Dec. 17, 1957 J. C. DANLY 2,816,758

CONTINUOUS STOCK FEED FOR POWER PRESSES

Filed Dec. 12, 1955 4 Sheets-Sheet 1

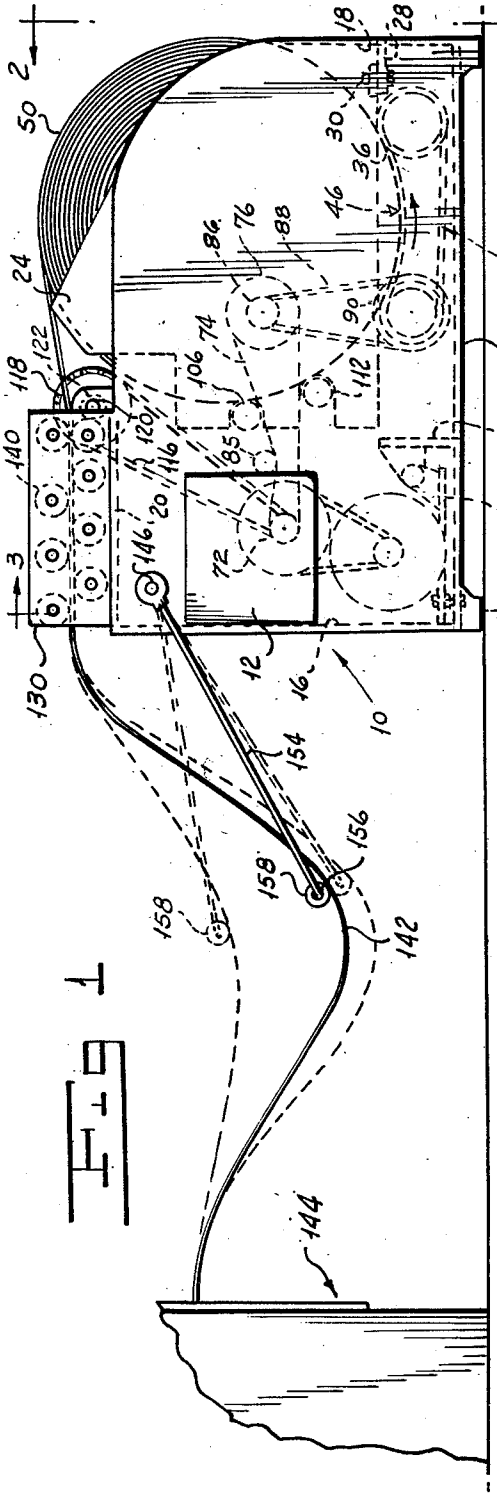


FIG. 1

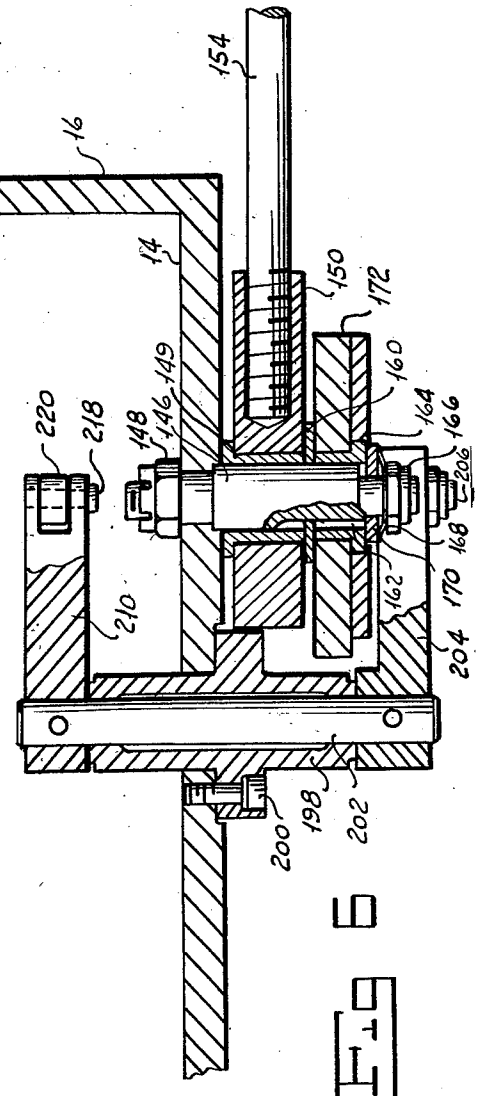


FIG. 6

