Feb. 10, 1942. J. R. GEORGE ET AL 2,272,195

WIRE DRAWING MACHINE

Filed June 28, 1939 2 Sheets-Sheet 1

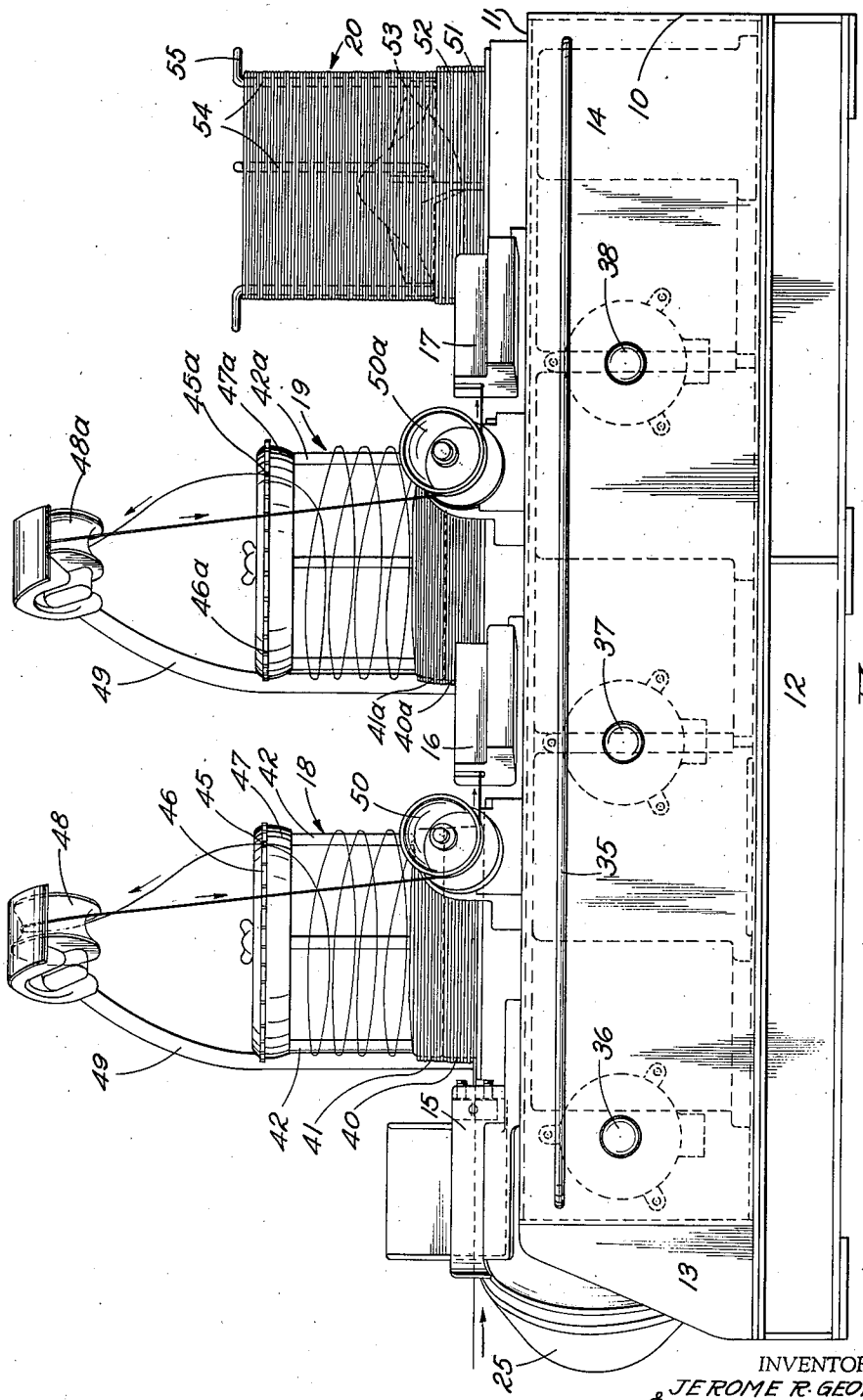


Fig. 1

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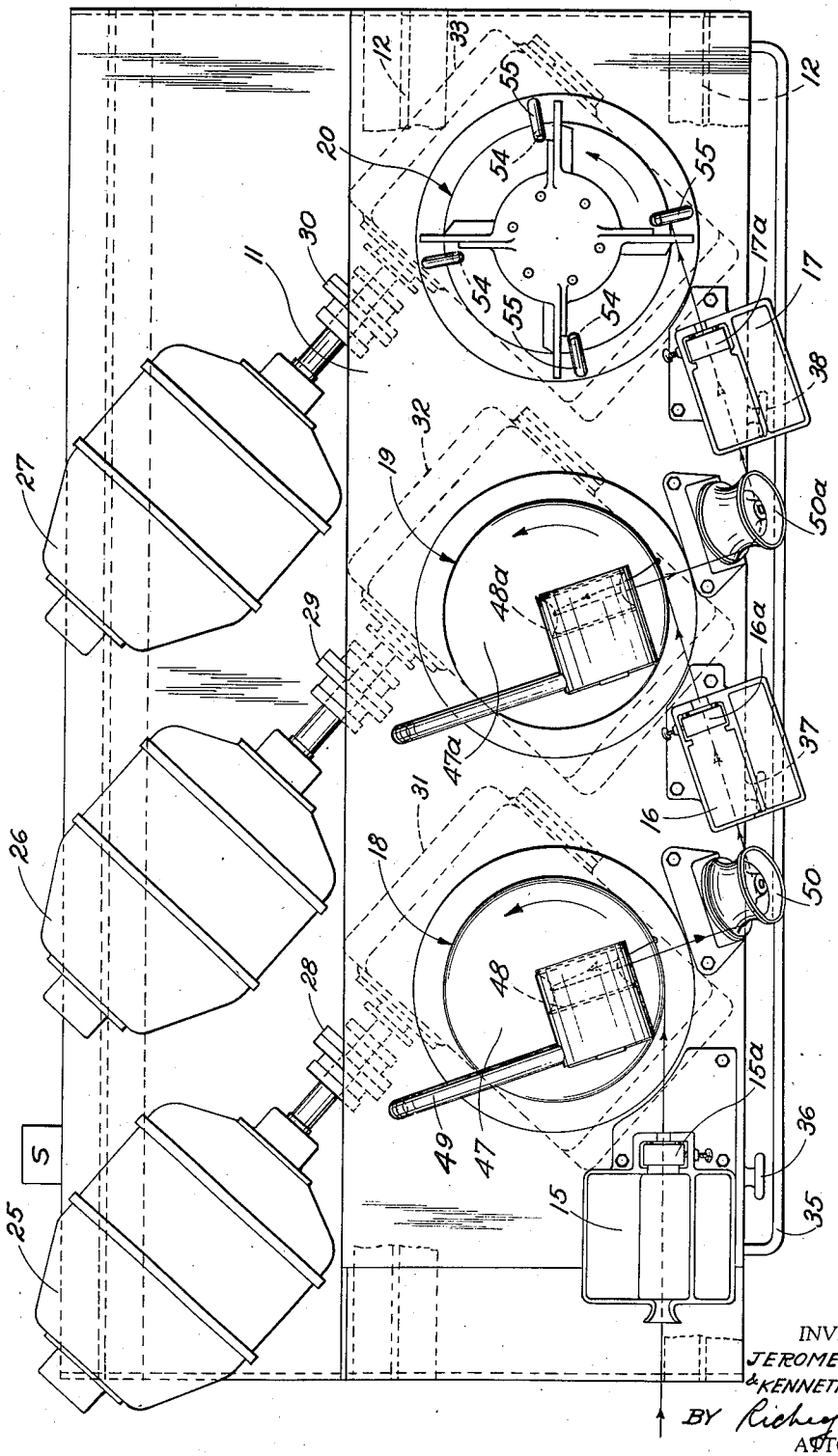


Fig. 2

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2,272,195

WIRE DRAWING MACHINE

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7 Claims. (Cl. 205—14)

This invention relates to wire drawing machinery, and more particularly to continuous wire drawing machines in which the wire is drawn continuously through a series of dies to effect, in a single apparatus, a series of reductions in the size of the wire.

