April 19, 1932. S. D. INSCHO 1,855,051

METHOD OF AND APPARATUS FOR COLD DRAWING TUBES

Filed June 4, 1930 5 Sheets-Sheet 1

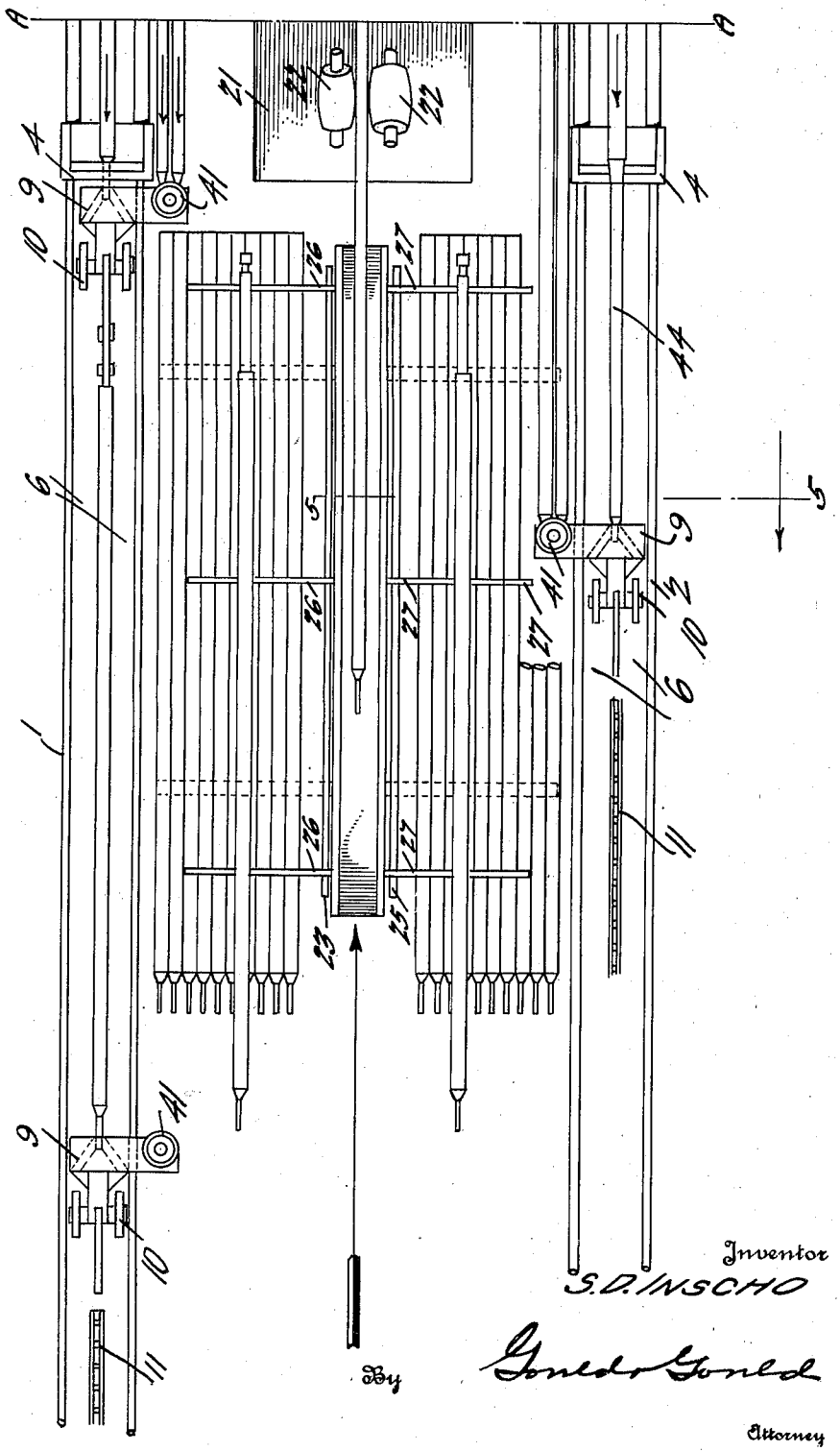

Fig. 1.