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FIG 2

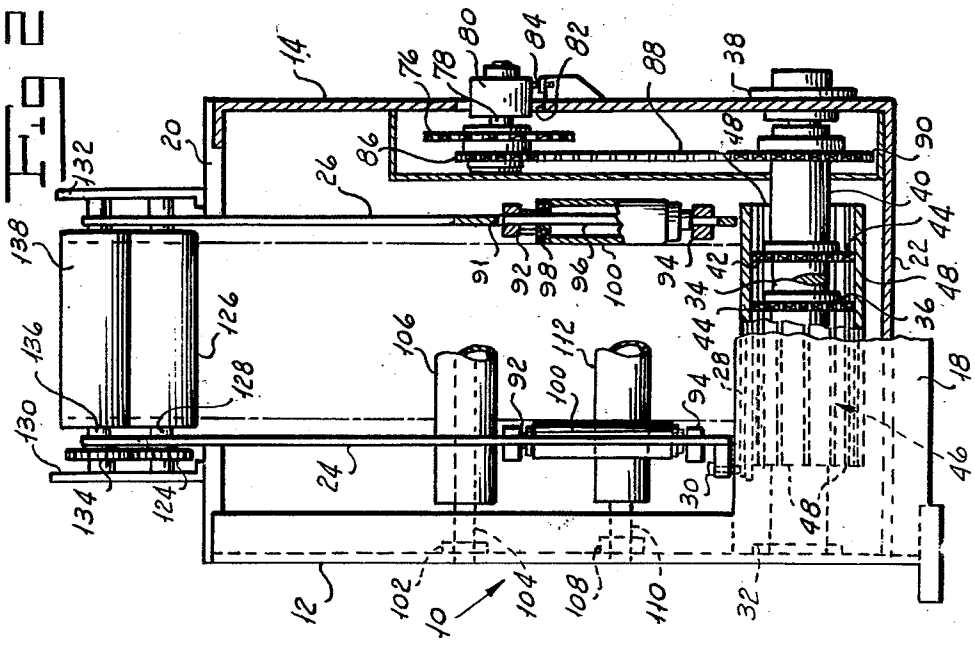
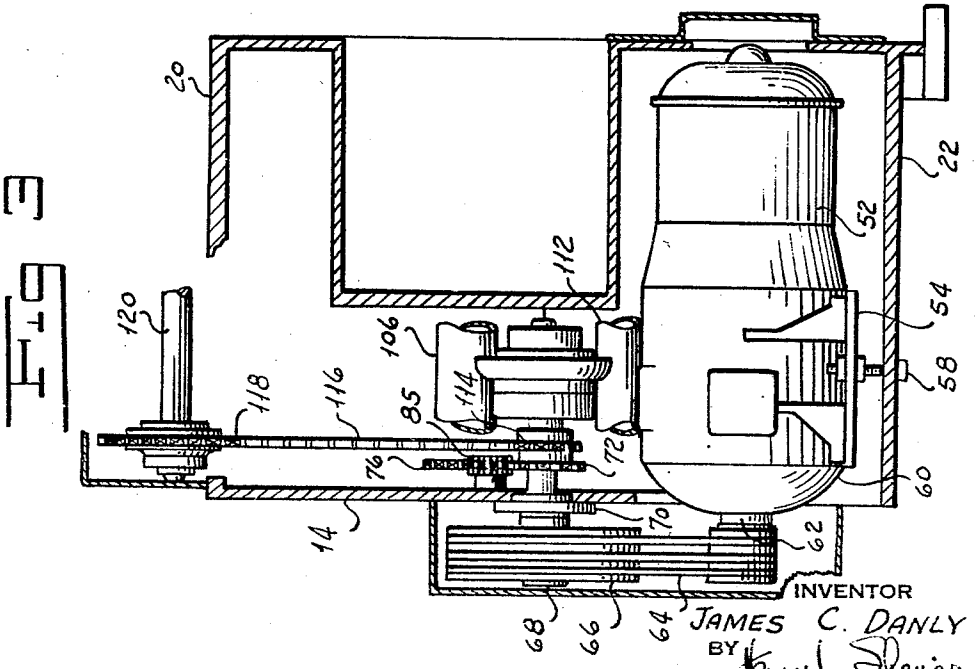


FIG 3



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CONTINUOUS STOCK FEED FOR POWER PRESSES

