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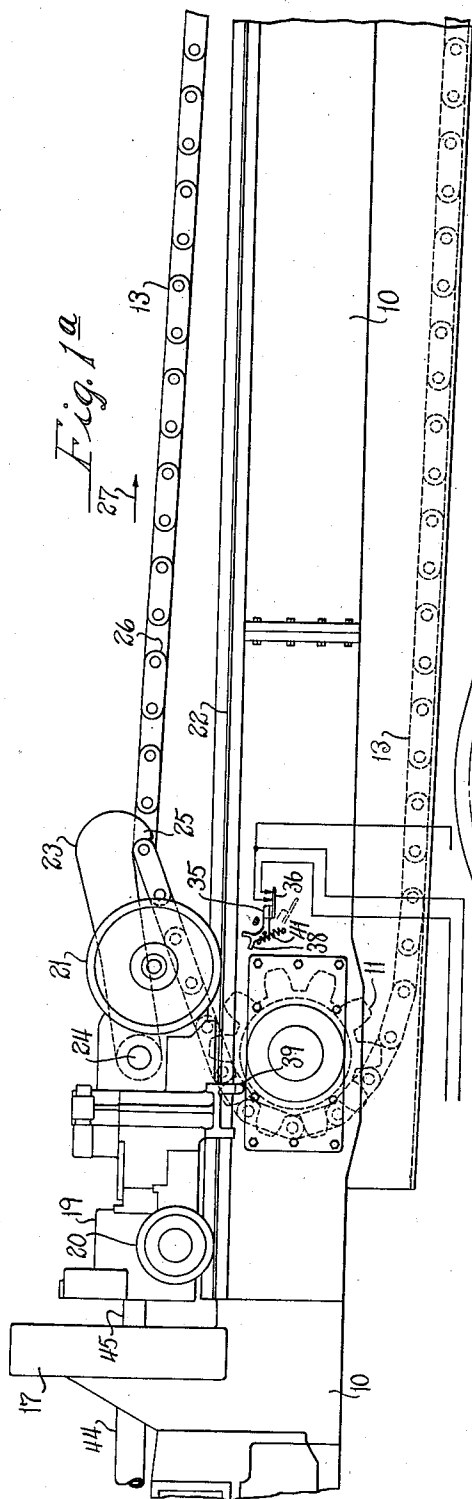
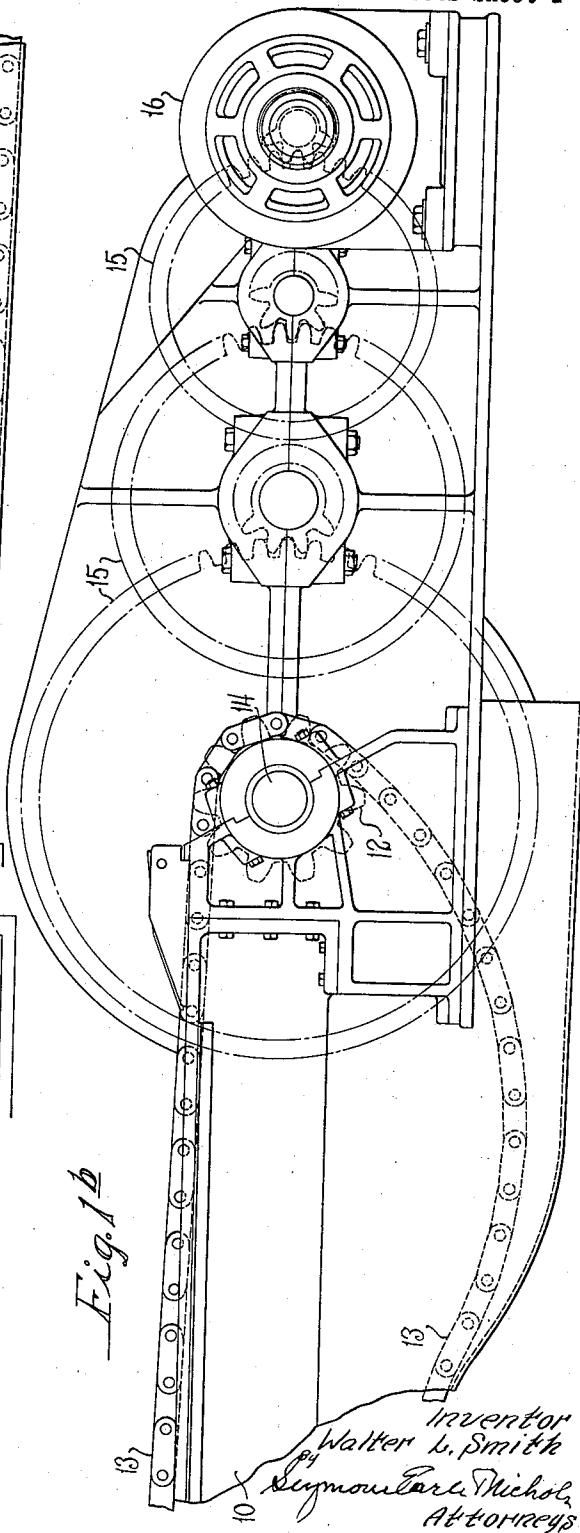
W. L. SMITH

