3 Sheets—Sheet 1.

C. DION.

APPARATUS FOR TEMPERING AND CONVERTING IRON.

No. 192,239. Patented June 19, 1877.

FIG. 1

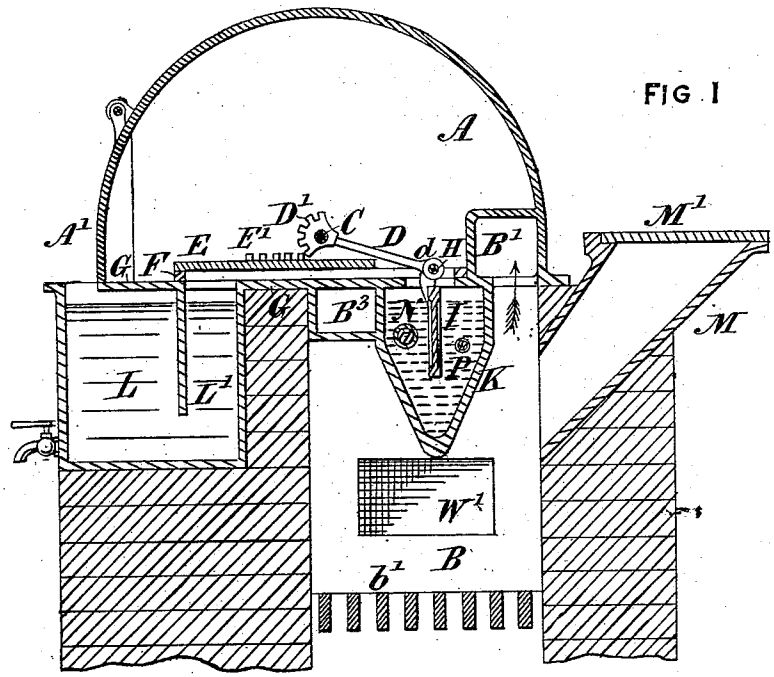
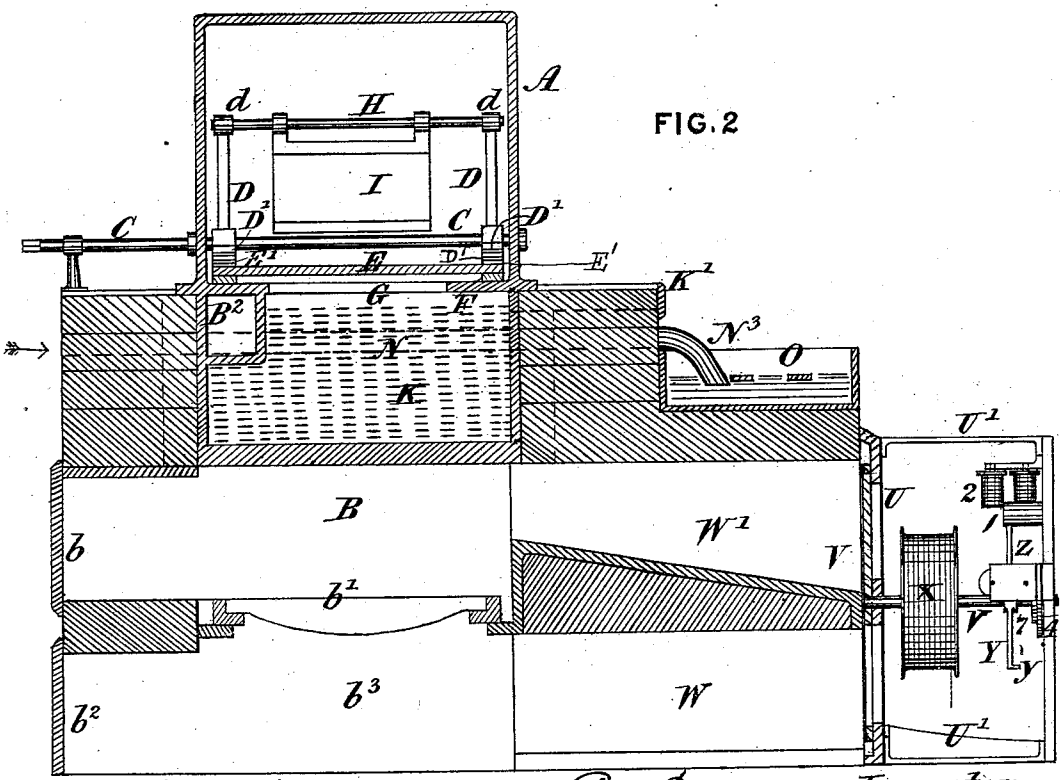


FIG. 2



Witnesses

Harley Laurie

William J. Kerr

Inventor

Chas Dion

per atty Chas. M. Pequolet

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

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APPARATUS FOR TEMPERING AND CONVERTING IRON.

