Aug. 15, 1944. A. KATZ 2,355,734

FLOATING PIN MANDREL

Filed May 6, 1943

Fig. 1

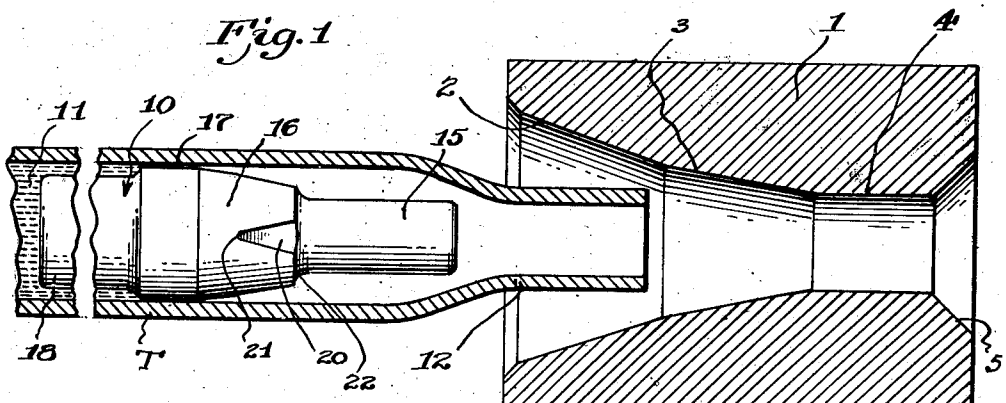


Fig. 2

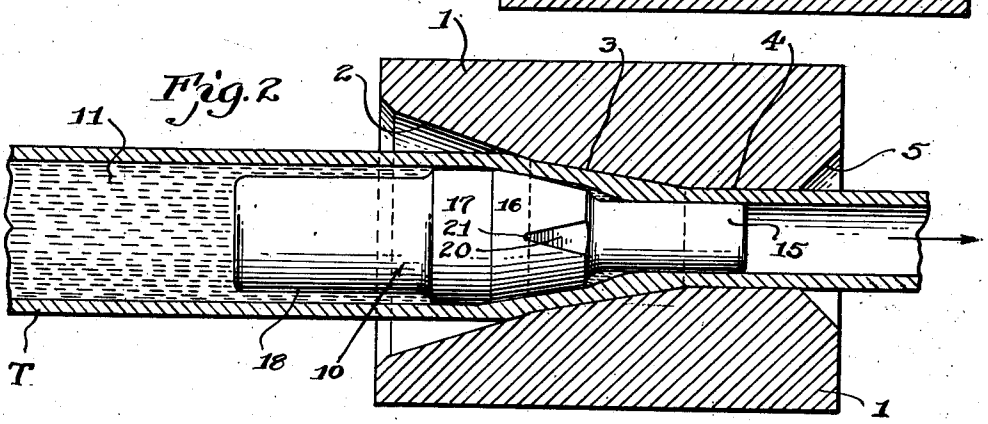


Fig. 3

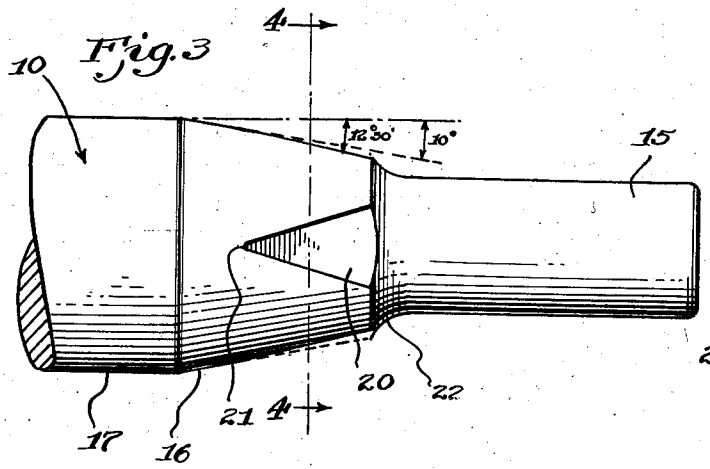
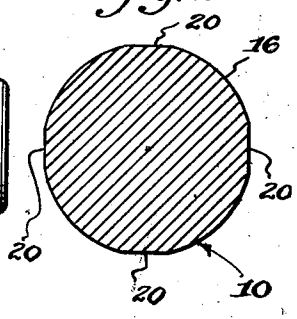


Fig. 4



INVENTOR.
Albert Katz

BY
Barnes, Kisselle, Raisch & Choate
Attorneys.

