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W. E. KERR

2,886,170

METHOD OF DRAWING TUBES

Original Filed June 8, 1943

3 Sheets-Sheet 1

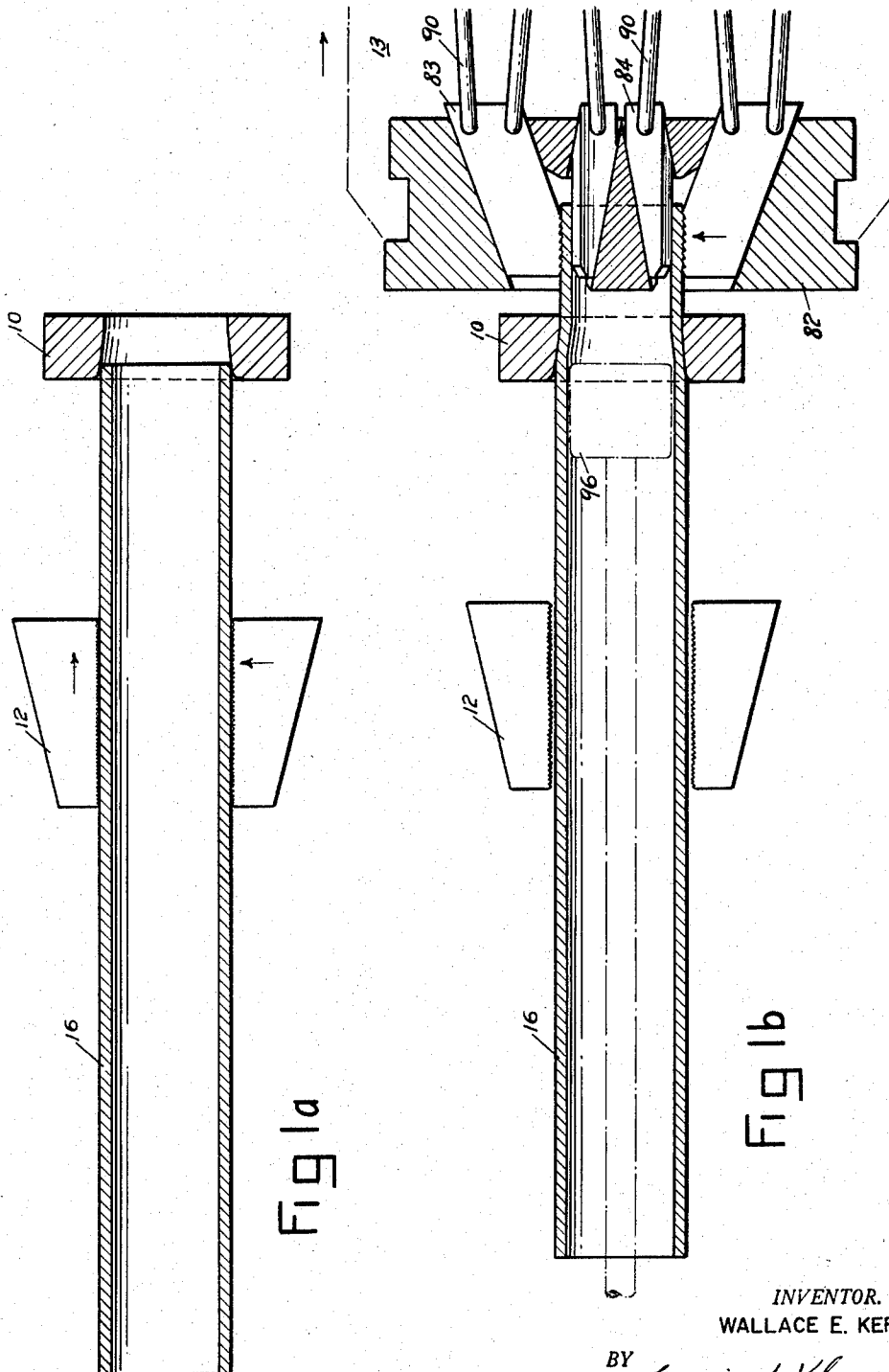


Fig 1a

Fig 1b