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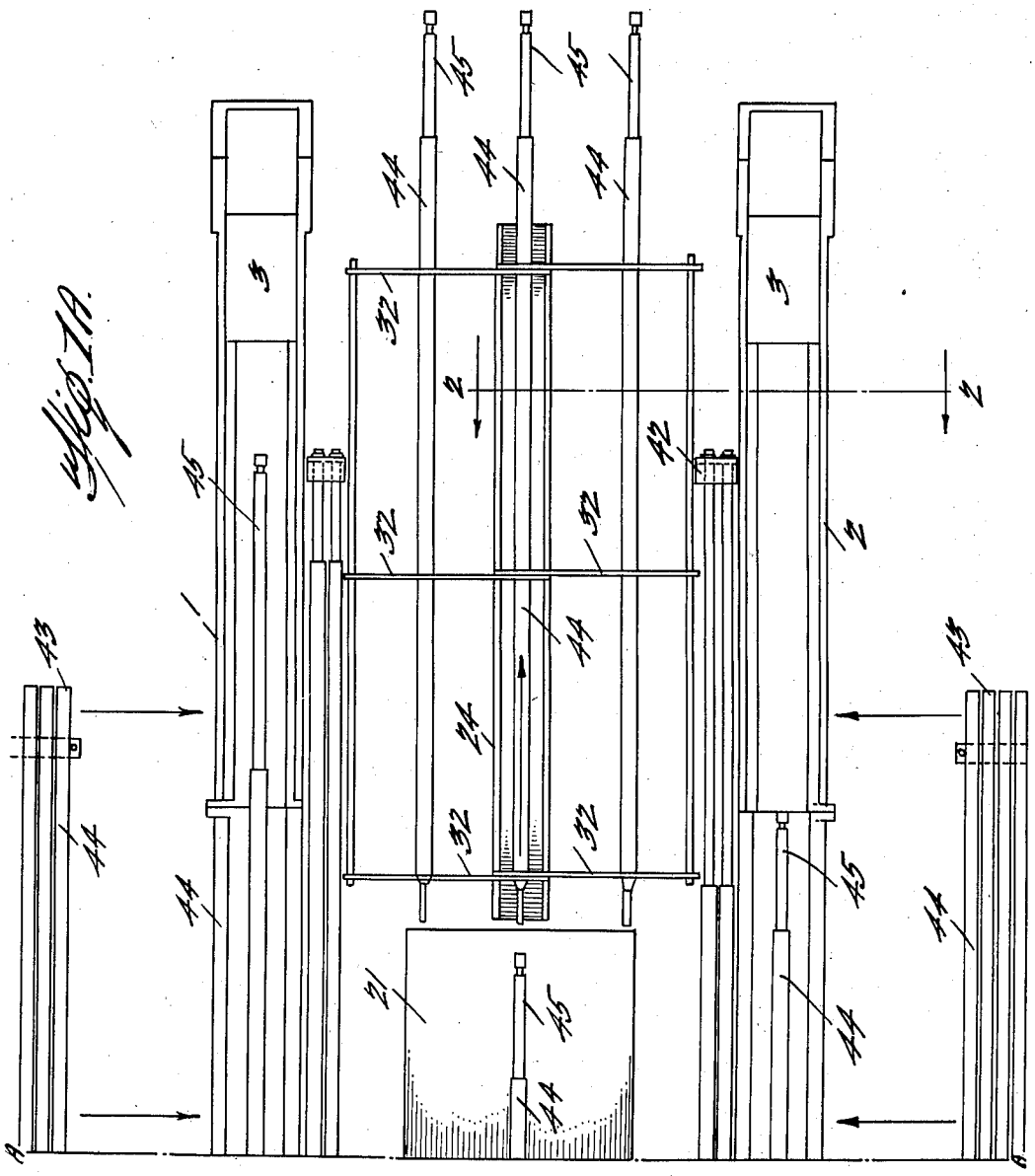

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METHOD OF AND APPARATUS FOR COLD DRAWING TUBES

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Fig. 2.

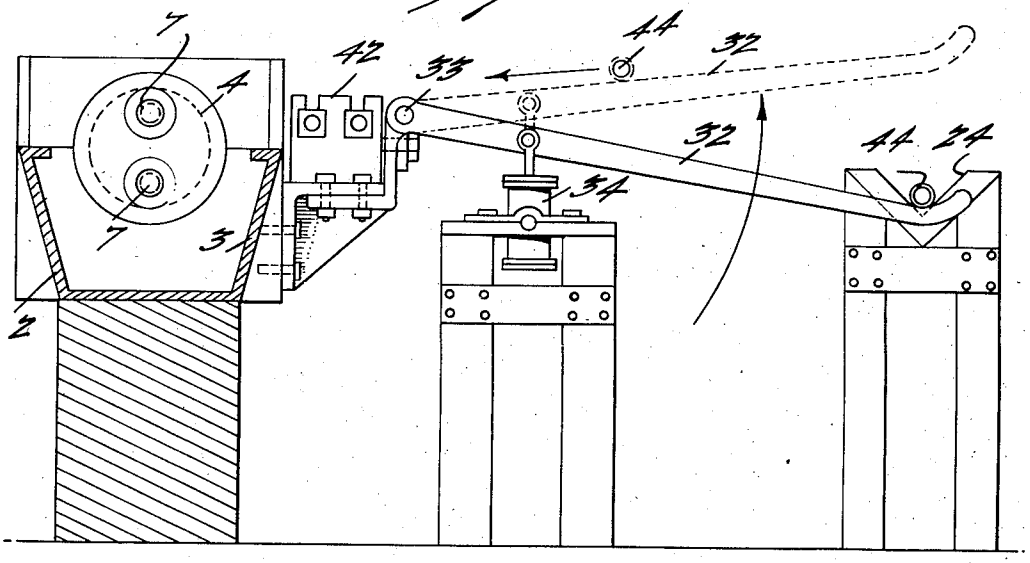


Fig. 3.

