TEMPEARING MACHINE

Fig. 1

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MANNUFACTURE OF SWAGED AND TEMPERED ARTICLES

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Fig. 5

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My invention relates to the manufacture of swaged and tempered articles, and the principal object of my invention is to provide new and improved processes and apparatus for the manufacture of such articles. In the drawings accompanying this specification and forming a part thereof I have shown, for purposes of illustration, one form of my invention which may assume, and in as much as my invention is particularly effective for the manufacture of machinists’ hammer heads, I have selected for illustration herein an embodiment of my invention peculiarly adapted for that purpose. In these drawings:

Figure 1 is a view in the nature of a layout showing the positioning and co-ordination of the units,

Figure 2 is a top plan view of the swaging unit and the tempering unit omitting, however, the tank and water feed of the tempering unit,

Figure 3 is a section through the swaging unit parallel to the front thereof and on the line 3--3 of Figure 2,

Figure 4 is a side elevation of the lower portion of the mechanism shown in Figure 3,

Figure 5 is a section through the swaging unit and the adjacent portions of the tempering unit taken at right angles to the section of Figure 3 and on the line 5--5 of Figure 2,

Figure 6 is a section through the tempering unit taken on the line 6--6 of Figure 2,

Figure 7 is a section through the tempering unit taken on the line 7--7 of Figure 6,

Figure 8 is a side elevation of the tempering unit, partly diagrammatic, showing particularly the drive arrangement,

Figure 9 is a detail of the article carrier and its supporting and actuating accessories, while

Figure 10 is a detail of the means supporting the hammer heads in the tempering unit.

According to the embodiment of my invention herein described, and illustrating with a machinist’s hammer head as the article being manufactured, the hammer head is formed in a drop forge unit 21 in the usual manner, is delivered into a chute 22 which carries the roughly formed hammer head into proximity to the trimming unit 23, is acted upon by the trimming unit 23 to remove the flange formed by the drop forge 21 and thus present the hammer head ready for swaging, is delivered to a suitable conveyor 24 which carries it into proximity to the swaging unit 25, is acted upon by the swaging unit 25 to complete the formation of the article, is inserted into a chute 26 leading to the tempering unit 27, and is acted upon by the tempering unit 27 to secure the desired hardening, the entire process being continuous, without interruption, with the hammer head retaining the original heat applied prior to the drop forging operation, and without the hammer head being reheated at any point or to any extent.

The drop forge unit 21 and the trimming unit 26 may be standard machines of any suitable type, the chute 24 is a simple chute of the type heretofore used, and the conveyor 24 may be of any type suitable for transferring the article from the trimming unit 25 to the swaging unit 25.

The swaging unit shown herein comprises a pedestal 30 supporting a super-structure 31 consisting of a table 32 on which is mounted a lower die 33 and from which rise two posts 34 acting as a guide for an upper die 35 and as a support for an air hammer 36 provided with a piston 37 carrying and operating the upper die 35 in the usual manner and provided with the usual air inlets 38 and 39 to which the compressed air is supplied from any suitable source through a main valve 40 operated by a valve lever 41 actuated by means of a rod 42 connected to a foot lever 43 mounted on a shaft 44 pivoted in the pedestal 30 and having its tread 45 positioned for actuation by the foot of the operator, the valve 40 and valve lever 41 and rod 42, and the greater part of the foot lever 43, being enclosed within the pedestal 30 and accessible through the door 46.

In order to prevent the formation of points or projections on the ends or faces of the hammer head, or other article, I find it desirable to divide the upper and lower dies 35...
and 33 along a plane disposed slightly above the center line, to thus increase the depth of the lower die and correspondingly decrease the depth of the upper die.