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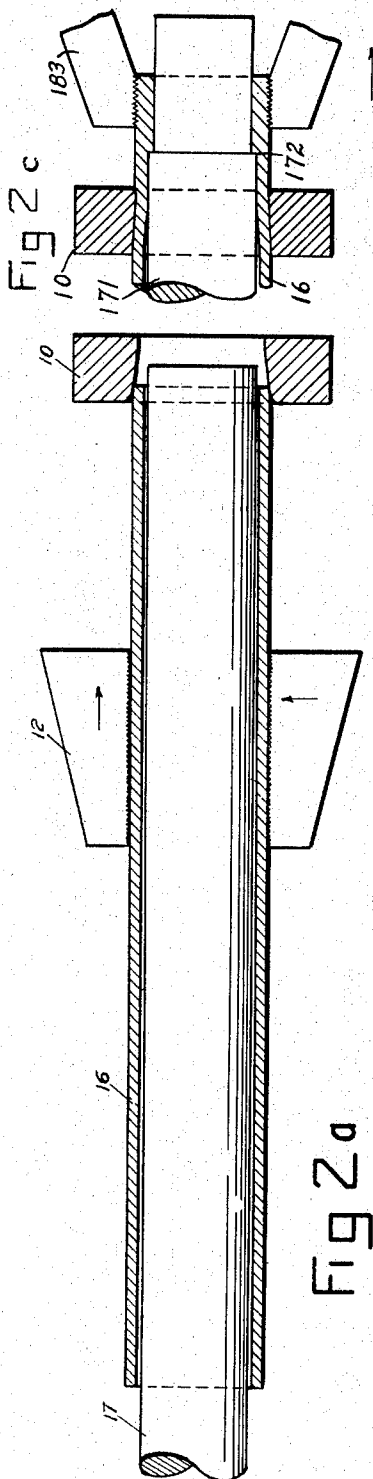
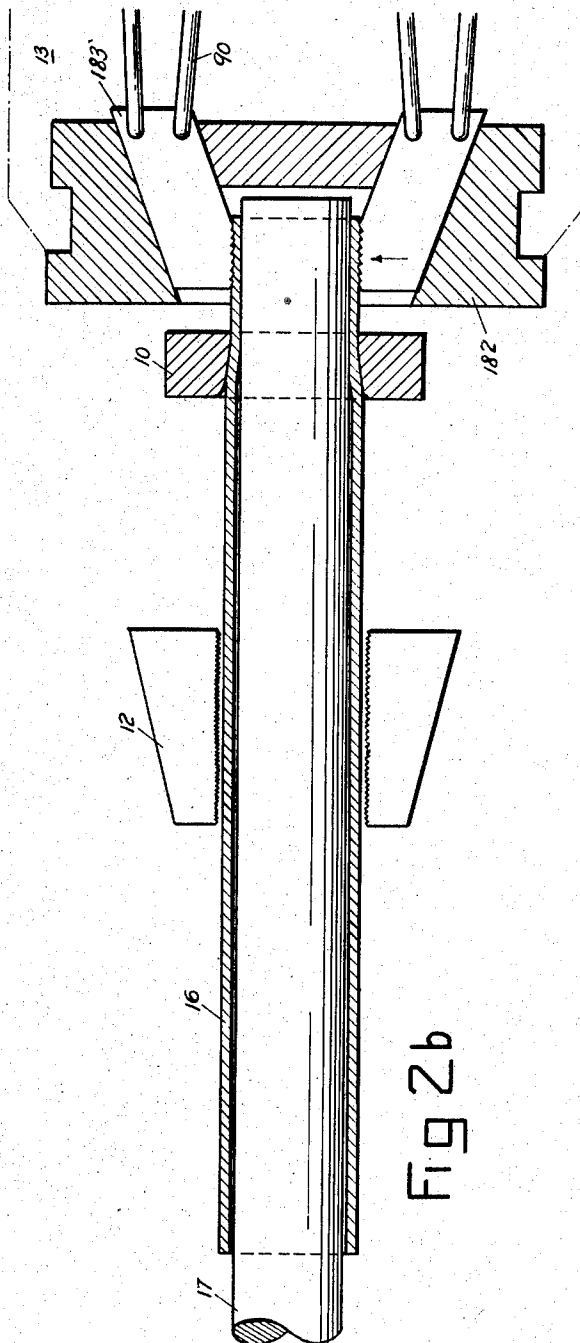
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3 Sheets-Sheet 2