Continuous wire drawing machines heretofore have generally been of two types. In one type, as exemplified by the machine disclosed in the Connor Patent No. 1,198,111, a series of blocks or drums are provided which are driven at speeds to compensate roughly for the elongation of the wire in the successive drafts and the drums are arranged to permit an accumulation of wire thereon to allow steady operation of the machine for some time even though the speeds of the various drums are not in exact proportion to the elongation of the wire. In practice the gearing of the Connor machines is arranged so that each block or drum operates at a speed with respect to the speed of operation of the other blocks or drums and with respect to the elongation effected in each die such that wire will slowly accumulate on each drum. Machines of this type are advantageous in that the accumulation of the wire on the drums gives the wire time to cool considerably between successive drawing operations. This delay is especially advantageous in conjunction with the drawing of high carbon wire. Also in machines of this type, a slight amount of twist is imparted to the wire, due to the fact that it is withdrawn axially from the drum or block, which results in more uniform wear of the dies. This type of machine is disadvantageous, however, in that the increasing accumulations of wire on the blocks must be run off at intervals of say two or three hours, and after each "run off" the machine must be rethreaded, an operation which requires considerable time.

The other general type of continuous wire drawing machine embodies a series of drums around which the wire is turned only a few times. The number of turns on each drum remains constant during the operation of the machine and the wire is withdrawn from the drums in a tangential direction rather than in an axial direction as in the Connor type of machine. In some machines of this sort the wire is permitted to slip on the drums or blocks to compensate for inaccuracies in the speeds of the drums, and in other machines, individual, automatically operated speed control devices are provided for each drum, the mechanisms being arranged to adjust the relative speeds of the drums to the elongation of the wire. Machines of this general type can be operated for long periods of time without stopping, but have a serious disadvantage, particularly in modern wire drawing operations where the wire is subjected to a severe reduction in each die, in that there is little opportunity for the wire to dissipate its heat and to rest between the successive dies. As a result, machines of this type can not be operated at as high speeds as the speeds of operation possible in machines where ample time for cooling and resting is provided. The heat developed adversely affects some types of wires, such as wires of high carbon steel. Also the heat is apt to destroy the coating on the wire, which may result in damage to the dies.

It is a general object of our invention to provide a continuous wire drawing machine embodying the advantages of both types of prior art machines as noted above and eliminating the disadvantages of each type. It is a further object of our invention to provide continuous wire drawing machines which can be operated continuously for indefinitely long periods of time and in which the wire is given an opportunity to rest and dissipate its heat between each drawing operation. Another object is to provide a machine which will produce wire of uniform characteristics over long periods of time. A further object is to provide such a machine in which the wire may be given a slight amount of twist so that the wear on the dies will be uniform. Further objects and advantages of our invention will become apparent from the following description of a preferred form thereof reference being made to the accompanying drawings. The essential characteristics are summarized in the claims.

Our invention, in its preferred form, contemplates a continuous wire drawing machine embodying a series of dies and associated blocks or drums, each block being driven by a variable speed drive and each block being arranged so that it can accumulate and hold a reserve of wire to permit the wire to rest and dissipate its heat between successive dies. The speed of each block or drum may be controlled independently of the speed of every other block or drum so that the amount of wire accumulated or held in reserve on each drum can be maintained substantially constant, or can be varied at the will of the operator. By this arrangement the amount of accumulation on each drum can be controlled so that the wire will be sufficiently cooled and permitted to rest between successive drafts, and the machine can be operated indefinitely without the necessity for running off the wire on the drums.

