Nov. 7, 1950 H. E. GROSS 2,528,651

TANDEM ROTARY EXPANDING MILL

Filed Aug. 25, 1948 6 Sheets-Sheet 1

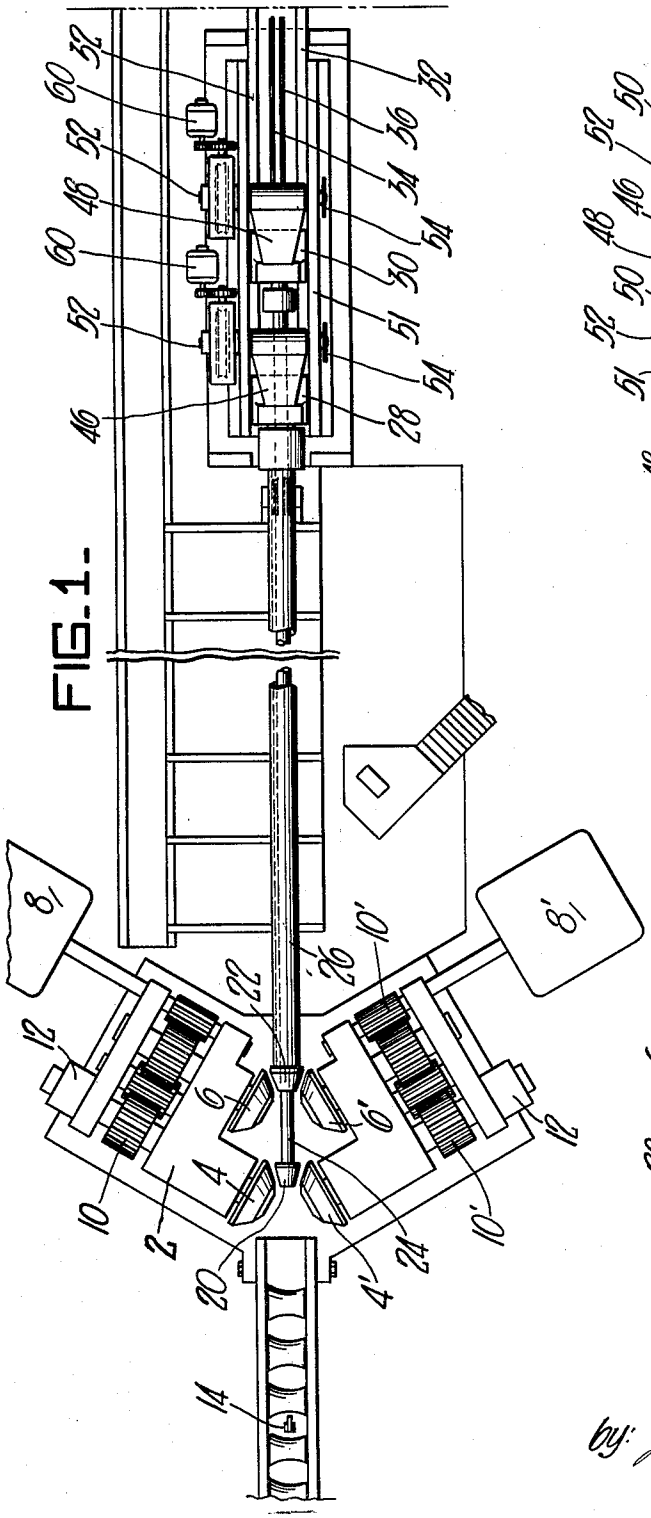


FIG. 1.

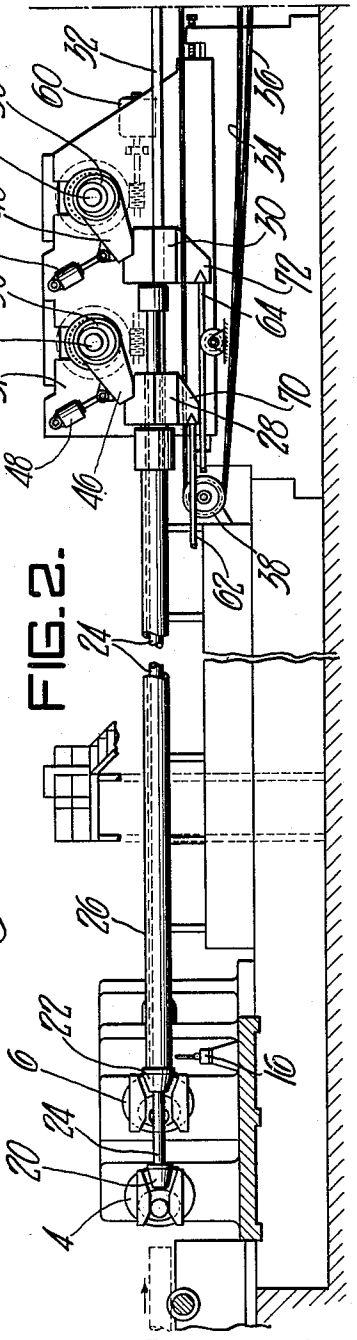


FIG. 2.