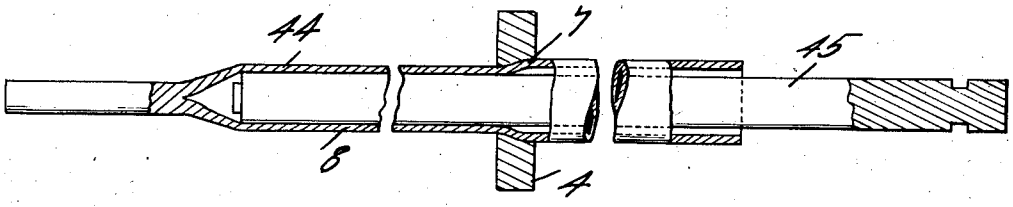
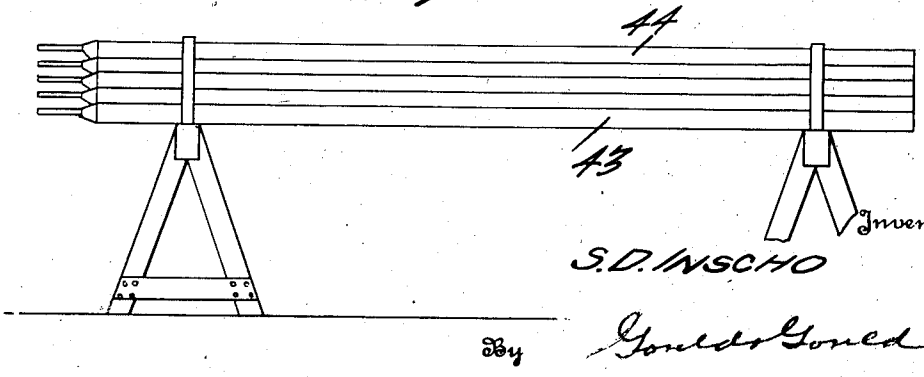


Fig. 4.



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METHOD OF AND APPARATUS FOR COLD DRAWING TUBES

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Fig. 5.

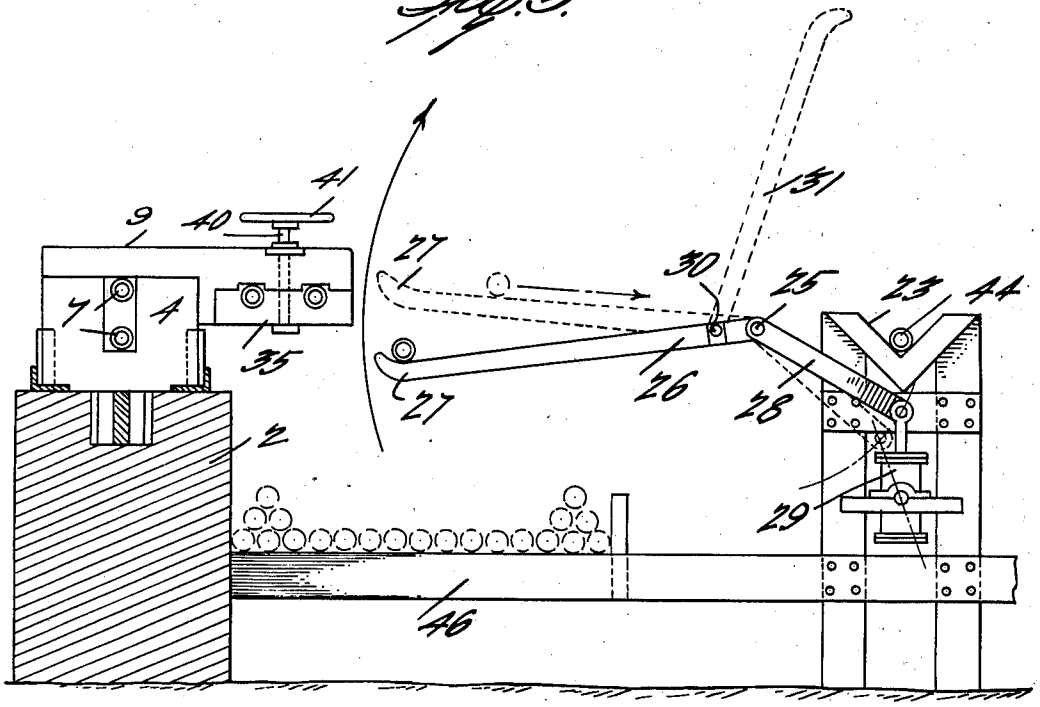

Fig. 6.

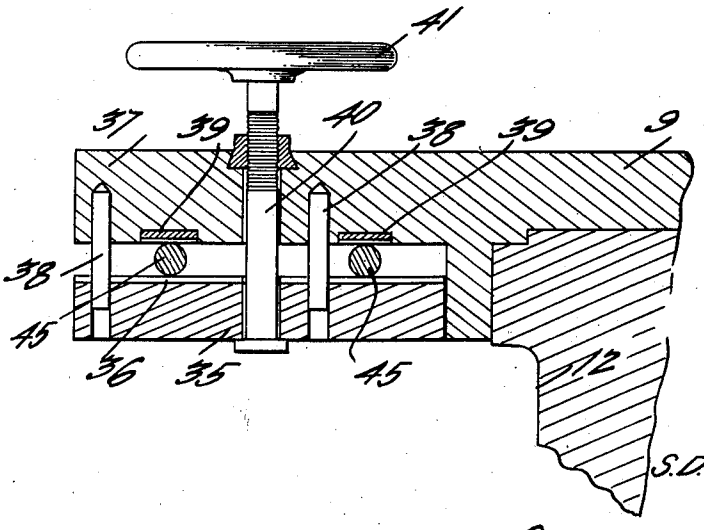

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Fig. 7.

