G. THUILLIER.

APPARATUS FOR HARDENING VERY THIN METALLIC PLATES.

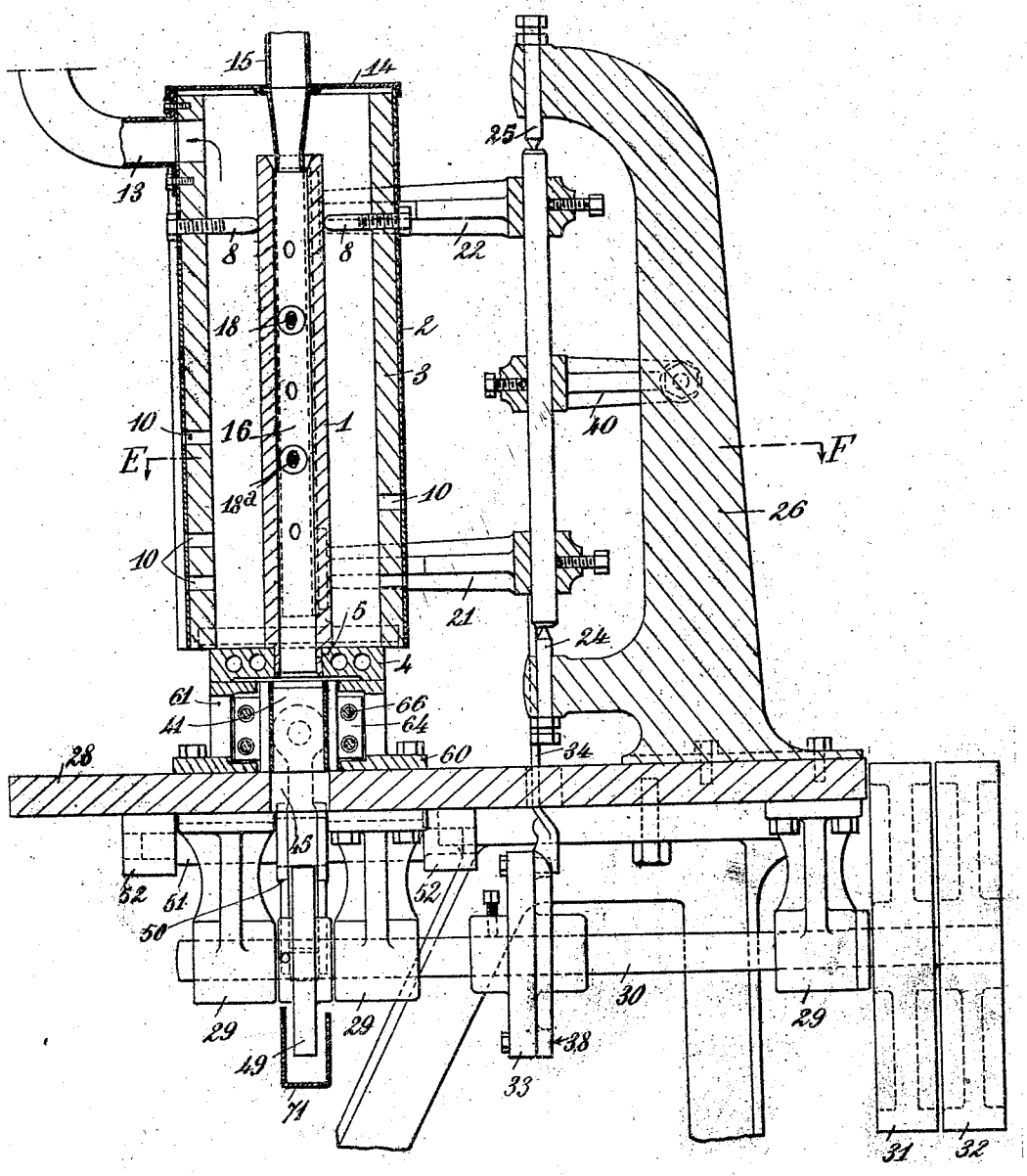
APPLICATION FILED MAR. 25, 1908.

1,141,155.

Patented June 1, 1915.

4 SHEETS—SHEET 1.

Fig. 1.



