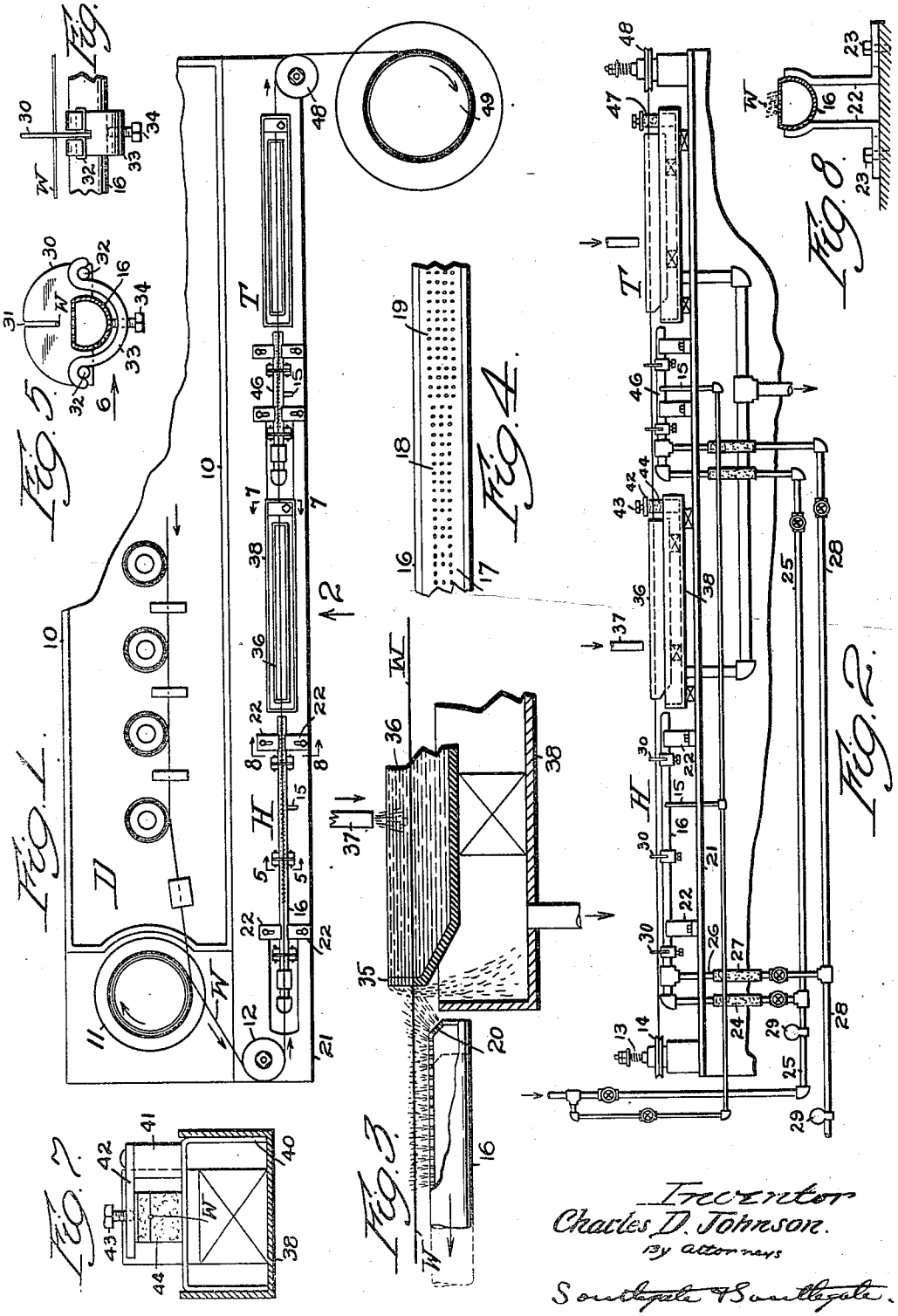
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MACHINE FOR HARDENING AND TEMPERING WIRE.

APPLICATION FILED JUNE 12, 1920.

1,409,452. Patented Mar. 14, 1922.



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# UNITED STATES PATENT OFFICE.

CHARLES D. JOHNSON, OF WORCESTER, MASSACHUSETTS.

