C. C. JACKMAN AND R. S. SQUIRE.

HARDENING MACHINE.

APPLICATION FILED FEB. 24, 1919.

1,367,049.

Patented Feb. 1, 1921.

2 SHEETS—SHEET 1.

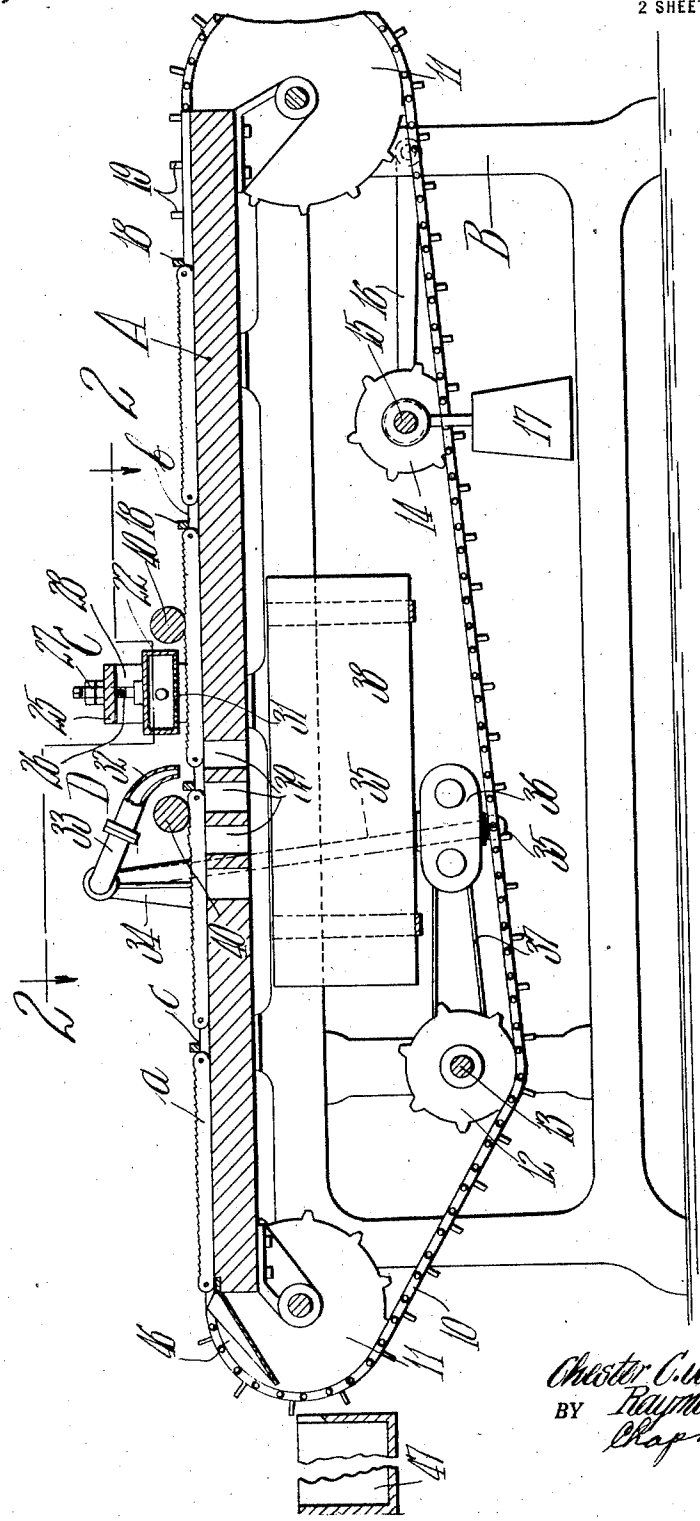


Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 2.

