

May 16, 1961

A. F. GROLL
STOCK METERING DEVICE

2,984,012

Filed June 18, 1959

7 Sheets-Sheet 1

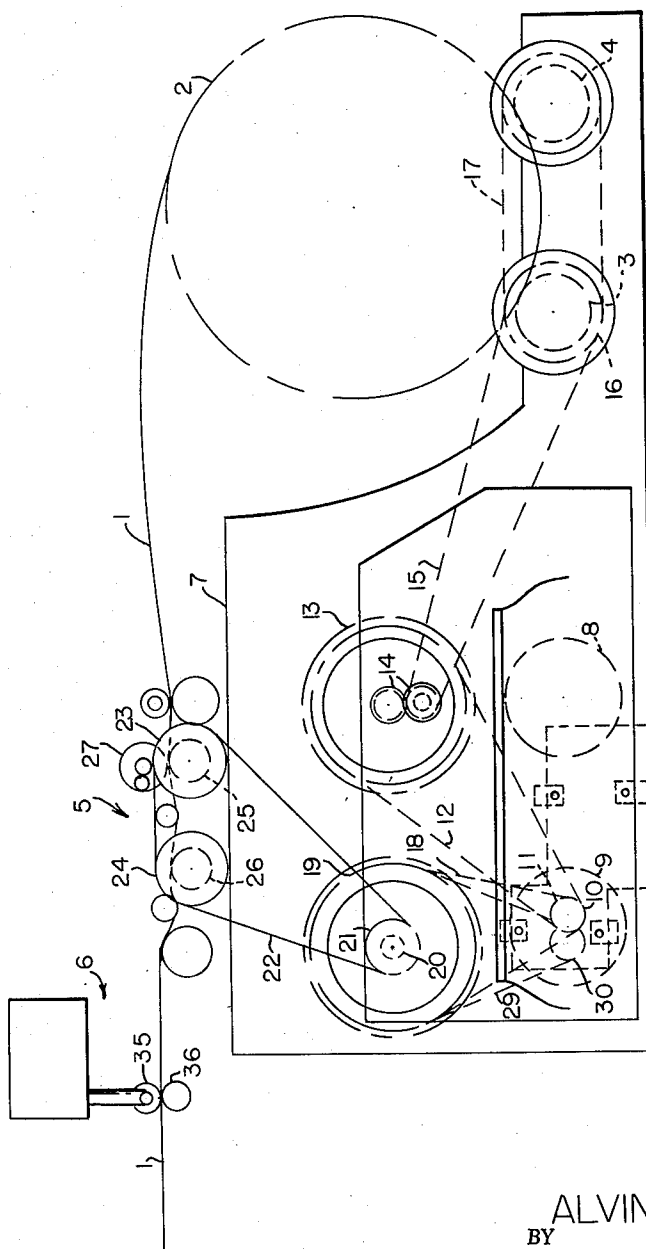


Fig. 1

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7 Sheets-Sheet 2

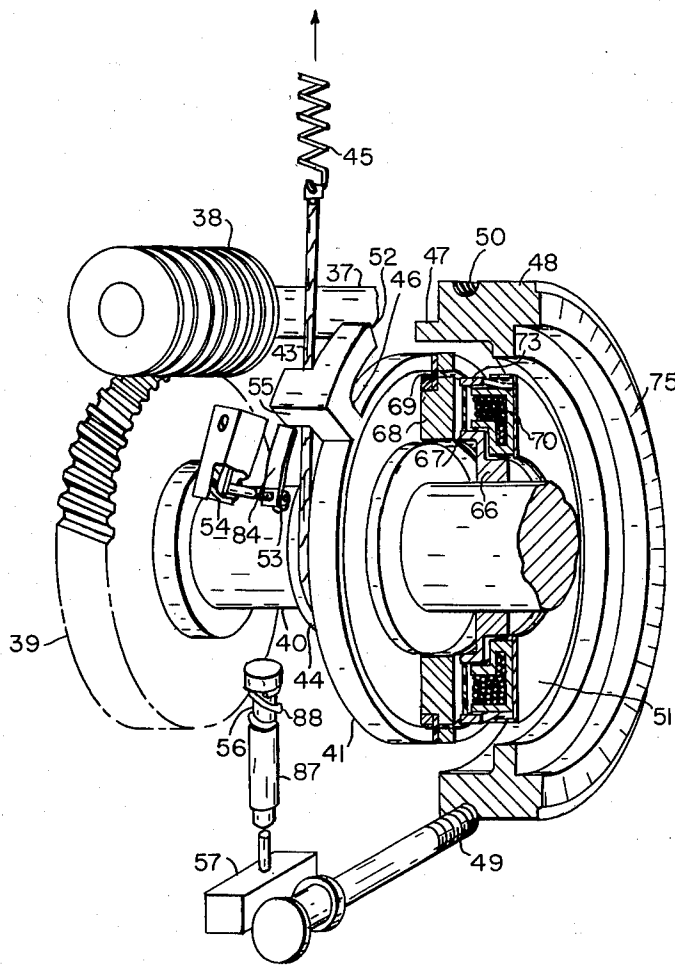


Fig. II

