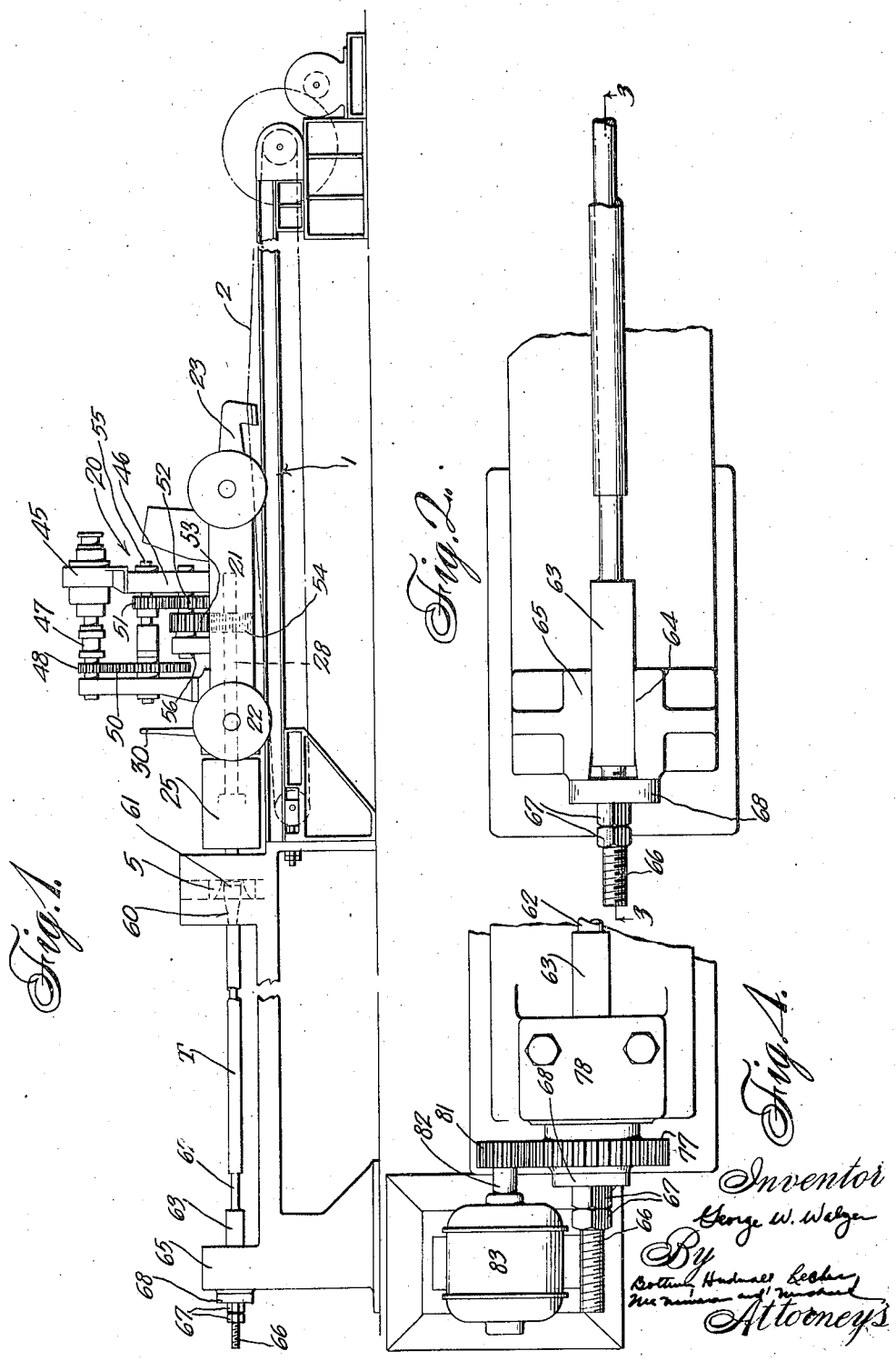
Aug. 4, 1936. G. W. WALZER 2,049,577

TUBE DRAWING MACHINE

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TUBE DRAWING MACHINE

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Fig. 3.