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METHOD OF DRAWING TUBES

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3 Sheets-Sheet 3

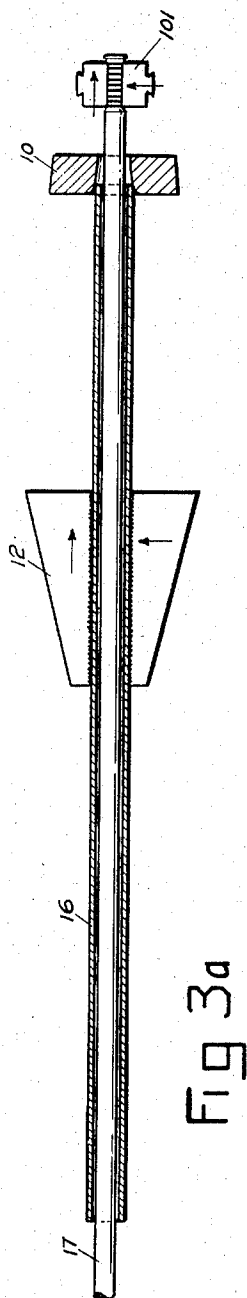


Fig 3a

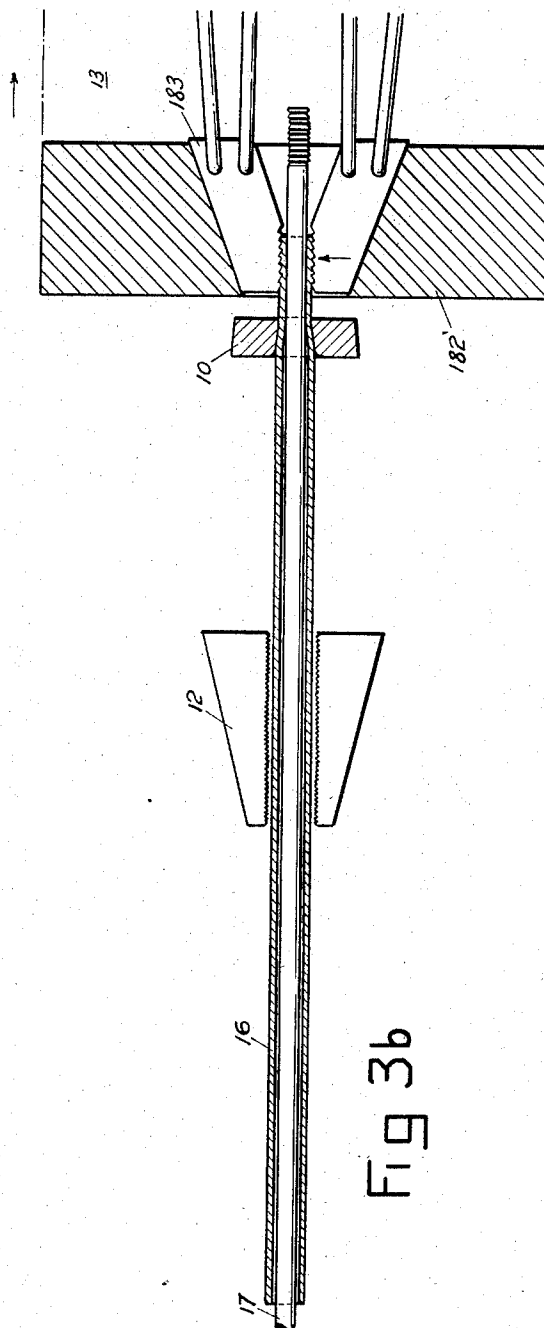


Fig 3b

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2,886,170

METHOD OF DRAWING TUBES

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Original application June 8, 1943, Serial No. 490,060, now Patent No. 2,597,499, dated May 20, 1952. Divided and this application August 4, 1950, Serial No. 177,745