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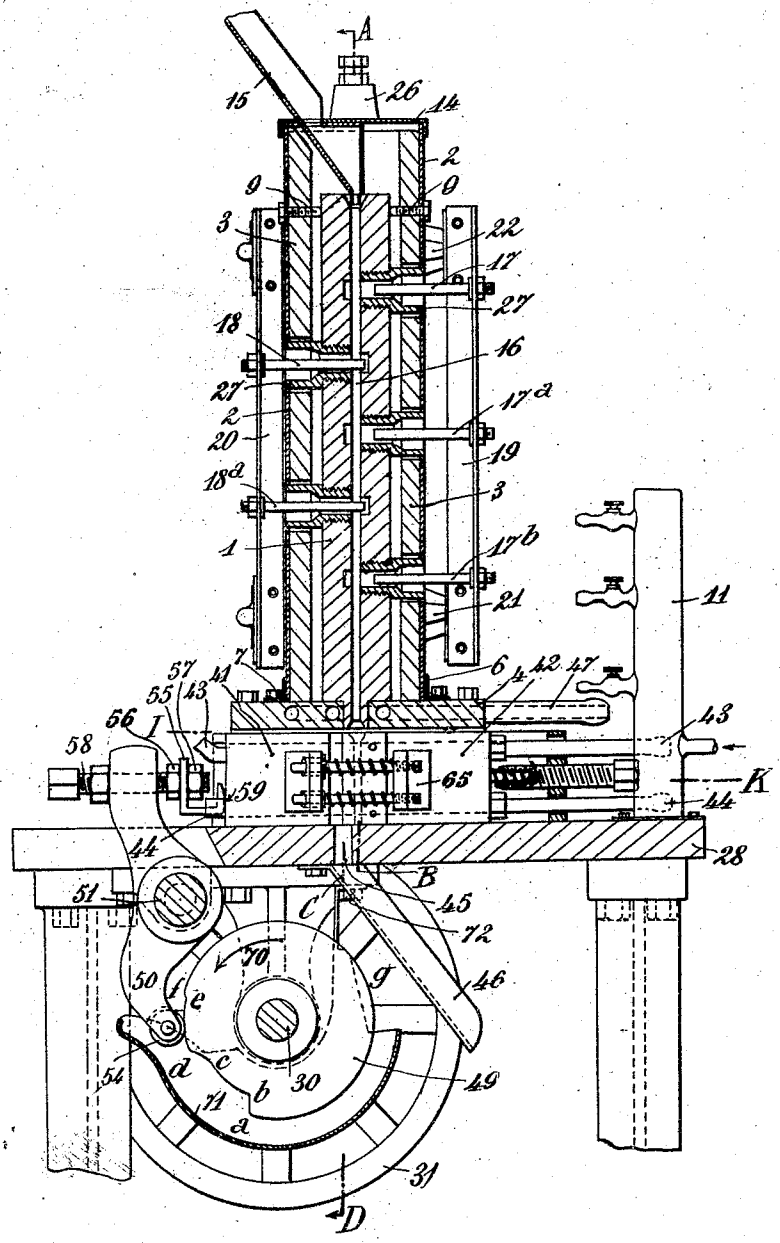
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4 SHEETS—SHEET 2.

Fig. 2.



