M. J. A. VICAIRE.

MULTIPLE WIRE DRAWING MACHINE.

APPLICATION FILED MAY 5, 1913.

1,281,439.

Patented Oct. 15, 1918.

3 SHEETS—SHEET 1.

Fig. 1.

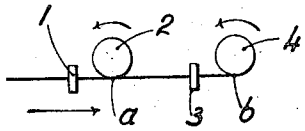


Fig. 2.

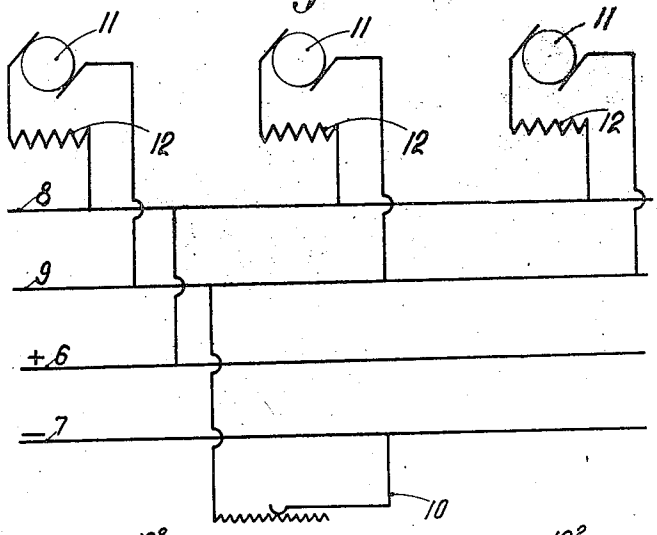
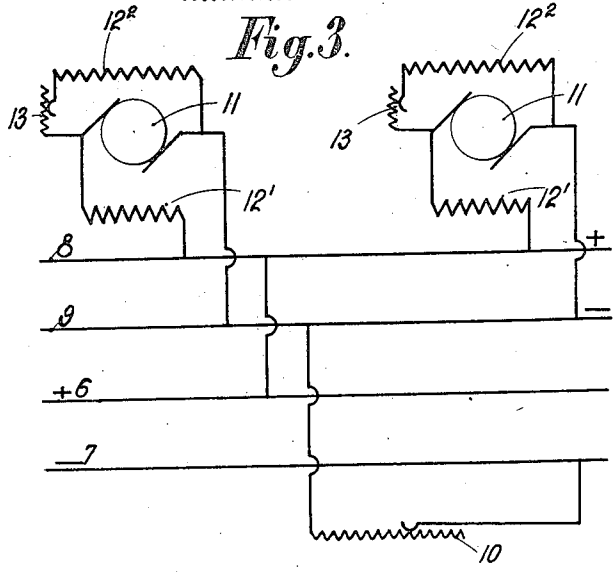


Fig. 3.



Witnesses.

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3 SHEETS—SHEET 2.

Fig. 4

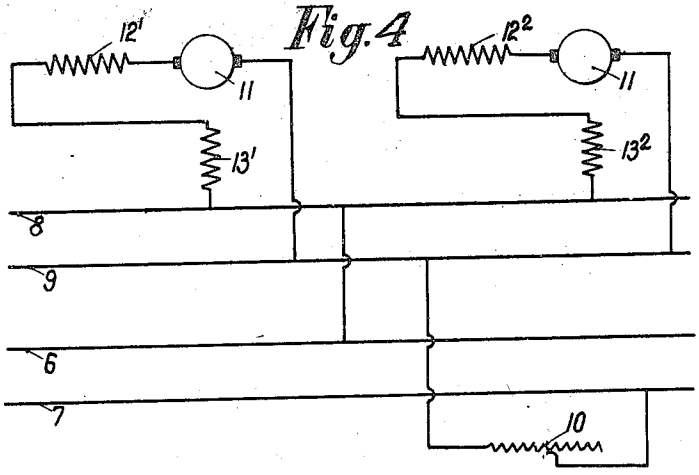
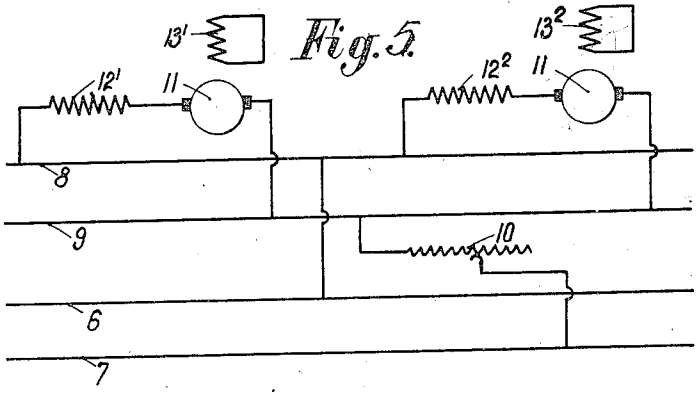


Fig. 5.



