Oct. 15, 1935. J. H. FRIEDMAN 2,017,309

METHOD OF AND APPARATUS FOR MANUFACTURE OF BOLTS, RIVETS AND LIKE ARTICLES

Filed May 4, 1934 2 Sheets-Sheet 1

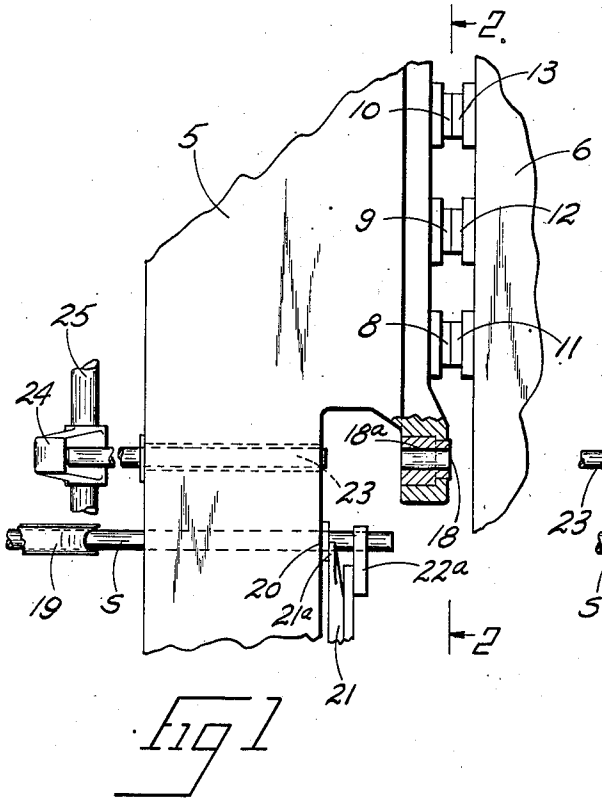

Fig 1

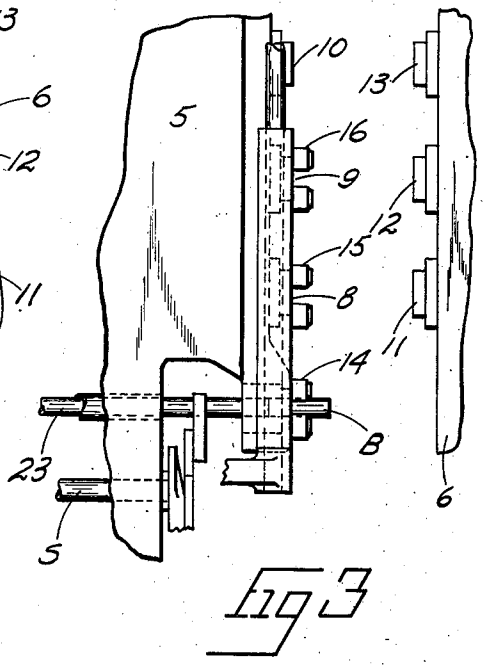

Fig 3

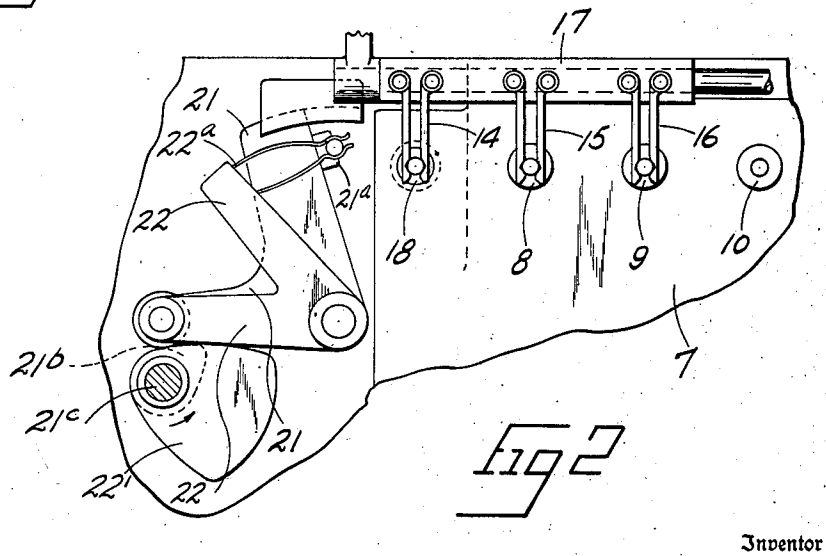

Fig 2

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METHOD OF AND APPARATUS FOR MANUFACTURE OF BOLTS, RIVETS AND LIKE ARTICLES

