

Oct. 17, 1933.

W. R. WEBSTER

1,930,702

TUBE MILL

Original Filed July 14, 1928

2 Sheets-Sheet 1

Fig. 1.

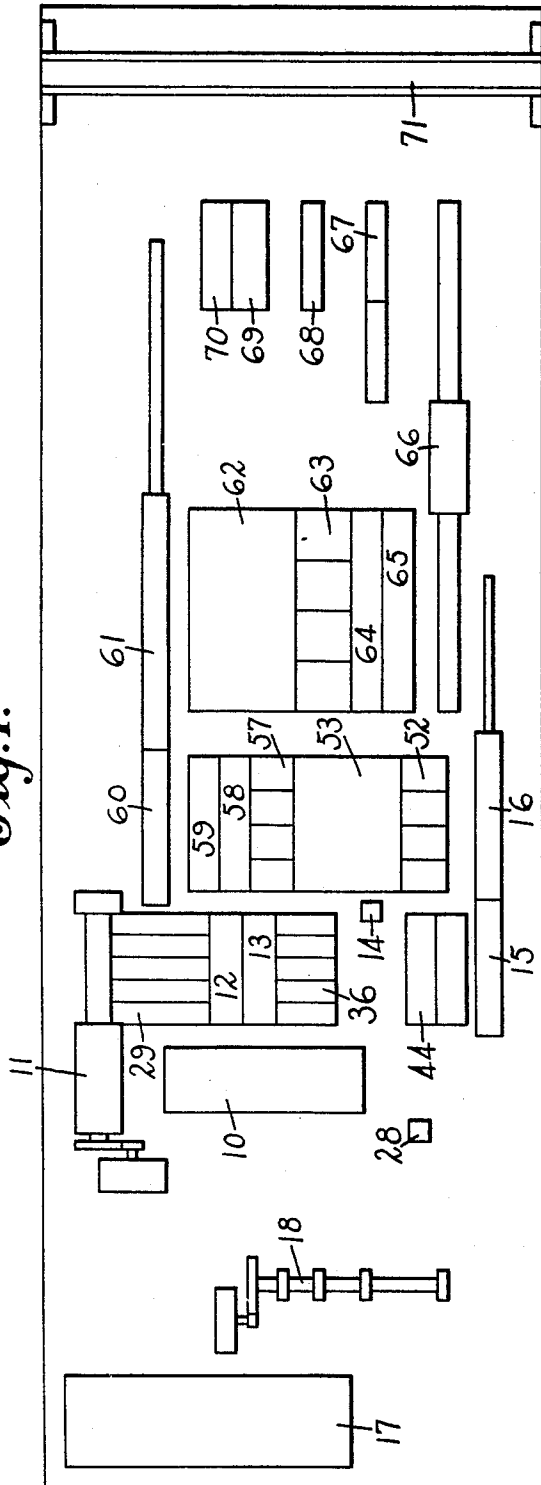


Fig. 2.

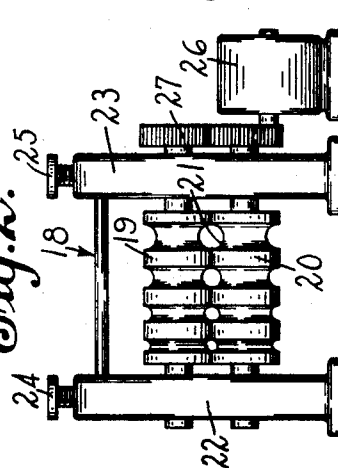
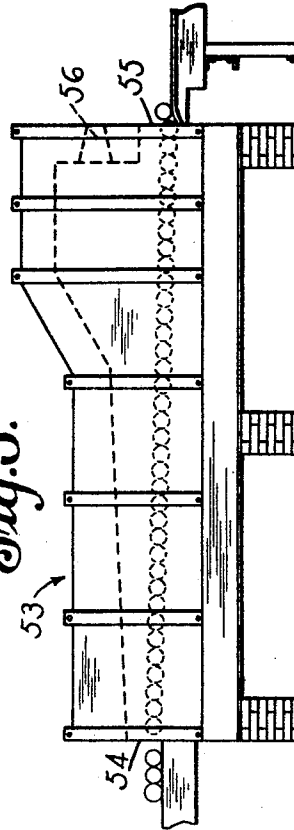


Fig. 3.



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Fig. 4.

