Feb. 27, 1945. W. MORGAN 2,370,481

WIRE DRAWING MACHINE

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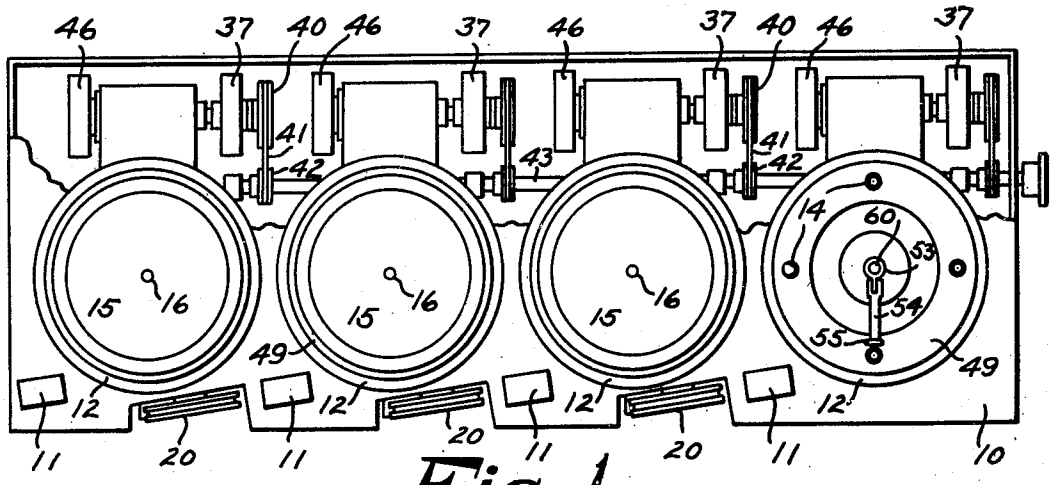


