

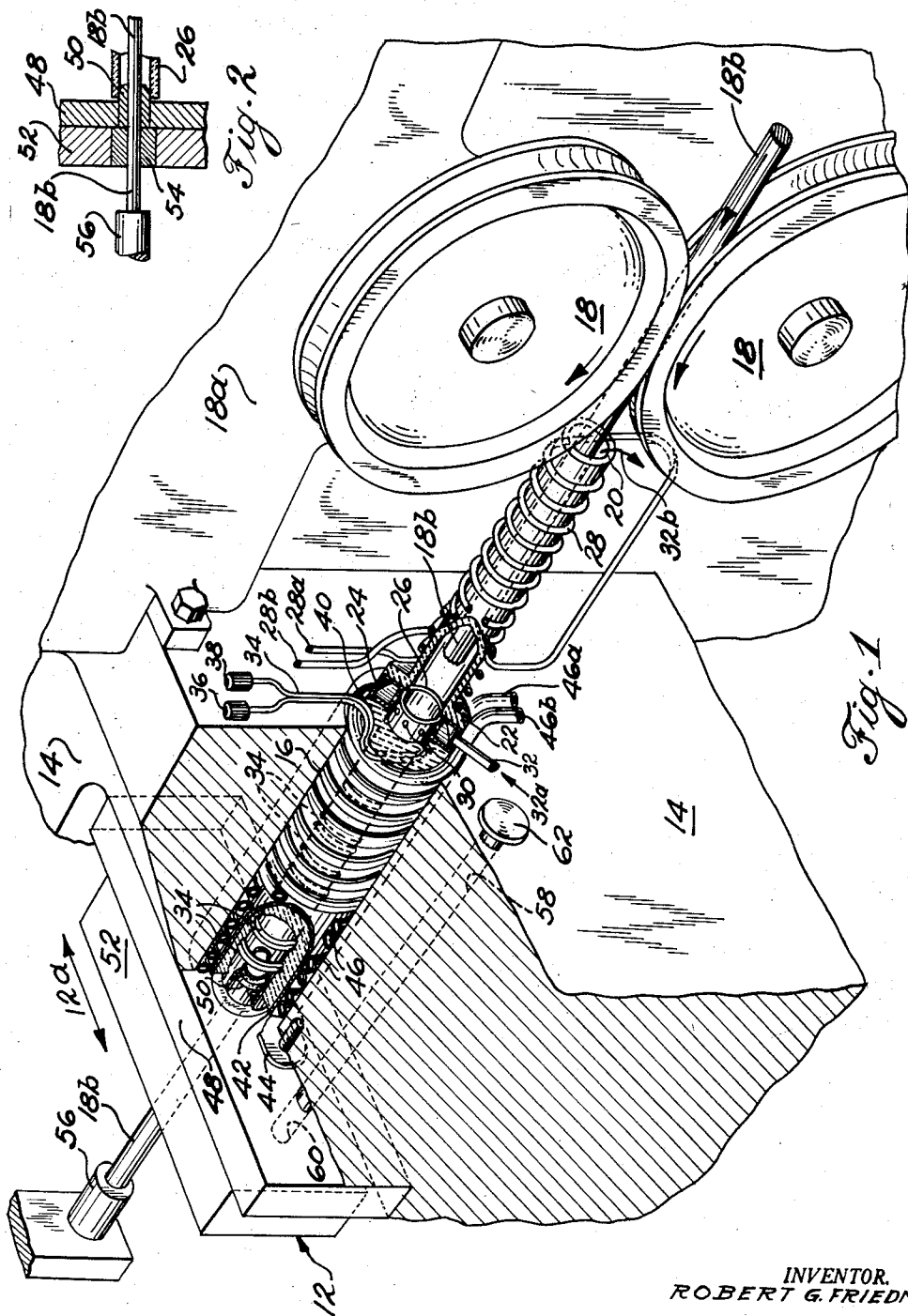
April 7, 1959

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2,881,297

METAL WORKING APPARATUS

Filed July 29, 1957



1

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METAL WORKING APPARATUS

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Application July 29, 1957, Serial No. 674,694

3 Claims. (Cl. 219—10.47)

This invention relates to apparatus for making metal articles and more particularly to a heating apparatus combined with a header for making bolts, or the like, from round rod stock.

Numerous attempts have been made to utilize hot rod stock in headers inasmuch as the stock being softened by heating greatly lowers the working pressures relative to the working pressures where the stock is worked cold as in cold headers. Such prior art efforts have included means for heating the stock between the stock coil and the feed rolls and attempts to use such arrangements have required the provision of wire brushes, or the like, to remove the scale from the hot rod stock prior to its being cut off and worked in the dies of the header. Hot rod stock is difficult to feed because of the tendency of the hot stock to deform under the pressure of the feed rolls. It will also be understood by those skilled in the art that the heating of the stock and the exposure of the hot stock to atmosphere results in the formation of hard oxides and scale particles which adversely affect the life of the dies in which such material is worked.