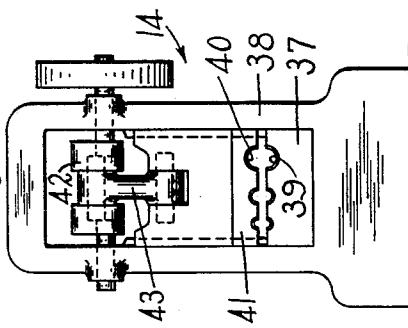


Fig. 5.

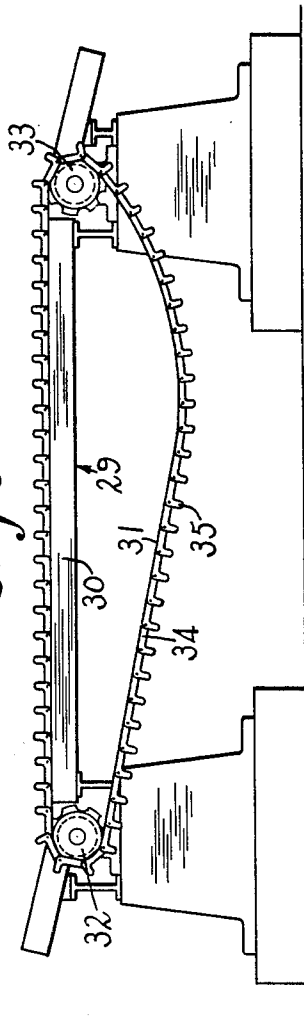
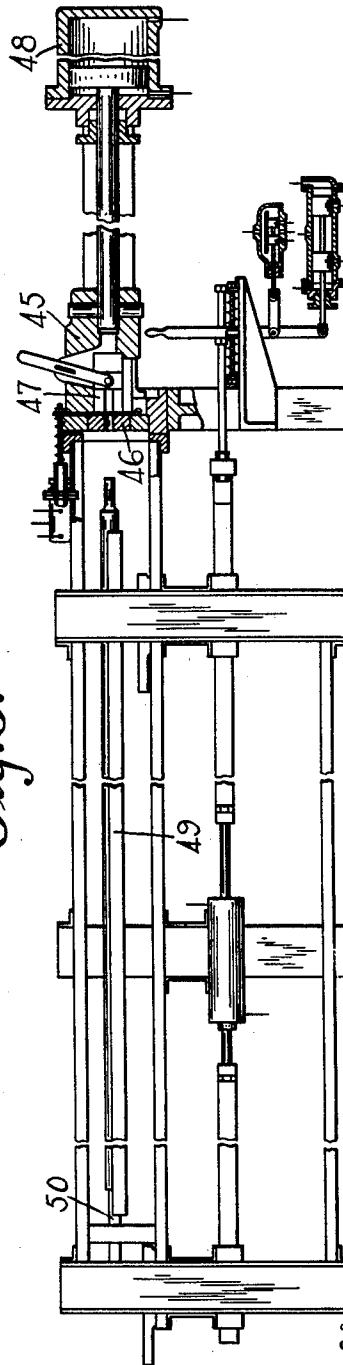


Fig. 6.



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## UNITED STATES PATENT OFFICE

1,930,702

## TUBE MILL

William R. Webster, Bridgeport, Conn.

Original application July 14, 1928, Serial No. 292,718. Divided and this application November 5, 1931. Serial No. 573,107

27 Claims. (Cl. 29—33)

My invention relates to a tube mill, and more particularly to a mill in which seamless tubes are drawn from solid billets of ductile materials, such as copper or brass, this application being a division of my copending application for a tube mill, filed July 14, 1928, Serial No. 292,718.

There are several methods of making seamless tubes of which three, namely, the piercing process, the cast shell process and the cupping process are the most common. Of these processes, I shall be chiefly concerned herein with tubes formed by the piercing process, although it will be apparent as the description of the invention proceeds that the features of the invention may be applied to other processes as well.

In the piercing process, cast billets of suitable diameter are delivered to a piercing mill in the form of castings which have been machined to remove surface impurities and mechanical imperfections. In the piercing mill, the castings, which have been previously heated to a proper temperature by a furnace, are rotated and forced against a projectile-like steel point carried on a long rod, the point forming the opening in the tube. The tubes are then pointed and drawn successively to smaller diameters, being customarily annealed, pickled and washed between the drawing operations. When the tubes have been drawn to the proper diameter they are straightened and sawed to standard lengths. It is customary in tube mills to provide a crane or trucks by means of which the billets and tubing are transferred from one machine to another during the various steps of the process. The disadvantages of the usual system in transporting batches of materials around the mill in this manner are so well understood as not to necessitate an extended description thereof herein. It will be sufficient to point out that the loss in time in transporting the materials, as well as the interruptions to the various steps of the processes are such as not only to result in confusion in the tube mills, but also to decrease the output.

