Oct. 28, 1952 J. H. FRIEDMAN 2,615,355

STOCK GAUGE TRIP APPARATUS

Filed Feb. 13, 1951 4 Sheets-Sheet 1

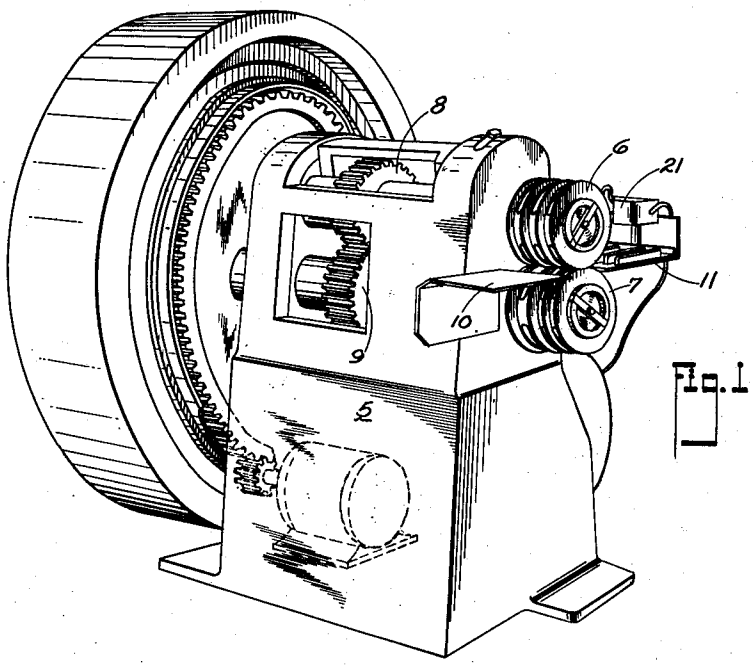
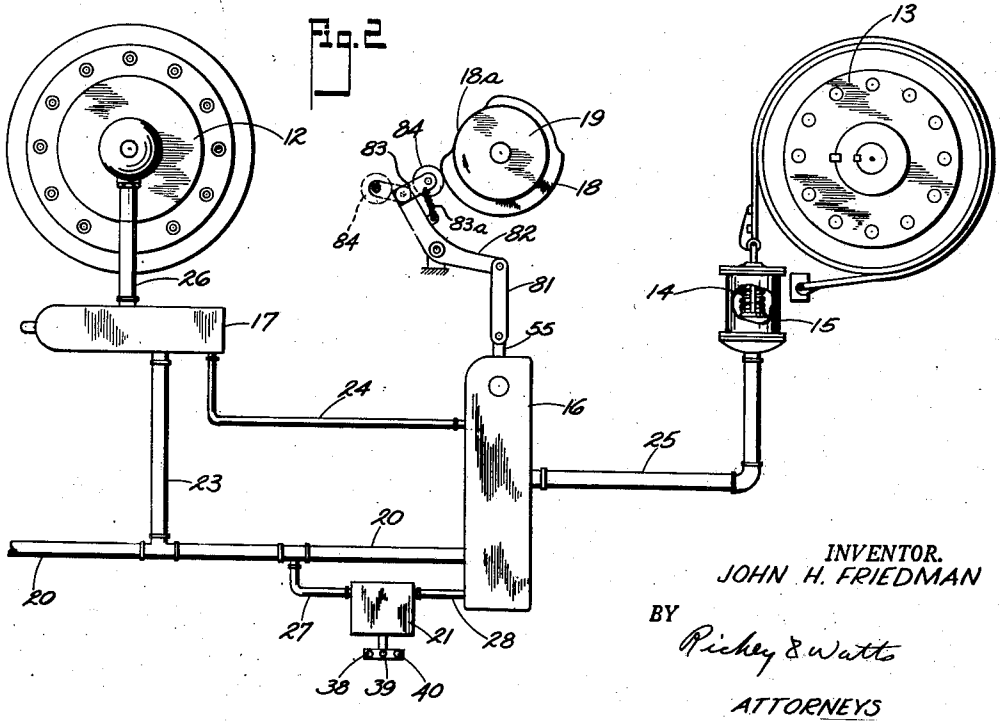