According to the present invention, relatively cold rod stock from a stock coil enters the feed rolls and such stock is heated between the feed rolls and the shear, and the heating apparatus provided in this location includes means to prevent the formation of scale and means to prevent the hot rod stock from heating up the bed frame of the machine in that location where the stock enters the machine.

It is among the objects of the present invention to provide a heating apparatus for a header which is mounted between the feed rolls and the cutoff for the header and wherein the stock nearest the feed rolls is heated by induction heating and the stock adjacent the shear is maintained at an elevated temperature by resistance heating and wherein the hot stock between the feed rolls and the shear is maintained in an inert or non-oxidizing atmosphere so as to prevent the formation of scale.

It is a further object of this invention to provide an apparatus according to the preceding object wherein the resistance heating device is surrounded by cooling coils to limit the transmission of heat from the resistance heating element to the bed frame of the header.

Further objects and advantages will appear from the following description and the appended drawings, wherein:

Fig. 1 is a perspective view with parts in section showing the feeding apparatus as mounted in a header; and

Fig. 2 is a sectional elevation showing the arrangement for gauging the hot stock to be cut and the shear.

The invention is illustrated in the environment of a header in Fig. 1 of the type having a bed frame 14 and feed rolls 18 to advance the stock into the header. The machine is preferably of the type disclosed in United States Patent No. 2,139,936 to William L. Clouse and assigned to the National Machinery Company of Tiffin, Ohio. Such machines include a header slide provided with tools and bed frame dies wherein the blank cut from

2

rod stock is shaped. Such machines also include means to drive the feed rolls in timed relation to the header slide movement so that the stock 18b is intermittently advanced against a stock gauge 56 and means operating in timed relation to the header slide to move the shear indicated at 12 so that on each cycle of the machine a new blank is cut off and a finished blank is discharged from the machine.

According to the present invention, the bed frame 14 is provided with an enlarged tubular bore 16 in which the heating apparatus is mounted. This bore is concentrically aligned with the rod stock 18b being advanced into the machine by the feed rolls 18 against the stock gauge 56. The arrangement is such that about half of the heating device is within the bore 16 and the other half projects outside of the bed frame toward the feed rolls.

Aligned ceramic tubes 20 and 26 surround the rod stock 18b between the feed rolls and the block 48 which is fixed in the bed frame. The outermost ceramic tube 20 is provided with an induction heating coil 28 which terminates in leads 28a and 28b leading to a high frequency electric power source. The ceramic tube 26 is disposed mainly within the bed frame bore and projects slightly beyond the face of the bed frame 14 and in said projected area is provided with a plurality of openings 30. The projecting end of the tube 26 is surrounded in the area of said openings by an annular chamber 24 having an inlet pipe 32 to admit an inert gas in the direction indicated by arrow 32a. The hollow chamber 24 is also secured to the flange 22 of the outermost ceramic tube 20.

The diameter of the ceramic tubes 20 and 26 is greater than the outer diameter of the rod stock 18b and since the inner end of the tube 26 is substantially closed at the shear, the inert gas admitted at 32a may move outwardly around the rod stock and exit as indicated by arrow 32b. In this way all of the rod stock within the tubes 26 and 20 is maintained under a non-oxidizing atmosphere and the formation of scale is prevented. A resistance heater 34 is provided by resistance heating wires wrapped about a tube 26 within the bed frame. The wires of heater 34 terminate at connectors 36 and 38 adapted to be connected to a source of electric current. The resistance heater 34 is surrounded by a thermo-insulating tubular structure 40 and a metal sleeve 42 in turn encloses the thermo-insulating material 40. A cooling coil unit 46 having an inlet and outlet 46a and 46b, respectively, is applied to the exterior of the metal tube 42 and the entire assembly, including the cooling coil, is mounted in the bore 16 by means of flanges such as 44 carried by the tube 42 being anchored to the bed frame.

The shear mechanism 12 includes a movable shear block 52 having a hardened metal shearing quill 54 therein. The shear block 12 reciprocates as indicated by the arrow 12a transversely of the plate 48 mounted on the bed frame. The fixed plate 48 is provided with a tubular member 50 which extends within the ceramic tube 26. It will be noted by reference to Fig. 2 that the tubular bushing member 50 snugly fits the outer diameter of the rod stock 18b and also the inner diameter of the tube 26 and thus the inert gas is retained in the ceramic tubular structure except for exit at the open end of tube 20. When the shear block 52 moves to the left as viewed in Fig. 1, it is moved so that the shearing quill 54 is brought into alignment with an ejector 62 mounted in the bed frame bore 58. It will be understood that the header includes means (not shown) to move the ejector 62 in timed relation to the shear block 52 so that a cut blank may be ejected from the shear block 52 into transfer fingers so that the cut blank may be transferred to the first die working station.