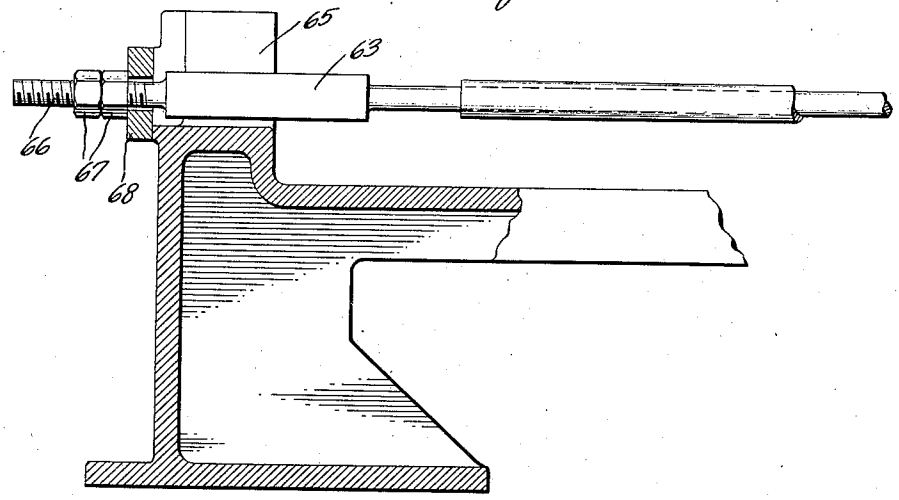


Fig. 5.

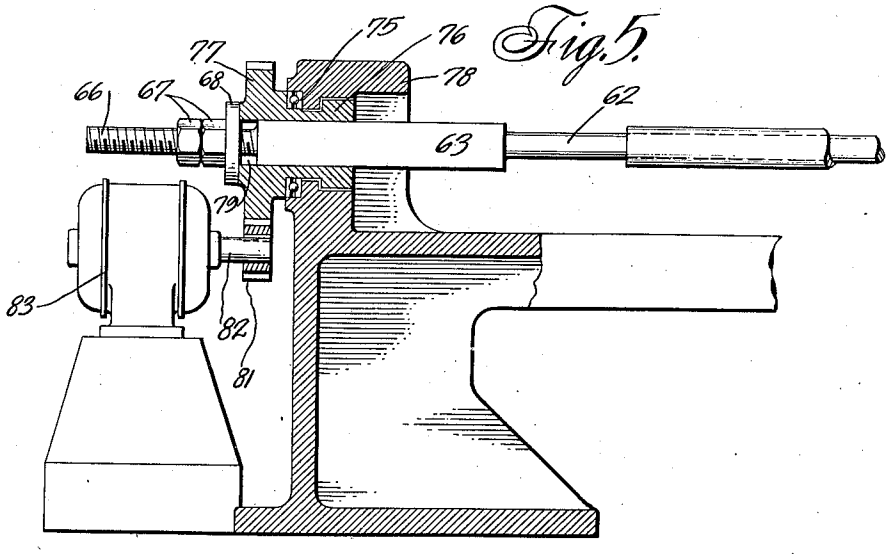
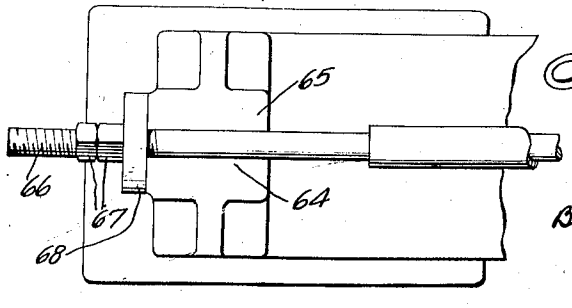


Fig. 6.



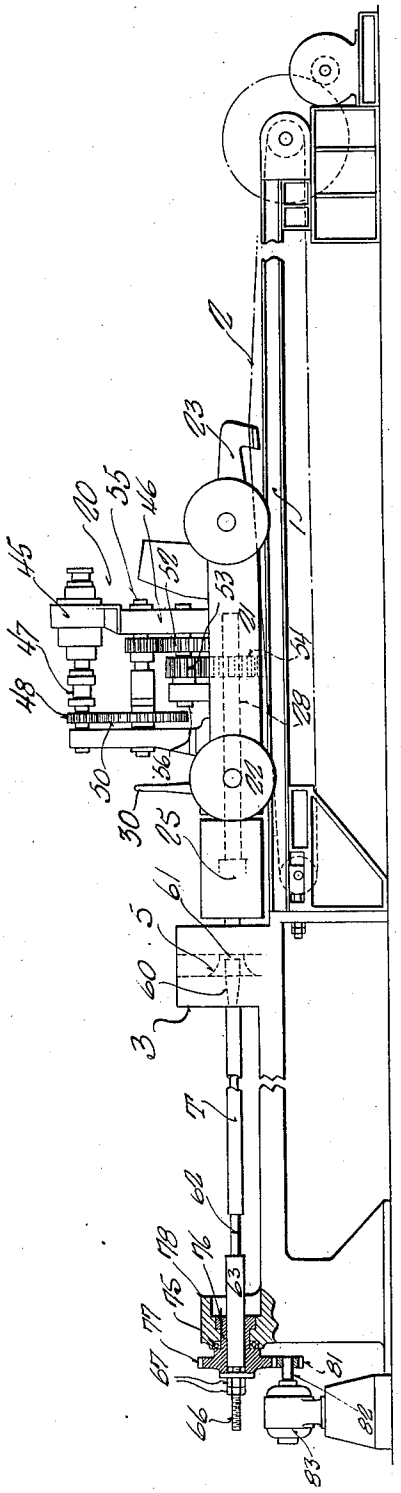
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TUBE DRAWING MACHINE