The present invention differs from the known tube mills in that it is here proposed to effect an arrangement in the tube mill wherein the billets and tubing may be transformed by a continuous process from a cast billet into a finished tube.

Another object of the invention is to bring about an arrangement in a tube mill in which a minimum amount of handling of the tubes is necessary.

To these and other ends, the invention consists in the novel features and combinations of parts to be hereinafter described and claimed.

In the drawings:

Fig. 1 is a diagrammatic view of a tube mill embodying my invention therein;

Fig. 2 is a view of a rolling mill used in the mill arrangement shown in Fig. 1;

Fig. 3 is a view of an annealing furnace;

Fig. 4 is a view of a pointing machine;

Fig. 5 is a view of a conveyor for moving tubing from one machine to another, and

Fig. 6 is a view of a drawbench.

I will now describe my invention in connection with the preferred embodiment thereof shown in the accompanying drawings, in which Fig. 1 shows in a diagrammatic manner a tube mill in accordance with my invention. Referring then to Fig. 1, the reference numeral indicates a heating furnace in which, according to the previous processes, billets may be heated to a proper temperature before being pierced in the piercing mill 11, whereupon they may be pickled in tub 12, washed in tub 13, pointed in pointer 14, and then delivered to extension 15 of drawbench 16, where the first drawing operation takes place.

Herein a furnace 17 is provided in which billets are heated, and then passed one or more times between the rolls or rolling mill 18. The latter is shown in Fig. 2 and comprises a pair of rolls 19 and 20 having a series of grooves 21 formed therein of different radii, the rolls 19 and 20 being mounted in housings 22 and 23 in the usual manner, and being adjustable relatively to one another by means of screws 24 and 25 and being driven by motor 26 by means of gearing 27. The billets are first passed between the rolls in the grooves of largest radius and then successively through the grooves of smaller radii until the desired diameters are reached.

The billets after being rolled to a proper diameter are cut to the required length by a cutting device 28, which may be a saw or a shear, both of which are well known and will not be described herein in detail. The billets are then heated in heating furnace 10 and are passed through piercing mill 11 which may be of any usual form. Instead of collecting the pierced billets in batches, it is contemplated by the present invention to move the billets and tubing as a substantially continuous operation through the mill. Accordingly, between the piercing mill 11 and pickling tub 12 is a conveyor 29 which may be of a form shown in Fig. 5, in which a number

of horizontally spaced rails 30 are provided between which are spaced conveyor chains 31, mounted on sprockets 32 and 33, chains 31 being made up out of the usual links 34, each link  
5 being provided, however, with a finger 35 which engages a pierced billet as it passes from the piercing mill 11 and conveys the billet to the pickling tub 12. The sprockets 32 and 33 may be driven by any suitable means.

10 From tub 12 the pierced billets pass to the wash tub 13 through which they are moved by a conveying apparatus of the type shown in Fig. 5, and delivered onto skids 36. The tubes are then pointed by means of pointing mill 14,  
15 a somewhat diagrammatic form of which is shown in Fig. 4, wherein an anvil 37 is provided in frame 38, anvil 37 having in the upper surface thereof a number of semi-cylindrical openings 39, which together with a similar number of oppositely arranged openings 40, in hammer 41,  
20 reduce the end of the tube inserted therein. It will be understood that the hammer 41 may be reciprocated in any desired manner, as, for example, by means of crank 42 and connecting  
25 rod 43.

From the pointing mill 14, the tubes are placed in handling rack 44, which may be of the type shown and described in Patent No. 896,781, issued on August 26, 1908, to W. R. Clark and myself.  
30 The use of this handling rack, besides its usual function, also lends considerable flexibility to the process by providing a small storage space to take care of small delays which may take place in individual operations. It is within the con-  
35 templation of the invention to place these racks wherever desired, in the cycle of operations, the use of the racks not being limited to the precise location illustrated.

