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PROCESS OF MAKING REACH RODS

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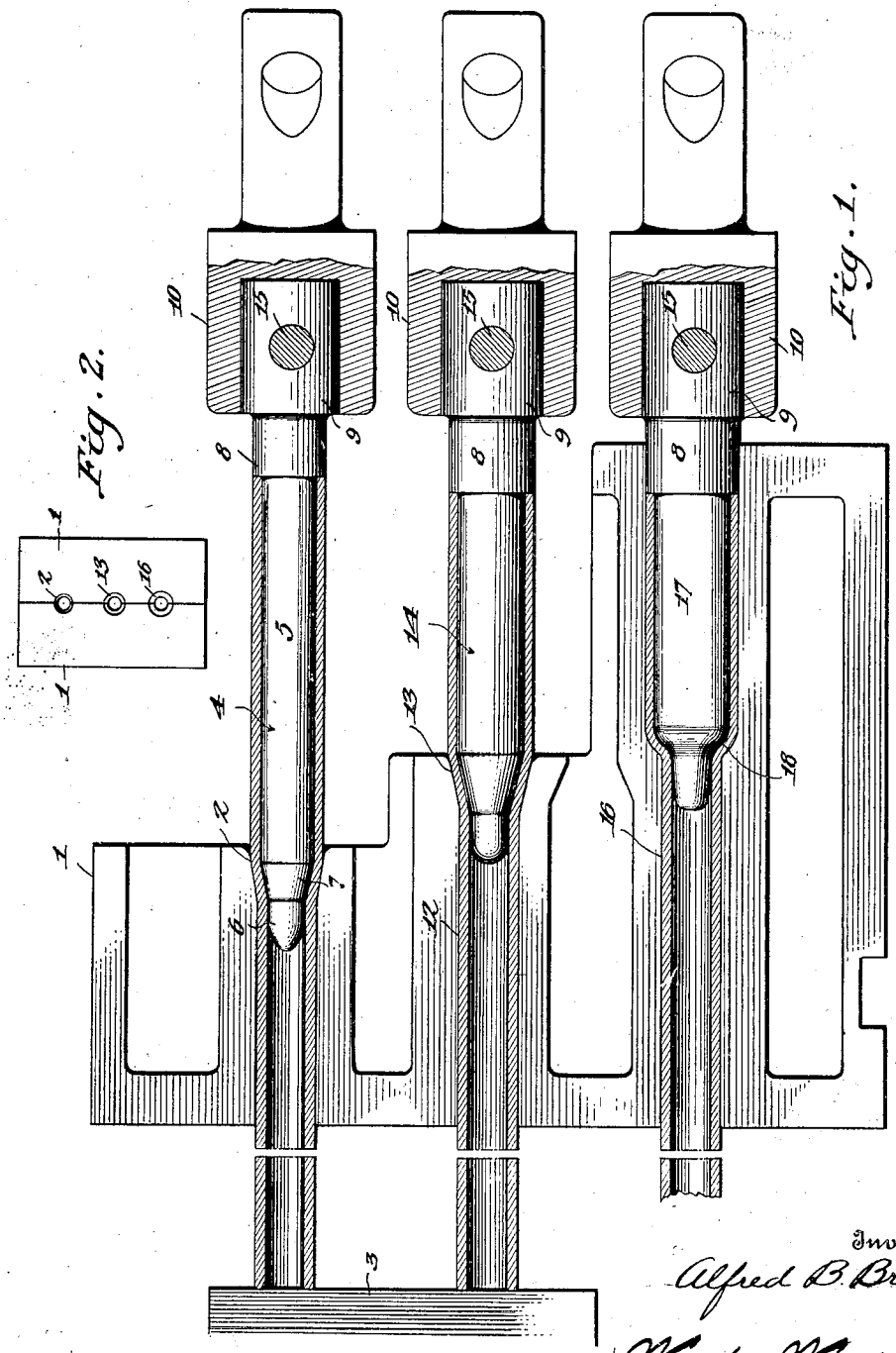


Fig. 1.

Fig. 2.

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UNITED STATES PATENT OFFICE.

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PROCESS OF MAKING REACH RODS.

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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 Processes of Making Reach Rods, of which the following specification is a full disclosure.

This invention relates to the method of producing a steering reach rod or drag link consisting of a length of tubing with one or both of its ends enlarged or expanded to provide a hub end or ends for the reception of the parts of a ball and socket joint, by compressing the hub longitudinally in the process of manufacture to increase the metal thickness reduced by expanding the tube, so that the thickness of the finished hub will be equal to or greater than the initial metal thickness of the tube.

An object therefore of this invention is to provide a method for efficiently and successfully producing the product of the invention shown and described in Letters Patent No. 1,272,033, to Clifford Greene, dated July 9, 1918, for steering reach rod.