Filed May 4, 1934 2 Sheets-Sheet 2

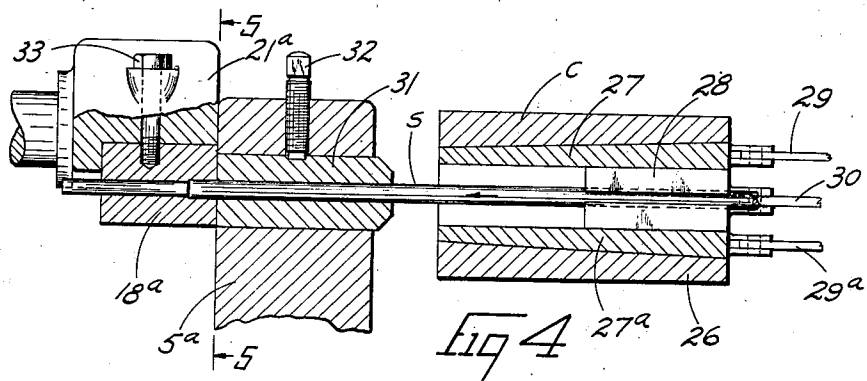

Fig 4

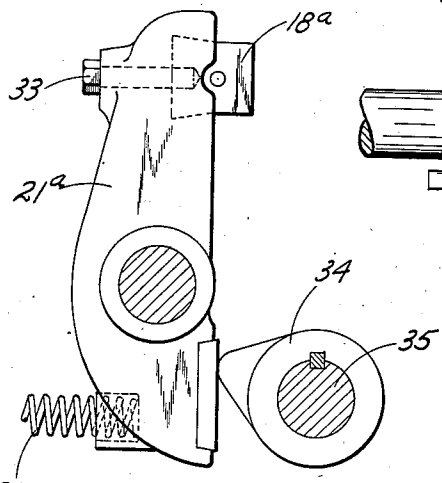

Fig 5

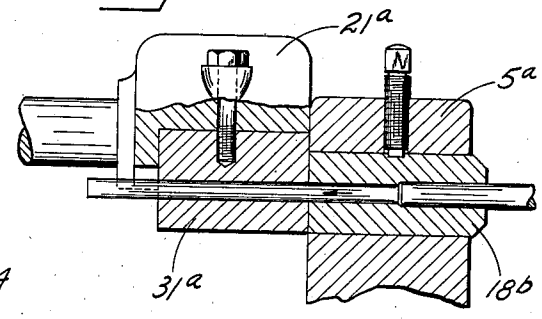

Fig 7

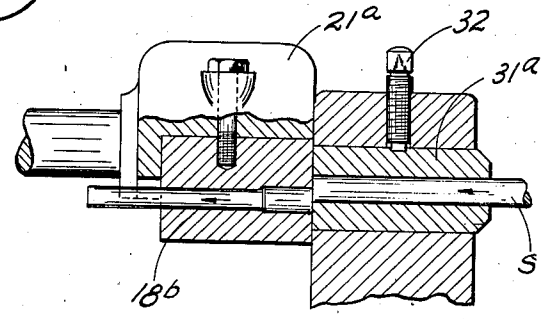

Fig 8

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UNITED STATES PATENT OFFICE

2,017,309

METHOD OF AND APPARATUS FOR MANUFACTURE OF BOLTS, RIVETS, AND LIKE ARTICLES

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Application May 4, 1934, Serial No. 723,933

12 Claims. (Cl. 10—27)

This invention relates to the manufacture of bolts, nuts, rivets and like metal articles which are shaped from suitable blank lengths sheared from wire or rod stock and then subjected to an upsetting or forging operation.