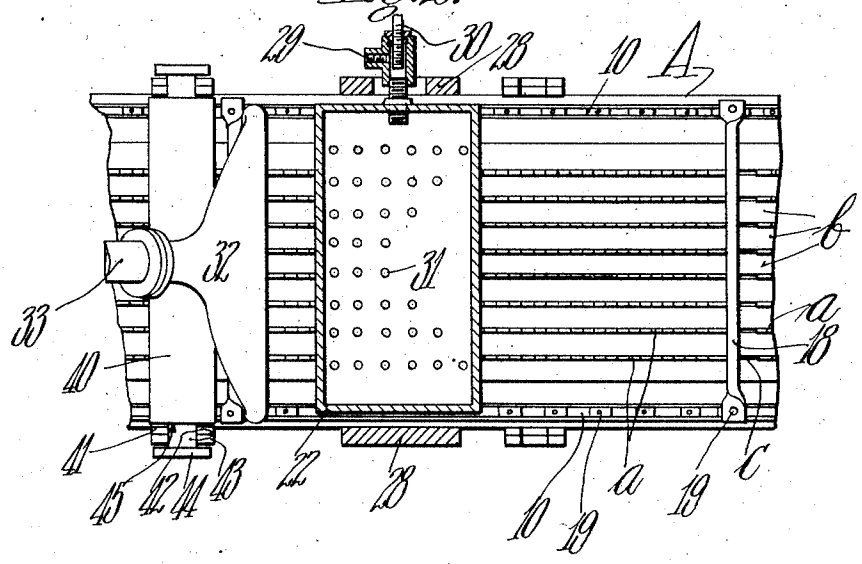


Fig. 3.

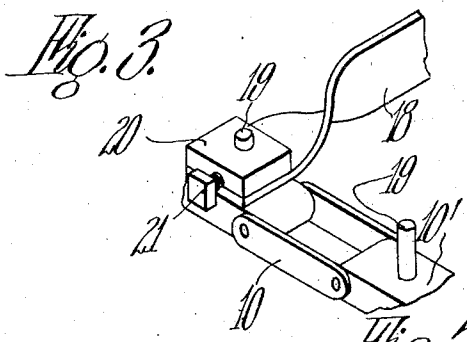


Fig. 4.

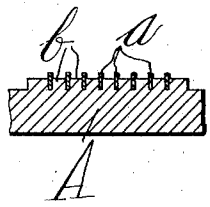
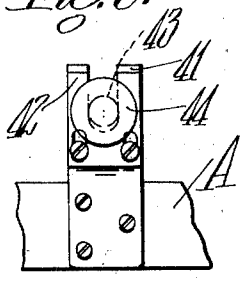


Fig. 5.



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HARDENING-MACHINE.

1,367,049. Specification of Letters Patent. Patented Feb. 1, 1921.

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To all whom it may concern:

Be it known that we, CHESTER C. JACKMAN and RAYMOND S. SQUIRE, citizens of the United States of America, residing at Springfield, in the county of Hampden and State of Massachusetts, have invented certan new and useful Improvements in Hardening-Machines, of which the following is a specification.

This invention relates to improvements in machines for performing a hardening operation, or an analogous operation, such as a tempering operation, for example, on small and relatively thin articles.

Machines for this general purpose have been used heretofore and many examples will be found in the prior art. Commonly, these machines are of the type wherein the articles to be hardened are linked together in chain formation and pass successively through the heating and quenching means, with the major faces of the articles disposed substantially in a horizontal plane. In these machines, there results a heating of the entire article to that temperature, at which it will be hardened when quenched, and the articles therefore are generally of the same hardness throughout. In many instances, as with saw blades, knife blades and the like, it is desired to have the back of the blade of less hardness than the cutting edge and the prior machines generally are not suited for this purpose.

This invention has for an object to provide a machine, wherein the thin articles to be treated may be passed on edge successively past the heating and quenching means and wherein guiding means are provided to hold the thin articles in upright relation, the guiding means arranged to prevent warping of the articles and at the same time to protect portions thereof from the full action of the heating means.

The invention has for another object to provide in a machine of the character described, feeding means to carry the articles in close succession past the heating and quenching means, without necessitating the linking and subseqent de-linking of the articles in and from chain formation,—the machine therefore being suitable for articles, which do not have perforations, or other means, permitting them to be joined successively together.

A further object of the invention is to provide in a machine of the class described, an arrangement such that a plurality of rows of articles may be simultaneously propelled past the heating and quenching means by a single feeding means.