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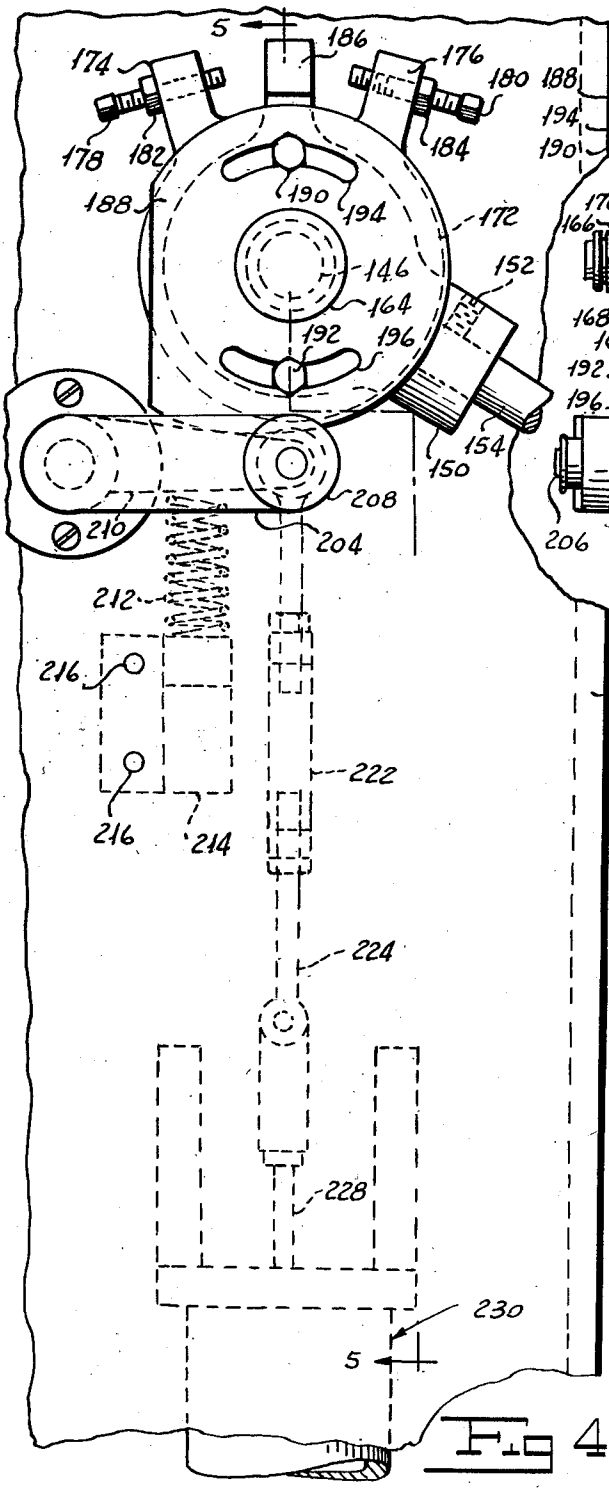


Fig 4

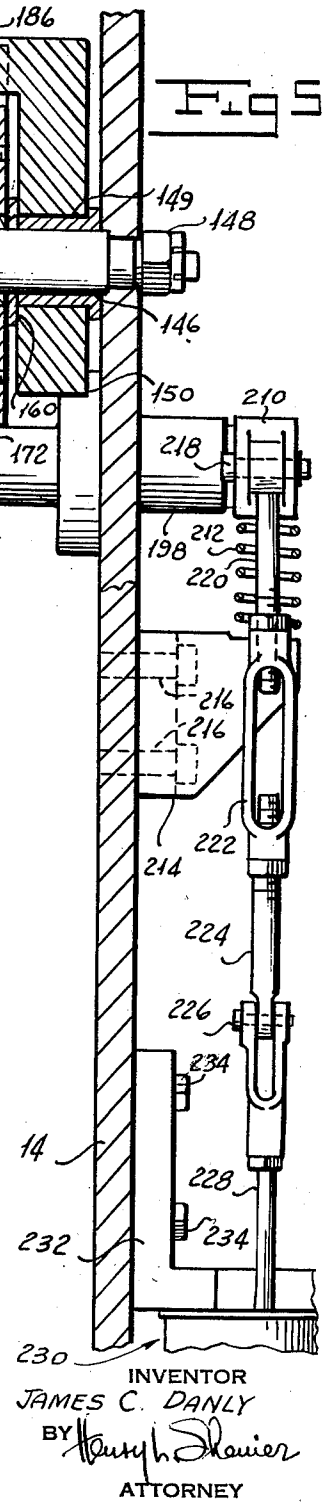


Fig 5

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CONTINUOUS STOCK FEED FOR POWER PRESSES