Witnesses.

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3 SHEETS—SHEET 3.

Fig. 6.

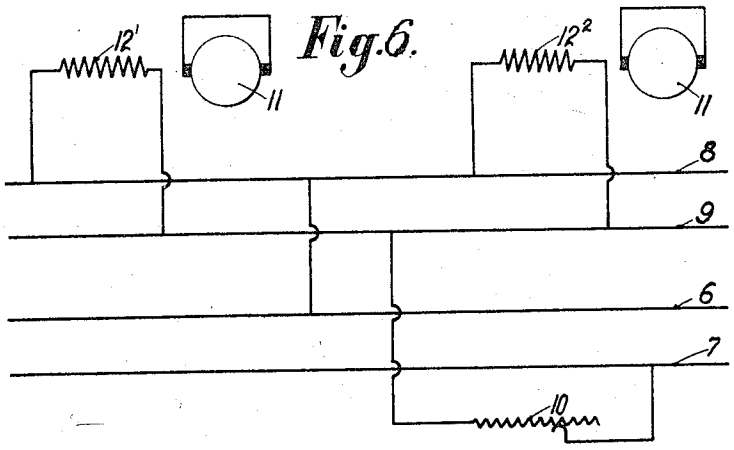
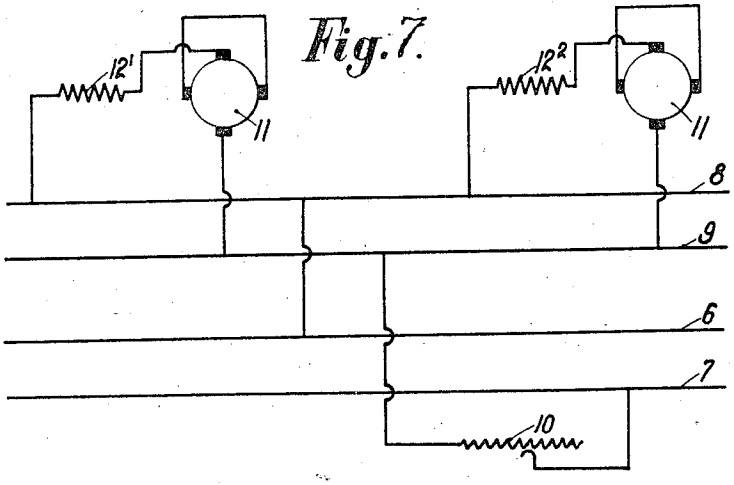


Fig. 7.



Witnesses.

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UNITED STATES PATENT OFFICE.

MARIE JULES ANDRÉ VICAIRE, OF PARIS, FRANCE, ASSIGNOR, BY MESNE ASSIGNMENTS, TO BRIDGEPORT BRASS COMPANY, OF BRIDGEPORT, CONNECTICUT, A CORPORATION OF CONNECTICUT.

MULTIPLE-WIRE-DRAWING MACHINE.

1,281,439. Specification of Letters Patent. Patented Oct. 15, 1918.

Application filed May 5, 1913. Serial No. 765,495.

To all whom it may concern:

Be it known that I, MARIE JULES ANDRÉ VICAIRE, citizen of the French Republic, residing at Paris, Department of the Seine, in France, have invented certain new and useful Improvements in Multiple-Wire-Drawing Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The present invention has for its object, an arrangement for automatically regulating multiple metal reducing machines for cold drawing metallic wires, bars, rods and the like, and the construction of machines for cold drawing a strip simultaneously at a plurality of points along its length.

