Feb. 27, 1962 A. F. GROLL 3,022,812

FEED CONTROL MEANS

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Fig. III

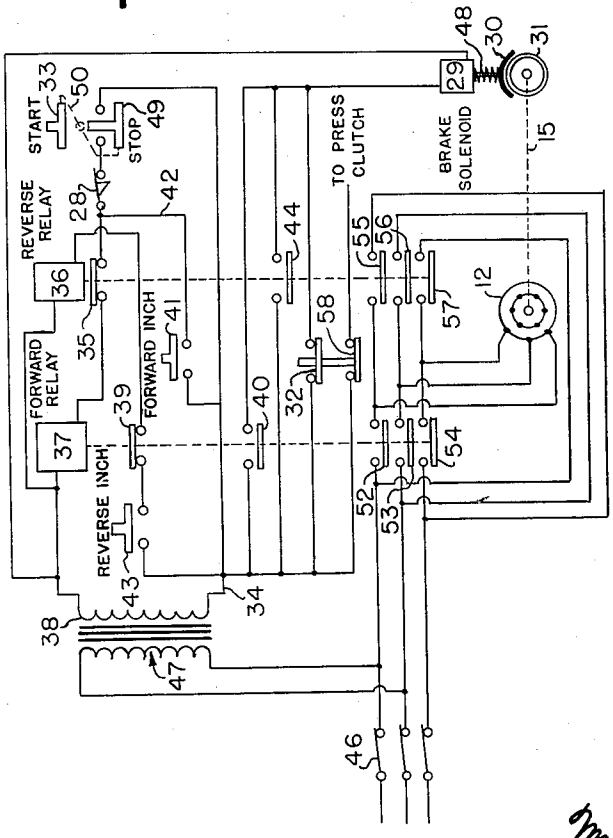
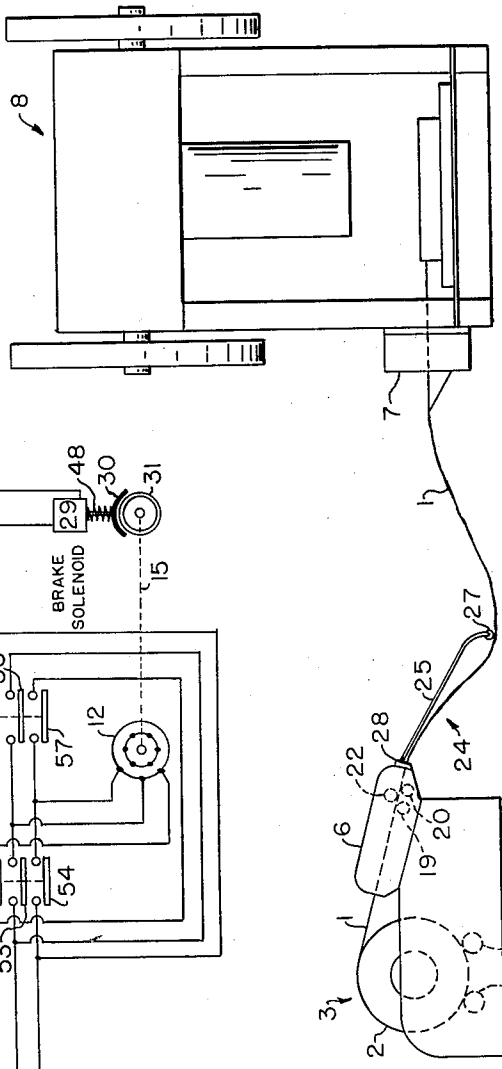