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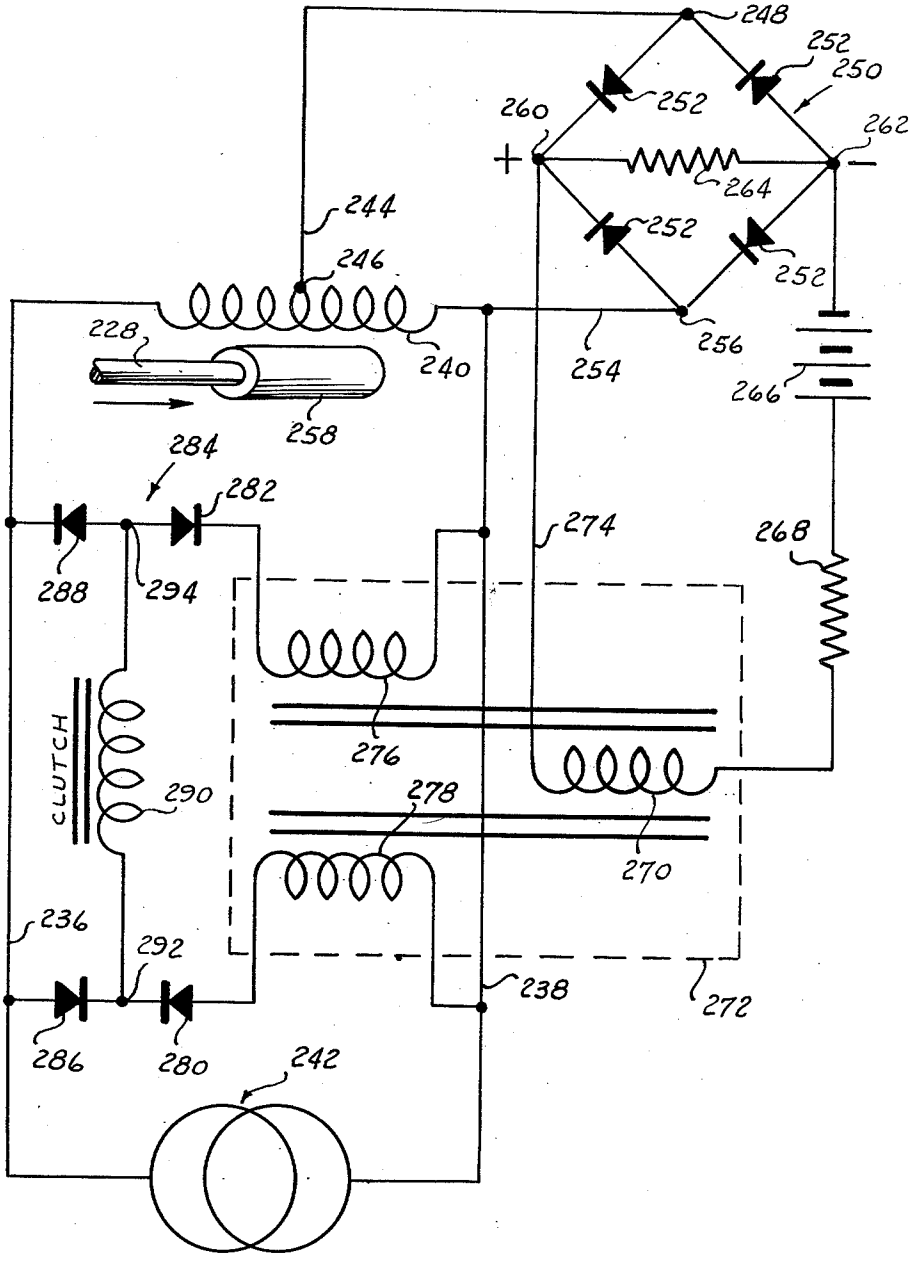


Fig 7

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CONTINUOUS STOCK FEED FOR POWER PRESSES

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Application December 12, 1955, Serial No. 552,572

2 Claims. (Cl. 271—2.3)

My invention relates to a continuous stock feed for power presses and more particularly to a continuous stock feed which employs a constant speed drive motor.

Owing to the cyclic nature of their operation, power presses require intermittent feed of stock such as sheet steel or the like. The co-pending application of Philo H. Danly and Vasil Georgeff, Serial No. 529,518, filed August 19, 1955, discloses a grip feed for intermittently feeding continuous sheet material to a power press or the like. The continuous material fed to the press comes initially from a coil or roll which may weigh as much as 40,000 pounds. It is impractical to arrange a feed such as the grip feed disclosed in the said copending application to work against the inertia of such a large mass in drawing material from the coil. In the prior art, in order to feed continuous sheet material from a large coil or roll, the roll is supported on a cradle which is driven to form a loop of sheet material extending from the coil to the intermittent feed. With this arrangement the intermittent feed device acts only against the weight of the material in the loop. It will be appreciated that the cradle drive means must replenish the loop after a length of material has been drawn out of the loop by the intermittent feed. In the prior art various means are employed to accomplish this result. For example, a combination motor and brake is used intermittently to feed material to the loop. Other means are a continuously driven motor with a combination clutch and brake arrangement responsive to the amount of material in the loop. Still another means which is used is a variable speed motor. All these methods waste power in starting and stopping motors, in alternately driving and braking the feed, or in varying motor speed. Further, in these methods of the prior art the control devices must function continuously to ensure that the proper length of sheet material is in the loop from which the intermittent feed draws lengths of material.

I have invented a continuous stock feed for power presses which overcomes the disadvantages of the feeds of the prior art. My feed includes a constant speed drive motor which does not require the large amount of power necessary to operate feeds of the prior art. In normal operation, my motor drives at a speed which ensures a proper average supply of sheet material to the loop from which lengths are intermittently drawn. My feed is self-adjusting for variations in the speed of the intermittent feed.