3 Claims. (Cl. 205—8)

This invention relates to an improved method for drawing metal tubes and, more particularly, to an improved method for drawing tube blanks of uniform cross-sectional shape and dimension throughout their lengths through a drawing die whereby the necessity for first pointing the tube blanks is avoided, scrap loss is reduced, and the processes of pickling and/or lubricating the tube blanks either initially or at intermediate stages of manufacture are facilitated. The present application is a division of my co-pending application Serial No. 490,060, filed June 8, 1943, and entitled "Method and Means for Drawing Tubes," Patent No. 2,597,499 granted May 20, 1952.

A source of particular difficulty in the drawing of metal shapes through a die or other metal working device is the positioning of an integral portion of the blank beyond the die or device where it may be grasped by suitable tongs or grippers to effect the completion of the drawing operation. In drawing rods and bars the necessary step of starting the stock through the die or other device can be satisfactorily provided for by grasping the stock piece ahead of the working station by a mechanism commonly termed a "push-pointer" which is operative to forcibly project the end of the work piece through the station. The reduced and projecting end, being solid, may be readily grasped by the grippers on the drawbench buggy and in this manner successive drawings may be rapidly accomplished with attendant economy in the production of the shapes.

Heretofore, tube blanks could not be drawn in the manner described above for rods and bars because of the lack of practical methods for extruding the leading ends of the blank through the die or other working device, thereby to provide extruded portions capable of being gripped by a draw carriage to complete the draws. The tube blanks, being hollow, collapse upon the application of heavy lateral pressure normally exerted by the grippers of a push-pointer and of a draw bench and, further, it is not possible with known practical methods to exert sufficient force through a reasonably long tube blank to extrude the leading end portion of it through the die unless the blank has previously been pointed to reduce the diameter of its leading end portion. I am aware of the existence of tube reducing machines wherein a tube blank of uniform cross-sectional shape and dimension is fed into and through a reducing head having power driven reducing rolls but such methods are costly in operation and low in production whereas the present invention is concerned with the more conventional, high production and more economical method of effecting the working on the tube blank by forcibly moving the blank through a fixed die or other non-driven tube reducing or working device. I am also aware of various prior processes which produce drawn tubes entirely by extrusion by the use of a push-pointer, for example, but these prior processes are practical only for the drawing of short lengths of tubes from previously prepared blanks, whereas the present invention does not

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require specially prepared blanks and is not limited as to the length of the tubes produced. Moreover, in accordance with the present invention the greater part of the working done on the tube blank is accomplished by pulling the tube blank through the reducing die by which a high rate of production of standard or long-length tubes is accomplished.

In one embodiment of the method of my invention the conventional plug-type of tube bench mandrel is employed and means such as a push-pointer, for example, may be employed to force the leading end portion of a tube blank through a die, after which the projecting end of the tube blank is engaged by a pulling force applied both externally and internally of the tube blank while the mandrel plug is allowed to be drawn into its proper working position in the die whereby a drawn tube may be produced which is off-standard only in its thicker side wall at its leading end portion. In this manner, tube blanks to be drawn are expeditiously processed and substantial economy in the operation of the plant may be effected. If it is desired to only sink the tube, not reducing its side wall thickness, the plug mandrel is not employed, of course.