Patented Aug. 15, 1944 2,355,734

UNITED STATES PATENT OFFICE

2,355,734

FLOATING PIN MANDREL

Albert Katz, Detroit, Mich., assignor to Bundy Tubing Company, Detroit, Mich., a corporation of Michigan

Application May 6, 1943, Serial No. 485,874

10 Claims. (Cl. 205—7)

In the art of drawing pipe or tubing, a drawing apparatus having a floating mandrel, or pin as it is sometimes called, in conjunction with a die, has a number of advantages over an apparatus which had a mandrel held in drawing position by a tension rod. Where a tension rod is used the tube to be drawn has to be threaded over the mandrel and the tension rod and this is an unhandy and time-consuming procedure, particularly where long lengths of tube are handled. The floating pin is merely inserted into the leading end of the tube, the leading end is swaged, then the leading end of the tube is passed into the die and as the tube is drawn the floating mandrel or pin is moved into and held in drawing position by friction.

However, some difficult problems present themselves in the use of the floating pin in that it is liable to set up a chattering action. This chattering action results in longitudinal vibrations. The pin is pulled tightly into position by the drawing section on the leading end of the tube thus increasing the friction to the point where the forces overcome friction allowing the pin to shift or jump back away from the die so that it is again picked up by friction and moved tightly into drawing position resulting in longitudinal chatter. Moreover, the wear on the floating pin is such that heretofore the pins have had a relatively short life, particularly where a single drawing action accomplished a relatively great or severe draw or tube reduction.

It is the object of the present invention to provide an improved tube drawing device, and an improved floating mandrel or pin, particularly for use in making a heavy draw on a tube, wherein chatter is eliminated or at least the possibilities of chatter are minimized, and wherein the useful life of the pin is greatly increased.

An apparatus and a floating mandrel for carrying out the invention are disclosed in the accompanying drawing.

Fig. 1 is a cross-sectional view of a tube, a die and a floating pin showing the parts in position preparatory to the commencement of a drawing action.

Fig. 2 is a sectional view illustrating the drawing in progress.

Fig. 3 is a side elevational view somewhat enlarged showing the improved pin.

Fig. 4 is a sectional view taken substantially on line 4—4 of Fig. 3.

The die, as illustrated, embodies suitable materials, and it has a body 1 formed with a die passage therein. The entrance opening is shaped to provide a suitable entrance angle 2; an intermediate portion has a working angle 3; to the rear of the working portion is a land 4 the walls of which preferably substantially parallel the axis; the outlet of the passage preferably has a relief angle shown at 5. At the intersections of these angles the surfaces are suitably blended to eliminate sharp corners. The movement of the tube through the die is from left to right, as the drawing is viewed.

The floating pin is generally illustrated at 10 and to start the drawing action the pin is inserted in the leading end of the tube, as shown in Fig. 1. The tube, of course, may be of any length. To the rear of the pin within the tube is placed a quantity of lubricant, illustrated at 11. The lubricant is preferably in the nature of grease, as distinguished from a fluid oil, although it should not be too viscous. After the mandrel is thus inserted, the leading end of the tube is reduced or swaged by a suitable swaging tool, as illustrated at 12, so that this end of the tube may be passed through the die and gripped by a suitable pulling device (not shown).

The pin structure is shown in Figs. 3 and 4. At one end it has a land section 15 of cylindrical form designed to fit in the land section 4 of the die with the desired clearance. Extending from the land section is a tapered portion which may be termed the pin angle, as shown at 16. This is the working portion of the mandrel. A body portion 17 lies next adjacent the working portion. Extending from the body 17 is a tail piece 18 of slightly smaller diameter than the body. The body preferably fairly well fits the interior of the tube to be drawn.

In the face of the working angle 16 one or more areas of depression are provided, as shown at 20. These areas may be formed by flats or relieved surfaces formed in the mandrel. As indicated in Fig. 4, there may be four of such flats equally spaced throughout the circumference, although this number may be varied to meet variable conditions. These flats extend substantially from the line of juncture between the working angle and the land 15 but do not extend throughout the whole lineal extent of the working angle, but to the contrary, terminate in an intermediate portion of the working angle, as illustrated at 21. At the juncture of the working angle and the land there is an undercut 22 and the flats are formed in the working angle so as to extend into communication with the undercut. In the pin shown, the angle of the working part 16 is 10° from the axis of the pin,

and the surfaces 20 are 12° 30' from the axis.