From the handling rack, the tubes pass to the  
40 extension 15 of drawbench 16. In Fig. 6, I have shown a drawbench suitable for use in drawing seamless tubes, the particular bench shown being of the form described in my prior Patent No. 1,132,531, issued on March 16, 1915.  
45 It will be sufficient for the purposes of the present application to point out that the drawbench comprises a drawhead 45, mounted to slide in ways in the usual manner, a die 46 for reducing the tube, jaws 47 which engage the tube to draw  
50 it through the die by means of hydraulic motor 48, a carrier trough 49 in which a triblet rod 50 is supported, triblet rod 50 receiving thereon the tube to be drawn and being provided with a head  
55 which supports the tube adjacent the die 46 and limits the inward displacement of the walls of the tube. The use of the particular drawbench illustrated also permits the dropping of the tube through the bench by gravity, after it is drawn,  
60 so that it may be delivered to a conveyor.

From the drawbench 16 the reduced tubing passes by means of conveyor 52, which may be of the type illustrated in Fig. 5, to the annealing furnace 53, which may be of the type shown in Fig. 3 of the drawings. This furnace is made up  
65 out of suitable refractory material and has an opening 54 through which the tubes enter the furnace, an opening 55 at the opposite end through which the tubes pass out of the furnace, and an opening 56 through which the flame pro-  
70 ducing the annealing temperature is introduced.

The bottom of the furnace may slope as in the drawings so that the tubes will pass through the furnace by gravity or a suitable conveyor may be provided, as, for example, one made in  
75 accordance with Fig. 5. In certain cases, it may

not be necessary to anneal the tubing between each drawing operation, and in such cases the tubing may be conducted directly to the next drawbench by means of an overhead crane, or by  
80 an auxiliary chain conveyor passing over or under conveyor 52, furnace 53, skids 57, and tubs 58 and 59. After leaving the furnace, the tubes pass over cooling skids 57 by gravity or by means of a conveyor, and are delivered to the pickling  
85 and washing tubs 58 and 59. From washing tub 59 they pass to extension 60 of drawbench 61 where a further reduction takes place. From drawbench 61 the tubes pass through annealing furnace 62, which may be of the same type as  
90 that shown in Fig. 3, and over cooling skids 63 into pickling and wash tubs 64 and 65.

According to the present invention, one or two drawings are all that are generally necessary, since the formation of the billet by rolling it or  
95 otherwise reducing the stock previous to piercing it eliminates a certain number of drawing steps which have usually been found necessary. If in exceptional cases it should be found necessary to further reduce the tubes they may be trans-  
100 ported by means of travelling overhead crane 71 to one of the drawbenches, where the reduction may take place. This is not the usual practice, however, two drawings being all that are neces-  
105 sary to properly reduce the tubes. From washing tub 65 the tubes first pass to the straightening machine 66, which may be of any suitable or usual type, and then to the saw 67 where they are cut to proper lengths. The reference num-  
110 eral 68 indicates a hydraulic machine for testing tubing, while at 69 and 70 are tubs wherein the tubes are washed prior to their shipment. It is within the invention to provide carriers for conducting the tubing from straightening ma-  
115 chine 66, to saw 67, hydraulic testing machine 68 and tubs 69 and 70, although in certain instances these devices may be so disposed that no conveyor is necessary.

From the foregoing description of the nature of my invention and the preferred embodiment  
120 for carrying out the same, it will be readily understood that the method of forming seamless tubes is not only simplified as compared to the usual methods, but the amount of scrap involved is greatly reduced, owing, among other partic-  
125 ulars, to the treatment of the billet before it is pierced and drawn.

It will be also readily understood that the billets and tubing pass through the various stages of the process in a substantially continuous  
130 movement as distinct from the usual processes in which a batch of material is subjected to one step of the process, collected and transported by wagons or cranes to the machine for performing the next step. As a result, the process as a  
135 whole is speeded up resulting in a greater output at less cost.

While I have shown and described a preferred embodiment of my invention, it will be under-  
140 stood that it is not to be limited to the details shown but is capable of modification and variation within the spirit of the invention and the scope of the appended claims.

What I claim is:

1. In a system for the manufacture of drawn tubing, a piercing mill, a drawbench substantially  
145 aligned with said piercing mill, and a second drawbench parallel to and at a spaced interval from said piercing mill and said first named drawbench, and means for conveying tubes later-  
150 ally from the piercing mill to the second named

drawbench, and laterally from the second named drawbench to the first named drawbench.

2. In a system for the manufacture of drawn tubing, a piercing mill, a drawbench arranged at a spaced interval from and parallel to said piercing mill, pickling and washing tubs arranged between said mill and bench, and a conveyor adapted to receive tubing from said mill without intermediate handling and to deliver the same in parallel relation to the pickling tub.

