

Aug. 29, 1939.

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2,170,876

MACHINE FOR SURFACE HARDENING METAL ARTICLES

Filed April 29, 1938

2 Sheets-Sheet 1

Fig. 1.

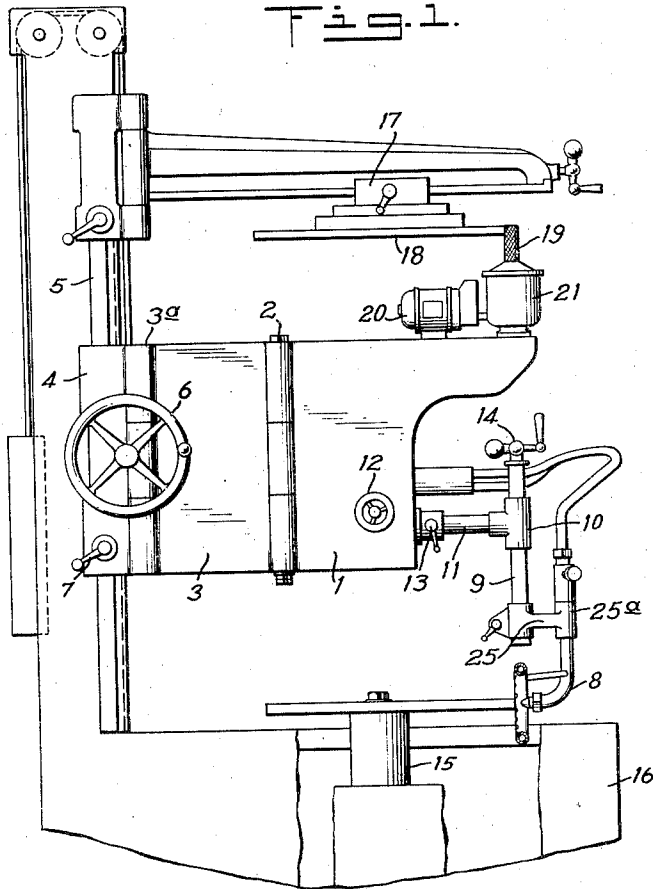
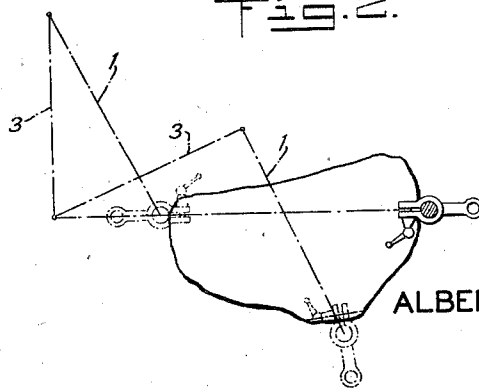


Fig. 2.



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Fig. 3.

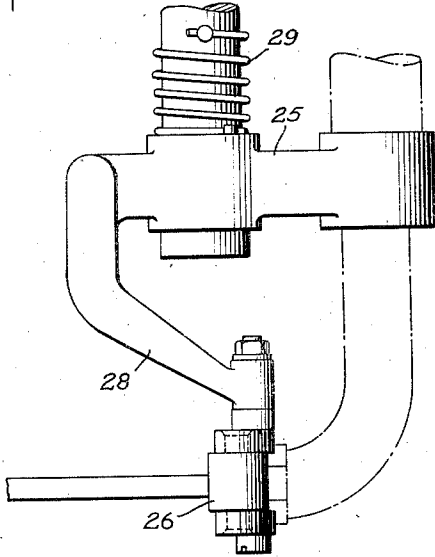


Fig. 4.

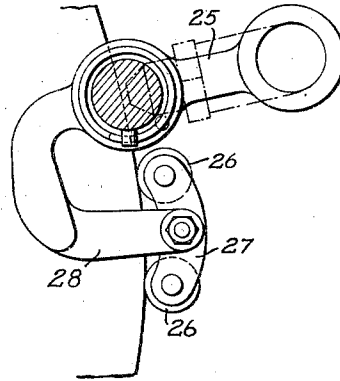


Fig. 5.