Inventor:
HARRY E. GROSS,
by: Donald G. Dalton
his Attorney.

Nov. 7, 1950 H. E. GROSS 2,528,651

TANDEM ROTARY EXPANDING MILL

Filed Aug. 25, 1948 6 Sheets-Sheet 2

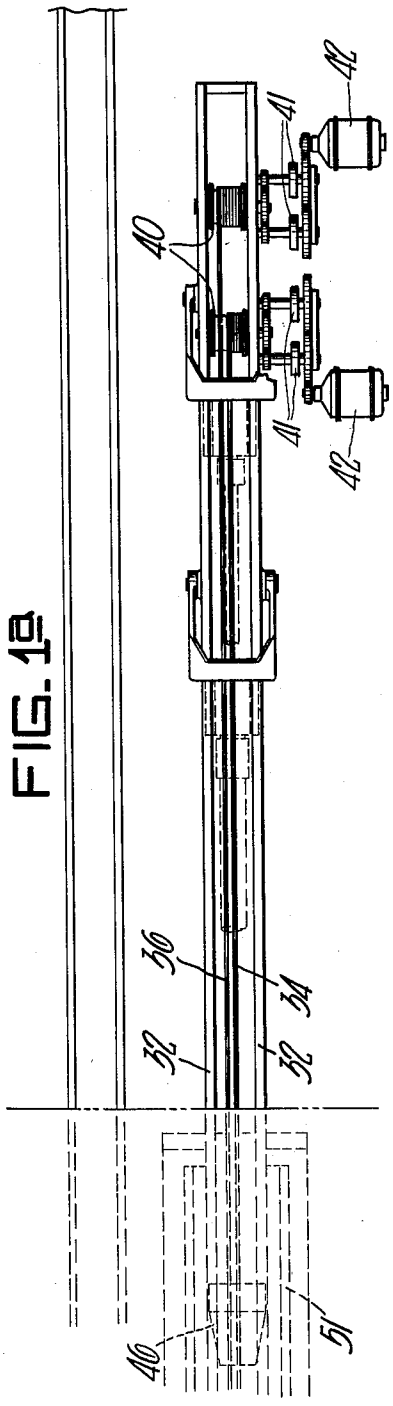


FIG. 1a

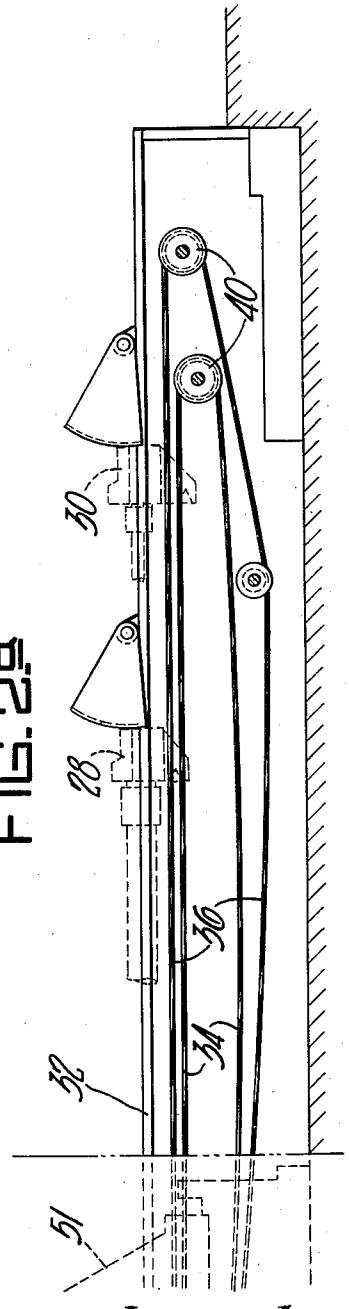


FIG. 2a

Inventor:
HARRY E. GROSS,
by: Donald G. Dalton
his Attorney.