3. In a system for the manufacture of drawn tubing, a pair of drawbenches arranged parallel to and at a spaced interval from one another and adapted to successively draw tubing to smaller diameters, an annealing furnace, and pickling and washing tubs mounted between said benches, and means for conveying tubing laterally from one bench to the other, said tubing passing through said annealing furnace and said tubs.

4. In a system for the manufacture of drawn tubing, a piercing mill, pickling and washing tubs, a pointing device and a drawbench, said mill, tubs, device and bench being arranged in parallel relation whereby tubing may pass there-through in a direction constantly parallel to itself.

5. In a system for the manufacture of drawn tubing, a piercing mill and a plurality of drawbenches, said mill and drawbenches being generally parallel to and spaced from one another, and means for passing tubing laterally from the piercing mill to one of said drawbenches and laterally from the latter to the other of said drawbenches.

6. In a system for the manufacture of drawn tubing, a piercing mill and a plurality of drawbenches, said mill and drawbenches being generally parallel to and spaced from one another, means for passing tubing laterally from the piercing mill to one of said drawbenches and laterally from the latter to the other of said drawbenches, and means for pickling and washing the tubing during its passage from the piercing mill to the first drawbench, and means for annealing and washing the tubing during its passage between the drawbenches.

7. In a system for the manufacture of drawn tubing, a piercing mill, a drawbench substantially aligned with said piercing mill, and a second drawbench parallel to and at a spaced interval from said piercing mill and said first named drawbench, and means for conveying tubes laterally from the piercing mill to the second named drawbench, and laterally from the second named drawbench to the first named drawbench, the last lateral movement of the tubes being in a reverse direction as compared to the first lateral movement.

8. In a system for the manufacture of drawn tubing, a piercing mill, a drawbench substantially aligned with said piercing mill, and a second drawbench parallel to and at a spaced interval from said piercing mill and said first named drawbench, and means for conveying tubes laterally from the piercing mill to the second named drawbench, and laterally from the second named drawbench to the first named drawbench, the last movement of the tubes being in a reverse direction as compared to the first movement, and said tubes being maintained during both of said movements in parallel positions.

9. In a system for the manufacture of drawn tubing, a piercing mill, a plurality of drawbenches and a straightening machine arranged

to have tubing pass therethrough successively and in constantly parallel positions.

10. In a system for the manufacture of drawn tubing, a piercing mill, a plurality of drawbenches and a straightening machine arranged with their axes all pointing in the same direction to have tubing pass therethrough successively as a substantially continuous operation and in constantly parallel positions.

11. In a system for the manufacture of drawn tubing, a piercing mill, a plurality of drawbenches and a straightening machine arranged with their axes all pointing in the same direction to have tubing pass therethrough successively at right angles to their axes as a substantially continuous operation and in constantly parallel positions, and means for annealing the tubing after each drawing operation and during such movement.

12. In a system for the manufacture of drawn tubing, a piercing mill, a plurality of drawbenches and a straightening machine arranged with their axes all pointing in the same direction to have tubing pass therethrough successively at right angles to their axes as a substantially continuous operation and in constantly parallel positions, means for pickling and washing the tubing after each operation thereon, and means for annealing the tubing after each drawing operation.

13. In a system for the manufacture of drawn tubing, a piercing mill, pickling and washing tubs closely adjacent said mill, a conveyor for delivering tubes from said mill to said tubs, a drawbench closely adjacent said tubs, a pointing tool between said tubs and bench, and a handling rack between said tubs and bench, all of said parts being arranged in parallel relation whereby tubing may be passed therethrough substantially without intermediate handling.

14. In a system for the manufacture of drawn tubing, a piercing mill, pickling and washing tubs, a conveyor for delivering tubes from said mill to said tubs, a pointing tool, a drawbench, and means for conveying tubes coming from the pointing tool to said bench, said means including at least one handling rack.

15. In a system for the manufacture of drawn tubing, a pair of drawbenches arranged parallel to and at a spaced interval from one another and adapted to have tubing passed therethrough successively, an annealing furnace between said drawbenches, and means for conveying tubing laterally from one bench to the other, the tubing passing through the annealing furnace during the lateral movement thereof.

16. In a system for the manufacture of drawn tubing, a piercing mill, a plurality of drawbenches and a straightening machine all arranged in parallel relation and through which a billet is passed successively to emerge as a finished tube, and means for conveying the billets laterally from one of said machines to another.

17. In a system for the manufacture of drawn tubing, a piercing mill and a plurality of drawbenches arranged parallel to one another, means for passing tubing in a lateral direction from one of said drawbenches to another, and means for annealing the tubing after each drawing operation and during the lateral movement of the tubing, the annealing of the tubing being without interruption to the continuous movement thereof.