Also mounted within the pedestal 30 adjacent the main valve 40 is an auxiliary valve 47 which controls the opening to atmosphere of a bleed (not shown) extending from the upper air inlet 38 of the hammer 36, and which is itself controlled by a lever 48 pivoted at 49 to the pedestal 30, pivoted at 50 to the reciprocating stem 51 of the auxiliary valve 47, and pivoted at 52 to the rod 42 extending between the main valve lever 41 and the foot lever 43, the connections being such that opening of the main valve 40 closes the auxiliary valve 47 to render the bleed inoperative but closing of the valve 40 opens the auxiliary valve 47 to render the bleed effective to permit escape of any air within the air inlet 38 or air chamber 53 to thus prevent accumulation of air pressure otherwise effective to force the plunger 37 and upper die 35 down against the lower die 33, to thus cause the upper die 35 to be held in a raised position permitting free access for the removal of one article from swaging position and the insertion of another article into position to be swaged.

In the case of the machinist's hammer head, the article selected for illustration herein, the swaging need not be applied to the central portion of the article but the swaging must be applied to finish both ends of the article. Accordingly the upper and lower dies 35 and 33 are herein shown as provided with surfaces 54 and 55 effective to swage and finish the small and large ends 36 and 37 of the hammer 36, and are cut away intermediate these surfaces to omit swaging and finishing of the article intermediate the two ends 56 and 57, and in the embodiment of my invention herein shown this cutting away of the intermediate portion of the dies is extended to provide in the upper and lower dies 35 and 33 registering recesses 59 and 60, and in these recesses 59 and 60 there is positioned means for automatically rotating the article during the swaging operation, this means being shown herein as a rotatable carrier member 61 provided with a central aperture 62 formed to non-rotatably receive the article being swaged, and mounted for rotation of itself and the article positioned within the aperture 62, and for reciprocation vertically to permit elevation of the carrier for removal of the article therefrom, and held against movement in any horizontal direction, all by two pair of bars 63 mounted in recesses 64 in the lower die 33 and each engaging one of the lateral faces of the carrier 61 on opposite sides of an annular externally circular hub 65 carried by that lateral face of the carrier 61.

It will be understood, however, that after it is in position the hammer head, or other article, itself acts as a shaft rotatably supporting the carrier 61, and also that the function is facilitated by the continuation of the lower die 33 above the center line.

Rotation of the carrier 61, and the article carried thereby, is effected, from a continuously rotating shaft 66 carried by a bearing 67 supported by a bracket 68 rising from the table 32, by engagement, with a clutch disc 69 carried by the shaft 66, of a cooperating clutch disc 70 carried by a hub 71 which is rotatable on the shaft 66 and in a bracket 72 also rising from the table 32, and which carries a sprocket 73 connected by a chain 74 to a cooperating sprocket 75 mounted on the carrier 61 intermediate the two pairs of bars 64, while rotation of the shaft 66 is effected from a motor 76 by means of a first counter-shaft 77 carrying a pulley 78 connected by a belt 79 to the pulley 80 of the motor 76, a second counter-shaft 81 carrying a gear 82 meshing with a pinion 83 carried by the first counter-shaft 77, and a chain 84 connecting a sprocket 85 on the second counter-shaft 81 with a sprocket 86 on the shaft 66.

Reciprocation of the clutch disc 70 to bring the clutch discs 69 and 70 into engagement is effected by means of a lever 85 pivoted to a strut 86 extending from the bearing 72 and arranged to engage the end of a cap 87 mounted over the end of the shaft 66 with its inner end in engagement with the adjacent end of the hub 71, while the lever 85 is itself actuated by connecting it to the shaft 44 through a lever 88 pivoting from the shaft 44 and connected by a link 89 to one arm 90 of a bell crank lever 91 pivoted to the bracket 72 and having its other arm 92 pivoted to the free end of the lever 85, these connections being such that when the foot pedal 45 is depressed to operate the hammer 37 the clutch discs 69 and 70 are engaged to simultaneously rotate the carrier member 61 and the article carried thereby, and when the foot pedal 45 is released to discontinue operation of the hammer 37 and permit the auxiliary valve 47 to hold the hammer 37 raised the clutch discs 69 and 70 are disengaged to permit article insertion and removal into and from the article carrier 61.