Another object of the invention is to provide, in a machine of the class described, a heating means which is effective simultaneously upon a group of articles arranged side by side in adjacent relation, the heating means being characterized by special construction whereby all the articles, whether on the inside or outside of the group, are heated with substantial uniformity.

A further object of the invention is to provide in a machine, of the character described, generally simplified and improved mechanical structure.

Other objects and advantages will appear in the following description and in the illustrative embodiment of the invention in the accompanying drawings, in which:—

Figure 1 is a sectional elevational view of a machine embodying the invention;

Fig. 2 is a fragmentary plan view thereof;

Fig. 3 is a perspective view illustrative of the adjustable mounting of the feeding means;

Fig. 4 is a partial cross sectional view of the bed of the machine and illustrates the guiding means; and

Fig. 5 is an enlarged elevational view of a detail shown in Fig. 2.

Referring to these drawings, the machine includes a bed or table A, which is suitably supported upon two spaced side frames B. Above the bed A, a suitable heating means, indicated generally by C, is provided and, adjacent the heating means, is a quenching means, indicated generally by D. Articles *a* to be hardened, such as the saws illustrated or any other relatively small articles, are arranged to travel along bed A first to, and beneath, the heating means C and then to, and beneath, the quenching means D.

The articles *a* are guided during their travel along bed A in the following manner. The upper surface of bed A is provided with a plurality of longitudinally disposed bars *b* (Figs. 2 and 4) which are arranged closely adjacent one another in spaced parallel relation. These bars, as indicated in Fig. 1, extend from one end of bed A to the other

and afford between them a series of grooves *c*, in which the articles may be positioned and by which they may be guided in their travel. The shape of these grooves would, of course, be made suitable in each instance to the work in hand and the shape, chosen for the present illustrative example, is made suitable for flat, thin articles such as saw blades or the like. The grooves *c* are of such depth that only the upper portions of the articles are exposed. Thus, when the articles are hack saws, the grooves may be made as shown in Fig. 1, so that only the toothed edge portions are exposed, although, obviously the depth of the grooves may be varied according to the particular class of work in hand.

The means for feeding the articles longitudinally of the bed A will now be described. Such means includes at least one flexible driving member and, preferably, two driving members are provided, one on each side of the bed A. As illustrated, the driving members consist of sprocket chains 10, which are trained over sprockets 11, one pair at each end of bed A, so that the upper laps of the chains travel parallel with the upper surface of bed A. Below the latter other sprockets are provided for each chain 11. Thus, a pair of driving sprockets 12 are fixed to a shaft 13, which may be driven from a suitable source of power by any suitable means. Idler sprockets 14 are provided for the purpose of keeping the chains 10 under sufficient tension at all times. The idler sprockets 14 are mounted upon a shaft 15, which in turn is supported by the free ends of a pair of levers 16 (one of which is shown in Fig. 1). The levers 16 are suitably pivoted to frames B and tend to move downwardly under the action of a weight 17, which is suspended from shaft 15. Thus, as the chains 10 expand under the heat of the heating means C, the idler sprockets 14 are forced downwardly to tighten the chains. Any other suitable means may be provided for this purpose.

The two chains 10 travel in spaced parallel relation, one on each side of the group of bars *b*, and are supported by the bed A. At intervals along the chains 10 cross bars 18 are provided which extend transversely across and above bars *b* and are secured at their ends to the chains. Preferably, the cross bars 18 are removably secured to the latter to permit adjustment of the longitudinal space between successive bars and thus accommodate articles of varying length. As shown, the chains 10 are of the block type (Fig. 3) and each block, as 10′, has secured thereto an upstanding pin 19. The cross bars 18 are made of flat bars, the ends of which are given a quarter turn bend, so that such ends lie parallel to the chain, while the intermediate portions are substantially vertically disposed. To such ends of bars 18, blocks 20 are secured and a vertical hole is provided through each block, and the end of bar 18 therebelow, to receive pins 19. It will be seen that the bars 18 may be lifted from certain pins 19 and applied to other pins to change the spacing between the bars. Preferably, although not necessarily, the blocks 20 are removably secured to pins 19 by set screws 21 which are threaded horizontally into the blocks to bear against the pins 19. The intermediate portions of the cross bars 18 overlie the bars *b* in closely adjacent, if not quite contiguous relation, so that each cross bar 18 may simultaneously engage one article *a* of each of the several rows of articles. Thus, a plurality of articles may be moved in side by side relation to the heating means C and subsequently to the quenching means D. The number of rows of articles may, of course, be varied as desired but it will be obvious that the feeding means is of a character particularly adapted for large production, inasmuch as a very great number of articles may be fed by a single feeding means.