Fig. I



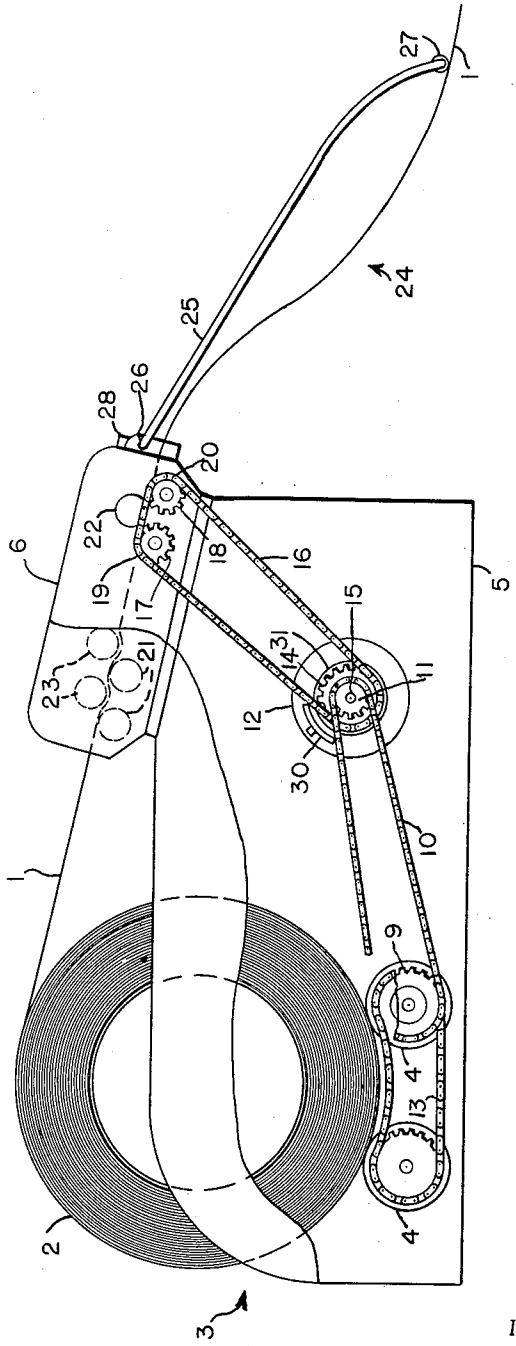
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Fig. II



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FEED CONTROL MEANS

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This invention relates to apparatus for feeding and straightening strip stock and in particular to improved means for the control of such apparatus.

Strip metal, usually steel, from which shapes are to be cut by power presses or shears is supplied in coils from which the strips are withdrawn step by step in synchronism with the cutting movements of the presses or shears through which the strips are fed. While the metal of a coil usually is annealed, it neverthless is quite stiff and is set in the curvature of the coil. Hence, it is necessary to pass the strip through straightening mechanism which usually comprises a series of rollers that progressively reduce the curvature.

Because of the high cost of such power presses and shears and also because of the high cost of operating them, it is important that provisions be made for feeding such strips to the presses or shears as rapidly as the presses or shears are capable of cutting shapes from them. It is important also that the strips be fed in increments which are uniform and which supply exactly the length of strip required for each cutting, no more no less, so that waste of material and imperfect shapes are avoided.

The coil to be unwound usually is supported in a cradle which carries the coil either on rotatable members that project axially into the center of the coil or on rollers which lie beneath the coil and are engaged by the periphery of the coil. The rotatable members or the rollers in some installations are permitted to turn freely as the coil is unwound by pulling the strip metal therefrom. But in other installations, at least one of the rotatable members or at least one of the rollers may be motor driven to turn the coil.

The heavy weight and large inertia of such coils, which may have outside diameters of four and one-half feet more or less, has long created a serious problem because of the tendency of the coils to continue turning after the cutting motion of the power presses or shears has ceased. That is, the continued turning of the coils due to their inertia unwinds slack strips which unless checked disturbs the smooth operation of the mechanism feeding the stripes to the power presses or shears. In order that the strips be fed in increments which are uniform, it is important that such continued turning of the coils be checked.

Heretofore, in some installations, the tendency of the coils to continue turning or overrun was controlled by means of one or more clutches and a constantly used brake which together had an initial high cost and a considerable maintenance expense. Furthermore, the driving motors in such installations were allowed to run continuously causing in time overheating and excessive wear. Attempts have been made in other installations to eliminate such clutch or clutches and to control the feeding of the strips by an intermittently operated driving motor and brake. Such attempts have not been entirely successful because the brake often would be set while the presses or shears were in operation at which time it would be advantageous for the coils to continue turning freely or coast.

It is accordingly, the principal object of this invention to provide improved means for the control of apparatus for feeding and straightening strip stock.