When the device is in use the parts take a position as illustrated in Fig. 2. The tube is being pulled through the die from left to right and the floating mandrel is pulled into drawing position with respect to the die and held in this position by friction. The lubricant plays a part in this function. It should be viscous enough to provide the desired friction. If it is too viscous the pin might be held in position by too much pressure. On the other hand, if the lubricant is too thin it may fail to push the pin into place. An example of a satisfactory lubricant is a commercially obtainable lubricant known as "Penola" No. 5214, which may in some instances be mixed four parts of Penola to one part of tallow.

In the drawing action, the metal of the tube wall first contacts the entrance angle 2 of the die. The tube is ensmalled as it moves through the die between the working angles 3 of the die and 16 of the pin, while the drawn tube is sized as to external and internal diameters and as to wall thickness by the land 4 of the die and land 15 of the pin. One example which may be given is that of drawing tube having an outside diameter of 3/8" with a wall thickness of .062", to 1/4" outside diameter with a wall thickness of .058". It will be noted that the tube diameter is the principal factor which is altered and that there is not much change in the wall thickness.

The lubricant is drawn into the tube working zone as the tube is pulled through the die. The body of the mandrel fits freely within the tube so that an adequate supply of lubricant passes the body and reaches the working angle of the mandrel. Some of the lubricant squeezes in between the tube and the working faces of the mandrel angle, and flows into the spaces or areas provided by the flats. In as much as the flats communicate with the undercut, the lubricant flows into the undercut and may accumulate into a complete annulus of lubricant at the undercut. The lubricant is drawn from this point over the land of the mandrel. As mentioned above, this reduces the friction and eliminates chatter and at the same time provides lubrication, thus promoting longer life for the mandrel.

One part of the mandrel which is subjected to considerable wear under ordinary circumstances is the land where the ensmalled tube is sized. If the areas of depression or flats are too extreme, the metal of the tube flows into the depressions thus providing localized thickening of the metal. This requires heavier drawing action on those portions of the land immediately forward of the flats, and this localized thickening of metal results in a relatively rapid wear of the land. This situation is liable to occur if the flats or areas of depressions extend throughout the axial dimension of the tapered working portion. However, by the expedient of providing the flats for only a portion of the axial extent of the angular working face the localized thickening of the metal of the tube is minimized and yet an adequate supply of lubricant is provided even though the lubricant must essentially squeeze in between the angular working face of the mandrel and the inner wall of the tube. The metal of the tube may thicken somewhat into the undercut, but there is enough free space for some of the lubricant to flow into the undercut and form an annulus so that the land may be lubricated throughout its circumferential extent. Moreover, what localized thickening occurs at the flat is in a measure offset by the relatively large supply of lubricant on those portions of the land immediately forward of the flats.

I claim:

1. A floating mandrel for use with a die for drawing tube, comprising a body portion having a diameter approximating the internal diameter of the tube to be drawn, a tapered portion extending from the body portion and having its small diameter remote from the body portion, a land portion extending from the small end of the tapered portion and having a diameter less than that of the body portion for sizing the ensmalled tube, and one or more areas of depression in the surfaces of the tapered portion extending substantially from the small end thereof a distance less than the axial dimension of the tapered portion.

2. A floating mandrel for use with a die for drawing tube, comprising a body portion having a cross dimension approximating the internal cross dimension of the tube to be drawn, a tapered portion extending from the body portion and having its small cross dimension remote from the body portion, a land portion extending from the small end of the tapered portion and having a cross dimension less than that of the body portion for sizing the ensmalled tube, and one or more areas of depression in the surfaces of the tapered portion extending substantially from the small end thereof a distance less than the axial dimension of the tapered portion.

3. A floating mandrel for use with a die for drawing tube, comprising a body portion having a diameter approximating the internal diameter of the tube to be drawn, a tapered portion extending from the body portion and having its small diameter remote from the body portion, a land portion extending from the small end of the tapered portion and having a diameter less than that of the body portion for sizing the ensmalled tube, one or more areas of depression in the surfaces of the tapered portion extending substantially from the small end thereof a distance less than the axial dimension of the tapered portion, and an undercut formation substantially at the juncture of the land and the tapered portion which which the one or more areas of depression communicate.