In the operation of this invention a suitable inert gas is admitted into enclosure 24 through inlet pipe 32 and is therefrom admitted to tubes 20 and 26 and into insert 50. Suitable electrical connections are preferably made to each of induction coil 28 and resistance heater 34 whereby the chamber within tube 26 is raised to a predetermined temperature. Thereafter stock material is fed through rollers 18 from a supply reel or other source into tube 20 wherein the stock is quickly heated by induction coil 28. The outer periphery of the stock material in initially heated to greater temperatures than the inner core and as the stock is moved axially along tube 20 into tube 26, the soaking or heat flow from the periphery to the core in the stock piece effects a uniform temperature throughout the piece. The stock piece is advanced from within tube 20 to the region within tube 26 wherein the heat generated by resistance heater 34 retains the stock piece at a temperature substantially equivalent to the temperature assumed thereby after completion of its soaking. Purely as an example, in the operation of this invention under one set of conditions, having regard for the size and type of stock material, the operation to be performed thereon and the like, the stock piece is advanced through tube 20 at a rate whereby the temperature of the outer portion of the piece is raised to a point within the range of 1400° F. to 1600° F. and the temperature within tube 26 is maintained from 1000° to 1200°. Subsequent to induction heating of the stock piece a heat distribution takes place therein whereby the same assumes an even temperature throughout, which is within the temperature range of tube 26. Accordingly, the primary function of tube 26 is to merely maintain the temperature of the stock piece as the same advances to shear 12 from within tube 20.

As the stock piece advances along tube 26 it enters the hollow of insert 50 in plate 48 and the hollow of insert 54 in shear block 52 when the same is in alignment with insert 50. The advancement of the stock piece within these inserts is limited by stock gauge 56.

Suitable mechanism as in said Clouse patent is operative to impart a reciprocating sliding movement to shear block 52 whereby the stock piece may be severed at the junction of inserts 50 and 54. Subsequent to ejection of the severed piece for working thereof, the shear block 52 is returnable to receive another length of the stock piece that was conditioned in the manner described. Suitable mechanism as in the aforesaid Clouse patent may be provided for advancing rollers 18 upon the return of shear block 52 in automatic timed relationship whereby conditioning, severing and advancing of the stock takes place in a continuous, orderly sequence to produce a multiplicity of pieces for working.

It is noted that in all stages of heating and conditioning of the stock material the same is in an atmosphere of an inert gas and that the stock piece by virtue of the proximity of the conditioner to the shear is not subjected or exposed to cold atmosphere or cold parts in its advancement from the conditioner to the shear. Advantages resulting from these features are the freedom from scale forming influences on the stock piece during heating and during transfer to the shear and the obviating of need for heating the stock material to higher temperatures to allow for cooling of the same in its transfer from heater to shear. Scale formation being minimized the damaging effect to the working dies is similarly minimized.

Having thus described this invention in such full, clear, concise and exact terms as to enable any person skilled in the art to which it pertains to make and use the same, and having set forth the best mode contemplated of

carrying out this invention, I state that the subject matter which I regard as being my invention is particularly pointed out and distinctly claimed in what is claimed, it being understood that equivalents or modifications of, or substitutions for, parts of the above specifically described embodiment of the invention may be made without departing from the scope of the invention as set forth in what is claimed.

I claim:

1. In combination, a header having a bed frame and a pair of co-operating feed rolls mounted on the bed frame for intermittently advancing stock into the header, a shear and a stock gauge, means to heat the stock between the feed rolls and the shear comprising a pair of abutting co-axially aligned tubes carried by the bed frame and proportioned to loosely surround the stock between the feed rolls and the shear, induction heating means on that tube adjacent the feed rolls and resistance heating means on the tube adjacent the shear, and means to introduce an inert gas into the tubes at the junction of the tubes, said resistance heating means being provided with a cylindrical thermo-insulating unit to confine the heat to the tube adjacent the shear and said thermo-insulating unit having a cooling coil surrounding the same to prevent the heating of the bed frame.

2. In combination with a metal working apparatus having a bed frame and shear means for shearing stock material entering the bed frame, a first enclosure for receiving a piece of stock, an induction heater surrounding said enclosure for heating the same to a predetermined temperature, a second enclosure in alignment with the first enclosure, said second enclosure being disposed within said bed frame, an electrical heating element coiled about said second enclosure for heating the space therein to a temperature below said predetermined temperature, insulating means and means for circulating a coolant around said second enclosure to prevent transfer of heat from said second enclosure to said bed frame, and a pair of rolls for advancing stock material progressively through said first and second chambers to said shear means whereby actuation of the shear produces cut lengths of scale-free stock for working in said apparatus.

3. Metal conditioning and shearing apparatus comprising a bed frame, a tubular opening in the bed frame, a shear mounted for reciprocation transversely of said opening, said shear having an opening therein adapted to be aligned with the tubular opening of the bed frame at one end of the shear reciprocation, a stock material conditioning device having a first enclosure with an induction heating coil surrounding the enclosure, a second enclosure disposed in the said tubular opening in the bed frame and having a heating coil therein, means including an insulator and cooling coil for preventing transfer of heat from said second enclosure to said bed frame, means for delivering an inert gas to said enclosures whereby stock material being advanced therethrough is within an inert atmosphere during the heating of the stock, and means for advancing said stock material through said enclosure to said shear whereby scaling and cooling of said stock is prevented prior to the shearing of the stock.

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