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Fig. 1.



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2,049,577

UNITED STATES PATENT OFFICE

2,049,577

TUBE DRAWING MACHINE

George W. Walzer, Milwaukee, Wis., assignor to Globe Steel Tubes Co., Milwaukee, Wis., a corporation of Delaware

Application October 15, 1930, Serial No. 488,771

3 Claims. (Cl. 205—7)

This invention relates generally to the production of drawn tubing and more particularly to the cold drawing operations involved in producing such tubing.

Cold drawing tubing consists in passing the tube through a die and over a mandrel. For this purpose a draw bench is employed which supports the die and mandrel in fixed position and which provides a track along which the draw carriage travels. Tube engaging pliers are fixed on the draw carriage and are designed to effectively grip the reduced end of the tubing which is inserted through the die. The carriage moves in a straight path along the draw bench under the actuation of the draw chain associated therewith when the carriage is connected to the chain by its draw chain hook. With this conventional draw bench the tube is pulled with a rectilinear movement through the die and over the mandrel and as a result its wall thickness and also its diameter is reduced and its length correspondingly increased.

The extent to which tubing may be reduced (in diameter and in wall thickness) in each drawing operation is decidedly limited and an attempt to exceed the limit results in a breakage of the tubing. It is obvious that a high degree of friction is exerted between both the die and mandrel and the tubing and this friction and consequent resistance to the passage of the tubing sets up severe stress in the metal of the tubing, which stress increases directly as the amount of reduction. Of course, when the stress set up in the metal of the tubing exceeds its tension strength, breakage ensues. These difficulties are more pronounced with some metals, as for example, stainless steel, than with others.

Because of the small amount that tubing may be reduced in any single drawing operation, it is necessary to resort to a succession of drawing operations wherever a material amount of reduction is involved. Between each drawing operation the tubing must be annealed and pickled. All of this is very expensive and slows up the production of the tubing.

Another serious disadvantage of the prior practice has been the mutual bad effects of the mandrel and tubing on each other. The fixed mandrel engages the tubing with a scraping effect as the tubing is pulled thereover. This tends to load the surface of the mandrel with metal of the tubing and not infrequently to scratch and roughen up or otherwise impair the interior of the tubing. Not only is the quality of the tubing impaired but production is slowed up and costs increased because the operators are required to frequently "doctor" the mandrels, that is, to remove the metal accumulated thereon during the drawing operations.

One of the principal objects of the present invention is to provide a machine for drawing tubing which is so constituted as to materially increase the amount of reduction of the tubing (in wall thickness and diameter) in each drawing operation and thereby decrease the number of drawing operations and intermediate pickling and annealing operations that are required to bring about the desired reduction.

Another object of prime importance is to eliminate the scraping action between the tubing and mandrel thereby avoiding the accumulation of metal from the tube on the mandrel and dispensing with the necessity of "doctoring" the mandrel and to do this in such manner as to smooth and finish the interior of the tubing thereby enhancing the quality of the tubing and its capacity for its intended purposes. Instead of scraping or roughening the interior of the tube, the mandrel exerts a polishing or smoothing action thereon and the resistance which the mandrel presents to the passage of the tube thereover is decreased materially.

Another object of the invention is to provide for the economical production on a commercial scale of drawn tubing having its interior smoothed and finished.

A further object resides in the provision of a machine capable of simultaneously drawing tubing and finishing and smoothing the interior thereof and which is of simple and durable construction reliable and effective in operation and easy and comparatively inexpensive to manufacture and operate.