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FIG. 3

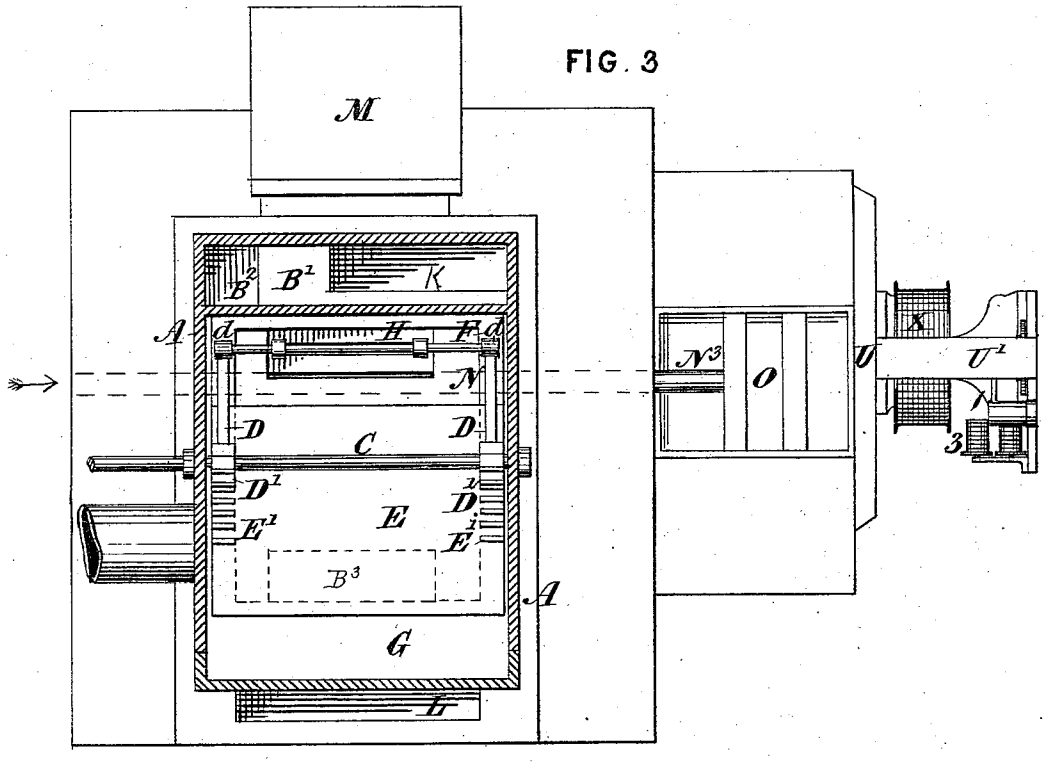


FIG. 4

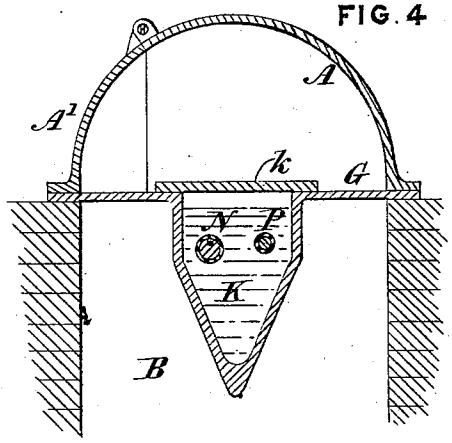


FIG. 5

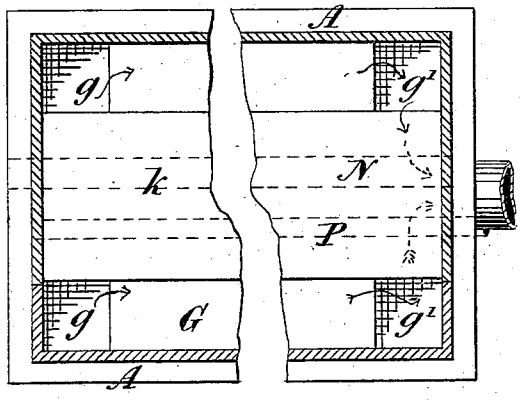
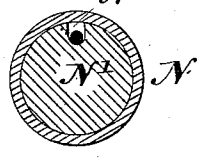


FIG. 6 N^2



Witnesses:
Harley Laurie
William J. Kerr.

Chas. Dion
Inventor
per atty
Thos. H. Reynolds

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

3 Sheets—Sheet 3.

C. DION.

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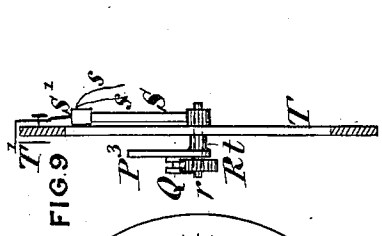


FIG. 9

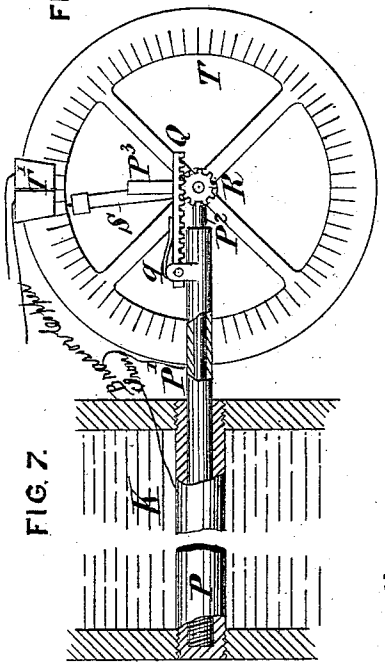


FIG. 7.