In the manufacture of bolts and nuts by cold working, it has been customary to purchase rolls of drawn wire stock which is first sheared into suitable lengths for blanks and then subjected to upsetting or forging operations. The wire stock is manufactured by hot rolling substantially to size, producing what is generally known as hot rolled rod stock, and then drawing the rod stock in the usual manner in wire drawing machines to accurately size and finish the stock. The hot rolled rod stock is substantially cheaper than the drawn wire stock, but is not satisfactory for use in cold headers for making bolts, or machines for making nuts by cold working, due to variations in size and shape and surface imperfections. Intermediate handling of the material between the drawing operation and the upsetting operations is necessitated by the fact that the wire drawing machines operate continuously whereas the bolt and upsetting machines, which commonly embody or are associated with shears for severing the material into blanks of the desired size, operate with an intermittent stop feed. As a result, it is necessary to coil the wire as it leaves the drawing machine and feed the wire to the upsetting machines from the coils so formed.

The present invention is directed primarily to a process permitting the elimination of the usual wire drawing operation and intermediate handling so that bolts, nuts and the like may be made by cold working directly from continuous lengths of hot rolled rod stock, and apparatus for carrying out this process. Generally speaking, the process of the present invention consists in sizing and finishing the rough rod stock by intermittent extrusion or drawing in timed relation to the shearing of the stock into blanks to be upset, and also preferably in timed relation to the upsetting of the blanks. Specifically, my invention includes as alternative embodiments the shearing off of blanks from the continuous rod stock, forcing the blanks through an extrusion die and feeding the same to the upsetting dies; or feeding the rough rod stock through a pair of aligned bushes, one of which acts to extrude or draw the stock, moving the bushes relative to each other to shear off a blank and subsequently upsetting the blanks. Other features of the process of my invention which may be utilized either in combination, as in the preferred embodiment, or independently with other operations, include the completion of the shearing, sizing and finishing operations by forcing a sheared blank through the various parts of the apparatus by the advancing end of the next blank or the stock, and generally, the intermittent feeding of stock through a sizing and reducing die by the feeding means for the shear mechanism operating in timed relation to the shear mechanism. My invention also includes in its preferred embodiment for the manufacture of bolts, shearing off blanks from continuous rod stock, transferring the blanks into alignment with an extrusion die, forcing the blanks through the extrusion die by an ejector operating in timed relation to the ejectors for the upsetting dies, transferring the extruded blank to the upsetting dies, and completing the formation of the bolt blank by cold heading, preferably in the manner disclosed in the copending application of Earl R. Frost, Serial No. 639,054, filed October 24, 1932. Subject matter relating to the present invention is disclosed and claimed in the co-pending application of Norman W. Cummins, Serial No. 583,421, filed December 28, 1931.

My invention also includes the combination of any of the above embodiments of the process of reducing rod stock and shearing off finished blanks with the steps of extruding the portion of the blank to the pitch diameter of the threads to be rolled thereon and upsetting the head of the blank either by single or double extrusion as disclosed in the above referred to application of Earl R. Frost.

Among the advantages of my invention are, economy of manufacture resulting from the elimination of the cost of separate wire drawing machinery and intermediate handling of the material, the removal of any roughening of the end of the sheared blanks resulting from the shearing operation when the drawing or extrusion is performed subsequently to the shearing, and greater accuracy resulting from the correlation of one machine of the sizing and finishing dies and the shearing and upsetting dies.

The drawings illustrate certain types of apparatus which may be used for carrying out the method, and wherein:

Figure 1 is a fragmentary plan view of the forward extremity of a bolt-making machine, showing means for feeding rough stock into the machine, shearing the stock into blanks, extruding the blanks and thereafter forming the blanks into the desired shape, the header slide being in advanced position;

Figure 2 is a view in elevation of the apparatus

of Figure 1 taken on the line 2—2 of the latter figure;

Figure 3 is a view similar to Figure 1, showing the parts in the positions they assume when the header slide is retracted;

Figure 4 is a central longitudinal sectional view through a stock shear or cut-off arm having an extrusion bush therein, a coacting stationary guide bush, and stock-advancing or feeding mechanism;

Figure 5 is a view in end elevation of Figure 4 as indicated by the line 5—5 of the latter figure;

Figure 6 is a sectional view of the shear bush and guide bush of Figure 4, showing the parts in cut-off or shearing position;

Figure 7 is a central longitudinal section through a shear bush and extrusion bush showing a reversal of parts relatively to Figure 4.

