

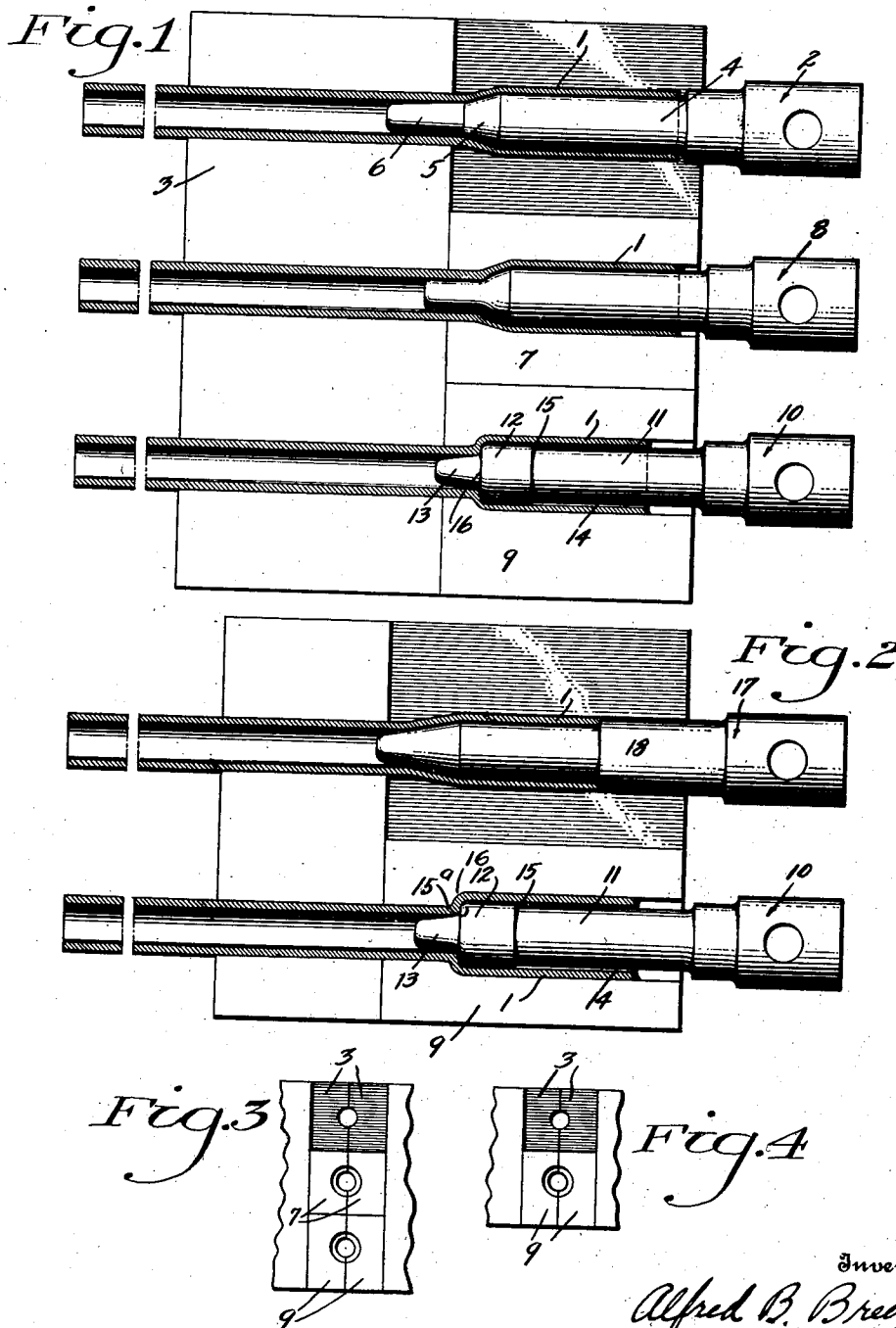
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TUBE EXPANDING AND COMPRESSING TOOL

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TUBE EXPANDING AND COMPRESSING TOOL.