Nov. 7, 1950 H. E. GROSS 2,528,651

TANDEM ROTARY EXPANDING MILL

Filed Aug. 25, 1948 6 Sheets-Sheet 3

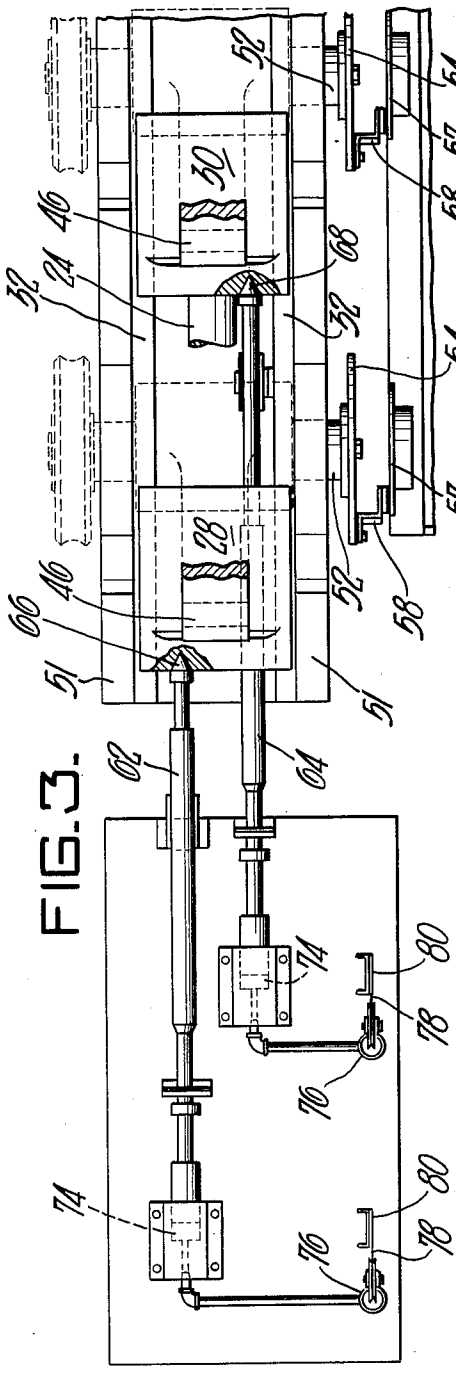


FIG. 3.

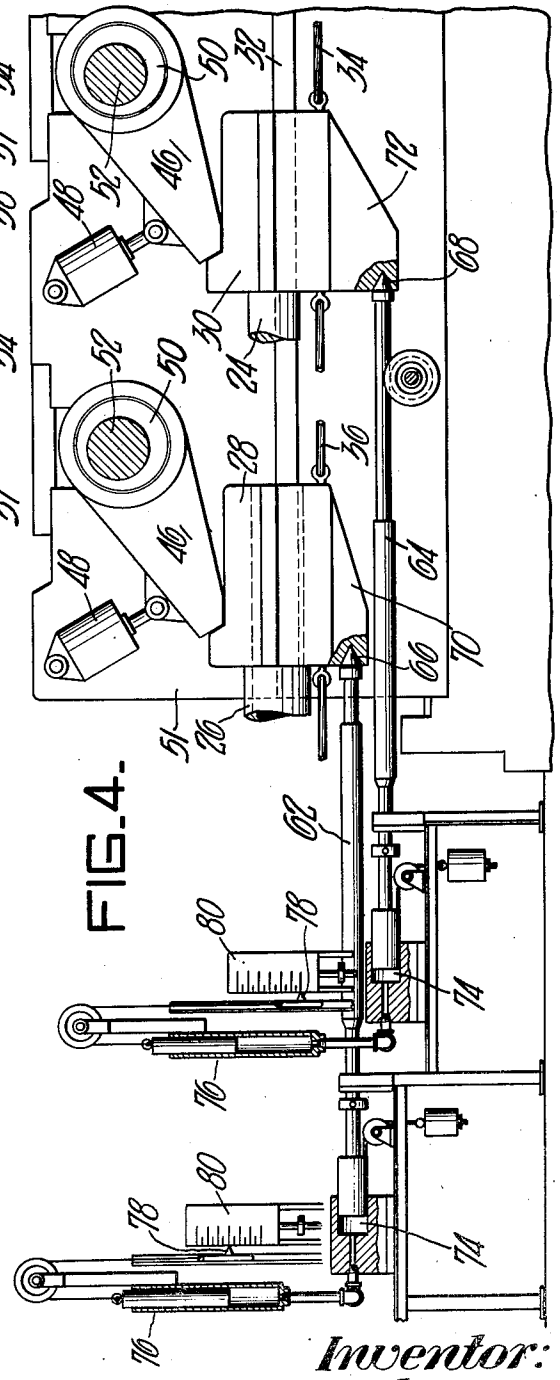


FIG. 4.

Inventor:
HARRY E. GROSS,
by: Donald G. Dalton
his Attorney.