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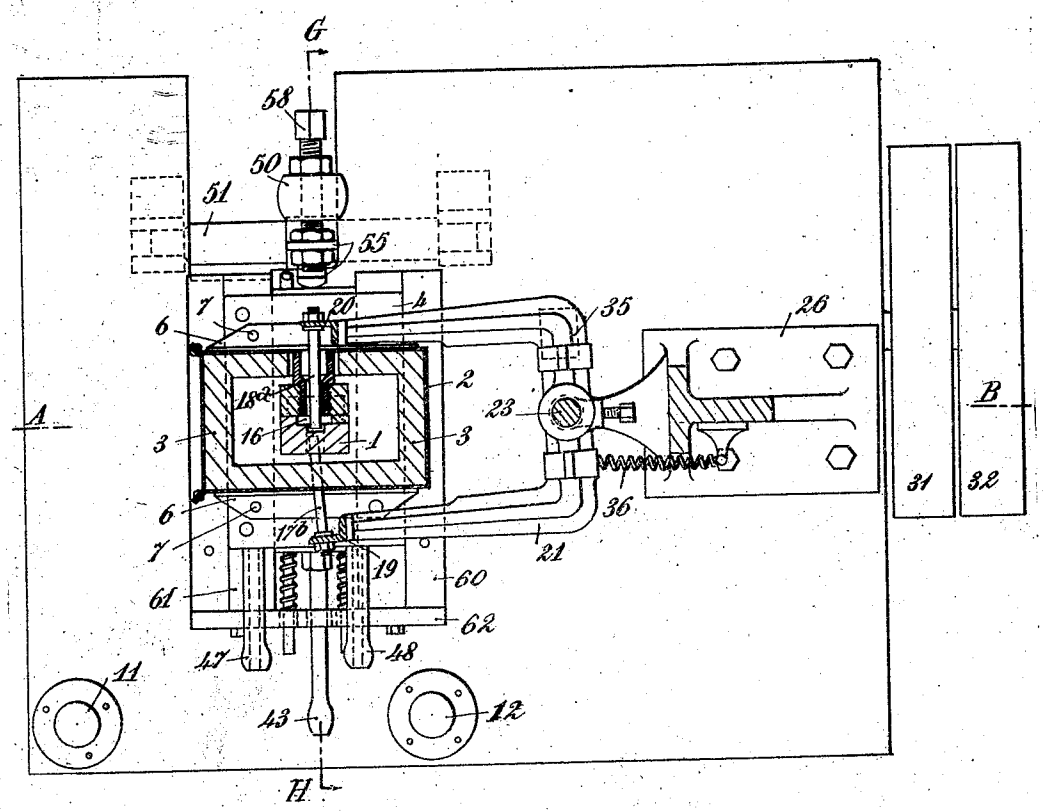
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4 SHEETS—SHEET 3.

Fig. 3.



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4 SHEETS—SHEET 4.

1,141,155.

Fig. 4.

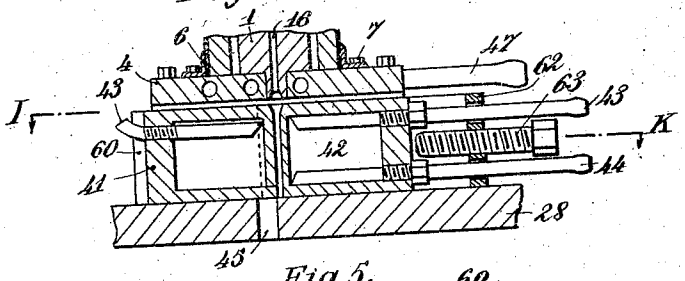


Fig. 5.

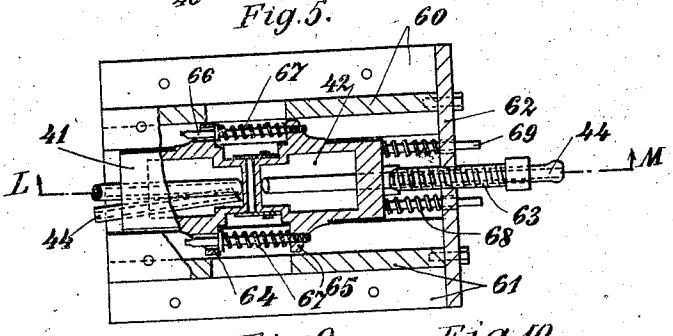


Fig. 8.

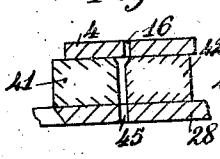


Fig. 9.

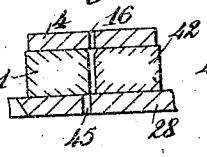


Fig. 10.

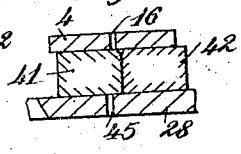


Fig. 6.