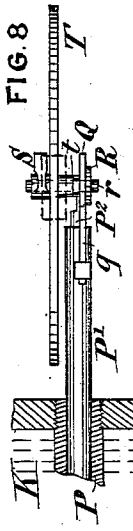


FIG. 8

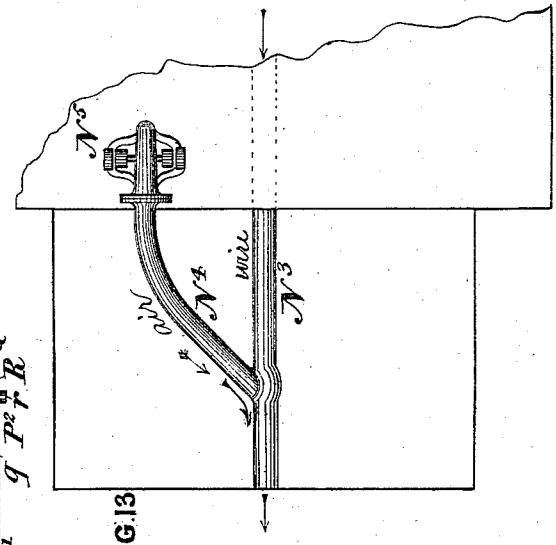


FIG. 13

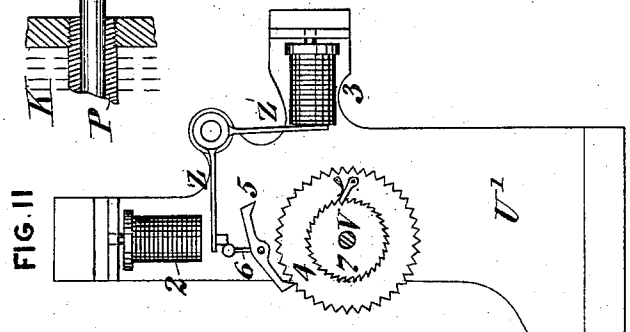


FIG. 11

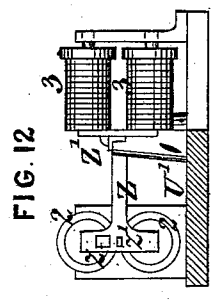


FIG. 12

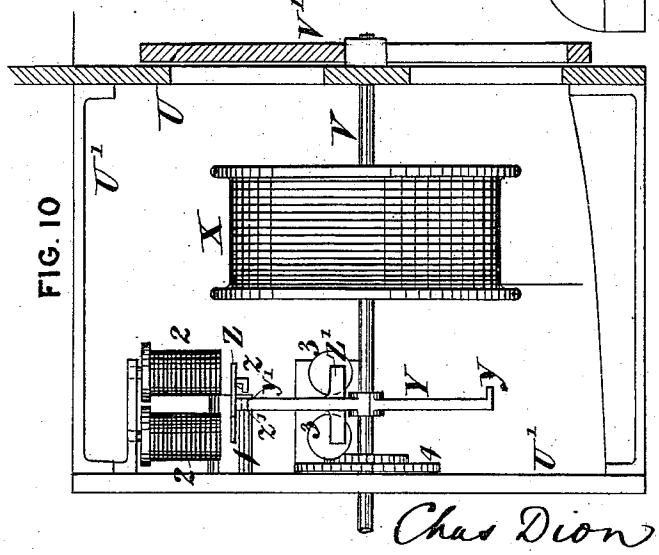


FIG. 10

Witnesses:
Harley Lauric
William J Kerr

Chas Dion
Inventor
per atty Rastus Hayes

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

CHARLES DION, OF CHAMBLY BASIN, ASSIGNOR OF ONE-HALF HIS RIGHT TO JAMES BAYLIS, OF MONTREAL, QUEBEC, CANADA.

IMPROVEMENT IN APPARATUS FOR TEMPERING AND CONVERTING IRON.

Specification forming part of Letters Patent No. **192,239**, dated June 19, 1877; application filed September 22, 1876.

To all whom it may concern:

Be it known that I, CHARLES DION, of the village of Chambly Basin, in the county of Chambly and Province of Quebec, Canada, have invented certain new and useful Improvements on Apparatus for the Treatment of Iron and Steel; and I do hereby declare that the following is a full, clear, and exact description of the same.

My invention is primarily for the purpose of tempering steel or iron, whether the same be in the form of wire, plates, cutting-edges, or any other shape into which these metals may be worked, and it enables this process to be performed far more effectually than by any means yet in use, the temperature of the furnace wherein the operation is carried out being automatically regulated and kept to the same degree of heat.

My invention will also be found applicable to, and useful in, the conversion of iron wire into steel.

It may be briefly described as follows: Above the furnace proper is placed a tempering-chamber, wholly covering a hot-chamber or bath of molten lead or other substance, and, partially so, a small water-tank, the portion of this latter which remains outside the chamber forming a seal, and not allowing the outside air to enter. Within this