Nov. 18, 1941. W. MORGAN 2,263,246

WIRE-DRAWING MACHINE

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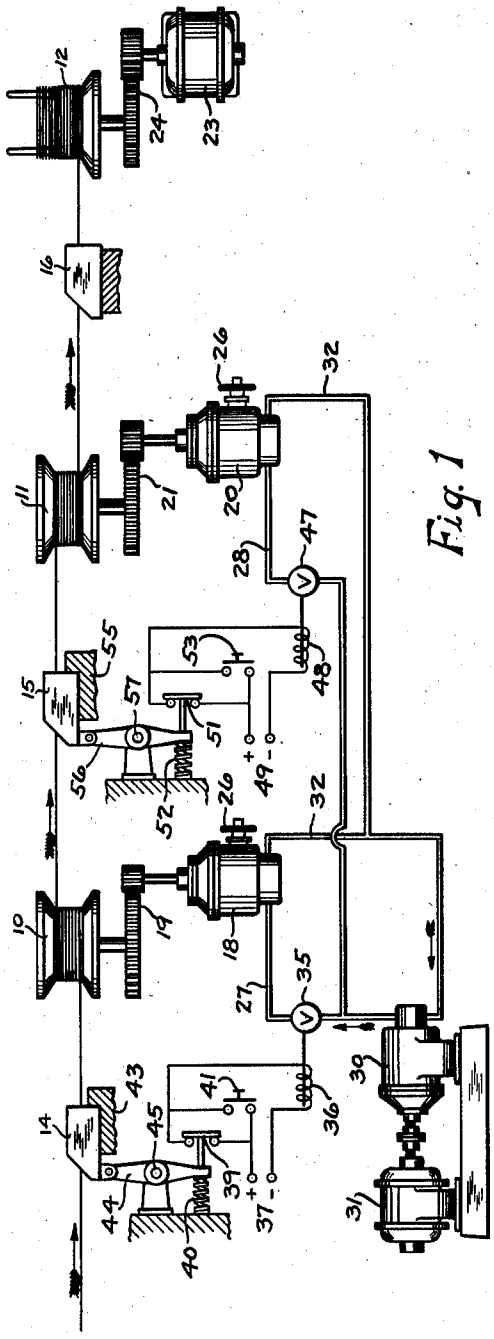


Fig. 1

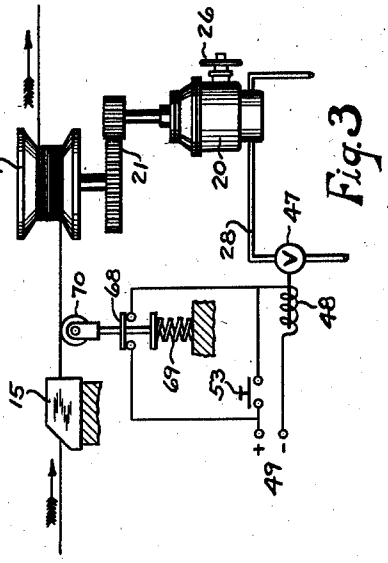


Fig. 3

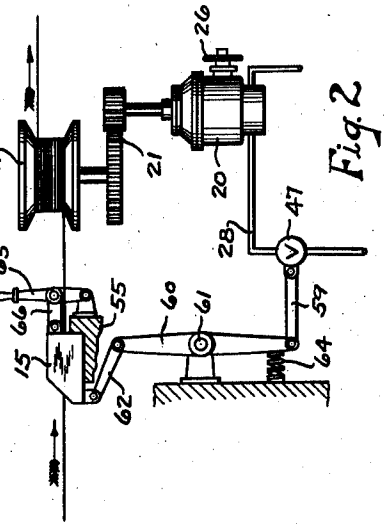


Fig. 2

INVENTOR
WELD MORGAN
BY Albert G. Blodgett
ATTORNEY

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WIRE-DRAWING MACHINE

Weld Morgan, Worcester, Mass., assignor to Morgan Construction Company, Worcester, Mass., a corporation of Massachusetts

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6 Claims. (Cl. 205—14)

This invention relates to wire-drawing machines, and more particularly to machines of the type having a series of dies through which the wire is drawn by means of rotating drums or blocks to effect successive reductions of the wire.