Fig. 1

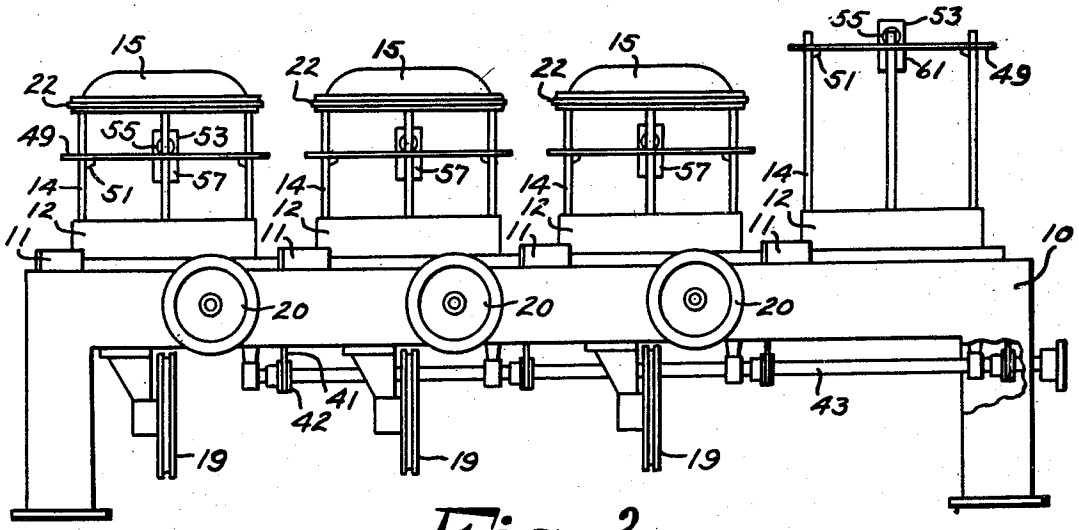


Fig. 2

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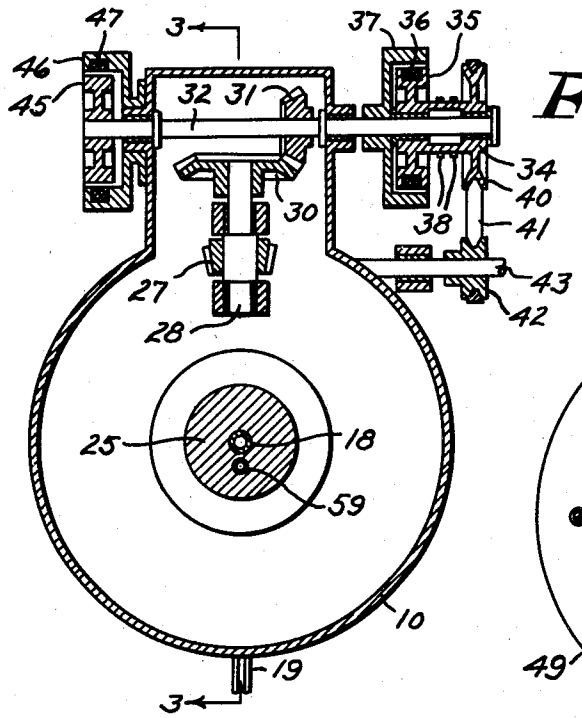