Mounted beneath the sprocket wheel 75 on the carrier 61, and in the recess 60 in the lower die 33, is a lever 93 carried by a shaft 94 pivotally mounted in the flanges 95 of one of the posts 34 and itself arranged to be rotated by means of a handle 96 to correspondingly rotate the arm 93 to thus bring the arm 93 into engagement with the carrier 61 to stop inertial rotation of the carrier 61 and then, upon further movement, to lift the carrier 61 into a position wherein the article supported thereby is free of the lower die.
and in position to be removed from the carrier 61. In addition, the aperture 62 formed in the carrier 61 to receive the article being swaged is herein shown as so formed as to not only non-rotatably receive the article but to also permit removal of the article from the carrier 61 by a continuation of the movement by which the article was inserted into the carrier 61, and accordingly to permit the operator to remove one article and insert another by a single movement wherein the article to be inserted engages the adjacent end of the article already in the carrier and forces this article out of the carrier 61 as it itself moves into position within the carrier 61 ready for the subsequent swaging operation, the article forced out of the carrier 61 then dropping automatically into a chute 26 ready for delivery to the tempering unit.

The tempering unit 27 is mounted on the same framework 98 which supports the motor 76 and the first counter-shaft 77 and the second counter-shaft 81, and comprises a pair of side chains 99 extending horizontally between end sprockets 100 mounted at one end upon an idler shaft (not shown) and at the other end upon a drive shaft 101 rotatably mounted in suitable bearings 102 on the framework 98 and rotated from the first counter-shaft 77 intermitently by means of connecting mechanism comprising a worm 103 carried by the end of the first counter-shaft 77 and meshing with a worm gear 104 carried by a cross shaft 105 which is rotatably mounted in the framework 98 and carries a driving disc 106 provided with a pin 107 arranged at each revolution of the disc 106 to engage in one of the recesses 108 in a cooperating driven disc 109 mounted on the drive shaft 101 to thus advance the driven disc 109 and drive shaft 101 and conveyor chains 99 intermittently a unit spacing upon each revolution of the driving disc 106; movement of the driven disc 109 and chains 99 between the impulses of the driving disc 106 and pin 107 being prevented by a locking detent 110 carried by a lever 111 pivoted at 112 to the framework 98 and arranged to seat within the adjacent recess 108 of the driven disc 109 except when it is withdrawn, preparatory to actuation of the driven disc 109, by a second pin 113 carried by the driving disc 106 in advance of the pin 107 and in position to engage a lug 114 depending from the lever 111 and, by engagement with this lug 114, to retract the lever 111 and locking pin 110 to permit the impending actuation of the driven disc 109 and chains 99; and the driving connections to the chains 99 being such as to operate the tempering unit 27 slightly faster than the normal operation of the swaging unit 25 to render the tempering unit 27 always in condition to receive the hammer heads delivered from the swaging unit 25 by the chute 26.

Intermediate the end sprockets 100 the chains 99 pass below depressing sprockets 115 mounted upon shafts 116 carried in the framework 98 and effective to provide intermediate these depressing sprockets 115 a central section of the upper pass of the chains 99 which is depressed below the end sections of the upper pass of the chains and is maintained and carried by means of a plurality of supporting sprockets 117 disposed intermediate the depressing sprockets 115 and carried on shafts 118 also mounted in the framework 98.

Carried by each of the two chains 99 are a succession of inwardly extending brackets 119 arranged to support a succession of article carriers 120 each formed to support one of the articles conveyed to the tempering unit 27 by the chute 28, and herein shown as each comprising a plate section 121 comprising lateral extensions 122 arranged to be secured to the brackets 119 by means of suitable bolts 123, comprising longitudinal extensions 124 arranged to substantially abut the corresponding longitudinal extensions 124 of the adjacent article carriers 120, and merging centrally into a depressed cup 125 formed on its upper end at 126 to snugly receive the body portion 127 of the hammer head 58 coincidentally with the snug reception of the small end 56 of the hammer head 58 by fingers 128 formed as extensions of the cup 125 and somewhat adjustable by bending to provide the desired coordination between the hammer head body engaging surfaces 126 of the cup 125 and the hammer head end engaging surfaces of the fingers 128 to insure coincident engagement of both agencies and thus insure support of the carried hammer head 58 not only vertically but also laterally against tilting.