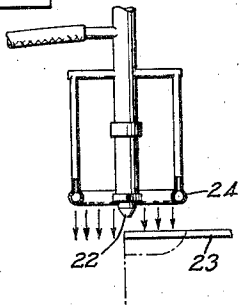


Fig. 7.

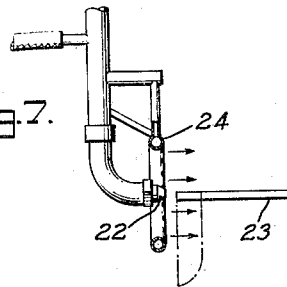


Fig. 6.

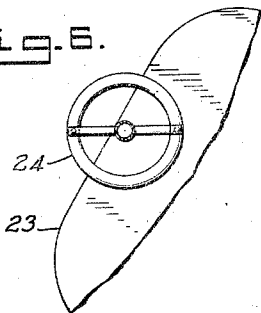
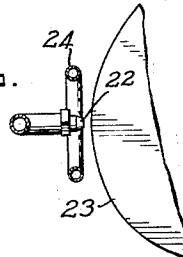


Fig. 8.



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MACHINE FOR SURFACE HARDENING
METAL ARTICLES

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In Great Britain April 29, 1937

9 Claims. (Cl. 266—5)

This invention relates to machines for surface hardening metal articles by means of an oxy-acetylene burner or other heater adapted to heat a small portion of the work to a temperature sufficient for hardening whilst leaving the bulk of the work unaffected, the heater being traversed relatively to the work and the heated zones being quenched by the application of a quenching fluid so that an extended surface is hardened progressively by the successive heat treatment of adjacent parts.

The object of the invention is to provide an improved arrangement of heating and quenching devices and traversing mechanism therefor adapted for the treatment of plates, discs, dies, tools and many other parts and using single or multiple jet burners to cover any required width or area of treatment.

According to the invention, a heating device adapted to apply local heat to the surface of a metal article and a quenching or cooling device adapted to quench the heated zone for the purpose of hardening the same are mounted on a universally movable traversing device adapted to run along a track shaped to guide the carriage in such a way that the heating device traverses a predetermined path. The track may be adjustable and/or interchangeable according to the course which the hardening process is required to follow. For example, if the edge of a plate is to be hardened, the track will be shaped so as to cause the heating device to move in a track conforming to the edge of the article.

According to a preferred form of the invention, applicable to articles of irregular shape as well as to straight-edged and circular articles, the quenching or cooling device is arranged to produce an annular jet or ring of jets and is located with respect to the heating device so that the axis of the annular jet or ring of jets passes through the centre of the region where the work is heated. By this arrangement a uniform interval between the heating and quenching regions is maintained in spite of variations of curvature or other irregularities of the surface being treated.

The invention will be more readily understood from the following particular description with reference to the accompanying drawings in which—

Figure 1 is a front elevation showing the principal elements of a machine constructed according to a preferred form of the invention;

Figure 2 is a diagrammatic plan illustrating the action of the traversing mechanism;

Figure 3 is an elevation drawn to a larger scale of a mechanism for automatically adjusting the heating device so that it faces the surface to be heated throughout the traversing movement;

Figure 4 is a plan of the mechanism shown in Fig. 3;

Figures 5 and 6 are an elevation and plan view, respectively, of one arrangement of heating and cooling jets; and

Figures 7 and 8 are views similar to Figs. 5 and 6, showing another arrangement of the heating and cooling jets.

Referring first to Figure 1 of the drawings, the reference numeral 1 indicates a universally movable traversing device mounted to swing about a vertical hinge 2 carried on a part 3 which is itself mounted to swing upon a vertical supporting hinge 3a so that the free end of the part 1 can move horizontally in any direction. The hinge 3a is mounted on a part 4 slidably mounted on a vertical post 5, a screw adjusting device controlled by a hand wheel 6 being provided for raising and lowering the part 4 to adjust it to a desired level. A fastening device 7 is provided for locking the part 4 in adjusted position on the post 5.