## MACHINE FOR HARDENING AND TEMPERING WIRE.

1,409,452. Specification of Letters Patent. Patented Mar. 14, 1922.

Application filed June 12, 1920. Serial No. 388,620.

*To all whom it may concern:*

Be it known that I, CHARLES D. JOHNSON, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented a new and useful Machine for Hardening and Tempering Wire, of which the following is a specification.

This invention relates to a hardening and tempering machine and involves its connection with a wire-drawing machine in such a manner that the hardening and tempering operations can be carried on continuously with the wire-drawing operation, thus economizing very materially in time and space and also in labor.

The invention also involves other objects, including an improved way of introducing wire from a flame heating zone into an oil bath in such a way that it need not be exposed to the air so that bright wire may be made; improvements in the heating mechanism by which the heat can be gradually increased as the wire passes along so that it will be at its maximum temperature when it enters the oil bath; the construction of the apparatus in such a way that the flame heating zone and the oil bath can be moved close enough to produce bright wire or separated sufficiently to produce black wire; also certain improvements in the way of supporting the several parts of the hardening and tempering apparatus. Some features of the invention are capable of application to both the hardening and tempering, or to either.

Reference is to be had to the accompanying drawings, in which—

Fig. 1 is a plan of a wire-drawing machine with a hardening and tempering attachment applied thereto for continuous operation in accordance with this invention;

Fig. 2 is a side view of the hardening and tempering apparatus;

Fig. 3 is a longitudinal central sectional view of a portion of the hardening apparatus on an enlarged scale;

Fig. 4 is a plan of the gas burner therefor;

Fig. 5 is a sectional view on the line 5—5 of Fig. 1, enlarged;

Fig. 6 is a side view of the same;

Fig. 7 is a sectional view on the line 7—7 of Fig. 1; and

Fig. 8 is a sectional view on the line 8—8 of Fig. 1.

The invention can be applied to any type of continuous wire-drawing apparatus D, and I have not shown the details thereof but merely illustrated a well known type. This delivers the wire W ordinarily to a drum, but in this case, a carrier 11 is substituted which receives the wire. It passes around it and on a friction roll 12, adapted to put friction on the wire and provided with a spring 13 for that purpose. This is formed of two discs 14, pressed together by the spring and exerting enough friction to keep the wire taut.

From the roll 12 the wire W is delivered to the hardening apparatus H, which I have shown as comprising a gas pipe 16. This is provided with a flat top having jet perforations therethrough for the gas and these are arranged in two or more series. In the first series 17, the perforations are arranged in such a manner as to afford a comparatively small number and therefore furnish a restricted gas flow toward the wire. In the second series at 18, the number of perforations for a given unit of length is increased. I have shown this as being accomplished by adding a single perforation to every section of eight. In the third series, 19 as shown, the number is increased by having four rows of perforations instead of three, the longitudinal distances being shown as the same, although this is not essential. The essential feature is that the total volume of gas flowing from all the jets shall be increased from one zone to the other so that the maximum heat will be applied at the point where the wire leaves the region of influence of these flames. I prefer to employ pilot burners 15 for lighting the jets.

For the purpose of throwing the flames against the wire after it passes beyond the end of the pipe 16, another series of perforations 20 are shown in an inclined surface at the top and end of the pipe. In this way, the wire W is continuously within the influence of the flame until it passes beyond the end of the pipe and the heat is increased as stated.

This pipe is supported from a table 21, mounted on the frame 10 of the wire-drawing machine. The pipe is carried by supports 22 which have slotted bases and are held down by screws. These supports clasp the pipe between them and positively support the pipe. The reason for the slotting of the bases is that when it is desired to adjust the pipe longitudinally, one of

these of each pair can be loosened and the pipe moved along in either direction, and then tightened up again and held there. This is rendered possible by a flexible connection 24, which connects the end of the gas pipe with the gas supply pipe 25. The air pipe 26 which supplies air to the gas for admixture therewith to increase the combustion, is also connected by a flexible connection 27 with the air supply pipe 28. I prefer to provide the gas and air supply pipes with any known form of pressure governor 29 to keep the pressure constant independently of other conditions.

