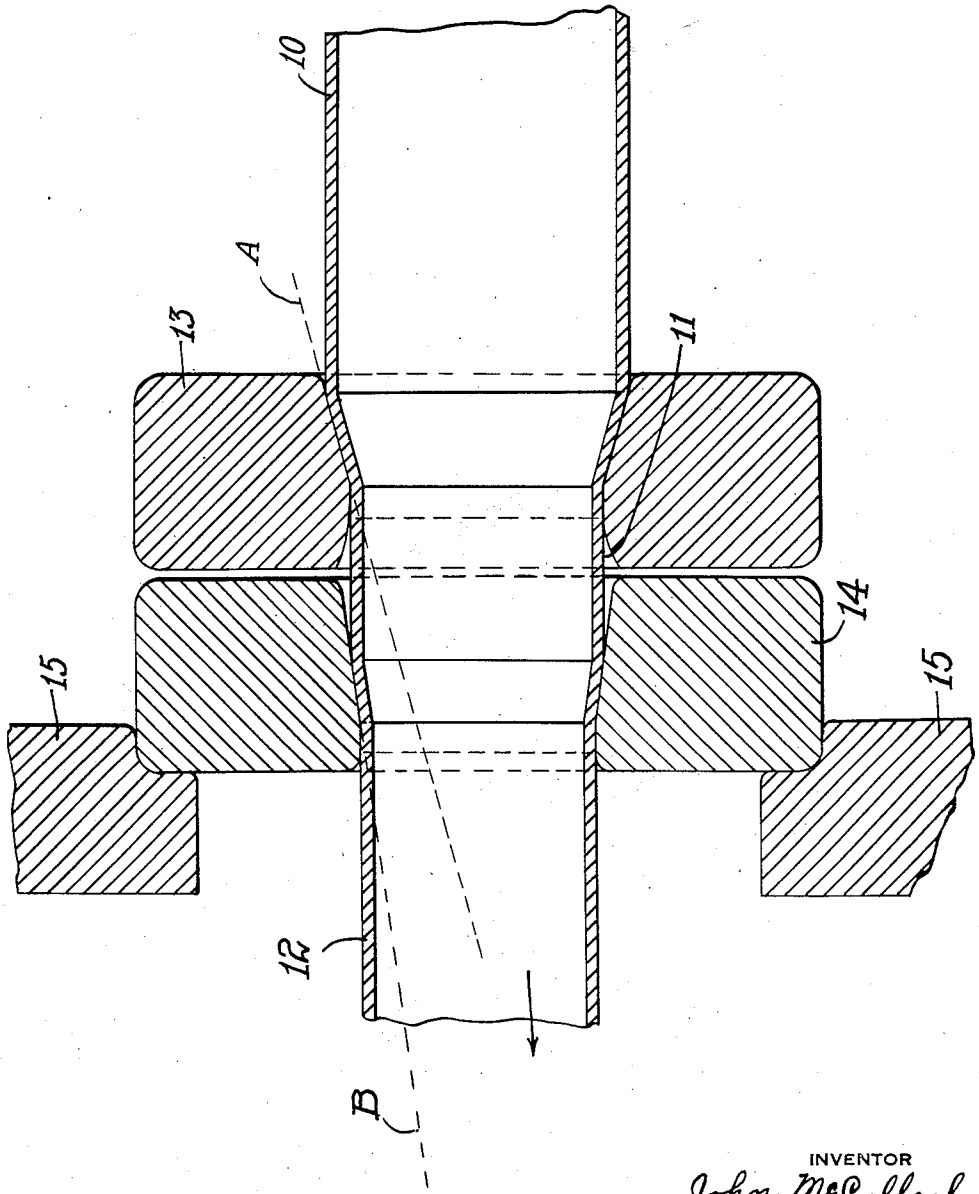
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DOUBLE REDUCTION ONE-PASS

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DOUBLE REDUCTION ONE-PASS

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This invention relates to the cold reduction in size of drawing of metal tubing and more specifically to the cold drawing of steel tubing using heavy drafts and less than prevailing standard operations from starting piece to finished tube.

