

July 7, 1942.

W. A. PURTELL

2,288,644

FORGING APPARATUS

Filed Jan. 22, 1941

2 Sheets-Sheet 1

Fig. 1.

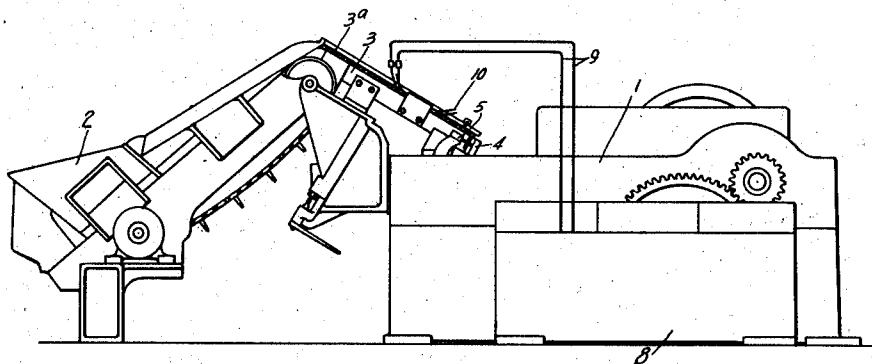


Fig. 4.

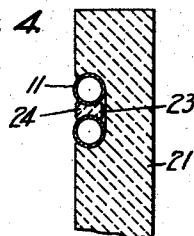


Fig. 2.

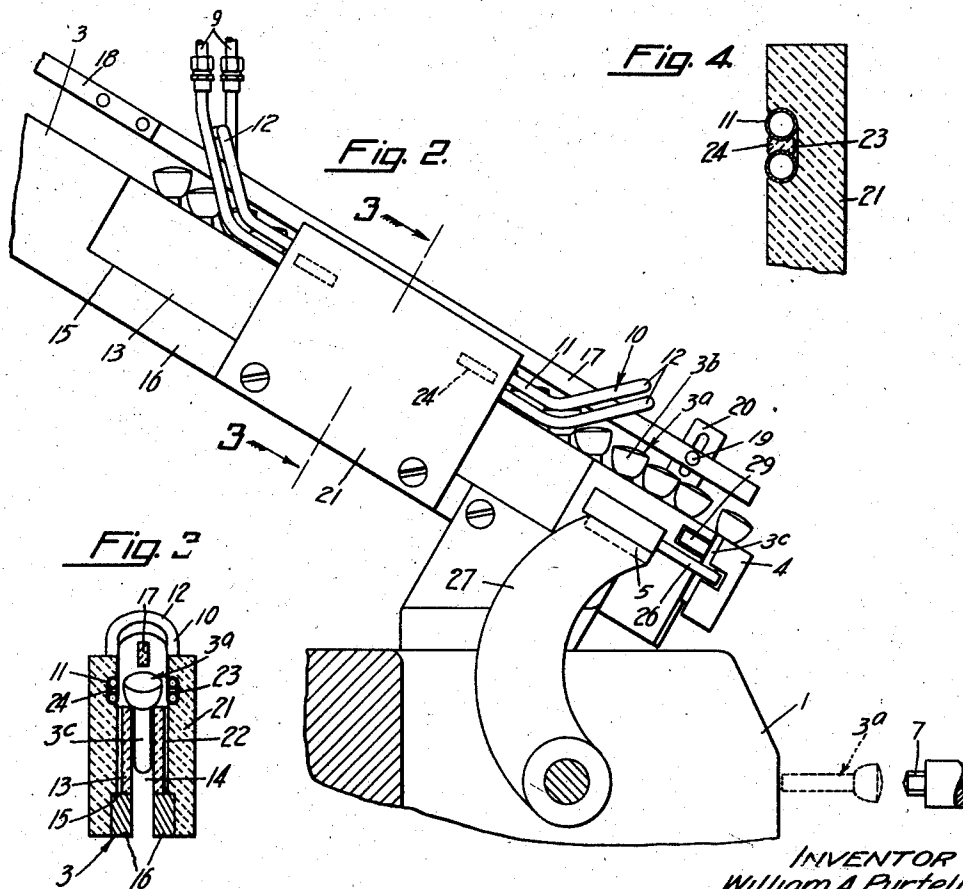
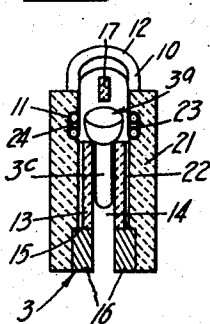


Fig. 3.