As the wire passes over the gas pipe 16, it is guided by a series of plates 30, each having a slot 31 centrally arranged therein. Each is provided with studs 32 and a binder 33 which has a binding screw 34 engaging the bottom of the pipe, its ends extending over the studs 32. In this way, the wire is guided straight and horizontally through the machine into a slot at 35 in the end of the oil bath tank 36. This tank is constantly supplied with oil through a feeder 37 and the oil flows out through the slot 35 and also over the sides and ends of the tank into a receiving tank 38 below into which it is discharged and from which it is pumped back again.

With the parts in the position shown in full lines in Fig. 3, the flames from the gas pipe remain in contact with the wire W until it enters the flowing oil. As is well known, oil is used which has a high flash-point and flowing at the speed from which it issues from the tank 36, it will not be ignited by such a flame. Consequently, I can bring the flame into direct contact with the oil while the wire is within the influence of both and prevent oxidation of the wire, so as to produce a bright wire. If, however, I desire to produce a black wire, I simply loosen the supports 22 on one side and move the pipe 16 back to the position indicated in dotted lines in Fig. 3. Then the wire will pass out of the direct influence of the gas jets before it enters the oil and will become oxidized and black. Thus, on the same machine, I can produce either bright or black wire at will with very little trouble and with a very rough adjustment.

The tank 38 is provided with a metal holder 40 at the end, which carries a post 41 on which is mounted a plate 42 and a pressure screw 43. Between the parts 40 and 42, a wiper 44 is mounted. This is made in two parts through which the wire W can pass and any desired amount of pressure can be applied to it.

After the wire passes out of the bath 36, and is given its hardened condition, it can be tempered by passing through a tempering device T. This involves a gas burner 46 connected with the pipes 25 and 28, adjustably supported in the same way as the pipe 16. It is intended that when one pipe is adjusted, the other shall be also, for the purpose of producing the desired kind of wire. The tempering apparatus is operated in exactly the same way and no specific description of it is necessary. Wire passes from it through the wiper 47 to a tension roll 48 and is wound therefrom on a drum 49 or disposed of in any other desired way.

From this it will be seen that a continuous wire-drawing, hardening and tempering process is possible and I have found in practice that a very high grade of wire, even of the finest sizes, can be produced by it with obvious economies in operation and equipment.

Although I have illustrated and described only a single form of the invention and shown the parts in only one way, I am aware of the fact that modifications can be made in both without departing from the scope of the invention as expressed in the claims.

Therefore I do not wish to be limited to all the details of construction or to the specific arrangement of parts shown and described, but what I do claim is:—

1. The combination with a machine for the continuous drawing of wire, of a carrier for continuously receiving the wire therefrom, a frame mounted adjacent to said wire-drawing machine, a winding block at the opposite end of said frame for continuously moving the wire along the frame toward the rear, and means mounted along said frame for continuously hardening or tempering the wire delivered from said carrier while on its way to said block.

2. The combination with a machine for the continuous drawing of wire, of a carrier for continuously receiving the wire therefrom, a friction guide roller for receiving the wire from the carrier and applying friction thereto to retard it and pass it along continuously, a frame supported on the side of said wire drawing machine, a winding block at the opposite end of said frame for taking the wire from said friction roller and continuously moving it along the frame toward the rear, and means mounted along said frame for continuously hardening and tempering the wire delivered from said friction roller while on its way to said block.

3. The combination with a continuous wire-drawing machine, of a frame located along the side thereof, a hardening device on said frame near the delivery end of the wire-drawing machine and delivering the wire therefrom, a tempering device near the receiving end of said wire-drawing machine adapted to receive the wire directly from said hardening device, and a block located at the end of said support, adjacent to the receiving end of the wire-drawing machine,

for pulling the wire through the hardening and tempering apparatus.

4. The combination with a continuous wire-drawing machine, of a frame supported along the side thereof, a hardening device on said frame near the delivery end of the wire-drawing machine and delivering the wire therefrom in the opposite direction, a tempering device on said frame near the receiving end of said wire-drawing machine located in alignment with the hardening apparatus and adapted to receive the wire directly therefrom, a block located at the end of said support adjacent to the receiving end of the wire-drawing machine for pulling the wire through the hardening and tempering apparatus, and means for guiding the wire from the wire-drawing machine to the opposite end of the hardening apparatus directly.