Fig. 4

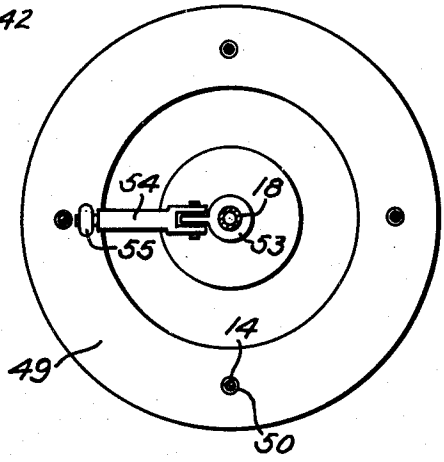


Fig. 5

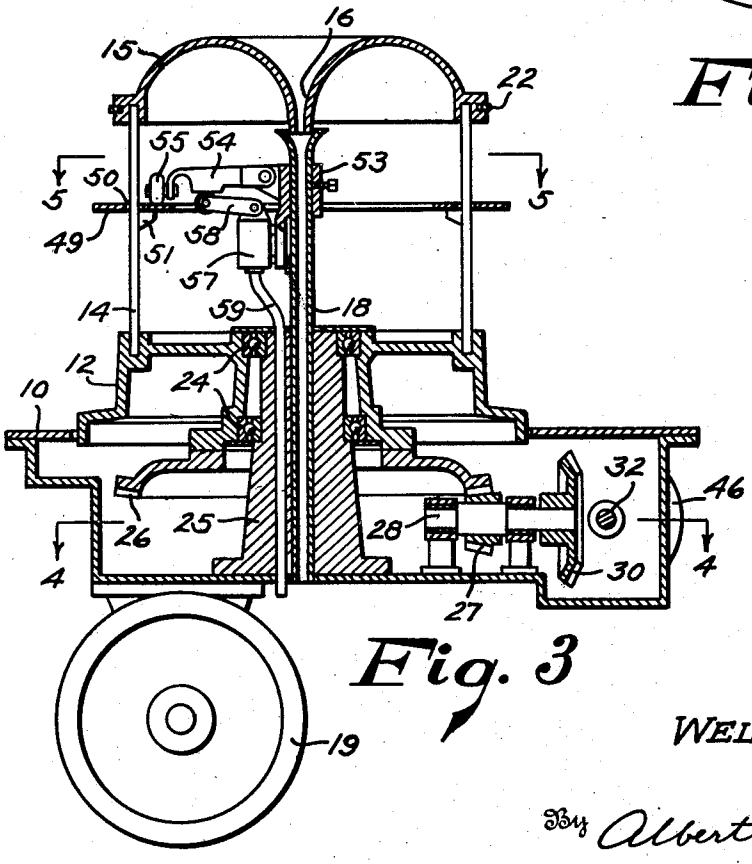


Fig. 3

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WIRE DRAWING MACHINE

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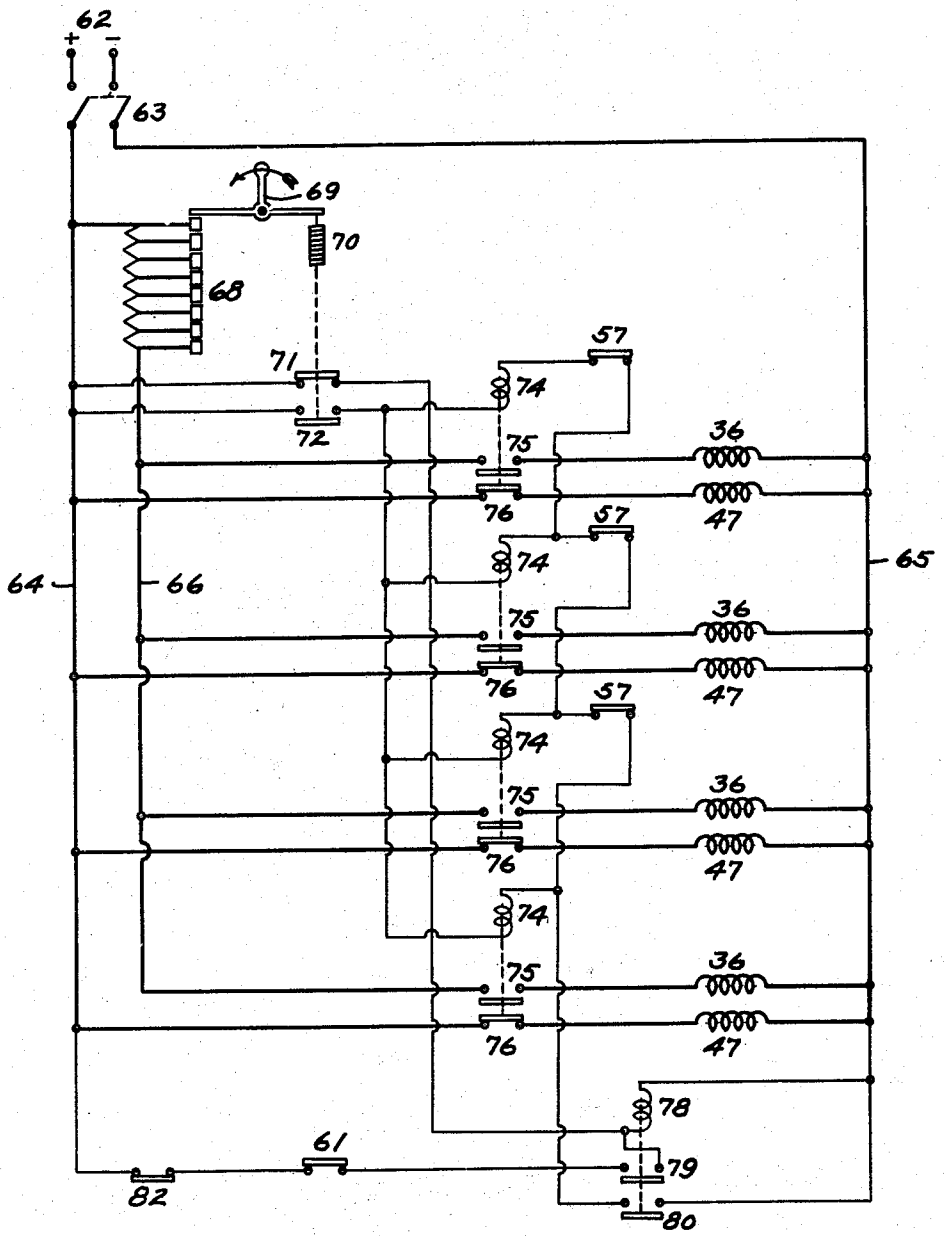


Fig. 6

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2,370,481

WIRE-DRAWING MACHINE

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Application August 27, 1942, Serial No. 456,376

12 Claims. (Cl. 205—14)

This invention relates to wire drawing machines, and more particularly to machines having a plurality of dies and a plurality of rotatable blocks which serve to draw wire through the dies to perform successive reductions on the wire.