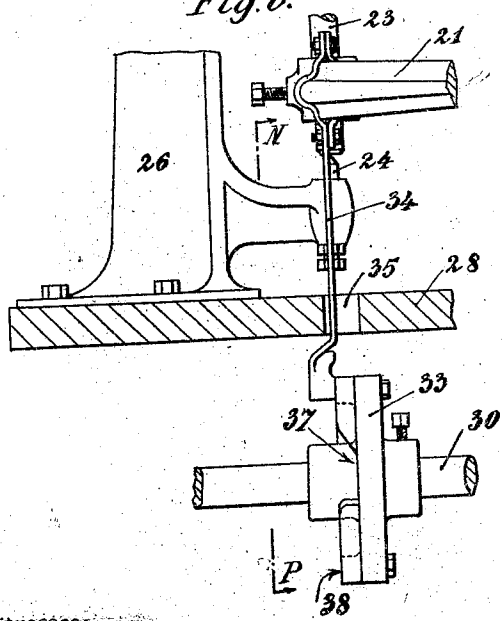
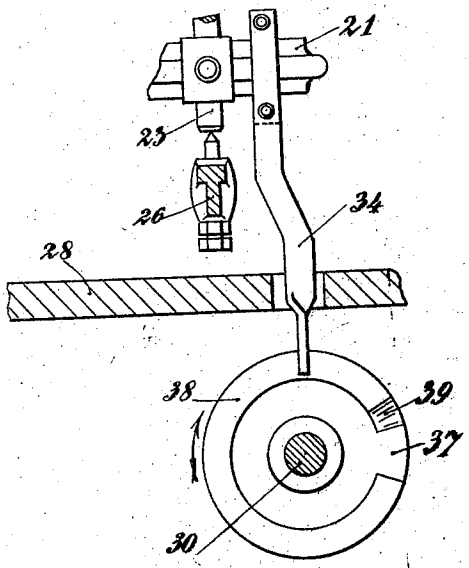


Fig. 7.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR HARDENING VERY THIN METALLIC PLATES.

1,141,155. Specification of Letters Patent. Patented June 1, 1915.

Application filed March 25, 1908. Serial No. 423,248.

To all whom it may concern:

Be it known that I, GEORGES THUILLIER, a citizen of the French Republic, and resident of Nogent en Bassigny, Haute-Marne, France, have invented a certain new and useful Improvement in Apparatus for Hardening Very Thin Metallic Plates, of which the following is a specification.

This invention relates to apparatus for hardening very thin metallic plates, such as the steel blades used in razors of the Gillette type according to United States Patent No. 775135.

These blades being only several hundredths parts of a millimeter in thickness, it is extremely difficult to harden the same thoroughly and homogeneously without risk of breakage and deformation. Above all such blades must be perfectly flat.

According to the present invention, which is intended to overcome the difficulties above mentioned, the blades are first heated, uniformly throughout, and are then subjected to a sudden and uniform cooling action by compressing the same between two plane cold surfaces, and preferably the invention is practised by heating the blades singly and successively by means of a muffle.

The heating means comprise a muffle traversed by the blades and externally heated so that the temperature increases from one end to the other; means are provided for passing the blades one by one through the muffle, from the least heated end to the most highly heated end, so that the blades slowly and gradually acquire a temperature increasing progressively to the maximum, when the hardening should be rapidly effected; at this moment the blade is quickly introduced or dropped between two plane cold surfaces which inclose it and subject it to high pressure throughout the period of cooling. Means are also provided whereby these plane surfaces are maintained at the desired temperature for effecting the hardening by contact, and whereby they perform the movements necessary for the cycle of operations.

The annexed drawings show by way of example one embodiment of the invention, adapted to the hardening of plates in the form of the blades of Gillette razors.

Figure 1 is a vertical section through A, B, C, D, (Fig. 2) of the whole apparatus, showing in section the muffle and the heating furnace which surrounds it and the path traversed by the blades. Fig. 2 is a part transverse section through G, H (Fig. 3); the blocks with plane surfaces for compression and for cooling the blades being shown in full. Fig. 3 is a plan of the machine, in section through the axis E, F. (Fig. 1) of a stopping device for the blades in their descent through the muffle. Fig. 4 is a transverse section through L, M, (Fig. 5) of the system of the compressing and hardening blocks and Fig. 5 shows in plan a section through I, K, (Fig. 4). Fig. 6 shows the actuating mechanism for the blade-stopping devices, seen from behind (Fig. 1); Fig. 7 is a section through N, P, (Fig. 6). Figs. 8, 9 and 10 are diagrams showing the positions of the cooling blocks at the different periods of their operation.