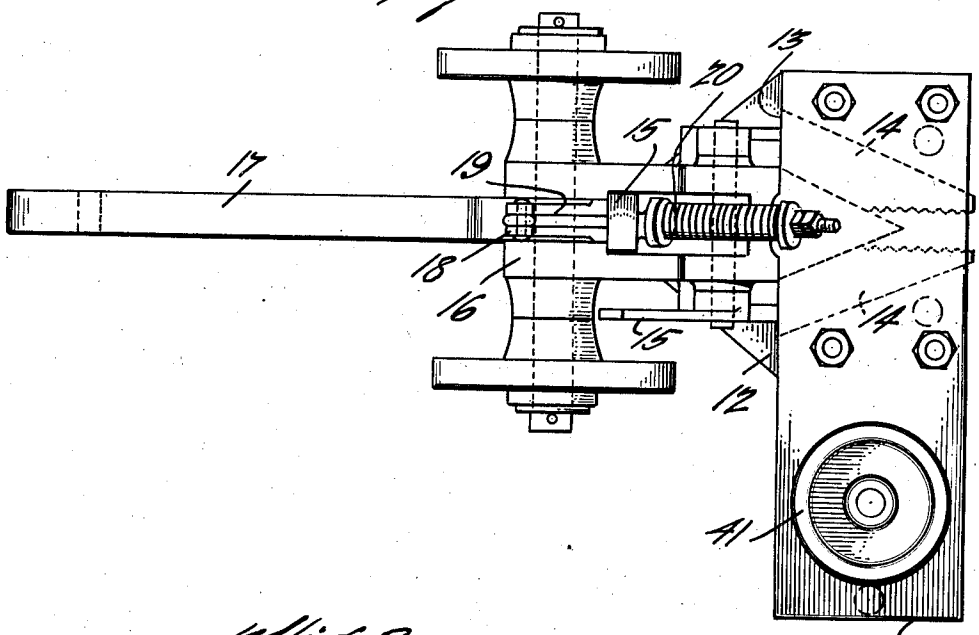
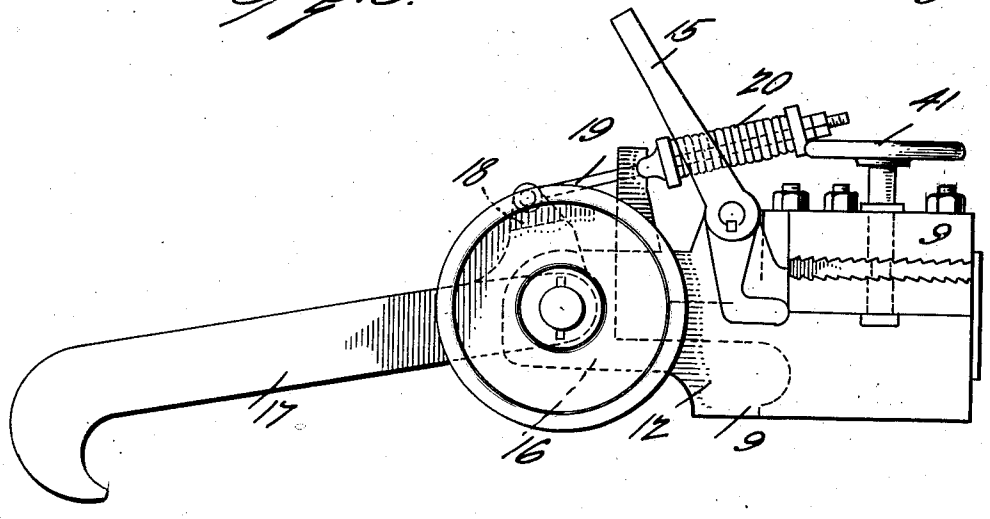


Fig. 8.



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UNITED STATES PATENT OFFICE

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METHOD OF AND APPARATUS FOR COLD DRAWING TUBES

Application filed June 4, 1930. Serial No. 459,185.

This invention is directed to a method of and apparatus for cold drawing tubes wherein the conventional steps of drawing, expanding, and stripping are so synchronized and corelated as to materially increase the output in a given time, without sacrificing quality and without increasing labor or power requirements.

The conventional steps in cold tube drawing, consisting in inserting a mandrel in the tubular body, drawing such body and mandrel through the predetermined die, subjecting the tube and mandrel to an expanding machine to loosen the tube on the mandrel, and finally stripping the drawn tube from the mandrel, have heretofore required the use of independent and separated machines for drawing, expanding, and stripping, and the necessity of attendant labor to transfer the tube from one machine to the other, with the result that each tube was subjected to the successive operation as a single element, and in its transference from one machine to the other, frequently requiring reversal, a time loss was occasioned which materially limited the possible output, to say nothing of the increased labor and space required in the incidental handling.

The present method materially increases the output by so arranging and corelating the various necessary machines that the successive operations are synchronized, dispensing substantially with the usual labor requirements and permitting comparatively few operators to carry out the full operation with a minimum of time and handling, with the result of a materially increased output.

An important and characteristic step of the improved method is the corelation of the drawing and stripping operation, wherein these operations may be simultaneously performed; the corelation permitting the stripping of one or more tubes which have been previously drawn and expanded simultaneously with the initial drawing of a tube, thus carrying out the drawing and stripping operations in a single operation.

The method also materially facilitates the handling of the tubes following any one stage of operation, for it provides for drawing, expanding, and stripping in immediately successive sequence without the necessity of physically reversing the tube or substantially changing its position, for following the drawing operation, the drawn tube is in position to be delivered to the expanding machine, and following the expanding operation, the expanded tube is in position to be secured in the stripping machine, whereby the time and labor elements incident to physical transference of the tubes from one machine to another is entirely avoided.