Preferably, the blocks are water cooled, the combination of adequate cooling and rest between drafts resulting in the production of wire having excellent physical characteristics.

In the drawings, Figure 1 is an elevation of a preferred form of machine embodying our invention and Figure 2 is a plan view of the machine shown in Figure 1.

As shown in the drawings a preferred form of our machine may comprise a suitable frame or bench 10 preferably in the form of a box-like structure having an upper surface 11 supported from base members 12 by vertical members such as the members 13 and 14. Die boxes 15, 16 and 17 are suitably mounted on the upper member 11 and support suitable dies 15*a*, 16*a* and 17*a* of any desired construction therein. The wire is drawn through the die boxes 15, 16 and 17 and associated dies by drums or blocks 18, 19 and 20, respectively. Preferably the dies are adjustably mounted in the die boxes, the die boxes illustrated herein being described in detail and claimed in the copending application of K. B. Lewis, Serial No. 271,541, filed May 3, 1939. In the drawing our machine is shown as including three dies and three blocks or drums, but those skilled in the art will appreciate that our invention is applicable to machines embodying two dies and blocks or any number greater than that. If the machine embodied only two dies, preferably die box 16 and associated drum 19 would be eliminated while if the machine were to embody more than three dies, additional units duplicating the die box 16 and drum 19 and associated mechanisms would be added between drum 18 and the finishing drum 20.

The drums 18, 19 and 20 are mounted for rotation about vertical axes on suitable bearings carried by the bench 10, and may be driven by any convenient variable speed mechanisms such as, for example, the variable speed motors 25, 26 and 27 which are connected to drive the drums 18, 19 and 20, respectively through flexible couplings 28, 29 and 30 and worm reduction gearing indicated generally at 31, 32 and 33. The motors are preferably arranged to be stopped and started simultaneously by means of a starting switch S controlled by the bar 35 extending throughout the length of the machine, while the speed of the individual motors may be controlled independently by rheostats 36, 37 and 38. We prefer to employ shunt motors to drive the blocks or drums and to control the speed, and in that case the rheostats 36, 37 and 38 control the strength of the motor fields.

In operation the wire W is led from a supply reel (not shown) through the die box 15 and associated die 15*a* where it is given the first reduction in diameter, then drawn from the die tangentially to the fillet at the base of the cylindrical portion 40 of the drum 18. As the drawing operation proceeds the wire drawn from the die forces the convolutions of wire wound on the cylindrical portion 14 to slide upwardly to the portion 41 where the surface of the drum is slightly tapered to permit contraction of the wire as it cools off. The cooling is preferably accelerated by employing water cooled drums, a preferred form of drum being disclosed and claimed in the copending application of Clarence L. Taylor, Serial No. 296,322, filed September 25, 1939. Above the portion 41 the coils of the wire are supported by vertical posts 42 spaced circumferentially around the drum and mounted near the periphery of the portion 41. The portions 40 and 41 and post 42 thus provide space to permit the accumulation of a considerable quantity of wire on the drum.

The wire is withdrawn from the drum in a generally axial direction through a guide ring 45 carried by a chain 46 slidably mounted in a circumferential groove in the member 47 which is supported by the post 42. From the guide ring 45 the wire is led upwardly over a pulley or sheave 48 supported by a bracket or arm 49 suitably mounted on the bench 10.

From the sheave 48 the wire is led downwardly to the sheave 50 which guides it to the die box 16 and its associated die. The wire is drawn from the die in tangential direction onto the drum 19 which in all material respects may be similar to the drum 18 just described and which includes a cylindrical portion 40*a*, a tapered portion 41*a*, post 42*a*, a guiding loop 45*a* mounted in the chain 46*a* supported on an upper member 47*a*. As before the wire is conducted from the guiding loop 45*a* to pulley 48*a* and thence downwardly to the pulley 50*a* which delivers the wire to the die 17.