In such a continuous wire drawing machine it is a common practice to provide for an accumulation of wire on each block, and to supply the following die from such accumulation, as shown for example in the patent to Connor No. 1,198,111. This construction has the advantage of avoiding any slippage of the blocks relative to the wire wrapped around the same, and it gives the wire a good opportunity to cool after each reduction. However, the amount of accumulated wire on the blocks will vary unless the peripheral speeds of the successive blocks are in exact proportion to the elongation of the wire. Such variations will change the amount of cooling, and in some cases may affect the properties of the finished wire. If the variations are too great, the operator may have to shut down the machine periodically and unclutch certain blocks until normal conditions have been restored. It has been proposed heretofore to control the speeds of the various blocks automatically in an attempt to maintain constant accumulations of wire on the blocks, but these prior machines have been unduly complicated, expensive and unreliable.

It is accordingly one object of the invention to provide a comparatively simple, inexpensive and dependable wire drawing machine which will automatically maintain the quantities of accumulated wire on the several blocks within a sufficiently narrow range to avoid any detrimental effect on the properties of the finished wire.

It is a further object of the invention to provide a continuous wire drawing machine having a relatively simple and reliable mechanism to stop and start certain blocks automatically whenever necessary to maintain the accumulations of wire on the blocks within predetermined limits.

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 drawings illustrating one embodiment of the invention and in which like reference numerals indicate like parts,

Fig. 1 is a plan view of a continuous wire drawing machine;

Fig. 2 is a front elevation of the machine;

Fig. 3 is a vertical section through one of the wire drawing blocks and its driving mechanism, taken on the line 3—3 of Fig. 4;

Fig. 4 is a section on the line 4—4 of Fig. 3;

Fig. 5 is a section on the line 5—5 of Fig. 3; and

Fig. 6 is an electrical wiring diagram.

The embodiment illustrated comprises a frame 10 having a series of four wire drawing dies 11 mounted thereon, each die having a rotatable block 12 associated therewith to draw the wire through the die. Each of these blocks is provided with the usual group of upright posts 14 to form a reel for the support of accumulated wire. These posts 14 are surmounted, except in the case of the last block, by a dome-shaped member 15 having a central opening 16 for the downward passage of the wire to an upright tube 18. After leaving the lower end of the tube 18, the wire passes under an idler guide sheave 19 and then over a second idler guide sheave 20 and into the succeeding die 11. Each of the dome-shaped members 15 is grooved peripherally for the reception of the usual flexible band 22 which engages the wire in known manner to create a slight tension therein in order that the wire will remain properly wrapped about the block. In leaving each block the wire travels in a generally axial direction over one end of the block, so that even though the block may be stopped temporarily the wire may nevertheless continue to be withdrawn therefrom and thus supplied to the following die. Machines of this general type are well-known, and are disclosed for example in the patent to Connor No. 1,198,111 and the patent to Lewis No. 1,492,644.

The blocks 12 are all driven from a common source of power through independently releasable connections. As shown in Figs. 3 and 4, each block is rotatably supported on bearings 24 carried by a stationary post 25 through which the tube 18 extends. A bevel gear 26 is secured to each block and meshes with a pinion 27 mounted on a short horizontal shaft 28. This shaft also carries a bevel gear 30 which meshes with a pinion 31 mounted on a horizontal countershaft 32, the several countershafts being aligned. A quill 34 is rotatably mounted on one end of each countershaft, each quill carrying the driving portion 35 and coil 36 of an eddy current clutch of well known construction, the driven portion 37 of the clutch being secured to the countershaft. Electrical connections with each coil 36 may be made through slip rings 38 (Fig. 4). Each quill 34 is provided with a sheave 40 which is con-

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nected by a V belt 41 to a sheave 42 mounted on a horizontal main drive shaft 43. This main shaft is driven by any suitable source of power, and serves to rotate all the countershafts through the medium of the corresponding V belt drives and the eddy current clutches. The ratios of the various bevel gear pairs will be so selected as to rotate the successive blocks at peripheral speeds which increase in somewhat smaller proportions than the elongation of the wire, so that wire will tend to accumulate slowly upon the first three blocks. It will be understood that each eddy current clutch will transmit torque only so long as its associated coil 36 is energized.