A burner head, indicated generally at 8 in Fig. 1, is carried by a vertical rod or bar 9 depending from a block 10 fixed to a horizontal bar 11 mounted to slide in the part 1. Horizontal adjustment of the burner head may be effected by sliding said horizontal bar 11 in the part 1 and vertical adjustment may be effected by sliding the bar 9 in the block 10. A suitable screw traversing device operated by a handle 12 is provided for controlling the horizontal movement, and a fastening or clamping device 13 is provided for fixing the horizontal adjustment. A control handle 14 is provided for operating a screw mechanism for controlling the vertical adjustment. By proper horizontal and vertical adjustments, the burner head 8 may be positioned in a desired operative relation with respect to the surface to be treated.

The machine comprises a work support 15 mounted in or over a collecting tank 16 for cooling liquid which is disposed below the traversing mechanism so that the burner head can be brought adjacent and level with the work as shown.

Mounted above the traversing carriage is an adjustable support 17 for a template 18 whose edge provides a track shaped to guide the part 1 in such a way as to cause the burner head 8 to

move in a predetermined path. The template 18 is not only adjustable but is also interchangeable to suit the shape of the article to be hardened.

The traversing movement of the part 1 is effected by means of a tracing roller 19 driven by an electric motor 20 carried on the traversing member, the roller 19 being adapted to roll round the edge of the template 18. The roller 19 is magnetised by means of a solenoid 21 so that the roller is attracted to and maintained in contact with the edge of the template 18.

In the arrangement shown in Figs. 5 and 6 of the drawings, the burner head comprises an oxy-acetylene burner having a nozzle 22 directed vertically downwards and intended to play on the edge of the work 23 as shown. The quenching device consists of a ring of nozzles 24 fixed to the burner head and adapted to produce a cylindrical curtain of jets of cooling air or liquid coaxial with the heating jet produced by the nozzle 22.

In the arrangement shown in Figs. 7 and 8 the nozzle 22 of the oxy-acetylene burner is directed horizontally and the ring of nozzles 24 is correspondingly directed so as to produce a cylindrical curtain of cooling jets coaxial with the heating jet.

When the arrangement shown in Figs. 7 and 8 is adopted, continuous rotational adjustment of the burner head is necessary in order that the burner may face the work throughout the traversing motion. In the machine shown in Figure 1, this is provided for by mounting the burner head on an arm 25 which is pivoted and rotatable on the vertical rod 9, the nozzle of the burner head being disposed in alignment with the rod 9 so that the rotational adjustment of the burner head does not involve any translation thereof. The arm 25 is intended to be adjusted by hand, the part 25a being used as a handle.

Figures 3 and 4 of the drawings show a mechanism for automatically controlling the above-mentioned rotatable adjustment so as to maintain the burner nozzle normal to the surface of the work without the intervention of an operator. This mechanism comprises a pair of rollers 26 carried on a two-armed lever 27. The lever 27 is fulcrumed upon a crank arm 28 fixed to the arm 25. A spring 29 tends to rock the arms 25 and 28 in the clockwise direction as seen in Fig. 4 so as to cause the rollers 26 to bear against the surface of the work. The arm 27 is so set that the burner nozzle is normal to the surface of the work when the rollers 26 are in contact with the surface of the work (see Fig. 4). The pressure of the spring 29 must be sufficient to hold the rollers firmly against the surface of the work but insufficient to pull the magnetic tracing roller 19 away from the template.

In the use of the machine the article whose edges are to be hardened is mounted on the work support, a corresponding template being fixed in the machine in properly adjusted position in relation to the work. The burner head is then adjusted to bring the heating jet or jets to bear upon the edge of the work. The heating flame and cooling jets are then turned on and the machine is set in motion so that the burner head and cooling device are caused to traverse the edges of the work at a uniform speed adjusted to suit the nature of the work. Successive positions of the traversing mechanism during the traversing motion are indicated by the dotted lines in Fig. 2 of the drawings.