Fig. 1

Fig. 2



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STOCK GAUGE TRIP APPARATUS

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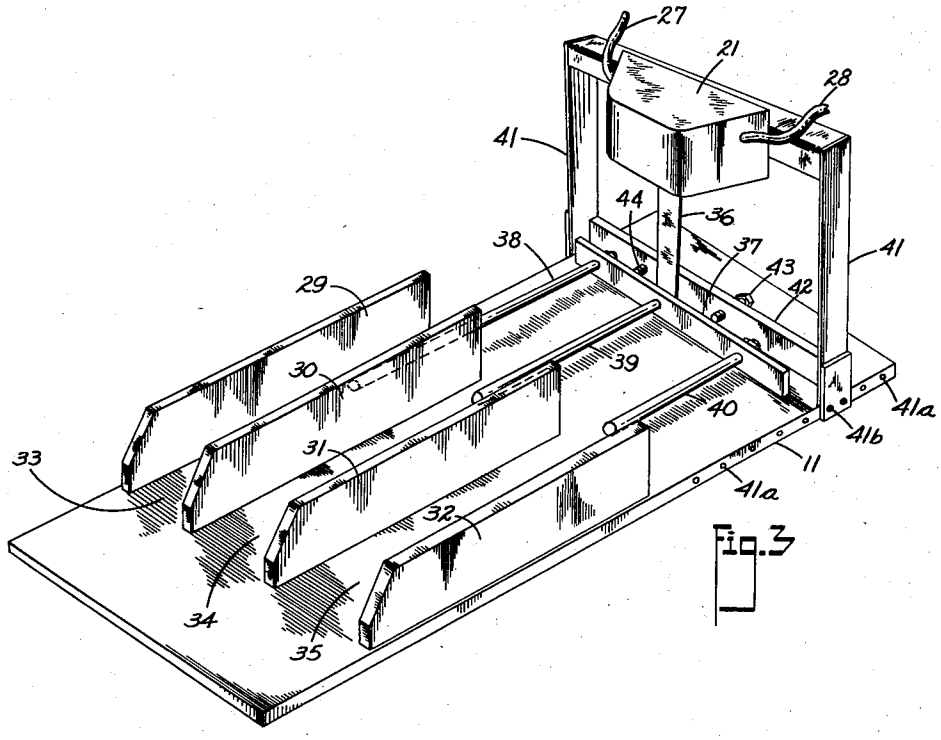
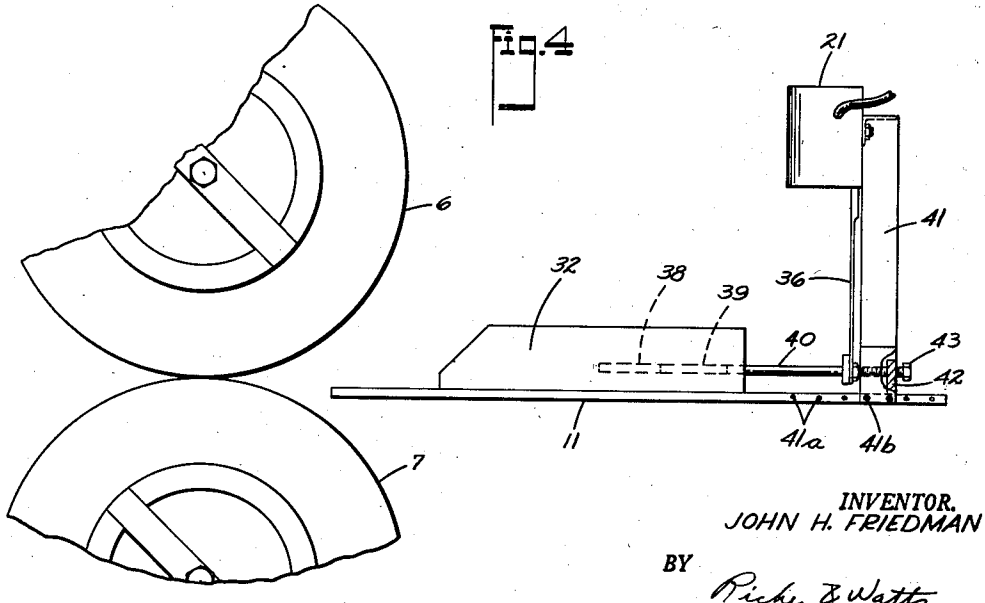