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To all whom it may concern:

Be it known that I, ALFRED B. BREEZE, a citizen of the United States, and residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented a new and useful Improvement in Tube Expanding and Compressing Tools, of which the following specification is a full disclosure.

This invention relates to dies and tools for enlarging and longitudinally compressing for increasing the metal thickness or upsetting the end of a tube to provide a length of tubing with an integral hub end. Tube lengths of this character are extensively used for automobile steering reach rods or drag links as connecting rods with the hub end or ends containing a bearing. A type of such product comprises the invention shown and described in Letters Patent No. 1,272,033, to Clifford Greene, dated July 9, 1918, for steering reach rod.

The exemplification of the present invention will be generally confined herein to such a product, although constituting but one of the various mechanical forms in which the principle of the invention may be used.

The dies and tools are used in connection with the process or method of enlarging or upsetting the end of a tube as made the subject-matter of the invention shown and described in the application for Letters Patent, Serial No. 476,340, to myself, filed July 9, 1921, in which the tube is preliminarily enlarged and longitudinally compressed free from the external die confinement, and to its final and finished form in a die.

It is desirable to form drag links, reach rods, tongue arms, radius rods, and similar members of the motor vehicle construction, of metal tubing, and it is also desirable that the enlarged ends required for containing a bearing and attaching the rod, be of a formation which will furnish the required metal thickness for threading, possess great strength and durability, and provide a socket and seat for the movable bearing elements.

In this capacity, the invention may be practised for forming the sockets only, comprising a stub portion of the normal diameter of the tubing and a socket portion of greater cross sectional area than the stub

portion. The stub portion may either be engaged over the end of a link length of tubing, or welded to the end of the link length, methods well known in the manufacture of reach rods or similar members of the motor vehicle construction.

The essential characteristics of the product as formed by my improved dies and tools are a great strength and durability, particularly at the junction connecting the two diameters, a wall thickness to allow for internal and external threading at the outer end of the larger diameter, so that the shell is not substantially weakened by the threading, a cylindrical surface on the inside of the increased diameter portion, for slidable bearing parts mounted within the socket, and a plane seat or shoulder surface on the inside of the tube between the two diameters. The dies and tools provide for the rapid and economical production of a socket, possessing the characteristics enumerated and the invention herein particularly relates to the tools and dies employed in the process of forming the socket, preferably for the final or finishing step. The tool is shaped to prevent freezing or wedging within the article to be upset, which would prevent the withdrawal of the tool.

To aid in a clear and comprehensive understanding of the invention, I shall describe the same in connection with the process of making a socket, forming a part of a drag link, as it is incorporated in the steering mechanism of motor vehicle constructions, and, as illustrated in the accompanying drawing, in which:

Figure 1 is a detail view illustrating the parting side of one of the die sections or halves, having a plurality of die chambers, and expanding, compressing and upsetting mandrels or tools, each tool shown in its co-operative position with its related die and performance upon the tubing, which tubing is illustrated in section.

This in a single view shows the several steps of the operation for obtaining a definitely shaped tube product, contemplating a showing of the different stages rather than the simultaneous operation upon a number of pieces of tubing.

The tube is passed from one die to a second

following in successive order which is necessary to bring it to its finished form.

In this instance the normal metal thickness of the tubing is sufficient for obtaining the desired metal thickness of the socket or enlarged end portion without longitudinally compressing the tube while expanding.

Figure 2 is a view similar to Figure 1, but showing a smaller number of tools, in which the tube is expanded and longitudinally compressed for the purpose of increasing the metal thickness of the expanded portion.

Figure 3 is a reduced end view of the separable dies shown in Figure 1.

Figure 4 is a similar view of the dies shown in Fig. 2.

The dies are of sectional form and combined as a unit and arranged in consecutive order so that the tube can be conveniently advanced from one die to a second in quick succession from the first to the last stage of forming, requiring only a single heating of the tube.