The heating means C may, according to most features of the invention, be constructed as desired. In the drawings, there has been shown a burner, which consists simply of a hollow rectangular box 22. Such box is suspended from a cross bar 25 (Fig. 1) by bolts 26, which pass loosely therethrough and have nuts 27 on their upper ends to engage the cross bar. The cross bar 25 is supported by a pair of laterally spaced brackets 28 which are secured in upstanding relation to bed A. By turning the nuts 27 the burner 22 may be raised or lowered with respect to the path of the articles *a* in an obvious manner. The burner 22 is supplied with a suitable medium, such for example, as gas and air. Thus, gas is admitted by a pipe 29 (Fig. 2) and air by a pipe 30, the two pipes constituting a well known burner arrangement. The heating flame issues through a series of holes 31 (Fig. 2) formed in the bottom wall of box 22 and is thus directed downwardly upon the articles traveling therebeneath.

Adjacent the heating means C, but beyond the latter in the direction of travel of articles *a*, the quenching means D is provided. Such means consists of a nozzle 32, the outlet of which is directed downwardly upon the articles *a*, and which is spread laterally, as shown in Fig. 2, to overlie all the grooves *c*. This nozzle 32 is connected to a supply pipe 33, which is angularly adjustable in a bracket 34 secured in upstanding relation to bed A. By swinging the pipe upon its axis in bracket 34, the outlet of nozzle 32 may be raised and lowered with respect to the path of travel of articles *a*. A pipe 35, connected at one end to pipe 33, extends downwardly

and is connected at its other end to the outlet end of a suitable pump, such as the gear pump 36, conventionally shown in Fig. 1. Pump 36 is driven by a chain 37 and suitable sprockets from the drive shaft 13 above described. The inlet of pump 36 is connected to the lower part of a tank 38, which is suitably suspended below bed A with its open upper end closely adjacent the latter. Thus, a suitable quenching medium, say oil for example, may be forced from tank 38 through the pipes 35 and 33 to issue from the nozzle 32 upon the articles *a* traveling therebeneath. The oil, thus delivered upon the articles flows back into the tank 38 by way of openings 39 provided in bed A above the tank, as shown in Fig. 1.

The heating means C, above described, is especially constructed to uniformly heat all the articles. The articles *a*, in or near the outside rows, are naturally exposed to some extent to the cooling influence of the adjacent air, while the articles, in or near the central rows, are not so exposed. Therefore, unless special means are provided, the articles in or near the central rows would become heated to a higher degree than those in or near the outside rows. To provide for uniform heating, the holes 31, above described, are arranged in several (six as shown) transverse rows and in certain rows, as those to the rear of the burners (in the direction of travel of articles *a*), holes are omitted near the central portion of the burner. Thus, in the fourth, fifth and sixth rows, holes are omitted and in increasing number in the order named so that a roughly triangular blank space is provided in the rear bottom portion of burner 22. No holes are omitted from the first row, and generally not from the immediately adjacent rows, for the articles of all rows are here subjected substantially equally to the action of the cooling means. The specific structure described will serve as an illustrative example of one way of obtaining the desired uniform heating and, obviously, other types of burners may be made to effect the same result. Obviously, also the number of rows of holes and the number of holes per row may be varied as desired and we do not intend, therefore, to limit ourselves to the one specific arrangement described for effecting the desired result of uniform heating of articles, which are passed side by side in group relation beneath a heating means.