18. In a system for the manufacture of drawn tubing, a piercing mill, a drawbench arranged at

a spaced interval from the piercing mill, pickling and washing tubs, a conveyor adapted to receive tubes from said mill and to deliver them in parallel relation to the pickling tub, and a handling rack adapted to receive tubes coming from the washing tub and to supply tubes in parallel relation to the drawbench.

19. In a system for the manufacture of drawn tubing, the combination of a piercing mill, a drawbench, and instrumentalities for handling the tubing intermediate the piercing mill and drawbench including devices for carrying the tubes away from the piercing mill laterally in parallel relation to each other and for feeding them to the drawbench laterally in parallel relation to each other.

20. In a system for the manufacture of drawn tubing, the combination of a piercing mill, a drawbench, and instrumentalities for handling the tubing intermediate the piercing mill and drawbench including means for carrying the tubes away from the piercing mill in parallel relation to each other, means for feeding them to the drawbench in parallel relation to each other, and means for pickling and washing the tubes in parallel relation to each other after they leave the piercing mill and before they reach the drawbench.

21. In a system for the manufacture of drawn tubing, the combination of a piercing mill, a drawbench and instrumentalities for handling the tubing intermediate the piercing mill and drawbench including means for carrying the tubes away from the piercing mill in parallel relation to each other, means for feeding them to the drawbench in parallel relation to each other, means for pickling and washing the tubes in parallel relation to each other after they leave the piercing mill and before they reach the drawbench, a second drawbench, and instrumentalities intermediate the drawbenches for handling the tubes including means to feed them away from one drawbench and toward the other while the tubes are in parallel relation to each other.

22. In a system for the manufacture of drawn tubing, the combination of a piercing mill, a drawbench, instrumentalities for handling the tubes intermediate the piercing mill and the drawbench including means for carrying the tubes in parallel relation away from the piercing mill, means for carrying the tubes in parallel relation to each other to the drawbench, means for pickling and washing the tubes after they leave the piercing mill and before they reach the drawbench, a second drawbench, means for moving the tubes laterally while in parallel relation to each other in the interval between the first drawbench and the second, and an annealing furnace and pickling and wash tubs through which the tubes pass in moving from one drawbench to the other.

23. In a system for the manufacture of drawn tubing, the combination of a piercing mill, a

drawbench, an annealing furnace, a second drawbench, a second annealing furnace, a straightening machine, means for moving the tubes laterally in parallel relation to each other in the interval between the piercing mill and the first drawbench, means for moving the tubes laterally in parallel relation to each other through the first annealing furnace and in the interval between the first and second drawbenches, and means for moving the tubes laterally in parallel relation to each other through the second annealing furnace and in the interval between the second drawbench and the straightening machine.

24. In a system for the manufacture of drawn tubing, the combination of a piercing mill, a drawbench, and instrumentalities for handling the tubing intermediate the piercing mill and drawbench including means for carrying the tubes away from the piercing mill in parallel relation to each other, and means for feeding them to the drawbench in parallel relation to each other, said piercing mill and drawbench having a parallel relation to each other.

25. In a system for the manufacture of drawn tubing, the combination of a piercing mill, a drawbench, instrumentalities for handling the tubing intermediate the piercing mill and drawbench including means for carrying the tubes away from the piercing mill in parallel relation to each other, means for feeding them to the drawbench in parallel relation to each other, said piercing mill and drawbench having a parallel relation to each other, and means for carrying tubes away from said drawbench in parallel relation to each other in a direction opposite to that of the incoming tubes.

26. In a system for the manufacture of drawn tubing, the combination of a drawbench, a second drawbench, and instrumentalities for handling the tubing intermediate said drawbenches including means for carrying the tubes away from the first drawbench in parallel relation to each other, and means for feeding them to the second drawbench in parallel relation to each other, said drawbenches having a substantially parallel relation to each other.

27. In a system for the manufacture of drawn tubing, the combination of a drawbench, a second drawbench, instrumentalities for handling the tubing intermediate said drawbenches including means for carrying the tubes away from the first drawbench in parallel relation to each other, means for feeding them to the second drawbench in parallel relation to each other, said drawbenches having a substantially parallel relation to each other, means for feeding tubes laterally in parallel relation to each other to the first drawbench, and means for carrying tubes away from the second drawbench in parallel relation to each other and in a lateral direction in respect to the tubes.

WILLIAM R. WEBSTER.