Means is preferably provided to stop each block quickly upon de-energization of the corresponding eddy current clutch. For this purpose, each countershaft 32 is provided with a suitable brake, which is preferably of the eddy current type. As shown particularly in Fig. 4, each brake comprises a rotatable inner member 45 secured to one end of the countershaft, this member being surrounded by a stationary outer member 46 having a coil 47 therein. These parts are so arranged that when the coil 47 is energized, eddy currents will be induced in the rotating inner member 45 to create a magnetic drag and quickly stop the rotation.

The energization of the eddy current clutches and brakes is controlled automatically in accordance with the amount of accumulated wire on the respective blocks. For this purpose, and as best shown in Figs. 3 and 5 each block is provided with a flat horizontal ring 49 which is formed with openings 50 for the passage of the posts 14 therethrough. This ring normally rests upon lugs 51 projecting inwardly from the posts, the construction being such that when a wire bundle of a predetermined height has accumulated on the block, the top of the bundle will engage the ring and lift it above the lugs. Such lifting of the ring is utilized to actuate a switch which controls the operation of the clutch and brake. As illustrated, a bracket 53 is mounted on the tube 18 to provide a pivotal support for a radially extending arm 54 which carries a small wheel 55 upon its outer end, this wheel resting by gravity upon the inner portion of the ring 49. The bracket 53 also supports a suitable limit switch 57 beneath the arm 54, this switch having an operating lever 58 which is engaged by the arm. The limit switch 57 is preferably of the well known snap-action type, and it is arranged to open when the ring 49 is raised a predetermined amount and to close when the ring is lowered to the lugs 51. Electrical leads may be brought to the switch through a tube 59 which extends downwardly through the central post 25. Since the finishing block has no tube 18, the corresponding bracket 53 may be mounted on a central vertical rod 60, as indicated in Fig. 1. The limit switch for the finishing block is designated by the numeral 61 (rather than 57) since it is somewhat differently connected in the electrical circuits.

The various electrical connections are illustrated diagrammatically in Fig. 6, which shows a source 62 of direct current and a main switch 63 connected to a positive lead 64 and to a negative lead 65. An auxiliary positive lead 66 is connected to the lead 64 through the medium of a caterpillar-type rheostat 68 having an operating handle 69. This handle is connected by a helical spring 70 to a double-throw switch having a pair of normally closed contacts 71 and a pair of normally open contacts 72. For each block on the machine there is provided a magnetic contactor having a solenoid 74, a pair of normally open contacts 75, and a pair of normally closed contacts 76. The contacts 75 are connected in series with the corresponding clutch coils 36, between the auxiliary positive lead 66 and the negative lead 65. The contacts 76 are connected in series with the corresponding brake coils 47, between the main positive lead 64 and the negative lead 65. These contactors are arranged in this diagram to correspond with the direction of travel of the wire through the machine, the contactor for the first block being at the top and that for the finishing block at the bottom. Preferably an additional magnetic contactor is provided having a solenoid 78 and two pairs of normally open contacts 79 and 80. I have also indicated a switch 82 which may be actuated by the usual safety bar (not shown).

The various switches and contactors are so arranged that whenever a wire bundle of sufficient size has accumulated on any one of the blocks, this block and all preceding blocks will stop automatically until the continued operation of the following block has reduced the bundle to a predetermined height, whereupon the blocks will automatically go into operation again. Furthermore, whenever the entire machine is stopped by the effect of accumulated wire on the finishing block, and this wire has been stripped from the block, it will be necessary for the operator to use the rheostat 68 in starting the machine again. For this purpose the contacts 71 are connected in series with the solenoid 78 across the leads 64 and 65. The switches 82 and 61, and the contacts 79, are also connected in series with the solenoid 78 across the leads 64 and 65. The contacts 72, the solenoid 74 for the first block, the three limit switches 57, and the contacts 80 are connected in series across the leads 64 and 65. Each of the other solenoids 74 is connected in shunt with the solenoid 74 and the limit switch 57 for the preceding block.