Fig. 3

Fig. 4



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STOCK GAUGE TRIP APPARATUS

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Fig. 5

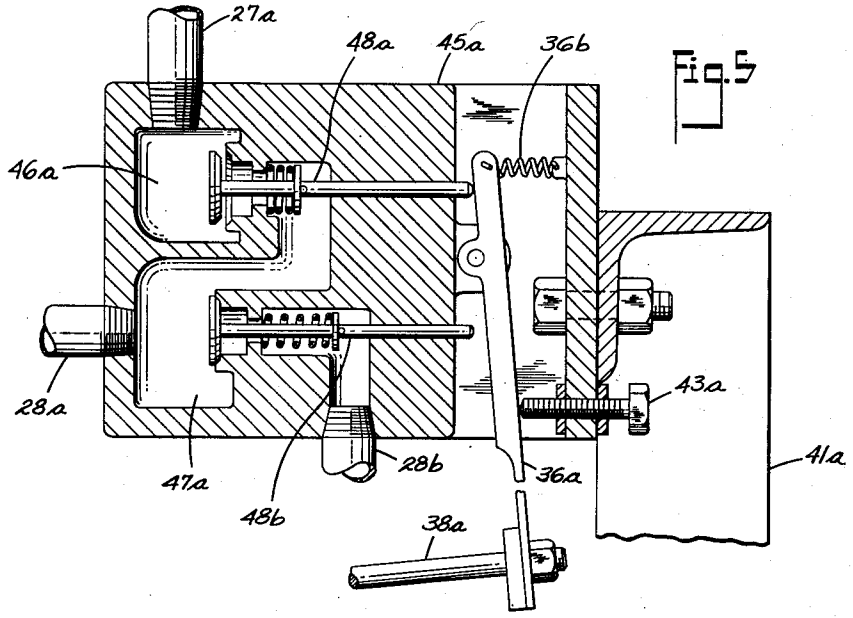
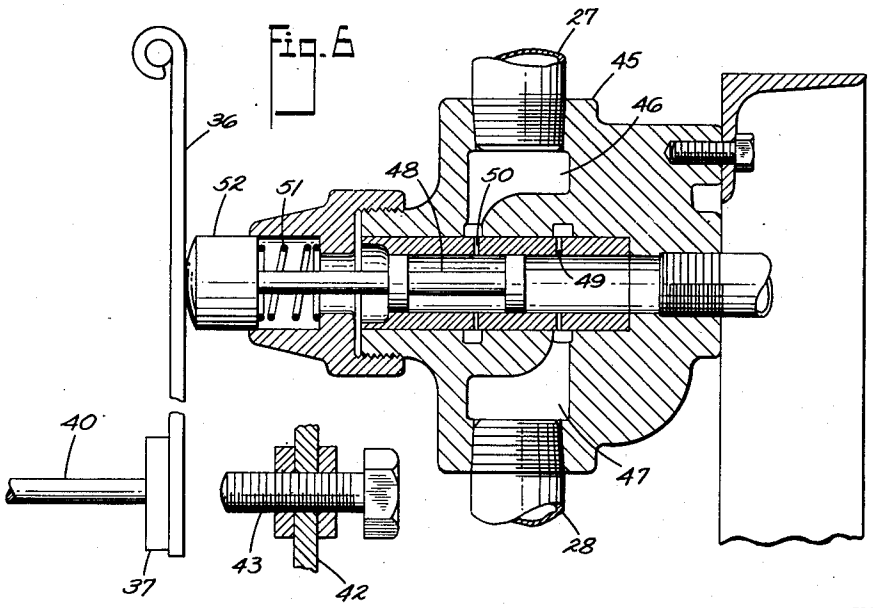