In the case of a machinist's hammer head 58, it is obviously desirable that the ends 56 and 57 of the hammer head 58 shall be tempered to provide on each end a hard striking face, and that the body 127 shall remain soft, strong, and tough, and the tempering means 27 herein shown provides means for accomplishing this result; the means for tempering the lower or small ends 56 of the hammer heads 58 comprising a tempering trough 129 extending beneath the upper pass of the conveyor, supported at that elevation at which the lower ends 56 of the hammer heads 58 will be immersed during the travel of the hammer heads 58 along the central depressed portion of the upper pass of the conveyor and projecting longitudinally beyond the ends of this central depressed portion to provide the necessary space to permit the conveyor, and the hammer heads carried thereby, to travel from one raised portion to the central depressed portion and from the cen-
tral depressed portion to the other raised portion all without interfering with the ends of the trough 129; and the means for tempering the upper or larger ends 57 of the hammer heads 58 comprises a tank 130 mounted on the framework 98 above the conveyor and having connected thereto a supply pipe 131 extending along the conveyor over the central depressed portion of the upper pass of the conveyor and itself provided with a succession of nozzles 132 spaced along the supply pipe 131 to conform to the spacing of the hammer head carriers 129 along the conveyor and positioned to coordinate with the rest positions of the carriers between the intermittent movements of the conveyor so that, except for the short periods during which the conveyor is in motion, each hammer head 58 is receiving continuously a stream of tempering fluid which is directed directly against the center of its striking face, and which, after exerting its tempering action on the center of the striking face of the large end 57 of the hammer head 58, flows outwardly over the remainder of the face, and then down into the trough 129 to supply the tempering fluid for tempering the small ends 56 of the hammer heads 58.

It will be understood that in this manner the striking faces of the large end 57 are tempered high at the center and less at the edges, to thus afford maximum resistance both to center wear and edge chipping, also that this entire end is tempered from the inside out to prevent the formation of the strains, and oftentimes cracks and checks, resulting when a body of this kind is tempered by immersion.

It will of course be apparent that the hammer heads 58 may be introduced into the conveyor at any desired point ahead of the nozzle 132, and may be removed at any desired point after the nozzles 132, and in any desired manner, but I prefer to introduce the hammer heads 58 into the depressed portion of the upper pass of the conveyor just ahead of the first nozzle 132, and to remove the hammer heads 58 by permitting them to drop by gravity as they have been carried around the sprockets 100 on the drive shaft 101, and to provide at that point a suitable receptacle 133 adapted to receive the hammer heads 58 as they fall by gravity from the conveyor.

It will be apparent from the above description that the embodiment of my invention therein shown provides for swaging and tempering the article under the original heat imparted prior to the drop-forging operation, and without any reheating, provides improved swaging means operating so uniformly and successfully as to provide on a machinist's hammer head faces not only ready for use without grinding but far more accurately contoured than faces produced by grinding, and provides improved tempering means effective to temper these hammer heads exactly where the tempering is desired and to leave these hammer heads soft where tempering is not desired. It will also be apparent that by supporting each hammer head in the article carrier laterally against tilting I insure that the tempering fluid shall at all times strike directly and evenly upon the upper face of the large end of the hammer head, and also that by this mounting, and by the longitudinal flanges on the article carriers, I am able to feed the hammer heads to the conveyor without the use of the usual elaborate automatic holding and releasing means and by the simple gravity chute herein shown.

From the above description it will be apparent to those skilled in the art that the embodiment of my invention herein shown and described provides a new and improved process whereby the article may be swaged and tempered all on the original heat applied prior to the drop-forging, provides new means for swaging provides new and improved means for introducing the article into the tempering means, and provides a new and improved tempering means.

At the same time, it will also be apparent to those skilled in the art that the swaging means herein shown will form the striking faces of the hammer head true and accurately and accordingly eliminate the grinding heretofore necessary. Inasmuch as it is well known to those skilled in the art that this grinding results in the formation of a large number of seconds and even a considerable quantity of scrap, and is never really accurate and correct, it will also be obvious to those skilled in the art that the embodiment of my invention herein shown and described also produces a superior article.