Nov. 7, 1950 H. E. GROSS 2,528,651

TANDEM ROTARY EXPANDING MILL

Filed Aug. 25, 1948 6 Sheets-Sheet 4

FIG. 5.

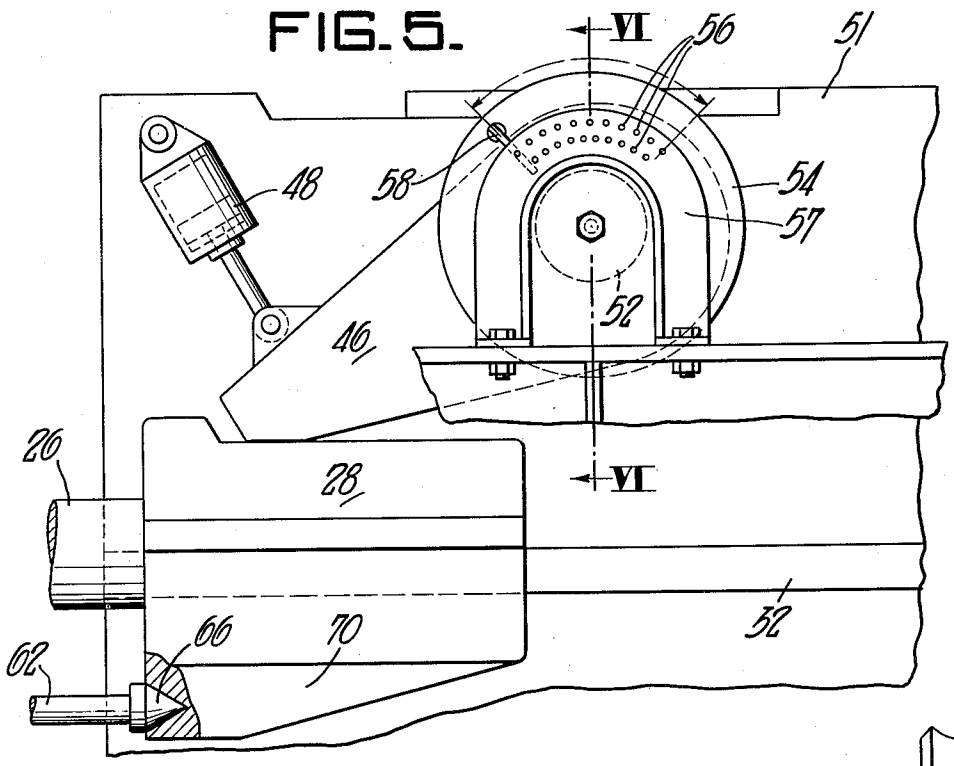
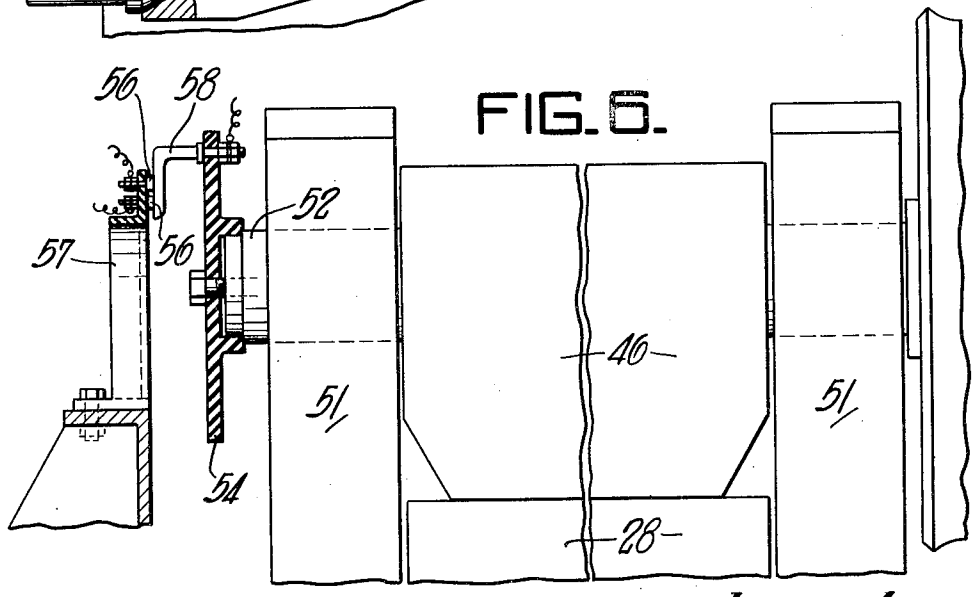


FIG. 6.



Inventor:
HARRY E. GROSS,
by: Donald G. Dalton
his Attorney.