chamber is arranged mechanism which, when put in motion, dips alternately into each bath the plate or article to be tempered, at the same time closing up whichever bath happens not to be in use. A pyrometer placed in a tube in connection with the hot-air chamber or lead-bath is furnished with a pointer and dial to register the temperature, and, should it rise above the desired point, certain devices which I have arranged for the purpose operate to automatically cut off the blast from under the grate and to turn it into the upper part of the fire-chamber, thus reducing the heat; or, on the contrary supposition—*i. e.*, that the temperature is not sufficiently high—the blast is automatically, by the same means, turned on under the grate.

Wire is tempered by being drawn through a tube peculiarly arranged, and running from end to end of the hot-chamber, the wire thence passing out into water, oil, or any fluid, without entering the external air.

Instead of being conducted into this fluid, the wire, on leaving the hot-chamber, may be brought in contact with a blast of air impelled by a fan-blower or any other device.

For fuller comprehension, however, of my invention, reference must be had to the annexed drawings, in which—

Figure 1 shows a vertical sectional elevation of my invention, taken transversely through the water-tank and hot-chamber; Fig. 2, a vertical sectional elevation, taken longitudinally through the fire-chamber; Fig. 3, a horizontal section through the fire-chamber; Fig. 4, a sectional elevation, showing modification of hot-chamber, &c.; Fig. 5, plan view of same; Fig. 6, detail of wire-tube; Figs. 7, 8, and 9, front, plan, and side views, respectively, of pyrometer, enlarged; Fig. 10, side view of apparatus for directing draft; Fig. 11, a front view of same; Fig. 12, plan view of apparatus, looking up; Fig. 13, view showing arrangement of cold-blast for wire.