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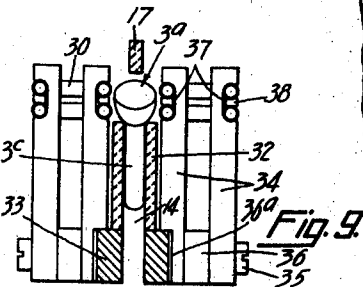
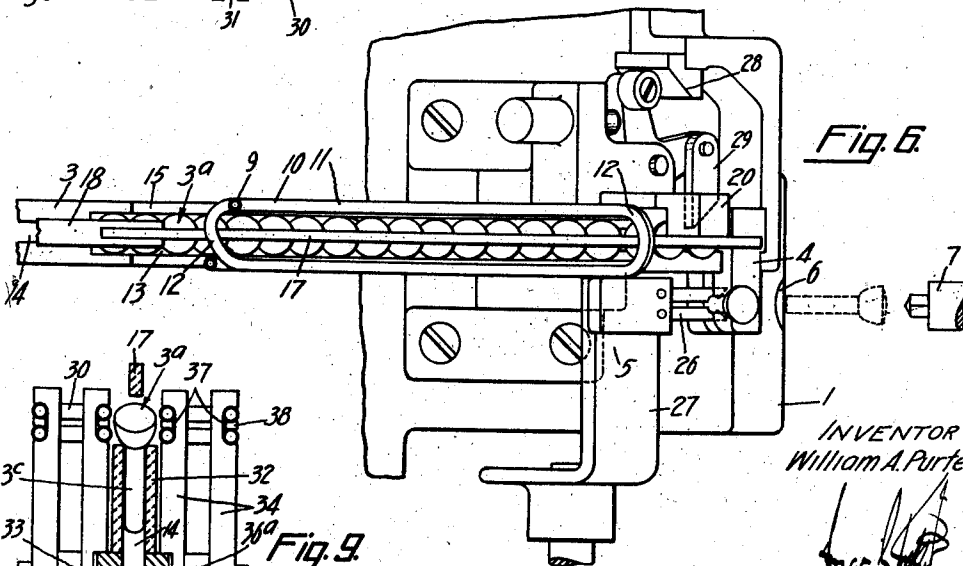
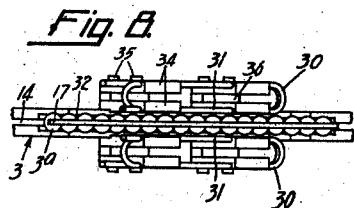
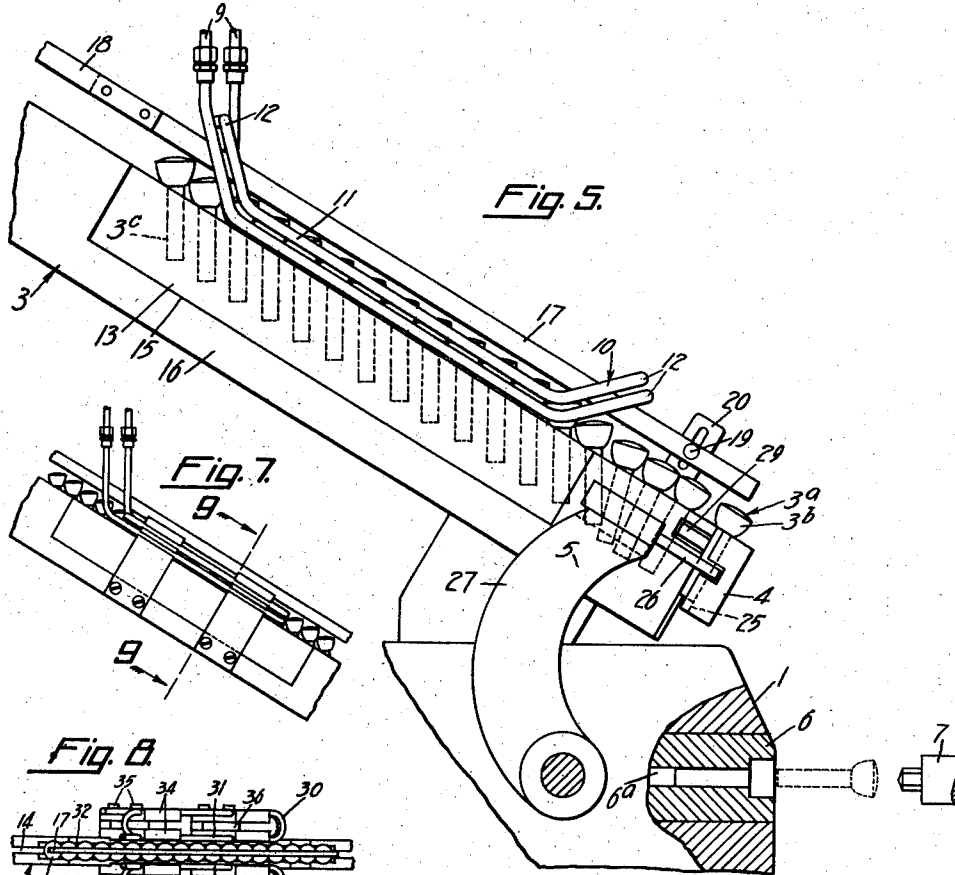
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2 Sheets-Sheet 2