Nov. 7, 1950 H. E. GROSS 2,528,651

TANDEM ROTARY EXPANDING MILL

Filed Aug. 25, 1948 6 Sheets-Sheet 5

FIG. 8.

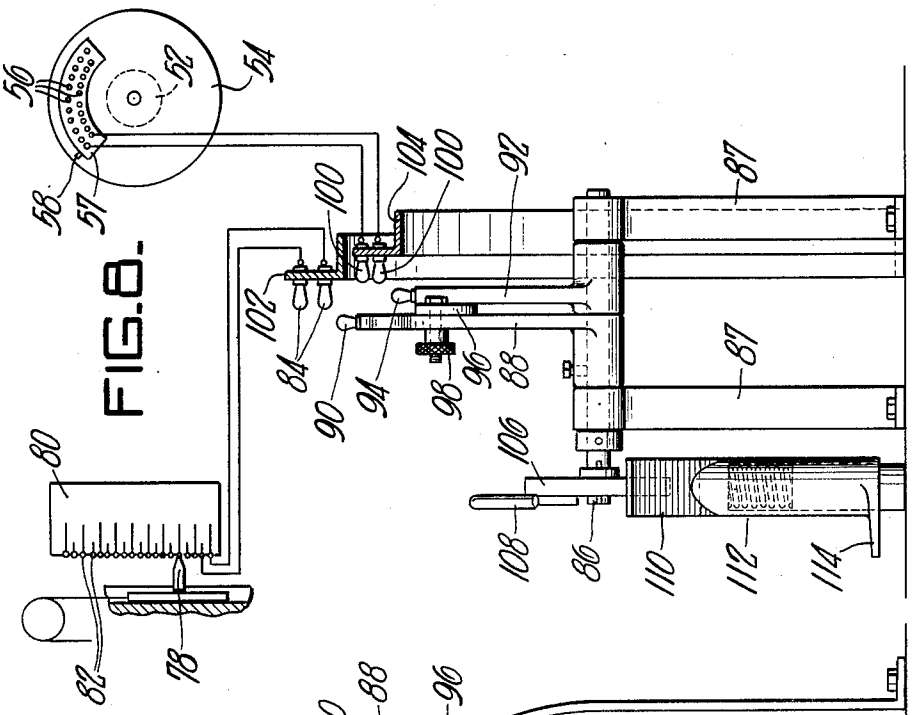
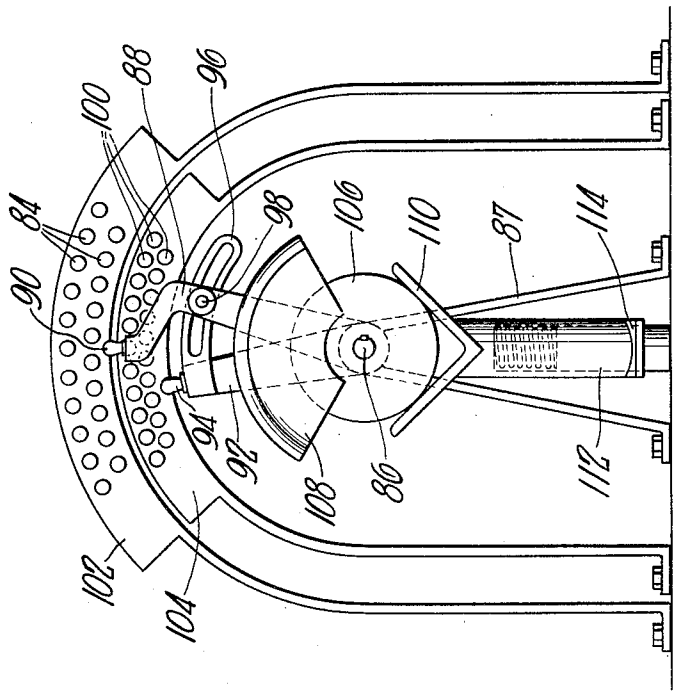


FIG. 7.



Inventor:
HARRY E. GROSS,
Donald G. Dalton
his Attorney.