It is accordingly the primary object of the present invention to provide an improved method for drawing metal tubes capable of being carried out by equipment which is largely conventional but which, nevertheless, avoids the necessity of first preparing the tube blanks by swaging or otherwise pointing an end portion of each blank, substantially reduces scrap loss, and enables the maintenance of a substantially uniform aperture throughout the tube blanks at all stages of the manufacture of the finished drawn tubes to thereby facilitate the pickling and interstage lubrication of the blanks.

My invention may also be carried out by the use of an elongated bar mandrel on which the tube blank is mounted before being passed through the die and to accomplish the extrusion of the leading end portion of the tube blank through the die the compressive pushing force of a push-pointer is applied to the tube blank immediately ahead of the die either per se or in combination with a pulling force exerted on the bare end of the mandrel which projects through the die at this stage of the process. Again, upon a short leading end portion of the tube blank being extruded through the die the same is engaged by a pulling force to complete the drawing of the entire tube blank through the die. In this particular embodiment of the method the tube blank is prevented from collapsing by the grippers of either the push-pointer or the pulling device or devices by the mandrel within the blank. Of course, the internal diameter of the die and the external diameter of the mandrel are so chosen and related that the drawn tube will have the desired diameter and side wall thickness. I am aware that it is known to insert separable plugs in the ends of tubes to prevent the collapsing thereof by the grip bits of the draw carriage and I make no claim to methods evolving about the use of separable plugs.

In the last described embodiment of the invention a tube blank of more or less uniform cross-section may be reduced as to side wall thickness throughout its entire length so that there will be little or no scrap loss. While the grippers used may or may not damage the tube, depending on their construction, the resulting marks, if any, may be removed before subsequent processing of the tube blank or before shipment, as the case may be.

In some applications where the forces required to extrude a leading end portion of the tube blank through the die are exceptionally large I have found that the method of my invention may be yet carried out through the use of

a bar type of mandrel having a reduced leading end portion onto which the leading end portion of the tube blank is shrunk during operation of the push-pointer thereby avoiding the necessity of applying the very large pushing forces required to reduce the side wall thickness of the blank while at the same time pushing its leading end portion through the die.

The invention herein resides in the method of drawing tubes through a metal working die or other device wherein tube blanks of uniform cross-section throughout their lengths are employed and wherein the greater part of the drawing work is accomplished by physically pulling the tube blanks through the die or other working device, the invention also including the teaching of practical methods for starting the leading ends of the tube blanks through the die or other working device whereby the completion of the draws is accomplished by the application of a continuous pulling force.

The above and other objects and advantages of the invention will become apparent upon consideration of the following detailed specification and the accompanying drawing wherein there is specifically disclosed certain preferred embodiments of the method of the invention.

In the drawing:

Figures 1a and 1b are schematic views of apparatus which may be utilized in carrying out the method of the invention, the views showing a tube blank about to be push-pointed and about to be drawn, respectively;

Figures 2a and 2b are schematic representations of an alternate method of initiating the drawing of the tube blank, the views showing the tube end about to be extruded and the tube about to be drawn, respectively;

Figure 2c is a fragmentary section illustrating the modification of the method of Figures 2a and 2b wherein the leading end of the tube blank is lipped over a shoulder formed on the mandrel, and

Figures 3a and 3b are schematic showings of a further modification in which the long mandrel employed is pulled by a separate and retractible pulling device to assist in the reducing of the end portion of the tube blank.

In the drawings, reference numeral 10 indicates, throughout all the views, a die, which in accordance with usual practice, is retained in a head block fixed with respect to the frame of the apparatus. The present invention, in its method aspects, contemplates the use of a push-pointer in conjunction with the die 10 or other metal working device employed and throughout all the views the grip bits of the push-pointing mechanism is indicated by reference numeral 12. The drawbench grip bit carrying buggy is indicated generally by the reference numeral 13 and, in accordance with usual practice, this device is arranged to travel on a bench or track, being moved in outward or drawing direction by a chain (not shown). The tube blank being processed is shown at 16.