The finishing block 20 is preferably of slightly different construction from the blocks 18 and 19 to facilitate removal of the finished wire from the machine. Thus the block 20 includes a cylindrical portion 51 and a tapered portion 52 generally similar to the portions 40 and 41 but provided with radial slots as indicated at 53 to receive tongs (not shown) for removing the wire from the block. Also the rods 54 are provided with outwardly extending end portions 55 to retain the wire on the block and the top ends of the rods are arranged to be turned inwardly to permit the coiled wire to be lifted upwardly off the block.

In starting the machine in operation the operator points the wire or rod, threads it through the die box 15 and die 15*a* and winds a number of turns on the block 18 by means of tongs in a manner known to those skilled in the art. The tongs are then disconnected and the end of the wire bent around one of the posts 42 and the machine operated until a considerable number of turns have accumulated on the drum 18 preferably until the portions 40 and 41 are full of wire and a few turns have accumulated on the post 42. Then the wire is threaded through the die 16*a*, wound on drum 19, threaded through the die 17, and sufficient wire accumulated on the drum 20 so that there will be no slipping of the wire thereon. The operator then adjusts the rheostats 36, 37 and 38 to approximately the correct speeds for the elongation being effected in the respective dies.

By observing the motion of the guide 45 and the chain 46 the operator can determine the relation between the speed at which wire is being fed to a given drum and the speed at which the wire is being withdrawn from the drum. If the wire is being fed and withdrawn at identical speeds, then the same number of turns will remain on the drum and the guide 45 and chain 46 will remain stationary, the chain sliding in the groove in the member 47. If wire is being withdrawn from the drum faster than it is being supplied to the drum then the guide 45 and chain 46 will rotate in a direction opposite to the direction of the drum, i. e., in the embodiment shown in the drawings, the guide will rotate in a clockwise direction while the drum is rotating in a counter-clockwise direction. On the other hand if wire is accumulating on the drum the guide will rotate in the same direction

as the drum, but at a slower speed. The speed of rotation of the guides gives the operator an accurate indication of the speed at which wire is accumulating on or being withdrawn from the drum, and furnishes him with a guide to govern his adjustments of the rheostats. Thus, if the operator desires to operate the machine continuously, welding succeeding coils of wire to each other, the motors can be adjusted so that substantially constant accumulations of wire will be held on each drum, readjustments being made as often as necessary to compensate for wear in the dies or changes in conditions of operation of the machine or characteristics of the wire. If, on the other hand, it is desired to operate the machine as a machine of the Connor type or to impart a desired degree of twist to the wire, the wire can be permitted to gradually accumulate on the drums until such time as it is necessary to run off the wire on the machine. Generally speaking, there will always be slight changes in the amounts of wire accumulated on the drums so that a slight degree of twist will always be imparted to the wire, the twist being insufficient to adversely affect the qualities of the wire but sufficient to prevent uneven wear of the dies.

From the foregoing description of a preferred form of our invention it will be evident that we have provided a wire drawing machine capable of obtaining results superior to those of the machines of the prior art. In our machine the advantageous features of prior art machines are retained while the disadvantages are eliminated. Our machine can be operated continuously over long periods of time without the necessity for running off the wire of the machine and rethreading it, and at the same time the wire is delayed sufficiently between successive dies to permit the wire to cool and rest. In our machine there is no backward slipping of the wire on the drums. The operator can accurately control the twist imparted to the wire, thus insuring uniform quality of the finished wire, and even wear of the dies. Because of the fact that the wire is delayed between successive drafts, the quality of the wire is improved and the speed of operation of the machine can be increased. The machine is of simple and sturdy design, and as the motors can be operated throughout a wide range of speeds, the operation of the machine can readily be varied to suit different conditions and different wire sizes. The machine may be readily controlled and adjusted by the operator, the speed of the various drums being adjustable between wide limits, at the discretion of the operator, to produce the desired results.

