wheels may be at any desired and different tensions so as to suit the different operating conditions and materials. For example, the slip clutches may be adjusted so that the strand leaving the capstan wheel 21, for example, will be supplied to the die 35 under any desired useful tension. For example, the capstan 21 may supply the wire to the die 35 under little or no tension or under a substantial tension to produce a back pull on the wire for the purposes known in the art of wire drawing, as, for example, for the purpose of reducing the load on the die and preventing breaking of the wire after it passes through the die. This can be accomplished by the initial adjustment of the machine, as, for example, the loop in the wire between the capstans 21 and 36 may be initially adjusted in size so that the associated resistors 17 are likewise adjusted to give the necessary field strength to the winding 33 to effect a back pull.

It will be apparent that the combination herein disclosed is particularly adapted for the purpose of creating an efficient back pull on the wire in order to gain such advantages. By the use of the slip clutches disclosed it will be apparent that the capstan 21 is relatively free to revolve at a speed necessary to supply the strand at the rate at which the capstan 36 demands it. On the other hand, however, the field strength of the magnetizing winding 33 may be varied so that the strand is supplied to the die 35 under the dragging action of capstan 21 to create a back pull on the wire between capstan 21 and die 35.

As those skilled in the art will appreciate, with this arrangement by proper adjustment of the mechanism it is possible to compensate automatically for any change in the tension in the strand sections between capstan wheels, thereby ensuring an automatic, smooth and continuous operation of the apparatus, eliminating likelihood of breaking or piling up of the wire therebetween. In view of the disclosure herein it will be apparent to those skilled in the art that many changes in details in construction and relative arrangement of parts may be effected without departure from the novel scope of the subject matter herein disclosed. For example, as is common in the art, the capstan wheels can be driven individually by separate motors through the gears 6 and 32. It will be apparent that by reason of this invention when individual motor drives are employed the inequalities in operation which might otherwise result will be completely

eliminated. We do not, therefore, desire to be strictly limited to these specifications since they have not been given for purposes of limiting the invention but solely for the purpose of illustrating it. We prefer, therefore, to be limited by the claims granted us.

What we claim is:

1. In a strand treating machine, the combination comprising a plurality of spaced capstan wheels mounted for rotation and arranged so that a strand passes successively from one to another of said wheels as it is pulled by each in a lengthwise direction, and power transmission means including magnetic induced current slip clutches respectively connected to said wheels to rotate them whereby the strand lengths between capstans may be held in tension.

2. In a strand treating machine, the combination comprising a plurality of spaced capstan wheels mounted for rotation and arranged so as to simultaneously engage a strand to be moved, induced current power transmission slip clutches each including a fixed magnetizing winding and cooperating clutch elements rotatable in the fields of said windings to rotate said wheels, and means engaging a strand being fed by said wheels for continuously varying the magnetization of each of said windings to maintain a predetermined tension in the strand lengths between said wheels.

3. In a strand treating machine, the combination comprising a plurality of spaced capstan wheels mounted for rotation and arranged so as to simultaneously engage a strand to be moved, induced current power transmission slip clutches each including a fixed magnetizing winding and cooperating clutch elements rotatable in the fields of said windings to rotate said wheels, and means engaging a strand being fed by said wheels for continuously and independently varying the magnetization of each of said windings to maintain a predetermined tension in the strand lengths between said wheels.

4. In a strand feeding mechanism, the combination including a plurality of capstan wheels mounted for rotation on parallel axes, and means for rotating each of said capstan wheels including a magnetic induced current slip cltuch having a fixed magnetizing winding, driving and driven members rotating in the field of said winding, the driven member being connected to the associated capstan wheel.

5. In a strand feeding mechanism, the combination including a plurality of capstan wheels mounted for rotation on parallel axes, means for rotating each of said capstan wheels including a magnetic induced current slip clutch having a fixed magnetizing winding, a driving member and a driven member, the driven member being connected to the associated capstan wheel, and means controlled by the length of strand between each pair of capstan wheels for controlling the magnetization of the winding of the associated slip clutch to maintain a desired tension in the strand length between each pair of wheels.

6. In a strand feeding mechanism, the combination including a plurality of capstan wheels mounted for rotation on parallel axes, means for rotating each of said capstan wheels including a magnetic induced current slip clutch having a fixed magnetizing winding, a driving member and a driven member, the driven member being connected to the associated capstan wheel, means for forming a loop in the strand between each pair of capstan wheels, and means controlled by variations in the size of the loop for varying the magnetizing current of the associated winding to maintain a desired tension in the strand length between each pair of wheels.

7. In a strand treating machine, the combination including a plurality of rotatably supported capstan wheels over which a strand being treated passes in succession, a power source for each capstan wheel, power transmission mechanism connecting each capstan wheel respectively with the power source, said mechanism including a fixed magnetizable member having a winding, a driving member and a driven member, means for supplying current to said windings respectively, and means engaging the strand between each pair of capstan wheels and actuated by variations in the tension thereof for varying said current supply means to maintain a substantially uniform tension throughout the unsupported portions of the strand.

8. In a wire drawing machine, the combination comprising a plurality of capstan wheels mounted for rotation, a wire drawing die positioned on the supply side of each capstan wheel, the wire being drawn passing successively through the dies and around said wheels, a magnetic induced current slip clutch connected to each of said capstan wheels to effect simultaneous rotation thereof, each of said clutches having a fixed magnetizing winding, and means engaging the wire between pairs of capstan wheels and actuated thereby to vary the magnetization of the windings of the associated clutches.

9. In a strand treating machine, the combination including a plurality of strand feeding wheels, strand working devices positioned between pairs of said wheels respectively, means for driving said wheels, continuously variable induced current slip clutches for connecting said wheels to said driving means, means forming loops in the strand between each pair of wheels, and means operated by variations in the size of the loops formed by said last means for continuously varying the slip of said clutches to maintain continuously a desired tension in the strand between each pair of wheels.

10. In a wire drawing machine, the combination including a plurality of reducing dies through which the wire passes successively, means in advance of each of said dies for pulling the wire therethrough, means for operating said pulling means, magnetic induced current slip clutches for connecting said pulling means to said operating means, and means at the rear of each die controlled by the wire for varying the magnetization of said clutches individually to continuously control the force which the operating means applies to said pulling means.

11. In a wire drawing machine, a plurality of reducing dies through which a wire passes successively, means in advance of each of said dies for pulling the wire therethrough, means for driving each of said pulling means, magnetic induced current slip clutches for connecting said pulling means to said driving means, and means for controlling the magnetization of said slip clutches individually to continuously control the force with which said driving means acts on said pulling means, whereby the pulling means at the rear of each die may be caused to exert a backward pull on the wire between it and the associated die.

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