According to the method of Figures 1a and 1b, the leading end portion of the tube blanks 16 are extruded through the die 10 by action of the grip bits 12 of the push-pointing mechanism and since, in accordance with usual practice, the grip bits of the push-pointing mechanism are positioned quite close to the die there is little likelihood of the blank collapsing between the die and grip bits. The grip bits are preferably made semi-cylindrical in cross-section to thereby engage substantially the entire girth of the blank to resist collapsing of the same due to the lateral pressure exerted by the grip bits. Upon a leading portion of the blank being extruded through the die such leading end portion is engaged internally by the bits 84 of an expanding assembly mounted on the carriage 13 and externally by the grip bits 83 also mounted on the carriage 13. As shown in Figure 1b, grip bits 83 and 84 oppose each other so that an effective clamping action on the side wall of the tube blank at circumferentially spaced points may be effected to cause the draw carriage to pull the blank through the die. The method as thus far described provides only for sinking the tube blank which is

well understood, meaning only that the external girth of the tube blank is worked and sized with no attempt made to reduce the side wall thickness of the blank.

If it is desired in the employment of the method of Figures 1a and 1b to reduce the side wall thickness of the tube blank the same is accomplished by using a plug mandrel as shown at 96 in Figure 1b, which plug mandrel is allowed to be drawn into proper operating position within the die 10 during the start of the actual drawing operation by forward movement of the carriage 13, all in accord with usual tube drawing practice. During the initial extrusion of the leading end portion of the tube blank through the die by the push-grips 12 the plug mandrel 96 is held retracted from the die and by being positioned within the tube blank and between the push-grips 12 during actuation of the latter it may further serve to resist collapsing of the tube blank in the same manner as does the mandrel 17 and 171 in Figures 2a, 3a and 2c. It is common practice in tube drawing benches to provide means to retract mandrels such as the plug mandrel 96 and additional means to adjustably anchor the mandrel in proper position within the drawing die.

Figures 2a and 2b illustrate the invention as employed in the drawing of tubes on a long mandrel 17 and in this modification, a draw grip assembly generally similar to the assembly 82-83 but employing only a single pair of grips 183' is employed. As explained above, the entire length of the tube blank is worked or reduced, and the only imperfection in the drawn tube are the marks made by the serrations on the grips 183'. These marks may be ground off before the next succeeding draw. It will be observed that if upon completion of all the drawing operations and the subsequent grinding and polishing of the marks made by the grip cropping is still necessary the scrap loss will be very small since the grips cover only a few inches of the end of the tube.

In Figure 2c I have illustrated a slight modification of the method illustrated by Figures 2a and 2b. In this modification, a mandrel 171 having a shoulder 172 is employed, and it should be apparent that at the start of an operation, the first thing accomplished is the sinking down of the leading end portion of the tube 16 onto the reduced portion of the mandrel 171. While this is accomplished primarily by the pushing grips, it will be understood that if the reduced portion of the mandrel is long enough to be engaged by the grips on the draw carriage, the latter may also be employed. To complete the draw, the grips (183) of the drawing carriage may engage either the reduced end portion of the mandrel or the end portion of the tube blank as illustrated in Figure 2c. In case the grips of the draw carriage are to engage the reduced end of the mandrel to complete the draw a ferrule may, if desired, be first placed over the sunk portion of the tube to positively prevent the mandrel from being pulled out of the tube blank as will be understood.

Figures 3a and 3b illustrate a method generally similar to that of Figures 2a and 2b, but including the additional step of applying, at the start of the drawing operation, a pulling force to the mandrel 17 to assist in the starting of the tube blank through the die. As the blank end enters the die, the blank is swaged into tight engagement with the mandrel and the very substantial friction created between the blank and mandrel results in the application of a heavy pulling force to the end of the blank. This additional pulling force is preferably applied by an additional element in the assembly since the push-pointer moving means cannot advantageously be utilized because of the difference in the rate of movement of the blank and mandrel while the necessity of correlating the drawing operation with movement of the grips 12 of the push-pointer may preclude the use of the draw carriage 13. Therefore, to provide this initial pulling force, I preferably employ a separate carriage (not shown) mounting a pair of grippers 101 and a force applying cylinder (not shown) and which may be readily

moved out of the way along laterally extending tracks or guides (not shown).