Similar letters of reference indicate like parts.

A is a metal chamber of any size and proportion, flanged so as to be secured to the brick-work inclosing the furnace B, to be hereinafter more particularly described, and provided with door A′.

C is a shaft passing transversely through the chamber A, and, as shown, carried out either on one or both sides, where it may be provided with a suitable handle for rotation. Upon this shaft C are secured arms D, the lower ends of which are enlarged, and have pinions formed upon them, as shown at D′.

These pinions intermesh with and work in the racks E′ formed on the plate E, to correspond with them, and thus give this plate a forward or backward movement on the rails or slides F arranged on the main plate or cover G.

Through the eyes *d*, formed on the outer ends of the arms D, runs a rod, H, secured in any suitable way against lateral movement, to which is hung loosely (so as to be always vertical, whatever angle the arms D D may assume) the plate I, arranged to receive the article to be tempered, and which dips alter-

nately in the hot chamber or bath K (which may be filled with molten metal) and the tank L, this last being placed where shown in the drawings, projecting somewhat beyond the inclosure of the chamber A, and having there an open trough, through which it may be replenished, an outlet-pipe being also provided. The plate I dips into this tank through an opening formed in the plate G, a diaphragm, L′, dipping down into the tank, and forming a perfect seal.

The bath K is preferably of some such section as that shown in Fig. 1, having its ends extended so as to be built into the brick-work of the furnace, and having, as shown at K′, Fig. 2, an opening communicating with the outside and provided with a proper door, through which a rake or scoop may be passed to remove that part of the lead which has become oxidized.

The furnace B, in which the bath K is set, is arranged as shown in Figs. 1 and 2, having proper feed-door *b*, fire-bars b^1, ash-pit door b^2, and ash-pit b^3, the bars being arranged so as to be shaken or tipped at pleasure. To insure the uniform heating of the lead contained in the bath K, the products of combustion are, preferably, first taken up into a flue, B^1, running along the back of the chamber A, thence passing down through its extension B^2 and the flue B^3, on their way to the chimney, which may be placed in any convenient spot. Should, however, the size of the furnace be such as to give a heat which will not necessitate this, the products of combustion may be carried directly from the furnace to the chimney-flue.

M is the coal-chute, provided with the proper cover M′, and constructed substantially as shown.

Within the bath K, and stretching transversely through it from side to side, but not communicating in any way with its contents, is placed a cast-iron or other metal pipe, N, containing within it a rod, N^1, in which is formed a groove, N^2. Along this the wire to be tempered passes, being unwound by any suitable means from a drum placed on one side of the furnace, and, on leaving this, is taken down through the tube or passage N^3 into the bath O, which may contain water, oil, or any other suitable fluid. On its exit from this the wire, which has, as yet, not come in contact with the external air, is wound up in any usual way upon another drum. (Not shown in the drawings.)

Instead of the arrangement above described, the bath O may be omitted and the passage N^3 carried along to the outside of the brick-work, an air-passage, N^4, being constructed at an angle to it, and the pipe N^3 being enlarged at their junction. Through this air-channel N^4 air at any temperature is blown by means of a fan-blower, N^5, driven in any ordinary way.

In Figs. 4 and 5 is shown a modified construction of the chamber A and bath K, which, in this instance, is provided with a cover, *k*, properly secured to the plate G, in which are formed four apertures, two, *g*, being placed at one end to allow the products of combustion to pass up into the chamber A, and two, *g′ g′*, down which they are taken to the chimney-flue.

Within the bath K is also placed the pyrometer, which is shown in detail in Figs. 7, 8, and 9, and will now be described.