Fig. 6



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STOCK GAUGE TRIP APPARATUS

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Fig. 7

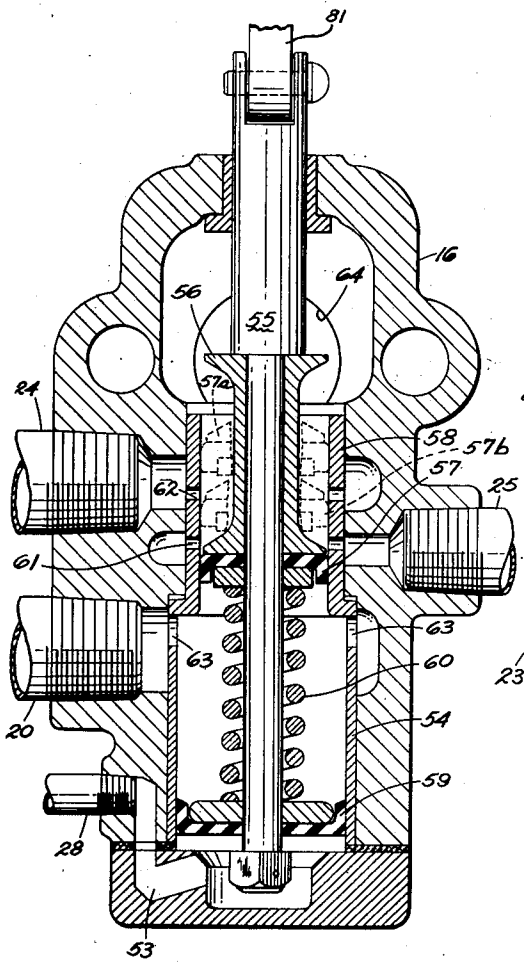
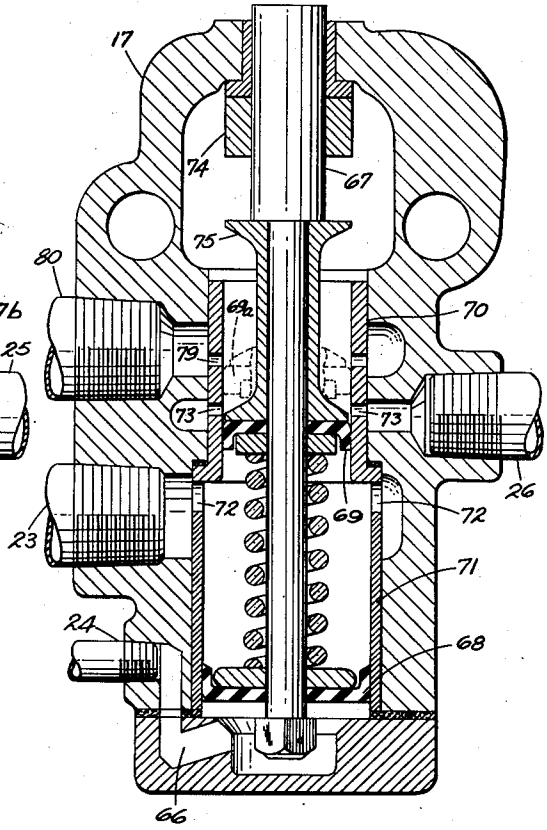


Fig. 8



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UNITED STATES PATENT OFFICE

2,615,355

STOCK GAUGE TRIP APPARATUS

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Application February 13, 1951, Serial No. 210,734

1 Claim. (Cl. 80—26)

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This invention relates to metal rolling mills, and more particularly to control mechanisms for gap mills of the type constructed to operate in a cyclic manner, wherein the rolls are stopped after each revolution of the rolls.

Recent developments in the rolling mill art have resulted in the wide current use of a rolling mill, wherein a pair of cooperating rolls are provided with cavities or dies to shape the article being rolled and, wherein the rolls are provided with complementary gaps. In such mills, the rolls are stationary at the gap portion when the blank to be rolled is arranged between the rolls and the rolls are turned one revolution so that the resulting rolled article is definitely shaped by the roll dies, a mill of this type is disclosed and claimed in my co-pending application Serial No. 168,218, filed June 15, 1950.

In gap type mills, as above described, the rotation of the rolls has been controlled by the use of a foot treadle that is manipulated by the operator of the mill after the blank to be rolled is arranged in rolling position between the rolls. Before the operator steps on the foot treadle to start the rolls in motion, the blank that is to be rolled is moved into rolling position against a stock gauge carried by the mill on that side of the rolls which is away from the operator. The hot blank is placed against the stock gauge by the operator by the use of tongs which grip one end of the hot blank. Since the rolls are disposed in the line of sight between the operator and the stock gauge in mills of the type above described, the operator must detect or "feel" the resistance afforded by the stock gauge to inform him that the blank has reached the stock gauge. Thereafter, while the hot blank is firmly against the stock gauge, he starts the mill by stepping on the foot treadle.