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2,288,644

FORGING APPARATUS

William A. Purtell, West Hartford, Conn., assign-
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corporation of Connecticut

Application January 22, 1941, Serial No. 375,413

20 Claims. (Cl. 10—11)

My invention relates to forging apparatus.

It has among its objects to provide an improved apparatus for heating blanks by high frequency induction heating as they are being fed, and, more particularly, to provide such an improved method whereby the blanks are enabled to move directly longitudinally through the heating mechanism as they are being delivered to the forging mechanism. Other objects of my invention are to provide such an improved apparatus for heating blanks while feeding the same to forging whereby it is made possible to heat the same to a forging temperature as they move in upright position to the forging mechanism, and, more particularly, to provide such an improved apparatus especially adapted to heat headed blanks, and also one wherein the blanks are heated as they move down a conveyor or slide during delivery to forging mechanism for a subsequent forging operation thereon, such, for example, as forming the socket in socketed cap screws. Still further objects of my invention are to provide improved heating mechanism of the type utilizing high frequency induction heating coils and adapted to create a high frequency field operating on such blanks as they are in process of delivery, and to provide a high frequency heating coil of an improved construction and disposed in an improved manner whereby it is made possible for the blanks to be fed or moved continuously longitudinally through said field. Still other objects of my invention are to provide such an improved induction type heating mechanism having improved means for supporting and insulating the coils thereof, and such a mechanism especially adapted to use in connection with headed blanks being fed in upright position through a conveyor or slide to forging mechanism, such, for example, as socketing mechanism for making socketed cap screws. These and other objects and advantages of my improvements will, however, hereinafter more fully appear.

In the accompanying drawings, I have shown for purposes of illustration certain embodiments of my apparatus which may be used, the same being illustrated in connection with forging mechanism for performing the socketing operation on headed cap screw blanks, although it will be understood that my invention is not limited to use in connection therewith.