The heating muffle 1, preferably of pure nickel, is placed inside a furnace formed of sheet steel 2 which incloses a wall 3 of refractory bricks. The muffle and the furnace stand vertically on a base plate 4, to which they are secured, the former by a projection 5 which enters a corresponding opening in the base, the latter by the angle irons 6 and bolts 7. The muffle is also secured at its upper end relatively to the furnace which surrounds it, by adjustable screws 8 and 9 which extend through the walls of the furnace. Heating is effected by gas jets or burners entering the furnace through openings 10 and receiving the gas and air under pressure from supply pipes 11 and 12; these jets are arranged and suitably distributed toward the base of the furnace so that the upper part of the muffle is only heated by conduction and by the hot gases which rise in the annular space forming the flue, between the outer walls of the muffle and the inner walls of the furnace; as a result the temperature is less at the top of the muffle than at the base.

A chimney 13 for the escape of the burnt gases is arranged at the upper end of the furnace, which is closed by a cover 14.

The blades to be hardened are fed one by one, in any suitable manner, to the chute 15 which guides them to the internal passage 16 of the muffle.

In order to regulate the descent of the blades in the passage 16 to the interior of the muffle, as also the duration of their passage to the successive heating stages the following escapement mechanism is provided: Two groups of stops 17, 17^a, 17^b and 18, 18^a pass through the walls of the furnace and enter the passage 16 and are carried respectively by two vertical supports formed by the angle irons 19 and 20: these angle irons are fixed to the ends of the arms of two forked levers 21 and 22 keyed on a vertical arm 23, which is held and oscillates between two adjustable pins 24 and 25 carried by the frame 26.

By a controlling arrangement described below an oscillating movement is imparted to the levers 21 and 22 so that the two groups of stops 17 and 18 alternately close the passage 16 through the muffle. To prevent the flame of the furnace coming in contact with the blades, which are heated on entering the passage 16 by the orifices for the entry of the stops, these orifices are provided with nickel tubes 27 screwed into the walls of the muffle and passing also through the walls of the furnace.

A blade introduced into the muffle by the chute 15 is first stopped by the stop 17, then at the moment of the oscillation of the levers 21 and 22, the stop 17 being withdrawn the blade is freed and falls, but is stopped by the stop 18 which is introduced into the passage 16. On the next oscillation of the levers, the blade continues to descend and is arrested on the stop 17^a, at the same time as a second blade introduced at this moment into the chute 15 comes against the stop 17, and so on. There are thus always in the apparatus several blades at different levels and therefore at different temperatures; these blades, descending one stage at each oscillation of the levers, are thus heated progressively to the final temperature desired which is that in the vicinity of the lower stop 17^b. When the stops 17 are removed, the first blade introduced which is on the stop 17^b falls from the lower end of the passage 16 of the muffle, into the part of the apparatus where the hardening is effected.

The oscillation of the levers 21 and 22 is effected as follows:—Under the table 28 of the machine is hung on brackets 29 a shaft 30 operated for example by fast and loose pulleys 31 and 32, and carrying a cam 33 suitably profiled on one of its lateral faces: this cam acts on the lower end of a lever 34 which passes through an opening 35 in the table 28 and the other end of which is rigidly secured to one of the arms of the lower lever 21 by suitable means: a spring 36 is secured to the second arm of this lever 21 and bears at its other end on the frame 26: this spring by pulling on the lever 21, presses continuously the lower end of the lever 34 against the cam 33. The cam face has a depression 37 and a raised part 38 connected in the direction of rotation by an inclined part 39. It is evident that when the depression 37 is opposite the lever 34, the levers 21, 22, pulled by the spring 36, are rocked so that the stops 18 obstruct the passage 16 at the position shown in the drawing; when, on the other hand, the incline 39 and the part 38 come opposite the lever 34, the levers 21, 22 swing to the other side, the stops 18 are withdrawn while those 17 obstruct the passage. These oscillating movements in the two directions are limited by adjustable set screws which are carried by the ends of the arms of a forked lever 40 keyed on the shaft 23 and which abut respectively at each oscillation against the front and rear faces (Fig. 1) of the frame 26. It will be understood that, for this reason, the lever 34 must have a certain elasticity.

In the embodiment shown, the depression 37 covers a small arc of the cam surface, the stops 18 will only stop the blades in their descent for a very short interval of time to interrupt the fall temporarily, but the stops 17 will actually stop the blades for the purpose of being heated at the different stages. It is also evident that the respective duration of action of the stops 17 and 18 might be otherwise selected. Also the number of stops and stages may be modified.