In addition to the method, the invention contemplates an apparatus for carrying out the method, wherein a single machine construction includes opposite parallel draw benches, which are arranged beyond a centrally disposed expanding machine, with the draw heads of the draw benches provided with means to strip the previously expanded tubes simultaneously with the tube-drawing operations of such heads; the machine structure including means for transferring the drawn tubes into line with and for easy transference to the expanding machine, and means beyond the expanding machine to transfer the expanded tubes into a position permitting their ready connection to the stripping means.

The apparatus, more specifically considered, includes a single machine unit, the sides of which are constructed to provide more or less conventional draw benches, and between which benches there is arranged a conventional expanding machine. The draw heads of the draw benches are provided with lateral clamps and the remote ends of the draw benches are also provided with fixed clamps, the said clamps providing respectively for engaging the tubes and mandrels in the stripping operation, to cause the operation of the draw heads in the drawing operation to simultaneously strip the tubes from their mandrels of previously drawn and expanded tubes. The ends of the machine unit beyond the expanding machine are provided with transferring arms, preferably mechanically operated, which at the entrance end of the expanding machine serve to transfer the drawn tubes from the draw bench on either side to a

position in line with and convenient to the expanding machine, while the arms at the exit end of the expanding machine serve to transfer the expanded tubes to a position convenient to the stripping instrumentalities forming in effect part of the draw bench.

The apparatus not only synchronizes the conventional steps in cold tube drawing, but so corelates the various necessary machines as to insure maximum speed and minimum handling in the various operations, obviously tending to better quality through lack of possible injury through handling together with a materially increased output over conventional methods and apparatus.

The invention in the preferred form of construction is shown in the accompanying drawings, in which:—

Figs. 1 and 1ª together constitute a plan view of the unit construction, including spaced draw benches and an intervening expanding machine, the draw benches having means for stripping the tubes from the mandrels.

Fig. 2 is an enlarged section on the line 2—2 of Fig. 1ª.

Fig. 3 is a longitudinal sectional view, partly in elevation, illustrating the tube-drawing operation.

Fig. 4 is a side elevation of the pile-rack for the tubes to be drawn.

Fig. 5 is a section on line 5—5 of Fig. 1.

Fig. 6 is a broken transverse section of the drawhead, showing particularly the clamps for the tubes during the stripping operation.

Fig. 7 is a plan view of the drawhead.

Fig. 8 is a side elevation thereof.

The apparatus for carrying out the improved method, consists generally in a more or less unitary construction including duplicate spaced draw benches, having as such a somewhat conventional construction and operation; an expanding machine, also substantially conventional in construction and operation, arranged between the draw benches, and serving to expand tubes drawn on both benches; and stripping instrumentalities, supported on the respective draw benches, and for the purposes of this invention coordinated with the drawheads of the draw benches, for the simultaneous drawings and stripping operations.

The construction includes opposed and relatively spaced draw benches, indicated at 1 and 2. The draw benches are of similar construction, both operating in the same direction, and each involving the familiar elongated arrangement 3, removably receiving a conventional die 4 at one end, with a trackway 6 beyond the die to movably support the draw head. The die, though interchangeably mounted, is fixed relative to the bench when in operative position, the die-aperture 7, serving to draw down the exterior of the tube, indicated 8, as the latter is drawn through the die.

The draw head 9 for each bench is mounted through wheels 10 for travel on the trackway 6 of the bench, this travel being selectively induced, when drawing of the tube is desired, by connecting the draw head with a chain 11, moving lengthwise and centrally of the trackway, and driven through suitable and preferably convention drive mechanism, not necessary to illustrate.

The draw head 9, as illustrated more particularly in Figs. 6, 7, and 8, includes a base 12, having relatively-rearwardly converging channels 13, to receive gripping jaws 14, for gripping the end of tube during the drawing operation. The jaws are serrated or otherwise formed on their proximate faces for good gripping action, and move toward each other in their gripping movement, to there insure that the resistance of the tube will increase the grip of the jaws. The base is provided with a lever 15, operated to initially move the jaws 14 into tube gripping relation, and further with an extension 16 in which a hook 17 is pivotally supported. This hook has a lateral projection 18 terminally connected to a rod 19, passing through a guide, and provided beyond the same with a spring held between the guide and an adjustably mounted collar on the rod. The spring 20 being thus tensioned, serves to hold the hook in operative position, as will later appear, and at the same time permit sufficient yielding under undue strain to prevent breakage. The hook terminal and lever 15 are normally inoperative, that is with the hook in raised position, free of the chain 11, and the lever moved to permit separation of the jaws 14. In this inoperative position the draw head is free of connection with the chain 11, and is arranged immediately adjacent the die 4.

Each draw head 9 is further provided with means for gripping the tubes, to cause the tubes to move with the draw heads in the stripping operation. This detail will be later described in connection with the stripping mechanism.

Arranged between and immediately adjacent the draw benches 1 and 2 is an expanding machine 21. This machine is of any conventional or preferred type, being here indicated as including rolls 22, with angularly-related axes. The expanding machine is of course understood to be complete in detail, so that tubes drawn down on the mandrel, as will later appear, may be sufficiently expanded relative to the mandrel, to permit stripping of the tube from the mandrel. The expanding machine is thus arranged between and closely adjacent the respective draw benches, with the intention of not only facilitating the expanding of tubes drawn on both benches, but for carry-

ing out the method of synchronizing the respective operations.