The drawing or reducing of steel tubing of the usual types is well known per se and has been practiced for many years in the industry. It has been customary, however, to draw the tube through a suitable die or pass once and then anneal for each reduction whether it be a reduction of diameter or one of wall thickness or both. This, where a number of passes or reductions are required, is a tedious and expensive task materially adding to the cost of the finished tubing and delaying the production not only by the physical limitations involved, but because of a higher percentage of defective tubes, due to the additional steps performed thereupon with the consequent cumulative effect of the results ordinarily encountered in each operation.

One of the objects of my invention is to considerably increase the rate of production of steel or other metal tubes and at the same time to decrease the cost per tube.

Another object of my invention is to obviate the time worn practice of making a separate pass and anneal for each reduction by, for example, making a plurality of reductions in a single pass.

A further object of my invention is to draw a tubing through two adjacent dies properly contoured and diametered to meet requirements and so arranged as to form in effect a single die with differently sized portions adapted to reduce the tubing entered into the first or leading die a given amount and then instantaneously thereafter or substantially simultaneously therewith to make such further reduction as desired, so that the tubing issues from the second die with a cross section substantially less than that obtained by one cycle under usual methods.

Other and further objects and advantages will be understood and appreciated by those skilled in the art to which this invention appertains.

In the accompanying drawing, I have illustrated in a more or less diagrammatic manner one desirable arrangement for accomplishing the objects of this invention.

Referring to the drawing there is shown a fragmentary piece of tubing which at any one time during cold drawing has a number of differently diametered portions, the portion 10 being of original size, the portion 11 being of intermediate size and the portion 12 being of final size. This tubing is drawn through the dies 13 and 14, the first of which may be the sinking or leading die and the second of which is the one which makes the final reduction. These dies singly are per se known in the industry. They are made of suitable metal designed for such purposes and may be suitably braced, mounted or supported by a die stock or other suitable arrangement fragmentarily shown at 15. Dies 13 and 14 have been shown as slightly separated from each other and they may either be maintained in such close juxtaposition by means of a suitable intermediate washer member, not shown, or if preferred or desired they may come into contact with each other, there being no essential or substantial change in the invention occasioned by or resulting from the use of either arrangement. Dies 13 and 14 are contoured to provide sloping portions intermediate their ends thus properly receiving and guiding the tubing into position for the reducing operation which is thus made a gradual one. This is clearly indicated on the drawing and dotted lines A and B show successive inclinations intermediate the starting portion 10 and finished portion 12. The distance between die centers may be about 1½ inches.

The process of drawing steel tubing through a single die and making a single reduction is, of course, well known in the art and hence I need not go into detail concerning the same, but it will suffice to say at this time that before the tubing is drawn a suitable "point" is formed in the usual way except that in the present invention the point is increased in length by about two inches, more or less. This elongated point is then inserted through the leading die, and projects through the other die also and the projecting end is grasped or seized by any usual or suitable tube drawing tool of the usual draw bench. In the usual manner a pull is then exerted on the point of the tube so as to draw the same through the dies. As shown on the drawing, the tube is moved in the direction indicated by the arrow and it has been deemed unnecessary to illustrate the usual features of a draw bench since such would clearly be but surplusage here.

As the tube is cold drawn through the dies the leading die reduces it to a diameter having the lowest possible limit in bore for the insertion of the usual mandrel (not shown) before entering the second die. The mandrel is, of course, used in its usual manner to prevent too great reduction or deformation in the tube. A greater reduction in wall can be made if my invention is followed, due to the resultant closer contact of such mandrel, not shown, with the second die.

The leading die generally makes a reduction in area without substantially decreasing the wall thickness of the tube, whereas the second die does the remainder of the work. The sizes of the dies are carefully and properly chosen not only to meet the requirements of the tube being drawn, but to obviate binding on the mandrel before entering the second die.