Other objects and advantages reside in certain novel features of the construction, arrangement and combination of parts which will be hereinafter more fully described and particularly pointed out in the appended claims, reference being had to the accompanying drawings, forming a part of the specification, and in which:

Figure 1 is a diagrammatic view in side elevation showing a draw bench embodying the present invention;

Figure 2 is a fragmentary plan view showing one arrangement employed at the tail end of the draw bench for holding the mandrel against rotation;

Figure 3 is a view in vertical section taken on line 3—3 of Figure 2 with parts shown in elevation for the sake of simplicity in illustration:

Figure 4 is a fragmentary plan view showing a modified construction of the tail stock of the draw bench and the provision of means for rotating the mandrel;

Figure 5 is a view in section taken on line 5—5 of Figure 4 and showing parts in elevation for the sake of simplicity in illustration;

Figure 6 is a fragmentary plan view showing another form of means which may be employed for retarding or tending to prevent rotation of the mandrel; and

Figure 7 is a view partly in side elevation and partly in section showing the tail stock of Figures 4 and 5 organized with the die, draw bench and draw carriage of Figure 1.

Referring to the drawings and more particularly to Figure 1, the numeral 1 designates a draw bench of conventional construction. Associated with the draw bench in the usual manner is the motor driven draw chain 2. The usual die head 3 is embodied in the structure of the draw bench and provides a support and mounting or fixture for a conventional drawing die 5.

In conjunction with this die assembly, a draw carriage, designated generally at 20, is provided and has a suitable frame structure 21 supported by flanged wheels 22 which ride on the side members of the draw bench.

At one end of the draw carriage 20 the usual counterweighted draw chain hook 23 is provided and its hooked end is adapted to engage the connecting pins between the links of the draw chain to cause the power of the draw chain to be applied to the carriage and pull the same along the draw bench during the drawing operation.

At the opposite end of the carriage, tube engaging pliers 25 are provided and are adapted to have gripping engagement with the reduced end of the tube to be drawn. A control lever 30 regulates the engagement and disengagement of the pliers with the tubing. The pliers are keyed to the forward end of a shaft 28 mounted on the carriage for free rotation and yet held against axial or longitudinal movement.

Means is provided for rotating the shaft 28 and consequently the pliers and tube gripped by the pliers and this means may comprise a suitable motor such as a rotary air motor 45 supported on and secured to an upright 46 rigidly interconnected with the frame of the drawing carriage. An extension 47 of motor shaft has a pinion 48 fixed or keyed thereto and this pinion engages and drives a reduction gear train comprising gear wheels 50, 51, 52, 53 and 54 and shafts 55, and 56. The gear wheel 54 is keyed to the shaft 28 so that the motor acts through the reduction gear train to rotate this shaft. Conventional flexible fluid pressure supply lines (not shown) are interconnected with the motor and have the usual controlling valves for providing for the operation of the motor 45 at will.

The construction of the draw carriage, the pliers, and the means for rotating the pliers has only been generally described as the details of these elements may be varied. For a detailed disclosure of one construction of these instrumentalities reference is made to my pending application for Tubes and machine for and method of making the same, filed July 14, 1930, Serial No. 466,777. It is also contemplated that the construction shown in the application of Emil Wrage for Machine for drawing and twisting tubes, executed August 7, 1930, filed August 18, 1930, Serial No. 477,000 may be employed.

In conjunction with the die 5 a mandrel designated generally at 60 is employed and has its effective end or head 61 shaped and adapted for its particular purpose. The mandrel also has an elongated rod-like shank or section 62. In the embodiment of the invention shown in Figure 1, the shank of the mandrel has a squared portion 63 which is fitted in a correspondingly formed slot 64 provided in a tail stock 65. Beyond the squared portion 63, the mandrel has a threaded end or extremity 66 on which nuts 67 are threaded. Interposed between the nut 67 and the rear face of the tail stock is a collar or abutment 68.

With this construction the mandrel is inserted through the tube T as shown in Figure 1 and has its squared portion 63 engaged in the slot 64. The mandrel is held against longitudinal movement in the direction of the line of pull by the nuts 67 and collar 68. The pliers 25 are now thrown into gripping engagement with the reduced end of the tube T, the reduced end having been projected through the die 5. The hook 23 is now thrown into engagement with the draw chain and the motor 45 started. As a result the pliers 25 are moved longitudinally of the draw bench and are simultaneously rotated. This not only pulls the tube T through the die 5 and over the head 61 of the mandrel 60 to reduce and draw the tube, but also rotates the tube around the head of the mandrel which is held fixed by the coaction of its squared portion 63 with the slot 64 of the tail stock.