The blade released by the last stop 17^b falls between two metal blocks 41 and 42 at low temperature. These two blocks are preferably hollow as shown in Figs. 4 and 5 and cooled by internal circulation of water; the inlet and outlet pipes 43 and 44 for the water are extended to the thin walls between which the blade falls in order to insure thorough cooling.

At the moment the blade falls between the blocks, by means explained later, they approach each other and are pressed very tightly against each other, so that the blade will be pressed between the two smooth cold walls which harden it by metallic contact without deforming it by the rapid fall of temperature while keeping it perfectly flat. Then the blocks after the desired interval of time for hardening it are moved apart and at the same time are shifted toward the left (Fig. 2) in order to bring the blade above a slot 45 formed in the table 28 through which the blade falls into a passage 46 which directs it into a hopper. Then the blocks return into their former position so that the space left between them is an extension of the channel 16 from the muffle in order to receive a fresh blade to be hardened as in the preceding case.

The base 4 of the muffle which separates the latter from the blocks is itself provided with water circulation 47, 48 in order to prevent the high temperature in the base of

the furnace from being communicated to the blocks.

The movement of the blocks is effected by a cam 49 keyed on the cam shaft 30: this cam which has a suitable profile on its circumference acts through the intermediary of a roller 54 on the lower arm of a finger 50 which oscillates around a shaft 51 mounted in bearing brackets 52. The upper arm acts on the left block 41 (Fig. 2) through the intermediary of a bent part 55 having a certain elasticity and held between two nuts 56 and 57 on a threaded spindle 58 carried by the upper arm of the finger 50, so as to allow adjustment of the part 55 in relation to the finger 50 and therefore the pressure of the blocks. The position of the point of contact 59 of the part 55 with the block 41 is such that the pressure is exerted substantially at the center of the blade which is pressed between the blocks. These latter are guided in their movement by two U-shaped guides 60, 61 bolted to the table 28 and to which is fixed the base 4 of the muffle: at the end opposite that at which the finger 50 is located a plate 62 carries a set screw 63 serving as an adjustable abutment for limiting the movement of the blocks toward the right (Fig. 2). These blocks constantly tend to separate from one another on account of the springs 67 surrounding the spindles 66 fixed to the shoulders 65 of one of these blocks and passing freely through the shoulders 64 of the other block. Two other helical springs 68 of suitable power surrounding the spindle 69 bear at one end on the block 42 and at the other end on the plate 62 and thus constantly tend to push both the blocks toward the left (Figs. 2 and 3).

The arrangement of the cam 49 and of the finger 50 as well as the adjustment of the springs 67 and 68 are such that the operation is effected as follows:—The acting faces of the blocks having pressed and hardened a blade come first, on being separated, above the opening 45 of the table 28 to allow the hardened blade to fall (Fig. 8). Immediately afterward, the finger 50 exerts a thrust toward the right: the two blocks are displaced in this direction, but, on account of the compression of the springs the displacement of the left block 41 is greater than that of the right block 42: these two blocks while being displaced to the right thus approach each other and occupy the positions shown in Fig. 9. The retaining stop 17^b then releases a blade which falls between 41 and 42. Exactly at this moment the finger 50 is operated again and presses the blocks toward the right, but the block 42 is stopped by the abutment 63 and in spite of the spring 67, the block 41 is brought hard against its neighbor the blade being thus tightly pressed between the two plane cold metallic faces (Fig. 10). The hardening once finished the finger 50 is released: by the combined action of the springs 68 and 67 the two blocks are pushed toward the left above the opening of the passage 45 and at the same time they are separated thus allowing the blade to fall (Fig. 8). In order to obtain these movements, the operating cam 49 of the finger 50 may have the profile shown.

With the cam turning in the direction of the arrow 70, the steep part *a b* and the part *b c* correspond with the opening of the blocks and the release of the hardened blade (Fig. 8); the slope *c d* and the part *d e* correspond to the leading of the blocks below the heating passage 16 and the fall of the blade between the blocks by removing the retaining stop (Fig. 9), immediately followed (inclined part *e f*) by the pressing together of the blocks (Fig. 10): the remainder *f g a* of the circumference corresponds to time taken to harden the blade.