It has been recognized heretofore that certain advantages arise from the maintenance of an appreciable tension in the wire between each drum and the succeeding die. This so-called "back tension" not only decreases the power required to drive the machine, but it also prolongs the life of the dies by reducing the die friction and the resultant heat, and makes it possible to draw wire at higher speeds. While attempts have been made to construct machines which would operate in this manner, the prior machines have in general been complicated, expensive, unreliable, and difficult to maintain in proper adjustment.

It is accordingly one object of the invention to provide a simple, inexpensive and reliable wire-drawing machine of the type having rotatable drums to draw wire through a series of dies successively, the various parts being so constructed and arranged as to permit an accurate control of the back tension in the wire.

It is a further object of the invention to provide a wire-drawing machine having a plurality of rotatable drums, together with a simple and reliable mechanism for rotating the drums and applying a predetermined and readily adjustable torque to each of the drums.

It is a further object of the invention to provide a novel construction for a multiple wire-drawing machine which is so arranged that the wire will neither slip on the drums nor continuously accumulate thereon during the operation of the machine.

With these and other objects in view, as will be apparent to those skilled in the art, the invention resides in the combination of parts set forth in the specification and covered by the claims appended hereto.

Referring to the drawing illustrating one embodiment of the invention and in which like reference numerals indicate like parts,

Fig. 1 is a somewhat diagrammatic view of a wire-drawing machine;

Fig. 2 is a fragmentary view of a modification; and

Fig. 3 is a fragmentary view of a further modification.

The embodiment illustrated comprises a series of rotatable wire-drawing drums or blocks 10, 11 and 12 with which there are respectively associated a series of dies 14, 15 and 16. The drum 10 draws the wire through the first die 14, the wire then passing through the die 15 to the drum 11 and thence through the die 16 to the drum 12, which serves as a finishing drum. The drum 10 is driven by a motor 18 which is connected to the drum by means of suitable gearing 19. Similarly, the drum 11 is driven by a motor 20 through the medium of gearing 21. The finishing drum 12 is driven by a motor 23 which is connected to the drum by means of gearing 24. The rate at which the wire passes through the machine is determined by the speed of the finishing drum 12, which in turn is determined by the speed of the motor 23. This motor may be an electric motor, and it is preferably of the adjustable speed type so that the rate of wire drawing may be controlled.

The motors 18 and 20 are hydraulic motors of the adjustable displacement type, one suitable construction being disclosed in the patent to Ferris No. 1,998,984. Each of these motors is provided with a handwheel 26 whereby its displacement may be manually controlled. A suitable pressure fluid, such as oil, is supplied for the operation of the motors 18 and 20 through pipes 27 and 28 respectively from a suitable source, such as a pump 30 driven by an electric motor 31. This pump may be of the variable displacement type, similar to the motors, and its displacement may be automatically controlled to ensure delivery of fluid at a substantially constant predetermined pressure, as disclosed for example in the patent to Douglas No. 2,080,810. Pipes 32 serve to return the exhaust fluid from the motors to the pump.

It will now be understood that with the apparatus as so far described a predetermined torque will be applied to each of the drums 10 and 11 by their respective motors 18 and 20. By suitable adjustment of the handwheels 26, the torque may be controlled in a desired manner, and by proper selection of the applied torque it is possible to maintain a predetermined back tension in the wire immediately anterior to the dies 15 and 16. The speeds of the drums 10 and 11 will be determined by the speed of the finishing drum 12 and by the amount of reduction effected by the dies, so long as the wire extends throughout the entire machine. During the threading up of the machine, or during the run out of the tail end of the wire, or in case the wire breaks, the situation will be different. Under such circumstances there will be one of the hydraulically driven blocks which is not pulling wire

through a die, and as a result the corresponding hydraulic motor will take all the pressure fluid delivered by the pump 30, which will operate at full displacement in an attempt to maintain full discharge pressure. Consequently the unloaded drum will operate at a very high speed, and the remaining hydraulically driven block or blocks will not operate at all.