4. A floating mandrel for use with a die for drawing tube, comprising a body portion having a diameter approximating the internal diameter of the tube to be drawn, a tapered portion extending from the body portion and having its small diameter remote from the body portion, a land portion extending from the small end of the tapered portion and having a diameter less than that of the body portion for sizing the ensmalled tube, one or more areas of depression in the surfaces of the tapered portion extending substantially from the small end thereof a distance less than the axial dimension of the tapered portion, and a circumferential undercut formation substantially at the juncture of the land and tapered portion with which the one or more areas of depression communicate.

5. A floating mandrel for use with a die for drawing tube, comprising a body portion having a diameter approximating the internal diameter of the tube to be drawn, a tapered portion extending from the body portion and having its end of small diameter remote from the body portion, a land portion extending from the small end of the tapered portion and having a diameter less than that of the body portion for sizing the ensmalled tube, one or more substantially flat areas in the

surface of the tapered portion extending substantially from the juncture of the tapered portion and the land portion to an intermediate location between the junctures of the tapered portion with the body portion and the land portion, said substantially flat areas having an angularity relative to the axis somewhat greater than that of the tapered portion.

6. A floating mandrel for use with a die for drawing tube, comprising a body portion having a diameter approximating the internal diameter of the tube to be drawn, a tapered portion extending from the body portion and having its end of small diameter remote from the body portion, a land portion extending from the small end of the tapered portion and having a diameter less than that of the body portion for sizing the ensmalled tube, one or more substantially flat areas in the surface of the tapered portion extending substantially from the juncture of the tapered portion and the land portion to an intermediate location between the junctures of the tapered portion with the body portion and the land portion, said substantially flat areas having an angularity relative to the axis somewhat greater than that of the tapered portion, and a circumferential undercut at the juncture between the tapered portion and the land portion with which the substantially flat surfaces communicate.

7. A tube drawing device, comprising a die with a die passage for the movement of tube therethrough, said die passage having an entrance opening with interior surfaces at an angle to the axis, an intermediate working section with interior surfaces at an angle to the axis less than the angle of the surfaces of the entrance opening, and a land section adjacent the outlet and having surfaces substantially paralleling the axis, a floating mandrel for disposition within a tube to be moved through the passage, said mandrel having a body portion which substantially fits within the tube, an intermediate tapered working portion for cooperation with the working section of the die, a land portion of cylindrical form for projection into and cooperation with the land section of the die, and areas of depression in the working portion of mandrel extending from an intermediate part of the working portion to the juncture between the working portion and the land portion.

8. A tube drawing device, comprising a die with a die passage for the movement of tube therethrough, said die passage having an entrance opening, a working section with interior surfaces at an angle to the axis and a land section adjacent the outlet end having surfaces substantially paralleling the axis, a floating mandrel for disposition within a tube to be moved through a passage, said mandrel having a body portion which substantially fits within the tube, an intermediate tapered working portion for cooperation with the working section of the die, a land portion of cylindrical form for projection into and cooperation with the land section of the die, areas of depression in the working portion of mandrel extending from an intermediate part of the working portion to the juncture between the working portion and the land portion, and an undercut formation at the juncture between the working portion and the land portion forming a groove in communication with the areas of depression.

9. A tube drawing device, comprising a die with a die passage for the movement of tube therethrough, said die passage having an entrance opening with interior surfaces at an angle to the axis, an intermediate working section with interior surfaces at an angle to the axis less than the angle of the surfaces of the entrance opening, and a land section adjacent the outlet end having surfaces substantially paralleling the axis, a floating mandrel for disposition within a tube to be moved through the passage, said mandrel having a body portion which substantially fits within the tube, an intermediate tapered working portion for cooperation with the working section of the die, a land portion of cylindrical form for projection into and cooperation with the land section of the die, circumferentially spaced substantially flat areas on the working portion extending from an intermediate part of the working portion to the juncture between the working portion and the land portion at an angle greater than the angularity of the tapered working portion, and an undercut formation providing a circumferential groove at the juncture between the working portion and the land portion and which is in communication with the substantially flat areas.

10. A tube drawing device, comprising a die with a die passage for the movement of tube therethrough, said die passage having an entrance opening, a working section with interior surfaces at an angle to the axis and a land section adjacent the outlet having surfaces substantially paralleling the axis, a floating mandrel for disposition within a tube to be moved through the passage, said mandrel having a body portion which substantially fits within the tube, an intermediate tapered working portion for cooperation with the working section of the die, a land portion for projection into and cooperation with the land section of the die, and areas of depression in the working portion of the mandrel extending from an intermediate part of the working portion to the juncture between the working portion and the land portion.

ALBERT KATZ.