The apparatus for practicing the method of this invention is illustrated in Figures 1, 2 and 3 in conjunction with fragmentary portions of a bolt making machine of the type disclosed in the said application, Serial No. 639,054, filed October 22, 1932, solely by way of illustration, and not as a limitation. In these figures, 5 designates a bed frame, 6 a header slide, and 7 a die breast in which are mounted dies 8, 9 and 10. The die 8 is an extrusion die into which bolt blanks are pressed by a punch 11 on the header slide to extrude the shank portion of the blanks; the die 9 is also an extrusion die for extruding the thread-receiving portion of the bolt shank which is pressed into the die by a punch 12 on the header slide 6, which also heads the previously unextruded portion of the blank; while the die 10 is a holding die which co-operates with a hollow trimming punch 13 on the header slide, which trims the upset heads of the blanks to the desired polygonal form. Suitable mechanism is provided to transfer blanks from the position to which they are fed at the completion of the sizing operation to the first die 8, then to the die 9 and finally to the die 10. Any desired type of transfer mechanism may be used, such for example as that shown in the aforesaid application of Frost or the transfer mechanism illustrated and claimed in the co-pending application of William L. Clouse, Serial No. 670,108, filed May 9, 1933. The transfer mechanism is indicated by the pairs of spring-closed fingers 14, 15 and 16 mounted on a horizontally and vertically movable carriage 17. The carriage 17 may be actuated by any suitable mechanism, not shown, but which can be readily understood by referring to the co-pending application noted above.

In the apparatus illustrated in Figures 1, 2 and 3, rough hot rolled rod stock S is fed by feeding rolls, a fragment of which is shown at 19, through the frame of the machine, and through a suitable guide bushing 20.

When the desired length of stock to form a blank has been advanced through the bushing 20, the forward motion of the stock ceases and the blank is sheared off by any suitable type of shear mechanism. As illustrated, an oscillating arm 21, carrying a knife 21*a*, is rocked by means of a cam 21*b* through a sufficient distance to shear off the blank from the stock. An oscillating arm 22, mounted concentrically with the arm 21, is operated by a separate cam 22' and advances with the cut-off arm 21. Spring fingers 22*a* are mounted upon the arm 22 and positioned to grip the projecting end of the stock and hold the blank when it has been cut off. When the arm 21 has advanced a sufficient distance to sever the blank it is allowed to return to its initial position. The severed blank remains gripped in the fingers 22*a* and the arm 22 continues to rock until the blank carried thereby is aligned with the extrusion die or bushing 18. During the shearing action and the transferring of the blank by the fingers 22*a* into alignment with the die 18, the header slide 6 has been advancing. As the header slide starts to recede, a push rod 23 aligned with the die 18 is pressed forwardly by a lever 24 mounted on the shaft 25, forcing the blank held by the fingers 22*a* into the die. During this time the stock S is again fed forwardly through the guide bushing 20. As soon as the blank held by the fingers 22*a* has entered the die or bushing 18, the arm 22 is retracted allowing the fingers 22*a* to snap off of the blank. The stock having been fed forwardly between the spaced ends of the fingers 22*a* adjacent the arm 22, as the arm returns to the position shown in Figure 2, the fingers 22*a* snap over the end of the stock in position to grip the same when the end is severed during the next cycle of operation of the cut-off arm 21. When the header slide 6 completes its rearward movement and again starts forwardly, the two arms 21 and 22 are again actuated together to cut off the projecting end of the stock and carry the same over into alignment with the die 18. The push rod 23 preferably extends only a short distance into the extrusion die 18 and is then withdrawn. When the next blank is aligned with the die, the forward end of the blank pushes the preceding blank completely through and out of the die 18. As this movement is completed, the transfer fingers 14 are pushed in front of and in alignment with the die 18 and receive the blank ejected therefrom. As soon as the blank is ejected from the die 18 between the fingers 14, the transfer mechanism operates to carry the fingers 14 into alignment with the die 8, at which point the blank is held until the header slide on its next advancing movement presses the blank into the die 8.

