Oct. 17, 1933. J. KEMP 1,931,352

APPARATUS FOR DRAWING METAL TUBES

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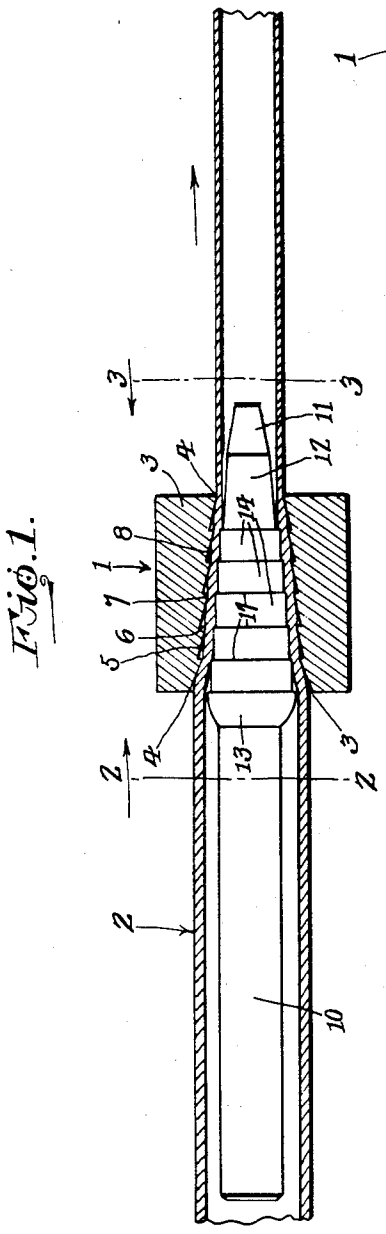


Fig. 1.

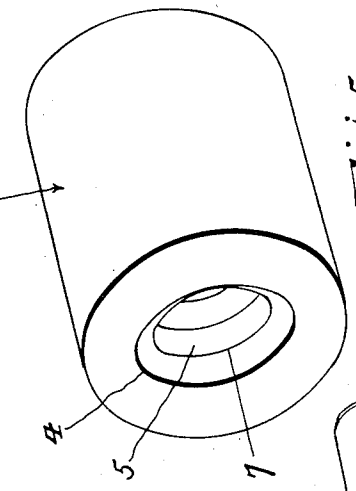


Fig. 5.

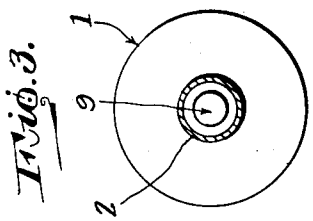


Fig. 3.

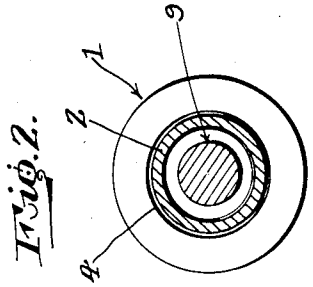


Fig. 2.

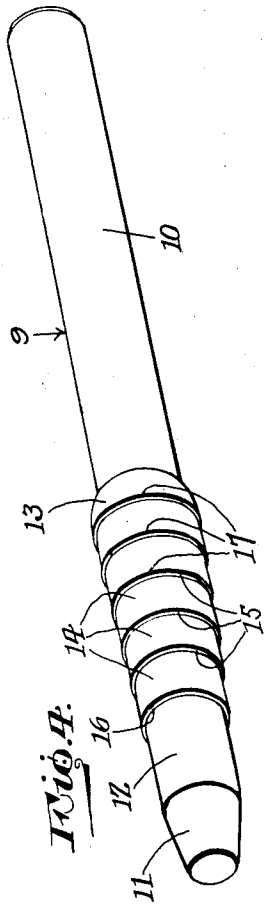


Fig. 4.

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APPARATUS FOR DRAWING METAL TUBES

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8 Claims. (Cl. 205—7)

This invention relates to a certain new and useful apparatus for drawing metal tubes, and has for its object to provide, in a manner as hereinafter set forth, an apparatus of the class referred to, so constructed and arranged as to attain at all times a thoroughly efficient drawing of the tube; to eliminate breakage of the tube during the drawing thereof; to reduce to a minimum missing, chatters, flivvers, and scratches in the tube and packing of the metal in the apparatus during operation of the latter; and obtaining a material saving in time, labor and material by effecting the same result in one drawing operation as was heretofore accomplished in two or more such operations.

Further objects of the invention are to provide, in a manner as hereinafter set forth, a tube drawing apparatus for effecting a gradual reduction in tubes and which is simple in its construction and arrangement, strong, unusually durable, compact, thoroughly efficient in its use, readily assembled, and comparatively inexpensive to manufacture.

With the foregoing and other objects in view, the invention consists in the novel construction, combination and arrangement of parts as hereinafter more specifically described and illustrated in the accompanying drawing wherein is shown an embodiment of the invention, but it is to be understood that changes, variations and modifications can be resorted to which fall within the scope of the invention as claimed.