It will of course be obvious that the embodiment of my invention herein shown and described lowers the cost of production both by actually lowering the manufacturing cost and by the saving effected by the elimination of seconds and scrap.

And it will also be obvious to those skilled in the art that even for the production of machinist's hammer heads the embodiment of my invention herein shown may be variously changed and modified without departing from the scope of my invention or sacrificing the advantages thereof. At the same time, it will also be obvious to those skilled in the art that my invention, either in the embodiment herein shown and described, and in that embodiment with or without such changes, or with other changes, or in other embodiments, may be utilized for the production of articles other than the machinist's hammer head herein referred to, and, in one or more such embodiments, may be utilized to produce any article to which any or all of my in-
vention is applicable, all without departing from the spirit of my invention or sacrificing the advantages thereof.

It will accordingly be understood that the disclosure herein is illustrative only, and that my invention is in no way limited thereto.

I claim:

1. Mechanism for tempering the striking face of an article, comprising means for supporting said article, and means for directing tempering fluid against only the center of said striking face.

2. Mechanism for tempering the striking faces of articles, comprising conveyor means arranged to support a plurality of articles evenly spaced along said means, means for directing tempering fluid against only the center of each such striking face, and means for advancing said conveyor means intermittently a distance equal to the spacing of such articles along said conveyor means.

3. The process of tempering the striking face of an article, which comprises directing tempering fluid against only the center of such striking face.

4. Tempering mechanism, comprising a gravity article delivery chute freely open; conveyor means disposed beneath the outlet of said chute to receive machinists' hammer heads from said chute small end first, and comprising a plurality of article carriers each having means to support said hammer heads therein both vertically and also laterally against tilting, and means for delivering a cooling fluid thereto while so held, said conveyor being provided with means for advancing the same step-by-step at such intervals that each of said carriers successively passes beneath said chute.

5. Tempering mechanism, comprising conveyor means arranged to support a plurality of articles evenly spaced along said means, a series of ducts arranged to direct suitably spaced streams of fluid, one on each of said articles while stationary during a pause in the advance of said conveyor, and means for advancing said conveyor means intermittently by a unit multiple of the spacing of such articles along said conveyor means.

6. Tempering mechanism, comprising conveyor means arranged to support a plurality of articles evenly spaced along said means, a tank mounted above said conveyor means, a series of ducts extending therefrom and arranged to direct suitably spaced streams of fluid, one on each of said articles while stationary during a pause in advance of said conveyor, and means for advancing said conveyor means intermittently by a unit multiple of the spacing of such articles along said conveyor means.

7. Tempering mechanism, comprising a receptacle containing tempering fluid, conveyor means arranged to support a plurality of articles evenly spaced along said means with the lower portions thereof extending into said fluid, means for directing a stream of fluid on the upper part of each of such articles, and means for advancing said conveyor means intermittently distances equal to the spacing of such articles along said conveyor means.

8. Tempering mechanism, comprising a receptacle containing tempering fluid, conveyor means arranged to support a plurality of articles evenly spaced along said means with the lower portions thereof extending into said fluid, means for directing a stream of fluid on the upper part of each of such articles, such fluid flowing thence into said receptacle to form said tempering fluid therein, and means for advancing said conveyor means intermittently by a unit multiple of the spacing of such articles along said conveyor means.

9. Tempering mechanism, comprising an elongated receptacle containing tempering fluid; a horizontal endless belt conveyor containing a plurality of article carriers evenly spaced therealong, having the central portion of its upper pass horizontal and at a level relative to said fluid to carry such articles with the lower portions thereof extending into said fluid, and having the end of said upper pass raised relative to said central portion, whereby such articles are carried down over the entry-end wall of said receptacle to the entry end of said central portion and raised from the exit end of said central portion over the exit-end wall of said receptacle; means for directing a stream of fluid on the upper part of each of such articles; and means for advancing said conveyor intermittently by a unit multiple of the spacing of said article carriers along said conveyor.