The die 18 is constructed with a reduced shoulder 18*a* preferably intermediate its length so that as a blank is pressed through the die it is extruded slightly to reduce the blank to correct size and shape, and remove any surface imperfections. During this operation any rough edges or projections formed on the end of the blank by the shearing operation are removed and forced into alignment with the external cylindrical surface of the extruded blank. When the invention is employed in connection with the type of machine disclosed in the aforesaid co-pending application of Earl R. Frost, or with any other multiple die machine, the blank after being acted upon by the punch 11 in the die 8 is ejected from the die 8 when the header slide recedes and is transferred by the fingers 15 to the die 9. Similarly the blank ejected from the die 9 is then transferred by the fingers 16 to the die 10. All of these operations take place during each stroke of the header slide so that when the header slide advances a new blank is sheared off and the three blanks held by these fingers 14, 15 and 16 are pressed into the dies 8, 9 and 10, respectively, and as the header slide recedes the blanks are ejected from the dies 8, 9 and 10 and the push rod 23 simultaneously operates to complete the extrusion of the blank positioned in the die 18 by pressing the next blank into the die. At this time the fingers 14, 15 and 16 are in alignment with the dies 18, 8 and 9 respectively, and receive the blanks ejected from these dies and carry each blank to the next die position.

It will be understood, of course, that the die 8 to which the blank is carried from the extrusion die 18 could be of any suitable type and could be the blank-receiving die of a single stage heading machine. Similarly, in the case of the manufacture of other articles than bolts, the dies to which the blanks are transferred after being extruded through the extrusion die may be of any type necessary to carry out the desired operations.

It will be seen that the finished article is made directly from rough hot rolled rod stock in one continuous process. Since the drawing or extruding of the stock is accomplished in the extrusion bush 12, the wear on this bushing will be uniform with respect to the die 8. Furthermore, labor incident to the separate drawing operation is entirely dispensed with.

In Figure 4, the rod stock S is intermittently advanced by a clutch type feeding mechanism, generally indicated at C, and comprising a housing 26, reciprocating wedges 27 and 27*a*, and clutch blocks 28 which move with the reciprocating wedges 27 and 27*a*. Connecting rods 29, 29*a* and 30 are operatively connected to the clutch wedges 27 and 27*a* and the blocks 28 extend to suitable actuating cam mechanism, not shown. As the clutch wedges 27 and 27*a* move forward, they exert a wedging action on the blocks 28 which grip the stock and carry it forward the desired length of the blank. On the return stroke, the wedges 27, 27*a* release the blocks 28 and the latter are returned to retracted position through suitable means acting on the connecting rod 30. This type of feed is accurate and dispenses with the conventional stock gauge used in most heading and bolt-making machines for accurately determining the lengths of the blanks.

In this instance, the stock is pushed through a suitable guide bush 31, held in place by means of a screw 32 in a portion 5*a* of the frame of the machine. The cut-off arm 21*a* in this instance is provided with an extrustion bush 18*a* which is held in place by means of a screw 33. In this instance, the blank is not transferred to the extrusion bush, but the cut-off arm is simply oscillated sufficiently to shear the blank and is then returned to its original position to bring the extrustion bush 18*a* back into alignment with the guide bush 31. The means for oscillating the arm is shown in Figure 5 and consists of a cam 34 mounted on a cam shaft 35, a spring 36 serving to return the arm to its original position.

It will be noted that in this instance the stock is intermittently advanced by the clutch mechanism generally indicated at C, which mechanism replaces the push rod 23 and cam 24 in Figure 1. As the stock is pushed through the guide bush 31 and extrusion bush 18*a*, the cut-off arm 21*a* is oscillated by means of cam 34 and moves to a position substantially as shown in Figure 6 to shear the blank. The arm 21*a* then moves back to the position shown in Figure 4 in alignment with the bush 31, and the next forward advance of the stock pushes the blank through the extrusion die ready to be taken by the transfer fingers 14 shown in Figure 2. This method of shearing and extruding has the advantage in that it cuts the ends of the blank flush and does not leave any irregular contours around the end of the blank ordinarily caused by shearing in the conventional type of heading or forging machine.

In Figure 7, the method is substantially the same as in Figure 4, with the exception that the extrusion bush 18*b* is held stationary while the guide bush 31*a* is carried by the shearing or cut-off arm 21*a*. The means for advancing the stock may be substantially the same as that shown at C in Figure 4, and likewise the means for oscillating the cut-off arm may be the same as that shown in Figure 5.