The operation of the invention will now be apparent from the above disclosure. The main shaft 43 will be rotated by any suitable source of power, and this shaft in turn will rotate all of the quills 34 by means of the V-belts 41. To start the machine the operator will close the main switch 63, which will energize the solenoid 78 and close the contacts 79 and 80, whereupon he will move the rheostat handle 69 slowly to the left. The initial movement of this handle will open the contacts 71 and close the contacts 72. The solenoid 78 will remain energized because of the holding circuit provided by the safety switch 82 and the finishing block limit switch 61. As the contacts 72 close, all the solenoids 74 will be energized, opening the contacts 76 and closing the contacts 75, which will energize all the coils 36 of the eddy current clutches through the resistance of the rheostat 68. As this resistance is gradually cut out by continued movement of the handle 69 (permitted by the yielding of the spring 70) the blocks will be gradually brought up to speed by the increased energization of the clutches. By returning the handle to its original position, the operator can open the contacts 72 and de-energize the solenoids 74, thus opening the contacts 75 and closing the contacts 76, which will de-energize all the clutch coils 36 and energize all the brake coils 47. This will stop the blocks very quickly. The machine can thus be controlled for threading-up purposes by ma-

nipulating the handle 69. Once the machine has been placed in operation, wire will slowly accumulate on each of the preliminary drawing blocks, and when the accumulation on a particular block has reached a sufficient height to lift the ring 49 and arm 54 high enough to open the corresponding limit switch 57, the corresponding solenoid 74 and the solenoids 74 corresponding to all the preceding blocks will be de-energized. This will result in stopping these blocks by de-energizing the corresponding clutch coils 36 and energizing the corresponding brake coils 47. The following blocks will continue to operate, so that the excess accumulation of wire will be quickly reduced, the resultant lowering of the ring 49 serving to close the limit switch 57 and place the temperarily stopped blocks back in service. When a sufficiently large bundle has accumulated on the finishing block, the corresponding limit switch 61 will be opened automatically, de-energizing the solenoid 78 and opening the contacts 79 and 80. This will de-energize all the solenoids 74 and stop all the blocks. When the completed bundle has been stripped from the finishing block and the switch 61 has been closed, the machine will not start automatically (which would be dangerous), and the operator must utilize the rheostat handle 69 to start it again. Opening of the safety switch 82 will have the same effect as the opening of the limit switch 61, so that the machine will stop at once if any one actuates the safety bar.

It will be apparent that the invention provides a comparatively simple and inexpensive machine so constructed that the accumulations of wire upon the preliminary blocks will be maintained automatically within predetermined limits. Thus any detrimental effects upon the properties of the finished wire, due to variations in the cooling of the wire between the dies, will be avoided. Furthermore, less attention will be required on the part of the operator, and he may be enabled to take care of more machines. Of course if automatic control of the size of the finished bundle is not desired, the limit switch 61 with its associated operating ring 49 and arm 54 may be omitted from the machine.

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 blocks to draw wire through the dies successively and each arranged to support an accumulation of wire thereon from which wire is withdrawn in a generally axial direction and supplied to the following die, a main driving means, separate clutches connecting the said driving means with the respective blocks, and means to control each clutch automatically in accordance with the amount of wire accumulated on the corresponding block.

2. A wire drawing machine comprising a plurality of dies, a plurality of rotatable blocks to draw wire through the dies successively and each arranged to support an accumulation of wire thereon from which wire is withdrawn in a generally axial direction and supplied to the following die, a main driving means, separate clutches connecting the said driving means with the respective blocks, and means automatically responsive to the amount of wire accumulated on each block and effective to control the corresponding clutch and the clutches corresponding to the preceding blocks.

3. A wire drawing machine comprising a plurality of dies, a plurality of rotatable blocks to draw wire through the dies successively and each arranged to support an accumulation of wire thereon from which wire is withdrawn in a generally axial direction and supplied to the following dies, a main driving means, separate clutches connecting the said driving means with the respective blocks, a brake for each block, and means to control each clutch and brake automatically in accordance with the amount of wire accumulated on the corresponding block.

4. A wire drawing machine comprising a plurality of dies, a plurality of rotatable blocks to draw wire through the dies successively and each arranged to support an accumulation of wire thereon from which wire is withdrawn in a generally axial direction and supplied to the following die, a main driving means, separate eddy current clutches connecting the said driving means with the respective blocks, and means to control the energization of each clutch automatically in accordance with the amount of wire accumulated on the corresponding block.