In machines for multiple wire drawing of the type herein described, different portions of a continuous strip of wire are passed simultaneously through several dies, so that in the same continuous operation the diameter of the wire is reduced at a plurality of points by passing the wire through the desired number of dies or draw plates. The continuous strip of wire is drawn through the dies by power driven drawing drums placed behind the die, about which the wire is looped or coiled several times before it passes on to the next die.

In order that the operation of such a machine shall be completely satisfactory in spite of wear or unequal pressure on the various draw plates in the course of the same drawing operation, it is necessary that the peripheral speed of each of the drawing drums should be able to be constantly varied and should be at each instant inversely proportional to the cross section of the draw plate which precedes it. The output of all the draw plates will then be at each instant exactly the same and the drawing will be absolutely regular without jerking or breaking the wire which is being drawn.

In practice it is believed that prior to my invention this condition had not been realized.

In almost all the multiple wire drawing machine heretofore devised where the drawing drums are driven by mechanical devices geared together, the speed of rotation of the various drawing drums remains constant during the drawing operation whatever may be the change in the work of the different drawing plates. Under these conditions in order to avoid breakage, the wire to be drawn should be able to slide upon the drums around which it is wound.

This sliding of the wire on the drawing drums while being drawn does not take place without serious difficulties. For when the drawing drums are driven at a constant speed, the reduction of the wire as it passes from one draw plate to the other will not take place at a corresponding rate, since, due to unequal wear on the several dies or to other reasons, the wire will be reduced more by one die than another, and, consequently, a greater load will be placed on one draw drum than on another, with the result that the wire is either broken or caused to slip about the heavily loaded drum, from which there results a considerable increase in the power required. Furthermore, part of the lubricant which covers the wire being drawn is completely lost, the wear of the draw plates is more rapid and the wire which is being drawn is roughened. Finally, and it is the principal evil of this system, it brings about a rapid destruction of the drawing drums and makes the cost of maintenance of the machine very heavy. This last disadvantage is so important that these multiple machines have only up to now been employed for drawing fine wires, the friction of the larger wires under the tension which is required to draw them through the draw plates rapidly rendering the drawing drums useless.

The sliding of the wire upon the drum and the other disadvantages above mentioned are avoided by the arrangement which forms the subject of the present invention, in which each drum is operated to deliver exactly the quantity of wire necessary to feed the next drum. To this end, the wire that is being drawn is itself used to control the speed of the drawing drums, and each of the drums is separately actuated by an electric motor having the property of decreasing considerably in speed when the load increases, so that each variation in the tension of the wire modifies the speed of the motor in such a way that each drum delivers exactly the quantity of wire necessary for feeding the next drum. I obtain the desired operation of each drum by actuating sepa-

rately each of the drawing shafts or drums by an electric motor which has the characteristic that its speed reduces when the load increases. With motors having this characteristic each variation in the tension of the wire will itself instantaneously alter the speed of the motors in such a manner that each drum will deliver exactly the amount of wire necessary to feed the following drum, in such a manner that the drawing will be absolutely regular.

For this purpose the motors which can be employed are the following:

Continuous current series, compound, or shunt wound motors with resistance inserted in the armature causing a diminution of the speed to occur automatically when the torque rises.

Also various alternating current motors having a speed which varies inversely to the torque, namely:

Single phase, series commutator motors (simple series motors, compensated series motors, repulsion motors and motors of the Latour type comprising the combination of a simple series motor and a repulsion motor).

Also asynchronous poly-phase motors of the following types, namely motors with a wound rotor having resistances inserted in the rotor either with constant resistance or with variable resistance regulated in accordance with the slip.

Motors having double squirrel cage rotors (Boucherot type Gamma) which develop automatically in case of retardation the amount of torque which is required for starting at the same speed.

By reason of the property which these motors have of slowing down considerably when the load increases each variation in the tension of the wire which is being drawn will modify the speed of the motors.

In the accompanying drawings:

Figure 1 shows diagrammatically by way of example and for the sake of simplicity a drawing machine having only two elements.

Figs. 2 to 7 are diagrams of electrical connections according to the type of motors having the property above described employed for operating the drawing drums.

In Fig. 1, 2 is a drawing drum or shaft driven by a series or compound electric motor. The wire is rolled several times around the drum 2. The drum being rotated draws the wire through the draw plate 1. The wire having been wound several times on the drum 2, unrolls at its free end in accordance with the rotation of the drum 2. This end after passing through the draw plate 3 is secured to the drum 4 which is driven by another series or compound motor and draws the wire by reason of its rotation.