If the arrangement of the burner head and cooling nozzles shown in Figs. 1, 7 and 8 is

adopted, it will be necessary to effect a continuous adjustment of the burner head by rotation about the rod 9 so that the heating and cooling jets may play on the work correctly throughout the traversing motion. The operator may attend to this by grasping the handle 25a and maintaining the nozzle 8 normal to the surface of the work as it follows the traversing movement of the rod 9. Alternatively, the necessary angular adjustment may be maintained automatically by the action of the mechanism shown in Figs. 3 and 4 of the drawings.

Owing to the circular construction of the cooling device and its arrangement relative to the burner, the portion of the work being heated is always surrounded by a concentric curtain of cooling fluid. The quenching or cooling jets thus follow the heating jets at a uniform interval, irrespective of irregularities in the shape of the work.

It is to be understood that the heating device employed in machines according to the present invention need not be a burner. Any other heating devices capable of applying intense heat to a small portion of the work may be employed. In particular, an electrical heating device operating by the "inductor method" may be employed.

What I claim as new and desire to secure by Letters Patent of the United States is—

1. A machine for surface hardening metal articles wherein a heating device adapted to apply local heat to the surface of the work and a quenching or cooling device adapted to quench the heated zone for the purpose of hardening the same are mounted on a universally movable traversing device adapted to run along a track shaped to guide the carriage in such a way that the heating device traverses a predetermined path.

2. A machine for surface hardening metal articles, comprising a work support; a universally movable traversing mechanism; means for propelling and guiding said mechanism along a predetermined path relative to the surface of a workpiece on said support; a heating and quenching device; means pivotally supporting said heating and quenching device upon said traversing mechanism; and means for positioning said device in operative relation to said surface.

3. A machine for surface hardening the peripheral edge of a metal article, comprising a support for the article; a universally movable traversing mechanism; means for propelling and guiding said traversing mechanism along a predetermined path corresponding in shape to said peripheral edge; means pivotally mounted on said traversing mechanism for directing a high temperature heating flame against said peripheral edge; and means engaging said peripheral edge adjacent the point of heat application for causing said heating means to pivot, whereby said heating flame is always directed at substantially the same angle against said edge.

4. A machine for surface hardening a peripheral edge of a metal article as defined in claim 3, in which said means engaging said peripheral edge comprises a pair of rollers.

5. A machine for surface hardening the peripheral edge of a metal article comprising a support for the article; a universally movable traversing mechanism; means for propelling and guiding said traversing mechanism along a path corresponding in shape to said peripheral edge; means pivotally mounted upon said traversing

mechanism for directing a high temperature heating flame against said peripheral edge; means engaging said peripheral edge adjacent the point of heat application for causing said heating means to pivot, whereby said heating flame is always directed at substantially the same angle against said edge; and resilient means for holding said edge engaging means against said peripheral edge.

6. A machine for surface hardening a peripheral edge of a metal article comprising a support for the article; a universally movable traversing mechanism; a cam plate and a roller magnetically held against said cam plate for propelling and guiding said traversing mechanism along a path corresponding in shape to said peripheral edge; means pivotally mounted upon said traversing mechanism for directing a high temperature heating flame against said peripheral edge; means engaging said peripheral edge adjacent the point of heat application for causing said heating means to pivot; and a spring holding said edge engaging means against said peripheral edge, said spring having a pressure effect sufficient to hold said engaging means against said edge but insufficient to cause said roller to be pulled away from said cam plate.

7. A machine for hardening a surface of a metal article comprising a traversing mechanism

universally movable in a plane; a heating device supported by such traversing mechanism for applying a heating medium locally to successive portions of said surface; a cooling device, supported by said traversing mechanism in spaced relationship with respect to said heating device, for applying a cooling medium to successive heated portions of said surface; means for guiding said traversing mechanism so as to maintain said heating and quenching devices at a constant distance from said surface; and means for rotating said heating and quenching devices relatively to said traversing mechanism so as to cause the heating and cooling media to be directed at a constant angle to said surface at all points along the traverse independently of the angle between the surface and the plane of movement of the traversing mechanism.

8. A machine for hardening a surface of a metal article as defined in claim 7, in which said means for rotating said heating and quenching devices is operable manually.

9. A machine for hardening a surface of a metal article as defined in claim 7, in which said means for rotating said heating and quenching devices is operable automatically to control the rotation of said heating and quenching devices.

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