5. A wire drawing machine comprising a plurality of dies, a plurality of rotatable blocks to draw wire through the dies successively and each arranged to support a bundle of accumulated wire thereon from which wire is withdrawn in a generally axial direction and supplied to the following die, a main driving means, separate clutches connecting the said driving means with the respective blocks, and means to control each clutch automatically in accordance with the size of the bundle on the corresponding block and also in accordance with the size of the bundle on the following block.

6. A wire drawing machine comprising a plurality of dies, a plurality of rotatable blocks to draw wire through the dies successively and each arranged to support a bundle of accumulated wire thereon from which wire is withdrawn in a generally axial direction and supplied to the following die, a main driving means, separate clutches connecting the said driving means with the respective blocks, and means automatically responsive to variations in the size of the bundle on each block and effective to control the clutch corresponding thereto and the clutches corresponding to all the preceding blocks.

7. A wire drawing machine comprising a plurality of dies, a plurality of rotatable blocks to draw wire through the dies successively and each arranged to support a bundle of accumulated wire thereon from which wire is withdrawn in a generally axial direction and supplied to the following die, a main driving means, separate clutches connecting the said driving means with the respective blocks, control means for each clutch automatically responsive to variations in the size of the bundle on the corresponding block, and means interconnecting the said control means and effective upon the release of any one clutch to release all the preceding clutches.

8. A wire drawing machine comprising a plurality of dies, a plurality of rotatable blocks to draw wire through the dies successively and each arranged to support a bundle of accumulated wire thereon from which wire is withdrawn in a generally axial direction and supplied to the following die, a main driving means, separate clutches connecting the said driving means with the respective blocks, a separate control means for each clutch including a solenoid, a switch for each block responsive to variations in the size of the corresponding bundle, means connecting

all the switches and the solenoid for the first block in series, and means connecting the solenoid for each of the other blocks in shunt with the solenoid and the switch for the preceding block.

9. A wire drawing machine comprising a plurality of dies, a plurality of rotatable blocks to draw wire through the dies successively and each arranged to support a bundle of accumulated wire thereon from which wire is withdrawn in a generally axial direction and supplied to the following die, a main driving means, separate eddy current clutches connecting the said driving means with the respective blocks, a magnetic contactor for each clutch to control the energization thereof, each contactor including a solenoid, a switch for each block responsive to variations in the size of the corresponding bundle, means connecting all the switches and the solenoid for the first block in series, and means connecting the solenoid for each of the other blocks in shunt with the solenoid and the switch for the preceding block.

10. A wire drawing machine comprising a plurality of dies, a plurality of rotatable blocks to draw wire through the dies successively and each arranged to support a bundle of accumulated wire thereon from which wire is withdrawn in a generally axial direction and supplied to the following die, a main driving means, separate clutches connecting the said driving means with the respective blocks, a separate control means for each clutch, a ring engaging each bundle and movable in response to variations in the size thereof, and means connecting each ring to the corresponding control means to actuate the same.

11. A wire drawing machine comprising a plurality of dies, a plurality of rotatable blocks to draw wire through the dies successively and each provided with a group of upright posts to support a bundle of accumulated wire thereon from which wire is withdrawn in a generally axial direction and supplied to the following die, a ring arranged to rest by gravity on each bundle and provided with openings through which the posts extend, a switch mounted within each group of posts, means connecting the inner portions of the rings with the switches to actuate the same, a main driving means, separate clutches connecting the said driving means with the respective blocks, and means connecting each switch with the corresponding clutch to control the same.

12. A wire drawing machine comprising a plurality of dies, a plurality of stationary members, a block rotatably mounted on each member in surrounding relation thereto, the blocks serving to draw wire through the dies successively and each having a group of upright posts thereon to support a bundle of accumulated wire from which wire is withdrawn in a generally axial direction and supplied to the following die, a device arranged to rest by gravity on each bundle and having an annular portion located within the group of posts, a switch mounted on each stationary member, a lever connecting the annular portion of each device with the corresponding switch to actuate the same, a main driving means, separate clutches connecting the said driving means with the respective blocks, and means connecting each switch with the corresponding clutch to control the same and including leads extending through the said stationary members.

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