Another object of the invention is the provision of improved apparatus for feeding and straightening strip stock.

These and other objects and advantages will be apparent from the following description of a preferred form of the invention.

According to the invention, the improved apparatus for feeding and straightening strip stock and the control means for such apparatus includes no clutch which in itself is a major step forward in the art. Such apparatus and control means includes a motor for driving or withdrawing the strip stock and a brake for preventing overrun of the coil of strip stock, which motor automatically stops when the machine to which the strip stock is being fed gets behind the feeding and straightening apparatus or stops and which brake acts only when such machine stops.

A preferred embodiment is illustrated in the accompanying drawings.

In the drawings:

FIGURE I is a more or less schematic side elevational view showing the general overall combination of a strip stock straightening device, a feeder and a power press to which the stock is being supplied;

FIGURE II is an enlarged and detailed view of the strip stock straightening device which is illustrated in FIGURE I; and

FIGURE III is a schematic wiring diagram of a control system for the apparatus shown in FIGURES I and II.

These specific figures and the accompanying description that follows are intended merely to illustrate the invention but not to impose limitations upon the claims.

Referring to the drawings in detail:

Apparatus for straightening strip stock 1 supplied from a stock reel 2 includes an ordinary cradle 3 having power driven rollers 4 for supporting and turning the reel 2. A frame 5 of the cradle 3 supports a conventional straightening device 6 of the general type shown and described in U.S. Patent No. 2,246,840, that draws the strip stock 1 from the reel 2 and supplies it to an ordinary feeder 7 which delivers the strip stock in turn to an ordinary power press 8. The frame 5 of the cradle 3, in addition to serving as a support for the straightening device 6, functions as a support for the pair of rollers 4 and for mechanism that both drives the rollers 4 and the straightening device 6.

The mechanism for driving the rollers 4 includes a sprocket 9 which turns as one with the right-hand one of the rollers 4 as viewed in FIGURES I and II and that is connected through a chain drive 10 to a driving sprocket 11 that is turned by a motor 12. The rollers 4 are interconnected by means of a chain drive 13 so that both rollers are power driven and turn at the same speed.

The conventional straightening device 6 is driven by the motor 12 by means of a sprocket 14 that is mounted on a common drive shaft 15 of the motor 12 and a chain drive 16 which interconnects the sprocket 14 and a pair of driving sprockets 17 and 18 that are fixed to rolls 19 and 20, respectively, in the straightening device 6. Additional rolls 21 may be provided, if necessary, and they may be driven by a drive (not shown) from the rolls 19 and 20. A pressure roll 22 which continuously forces the strip stock 1 against the roll 20 insures that the strip stock is positively fed as long as the rolls turn. Additional pressure rolls 23 may be provided, if necessary, in installations that are required to handle extra heavy strip stock.

Frictional losses in the several rotating parts are reduced by means of antifriction bearings. In one embodiment of the machine the rollers 4 supporting the roll of strip stock were mounted on roller bearings, bronze bearings were employed in the motor 12 and both roller and ball bearings were used in the straightener 6 for the pinch and straightening rolls 20 and 19, all in conventional manner (not shown). When so mounted, the inertia of the system at its operating speed is sufficient to permit the roll of sheet stock 2 to continue to feed through the straighener 6 after the motor has ben disconnected, for

from 3 to 10 or more revolutions of the roll. This can amount to up to tens of feet of aditional stock 1 accumulating in the loop 24.

The rate of speed of the rolls 19 and 20 which function to draw the strip stock 1 from the reel 2 is slightly greater than the rate of speed of the reel supporting rollers 4 which function to advance the strip stock 1 from the reel 2 to the straightening device 6. This allows the strip stock 1 to slip slightly on the rolls in the straightening device 6 keeping the outermost coil of the reel 2 tight to prevent stock overrun or an open slack loop between the reel 2 and the straightening device 6.