P is an iron tube passing through the bath or hot-chamber K, secured at both ends, so as not to allow the hot metal to pass, and having one end closed. Into this closed end is screwed a tube, P^1, of brass, copper, or other metal which is more expansive under heat than iron, and into the end of this tube again is screwed a rod of steel or iron, P^2, having its end turned up, as shown at P^3. Upon the tube P^1 is mounted a rack-bar, Q, provided with a spring, *q*, to keep it tightly pressed down, so as to intermesh with a pinion, R, the spindle *r* of which passes through the end P^3 of the rod P^2, and carries on its further extremity a pointer, S, moving with the pinion R, and having its stem made of some material which does not conduct electricity.

The end S′ of the pointer is formed with a springing piece of metal or other device, so as always to remain in contact with the face of the plate T′, to be presently described, and its inner end is arranged to receive two wires, *s s*, the negative poles of two magnets.

The dial T, which may be either a solid disk or as shown in the drawing, is mounted upon a sleeve, *t*, through which the spindle *r* runs, and which is secured firmly to the turned-up end P^3.

Upon any point of the circumference of the dial, and arranged so as to be completely isolated from it, is placed a plate, T′, secured by a screw, or in any usual way, divided up into two parts by non-conducting material, each of these parts forming the end of the positive pole of a magnet.

To the door U of the blasts is secured, as shown in Figs. 2 and 10, a frame, U′, in the upright part of which is formed a bearing for a shaft, V, passing through the blast-door, and carrying on its inner end the damper V′, rotating with the shaft always in the same direction, and arranged to close either one of the apertures in the door which communicates with the upper and lower blast-ports W W′. This shaft passes out beyond the frame, and is provided with a handle for the purpose of winding up on a drum, X, mounted on the shaft, a line weighted at its free end.

Upon this shaft V is also secured an escapement-rod, Y, having one end bent so as to form a hook, *y*, to engage with a corresponding hook, *z*, formed on the end of an armature, Z, to be presently referred to, the other end (marked *y′*) of this rod engaging with a corresponding projection, *z′*, formed on the armature.

The armature Z is secured to the projecting

support 1 attached to the frame U′ in such a way as to allow it to turn, a corresponding armature, Z′, being secured to it at right angles to Z. 2 2 and 3 3 are electro-magnets, each connected with a suitable battery, the wires of their negative poles being taken to the pointer S, and of their positive poles to the split plate T′, placed upon and isolated from the dial.

The passages W W′, along which the blast passes to the furnace, are formed as shown in Fig. 2, the under side of W′ being set at any angle, and formed by an iron plate, or in any suitable way, so as to give a seat for the grate to rest in, and at the same time cut off all communication between the upper and lower blasts.

Upon the shaft V is placed loosely a toothed wheel, 4, in the teeth of which works a double lever, 5, like the escapement of a watch, pivoted at the end of a weighted rod, 6, and upon the shaft is fixed a smaller ratchet, 7, in the teeth of which works a pawl pivoted to the large wheel 4, and held in place by a spring, the whole arrangement being similar to that of an alarm-clock; or any other equivalent device may be adopted for regulating the motion.

I will now proceed to describe the operation of my invention.

The parts being arranged as shown in the drawings, and the article to be tempered, if a plate or cutting-edge, being secured on the plate I, the shaft C is rotated, thus gradually lowering the plate into the metal bath or hot-chamber K, the pinion D, by the same movement, working in the rack E′, and pushing forward the plate E along the rail F until it assumes the position shown in Fig. 1, completely closing the water-tank L.

When it is considered that the article has remained long enough in the bath K the shaft C is rotated in the opposite direction, thus lifting the plate I out of the bath, raising it to the position shown in Fig. 2, and then lowering it into the tank L, the plate E at the same time, by the action of the pinions D′ in the racks E′, being run backward until it completely covers the opening of the bath K, its elevation on the rails F preventing it from being stopped by any splashes of molten metal on the plate G. Fresh water may be constantly introduced through the outside opening of the tank L, the outlet-pipe running off any surplus.

The plate I may be raised from the tank and again dipped into the bath, and the whole operation be repeated as often as desired, according to the article to be tempered.

The bath K may be filled with molten lead or other metal, or be merely heated to a certain degree of temperature, and the tank L contain oil or other fluid instead of water.

So long as the temperature of the metal or heated air contained in the bath or hot-chamber K does not rise beyond a certain point the blast-regulating apparatus will keep the damper V′ in such a position that the opening in the blast-door U to the passage W′ shall be closed, and that to the passage W be open, thus bringing the blast to the under side of the grate.