Nov. 7, 1950 H. E. GROSS 2,528,651

TANDEM ROTARY EXPANDING MILL

Filed Aug. 25, 1948 6 Sheets-Sheet 6

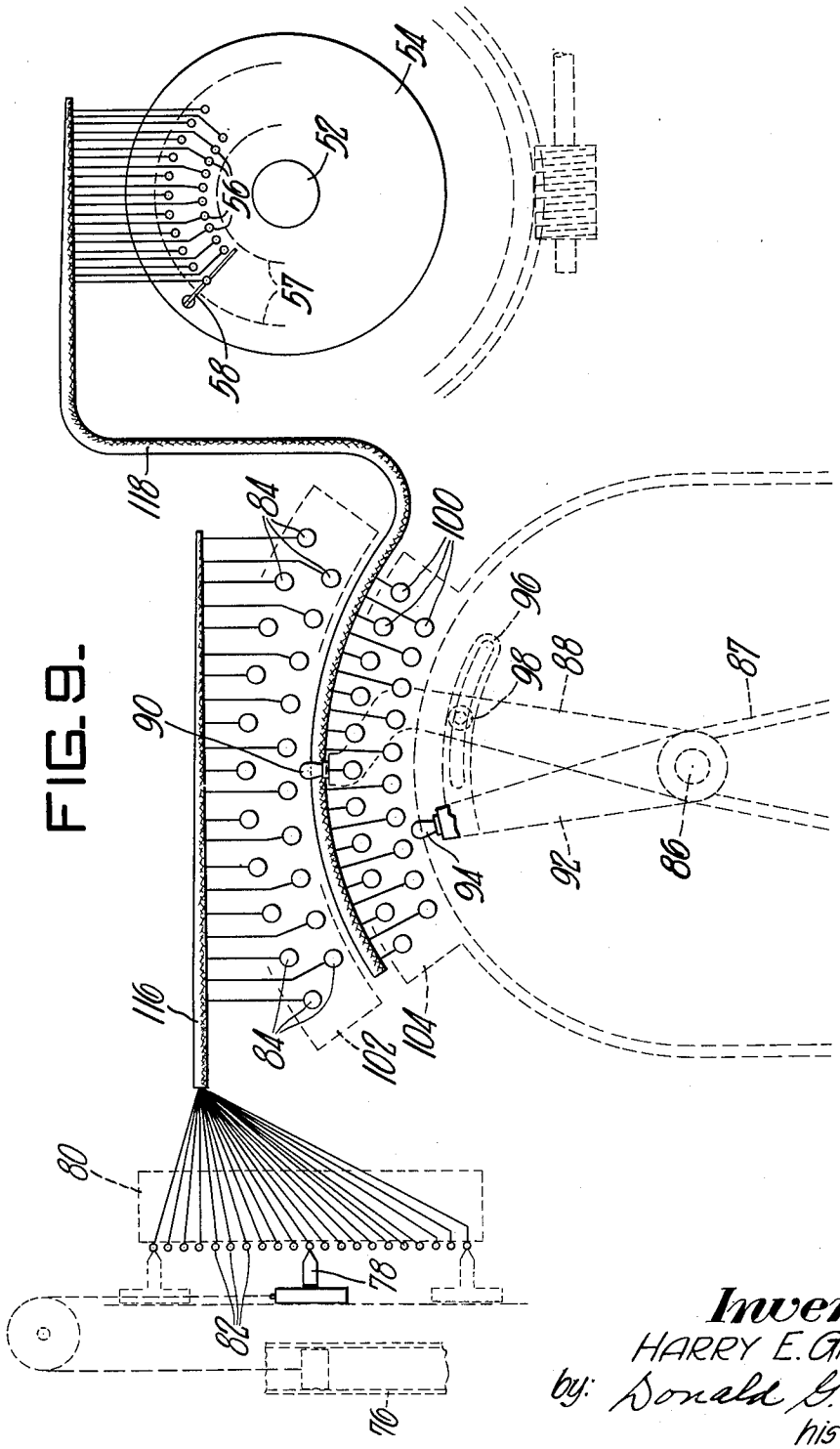


FIG. 9.

Inventor:
HARRY E. GROSS,
by: Donald G. Dalton
his Attorney.

Patented Nov. 7, 1950 2,528,651

UNITED STATES PATENT OFFICE

2,528,651

TANDEM ROTARY EXPANDING MILL

Harry E. Gross, Lorain, Ohio, assignor to National Tube Company, a corporation of New Jersey

Application August 25, 1948, Serial No. 46,028

2 Claims. (Cl. 80—13)

1

This invention relates to tandem vertical disc type rotary pipe or tube expanding mills and to plug positioning means therefor.

Large diameter seamless, i. e., over 2½" outside diameter, pipe is manufactured by expanding pierced shells in a rotary expanding mill. The diameter of such pipe is limited by the expansion that can be given the shells in a single pass. Moreover, the minimum wall thickness and concentricity of the pipe walls are limited by the necessity of obtaining the expansion in a single pass through the mill. I have proposed expanding pipe in a tandem rotary disc mill which overcomes the foregoing difficulties without additional costs due to reheating and the like. Further, the pipe size range is greatly increased.

It is, accordingly, an object of the present invention to provide a tandem rotary mill for expanding pipe.