In the drawing wherein like numerals throughout the several views denote corresponding parts:

Figure 1 is a sectional elevation showing the adaptation of the apparatus with respect to the tube during the drawing operation.

Figure 2 is a section on line 2—2 Figure 1.

Figure 3 is a section on line 3—3 Figure 1.

Figure 4 is a perspective view of a mandrel forming one of the elements of the apparatus.

Figure 5 is a side elevation of a die forming the other element of the apparatus.

Referring to the drawing in detail, the apparatus includes a die 1 which contacts with the exterior surface of a metal tube 2 to be gradually reduced in diameter and increased in length in a drawing operation by the apparatus in accordance with this invention.

The die 1 includes a body part 3 formed with a lengthwise extending bore increasing in diameter from one end to the other and has the end thereof of smallest diameter at the forward end of body part 3. The wall of bore 4 is formed with a series of inset successively arranged tapered pipe body reducing portions or surfaces 5 of equal length. Each follower reducing portion has a part of its length corresponding in diameter to a part of the length of an adjacent leading reducing portion and the remaining part of its length of a different diameter than that of the remaining part of the length of such adjacent leading reducing portion. The leading end of each follower reducing portion is of greater diameter than the leading end of each leading reducing portion. The leading end of each follower reducing portion is of less diameter than the follower end of each leading reducing portion thereby providing at the follower end of each leading portion a shoulder 6 which merges into the forward end of a follower portion. Each reducing portion gradually increases in diameter from its forward end to its rear end. The reducing portions 5 are disposed at such an inclination with respect to the tube 2 being drawn, as to define contact edges or points 7 and pockets 8. The function of pockets 8 is to allow for the expansion of the tube body during the drawing operation to prevent the reducing action on the tube breaking the latter.

The apparatus also includes a mandrel 9 formed with a stem 10, a tapered nose 11, a tapered gauge part 12 extended rearwardly from nose 11, a rounded tube support 13 at the forward end of the stem 10, and series of successively arranged, outset, peripheral, frusto-conical pipe body reducing portions 14 of the same length and which are arranged between part 12 and support 13. The forward or outer reducing portion 14 of said series has its leading end merge into the follower end of the gauge part 12. The leading end of support 13 merges into the follower end of the rear or inner reducing portion of said series. Each leading reducing portion 14 is of less diameter throughout than each follower portion 14 thereby providing at the rear end of each leading portion 14 a shoulder 15 which merges into the forward end of a follower portion 14. Each reducing portion 14 increases in diameter from its forward end to its rear end. The forward portion 14 of the series is of greater diameter than part 12 and between the rear end of the latter and the forward reducing portion 14 a peripheral shoulder 16 is provided. The shoulders 15 and 16 provide tube contact edges 17. The part 12 is of greater length than any one of the reducing portions 14. The leading end of support 13 is of greater diameter than the follower end of that reducing portion 14 with which support 13 merges and

it is also of greater diameter than any one of the other reducing portions of the series.

The two series of reducing portions coact to effect upon the tube a gradually tapering reduction in a successive step-like manner to provide a tube body of reduced uniform diameter as it leaves the forward end of the die.

The operation of the apparatus is as follows: the mandrel is inserted in the tube and in this relation inserted in the die. As soon as the mandrel and tube have been drawn into the die a proper distance, which is when coacting edges 7 and contact edges 17 are opposite each other, a further pull on the tube will cause the two series of reducing portions to draw or reduce and lengthen the tube gradually. As a result of the construction herein set forth each of the contact edges 7 on the die together with the pockets 6 and coacting edges 17 of the mandrel will in effect constitute separate sets of successively acting reducers for gradually reducing the diameter of a tube being drawn and extending the length thereof with such minimum of breakage in the action thereof, as to constitute a valuable step in advance in this art and which accomplishes a long sought for result.

What I claim is:—

1. An apparatus for drawing metal tubes comprising a die formed of a body part formed with a bore increasing in diameter from front to rear, the wall of said bore being provided with a series of successively arranged tapered pipe reducing portions, each gradually increasing in diameter from front to rear, the diameter at the inner end of a leading portion being less than the diameter of the front end of a follower portion thereby providing shoulders separating said portions, and a mandrel for extending into said bore and for mounting into the pipe to be drawn, said mandrel formed intermediate its ends with a series of successively arranged, peripheral outset, frusto-conical pipe body reducing portions separated by shoulders and coacting during the drawing operation with the said series of tapered portions, each of the frusto-conical portions gradually increasing in diameter from front to rear and of a different diameter throughout than the other frusto-conical partions.