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7 Sheets-Sheet 3

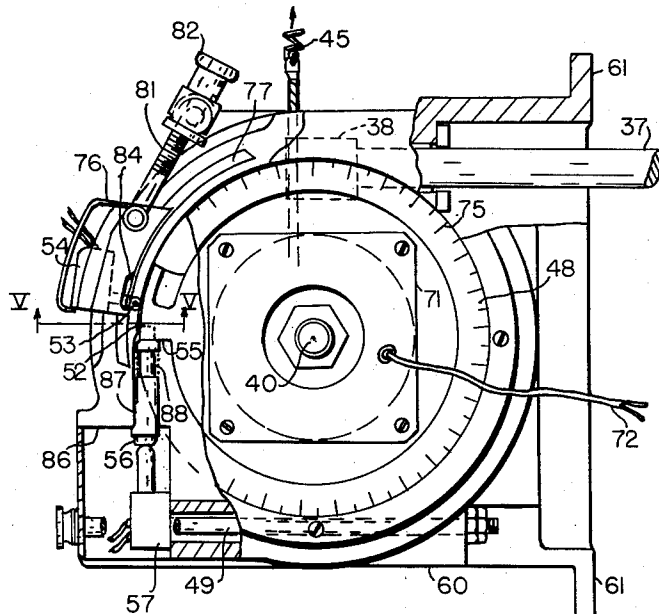


Fig. III

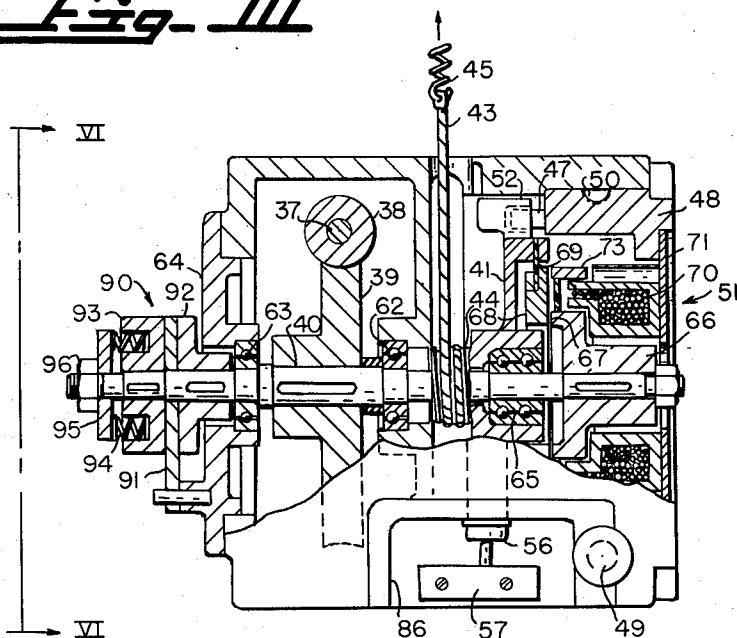


Fig. IV

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7 Sheets-Sheet 4

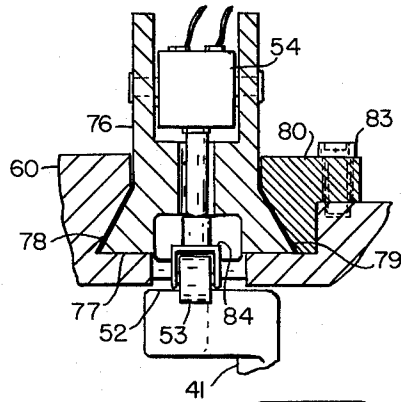


Fig. V