It should be observed that in any of the modifications of the invention outlined above there is no necessity for pointing or otherwise preparing the tube blanks either initially or at any stage in the production of the drawn tubes and, further, that at the completion of any particular drawing operation the tube blank is left with a large opening entirely through it which facilitates the application of lubricant or other liquid to both the internal and external surfaces of the tube blank as is normally required in drawn tube manufacturing operations. Also in the methods proposed herein scrap loss is either entirely eliminated or is substantially reduced. In the embodiment of Figures 1a and 1b, side wall thickness is not reduced in only a small leading end portion of the tube blank and the same is also true for the embodiment of Figure 2c. In the methods of Figures 2a, 2b, 3a and 3b the tube blank is uniformly worked throughout its entire length and while some damage may be done by the pulling grip bits, depending on their construction, the damage may possibly be removed by grinding, for example. However, the axial length of the damaged end portion of the tube is quite small and even though it is eventually cropped off, it does not represent substantial scrap loss.

The above specifically described embodiments of the method of my invention should be considered as illustrative as variations may be made therein without departing from the spirit or scope of the invention. Reference should therefore be had to the appended claims in determining the scope of the invention.

I claim:

1. In the method of drawing a metal tube from a tube blank of uniform cross-section throughout its length and wherein an elongated mandrel of substantially uniform cross-section throughout the length of its working zone is assembled within the blank and the assembly moved through a constricting die whereby the tube wall is reduced in thickness between the die and mandrel; the steps of mounting the blank on the mandrel in loose and otherwise unattached relation thereto, of inserting the leading end portion of the mandrel through the die with the leading end of the blank positioned adjacent the entering end of the die, applying a pushing force directly to the outer surface of the side wall of said blank adjacent said leading end while simultaneously applying a pulling force to the said end portion of the mandrel to thereby move the mandrel relative to the die while the leading end portion of the tube blank is constricted into frictional engagement with the mandrel whereby said pulling force is transmitted to said leading portion of the tube blank solely because of said frictional engagement, continuing the application of said pushing force and said pulling force to provide a length of reduced tube sufficient to be gripped, discontinuing said pushing force, and thereafter applying a pulling force to said length to draw the remaining portion of the blank through said die.

2. In the method of drawing a tube from a tube blank of uniform cross section through its length wherein an

elongated mandrel of substantially uniform cross section throughout the length of its working zone is placed within the tube blank and the tube blank and mandrel are moved through a die whereby the tube wall is reduced in thickness between the die and the mandrel; the steps of placing the tube over the mandrel in loose and otherwise unattached relation thereto, inserting the leading end portion of the mandrel in the die, applying a pushing force to said tube blank in the direction towards the die whereby the leading end portion of said tube blank is constricted onto said mandrel so that the resulting frictional engagement with the leading end portion of said tube blank with said mandrel causes said mandrel to progress through the die along with the extruded end portion of said blank, discontinuing said pushing force, and thereafter applying a drawing force to said extruded end portion to complete the drawing of the tube blank and moving the mandrel therewith through said die.

3. In the method of drawing a tube from a tube blank of uniform cross section throughout its length wherein an elongated mandrel is placed within the tube blank and the tube blank and mandrel are moved through a die whereby the tube wall is reduced in thickness between the die and the mandrel; the steps of inserting the mandrel within the tube blank in loose and otherwise unattached relation, aligning the blank and mandrel with the die, applying a gripping pressure onto the external longitudinal surface of said tube blank before said die, said pressure being opposite said mandrel which prevents undue tube deformation under said gripping pressure, then applying a moving force in addition to said gripping pressure, thus moving said tube and mandrel and advancing said tube blank into and through said die to provide a worked portion, discontinuing the application of said moving force, and thereafter applying a drawing force to said worked portion to draw the remaining portion of said tube through said die.

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