The foregoing mechanisms are illustrative of various forms of means for carrying out the method, it being understood that these mechanisms may be varied within the scope of the invention as defined by the appended claims.

I claim:

1. In the manufacture of bolts, rivets and like metal articles, the process which consists in the steps of shearing rough wire or rod stock into suitable blank lengths, passing the blanks completely through a reducing die to obtain the desired blank diameter, and upsetting the blanks to head the latter.

2. In the manufacture of bolts, rivets and like metal articles, the process which consists in forcefully passing rough hot rolled wire or rod stock through aligned guide and extrusion bushings, moving one bushing relatively to the other to shear the stock into suitable blank lengths, and then upsetting the blanks to head the latter.

3. In the manufacture of bolts, rivets and like metal articles, the process which consists in forcefully advancing rough hot rolled wire or rod stock through aligned guide and extrusion bushings, interrupting the advance of the stock and moving one bushing relatively to the other to shear the stock into suitable blank lengths, then moving the bushings back into alignment and ejecting the reduced and sheared blank by advancing the stock, and then upsetting the blank to head the latter.

4. In a bolt making machine, a guide bush, means for passing rough wire or rod stock through said bush, a bushing or die for reducing the stock to the desired bolt blank diameter, means co-acting with said guide bush for shearing the stock into suitable blank lengths and for transferring the blanks to a position in alignment with said die, means for extruding the blank through said die, and means for upsetting the blank.

5. In a bolt making machine, a shear, an extrusion or drawing die carried by said shear, a guide bush adapted to co-act with said die and shear, means for advancing rough wire or rod stock through said bush and die, means for actuating said shear to sever the stock into suitable blank lengths, and means for upsetting the blanks.

6. The method of producing cold upset products which comprises intermittently feeding a predetermined distance, substantially round hot rod-stock of indefinite length and having a greater cross-sectional area than the cross-sectional area of the body of the finished products, successively transversely cutting off sections of the fed stock, extruding and reducing the cross-sectional area of the entire length of the cut-off sections, transferring said reduced cut sections transversely to other instrumentalities and operating on the cut sections by exerting pressure longitudinally thereon.

7. The method of producing cold upset products which comprises intermittently feeding a predetermined distance, rod stock of indeterminate length having a greater cross sectional area than the cross sectional area of the body of the finished products, acting on said rod stock to form cut-off blanks extruded throughout their length and transferring said blanks to other in-

strumentalities and working the blanks in said instrumentalities by exerting pressure longitudinally thereon.

8. A unitary machine for producing a cold formed product directly from crude rod stock of indeterminate length, a movable sizing die, means to effect a relative movement between said die and stock to reduce the diameter of the stock, means for cutting off portions of said stock and means for transferring cut-off portions to other instrumentalities for further treatment before delivery from said machine, each of the said three means being an organized part of said unitary machine.

9. In a bolt making machine, a stock guiding bush, a shear member having a bore therein arranged to be aligned with said stock guiding bush, an extrusion die in said shear bore spaced from the shearing face of the member, means to move stock through said bush and shear, means to actuate said shear member and cut off a bolt blank extruded through a portion of its length and means to move said blank through said extrusion die to produce a blank extruded throughout its length.

10. The method of producing cold upset products which comprises intermittently feeding a predetermined distance, substantially round hot rod-stock of indefinite length and having a greater cross-sectional area than the cross-sectional area of the body of the finished products, successively transversely cutting off sections of the fed stock, extruding and reducing the cross-sectional area of the entire length of the cut-off sections, transferring said reduced cut sections and further extruding a portion of the cut section and upsetting a head upon a portion of the cut section.

11. In the manufacture of bolts from elongated wire or rod material the process which comprises shearing the material to obtain the desired blank length and extruding the entire blank to the desired blank diameter, further extruding the resulting extruded and sheared blank to form a thread receiving portion thereon, and upsetting the blank to form a head thereon.

12. A unitary machine for producing a cold formed product directly from elongated rod or wire stock material, means to shear said material into blank lengths and means to extrude said material to uniform blank diameter throughout its length, means to transfer the extruded cut off blanks to work stations, reciprocating tools to work said blanks at said work stations, said shearing means and said extruding means operating in timed relation to said reciprocating tools.

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