Another object of the invention is to provide a method for expanding the end of the tube, consisting in simultaneously expanding and longitudinally compressing an end of the tube and producing the desired degree of expansion and longitudinal compression in gradations from the normal tube dimension to its finished proportions, by a number of operations following in quick succession.

Other features and advantages of the invention will be more fully revealed in the following description of the accompanying drawings, forming a part of this specification, and in the drawings like characters of reference denote corresponding parts throughout the several views, of which:

Fig. 1 is a detail view illustrating the parting side of one of the die halves, having three die chambers, expanding and compressing mandrels and their respective holders or chucks in operative position within a tube showing their respective functions.

Fig. 2 is a reduced end view of the separable dies.

The drawings illustrate the dies, for the several operations, as of a unitary structure, a section of tubing being shown in each die, which is principally for the purpose of illustrating in a single view each step of the operation for expanding and compressing the tube end to the desired proportions for a definite final form, rather than a showing of performing the different stages upon a plurality of pieces of tubing in a single stroke of the machine.

The dies are arranged in a consecutive order in the unit so that the tube can be conveniently advanced from one die to the second, in quick succession, and so that the tube preliminarily need only be subjected to a single heating.

The tubing of the required size and length is heated at the end to be operated upon to a forging heat of 1500° to 1800° F., whereupon it is placed between the sections of the gripping dies 1, 1. The die has a bore approximately corresponding to the diameter of the tube which develops into a forward conical or outwardly tapering end 2. The rear or cool end of the tube is engaged against a stationary abutment 3, to prevent longitudinal movement of the tube when the expanding mandrel 4 is forced into the heated end of the tube, projecting beyond the die. The expanding mandrel consists of a shank portion 5 of an appropriate diameter of slightly larger diameter than the normal inner diameter of the tube to be expanded. The forward end of the mandrel is provided with a conical head 6 slightly tapered and somewhat smaller than the internal diameter of the tubing, and an intermediate tapering portion 7 between the head 6 and the forward end of the shank portion 5. At the rear end of the shank the mandrel is provided with enlarged diameter hammer portions 8 of a diameter approximately equal to the outside diameter of the tubing, after the first expanding operation. The chucking end 9 of the expanding mandrel is socketed and fixed within a stock 10, which is suitably mounted within the reciprocating head stock of the forging machine, (not shown). In the first expanding operation, the tube end is extended for the approximate length required for the finished product, beyond the end of the die, leaving such portion substantially free from any external die clamping pressure while the expanding mandrel is forced into the end of the tube. The mandrel is forced into

the tube to a depth to bring its head end and tapered portion within the bore of the die, thus centering the tube and mandrel.

The first operation is completed with a complete forward and return stroke of the expanding tool, after which the tubing is quickly removed from the first die and placed in position within the second die bore 12, which corresponds to the first die bore excepting that the forward end 13 of the die bore is of slightly greater degree of taper.

An expanding tool 14 of increased diameter and reduced length from that of the tool 4 is then forced into the end of the tube, further expanding the tube and compressing the same longitudinally. The hammer portion of the tool engages the end of the tube in the operating stroke, materially reducing the length thereof. This compressing operation increases the metal thickness of the tube previously reduced by the preceding expanding operation. The elimination of the full die impression for the first and second operations permits the free expansion of the metal, outside of the die bore and reduces greatly the strain of the die operating mechanism and prevents undue wedging of the mandrel within the tube, which latter features are important in cost and maintenance of the tools. The expanding tools are of a floating type secured in their holders respectively by a steel pin 15. This accommodates for the variations in the size of the tube and also for the vibration or play which may occur in the operating parts of the machine. A blast of air is directed upon the tubing during the forging operation for removing all loose scale to prevent its accumulation for the final operation in a full die, wherein the tube is shaped to its finished form.

After the second expanding and longitudinally compressing operation, the tube is placed in the full length die bore 16 for producing the final impression. The die configuration at the junction of the two different diameters is of ogee outline in cross section to produce a more abrupt or shouldered effect in the finished product. The expanding mandrel or tool 17 corresponds as to elements with the expanding tool for the first and second operations, but of a dimension necessary for the final shaping of the product within a full die. The expanding tool has a more extensive head than the tools for the first and second operations and slightly tapered with a more blunt rounded end, thus reaching further into the non-expanded portion of the tube, so that such portion of the tube is not distorted in the final pressing. The hammer of the tool telescopically moves into the end of the die as a piston or plunger, thus confining all of the expanded tube material in the die bore space between the die and expanding tool. The tool in the third step advances into the die within the partially expanded tube and expands the same to its finished size, compresses the wall of the tube the desired or proper gauge, and at the end of the forward stroke shapes the metal between the two diameters exactly the shape of the die, as at 18. The tube in the final operation need not necessarily be engaged against an end abutment, as it has a tendency toward forward movement when the metal is forged to a more acute angle, or bends over the tapering or conical configuration given to it in the previous operation.