As an example, a tube 2⅜ inches in overall diameter and $\frac{3}{16}$ of an inch in wall thickness is to be reduced to 1⅞ inches overall diameter having an internal diameter of 1.565 inches which represents a reduction in area of 34.5% of which 17% is reduction in wall thickness. The die reduction may amount to about 21%. The leading die reduces the tube to a two inch bore thus making a reduction in area of about 17% without decreasing the wall thickness. The second die does the remainder of the work of reducing the area by 20.8%, the resultant tubing having a bore of 1.565 inches.

It is clear from the foregoing that I make a double reduction in a single pass by drawing the tube through differently diametered dies in immediate succession or substantially simultaneously and that the dies are so related to the progress of the tube therethrough that they are in order of decreasing internal diameter. My invention has an important result in that the rate of production of the tube is more than doubled with a consequent increase in efficiency and decrease in cost of the drawn tubing.

I do not, of course, limit myself to precisely the details shown which are rather to be taken in an illustrative than in a limitative sense and I may vary the details above mentioned in accordance with requirements and good practice. The speed with which the tubing is drawn through the dies is adjusted to the conditions present and the composition of the tubing being drawn. It is a known fact that when tubing is drawn through a die a considerable heating of the tubing occurs due to frictional and similar forces and it is likely that this heated tubing is much more easily drawn through the second die for reasons understood by those skilled in drawing tubes, although naturally, I do not intend to limit myself to this theory of operation.

The lubricating effect on the heated tube may be an enhanced one, thus further facilitating drawing through the second die.

Attention is further called to additional examples thereby illustrating what can be accomplished by the present invention.

On mild steel by the above method I can make a reduction in area of 40–45%; e. g., a tube 1½" x .110" wall can be drawn to 1" x .095" wall, a reduction of 43%. Otherwise than by my invention this would be done in not less than two passes with the usual anneal and pickle. In such a case, the reduction in area by two such passes would be 24–25% respectively to accomplish as much work as the single pass through a double die according to my invention.

By drawing a $2\frac{5}{16}$" x .2" tube to 1¾" x .12025" in one pass I secure a reduction in area of 41.7%, equal to two ordinary passes of 23% and 24% reduction in area by other means than by my invention.

What I claim as new and desire to secure by Letters Patent is:

1. The steps in the process of cold drawing steel tubes in heavy drafts comprising forming on said tube a point longer than standard practice and cold drawing said tube, by means of said point, through a single composite pass wherein said tube is doubly reduced in a single passage by substantially simultaneously first reducing it to the lowest possible limit in bore and then completing the reduction.

2. The steps in the process of cold drawing steel tubes in heavy drafts comprising forming on said tube a point longer than standard practice and pulling the tube by means of said point through a single composite pass constructed to impart double reduction to said tube in a single passage therethrough, said composite pass including two substantially abutting reducing dies arranged to form in effect a single compound die.

3. The steps in the process of cold drawing steel tubes in heavy drafts comprising forming on said tube a point longer than standard practice and pulling the tube by means of said point through a single composite pass constructed to impart double reduction to said tube in a single passage therethrough, said composite pass including two substantially abutting reducing dies arranged to form in effect a single compound die, and said drawing being so carried out as to utilize at the second die such heat and lubricating properties as may become available at the first die.

4. Those steps in the process of cold drawing a steel tube in heavy drafts including forming on said tube a point exceeding by about two inches (2") the standard length of point, and drawing said tube by said point through a single composite pass imparting double reduction to said tube in a single passage therethrough, said drawing being so carried out as to utilize at the second stage of said double reduction the heat and lubricating properties developed at the first stage of said double reduction in which first stage the tube is reduced to the lowest possible limit in bore, thereby more than doubling the rate of production of such reduced tube at materially increased efficiency and decreased cost.

5. For use in the cold drawing of steel tubes wherein reduction in heavy drafts is carried out, a composite doubly reducing die pass comprising two separate but contiguous differently diametered die stages so constructed and arranged that the first or leading die stage reduces the tubes to the lowest possible limit in bore and the second die stage completes the work, the second die stage taking advantage of heat and lubricating effects developed at the first die stage, and the whole pass producing reduced tubes at a rate of production more than double that produced by doing the same work in more than one stage with intermediate annealing.

JOHN McCULLOCH.