5. In a machine for heating wire for hardening or tempering purposes, the combination of a burner, and an oil bath provided with a slit in the receiving end for the wire and being arranged to deliver a current of oil through said slit directly toward the burner, said burner being arranged to direct its flame against the wire all the way to the point at which the wire enters the current of oil to produce bright wire.

6. In a machine for hardening or tempering wire, the combination of a burner, an oil bath, said oil bath being provided with a slit in the receiving end for the wire and being arranged to deliver a current of oil through said slit directly toward the burner with the wire immersed therein, said burner being arranged to direct its flame against the wire all the way to the point at which the wire enters the current of oil to produce bright wire, and means below the oil bath for receiving the overflow therefrom through said slit and over its sides and ends.

7. In a machine for heating wire for hardening or tempering purposes, the combination with a burner and an oil bath provided with a slit in the receiving end for the wire and being arranged to deliver a current of oil through said slit directly toward the burner, said burner being arranged to direct its flame against the wire all the way to the point at which the wire enters the current of oil, the distance between said burner and oil bath being adjustable to permit the wire to pass through the air after it leaves the flame and before it enters the oil to produce black wire.

8. In a machine for heating wire for hardening or tempering purposes, the combination with a burner and an oil bath provided with a slit in the receiving end for the wire, said burner being arranged to direct its flame against the wire, of means below the oil bath for receiving the overflow therefrom, the distance between said burner and oil bath being adjustable to permit the wire to pass through the air after it leaves the flame and before it enters the oil to produce black wire or to pass directly into the oil from the flame to produce bright wire.

9. In an apparatus for heating wire to harden or temper it, the combination with a liquid bath, of means for preliminarily heating the wire before it enters the bath comprising a burner provided with a heating surface having perforations therethrough constituting jets, the jets being arranged closer together at the end of the burner toward the bath than at the opposite end, and means for moving the wire along said burner into the bath.

10. In a machine for heating wire for hardening or tempering purposes, the combination with a burner and a bath, said burner being arranged to direct its flame against the wire, the distance between said burner and bath being adjustable to permit the wire to pass through the air after it leaves the flame and before it enters the bath to produce black wire or to pass directly into the bath from the flame to produce bright wire.

11. In a hardening or tempering apparatus for wire, the combination with an oil bath, of means for preliminarily heating the wire before it enters the oil bath comprising a gas burner having means for admitting gas and air and provided with a heating surface having perforations therethrough constituting jets, the jets being arranged closer together at the end of the burner toward the oil bath than at the opposite end, and means for moving the wire along said burner into the oil bath below its surface.

12. In a hardening or tempering apparatus for wire, the combination with a bath, of means for preliminarily heating the wire before it enters the bath comprising a gas burner having means for admitting gas and air and provided with a heating surface having perforations therethrough constituting jets, the jets being arranged closer together at the end of the burner toward the bath than at the opposite end, means for moving the wire along said burner into the bath, and means for automatically regulating the pressure of the gas and air admitted to said burner.

13. In a device for heating wire for hardening or tempering purposes, the combination of a hollow burner having jet openings in one surface and provided with means for introducing air and gas, supports for said burner, said supports being movable to permit of the adjustment of said burner longitudinally and the clamping of the same in its adjusted position, a tank for an oil bath having a slit in its end for receiving the wire located in position for the level of the oil to

be above the bottom of said slit, the burner having jet openings for directing the flame against the wire up to the point at which it enters the slit in the tank, and a wiper located at the discharge end of the tank for removing excess oil.

14. In a device for heating wire for hardening or tempering purposes, the combination of a burner having jet openings, supports for said burner, said supports being movable sidewise to permit of the adjustment of said burner longitudinally and the clamping of the same in its adjusted position, a series of wire guide plates carried by said burner, clamping means for clamping said plates to the burner, said guides having slits therein for the wire, said slits being located substantially centrally with respect to the jet area, a tank for an oil bath having a slit in its end for receiving the wire in alignment with the slits in said guides and being located in position for the level of the oil to be above the bottom of said slit, the burner having jet openings for directing the flame against the wire, and a wiper located at the discharge end of the tank for removing excess oil.

In testimony whereof I have hereunto affixed my signature.

CHARLES D. JOHNSON.