As soon as, however, the heat of the bath K rises above a certain degree, (the mark of which on the dial will coincide with that of the division in the plate T′,) the tube P^1, expanding more than the rod P^2, causes the rack Q to rotate the pinion R, making the pointer S to advance till it passes the division-line in the plate T′, thus cutting off the currents from the magnets marked 3 3, and forming a circuit with those marked 2 2.

By this means the armature Z is attracted to the magnets 2 2, the corresponding armature Z′ being no longer influenced by the magnets 3 3, and the projection z' is thus disengaged from the end y' of the rod Y, which, by means of the weighted line on the drum X, is revolved so as to make one complete half-turn, the hook y on the end of the rod Y then engaging with that, z, formed on the under side of the armature.

It will, of course, be seen that the damper V′, mounted on the shaft V, and rotating with it, will, by this half-turn, cut off the blast from under the grate and open the port W′ leading into the fire-chamber.

When the heat of the bath W falls below the point desired the pointer S falls back to its former position on the other side of the dividing-line in the plate T′, thus forming a circuit with the magnets 3 3 and cutting off that with the magnets 2 2, releasing the armature Z and bringing that marked Z′ in contact with the magnets 3 3. The hook y being thus disengaged from the corresponding hook z, the escapement-rod, shaft, and damper, as before described, perform the revolution of half a circle till the end of the rod comes in contact with the projection z', the upper blast-port W′ being thus closed, and the lower, W, opened.

The escapement movement and double ratchet-wheel above described assist in governing and regulating the above action.

The action above described will be repeated at intervals while the furnace is in work, according as the rise and fall of the temperature of the heated chamber actuates the parts.

When wire is to be tempered it is taken off a drum rotated a belt from a take-up drum, (on which the wire, when tempered, is wound,) and is drawn very slowly along the groove N^2 in the rod N^1, placed in the tube N, at no point coming in contact with the heated air or molten metal contained in the chamber K. The wire is then drawn down the passage N^3 into the bath O of oil or water, and the operation should be repeated in a similar furnace at a lower degree of heat to complete the operation of tempering.

The same conditions as to the process of tempering the wire will hold good when the

air-passage N^4 and blower are substituted for the bath O.

The process of tempering the wire in the bath constructed as shown in Figs. 4 and 5 will be identical with that first described. This modification of furnace is, however, only adapted for wire-tempering, the heat being arranged to completely envelop the bath.

To convert iron wire into steel I fill the bath K with molten iron, placing in it, by preference, guides, along which and through the metal the iron to be operated upon is drawn, the tube N and rod N^1 being in this case omitted.

I refrain from making claim, in this specification, upon the mechanism intermediate between the pyrometer-rod and the damper, and reserve the right to cover the novel features thereof by another patent.

Having thus described my invention, what I claim is—

1. The combination, in the tempering-chamber A, of the transverse shaft, operating, by means of projecting arms holding the rod, from which hangs the carrying-plate, to dip alternately into a hot-chamber and tank the article to be tempered, as herein set forth.

2. The combination, substantially as specified, of the tempering-furnace A, the shaft C, and the cover-plate E, reciprocated by means of pinions D′ and rack C′.

3. The combination, with the tempering chamber A, of the tank L, having diaphragm L′, and arranged substantially as and for the purposes set forth.

4. In combination with the furnace-chamber B and tempering-chamber A, the flues B^1, B^2, and B^3, and the heated chamber K, as and for the purposes herein set forth.

5. In combination with a bath or vessel containing hot air or molten metal, a tube passing through it and entering a bath of oil, water, or other fluid, so that the wire drawn through such tube shall not come in contact with the external air, as herein described.

6. The combination of the tube N and rod N^1 with groove N^2, as herein described.

7. In an apparatus for tempering iron and steel, the combination, substantially as specified, of the tempering-bath, the pyrometer, and the damper controlling the draft of the furnace.

8. The combination, with a furnace-chamber and ash-pit, of upper and lower blast-flues, communicating, respectively, with them, and opened and closed automatically by the rise and fall of the temperature of the furnace.

Montreal, 12th day of September, 1876.

CHAS. DION.

Witnesses:

FRAS. HY. REYNOLDS,

W. DE M. MARBER.