One object of my invention is to provide a continuous stock feed for power presses which is more economical than feeds of the prior art.

Another object of my invention is to provide a continuous stock feed for power presses which includes a constant speed drive motor.

A further object of my invention is to provide a continuous stock feed for power presses which is self-adjusting for changes in speed of the intermittent feed with which it is used.

Other and further objects of my invention will appear from the following description.

In general, my invention contemplates the provision of a continuous stock feed for power presses including a cradle driven by a constant speed motor through a slip clutch. The cradle supports and drives a coil of sheet material, a loop of which extends from the coil to the intermittent press feed with which my continuous feed is used. The intermittent press feed alternately draws lengths of material out of the loop and permits the cradle drive to replenish the loop. In normal operation of my feed, the slip clutch drives the cradle at a continuous speed which ensures an adequate length of material in the loop to permit the press intermittent feed to draw material from the loop without pulling directly on the coil. I provide means responsive to the condition of the loop for varying the clutch slip when the length of material in the loop varies outside predetermined limits. This means responsive to the loop condition automatically adjusts my feed for chanegs in speed of the intermittent feed with which it is used.

In the accompanying drawings which form part of the instant specification and which are to be read in conjunction therewith and in which like reference numerals are used to indicate like parts in the various views:

Figure 1 is a side elevation of my continuous stock feed for power presses.

Figure 2 is a rear elevation of my continuous stock feed for power presses with parts broken away and with other parts in section, drawn on an enlarged scale, and taken along the line 2—2 of Figure 1.

Figure 3 is a sectional view of my continuous stock feed for power presses, drawn on an enlarged scale, and taken along the line 3—3 of Figure 1.

Figure 4 is a fragmentary elevation of the clutch control actuating means of my continuous stock feed for power presses, drawn on an enlarged scale.

Figure 5 is a sectional view of the clutch control actuating means of my continuous stock feed for power presses taken along the line 5—5 of Figure 4.

Figure 6 is a fragmentary view of the clutch control actuating means of my continuous stock feed for power presses with some parts broken away and with other parts in section.

Figure 7 is a schematic view of one form of electrical circuit which may be used with my continuous stock feed for power presses.

More particularly referring now to Figures 1 to 3 of the drawings, my continuous stock feed for power presses includes a frame, indicated generally by the reference character 10, having sides 12 and 14, a front 16, a back 18, a top 20, and a base 22. I mount a pair of spaced coil guide plates 24 and 26 on a bracket 28 by any convenient means such as bolts or the like 30. A pair of bearings 32 carried by the respective sides 12 and 14 of the frame 10 rotatably support a shaft 34 carrying a plurality of sprocket wheels 36 spaced along its length. Any convenient means may be employed to mount wheels 36 on shaft 34 for rotation with it. A pair of bearings 38 carried by the respective sides 12 and 14 rotatably support a second shaft 40 carrying a plurality of sprocket wheels 42 spaced along its length. Any convenient means may be employed to mount sprocket wheels 42 on shaft 40 for rotation with it. Each pair of corresponding sprocket wheels 36 and 42 drives a pitch chain 44. Pitch chains 44 carry for movement with them a cradle drive belt, indicated generally by the reference character 46, which may, for example, be made up of a plurality of slats or flights 48. Any appropriate means may be used to mount slats 48 on pitch chains 44.

The construction of frame 10 is such that it permits

entry of coil 50 of stock material such as sheet steel. Cradle belt 46 supports the coil 50 of material being fed.

My feed includes a drive motor 52 supported on a platform 54 pivoted on a bracket 56 carried by base 22. An adjusting bolt 58 positions platform 54 with respect to base 22. Motor 52 drives a clutch contained in a housing 60 carried by platform 54. The clutch in housing 60 is an eddy-current clutch of any type known to the art, such as the "Dynamatic" eddy-current clutch manufactured by the Dynamatic Division of Eaton Manufacturing Company at Kenosha, Wisconsin. This clutch includes an output shaft 62 which drives a plurality of V belts 64 to drive a sheave 66 carried by a shaft 68 for rotation with it. A bearing 70 carried by side 14 rotatably carries shaft 68. I mount by any convenient means a first sprocket wheel 72 on shaft 68 for rotation with it. Sprocket wheel 72 drives a pitch chain 74 which drives a sprocket wheel 76 carried by a shaft 78 for rotation with it. A bearing 80 adjustably mounted in a slot 82 in side 14 rotatably supports shaft 78 on frame 10. A nut 84 provides a means for adjusting the position of bearing 80 in slot 82. As can be seen by reference to Figure 1, in passing from sprocket wheel 76, chain 74 engages an idler sprocket wheel 85 rotatably carried by side 14. It will be seen that the chain 74 may be adjusted by moving bearing 80 up or down in slot 82. Shaft 78 carries for rotation with it a sprocket wheel 86 which drives a pitch chain 88 which engages the sprocket wheel 90 carried by shaft 40 for rotation with it. When motor 52 is energized, the output shaft 62 of the clutch in housing 60 drives shaft 68 to drive pitch chain 74 to drive shaft 78 to drive shaft 40 and the cradle drive belt 46. When belt 46 moves in the direction of the arrow in Figure 1, it rotates coil 50 to feed the sheet material out of my feed.