With the advent of larger sizes of mill of the type above described, it has required greater skill on the part of the operator to manipulate the blank and make sure that it is against the stock gauge in proper position for rolling and at the same time manipulate the foot treadle to set the mill in motion. It will be understood that the rolled article would not be completely formed if the rolling were started before the free end of the blank was in position against the stock gauge. It will also be understood that premature tripping of the foot treadle, that is setting the mill in motion before the blank is in position against the stock gauge is dangerous to the person of the operator because of his tong grip on the blank.

The present invention is directed to a rolling

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mill of the gap type wherein the placing of the blank in rolling position against the stock gauge sets the mill in motion and thus makes it unnecessary for the operator to determine the position of the blank or consciously exert any physical effort to start the rolling operation. It is accordingly an object of my invention to provide a mill having a pair of cooperating gap rolls, a blank support at each side of the rolls and a stock gauge on one of the blank supports that is mounted for limited movement with respect to the support and wherein the placing of the blank on the support so as to move the stock gauge, sequentially releases the brake for the mill, engages the clutch so as to produce one revolution of the rolls and thereafter re-engages the brake for the mill. It is a further object of my invention to provide a mill according to the preceding object wherein the operator is protected against the danger of prematurely starting the mill and wherein the control of the mill is restricted to the proper positioning of the blank between the rolls. It is a further object of my invention to provide a mill having a clutch and a brake and having a stock gauge for the blank to be rolled wherein movement of the stock gauge by contact with the blank releases the brake for the mill and maintains the clutch in engagement for one revolution of the rolls. Further objects and advantages will appear from the following description and the drawings wherein:

Fig. 1 is a perspective view of a mill embodying my invention.

Fig. 2 is a diagrammatic layout of the clutch and brake and control embodying the present invention.

Fig. 3 is a perspective view of a blank support for the mill showing the stock gauge for controlling the clutch and brake.

Fig. 4 is an elevation of the apparatus in Fig. 3 showing the disposition of the blank support with respect to the rolls.

Fig. 5 is a sectional view of an air line valve operatively connected to the stock gauge for the mill.

Fig. 6 is a sectional view of a preferred form of air line valve adapted to be operated by the stock gauge.

Fig. 7 is a sectional view of a control valve forming a part of the present invention, and:

Fig. 8 is a sectional view of a clutch valve made according to the present invention.

Referring to the drawings the mill in its entirety is indicated as in Fig. 1 at 5 and preferably includes a pair of cooperating rolls 6 and 7 which

are geared to each other as 8 and 9. A front blank support 10 is arranged on that side of the mill toward the operator and a similar blank support 11 is carried by the mill at the other side of the rolls 6 and 7. The mill 5 includes a clutch and brake 12 and 13 respectively arranged so that the continuously rotating fly wheel may be engaged so as to transmit fly wheel rotation to the rolls 6 and 7 as described in detail in my said co-pending application.

The control for the clutch and brake as diagrammatically shown in Fig. 2 includes a trip valve 21 which is mounted on the rear stock gauge 11 and an air line 20 from a compressed air supply leads to a control valve 16. The construction is such that when the trip valve 21 is actuated air under pressure is directed by the control valve 16 through the line 25 to the brake cylinder 15 so as to move the piston in said cylinder against the spring 14 and thereby release the brake 13. Thereafter the control valve 16 directs air under pressure through line 24 to the clutch valve 17 which in turn admits air from the branch line 23 into the air clutch 12 by way of air line 26 effecting clutch engagement. A roll shaft 19 is provided with a cam 18 which through linkage 81 and 82 maintains the brake in disengaged position and the clutch in engaged position throughout one revolution of the roll shaft 19.

The actuation of the control valve 16 and the clutch valve 17 is brought about by movement of a stock gauge carried on the rear stock support 11. In the mill illustrated the rolls are shaped to provide three different roll passes, each pass being effective to further shape the blank. The initial position for the blank is indicated in Fig. 3 as being between the blank guides 29 and 30 namely in the area indicated at 33. This will be referred to herein as the first roll pass. In the second roll pass the blank is placed in the area indicated at 34 between the blank guides 30 and 31 and in the third roll pass the blank is placed in the area indicated at 35 between the blank guides 31 and 32. A gauge support frame 41 is secured to the blank support 11 as at 41*b*. The frame 41 is adapted to be secured in different positions of adjustment along the length of the blank support 11 as indicated by the tapped holes 41*a*. The frame 41 supports the trip valve 21 and depending from the valve 21 is a lever 36 which is secured at its lower end to the transverse gauge bar 37. A series of stock gauges 38, 39 and 40 project from the gauge bar 37 and extend longitudinally of the table 11 in between the blank guides 29—30—31—32. It will be noted that stock gauge 38 is longer than the gauge 39 and that 39 in turn is longer than the stock gauge 40 so as to accommodate the increase in length of the blank effected in each roll pass. The frame 41 includes a lower cross bar 42 which is provided with screws 43 and 44 which limit the movement of the gauge bar 37.