It is a further object to provide means for independently controlling the position of the mandrel plugs in tandem disc mills.

It is another object to provide apparatus for making large diameter, light-wall seamless pipe in an efficient manner.

The foregoing and further objects will be apparent from the following specification, when read in conjunction with the attached drawings, wherein:

Figure 1 is a plan view of a seamless tube mill embodying my invention;

Figure 1*a* is a plan view of the mandrel reciprocating mechanism;

Figure 2 is a side elevation;

Figure 2*a* is a side elevation of the mechanism shown in Figure 1*a*;

Figure 3 is an enlarged plan view of the mandrel position indicating arrangement;

Figure 4 is a side elevation of the arrangement shown in Figure 3;

Figure 5 is an enlarged side elevation of the latch position indicating means;

Figure 6 is a view, partially in section, taken on line VI—VI of Figure 5;

Figure 7 is an elevational view of the mill control station;

Figure 8 is an end view of the mill control station including a schematic view of the mandrel and latch position indicating devices; and

Figure 9 is a wiring diagram.

Referring more particularly to the drawings, the numeral **2** designates a mill housing containing forward and rearward pairs of rotary expanding rolls **4**, **4'** and **6**, **6'**. Rolls **6**, **6'** and **4**, **4'** are driven by synchronous motors **8**, **8'**. The motors **8**, **8'** are geared directly to the shafts of

2

rolls **6**, **6'** and to rolls **4**, **4'** through intermediate gears **10**, **10'**. In order to take up any slack in the gear train, magnetic friction brakes **12** are provided on the outer end of the shafts of the forward rolls **4**, **4'**. These brakes may be automatically applied by the shell contacting a switch **14** as it enters the rolls **4**, **4'** and released by the forward end of the workpiece operating switch **16** after it has progressed through rolls **6**, **6'**. This arrangement assures a continuous smooth pull of the rearward rolls as the workpiece spirally feeds into the metal-working pass thereof. If desired, a separate motor may be used to drive each of the rolls **4**, **4'** and **6**, **6'**.

Mandrel plugs **20** and **22** are positioned between the rotary expanding rolls by interior and exterior, individually-operable telescoped mandrel rods **24** and **26**, respectively. These mandrel rods are carried by thrust blocks **28** and **30** which can be moved toward and away from the mill on slideways **32** by cables **34** and **36** disposed on drums **38** and **40**. The drums are operable through suitable magnetic friction clutches **41** driven by constant speed motors **42** whereby the thrust blocks and the mandrels carried thereby can be positioned and withdrawn from the metal-working position to clear the expanded workpiece therefrom and to move the mandrel plugs into metal-working position after the workpiece has been cleared from the mandrel bars and the mill delivery trough. The inner bar is rotatably supported within the outer bar by "spider rings" so that it can rotate with or independently of the outer bar. The thrust blocks are held in their metal-working position by latches **46** which are lifted from or dropped into working position by means of air cylinders **48**. The latches **46** can be adjusted toward and away from the mill to control the position of the plugs and thereby fix the space between the plug and metal-working rolls, which space determines the thickness of the workpiece. Such adjustment results from the latches **46** being rotatably mounted on eccentric cams **50** keyed to the center of shafts **52** journaled in the thrust bearing housing **51**, whereby rotation of the shafts **52** moves the latches **46** toward or away from the rolls. Mounted on the inner ends of shafts **52** are disc members **54** carrying contact arms **58**. Contact points **56** are mounted on the inner faces of arcuate frames **57**. Each of the contact points **56** is individually connected to a corresponding light on a control board, to be hereinafter described, situated before the mill operator. The relative position of the shafts **52** and cams **50** is indicated to the mill operator by the lights on the control board which are actuated when the

contact points 56 are rubbed by contact arms 58 which are carried by disc members 54. The contact arms 58 are moved over the contact points 56 by rotation of the shafts 52. Shafts 52 are suitably connected to motors 60 and are rotatable thereby.

Motors 60 are controlled manually by the mill operator in accordance with the position-indicating panel lights which are actuated as the mandrel plugs approach the metal-working position. This actuating mechanism comprises plunger members 62 and 64 having conical heads 66 and 68 which engage conical recesses in abutments 70 and 72 extending from the thrust blocks 28 and 30. The forward ends of the plungers are disposed in chambers 74 which contain mercury. The chambers 74 are, in turn, suitably connected to vertical columns 76 which receive the mercury displaced from the chambers 74. Float actuated type contactors 78 are connected to the mercury column, which indicators slide up and down scales 80. These scales have a number of contacts 82 thereon which are individually connected to corresponding indicator lights on the mill operator's control panel.