In line with the inlet end of the expanding machine and between the respective draw benches, is arranged a trough-like support 23, in which the drawn tubes are arranged for delivery to the expanding machine. A somewhat similar trough like support 24 is arranged in line with the expanding machine beyond the exit end of the latter, this latter trough receiving the drawn tubes after expanding. The trough 23 is of V-form in vertical section, and arranged on each side of this trough is a shaft 25. Arms 26 are secured to each shaft, and extend, respectively, toward the opposed draw benches. The arms, of which there may be any desired number in each group, have slightly-upturned free ends 27, and terminate at one side of the adjacent draw bench. The arms of each group are designed to receive the tubes following the drawing operation on each draw bench, and transfer such tubes to the trough 23 for delivery to the expanding machine. To operate the respective groups of arms, each shaft 25 has a lever fixed thereto as 28, the levers being in turn connected to operating devices, as air cylinders 29 or any convenient power the air pressure of which is suitably controlled in any appropriate manner. Thus at will, a tube drawn on either bench, may be placed on the arms 26, and following appropriate control of the operation means the free ends of the arms may be elevated to cause the drawn tube to gravitate into the trough 23, ready for delivery to the expanding machine 21. In order to facilitate the withdrawal of the tubes from their supporting jack after stripping, as will be later explained, each arm 26 is hinged adjacent the shaft 25, as at 30, permitting the greater length of the arm toward the free end to be turned up out of the way when desired, as indicated at 31 in Fig. 5.

Thus through the selective use of the transfer arms 26 of either group, the tubes drawn on either bench may be delivered to the trough 23 for passage through the expanding machine, and as the tube delivery from the respective draw benches may be in succession, or in any order, it is apparent that the expanding is at all times conveniently arranged for a synchronized operation with the tubes from both or either draw bench.

Transfer arms are also arranged for cooperation with the expanded tubes delivered into the trough 24. These arms, indicated at 32 and shown more particularly in Fig. 2, are arranged in groups, on each side of the trough 24, being, however, connected to a common shaft 33, mounted adjacent each draw bench. The free ends of the arms 32 lie normally in vertical divisions of the trough 24, so that the free, slightly upturned ends of the arms, when in normal positions, are in effect part of the bottom of the trough, and directly support the expanded tubes delivered to said trough 24. One of the arms of each group is connected to an air cylinder, or other operator, indicated at 34, the air pressure to which is manually controlled in any appropriate manner, so that at will either group of arms 32 may have their free ends elevated, carrying with them the particular tube in the trough 24, and delivering this tube toward the adjacent draw bench.

Of course it is to be understood that each group of arms 32 leads from the trough to one of the draw-benches, so that an expanded tube may be selectively directed to one or the other of the draw benches. The expanded tubes are delivered by the arms 32 to the draw bench for the stripping operation, and this operation, in its relation to the drawing operation, constitutes one of the important features of the present invention.

As previously stated each draw head 9 is provided with means whereby such draw head may serve during and incidental to the drawing operation, for stripping the expanded tubes from the mandrels. For this purpose the base 12 of the draw head is laterally extended, preferably toward the expanding machine 21, to provide a clamp plate 35, the upper surface of which is provided with spaced serrated areas 36. A cooperating clamp plate 37, having guide pin connection at 38 with the plate 35, is also provided with serrated areas 39 to register with the areas 36 of the plate 35. Adjusting means, such as a shaft 40, terminally mounted in the plate 35 and having threaded cooperation with the plate 37, and operated through a hand wheel 41, provides for the desired relative operation of the plates for clamping or releasing the tubes.

In longitudinal alinement with the gripping means described, the bed of the draw bench, or a lateral extension thereof, is provided with cooperating clamp plates, indicated at 42, and suitably formed for receiving and holding the ends of the tube mandrels. These latter clamping plates may be similar to the clamping plates 35 and 37, except that they are in fixed position relative to the draw bench, and their cooperating clamping surfaces are particularly formed to receive and grip the ends of the mandrels.

Racks 43 are arranged conveniently adjacent each draw bench to receive the tubes to be drawn, and in the operation of the improved apparatus for carrying out the novel method of tube treatment, it is to be understood that either draw bench may be operated to the exclusion of the other, or both may be operated simultaneously.

In operation, a tube indicated at 44, is lifted from one of the racks 43 and placed on the adjacent draw bench, where one operator inserts a mandrel 45 into the tube, and a

second passes the pointed and flattened end of the tube through the die 4, and between the jaws 14 of the draw head 9. The second operator then operates the lever 15 to clamp the jaws 14 on the end of the tube, the draw head at this time being immediately beyond the die. Such second operator then moves the hook 17 downwardly to cause its hooked end to engage in the moving chain 11. The tube and mandrel are thus drawn through the fixed die 4, drawing the material of the tube onto the mandrel, as clearly shown in Fig. 3, and as well known in the tube drawing art. Thus the mandrel, which extends the full length and beyond one end of the tube, defines the inner diameter of the tube, while the die defines the outer diameter.