With the arrangement above described the operator advances a hot blank across the front blank support 10, in between the gaps in the rolls and thence on to the rear blank support 11 into the first roll pass area 33 where the free end of the blank engages the stock gauge 38 and moves the same so that the gauge bar 37 abuts the adjusting screws 43 and 44. The movement of the gauge bar 37 and the lever 36 secured thereto admits air from line 27 into the line 28 leading to the control valve 16 and thus initiates the sequential release of the brake and engagement of the clutch.

Preferably the trip valve 21 includes a valve body 45 as shown in Fig. 6 wherein air from the inlet chamber 46 may be directed to the outlet chamber 47 in response to movement of the valve spool 48. The valve spool 48 is normally urged toward the left as shown in Fig. 6 by the spring 51 so that the head 52 of the spool bears against the stock gauge lever 36. When the valve spool 48 is moved to the right inlet air from the port 50 is admitted to the outlet port 49 so that air under pressure flows outwardly from the valve 21 through line 28. Air from the line 28 is admitted to the control valve 16 by way of passage 53 therein where the pressure is effective against piston 59 to move the piston rod 55 and spool 56 carried thereby. The valve 16 includes the actuating cylinder 54 and the port cylinder 58. Air at line pressure is admitted to the cylinder 54 through the openings 63 and line 20. The lower end of the spool 56 serves as an abutment for the piston 57 which moves in the port cylinder 58. Ports are provided in the cylinder 58 as at 61 leading to line 25 and as at 62 leading to line 24. An opening in the control valve casing as at 64 leads to atmosphere so that when air or pressure is admitted through line 28 the valve rod 55 and its assembly 56—57 is moved upwardly so as to sequentially occupy the positions shown in dotted lines as at 57*b* and 57*a*. When the piston 57 reaches the position shown at 57*b* line pressure from line 20 is directed through ports 61 to the brake line 25 so as to release the brake as heretofore described. Thereafter the piston 57 reaches the dotted line position 57*a* so that line pressure is directed through ports 62 to effect clutch engagement.

The clutch valve 17 is constructed like the control valve 16 in a number of respects. It includes an actuating cylinder 71 and the piston 68 arranged to move the piston rod 67 and its assembly upwardly in the valve body. The piston rod includes a spool 75 having a piston 69 at the lower end thereof which operates in the port cylinder 70. The port cylinder is provided with ports 73 for the air line 26 leading to the air clutch 12 and port 79 leading to the atmosphere through line 80. Line pressure is admitted to the actuating cylinder by way of ports 72 and line 23 so that when air under pressure is admitted to the clutch valve 17 by way of line 24 and passage 66 the piston 69 is moved to the position 69*a* shown in dotted lines. The movement of the piston 69*a* upwardly admits line pressure from branch 23 to the clutch by way of line 26 and when the piston 69 is restored to its full line position as shown air from the clutch is exhausted through ports 73 and 79 to the atmosphere. When the line 24 is exhausted by the control valve 16 the piston assembly in the clutch valve 17 is restored to its full line position shown in Fig. 8 due to the differential areas of pistons 68—69. The line pressure through 23 is effective through the greater area of piston 68 compared to area of piston 69 to move the assembly downwardly.