The head or leader on the end of each tool serves as a guide, and being tapered slightly and somewhat smaller than the inside diameter of the tubing, prevents any accumulation and compression of air or gas, within the tube which would distort the wall of the tubing. The air or gas freely escapes through the spacing between the head of the tool and tube to and through the open opposite end of the tube.

The exact length of the hub or socket is calculated by the length of the shank and the shoulder or hammer end, forcing all excess metal into the wall and seat of the tube hub. This eliminates any waste of metal from flashes or overflow and strengthens the walls of the hub.

As the metal thickness of the tube is reduced by expanding the tube, it is again increased by longitudinal compression, so that the hub portion may present a metal thickness equal to a greater than the normal metal thickness of the tube. Thus the enlarged portion may possess equal or greater strength than the metal of normal tube dimension, or the metal thickness may be increased solely for the purpose of cutting screw threads therein, either externally or internally for receiving a cap or plug as a closure for the end of the hub.

As the several steps or operations follow each other in quick succession, a single heating of the tube is sufficient, and the employment of only end impression dies for several of the operations, leaves the major portion of the expanding metal free externally, so that its heat is not reduced by contact with a cold wall or die wall, which would result in a shrinkage and binding the tube upon the expanding tool.

A tube constructed in this manner provides an integral structure made from a single length of tubing, eliminating the welding together of two pieces, as now generally practised, and provides a very smooth and uniform diameter and inner surface.

This process enables the use of comparatively light weight tubing for the intermediate portion, which would not be adaptable for making a similar device under the prevailing methods, nor could the same be

satisfactorily employed by merely expanding the tube, which would leave its metal thickness too weak and thin.

It is necessary to swab the dies and tools with a lubricant for each operation.

Having described my invention, I claim:

1. The method of expanding the end of a tube consisting in holding the tube within a clamping device, with the end to be expanded extending free therefrom and in a heated state expanding said extended end in gradual degrees from the normal tube diameter to a determined enlarged diameter by forcing different dimension forging tools successively into the end of the tube and within and against a die at the juncture between the normal and clamped dimensions.

2. The method of expanding the end of a tube consisting in externally holding the tube within a clamping device with the end in a heated state extending free therefrom expanding the free end part in gradual degree by different dimension forging tools successively forced into the tube end and expanding the same in final shape within a die.

3. The method of forging the end of a tube consisting in expanding the end of the tube circumferentially and free from any external confinement and compressing the same longitudinally in an operation and from the normal tube dimension to a determined finished shape and dimension by a number of consecutive operations for a development in gradual proportions.

4. The method of forging the end of a tube consisting in expanding the end of the tube circumferentially and free from any external confinement and compressing the same longitudinally in an operation and from the normal tube dimension to a determined finished shape and dimension by a number of consecutive operations for a development in gradual proportions and finally expanding and longitudinally compressing the partially shaped product in a die.

5. The method of forging the end of a tube consisting in forcing the expanding tools of different proportion in seriatim into the heated externally non-confined end of the tube and against an end die for shaping the flare from the normal to the expanded diameter, and finally expanding and longitudinally compressing the partially shaped product complete in a die.

6. The method of expanding the end of a tube consisting in forcing a tube expanding tool into the end of the tube, with the tube end for the length to be expanded free from external confinement and subsequently in forcing an expanding tool into the end of the tube confined within a die.

7. The method of expanding and upsetting the end of the tube consisting in forcing a tube expanding tool into and against the end of the tube with the tube end for the length to be expanded free from external confinement, and in subsequently forcing a tool into and against the end of the tube while confined within a die.

8. The method of expanding the end of a tube consisting in holding the tube within a die with the end to be expanded extending from the die and free from external confinement, forcing a tube expanding tool into said extended end of the tube and against a die at the intermediate portion between the normal and expanded diameters of the tube, and subsequently forcing a second tube expanding tool into the expanded portion of the tube while confined in a die.

9. The method of expanding and upsetting the end of a tube, consisting in holding the tube within a die with the end portion to be expanded extending from the die and free from external confinement, forcing a tube expanding tool into and against the end of said extended end of the tube, expanding and compressing the same and the tool cooperating with the die to shape the tube at the intermediate portion between the normal ,and expanded diameters thereof and expanding and compressing the partially shaped end while confined within a die.

10. The method of expanding the end of a tube consisting in nominally expanding the tube by forcing a tool into the end of the tube, with the tube for the expanded length being free from external die confinement and finally by forcing a tool into said nominally expanded portion with the tube confined within a die.

In witness whereof, I hereunto subscribe my name, as attested by the two subscribing witnesses.

ALFRED B. BREEZE.

Witnesses:
L. A. Beck,
H. E. Burdge.