As can be seen by referenec to Figure 2, each of the plates 24 and 26 is formed with a slot 91 in which I fix a respective pair of shaft support members 92 and 94. Each pair of members 92 and 94 supports a shaft 96. Bearings 98, carried by each shaft 96 rotatably support respective guide rolls 100. The pair of guide rolls 100 properly position coil 50 between guide plates 24 and 26 to prevent lateral shifting of the coil of sheet metal.

A pair of bearings 102 carried by the respective sides 12 and 14 rotatably carry a shaft 104 carrying a guide roll 106. A second pair of bearings 108 carried by the respective sides 12 and 14 rotatably support a shaft 110 carrying a roll 112. As can best be seen by reference to Figure 1, rolls 106 and 112 prevent coil 50 from shifting to the left off belt 46, as viewed in Figure 1, as the belt drives the roll.

Referring now to Figure 3, shaft 68 carries for rotation with it by any convenient means a sprocket wheel 114 which drives a pitch chain 116 which engages and drives a sprocket wheel 118 carried by any convenient means on a shaft 120 for rotation with it. Shaft 120 also carries for rotation with it a pinion 122, shown in Figure 1, which engages a gear 124, shown in Figure 2, fixed on the end of a roll 126 carried by a shaft 128 rotatably mounted by any convenient means in a pair of bearing supports 130 and 132 carried by frame top 20. Gear 124 drives a gear 134 carried by the shaft 136 of a roll 138 rotatably supported in supports 130 and 132. Rolls 126 and 138 feed the material from coil 50 to a number of straightening rolls 140 rotatably carried by supports 130 and 132. After passing from rolls 140 the sheet material from coil 50 forms a loop 142 in passing to the intermittent feed mechanism, indicated generally by the reference character 144, with which it is used. This mechanism supplies the work stock to the press for each forming operation.

Motor 52 drives the cradle feed belt 46 through the eddy-current clutch in housing 60. I have arranged my feed so that motor 52 rotates at substantially constant speed to supply loop 142 with the proper average amount of material required by the intermittent press feed 144. My feed includes means for varying the energization of the clutch in housing 60 when the length of material of loop 142 is outside of predetermined limits.

Referring now to Figures 1 and 4 to 6, a pair of shafts 146 fixed in side plates 12 and 14 by nuts 148 rotatably carry by means such as bushings 149 or the like a pair of dancer roll support rod mounting members 150. Set screws 152 secure dancer roll support rods 154 in the respective members 150. Rods 154 carry respective bearings 156 which rotatably support a dancer roll 158. In normal operation of my feed, roll 158 rests on the sheet material in loop 142.

From the foregoing it will be seen that as the length of material in loop 142 decreases, dancer roll 158 moves to pivot rods 154 in a clockwise direction as viewed in Figure 1, and a counterclockwise direction as viewed in Figure 4. Conversely, as the length of material in loop 142 increases, dancer roll 158 pivots in a counterclockwise direction as viewed in Figure 1, and a clockwise direction as viewed in Figure 4. When motor 52 is running at the proper constant speed, it supplies the required average amount of sheet material to loop 142. In this condition of my feed, dancer roll 158 moves up and down between limits determined by the length of material required by intermittent press feed 144 for a single stroke of the press.

I provide means for changing the energization of the eddy-current clutch in housing 60 and hence the amount of slip to regulate the rate at which material is uncoiled. This means operates when dancer roll 158 moves outside its predetermined limits. A spacing washer 160 engages a keyway 162 in one of the shafts 146 to be carried by the shaft for rotation with it. Washer 160 separates bushing 149 from a second bushing 164 carried by one of the shafts 146. A nut 166 carried by the shaft 146 bears against a spring 168 which engages a washer 170 to clamp bushings 149 and 164 to spacing washer 160 and hence frictionally to shaft 146 for rotation with it. Bushing 164 rotatably supports a cam actuating member 172 formed with a pair of relatively angularly spaced limit determining ears 174 and 176. Ears 174 and 176 carry respective limit adjusting screws 178 and 180 held in position on the ears by nuts 182 and 184. I form one of the members 150 with an arm 186 for engaging the limit determining screws 178 and 180 to move the cam actuating member when the members 150 pivot outside the predetermined limits. Bushing 164 rotatably carries a cam 188. Screws 190 and 192 passing through respective arcuate slots 194 and 196 in cam 188 secure the cam to actuating member 172 for rotation with it. It will be seen that when arm 186 engages one of the screws 178 or 180 to pivot member 172, the member 172 also pivots cam 188.