As a result of this action the interior of the tube is smoothed and polished. Scratching and roughening are avoided. The quality of the tube and its capacity for its intended purposes are enhanced. Because the mandrel does not have a scraping engagement with the interior of the tube, the mandrel does not have its surface loaded with metal from the tube and "doctoring" of the mandrel is avoided. Due to the relative rotation between the tube and mandrel, the resistance which the mandrel presents to the passage of the tube thereover and consequently the stress set up in the metal of the tube is decreased. This permits the reduction in the tube diameter and wall thickness effected in any single drawing operation to be materially increased inasmuch as with a larger reduction the stress set up will not exceed the tension strength of the tube and will not cause breakage. It follows that the desired reduction may be obtained with fewer drawing operations and with a corresponding decrease in the intermediate annealing and pickling operation.

Under some circumstances it may be found sufficient to rely entirely on the frictional engagement of the collar 68 with the rear face of the tail stock to hold the mandrel against rotation. When this expedient is resorted to the construction shown in Figure 6 is employed. As illustrated, the construction of Figure 6 merely involves the omission of the squared portion 63 of the mandrel, the shank of the mandrel being of rod-like formation throughout its extent. It is true, that with such an expedient there may be some slippage and some slight turning of the mandrel, but the turning of the mandrel will be sufficiently retarded to produce the desired smoothing and polishing effect on the interior wall of the tube.

The polishing and burnishing and consequent finishing and smoothing of the interior of the tube being drawn may also be effected by turning

the mandrel during the drawing operation and merely pulling the tube through the die and the mandrel without rotating it or by rotating the mandrel and tube at different speeds or in opposite directions. In carrying out these purposes, the draw bench and draw carriage in Figure 1 is employed, but the tail stock of the draw bench is modified in its construction as illustrated in detail in Figures 4 and 5. Figure 7 illustrates the tail stock, shown in detail in Figures 4 and 5, assembled with the die, draw bench and draw carriage of Figure 1. As shown in Figures 4, 5 and 7, the tail stock is provided with a radial and thrust bearing assembly designated at **75** and supporting the elongated hub **76** of a gear wheel **77**. To permit of assembly of the gear wheel with the tail stock it is provided with a removable top plate **78**. The hub of the gear wheel **77** is provided with an opening **79** of non-circular cross section which snugly receives a correspondingly formed portion **63** of the shank **62** of the mandrel. As in the other embodiments of the invention, nuts **67** are threaded on the mandrel and an abutment collar **68** is positioned on the mandrel adjacent the nuts although the abutment collar in this instance engages the gear wheel **77**. A pinion **81** meshes with the gear wheel **77** and is keyed on an extension **82** of the armature shaft of an electric motor **83**. The motor **83** may be employed to rotate the gear wheel **77** and consequently the mandrel **60** in either direction and at variable speeds to carry out the burnishing and polishing of the interior of the tube during the drawing operation and as a result of the combined and differential rotation of the mandrel and tubing or by virtue of the rotation of the mandrel alone.

The invention claimed is:

1. A machine for drawing tubing and simultaneously smoothing and finishing the interior thereof and comprising a draw bench having the usual draw chain and die head, a drawing die mounted in the die head, a mandrel having a head engageable with the interior of the tubing and in cooperative relation to the die, the head of the mandrel being shaped and adapted to coact with the interior of the tubing to polish and burnish the same when the tube is rotated, means supporting the mandrel and tending to hold the same against rotation, a draw carriage supported for movement along the draw bench and connectible with the draw chain to be actuated thereby, tube engaging pliers mounted on and interconnected with the draw carriage so as to be constrained to move longitudinally therewith while free to rotate relative thereto, and a motor mounted on said carriage and geared to said pliers for rotating said pliers as said carriage is moved longitudinally of the draw bench.

2. A machine for drawing tubing and simultaneously smoothing and finishing the interior thereof and comprising a draw bench having the usual draw chain and die head, a drawing die mounted in said die head, a draw carriage supported for movement along the draw bench and connectible with the draw chain to be actuated thereby, tube engaging pliers mounted on and interconnected with the carriage so as to be constrained to move longitudinally therewith while free to rotate relative thereto, a motor mounted on said carriage and geared to said pliers for rotating said pliers as said carriage is moved along the draw bench, a mandrel engageable with the interior of the tubing and in cooperative relation to the die, and means coacting with the mandrel to cause it to rotate relative to the tubing.

3. A machine for drawing tubing and simultaneously smoothing and finishing the interior thereof and comprising a draw bench having a slotted tail stock, a drawing die mounted on the draw bench, a cooperable mandrel having its rearward end received in the slot of the tail stock, an abutment secured to the mandrel and engaged with the tail stock, cooperating means between the mandrel and tail stock for preventing any rotation of the mandrel, and means for pulling the tubing through the die and over the mandrel and for rotating the tubing.

GEORGE W. WALZER.