In these drawings:

Figure 1 is a side elevation of a complete installation including an induction heater operatively connected to the forging mechanism, the latter including blank conveying mechanism, the

several devices being shown in diagrammatic form to facilitate illustration;

Fig. 2 is an enlarged side elevational detail of the conveyor or slide shown in Figure 1, with the induction heating mechanism and transfer mechanism associated therewith;

Fig. 3 is a sectional view on line 3—3 of Figure 2;

Fig. 4 is an enlarged detail of a portion of the coil supporting and spacing structure shown in Figure 3;

Fig. 5 is a view similar to Figure 2 with a part of the coil supporting and insulating structure removed to facilitate illustration, and with the socketing die shown in section;

Fig. 6 is a plan view of the construction shown in Figure 5;

Fig. 7 is a view similar to Figure 2 showing a modified structure of coils and supporting mechanism;

Fig. 8 is a plan view of the structure shown in Figure 7, and

Fig. 9 is an enlarged sectional view on line 9—9 of Figure 7.

In this illustrative construction, I have shown my invention applied to use in connection with a forging machine 1 of a well known type adapted to socket headed blanks to form socketed cap screws, and having a hopper 2 and associated conveyor mechanism delivering the headed blanks therefrom into upright position in an inclined slide 3, with associated transfer mechanisms 4 and 5 adapted to deliver the blanks in the slide 3 in a well known manner in alignment with the socketing aperture in a socketing die 6, so that they may be forced into the same and socketed therein by a usual socketing punch 7 and thereafter ejected by a usual knockout 8a; improved induction type heating mechanism being supported on the slide 3 and operating on the headed blanks as they move through the latter to bring the same to the selected temperature before forging, all as hereinafter more fully described.

Referring more particularly to this heating mechanism, it will be noted that the same herein includes an induction type heating unit 9 such, for example, as a well known "Tocco" type unit of the high frequency type used in metal hardening. Since such units are well known, it is unnecessary herein more specifically to describe the same than to say that it has usual tubular copper terminal or bus members 9 adapted, when connected to a suitable coil forming a continuation of these members 9, to gener-

ate a high frequency field. Herein, the coil, hereinafter described if of the same general elongated type described and claimed in my copending application Serial No. 375,412, filed January 22nd, 1941, but of an improved construction, and both the members 9 and this coil are also im-

perforate and supplied with cooling water, while usual controlling mechanism is provided in the unit 8 to control the frequency and cooling flow, as is usual in such units.

In my improved construction, the coil supplied through the members 9 is both of an improved construction and arranged in an improved manner relative to the headed blanks being fed through the inclined conveyor or slide 3. Herein, this coil, generally indicated at 10, is of such an improved conformation that the headed blanks, generally indicated at 3a, may move continuously longitudinally through the field of this coil in an improved and simplified manner. The coil 10, as shown, is generally elliptical and provided with elongated parallel side portions 11 and upturned closed ends 12 on its opposite ends. Further, as illustrated, it includes a plurality of turns, two being illustrated, one above the other, although it will be evident that, if desired, under different conditions, I may use only one turn or more than two. Attention is also directed to the fact that the parallel side portions 11 are disposed longitudinally of the slide 3 and on opposite sides of the portions of the blanks to be heated, herein the upset heads 3b thereof, while the upturned ends 12 permit the heads of the blanks to enter one end of the elliptical coil by passing under one upturned end and passing out under the other upturned end, all while the blanks 3a continue to move longitudinally in the slide 3.

Cooperating with this improved coil is also improved means for supporting the same and the blanks relative to the slide 3. As shown, this means includes upright, parallel non-magnetic or insulating members 13 in plate form and forming continuations of corresponding upper edges on the slide 3. Thus, these members cooperate to define a passage 14 therebetween adapted to receive the shanks 3c of the blanks while supporting the heads 3b thereof on the inclined upper edge of the members 13. Herein, these members 13 are also inserted in corresponding cut out portions 15 in the slide 3 to which they are suitably attached, while these members 13 are also of such length as to underlie the whole length of the coils 10 and are also supported in spaced relation on the upper surface of the bottom portions 16 of the cut out 15 as shown in Fig. 3. In a preferred construction, an upper non-magnetic or insulating rod 17 is also provided which is suitably connected at its upper end to a like part 18 on the slide and also preferably suitably adjustably mounted as at 19, on a bracket 20 at the bottom of the slide; this rod 17 cooperating with the blanks as is usual in such slides and herein also having its ends passing through and under the upturned ends 12 of the coils 10 and being disposed out of contact therewith. Herein also, in a preferred construction, the longitudinal portions of the coils 10 are also supported in spaced relation in suitable insulating side members 21, preferably spaced as at 22 from the members 13 and also supported on and suitably attached to the members 16; these members 21 having upright, U-shaped, parallel grooves 23 in the upper part of their inner faces to receive the coil portions 11. As shown in Figures 3 and 4,