Preferably also, means are provided to hold the articles against the bottoms of their grooves during their travel past the heating means C or the quenching means D. Thus, one or more rolls 40, desirably two, as shown in Fig. 1 are arranged one adjacent the rear side of the heating means and one adjacent the forward side of the quenching means. Each roll 40 extends transversely across all the bars *b* and is adapted to rest upon the upper exposed edges of the articles, the weight of the rolls being suitably proportioned to the work in hand. Each roll 40 is loosely journaled at its ends in open ended bearings 41 secured to bed A. On the bearings 41 are vertically adjustable U-shaped plates 42, which also receive the necked down portions 43 of the roll and serve to limit the downward travel of the roll. Flanges 44, on the ends of the rolls 40, cooperate with shoulders 45 thereon to limit the endwise play of the roll by engagement with the members 42 and 41, respectively.

At the delivery end of bed A an inclined chute 46 is provided, into which the articles *a* fall and along which they slide into a suitable receptacle 47. The articles *a* are moved by bars 18 until slightly more than half their lengths are projected beyond the forward edge of bed A, at which time they tip on such edge and fall into the chute 46 and slide rapidly therealong and into receptacle 47 in time to permit the passage of the cross bars 18.

The operation of the machine will largely appear from the foregoing description. It is to be noted, however, that the articles are not fully exposed to the action of the heating means C. That is, the lower portions of the articles are protected and shielded from the heating flame by the bars *b*, which cover the major portion of the sides of the articles, leaving only the upper edge exposed. This is most desirable, where the articles have cutting edges, for such edges only need to be hardened and the back of the article may be left of less hardness and far less brittle. Where, as shown, the articles are saw blades, the toothed edge only is left exposed and this edge only is hardened.

The feeding means disclosed is especially suited to quantity production and is, withal, of simple and efficient character. As many rows of articles may be simultaneously fed by the heating means, as desired, and practically the only limitation to the type of feeding means is the capacity of the operator in feeding the articles into the grooves *c*. The feeding means is most desirable, since it does not depend upon arranging the articles in chain formation and therefore can be used with articles, such as could not be handled in the so-called "chain" type of machine. Moreover, the necessity for linking, or otherwise connecting successive articles together, is dispensed with as well as the mechanism usually provided to subsequently disconnect the articles.

The invention has been disclosed herein in a single illustrative embodiment and it is recognized that many modifications may be made in the specific structure disclosed, having for their object the use of the invention in a form differing from that herein dis-

closed. It is therefore desired to have the scope of the invention determined by the appended claims interpreted by the spirit of the present disclosure rather than by the letter of the exact form disclosed.

What we claim is:—

1. The combination, with a heating and a quenching means, of guiding means along which a plurality of rows of articles may be moved to the heating and quenching means, and a single feeding mechanism to simultaneously move the articles of all said rows and including a series of members each adapted to simultaneously engage and move one article of each of the several rows.

2. In a machine of the class described, a heating and a quenching means, a support along which a series of separate and unattached articles may be moved and successively carried to the heating and quenching means, feeding mechanism to separately move each article along the support, and means to guide the articles laterally in their travel, each guiding means affording a groove to receive the articles and leave only a portion of each fully exposed to the heating means.

3. In a machine of the class described, a heating means, a quenching means, a table having a series of tracks along which a plurality of rows of articles may be moved to the heating and quenching means, a member movable along the table at one side of the tracks and having a series of bars each extending across the tracks and adapted to simultaneously engage one article of each row.

4. In a machine of the class described, a heating means, a quenching means, a table having a series of tracks along which a plurality of rows of articles may be moved to the heating and quenching means, a flexible driving member movable along each side of the table, and a series of cross bars the ends of which are attached to said members and the intermediate portions of which are arranged to simultaneously engage one article of each row.

5. In a machine of the class described, a heating means, a quenching means, a table having a series of tracks along which a plurality of rows of articles may be moved to the heating and quenching means, a flexible driving member movable along each side of the table, a series of pins at spaced intervals along and upstanding from said members, and a series of cross bars, the ends of which are removably secured to certain of said pins, said cross bars arranged to simultaneously engage one article in each row and adapted to be secured to other of said pins when desired, to adjust the machine for articles of varying length.