The angle of displacement between the two cams 33 and 49 is such that the movements of the retaining stops correspond exactly with the movements of the blocks.

The cam 49 dips into the oil of a lubricator 71 secured to the table 28 by one of the bolts 72 of one of the brackets 29.

It will be understood that, without departing from the spirit of the invention, the detail of construction may be modified, and in particular the means for preventing the hot blade coming between the two blocks, from falling lower, and for allowing it to fall after the hardening is finished.

Having described my invention what I claim and desire to secure by Letters Patent of the United States is:—

1. Apparatus for hardening thin metallic plates comprising, in combination, a muffle, means for heating said muffle externally so that its temperature increases from one end to the other, means for advancing the plates one by one to the outlet end of the muffle so that they will be progressively heated, and means for hardening the plates immediately at their exit from the muffle.

2. Apparatus for hardening thin metallic plates, comprising, in combination, a vertical muffle, formed with an internal passage-way, a furnace surrounding the muffle, burners suitably distributed at the lower part of this furnace so that the bottom of the muffle will be directly heated and the upper part only by conduction and by the hot gases which rise in the furnace, means for advancing the plates in said passage-way so that they will be progressively heated, and means for hardening these plates immediately they leave the muffle.

3. Apparatus for hardening thin metallic plates, comprising, in combination, a muffle having an internal passage-way, means for

heating said muffle so that its temperature increases from one of its ends to the other, a system of stops, means for moving said stops alternately so as to close and open the passage-way and let the plates descend progressively and means for hardening the plates immediately they fall from the muffle.

4. Apparatus for hardening thin metallic plates, comprising, in combination, a muffle, a furnace for heating the muffle externally in such manner that its temperature increases from one end to the other, said furnace being formed with a number of orifices, a system of stops passing through the orifices for permitting the plates to descend to the lower part of the muffle so that they will be progressively heated, nickel tubes surrounding the stops and preventing the flame from coming in contact with the plates being heated, and means for hardening the plates immediately they leave the muffle.

5. Apparatus for hardening thin metallic plates, comprising, in combination, a muffle formed with an internal passage-way, means for heating the muffle externally in such manner that its temperature increases from one end to the other, means for advancing the plates to the lower part of the muffle so that they will be progressively heated, a system of two plane cold metallic surfaces below the passage-way and means for bringing said surfaces together and moving them apart so as to press the plate immediately it leaves the muffle.

6. Apparatus for hardening thin metallic plates, comprising, in combination, a muffle, means for heating the muffle externally so that its temperature increases from one end to the other, means for advancing the plates through the muffle, two hollow metallic blocks with flat faces below said passage-way, said blocks being adapted to press the plate immediately it leaves the muffle, and means for maintaining the hardening surfaces of said blocks at the desired temperature.

7. Apparatus for hardening thin metallic plates, comprising in combination, a muffle, means for heating the muffle externally, means for advancing the plates so as to heat the same progressively, means for hardening the plates immediately they leave the muffle, and means for heat insulating the hardening means from the heating part of the apparatus.

8. Apparatus for hardening thin metallic plates, comprising in combination a muffle, means for heating the muffle externally, means for advancing the plates so that they are progressively heated, metallic blocks formed with flat faces serving to press each plate as it leaves the muffle, means for bringing the blocks together and moving them apart, and means for preventing each plate from falling out of the space between the blocks before the latter are brought together, and allowing them to fall after the hardening is finished.

9. Apparatus for hardening thin metallic plates, comprising, in combination, a muffle having an internal passage-way, means for heating the muffle externally, means for advancing the plates through the muffle so as to heat the same progressively, two metallic blocks having flat adjacent faces, a table on which said blocks are carried, said table being formed with a slot located above hopper, springs tending to separate said blocks, springs tending to move both blocks away from the side of the slot, an adjustable abutment, and means for moving the blocks against this abutment against the action of the springs so as to bring the space between the separated blocks underneath said passage-way and press a plate between the blocks and then allow said springs to bring the blocks and therewith the plate above said slot, thereby permitting the plate to fall into the hopper.

10. Apparatus for hardening thin metallic plates comprising, in combination, a muffle, means for heating said muffle externally, means for advancing the plates through the muffle, and means for hardening the plates immediately upon their exit from the muffle.