Figures 7 and 8 show the signal and control equipment in the mill operator's pulpit. Reference numeral 102 indicates an arcuate frame which supports automatic target lights 84 individually connected to contacts 82. A shaft 86 is rotatably mounted on supports 87 below the frame 102. A target arm 88 having a top light 90 is secured to the outer end of shaft 86. Also mounted on shaft 86 is a shorter arm 92 having a top light 94 affixed to the end thereof and adapted to be adjustably separated from arm 88 by means of a vernier scale extension 96 and jam nut 98. Between frame 102 and shaft 86 is another arcuate frame 104 supporting indicating lights 100 which are individually connected to contact points 56 on the inner faces of arcuate frames 57. Mounted on the end of shaft 86 is a brake disc 106. A hand-wheel bracket 108, for manipulating the position of arm 88, is mounted on the brake disc 106. A V-shaped brake shoe 110, for contacting brake 106, is mounted in the top of a coil spring jack 112, and serves as a lock or latch to hold target arm 88 in fixed position. The brake shoe is released from the brake disc by means of a jack pedal 114.

Figure 9 is a schematic wiring diagram of the above described micrometer control mechanisms for one latch. Since the control mechanisms are identical for the tandem set-up only one is shown. The contact points 82 on scales 80 are shown individually connected to corresponding target lights 84 by means of a multi-conductor cable 116. Indicating lights 100 are shown individually connected to corresponding contact points 56 on arcuate frame 57 by means of a multi-conductor cable 118.

In operation, one operator moves the thrust blocks 28 and 30 with mandrel plugs 20 and 22 snug into the revolving expanding roll passes by means of conventional mill electric friction controllers. When the plugs 20 and 22 make contact with the rotary expanding rolls 4, 4' and 6, 6', the extruded mercury column 76 moves the float actuated contactors 78 upwardly. This causes contactors 78 to rub the contact points 82 and the automatic target lights 84 to be flashed. At the top position of the indicator a corresponding light 84 will be lighted in front of a second operator, who then places his foot on jack pedal 114 and manipulates hand-wheel bracket 108 to move target arm 88 until its top light 90 is in position opposite the lighted automatic target light 84. He then lifts his foot from pedal 114 and the coil spring jack 112 raises the V-shaped member 110 to contact the brake disc 106 which thus holds the target arm 88 set up in fixed position. He then starts motors 60 to rotate shafts 52. As the shaft 52 rotates, the contact arm 58, carried by disc 54, rubs over the contact points 56, which each, in turn, flash a corresponding light 100. In this case the top light 94 on the end of arm 92, which is in fixed position, is the target light and rotation of shaft 52 is allowed to continue until the indicating light 100 opposite top light 94 is flashed on. The second operator then stops the rotation of shafts 52 and actuates air cylinders 48 which drop the latches 46 into working position. The mill is then in proper operating position.

Allowance, of course, must be made for pipe wall thickness between the rotary expanding rolls 4, 4' and 6, 6' and plugs 20 and 22 in the roll passes. This is done by spreading arm 92 backward from the target arm 88 to any space or wall thickness required. The vernier scale extension 96, which is an integral part of arm 92, and a jam nut 98 provide a quick method for any such space or gauge adjustment. This adjustment is usually made by the mill foreman before operations are begun.

While one embodiment of my invention has been shown and described it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claims.

I claim:

1. Apparatus for helically rolling tubular workpieces comprising forward and rearward pairs of cross rolls, telescoped mandrel bars constructed and arranged to hold mandrel plugs in metal-working position between each of said pairs of rolls and means for independently controlling and adjusting said mandrel bars to determine the spacing of the mandrel lugs from said cross rolls.

2. Apparatus for helically rolling tubular workpieces comprising forward and rearward pairs of cross rolls having spindles, said rolls defining a two-stage working pass, the forward and rearward rolls on each side of said pass being in unitary housings, motors connected to the spindles of the rearward rolls, gear means connecting the spindles of the rearward rolls to the spindles of the forward rolls, brake means on the spindles of the forward rolls for preventing any lost motion in the gear means connecting the forward and rearward rolls, telescoped mandrel bars constructed and arranged to hold mandrel plugs in metal-working position and individually operable means for independently adjusting each of said mandrel bars.

HARRY E. GROSS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,190,698	Abramsen	July 11, 1916
2,025,439	Brownstein	Dec. 24, 1935
2,084,330	Findlater	June 22, 1937
2,145,588	Findlater	Jan. 31, 1939

Certificate of Correction

Patent No. 2,528,651 November 7, 1950

HARRY E. GROSS

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 4, line 45, for the word "lugs" read *plugs*;

and that the said Letters Patent should be read as corrected above, so that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 9th day of January, A. D. 1951.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.