As can be seen in Figure 6, a bearing 198 fixed in side 14 by any convenient means such as screws 200, rotatably carries a shaft 202. I mount a cam follower crank 204 on one end of shaft 202 for rotation with it. As can best be seen in Figures 4 and 5, a pin 206 carried by arm 204 rotatably supports a cam follower roller 208. Shaft 202 carries for rotation with it by any convenient means a second crank arm 210. A spring 212 bears between a bracket 214 fixed on side 14, by any convenient means such as screws 216, and the underside of arm 210. Spring 212 normally urges arm 210 to rotate in a counterclockwise direction as viewed in Figure 4 to urge a surface of follower 208 against the surface of cam 188. A pin 218 pivotally connected a link 220 to arm 210. A turnbuckle 222 connects link 220 to a second link 224. A pin 226 pivotally connects link 224 to the supporting rod 228 adapted to carry the core of a variable reactor, indicated generally by the reference character 230. I secure reactor 230 by any convenient means to a bracket 232 fixed on side 14 by screws 234.

From the foregoing it will be seen that if dancer roll

158 pivots rods 154 more than a predetermined distance in a clockwise direction as viewed in Figure 1 as the length of material in loop 142 decreases, arm 186 engages screw 178 to drive member 172 in a counterclockwise direction as viewed in Figure 4. As member 172 moves in a counterclockwise direction, it drives cam 188 to move crank arm 204 in a clockwise direction as viewed in Figure 4. This movement of arm 204 moves crank 210 to drive rod 228 downward as viewed in Figures 4 and 5. Conversely, if an excess of material is fed to loop 142, dancer roll 158 moves arm 186 into engagement with screw 180 to permit spring 212 to move rod 228 upward as viewed in Figure 5. It will be seen that when the movement of rods 154 exceeds predetermined limits, rod 228 is moved up or down in accordance with the direction of movement of rods 154.

In Figure 7 I have shown one form of electrical circuit for varying the energization of the eddy-current clutch in housing 60 in accordance with changes in position of rod 228. Respective conductors 236 and 238 connect the winding 240 of inductor 230 across a suitable alternating current potential, indicated generally by the reference character 242. A conductor 244 connects a center tap 246 of winding 240 to one terminal 248 of a full wave bridge rectifier, indicated generally by the reference character 250. Thebridge 250 includes a plurality of rectifiers 252 such as diodes, crystals, or the like. A conductor 254 connects conductor 238 to a terminal 256 of bridge 250. Rod 228 carries for movement with it a paramagnetic slug 258 disposed within winding 240. It will be understood that the ratio of the inductance of the portions of winding 240 on either side of center tap 246 will vary in accordance with changes in position of slug 258. As slug 258 moves to the left as viewed in Figure 7, the potential drop across the portion of winding 240 between center tap 246 and conductor 236 will be greater than the potential drop between tap 246 and conductor 238. If slug 258 moves to the right as viewed in Figure 7 from the central position, the potential drop across the portion of winding 240 between tap 246 and conductor 238 is greater than that between tap 246 and conductor 236.

Bridge 250 rectifies the alternating current potential across the portion of winding 240 between tap 246 and conductor 238 to produce a direct current potential of the polarity indicated in Figure 7 between the output terminals 260 and 262 of bridge 250. I connect a load resistor 264 between terminals 260 and 262. I connect a biasing battery 266 and a ballast resistor 268 in series between bridge output terminal 262 and one terminal of the control winding 270 of a magnetic amplifier 272. A conductor 274 connects the other bridge output terminal 260 to the other terminal of winding 270. The polarity of battery 266 is opposite to the polarity of the direct current potential produced by bridge 250. Resistor 268 limits the current drawn from bridge 250.

Amplifier 272 includes a pair of output windings 276 and 278, one terminal of each of which is connected to conductor 238. The other respective terminals of windings 276 and 278 are connected to rectifiers such as crystals 280 and 282, or the like, connected in a full wave bridge rectifier circuit, indicated generally by the reference character 284. Bridge 289 includes a second pair of rectifiers 286 and 288 connected respectively between rectifiers 280 and 282 and conductor 236. I connect the winding 290 of the eddy-current clutch in housing 60 between the output terminals 292 and 294 of bridge 284.