2. In an apparatus for drawing metal tubes, a die including a body part formed with a bore increasing in diameter from the front end of the body part to the rear end of the latter, the wall of said bore being provided with an inset series of successively tapered portions lengthwise thereof, each gradually increasing in diameter, each follower portion having its forward end of greater diameter than the forward end of an adjacent leading portion, each follower portion having a part of its length corresponding in diameter to a part of the length of an adjacent leading portion and the remaining part of its length being of a different diameter than the remaining part of the length of such adjacent leading portion, the forward end of each follower portion being of less diameter than the rear end of a leading portion, said wall being formed with a shoulder between the forward end of each follower portion and the rear end of each leading portion, the forward portion of said series of portions having that end of smallest diameter flush with the forward end of said body part, and the rear portion of said series of portions having that end of largest diameter flush with the rear end of said body part.

3. In an apparatus for drawing metal tubes, a mandrel provided intermediate its ends with a series of peripheral, successive, outset, frusto-conical portions extending lengthwise thereof and each of the same length and gradually increasing in diameter from front to rear, each of said portions being of a different diameter throughout with respect to the others, a leading portion being of less diameter throughout than that of a follower portion, the forward end of said follower portions providing shoulders merging into the rear end of the leading portions, said mandrel having an outset curved peripheral supporting portion for the tube at the inner end of said series, a tapered gauge portion at the outer end of said series, a nose extended from said tapered portion and a stem extended rearwardly from said supporting portion.

4. In an apparatus for drawing metal tubes, a mandrel including a stem portion, a work support at the forward end of the stem portion, a tapered gauge spaced forwardly of said support and a series of peripheral successive, frusto-conical work reducing portions interposed between the leading end of the work support and the follower end of the gauge, each of said portions gradually increasing in diameter from its leading to its follower end and of a different diameter throughout with respect to the others, a leading portion being of different diameter throughout than that of a follower portion, the leading end of said follower portions providing shoulders merging into the follower end of the leading portions, the leading end of the work support being of greater diameter than the follower end of the rear portion of said series, and the leading end of the forward portion of said series being of greater diameter than the follower end of said gauge.

5. In an apparatus for drawing metal tubes, a mandrel including a stem portion, a work support at the forward end of the stem portion, a tapered gauge spaced forwardly of said support and a series of peripheral successive, frusto-conical work reducing portions interposed between the leading end of the work support and the follower end of the gauge, each of said portions gradually increasing in diameter from its leading to its follower end and of a different diameter throughout with respect to the others, a leading portion being of different diameter throughout than that of a follower portion, the leading end of said follower portions providing shoulders merging into the follower end of the leading portions, the leading end of the work support being of greater diameter than the follower end of the rear portion of said series, and the leading end of the forward portion of said series being of greater diameter than the follower end of said gauge, said gauge being of greater length than any one of the portions of said series, and said support being rounded and having its leading end of greater diameter than any one of the portions of said series.

6. In an apparatus for drawing metal tubes, a mandrel including a stem portion, a work support at the forward end of the stem portion, a tapered gauge spaced forwardly of said support and a series of peripheral successive, frusto-conical work reducing portions interposed between the leading end of the work support and the follower end of the gauge, each of said portions gradually increasing in diameter from its leading to its follower end and of a different diameter throughout with respect to the others,

a leading portion being of different diameter throughout than that of a follower portion, the leading end of said follower portions providing shoulders merging into the follower end of the leading portions, the leading end of the work support being of greater diameter than the follower end of the rear portion of said series, the leading end of the forward portion of said series being of greater diameter than the follower end of said gauge, said gauge being of greater length than any one of the portions of said series, said support being rounded and having its leading end of greater diameter than any one of the portions of said series, and said mandrel including a tapered nose extended forwardly from the leading end of said gauge.

7. In an apparatus for drawing metal tubes, a die including a body part formed with a bore increasing in diameter from the front end of the body part to the rear end of the latter, the wall of said bore being provided with an inset series of successive, independent, tapered portions lengthwise thereof, each gradually increasing in diameter from front to rear, each follower portion having its leading end of greater diameter than the leading end of an adjacent leading portion, each of said portions being free of interruption from front to rear, each follower portion having its leading end of less diameter than the follower end of an adjacent leading portion, said wall being formed with an endless shoulder between the forward end of each follower portion and the follower end of each leading portion, said shoulders coacting with said tapered portions to provide spaced points and annular pockets, the latter being separated by the points.

8. In an apparatus for drawing metal tubes, a mandrel provided intermediate its ends with a series of peripheral, successive, outset, independent, frusto-conical work reducing portions extending lengthwise thereof, each of said portions gradually increasing in diameter from front to rear, each of said portions being of a different diameter throughout with respect to the others, a leading portion being of less diameter throughout than a follower portion, the forward end of said follower portions providing flat endless shoulders merging into the rear ends of the leading portions, and a tapered gauge portion gradually increasing in diameter from front to rear, the rear end of the gauge portion being of less diameter than the leading end of the forward work reducing portion of said series, the leading end of the forward work reducing portion of said series providing a flat endless shoulder merging into the follower end of said gauge portion.

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