In the foregoing specification we have described a preferred form of our invention in detail. It is to be understood that the foregoing description is given merely by way of example and those skilled in the art will appreciate that the invention may be modified in various respects without departing from the spirit and scope thereof. Therefore it is to be understood that our patent is not limited in any manner other than by the appended claims when given the range of equivalents to which our patent may be entitled.

We claim:

1. In a continuous wire drawing machine of the type in which wire is withdrawn in an axial direction from each block at a speed independent of the speed at which wire is being drawn onto the block, a plurality of wire drawing dies and blocks, means for water cooling said blocks, continuously operable variable speed means for driving said said blocks, and separate control means for each block for adjusting the speed of each block without stopping said blocks independently of the speed of every other block so that the relationship between the rate at which wire is being drawn onto any block and the rate at which it is being withdrawn from the block is at all times under the control of the operator whereby the amount of accumulation and time of cooling on each drum may be accurately controlled by the operator.

2. In a continuous wire drawing machine of the type in which wire is withdrawn from each block at a speed independent of the speed at which wire is being drawn onto the block, a plurality of wire drawing blocks, continuously operable variable speed means for driving said blocks, a single control for starting and stopping all of said blocks and separate control means for each block adjusting the speed of each block independently of the speed of every other block without stopping said blocks so that the relationship between the rate at which wire is being drawn onto any block and the rate at which it is being withdrawn from the block is at all times under the control of the operator.

3. In a continuous wire drawing machine of the type in which wire is withdrawn from each block at a speed independent of the speed at which wire is being drawn onto the block, a plurality of wire drawing blocks, a variable speed electric motor for driving each block and rheostats adapted for continuous operation associated with each of said motors for independently adjusting the speed of said blocks without stopping said blocks so that the relationship between the rate at which wire is being drawn onto any block and the rate at which it is being withdrawn from the block is at all times under the control of the operator.

4. A continuous wire drawing machine comprising a plurality of dies, a plurality of blocks for drawing the wire through said dies, said blocks being adapted to carry a reserve or accumulation of wire thereon, means for withdrawing the wire from said blocks in an axial direction and for guiding the wire to the succeeding die, individual motor drives for each of said blocks and means, adapted for continuous operation, for varying the speed of said motor drives without stopping said blocks to vary the speed of each of said blocks independently of the speed of the other blocks.

5. A continuous wire drawing machine comprising a plurality of dies, a plurality of blocks for drawing the wire through said dies, said blocks being adapted to carry a reserve or accumulation of wire thereon, means for withdrawing the wire from said blocks in an axial direction and for guiding the wire to a succeeding die, individual motors for driving each of said blocks, means for starting and stopping all of said motors simultaneously and means, adapted for continuous operation, for varying the speed of each of said motors independently of the speed of the other motors while the machine is operating and without stopping said blocks.

6. A wire drawing machine comprising a plurality of wire drawing dies arranged to act successively on the wire, a plurality of blocks or drums, each adapted to draw the wire through its associated die and being provided with space for the storage of wire thereon, means for withdrawing the wire from one block in an axial direction and guiding the wire to the die associated

with a succeeding block, means for driving said blocks and means, adapted for continuous operation, for independently adjusting the speed of each of said blocks without stopping said blocks while the machine is operating whereby the ratio between the speeds at which wire is being drawn onto and withdrawn from the blocks may be varied at the will of the operator.

7. In a wire drawing machine, a die, a block for drawing wire through the die and adapted to carry an accumulation of wire thereon, variable speed means for driving the block, means for withdrawing the wire from the block in an axial direction, means for driving said withdrawing means, a guide mounted for rotation with respect to the block for guiding the wire withdrawn therefrom, said guide indicating by its motion with respect to the block the relationship between the speeds of operation of said block and said withdrawing means, and separate control means, adapted for continuous operation, for independently adjusting the speeds of operation of said block and said withdrawing means without stopping said block or said withdrawing means whereby the amount of wire accumulated on said block may be controlled at all times by the operator.

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