As has been explained hereinabove, as slug 258 moves to the right as viewed in Figure 7, the output voltage from terminals 260 and 262 increases. The biasing battery 266 is such that with zero control current the impedance of coils 276 and 278 is at a maximum, ensuring a minimum output current. The polarity of this potential acts against the potential of battery 266 to increase the flux in the core of the magnetic amplifier to decrease the reactance of coils 276 and 278 to increase the output signal from amplifier 272 and hence rectifier 284. As is known in the art, an increase in the potential applied to the clutch winding 290 decreases the clutch slip to increase the speed at which the constant speed drive motor 52 drives cradle belt 46. I so arrange my feed that a decrease in material in loop 142 drives arm 186 in a direction to move slug 258 to the right as viewed in Figure 7. When this occurs, the clutch slip decreases and the speed of belt 46 increases to increase the length of material in loop 142. When the length of material in loop 142 becomes excessive, dancer roll 158 moves arms 154 to move slug 258 to the left as viewed in Figure 7. This movement of slug 258 decreases the control signal input to winding 270. As the excitation of control winding 270 decreases, the reactance of windings 276 and 278 increases. This reduces the current flowing through these windings and hence the input to the rectifier bridge 284. This reduces the current flowing through clutch winding 290 and thus increases the slip provided by the clutch in housing 60 to reduce the speed at which material is fed to loop 142.

In normal operation of my feed, I set limit screws 178 and 180 to provide for a predetermined movement of dancer roll 158 without actuating cam 188. In this condition of operation as long as the speed and demand of the intermittent feed 144 do not vary, motor 52 drives at constant speed. As the feed 144 intermittently draws lengths of material from loop 142, arm 186 oscillates between limits determined by screws 178 and 180 without engaging either of the limit screws. Motor 52 and the clutch in housing 60 drive belt 46 at a speed which supplies just enough material to loop 142 to permit feed 144 to draw predetermined lengths of material from the loop at the proper rate. If the amount of material drawn by intermittent feed 144 on each operation changes, the limits determined by screws 178 and 180 must be changed if my feed is to operate properly.

It is to be noted that my feed is self-adjusting for changes in speed of operation of the intermittent feed 144. If the lengths of material are to be drawn from loop 142 at a greater rate, in the course of operation of my feed, arm 186 engages screws 178 to pivot cam 188 in a counterclockwise direction as viewed in Figure 4. This movement of the cam forces rod 228 downward as viewed in Figure 5 and moves slug 258 to the right as viewed in Figure 7. This action increases the control signal input to winding 270 to increase the energization of clutch winding 290. As a result of this operation, the clutch slip is reduced and belt 46 is driven at a greater rate to supply more material in a given time to loop 142. Since ears 174 and 176 are integrally formed with member 172, movement of the member changes the speed of feed without changing the limits of movement of dancer roll 158. If the rate at which material is drawn by intermittent feed 144 is reduced, arm 186 engages screw 180 to reduce the feed speed of belt 46. Slots 194 and 196 provide a means for adjusting the position of cam 188 on member 172.

It will be seen that I have accomplished the objects of my invention. I have provided a continuous stock feed for power presses which operates more economically than feeds of the prior art. My feed includes a constant speed drive motor which consumes power at a substantially constant rate. The average power consumption of my system is less than that of feeds of the prior art. My system is self-adjusting for changes in the rate at which an intermittent feed or the like draws material from a loop. It avoids the high peak speeds present in feeds of the prior art.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of my claims. It is further obvious that various changes may be made

in details within the scope of my claims without departing from the spirit of my invention. It is, therefore, to be understood that my invention is not to be limited to the specific details shown and described.

Having thus described my invention, what I claim is:

1. A continuous feed for feeding sheet material from a coil of sheet material to a machine to be fed including in combination means for rotatably supporting the coil, a length of said material extending from said coil to said machine to be fed, said length being formed with a loop, means for revolving said coil, a drive motor, a slip clutch including an electromagnetic winding for coupling said drive motor to said coil revolving means and means responsive to the condition of said loop for varying the amount of slip of said clutch, said last named means being normally inoperative when the length of material in said loop is within predetermined limits, said means responsive to the condition of said loop including a magnetic amplifier for producing an output signal, means for producing a control signal for said amplifier, means for applying said control signal to said amplifier, means for applying said output signal to said electromagnetic winding and means for increasing said control signal when said length of material in said loop is less than a predetermined length and for decreasing said control signal when the length of material in said loop exceeds a second predetermined length.

2. A continuous feed for feeding sheet material from a coil of sheet material to a machine to be fed including in combination means for rotatably supporting the coil, a length of said material extending from said coil to said machine to be fed, said length being formed with a loop, means for revolving said coil, a drive motor, an electromagnetic slip clutch for coupling said drive motor to said coil revolving means, means comprising a reactance voltage divider having a movable core for energizing said clutch and means responsive to the condition of said loop for moving said movable core to vary the slip of said clutch, said last named means comprising a shaft, a stop actuating member pivotally carried by said shaft, a dancer roll in engagement with said loop, means connecting said dancer roll to said stop actuating member whereby the angular position of said stop actuating member is a function of the length of material in the loop, a limit determining member rotatably carried by said shaft, said limit determining member being formed with a pair of relatively angularly disposed stops adapted to be engaged by said actuating member, a cam carried by said limit determining member for movement therewith, said actuating member engaging the respective stops at predetermined lengths of material in said loop and means actuated by said cam to move said reactor core.

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