10. Tempering mechanism, comprising an elongated receptacle, containing tempering fluid; a horizontal endless belt conveyor containing a plurality of article carriers evenly spaced therealong, having the central portion of its upper pass horizontal and at a level relative to said fluid to carry such articles with the lower portions thereof extending into said fluid, and having the ends of said upper pass raised relative to said central portion, whereby such articles are carried down over the entry-end wall of said receptacle to the entry end of said central portion and raised from the exit end of said central portion over the exit-end wall of said receptacle; means for directing a stream of fluid on the upper part of each of such articles, such fluid flowing from such articles into said receptacle to supply said tempering fluid therein; and means for advancing said conveyor intermittently by a unit multiple of the spacing of said article carriers along said conveyor.

11. Tempering mechanism, comprising a
receptacle containing tempering fluid, conveyor means arranged to support a plurality of articles evenly spaced along said means with their lower portions extending into said fluid, a series of ducts arranged to direct a stream of fluid on the upper part of each of such articles, and means for advancing said conveyor means intermittently by a unit multiple of the spacing of such articles along said conveyor means.

12. Tempering mechanism, comprising a receptacle containing tempering fluid, conveyor means arranged to support a plurality of articles evenly spaced along said means with their lower portions extending into said fluid, a series of ducts arranged to direct a stream of fluid on the upper part of each of such articles, such fluid flowing from such articles into said receptacle to form said tempering fluid therein, and means for advancing said conveyor means intermittently by a unit multiple of the spacing of such articles along said conveyor means.

13. Tempering mechanism, comprising an elongated receptacle containing tempering fluid; a horizontal endless belt conveyor containing a plurality of article carriers evenly spaced therealong, having the central portion of its upper pass horizontal and at a level relative to said fluid to carry such articles with the lower portions thereof extending into said fluid, and having the ends of said upper pass raised relative to said central portion, whereby such articles are carried down over the entry-end wall of said receptacle to the entry end of said central portion and raised from the exit end of said central portion over the exit-end wall of said receptacle; a series of ducts arranged to direct a stream of fluid on the upper part of each of such articles; and means for advancing said conveyor intermittently by a unit multiple of the spacing of said article carriers along said conveyor.

14. Tempering mechanism, comprising an elongated receptacle containing tempering fluid; a horizontal endless belt conveyor containing a plurality of article carriers evenly spaced therealong, having the central portion of its upper pass horizontal and at a level relative to said fluid to carry such articles with the lower portions thereof extending into said fluid, and having the ends of said upper pass raised relative to said central portion, whereby such articles are carried down over the entry-end wall of said receptacle to the entry end of said central portion and raised from the exit end of said central portion over the exit-end wall of said receptacle; a series of ducts arranged to direct a stream of fluid on the upper part of each of such articles, such fluid flowing from such articles into said receptacle to form said tempering fluid therein; and means for advancing said conveyor intermittently by a unit multiple of the spacing of said article carriers along said conveyor.

15. In a tempering machine, an article carrier formed as a cup arranged to receive a machinist's hammer head small end down, and formed to engage both said small end and the body of said hammer head to support said hammer head both vertically and also laterally against tilting while exposing the ends to tempering means.

16. In a tempering machine, an article carrier formed as a cup arranged to receive a machinist's hammer head small end down, formed to engage the body of said hammer head, and provided at its lower end with fingers arranged to engage said small end of said hammer head, to thus support said hammer head both vertically and also laterally against tilting while exposing the ends to tempering means.

17. Mechanism for tempering the striking faces of articles, comprising conveyor means arranged to support a plurality of articles evenly spaced along said means, a series of ducts arranged to direct tempering fluid against only the center of each such striking face during a pause in the advance of said conveyor, and means for advancing said conveyor means intermittently by a unit multiple of the spacing of such articles along said conveyor means.

18. Tempering mechanism, comprising: conveyor means arranged to support a plurality of articles evenly spaced along said conveyor means with the ends thereof exposed, means for directing separate streams of fluid each upon an exposed end of each of said articles, and means for advancing said conveyor means intermittently distances equal to the spacing of said articles along said conveyor means.

In testimony whereof I hereunto affix my signature.

FRANK J. VLCHEK.