the opposite end walls of the grooves 23 are rounded to conform to the coils 11 and snugly receive the latter in opposite ends of the groove, while to lock and position the coil portions 11, short insulating locking and spacing members 24 also shown in Figure 2, are inserted longitudinally between the coil portions 11 at the opposite ends of the members 21, these portions being oppositely grooved also to conform to the portions 11. Thus, it will be evident that the blanks 3a will be free to move longitudinally in the slide 3 and in a like manner between the insulating plate members 13, in the relation shown in Figures 2, 3 and 5, through the high frequency field provided by the coils 10, while both the blanks and the coils 10 are suitably insulated from the slide 3 and one another.

Cooperating with the blanks 3a and acting to deliver the same to the socketing mechanism 6, 7 is also suitable transfer mechanism. This mechanism may be of any desired form such, for example, as the usual transfer mechanism illustrated which includes the transversely moving member 4 having a notch 25 therein adapted to be moved opposite the end of passage 14 in the end of the slide 3 and to transfer the heated blanks one by one from the lower end of the slide 3 laterally into a position to cooperate with a cooperating swinging transferring member 27 which, in turn, delivers the blank to the dotted line position shown in Figures 5 and 6, in the path of the socketing punch 1. Both of these mechanisms, however, being old and well known, and per se forming no part of my present invention, the same need not be more specifically described than to say that the member 4 is suitably operated from the machine 1 and also includes a cam face 28 operating a usual spring pressed separating finger 29 acting to force the last blank into notch 25, while the swinging transfer member 27 carries usual finger mechanism 26 adapted to grip the shank of each blank when it is disposed in the notch 25 in the member 4 and withdraw the same therefrom and, after withdrawal of the latter member, deliver the blank by a swinging movement of the member 27 into the horizontal position of the blank shown in dotted lines, ready to be pushed into the die 6 and socketed therein by the socketing punch 7.

In the operation of my improved mechanism, the blanks are fed into the hopper 2 of the conveyor mechanism and delivered thereby in a usual manner into the vertical relation illustrated in the slide 3, down which they are moved either by gravity or with the assistance of usual supplementary pusher mechanism if desired. As they move down the slide 3, the heads 3b of the blanks 3a, i. e. the portions thereof which are to be socketed, pass between the elongated side portions 11 of the coils 10, i. e. through the high frequency field between these portions 11, all while the blanks continue to move longitudinally, with the entering blanks passing in under the upturned closed ends 12 at the upper end of the coils and passing out under the upturned closed ends 12 at the lower end of the coils. Thus, the blanks 3a being fed out of the slide 3 one by one, the blanks are retained in the magazine provided in the coils 10 throughout a plurality of operations of the forging mechanism and the heads 3b are heated as desired preparatory to the socketing operation. Obviously, the length of the coils 10 may be varied as desired. The temperature to which the heads

3b are to be heated will obviously depend upon the material and the work to be done thereon and may, of course, be varied, but only a relatively low temperature of from 1200° to 1300° is necessary for ordinary purposes, while also thus avoiding excessive heating of the other parts of the structure.