6. In a machine of the class described, a heating means, a quenching means, a support having a plurality of grooves therein to receive a plurality of rows of flat thin articles and guide them on edge to the heating and quenching means, said grooves being of less depth than the width of the articles so that parts thereof are fully exposed and other parts are protected from the action of the heating means, and means engageable with one article of each row to move the articles along said support.

7. In a machine of the class described, a heating means, a quenching means, a support having a plurality of grooves therein to receive a plurality of rows of flat thin articles and guide them on edge to the heating and quenching means, said grooves being of less depth than the width of the articles so that parts thereof are fully exposed and other parts are protected from the action of the heating means, and means to move the articles along said support, and including a series of transverse members each engageable with one article of each row, said members engaging the articles below the tops of their exposed edges.

8. In a machine of the class described, a heating means, a quenching means, a support having a plurality of grooves therein to receive a plurality of rows of flat thin articles and guide them on edge to the heating and quenching means, said grooves being of less depth than the width of the articles so that parts thereof are fully exposed and other parts are protected from the action of the heating means, one or more rolls extending transversely across said support and arranged to ride upon the exposed edges of said articles, and feeding means for the articles including transverse members each engageable with one article of each row.

9. In a machine of the class described, a heating means, a quenching means, a support having a plurality of grooves therein to receive a plurality of rows of flat thin articles and guide them on edge to the heating and quenching means, said grooves being of less depth than the width of the articles so that parts thereof are fully exposed and other parts are protected from the action of the heating means, one or more rolls extending transversely across said support and arranged to ride upon the exposed edges of said articles, feeding means for the articles including transverse members each engageable with one article of each row, and means to limit the movement of said rolls toward the articles.

10. In a machine of the class described, a heating means, and means to simultaneously move a group of articles side by side past the heating means, the latter arranged to heat all the articles of the group with substantial uniformity irrespective of their position in the group.

11. In a machine of the class described,

a heating means, and means to move a group of articles side by side past the heating means, the heating surface of the latter extending across the path of all the articles and being of less width near the center of the group than along the edges thereof.

12. In a machine of the class described, a heating means, means to move a group of articles side by side past the heating means, and means closely adjacent the heating means to deliver a quenching medium upon the articles, the heating surface of said means being bounded on one side by a substantially straight line across the path of travel of the articles adjacent the quenching means and on the opposite side by two lines which converge in the direction of travel of the articles.

13. In a machine of the class described, a heating means, means to move a group of articles side by side past the heating means, and means closely adjacent the heating means to deliver a quenching medium upon the articles, the heating means comprising a burner having a plurality of rows of holes, the rows extending across the path of travel of the articles and there being less holes in the path of travel of the inner than in the path of the outer articles of the group.

14. In a machine of the class described, a heating means, a quenching means, and means to simultaneously carry a plurality of rows of flat thin articles on edge past the heating and quenching means.

15. In a machine of the class described, a heating means, a quenching means, and means to carry a plurality of rows of flat thin articles on edge successively past the heating and quenching means and to protect the articles exceept for one edge from the full action of the heating means.

16. In a machine of the class described, a heating means, a support having a series of longitudinal grooves in which rows of articles may travel to and beyond said means, flexible driving members along each side of the table, the upper lap of said members being parallel with said support and the members returning with their lower laps beneath the support, cross bars mounted at their ends on said members at spaced intervals therealong and each arranged to engage one article of each row, and an inclined delivery chute at one end of said support onto which the articles are carried by said bars after leaving the heating means.

17. In a machine of the class described, a heating means, a quenching means, a table having a series of tracks along which a plurality of rows of articles may be moved to the heating and quenching means, a flexible driving member movable along each side of the table, and a series of cross bars the ends of which are attached to said members and the intermediate portions of which are arranged to simultaneously engage one article of each row, and means permitting the heating means to be moved toward or away from the table.

18. In a machine of the class described, a heating means, a quenching means, a table having a series of tracks along which a plurality of rows of articles may be moved to the heating and quenching means, a member movable along the table at one side of the tracks and having a series of bars each extending across the tracks and adapted to simultaneously engage one article of each row, and means permitting the quenching means to be moved toward or away from the table.

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