In order to overcome this difficulty I provide means whereby the flow of pressure fluid through each hydraulic motor is prevented unless the corresponding block is maintaining a tension in the wire anterior thereto. For this purpose, as shown in Fig. 1, a valve 35 is provided in the pipe 27, this valve being operated by a solenoid 36, the construction being such that the valve will open when the solenoid is energized and close when the solenoid is de-energized. The solenoid is connected to a suitable electrical source 37 through a switch 39 which is biased toward open position by a spring 40. This switch is shunted by a normally-open push button 41. Means is provided to close the switch 39 when the drum 10 is drawing wire through the die 14, and for this purpose the die is slidably mounted on a support 43 and connected to the switch by means of a lever 44 fulcrummed on a pin 45. A similar construction is provided in connection with the second die 15 and the second block 11, the pipe 28 having a valve 47 therein which is operated by a solenoid 48 so arranged that the valve will open when the solenoid is energized and close when the solenoid is de-energized. The solenoid 48 is connected to a source 49 of electricity through a switch 51 which is biased toward open position by a spring 52 and shunted by a normally-open push button 53. The die 15 is slidable on a support 55 and connected to the switch 51 by means of a lever 56 fulcrumed on a pin 57.

The operation of this embodiment of the invention will now be apparent from the above disclosure. With the motor 31 running and no wire passing through the machine, the switches 39 and 51 will be held open by their respective springs 40 and 52, the solenoids 36 and 48 will be deenergized, and the valves 35 and 47 will be closed. Hence no fluid will flow through the motors 18 and 20, and the blocks 10 and 11 will be stationary. To thread the machine, the operator will point the end of the wire, pass it through the first die 14 and attach it by a suitable grip to the drum 10 in a well-known manner. He will then close the push button 41, which will energize the solenoid 36 and open the valve 35, admitting fluid to the motor 18. This will rotate the drum 10, and draw the wire through the die 14, which will slide along its support 43 until the switch 39 is closed, so that the operator may release the push button without de-energizing the solenoid. When a sufficient number of wraps of wire have been formed about the drum 10, the operator will stop the machine by stopping the electric motor 31. He will then re-point the wire, pass it through the second die 15, and attach it by a suitable grip to the second drum 11. Then by starting the motor 31 and closing the push button 53 momentarily, he can draw the wire through the die 15. In case the wire slackens sufficiently to allow rearward movement of the first die 14, it may be necessary to close the push button 41 also. When the desired number of wraps have been formed about the drum 11, the motor 31 will be stopped, and the wire will be re-pointed, passed through the die 16, and attached by a grip to the finishing drum 12. By starting both the motors 31 and 23, and if necessary closing the push button 53 momentarily, several turns of wire may be formed about the drum 12. The machine will then be stopped and the grip removed. This completes the threading of the machine. The operator will now decrease the displacement of the hydraulic motors 18 and 20 to predetermined values by turning their respective handwheels 26, whereupon he will start the electric motors 31 and 23. The machine will proceed to draw wire through the several dies, with a predetermined back-tension in the wire anterior to each of the dies 15 and 16, the speed of the wire being controlled by the speed of the motor 23. There will be no accumulation of wire except on the finishing drum, and no slipping between the wire and the drums. The pump 30 will supply fluid at a predetermined pressure and only in such quantities are required by the motors 18 and 20. These hydraulic motors operate with predetermined displacements and a constant fluid pressure, and hence will transmit predetermined torques to their respective drums. As the tail end of the wire passes through the first die 14, all load will be removed from the first drum 10 and its driving motor 18. The spring 40 will immediately open the switch 39, de-energizing the solenoid 36 and closing the valve 35. This will prevent fluid from entering the motor 18, so that this motor will stop, instead of accelerating to a high speed (as would otherwise occur), and full fluid pressure will be maintained for operation of the motor 20. The wire will loosen about the drum 10 and will be withdrawn therefrom by the continued rotation of the drum 11. As the tail end of the wire passes the die 15, the spring 52 will open the switch 51, de-energizing the solenoid 48 and closing the valve 47. This will stop the drum 11, and the wire will be withdrawn therefrom by the continued rotation of the finishing drum 12. The motor 23 will then be stopped, the finished wire will be removed from the drum 12, and the machine will be re-threaded as before.