In the use of my improved construction, all necessity for the annealing operation previously performed before the headed blanks are fed to the hopper 2 of the socketing machine, is completely eliminated. Thus, not only is the apparatus required substantially reduced, while manual handling is minimized, but the process of manufacture is materially expedited and cheapened. Further, as a result of my invention, it is made possible materially to simplify the process of feeding and heating the blanks while also enabling the same to be fed by gravity in the slide 3, the blanks herein being delivered in the simplest fashion longitudinally through the induction heating coils 10 without requiring opposite lateral deliveries of the blanks into and out of a laterally offset heating mechanism, as in my previously mentioned application. Further, it will be observed that the mechanism necessary to equip a standard machine, such for example as the machine 1 for performing the socketing operation on headed cap screws for such induction heating, is minimized, it only being necessary to provide the improved coils 10 and their supports and connecting means and associated unit 8, with a minimum of changes in the slide 3 and while using the remainder of the machine 1 without change. Attention is also directed to the fact that, while particularly adapted to use in connection with such machines for making socketed cap screws, my heating mechanism is also adapted to use in connection with various other forms of blanks, while it will also be evident that instead of heating only the protruding ends of the blanks as they move in the slide, the coils may be so disposed relative to the blanks as to heat other portions thereof or the entire blank, as desired.

In Figures 7, 8 and 9, I have shown a modified construction. Therein, a plurality of sets of parallel, laterally spaced coils 30 is provided and these sets have their adjacent elongated side portions 31 cooperating to define between the same a high frequency field and a passage for the blanks, similar to that heretofore described. Herein, each coil 3 is also flat, i. e. without upturned ends, due to the lateral spacing of the same from one another and the passage thus provided between their adjacent portions 31. In this construction, while utilizing insulating plates 32 similar to the plates 13, and supports 33 similar to the supports 16, each set of the coils 30 is also supported on improved spaced supporting means disposed between the longitudinal portions of each set of coils. Herein, a plurality of insulating members 34, generally similar to the members 21 but reversely disposed back to back, is also provided as shown in Figure 9, these members 34 being suitably connected as by connections 35 to the members 33 of the slide, as shown in that figure, with spacers 36 between the members 34 and shims 36a between the inner members 34 and the adjacent members 33. Here, also, it will be noted that both longitudinal portions 31 of each set of coils are disposed in grooves 37, similar to the grooves 23, and are positioned therein by insulating spacing members 38 similar to the spacing members 24. With this con-

struction, it will be evident that the heads 3b of the blanks 3a will move through the high frequency field created between the adjacent elongated portions 11, while the blank shanks 3c will move in the members 32 as heretofore. In this construction, however, it will be noted that by varying the thickness of the number of the shims 36a as desired, the width of the passage between the adjacent longitudinal portions 31 of the laterally spaced coils 30 may be varied as desired to accommodate blanks of different sizes, while retaining the desired adjacency thereof to the portions 31.

While I have in this application specifically described certain forms which my invention may assume in practice, it will be understood that these forms have been shown for purposes of illustration, and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In an induction heating apparatus, laterally spaced elongated coil portions developing a high frequency field therebetween and having between said portions an elongated article heating passage having open ends and an open side.

2. In an induction heating apparatus, laterally spaced elongated coil portions developing a high frequency field therebetween and having between said portions an elongated article heating passage having open ends and an open side, said coil portions being superimposed along each longitudinal wall of said passage.

3. In an induction heating apparatus, laterally spaced elongated coil portions developing a high frequency field therebetween and having between said portions an elongated article heating passage having open ends and an open side, and said coil portions having upwardly bent connecting portions at their opposite ends to provide said open ends.

4. In an induction heating apparatus, laterally spaced elongated coil portions having between said portions an elongated article heating passage having open ends and an open side, and said coil portions comprising separate complete coils having adjacent parallel portions defining said passage therebetween.

5. In an induction heating apparatus, means for producing a high frequency field including spaced elongated coil portions and having between said portions an elongated passage having open ends and an open side, and means for feeding lengthwise of said portions and through said passage articles to be heated extending into said passage through said open side.

6. In an induction heating apparatus, means for producing a high frequency field including a plurality of superimposed laterally spaced elongated coil portions and having between said laterally spaced portions an elongated passage having open ends and an open side, and means for feeding longitudinally of said passage articles to be heated extending in upright position through said side.

7. In an induction heating apparatus, means for producing an elongated high frequency field having open ends including laterally spaced elongated coil portions having an open side and connecting portions at their ends disposed above said field and forming said open ends, and means for feeding longitudinally through said field

and under said connecting portions, articles extending into said field through said side.