In Figure 1, for the first step, the end of the tube 1 is expanded free from external die confinement by the expanding tool 2. The tube of the required size and length is preliminarily heated to the required degree, and held between the gripping dies 3—3, with end 1, to be enlarged, extending beyond the gripping dies, and the opposite end of the tube may bear against an abutment (not shown) to prevent longitudinal movement of the tube within the dies while the tool is being forced into its end. The tool 2, for the first step, consists of a shank portion 4 of appropriate diameter, a conical head portion 5, and a tapering tool centering end 6, of a diameter which will telescope into the normal diameter of the tube without producing a tube expansion. For the second step, the tube is gripped between the gripping dies and the expanded end portion 1, engaged between the forming dies 7, 7, and an expanding tool 8, forced into the end portion 1, the tool 8 corresponding to the tool 2, except that the shank and head portions are of different or increased dimension. For the final forming operation, the tube is disposed between the gripping dies and appropriate shape-forming dies 9—9, after which a tool 10, to which the present invention is directed, is forced into the end of the socket 1.

The tool consists of a shank portion 11, a head portion 12, and a tip or tool center or end portion 13. The shank portion is of slightly less diameter than the full internal diameter the socket is to possess for its finished dimension, thus offering a clearance space 14 between the periphery of the shank and the internal surface of the socket, which allows for the escape of gases, and avoids a binding of the parts which would in-

terfere with the withdrawal of the tool. The head portion 12 is of larger diameter than the shank portion and of a diameter to produce the maximum expansion of the socket. The rear end of the head provides a shoulder 15, furnishing a circumferential edge, which serves to skive the internal surface of the socket with the return or withdrawal stroke of the tool. The forward end of the head 12 is squared and rounded at its outer edge to form a shoulder 15^a adapted to press the metal against a corresponding shoulder 16 of the die, to appropriately shoulder the interior of the socket at the juncture of the two diameters of the tube, as the tool is forced inwardly. The tip or centering end of the tool is tapered to telescope into the normal internal diameter of the tube and assist in properly shaping the tube at the juncture of the two diameters and not interfere with the withdrawal of the tool. The head of the tool, as it is forced into the tube, expands, draws and compresses or forges the metal to completely fill the die, crimping and expanding the conical portion of the tube, formed by the tool in a preceding step-forging of the same against the shouldered portion 16 of the die. The head, as it is withdrawn on the return stroke, again functions upon the tubing, due to the relative contraction of the tube and the expansion of the head, the temperature of the tube constantly decreasing while the tool absorbing the heat expands, so that its rear shoulder edge skives the surface of the tube, and, being of comparatively reduced longitudinal dimension, can be forced into the tube for quite a considerable length and withdrawn in a reverse direction of motion without freezing or becoming bound within the tube, and can be worked without lubrication.

The head, in reverse stroke of the tool, smooths the tube and renders it truly cylindrical, features highly desirable when the socket is to contain a slidably movable bearing.

Under the method shown in Figure 2, the tube end is expanded and compressed longitudinally by a tool 17, which is provided with a hammer portion 18, which strikes against the end of the tube as the tool is forced into the tube. After the tube has been initially shaped, as shown, it is subjected within a die to the action of a finishing tool 10 corresponding in construction substantially as heretofore described. The head 12 and tip 13 of the tool 10 may be removably secured upon the end of the shank portion for purposes of renewal or interchange.

Having described my invention, I claim:

In a device of the character described, comprising a separable die, and a forming tool adapted to be thrust into the end of a

tube disposed within the die, said tool having a cylindrical shank portion, and a cylindrical head portion of greater diameter than the shank portion for expanding and forming the tube, and a tapering tip extending from the forward end of the head portion, the head portion at the end toward the tip portion, providing a shoulder overhanging a shoulder of the die, for compressing the metal of the tube against the die shoulder. 10

In witness whereof, I hereunto subscribe my name.

ALFRED B. BREEZE.