2,196,646

MEANS FOR DRAWING TUBES

Filed June 20, 1938

2 Sheets-Sheet 1



Inventor
Walter L. Smith
Sigmund E. Nichols
Attorneys

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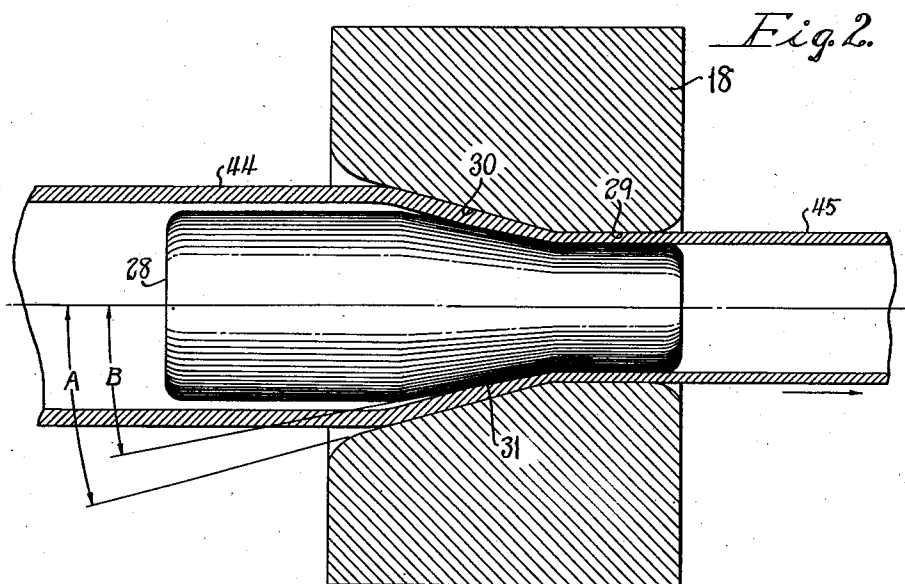
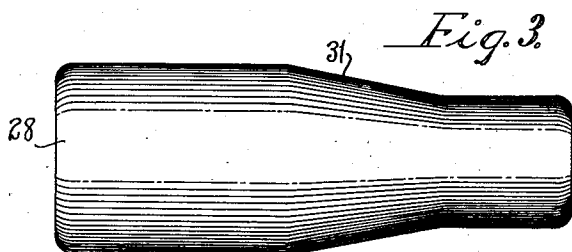
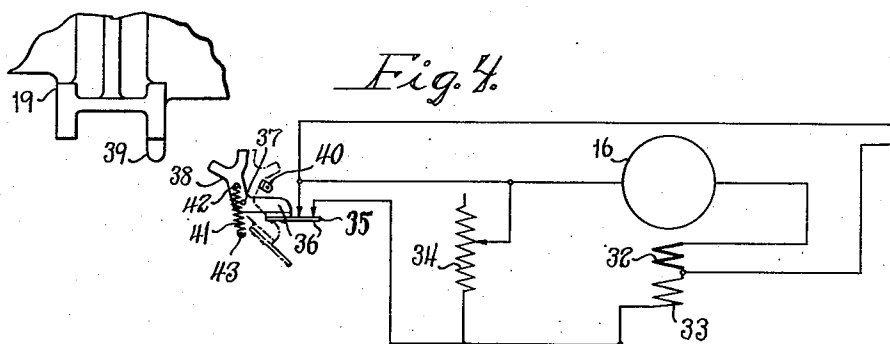
W. L. SMITH

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2 Sheets-Sheet 2



Inventor
Walter L. Smith
Seymour Carl Nichols
Attorneys

UNITED STATES PATENT OFFICE

2,196,646

MEANS FOR DRAWING TUBES

Walter L. Smith, Cleveland, Ohio, assignor to
Chase Brass & Copper Co. Incorporated, Water-
bury, Conn., a corporation

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4 Claims. (Cl. 205—7)

This invention relates to improvements in means for drawing tubes, and more particularly for drawing tubes with dies and floating-plugs.