When the drawing operation is completed, the drawn tube with its contained mandrel is transferred to the arms 26 adjacent the particular draw bench, and the cooperating air cylinder 29 or any convenient power is operated to raise the free ends of the arms 26, causing the drawn tube to gravitate toward and be delivered into the trough support 23. Another operator then simply moves the tube forwardly into the expanding machine 21, where the tube is loosened relative to the mandrel. Following the operation of the expanding machine, the tube is moved longitudinally for a short distance into the trough support 24, where it rests on the free ends of the arms 32. Either group of arms being operated by the appropriate air cylinder 34, the expanded tube is directed toward the draw bench and into a position between the clamps, one forming part of the draw head and including the plates 35 and 37 and the other fixed to the base structure, and including the plates 42. The pointed and flattened end of the tube is secured between the plates 35 and 37, and the projecting end of the mandrel is secured between the plates 42. Then as the draw head advances for the drawing operation of another tube subsequently secured therein, the clamps for the tube move relatively to the clamps for the mandrel and the tube is stripped from the mandrel simultaneously with and under the same power as employed for the drawing operation.

Of course the above description of the operation has been that of a single tube in its passage through the apparatus, during which it was subjected to a drawing, expanding and stripping operation. The continued operation of the machine results in a successive series of tubes in continuous treatment, that is while tubes are being drawn on one or both draw benches, previously drawn tubes are passing through the expanding machine, and previously expanded tubes are being subjected to the stripping operation. Thus for each drawing operation, following a sufficient operation of the apparatus, there will be a tube or tubes ready for stripping, and such tubes will be clamped in position and stripped simultaneously with the drawing operation. This provision for stripping is arranged to accommodate two tubes on each side, and therefore, as it is entirely practical to operate both draw benches at the same time, the apparatus provides for the simultaneous drawing of at least two tubes and the stripping at the same time and incidental to the drawing operation of at least four tubes.

This simultaneous drawing and stripping is an essential feature of the method and apparatus, and it is to be noted that the stripping operation takes place so close to the active area of the draw bench, that when the tube has been stripped, the withdrawn mandrel is in position to be most conveniently and readily used for insertion in the next tube to be, with such mandrel, subjected to the drawing operation.

Another and important characteristic feature of the method is the synchronization of the various operations, incident largely to the close relation of the operating mechanisms and the particular manner in which the tubes are delivered from one to the other. The tubes when drawn are delivered without change in endwise relation to the inlet trough for the expanding machine, and again without change in endwise relation delivered from the outlet trough beyond the expanding machine to the stripping means. Thus the tube is passed through the various steps of drawing, expanding, and stripping, without the necessity of reversing the tube, and following only a relatively lateral movement of the tube at the respective ends of the apparatus. Thus the tube is moved in one direction in drawing, and without change moved in a reverse direction for expanding, and still without change moved again in a reverse direction for stripping. The tube and mandrel thus maintains the same relative direction under all operations, is never reversed, and its relative lateral bodily movements from the draw bench to alinement with the expanding machine, and from beyond the expanding machine to the stripping means, are so nearly equal that the respective operations are or may be more or less exactly timed to insure steady and uniform output.

The tubes 44 when stripped from the mandrel, are released from the draw head clamps and dropped onto a jack 46 beneath the arms 26. The hinging of these arms, as at 30, previously referred to, permits the arms to be thrown back out of the way, to facilitate entrance to the jack 46 when it is desired to remove the tubes therefrom.

The method consists in simultaneously drawing and stripping tubes, using the draw head as the stripping head, and providing for

the expanding of the drawn tubes before stripping, whereby to increase the output and reduce the labor and expense in the operations. Furthermore, the method consists in so synchronizing the respective and necessarily successive operations, as to permit their being carried out in timed sequence, with any one operation being carried out with respect to one tube, while other operations are being carried out with respect to other tubes. The method of operation insures complete drawing, complete expanding, and complete stripping by subjecting the tube following each operation to direct reversal of travel for the succeeding operation, without bodily reversal of the tube and mandrel or the necessity of other than minimum handling of the same.

The apparatus employed reduces to a minimum the operating area required, provides two opposite draw benches, either or both of which may be operated, and arranges between the draw benches an expanding machine, the corelation permitting the expanding machine to selectively serve either or both draw benches, with the minimum of tube movement, and permits the draw head of the draw benches to serve as stripping means, a convenience largely incidental to the relative close disposition of the expanding machine.

Of course the invention contemplates the use of conventional machines for the various operations, and is to be in no wise restricted by the detail showing herein.

Having thus described the invention, what is claimed as new, is:—

1. A unit organization for tube treatment comprising a draw bench, means for moving the tube relative thereto for drawing, an expanding machine, means for moving the tube therethrough in a direction reverse to the movement of the tube on the draw bench, and stripping means through which the tube is moved in a direction opposite its travel through the expanding machine and in the same direction of travel on the draw bench, whereby the tube may be directed through the successive operations without reversing its position.

2. An apparatus for tube treatment including a unit organization comprising a draw bench including a draw head, an expanding machine located adjacent the draw bench, means for directing the tube through the expanding machine in a direction opposite to the travel of the tube under the influence of the draw head, and means carried by the draw head for connecting a tube thereto for stripping simultaneously with the operation of the draw head for drawing a subsequent tube, the movement of the tube in a similar direction for drawing and stripping and in a reverse direction for expanding providing for the successive operations without reversal of tube position.