The straightening device 6 supplies the strip stock 1 slightly faster than the feeder 7 feeds the strip stock into the press 8. Therefore, a loop 24 is formed in the strip stock 1 in the space between the straightening device 6 and the feeder 7. A loop control follower arm 25 is pivoted at 26 to the straightening device 6 at its one end and has its free end, which carries a roller follower 27, bearing on the loop 24 in the feed stock 1. When the loop 24 becomes longer than a predetermined value, the loop control follower arm 25 pivots clockwise about the pivot 26 under the influence of gravity and thereby opens a limit switch 28 in circuit with the motor 12. When the loop 24 becomes shorter than such predetermined value, the loop control follower arm 25 is pivoted counterclockwise about the pivot 26 by the strip stock 1 and thereby closes the limit switch 28.

The opening of the limit switch 28 breaks the flow of current to the motor 12 and it stops. However, the inertia of the turning stock reel 2 and the related apparatus causes the reel to overrun or to coast and to supply strip stock to the loop 24 even though the motor 12 is shut off. This permtis the motor to cool off. When the strip stock 1 in the loop 24 is used up by the continuously running press 8 so that the loop 24 becomes shorter than the predetermined length value, the loop control follower arm closes the limit switch 28. The closing of the limit switch 28 permits current to flow to the motor 12 which starts up and again turns the stock reel 2 and again drives the straightening device 6. Hence, as long as the press 8 continues to operate, the motor 12 is intermittently operated and advantage is taken of the high inertia of the stock reel 2 and the related apparatus to allow the stock reel 2 to coast while the motor is shut off. This on and off action of the motor prevents overheating of the motor since the motor is operated frequently enough so that its speed is not reduced to the point requiring high starting currents yet a substantial portion of the time no current flows therein.

The control of the size of the loop 24 is complicated, however, by the fact that the press 8 at any time during the process, for some reason or other, may be shut down. If the press 8 should be shut down, the overrun or coasting of the strip stock material being fed may cause the loop 24 to become excessively large. To prevent such overrun or coasting when the press 8 is stopped, a solenoid 29 operated brake 30 is engaged with a brake drum 31 that is mounted on the drive shaft 15 of the motor 12. The brake solenoid 29 (FIGURE III) is deenergized when a switch 32 is opened by the stopping of the press 8. The press coordinated switch 32 can be actuated in any of a number of ways. It has been combined with the control switch for a solenoid actuated press clutch (not shown) so that the opening of the switch in the energizing circuit for the press clutch solenoid to stop the press is coincidental with the opening of the switch 32 to deenergize the brake solenoid 29. Deenergization of the solenoid 29 permits the brake 30 to engage the brake drum 31.

In summary, while the press 8 is running, the limit switch 28 is intermittently closed and opened by the loop 24 in the strip stock 1 becoming shorter or longer than the predetermined length value of the loop. The intermittent actuation of the switch 28 causes the motor 12 in turn to run intermittently. While the motor 12 is running, the strip stock 1 is supplied by power drive to the press feeder 7. While the motor 12 is stopped, the strip stock 1 is supplied by inertia drive to the press feeder 7. Whether the motor is running or stopped, strips of material are fed in increments to the press 8 which are uniform and which supply exactly the length of strip required for each cutting, nor more no less, so that waste of material, imperfect shapes, and down time of the press 8 are avoided.

When the press 8 is stopped, limit switch 32 is opened to deenergize the brake solenoid 29 which causes the brake 30 to engage the brake drum 31. This slows down the speed of the motor drive shaft 15 until limit switch 28 is opened shortly thereafter by the loop 24 becoming longer than the predetermined length value of the loop to shut off the motor. The brake 30 then stops the shaft 15, for example with the feed of about an additional foot of strip 1, and the flow of strip stock 1 from the straightening device 6 ceases. Or if the motor 12 already happens to be stopped when the press 8 shuts down, the brake 30 stops the flow of strip stock 1 from the straightening device 6 as soon as the effect of the brake and the inherent friction of the apparatus counteract the inertia in the system, also with a maximum coast sufficient to permit only about one foot of material to issue from the straightener 6.

There is, thus provided an improved means for the control of apparatus for feeding and straightening strip stock which includes no clutch, yet functions perfectly whether the press 8 is running or not. Furthermore, the control means is universal in that it functions perfectly during all speeds of the press and is highly desirable because it is entirely automatic. Since the brake acts only when the press stops and since the motor is only intermittently operated, both the brake and the motor are long lasting which together with the initial low cost of the equipment provides a very low cost control means.