8. In an induction heating apparatus, means for producing a high frequency field including adjacent laterally spaced complete coils having adjacent portions elongated to define opposite sides of an elongated field having open ends and an open side, and means for feeding longitudinally through said field and between said coils, articles extending into said field through said side.

9. In an induction heating apparatus, a conveyor, and high frequency coil portions disposed along one edge of said conveyor and having means providing a high frequency field having open ends and an open side and through which the conveyed material is fed by said conveyor.

10. In an induction heating apparatus, a blank conveyor, induction heating mechanism having elongated high frequency coil portions providing an elongated high frequency field along one edge of said conveyor and having open ends and an open side, and insulating supporting means for said coil portions carried by said conveyor.

11. In an induction heating apparatus, induction heating mechanism having elongated high frequency coil portions providing an elongated high frequency field and having open ends and an open side, and laterally spaced blank supporting and directing means for supporting and directing headed blanks longitudinally between said portions.

12. In an induction heating apparatus, a blank conveyor, induction heating mechanism having elongated high frequency coil portions providing an elongated high frequency field along one edge of said conveyor and having open ends and an open side, and insulating supporting means for said coil portions carried by said conveyor including spaced insulating coil supporting members supporting said portions while providing an unobstructed space between said portions.

13. In an induction heating apparatus, a slide, and induction heating mechanism including laterally spaced high frequency coil portions carried on said slide and defining an elongated high frequency field having open ends and an open side through which the articles moving along said slide are passed between said portions.

14. In an induction heating apparatus, a blank slide, and induction heating mechanism including laterally spaced high frequency coil portions carried on the top of said slide and defining a high frequency field and having open ends and an open side through which the articles moving along said slide are passed, and insulating supporting means for said articles and for said coil portions carried by said slide.

15. In a forging apparatus, forging mechanism, transfer mechanism delivering blanks thereto, a conveyor including a magazine delivering blanks to said transfer mechanism, and

induction heating mechanism disposed along said magazine and having open ends and an open side through which blanks are fed in said magazine as they pass to said transfer mechanism.

16. In a forging apparatus, forging mechanism, transfer mechanism delivering blanks thereto, a conveyor for feeding blanks with their ends projecting beyond the top of said conveyor and delivering blanks to said transfer mechanism, and induction heating mechanism acting on the blanks as they are in process of being fed by said conveyor and comprising a plurality of elongated high frequency coil portions disposed along opposite sides of the top of said conveyor.

17. In a forging apparatus, forging mechanism, transfer mechanism delivering blanks thereto, a conveyor delivering blanks to said transfer mechanism, and induction heating mechanism acting on the blanks as they are in process of delivery by said conveyor, said conveyor comprising a slide having means for supporting headed blanks above the top thereof while the blanks move bodily downward in the slide, and said induction mechanism comprising a plurality of elongated high frequency coil portions disposed in parallel relation along the upper edges of said slide on opposite sides of said heads.

18. In a socketed screw making apparatus, socketing mechanism, mechanism for delivering headed blanks thereto, and induction heating mechanism for heating the heads of said blanks as said blanks are in process of delivery by said delivering mechanism to said socketing mechanism.

19. In a socketed screw making apparatus, socketing mechanism, means for delivering headed blanks thereto, and induction heating mechanism for heating the heads of said blanks as said blanks are in process of delivery by said delivering means to said socketing mechanism and comprising elongated high frequency coil portions extending along said delivering means and also having open ends through which said blanks are passed into and out of said induction heating mechanism as they move in said delivering means.

20. In a socketed screw making apparatus, socketing mechanism for socketing the heads of headed blanks, transfer mechanism delivering such blanks thereto, a slide delivering the blanks to said transfer mechanism and having means for supporting the heads of the blanks above the top of said slide while the blanks move bodily downward in said slide to said transfer mechanism, and induction heating mechanism for heating said heads prior to delivery to said transfer mechanism defining an elongated high frequency field disposed in parallel relation along the upper edges of said slide on opposite sides of the blank heads.

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