Heretofore, in connection with efforts to draw tubes with drawing-dies and floating-plugs, a number of practical difficulties have been encountered, among which may be mentioned chattering of the tube being drawn and the mechanism employed, breaking of the tube being drawn, formation of shoulders on the tube being drawn, and marring of the surfaces of the tube by the formation of scratches, etc., thereon.

I have found that by providing conical drawing-surfaces on the die and plug of particular angle-ranges, and by providing certain speed-changes during the drawing of a tube, that tubes can be successfully and economically drawn commercially and free of the defects heretofore referred to.

One object of this invention, therefore, is to provide an improved way of drawing tubes with dies and floating-plugs which will overcome the defects hereinbefore referred to.

Another object of this invention is to provide an improved way of drawing tubes with dies and floating-plugs under such speed conditions as will accomplish economical manufacture of tubes, while at the same time producing tubes of satisfactory commercial perfection, free of the hereinbefore-referred-to defects.

With the above and other objects in view, as will appear to those skilled in the art from the present disclosure, this invention includes all features in the said disclosure which are novel over the prior art.

In the accompanying drawings, in which one way of carrying out the invention is shown for illustrative purposes:

Figs. 1^a and 1^b illustrate side elevations respectively of the die-end and the drive-end portions of one form of draw-bench construction for carrying out the present invention;

Fig. 2 is a central longitudinal section through a die and floating-plug in conjunction with a tube being drawn therebetween;

Fig. 3 is a side view of the plug shown in Fig. 2; and

Fig. 4 is a diagrammatic view illustrating one form of mechanism for accomplishing a change of speed in the drawing of a tube while it is being drawn.

In the description and claims, the various parts and steps are identified by specific names for convenience, but they are intended to be as generic in their application as the prior art will permit.

Referring to the drawings, 10 indicates a draw-bench having sprockets 11 and 12 at opposite ends thereof and meshing with a drive-chain 13. The sprocket 12 is mounted on a shaft 14 which is

driven by reduction-gearing 15, from an electric motor 16.

At the die-end of the draw-bench, a die-head or die-block 17 has a draw- or drawing-die 18 (Fig. 2) mounted therein.

A draw-carriage 19 has pairs of wheels 20 and 21 (only one wheel of each pair being shown) mounted for travel along a pair of tracks 22 (only one being shown). The draw-carriage 19 has a draw-hook 23 pivoted at 24 and having a hook-end 25 adapted to be dropped onto the chain 13 to engage one of the links 26 in order to cause the chain 13 to draw the draw-carriage along in the direction of the arrow 27.

One important feature of my invention resides in certain angle characteristics of the draw-die 18 and a floating-plug 28. I have found that the hole 29 in the draw-die 18 should have a conical draw-surface 30, at least at the smaller conical portion shown on the drawings, which makes an angle A with the axis of the hole 29 of between approximately 12° and approximately 15°, and preferably this angle is approximately 15°. I have also found that the floating draw-plug 28 should have a conical draw-surface 31, at least at the smaller conical portion shown on the drawings, which makes an angle B with the longitudinal axis of the plug of between approximately 11° and approximately 14°, and preferably this angle is approximately 11°. While the draw-die and plug may each be made of hardened tool steel or tungsten carbide, it is satisfactory to have the die of tungsten carbide and the plug of hardened tool steel chromium plated.

I have also found that an important feature in connection with drawing tubes by the draw-die and floating-plug method is to start the draw at a relatively low speed and then increase the speed of draw during the remainder of the draw-stroke. Preferably, between the first and last portions of the draw-stroke, the speed of draw is accelerated considerably over a comparatively short interval of time. This change of speed of draw may be accomplished in various ways.

The particular way illustrated in the drawings for accomplishing the draw and the change of speed of the draw is accomplished with a compound-wound direct-current motor 16, having relatively strong shunt field-coil means 33 and series coil means 32. 34 is an adjusting-speed regulating-rheostat. A switch generally designated as 35 is mounted on the side of the draw-bench 10 and has a switch-arm 36 pivoted at 37 and having a fork-arm 38 adapted to be actuated in either of two opposite directions by the projecting operating-finger 39 carried by the buggy or draw-carriage 19. When the fork-arm 38 is moved to the right by the operating-finger 39 to the dotted-line position indicated in Fig. 4, the fork-arm 38 engages a limit-block 40. When

the fork-arm 38 is actuated by finger 39 to move to the left, the switch-arm 36 closes the switch. A spring 41 connected at 42 to the fork-arm and at 43 to the side of the draw-bench 10 acts to hold the switch-arm 36 in either of the opposite positions to which it is moved by the operating-finger 39.