3. An apparatus for tube treatment consisting in a unit organization comprising laterally spaced draw benches, stripping means arranged adjacent said draw benches, an expanding machine arranged between the draw benches, means for transferring tubes from either draw bench laterally and without reversal to a position to cooperate with the expanding machine, and means for transferring tubes laterally without reversal beyond the expanding machine to either stripping means.

4. An apparatus for tube treatment consisting in a unit organization comprising laterally spaced draw benches, stripping means arranged adjacent said draw benches, an expanding machine arranged between the draw benches, means for transferring tubes from either draw bench laterally and without reversal to a position to cooperate with the expanding machine, and means for transferring tubes laterally without reversal beyond the expanding machine to either stripping means, said latter means being manually selected.

5. An apparatus for tube treatment consisting in a unit organization comprising laterally spaced draw benches, an expanding machine arranged between them, arms for transferring drawn tubes from either bench to the expanding machine without reversal of tube position, stripping means associated with each draw bench, and arms for selectively transferring expanded tubes without reversal of position to the stripping means.

6. A unit organization including laterally spaced draw benches, an expanding machine arranged between them and in position to serve either or both draw benches, stripping means operative in the use of either draw bench for stripping a tube previously drawn and expanded, and means for transferring the tubes from the draw benches for cooperation with the expanding machine without reversal of tube position, said tubes in cooperation with the expanding machine moving in a direction opposite to their movement in the drawing or stripping operation.

7. An apparatus including as a unit organization laterally spaced draw benches each drawing in the same direction, an expanding machine arranged between the draw benches and operating in a direction opposite that of the draw benches, and stripping means arranged beyond the expanding machine and operating in the direction of the draw benches, whereby the tube may pass through the successive operations through reversal in direction of movement without reversal of position.

8. An apparatus including as a unit organization laterally spaced draw benches, an interposed expanding machine, arms for transferring the drawn tubes from the draw benches to the expanding machine, stripping means arranged beyond the expanding ma-

chine and adjacent the draw benches, and arms operative to transfer the expanded tubes to the stripping means, the tubes in the expanding machine moving in a direction opposite their movement during drawing and stripping without reversal of position.

9. An apparatus for tube treatment comprising in a unit organization laterally spaced draw benches, an interposed expanding machine, stripping means arranged adjacent each draw bench, groups of arms associated with each draw bench and arranged in both directions beyond the expanding machine, the groups of arms at one end of the expanding machine serving to direct the drawn tubes from the draw bench to the expanding machine and the groups of arms at the other end of the expanding machine serving to direct the expanded tubes to the stripping means, and means whereby the respective groups of arms may be selectively operated.

10. A method of tube treatment consisting in drawing a tube, moving the tube laterally and then in a direction opposite the drawing movement and expanding the tube during such opposite travel, then moving the expanded tube laterally and into a position for stripping under stripping movement in the same direction as the previous drawing movement, and stripping the tube.

11. A method of tube treatment consisting in drawing a tube, moving the tube laterally and then in a direction opposite the drawing movement and expanding the tube during such opposite travel, then moving the expanded tube laterally and into a position for stripping under stripping movement in the same directions as the previous drawing movement, and stripping the tube simultaneously with the drawing of a succeeding tube.

12. A method of tube treatment consisting in simultaneously drawing at least two tubes, moving the tubes toward each other into a common plane, then moving the tubes successively in a direction opposite to their drawing movement and expanding the tubes during such opposite travel, then moving the expanded tubes laterally into the plane of movement of a previous drawing operation, and stripping the tubes so positioned coincidently with the drawing of succeeding tubes.

13. A method of tube treatment consisting in drawing a tube, moving the tube bodily without reversal into a plane different from the drawing plane, then expanding the tube by movement of the tube in the new plane in a direction opposite to that during drawing movement, then returning the tube substantially into the drawing plane for stripping operation, and stripping the tube by stripping movement in a plane substantially coincident with the initial drawing plane.

14. A method of tube treatment consisting in drawing, expanding and stripping the tube without reversal of the tube, with the drawing and stripping operations being carried out in substantially the same plane and through movement in the same direction, and the expanding operation being carried out in a different plane and through movement of the tube in a directly opposite direction.

15. The herein described method of tube treatment consisting in drawing at least two tubes simultaneously in the same direction but in relatively different, laterallly spaced planes of operation, moving the drawn tubes from each drawing plane into a common intermediate plane, moving the tubes in such common intermediate plane successively in a direction opposite to that incident to the drawing operation and expanding the tubes during such opposite travel and then moving the tubes laterally into either previous drawing plane for stripping, and stripping the tubes through operation in the same direction as in drawing movement, with the effect to draw, expand and strip the tubes without endwise reversal and through movement in two relatively opposite directions in different planes.

16. The herein described method of tube treatment consisting in drawing at least two tubes simultaneously in the same direction but in relatively different, laterally spaced planes of operation, moving the drawn tubes from each drawing plane into a common intermediate plane, moving the tubes in such common intermediate plane successively in a direction opposite to that incident to the drawing operation and expanding the tubes during such opposite travel and then moving the tubes laterally into either previous drawing plane for stripping, and stripping the tubes simultaneously with the drawing of a succeeding tube through operation in the same direction as in drawing movement, with the effect to draw, expand and strip the tubes without endwise reversal and through movement in two relatively opposite directions in different planes.

In testimony whereof I affix my signature.

SIDNEY DAVID INSCHO.