It is clear that, if the respective cross-section of the draw plates are denoted by S_1 and S_2, and the peripheral speed of the drawing drums by V_1 V_2, it is necessary in order to obtain a regularity in the drawing that at every instant S_1 V_1 equals S_2 V_2.

This condition can be obtained by constructing or regulating the driving motors so that the normal speed of each successive drum will slightly exceed the normal speed of its preceding drum, so that as the continuous strip of wire is elongated by passing through a number of draw plates of decreasing cross-sectional area, the gradual increase of the length of the wire will be taken care of by the successive increase in the speed of the motors, and since the speed of each motor is controlled to a large extent by the variation in the tension of the wire, the wire will be drawn through the draw plates without being at any time submitted to an excessive strain.

Under these conditions equilibrium will be established from the starting of the multiple drawing. In fact, during the operation if the drum 4 has a tendency to deliver more than the drum 2 the wire acts instantaneously as a regulating means, for when the tension of the section *a*, *b*, increases, this increase in tension tends to drive the drum 2 and its motor by the drum 4, the load on the motor operating the drum 4 is thus increased, so that it tends to slow down while inversely the load on the motor driving the drum 2 diminishes and its speeds tends to increase. The equilibrium of the outputs is therefore automatically reëstablished and without any assistance on the part of the workman; the wire which is being drawn acts therefore as a regulating device for the speeds of the motors.

Generally, in machines having *n* passes, it will be sufficient to regulate the outputs of each of the elements considered as a single drawing machine in such a manner that they increase slightly from the first pass to the last. Under these conditions in the operation as a multiple drawing machine, the wire which is being drawn acts as a regulator for the speeds of the motor, and equilibrium will be established from the beginning of the operation and will continue during working without any intervention on the part of the workman.

This arrangement is completed by standard devices for causing the automatic arrest of the motors when, for any reason whatever and particularly at the end of the drawing operation, their load falls below a predetermined limit.

Fig. 2 is a diagram showing the electrical connections for series motors operating different drawing drums. The main supply conductors are shown at 6, 7, the secondary conductor 8 is connected directly to the main 6, and the conductor 9 is connected to the main 7 through a starting rheostat 10.

Each of the armatures 11 is mounted in series with its field coil 12, all the motors being controlled by the same rheostat 10.

Fig. 3 shows the connections for compound wound motors. The main conductors being 6, 7, the secondary conductor 8 is connected directly to the main 6 and the secondary line 9 is connected to the main 7 through the starting resistance 10. Each armature is connected in series with one of the windings 12^1 of its field and in parallel with the other winding 12^2. Field rheostats 13 permit the excitation of the motors to be regulated in order to properly divide the work between them; the starting and stopping of all the motors is obtained by means of the single starting rheostat 10.

Figs. 4 and 5 relate to the case of compensated motors in which the compensation windings 13^1 and 13^2 are either arranged in series with the field windings (Fig. 4) or are short-circuited upon themselves (Fig. 5).

Figs. 6 and 7 relate to repulsion motors and Latour motors respectively.

The starting is effected in all the above cases by means of a single controller and for synchronous poly-phase motors either with wound or squirrel cage rotors by the simple closure of a switch.

The machine herein described is particularly adapted for drawing iron wire and round iron rods, etc., but it also is well adapted to reduce metal of any material and of various dimensions and of all forms of cross-section.

I claim—

1. In an apparatus of the class described, a plurality of wire draw plates through which a continuous strand of wire is threaded, means for advancing the strand of wire simultaneously through each of said plates, electric motors similarly wound for operating said wire advancing means and for exerting a continuous pulling force throughout a large range of speed upon each portion of the wire being drawn, said motors being so wound as to decrease in speed with an increase in tension upon the portion of the wire being advanced by its motor.

2. In an apparatus of the class described, a plurality of wire draw plates through which a continuous strand of wire is threaded, wire engaging drums for advancing the successive portions of the wire simultaneously through each of said plates, electric motors similarly wound for operating said drums to exert a continuous pulling force through a large range of speed upon each portion of the wire being drawn, said motors being so wound as to decrease in speed as the load upon the drums increases, due to increase in tension of the portion of the wire being advanced by its drum.