With the carriage 19 at the extreme left at the start of the draw, the switch-arm 36 is in closed or short-circuiting position as shown in full lines in Figs. 1 and 4, so that the shunt field-coil 33 receives increased current, thereby increasing the strength of the field of the motor 16 and causing the motor to run at a lower speed. It is understood, of course, that the motor 16 is now turning continuously at the lower speed mentioned and in consequence the chain 13 continues its travel at a corresponding low speed about the two sprockets 11 and 12. When a tube 44 is to be drawn in accordance with applicant's improved invention, the end of the tube 44 is provided with a reduced or bulldozed end 45 which will extend through the draw-die so as to be grasped by a gripper part of the carriage 19. A proper-sized floating draw-plug 28 is then inserted in the far end (not shown) of the tube 44 and forced therealong to its position shown in Fig. 2 by any suitable means such, for example, as a blast of compressed air shot into the tube 44 behind the floating-plug 28.

The hook 23 is now dropped onto the chain 13 to cause the hook-end 25 to engage one of the links thereof, whereupon the carriage 19 is instantly pulled forward by the chain to start the draw of the tube 44 through the draw-die 18. When the carriage 19 has traveled sufficiently far to cause the finger 39 to swing the fork-arm 38 to the right, the switch-arm 36 is swung down to open the switch 35, thereby decreasing the current through the shunt field-coil 33, and consequently increasing the speed of the motor 16 with corresponding increase in the speed of travel of the chain 13 and the speed of draw of the tube being drawn. After a certain short interval of time, the motor has increased to a maximum and uniform speed at which it continues to rotate to cause the final period of travel of the carriage 19 to be at a substantially higher speed during the remainder of the draw or draw-movement. It will be obvious that by suitably selecting the characteristics of the motor and control-mechanism therefor that practically any desired starting, accelerating and final speeds may be obtained.

One group of speeds that I have found to be satisfactory and give satisfactory results consists in having the initial speed of draw at forty feet per minute for a period of between two- and three-hundredths minute when the switch 35 is actuated, whereupon the speed is rapidly accelerated to nearly top speed at from eight- to nine-hundredths minute after the start of the draw, at the end of which time the chain reaches a substantially uniform speed of travel of between one hundred fifty-five and one hundred sixty feet per minute for the remainder of the draw-movement. Instead of having a single acceleration of speed-adjustment, it will be evident that the acceleration-period could be divided into several separate units of acceleration. This could be accomplished in various ways as will be evident. Thus, for example, the finger 39 could be arranged to successively close a series of contacts to bring about successive units of acceleration.

It will be obvious that other types of motor and mechanism, either automatic or otherwise,

may be employed instead of the specific mechanism hereinbefore disclosed. Thus, for example, instead of having an automatically actuated switch 35, the entire mechanism could be controlled by hand by an operator.

With the features of applicant's invention hereinbefore set forth, tubes can be readily drawn at satisfactory commercial speeds without chattering, without breakage or sheering off of the tube, and without producing shoulders or a defective or scratchy surface on either the outside or inside of the tube. In other words, tubes produced according to applicant's invention are entirely satisfactory in finish and cost.

The invention may be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention, and the present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

I claim:

1. Tube-drawing means comprising: a tube-drawing die having a hole therethrough providing a substantially-conical drawing-surface making an angle of from approximately 12° to approximately 15° with its axis; a floating drawing-plug for use inside of a tube being drawn through said hole and having a substantially conical drawing-surface making an angle of from approximately 11° to approximately 14° with its axis, the difference between said angle of the die and said angle of the plug being from approximately 1° to approximately 4°; a draw-bench including traveling-means for drawing a tube between said die and plug; and means for increasing the speed of travel of said traveling-means after the tube has been only partly drawn.

2. Tube-drawing means comprising: a tube-drawing die having a hole therethrough providing a substantially conical drawing-surface making an angle of approximately 15° with its axis; a floating drawing-plug for use inside of a tube being drawn through said hole and having a substantially conical drawing-surface making an angle of approximately 11°; a draw-bench including traveling-means for drawing a tube between said die and plug; and means for increasing the speed of travel of said traveling-means after the tube has been only partly drawn.

3. Tube-drawing means comprising: a tube-drawing die having a hole therethrough providing a substantially conical drawing-surface making an angle of from approximately 12° to approximately 15° with its axis; and a floating drawing-plug for use inside of a tube being drawn through said hole and having a substantially conical drawing-surface making an angle of from approximately 11° to approximately 14° with its axis, the difference between said angle of the die and said angle of the plug being from approximately 1° to approximately 4°.

4. Tube-drawing means comprising: a tube-drawing die having a hole therethrough providing a substantially conical drawing-surface making an angle of approximately 15° with its axis; and a floating drawing-plug for use inside of a tube being drawn through said hole and having a substantially conical drawing-surface making an angle of approximately 11°.