In Fig. 2 there is shown a slight modification in which the valve 47 is connected mechanically to the slidable die 15 by means of a link 59, a lever 60 fulcrummed on a pin 61, and a link 62. A spring 64 engages the lever and urges the valve toward closed position. A hand lever 65 is connected to the die 15 by means of a link 66. By actuating the hand lever 65 the operator can open the valve 47 in opposition to the spring 64 during the threading of the machine, this hand lever performing a function which is substantially equivalent to that of the push button 53 of Fig. 1. Obviously, the construction of Fig. 2 may be applied to the die 14 of Fig. 1 as well as to the die 15. It will be understood that the operation of the embodiment shown in Fig. 2 will be the same as that of Fig. 1 except as brought about by the different arrangement for actuating the valve 47.

In Fig. 3 there is shown a further modification in which the switch 51 of Fig. 1 is replaced by a switch 68 having a spring 69 to urge it upwardly toward open position. At the upper end of the switch 68 there is provided an idler roller 70 adapted to engage the wire between the die 15 and the drum 11. These parts are so arranged that while the wire is taut it will hold the switch closed against the pressure of the spring 69, but when the tail end of the wire has passed the die

15, the spring will open the switch, de-energizing the solenoid 48 and closing the valve 47. This construction may of course be applied to the first valve 35 as well as to the valve 47. It will be understood that the operation of the embodiment shown in Fig. 3 will be the same as that of Fig. 1, except as it is affected by the slightly different switch arrangement for controlling the energization of the solenoid 48.

It will now be apparent that the invention provides a dependable multiple-die machine of a comparatively simple and inexpensive construction adapted to draw wire with a predetermined back tension and without slipping of the wire on the drums.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A wire-drawing machine comprising a plurality of dies, a plurality of rotatable drums to draw wire through the dies successively, means to drive one of the drums at a predetermined speed, an adjustable displacement hydraulic motor connected to another of the drums to drive the same, and means to supply fluid to said motor at a predetermined pressure.

2. A wire-drawing machine comprising a plurality of dies, a plurality of rotatable drums to draw wire through the dies successively, means to drive one of the drums at a predetermined speed, a plurality of adjustable displacement hydraulic motors each of which is connected to another of the drums to drive the same, and means to supply fluid to all of the motors at a predetermined pressure.

3. A wire-drawing machine comprising a plurality of dies, a plurality of rotatable drums to draw wire through the dies successively, means to drive one of the drums at a predetermined speed, a plurality of adjustable displacement hydraulic motors each of which is connected to another of the drums to drive the same, and a variable displacement pump arranged to supply fluid to all of the motors at a predetermined pressure.

4. A wire-drawing machine comprising a plurality of dies, a plurality of rotatable drums to draw wire through the dies successively, means to drive one of the drums at a predetermined speed, a plurality of hydraulic motors each of which is connected to another of the drums to drive the same, a pump arranged to supply fluid to all of the said motors for the operation thereof, and means operable upon failure of tension in the wire anterior to any of the hydraulically driven drums to prevent the flow of fluid through the corresponding motor.

5. A wire-drawing machine comprising a plurality of dies, a plurality of rotatable drums to draw wire through the dies successively, means to drive one of the drums at a predetermined speed, a plurality of adjustable displacement hydraulic motors each of which is connected to another of the drums to drive the same, a pump arranged to supply fluid to all of the motors at a predetermined pressure, and means operable upon failure of tension in the wire anterior to any of the hydraulically driven drums to prevent operation of the corresponding motor.

6. A wire-drawing machine comprising a plurality of dies, a plurality of rotatable drums to draw wire through the dies successively, means to drive one of the drums at a predetermined speed, a plurality of adjustable displacement hydraulic motors each of which is connected to another of the drums to drive the same, a pump arranged to supply fluid to all of the motors at a predetermined pressure, automatic means operable upon failure of tension in the wire anterior to any of the hydraulically driven drums to prevent operation of the corresponding motor, and manually operable means associated with each motor and capable of rendering the corresponding automatic means ineffective.

WELD MORGAN.