Referring to FIGURE III, after line switches 46 are closed from a three phase alternating current supply (not shown), the apparatus is conditioned for operation by closing a start push button 33 by finger pressure. Current then flows from a supply lead 34 connected to the secondary of transformer 47, having its primary across two of the supply wires, through the now closed push button 33, limit switch 28, normally closed contact 35 of a reverse relay 36, the coil of a forward relay 37 to energize the motor 12 and then to a return lead 38 to the other side of the secondary winding.

Energization of the forward relay 37 causes it to open its normally closed contact 39 and to close its normally open contact 40. Current then flows from the supply lead 34 through the now closed contact 40 to energize the brake solenoid 29 which overcomes the seating force of spring 48 and releases the brake 30. The energized motor 12, with the brake 30 released, turns the rollers 4 which rotate the stock reel 2 and also turns the rolls 19 and 20 in the straightening device 6.

Under some conditions, such as threading the end of a new stock reel 2 through the straightening device 6, it is desirable to move the strip stock 1 forward at a very low or creep speed even though limit switch 28 is open. For this purpose, a by-pass circuit is provided which includes push button 41. When the contacts of push button 41 are closed, current flows through a lead 42 to energize the coil of the forward relay 37 and the motor 12.

A portion of the strip stock 1 may be rewound at creep speed onto the stock reel 2 by opening push button 33, as by depressing stop button 49 coupled to push button 33 through toggle linkage 50, and by depressing push button 43. Current then flows through the contacts of the push button 43, the normally closed contact 39 of the forward relay 37, and the coil of the reverse relay 36 to energize the motor 12 which may be of an

ordinary reversible type of the general type shown and described in the hereinbefore mentioned U.S. Patent No. 2,246,840. Motor 12 can be of the three phase, squirrel cage, induction type coupled to the line through contacts 52, 53 and 54 of forward relay 37 for forward drive and contacts 55, 56 and 57 of reverse relay 36 for reverse drive. Energization of the reverse relay 36 causes it to open its normally closed contact 35 and to close its normally open contact 44. Closing of relay contact 44 permits current to flow through contact 44 to energize the brake solenoid 29 which releases the brake 30 so that the strip stock 1 may be rewound. Brake solenoid 29 is maintained energized while the motor is running through either forward relay contact 40 or reverse relay contact 44. However, coasting of stock is permitted even though relays 36 and 37 are deenergized if the press clutch is energized through closed contact 58 coupled to contact 32, and the brake is applied only when the clutch is deenergized by opening contact 58 and, incidental thereto, contact 32 in the brake solenoid circuit.

It is to be understood that the apparatus and its control means described in the foregoing specification and illustrated in the accompanying drawings is exemplary only and that it is subject to anticipation and change within the spirit and scope of the subjoined claims.

Having described the invention, I claim:

1. Apparatus for straightening strip stock and feeding it to a machine and feed control means for the apparatus comprising, in combination, a cradle for rotatably mounting a coiled supply of strip stock, a plurality of straightening and feeding rolls, drive means including a motor for driving said rolls to move strip stock through the apparatus, a brake for the drive means, brake operating means, means for sensing the length of strip stock between the apparatus and the machine, motor control means for actuating said motor to feed stock from said

apparatus to said machine in response to the presence of less than a given amount of strip stock as sensed by said sensing means, machine control means for actuating said machine to utilize strip stock and means for actuating said brake operating means to a brake releasing state in response to either said actuated motor control means or said actuated machine control means..

2. Apparatus for feeding strip stock to a machine for utilizing said stock and feed control apparatus comprising, in combination, a cradle for rotatably mounting a coiled supply of strip stock, drive means including a motor for removing strip stock from the coiled supply and for moving strip stock through the apparatus, a brake for the drive means, brake operating means, means for sensing the amount of strip stock between the coil supply and the machine, drive control means for actuating said drive to feed said stock in response to less than a given amount of strip stock as sensed by said sensing means, machine control means for actuating said machine to utilize strip stock, and means for actuating said brake actuating means to a brake releasing state in response to either said actuated drive control means or said actuated machine control means.

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