3. In a wire drawing machine, a plurality of wire draw plates through which a continuous strand of wire is threaded, wire engaging drums about which the wire is looped for advancing successive portions of the strand simultaneously through said plates, each successive portion of the wire extending in a straight and undeflected line from the periphery of the drum from which it is unwinding to the periphery of the drum upon which it is wound, driving means for each of said drums constructed and arranged to exert a continuous pulling force throughout a large range of speed upon each portion of the wire being drawn and to automatically decrease in speed with an increase in the tension of the wire.

4. In a wire drawing machine, a plurality of wire draw plates through which a continuous strand of wire is threaded, means for advancing successive portions of the strand simultaneously through said plates, each successive portion of the wire extending and traveling in a straight and undeflected line from one wire advancing means to the next wire advancing means, driving means for each of the wire advancing means, constructed and arranged to automatically decrease in speed with an increase in the tension of the wire.

5. In a wire drawing machine, a plurality of wire draw plates through which a continuous strand of wire is threaded, wire engaging drums about which the wire is looped for advancing successive portions of the strand simultaneously through said plates, each successive portion of the wire extending in a straight and undeflected line from the periphery of the drum from which it is unwound to the periphery of the drum upon which it is being wound, electric motors for driving each of said drums to exert a continuous pulling force throughout a large range of speed upon each portion of the wire being drawn, said motors being adapted to decrease in speed with an increase of load, whereby the tension of the wire automatically controls the speed of the motors.

6. In a metal reducing machine, a plurality of metal draw plates through which a continuous length of the metal to be drawn passes, drums about which the metal is looped for advancing successive portions of the metal simultaneously through said plates, electric motors for driving said drums, means acting through the armature of each drum-driving motor, whereby each armature varies the current through its motor to automatically decrease the speed of each motor with an increase in the tension of the metal being wound on its drum.

7. In a metal reducing machine, a plurality of metal draw plates through which a continuous length of the metal to be drawn passes, drums for advancing successive portions of the metal simultaneously through said plates, electric motors for driving said

drums, each of said electric motors being constructed and arranged so that its armature varies the current through its motor to decrease its speed with an increase of load imposed thereon through the drum driving connections by variation of tension in the portion of the metal advanced by each drum, whereby the tension of the metal automatically controls the speed of the motors.

8. In a metal reducing machine, a plurality of metal draw plates through which a continuous length of the metal to be drawn passes, drums for advancing successive portions of the metal simultaneously through said plates, electric motors for driving said drums, having series field windings whereby each motor is adapted to automatically decrease in speed with an increase of load and to exert an appreciable advancing force upon each portion of the metal being drawn throughout a large range of speed, substantially as described.

9. The combination of metal working devices arranged in tandem for simultaneously advancing a length of stock, a plurality of draw plates through which the stock is advanced, a prime mover for driving one of said stock advancing devices, a prime mover for the other device, connecting means for positively driving each of said devices from its prime mover, and a current controlled means for simultaneously controlling the speed of said prime movers, each of said prime movers being constructed and arranged to vary its speed directly and automatically with variations of tension in the stock transmitted to it through its connecting means, and independently of said simultaneously controlling means.

10. The combination of metal working devices arranged in tandem for simultaneous operation on a length of stock fed by one of said devices to the other, an electric motor for driving each of said devices, and adjustable means for controlling the speed of said electric motor, each of said motors being so wound as to decrease in speed with an increase of load on its reducing device and to exert a continuous pulling force throughout a large range of speed upon each portion of the stock being drawn, without actuation of said speed-controlling means, whereby the speeds of the reducing devices are directly and automatically controlled by variation of the tension of the stock; substantially as described.

11. In an apparatus of the class decribed, a plurality of wire drawing plates through which a continuous strand is threaded, means for advancing the strand of wire simultaneously through each of said plates, each successive portion of the wire extending and traveling in a straight and undeflected line from one wire advancing means to the next wire advancing means, electric motors similarly wound for operating said wire advancing means and for exerting a continuous pulling force throughout a large range of speed upon each of the portions of the wire being drawn, said motors being so wound as to decrease in speed with an increase in tension upon the portion of the wire being advanced by its motor.

In testimony whereof I affix my signature in presence of two witnesses.

MARIE JULES ANDRÉ VICAIRE.

Witnesses:
LUCIEN MEMMENGER,
ERRICK KLOTZ.