11. The herein described process of hardening thin metallic plates which consists in heating a muffle progressively from one end to the other, passing each plate through the muffle and chilling the plate immediately upon its exit therefrom.

12. The herein described process of hardening thin metallic plates which consists in heating a muffle progressively from one end to the other, passing each plate through the muffle, and chilling the plate between cold conducting surfaces immediately upon its exit from the muffle.

13. In apparatus of the class described, means to heat a blade while protecting it from direct contact with the heating medium, means to introduce successive blades to said heating means; means to cool the heated blades; a channel to conduct the hot blades from the heating to the cooling means, and an instrumentality to retain each blade in the heating means a predetermined length of time.

14. In apparatus of the class described, a heater to receive the object to be heated and protect it from contact with the heating medium, an intermittently operating support to temporarily retain the object in the heater, cooling means, and a closed channel leading from the heater to the cooling means, to conduct the heated object to said cooling means when the support is rendered inoperative.

15. In apparatus of the class described, a metallic block maintained at high tempera-

ture and having a passage through it to receive the object to be heated, a device to temporarily arrest and automatically release such object, the latter being protected by the walls of the passage from contact with the heating medium for the block, a closed channel leading from the passage, and cooling means to act upon a hot object delivered thereto by the channel.

16. In apparatus for hardening blades, heating means including an externally heated metal block having an upright passage therethrough to receive the blade to be hardened, means to arrest the blade within said passage and release it automatically, an inclosed channel leading from the bottom of the passage, to conduct therefrom the heated blade when released, and means to simultaneously cool and subject the hot blade to pressure when delivered from said channel.

17. In apparatus for hardening blades, a heater to receive and protect a blade from direct contact with the heating medium, means to retain the blade in the heater and release it at a predetermined time, means to simultaneously cool and subject the hot blade to pressure, and means to conduct the latter from the heater to the cooling and pressure-producing means.

18. In apparatus for hardening blades, a heater to receive and protect a blade from direct contact with the heating medium, means to retain the blade in the heater and release it at a predetermined time, means located below the heater to cool the hot blade, and a device to conduct by gravity the hot blade to the cooling means when released from the heater.

19. In apparatus for hardening blades, a heater consisting of an upright, massive metal block having a vertical blade passage therethrough, means to raise the temperature of said heater from the exterior thereof, and a blade-arrester moved automatically into and out of the passage, to arrest temporarily and then release a blade on its way through the passage.

20. In hardening apparatus, a heater consisting of a massive metallic block having an elongated, upright passage therethrough, means to raise the temperature of the passage by application of a heating medium to the exterior of the heater, and means to support temporarily in said passage the object to be heated.

21. In apparatus for hardening blades, a metallic heater having a blade-receiving passage through it, means to raise the temperature of the passage by the action of a heating medium upon the exterior of the heater, whereby a blade in the passage is heated and protected from contact with the heating medium, automatic means to retain the blade a predetermined period in the passage and then release it, an instrumentality to deliver blades one by one to the passage, and cooling means connected with the heater to receive therefrom and cool the hot blades as they are released from the passage.

22. In apparatus for hardening blades, heating means, comprising a covered chamber to contain the heating medium, a metallic block constituting a heater and having a blade-passage through it, said heater being set in the chamber with the upper end of the passage above the closed top thereof, the bottom of said chamber having an opening registering with the lower end of the passage, and a blade-arrester movable into and out of the passage at right angles thereto, the blades passing lengthwise down the passage and being arrested temporarily therein to acquire the requisite temperature.

23. In apparatus for hardening blades, a heater maintained at high temperature and having a passage through it to receive a blade and protect the same from access of air during the heating operation, and a device to temporarily arrest movement of the blade through the passage.

24. In apparatus for hardening blades, a block of large mass and high heat conductivity having a passage therethrough to receive a blade to be heated, means to raise the temperature of the block, and thereby that of the passage, to the required degree, and a device to govern the movement of a blade through the passage.

25. In apparatus for hardening blades, a block of material capable of being highly heated and having an elongated blade passage therethrough, means to raise the temperature of the block to the required degree, and means to arrest temporarily a blade in the passage, whereby the blade is heated while protected from access of air and direct contact with the heating means.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GEORGES THUILLIER.

Witnesses:
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T. DRIVIÈRE.