In the modified form of trip valve illustrated in Fig. 5, a valve body, 45*a* is provided with an inlet chamber, 46*a* connected to line 27*a* which is a line connected to the air supply line like 27 in the preferred embodiment. The valve body 45*a* also includes an outlet chamber 47*a* connected to line 28*a* which corresponds to line 28 in

the preferred embodiment. A stock gauge trip lever 36a is pivoted on the valve body and is normally urged in a clockwise direction by the spring 36b. The lever 36a is extended beyond its pivoted mounting so as to overhang the ends of the valve stems 48a and 48b. In the position shown in Fig. 5, the blank to be rolled has moved the lever 36a in a counter-clockwise direction so as to open the valve 48a and let air under pressure from the inlet chamber, 46a into the outlet chamber, 47a. The effect of letting air or pressure into line 28a is like that in the preferred embodiment in that it sequentially releases the brake and engages the clutch. The clutch engagement is effective to move the blank away from the end of the stock gauge 38a and thus turning the lever 36a in a clockwise direction closing the valve 48a and opening the valve 48b so that the outlet chamber, 47a is exhausted through line 28b. As in the preferred embodiment, the stock gauge lever 36a is limited in its movement in a counter-clockwise direction by an adjustable abutment, 43a.

In using a mill according to the present invention, the operator inserts a heated blank between the rolls and moves the same rearwardly until it has engaged and moved the stock gauge against the abutments 43—44. The movement of the stock gauge directs air under pressure from the air supply through lines 27—28 to the control valve 16 where it is effective to move the piston 57 to the position indicated at 57b and releases the brake 13 which normally holds the rolls against rotation. Thereafter, the piston 57 is moved to the position 57a whereby air is directed through line 24 to the clutch valve 17, where it is effective to engage the clutch 12 and initiate the turning of the roll shaft 19. As the roll shaft 19 and the cam 18 carried thereby turns the roller 84 carried by bell crank 82 is moved to the high point of the cam 18 and thus the link 81 holds the piston rod 55 of the valve 16 in its highest position indicated at 57a in Figure 7.

Preferably, the control cam is proportioned substantially as shown in Fig. 2 so that the cam maintains the brake in disengaged position and the clutch in its engaged position for about 270° of roll shaft rotation. During the remainder of the roll shaft rotation, the roller 83 is in the low portion of the cam as at 18a, wherein the clutch is disengaged and the brake is applied to decelerate and stop the roll shaft. The roller 84 is carried by the link 83 which is pivotly mounted on the end of the bell crank 82 so that it may occupy either of two positions. In the normally operative position, the roller 84 and its link 83 is biased toward the cam by spring 83a. When however, it is desired to rotate the roll shaft through less than one revolution, the link 83 may be swung to the dotted line position shown in Fig. 2 so that the cam 18 will not hold the control rod 55 in its uppermost position as indicated in 57a of Fig. 7. Such intermittent turning of the roll may be effected by intermittently tripping the valve 21. In the absence of line pressure through line 28 in control valve 16, the pressure admitted through line 20 is effective on the differential piston areas 57 and 59 so as to move the piston assembly to the full line position shown in Fig. 7. Due to the inertia of the moving parts of the clutch, brake and control mechanisms and due to the inertia and restrictions in the air lines, there is a momentary dwell after the valve 21 is tripped by the blank so that the blank is stationary and in proper position for rolling when the roll starts to turn. This enables the operator to firmly position the blank against the stock gauge and retain his grip upon the blank by means of the tongs as the rolls start to turn and move the blank toward the operator.

The use of a mill, according to the present invention, merely requires the operator to advance the blank into the mill as far as it will go, wherein the stock gauge is tripped and thus the invention eliminates the need for the hand and foot coordination heretofore required. The operator by retaining his tong grip on the blank is ready to turn the blank about its longitudinal axis 90° after the first roll pass and advance the blank into the second roll pass with less manual and mental effort than heretofore required. Accordingly, it will be understood that the operator retains control of the blank throughout the successive roll passes, and that the production of defective blanks due to premature turning of the rolls is eliminated.

Although I have shown and described a preferred form of my invention and a modification of a component part thereof in considerable detail, it will be understood that numerous modifications may be made therein without departing from the scope of the invention as defined in the following claim.

What is claimed is:

A rolling mill comprising a pair of cooperating gap rolls, a continuously rotating fly wheel, a clutch for transmitting fly wheel rotation to the rolls and a brake for arresting rotation of the rolls, a stock gauge mounted on the mill in alignment with the roll pass to be engaged by a blank passed through the gap in the rolls, said gauge being mounted for limited movement in response to said blank engagement, a control for said clutch, a control for said brake and common means operatively connecting said gauge and controls, said common means actuated by movement of said gauge to rotate the rolls and move the blank away from the gauge as it is being rolled, and means operated by roll rotation to disengage the clutch and apply the brake to stop the rolls with the roll gaps opposed.

JOHN H. FRIEDMAN.

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