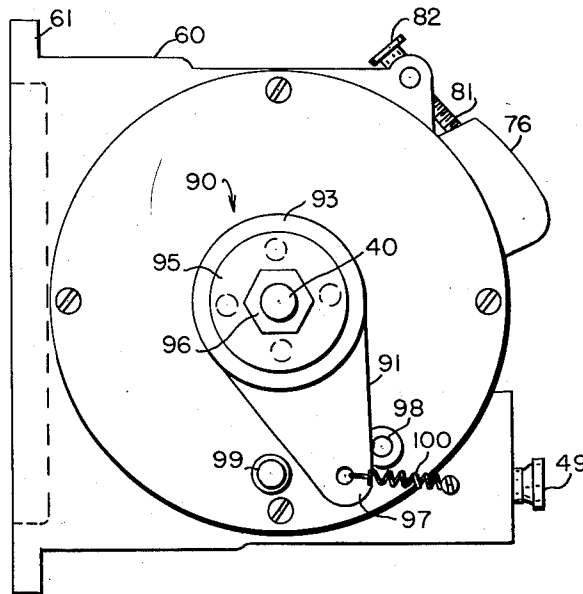


Fig. VI

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7 Sheets-Sheet 5

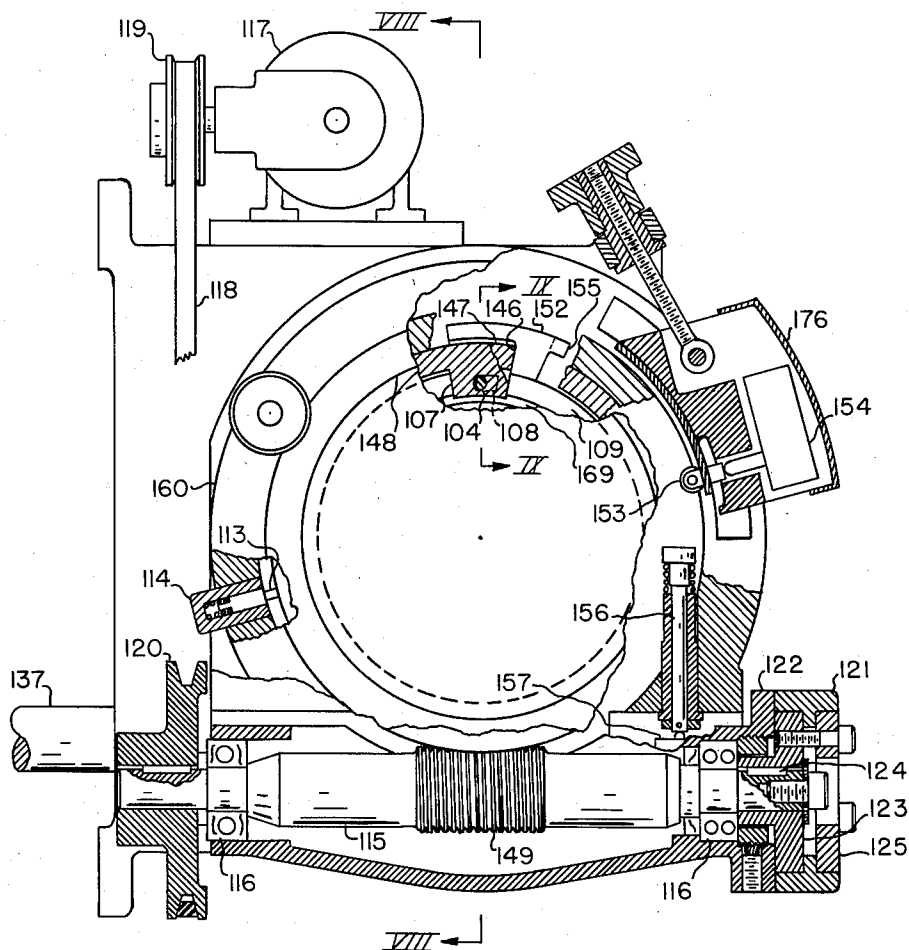


Fig. VII

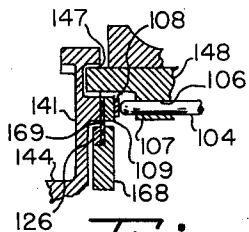


Fig. IX

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7 Sheets-Sheet 6

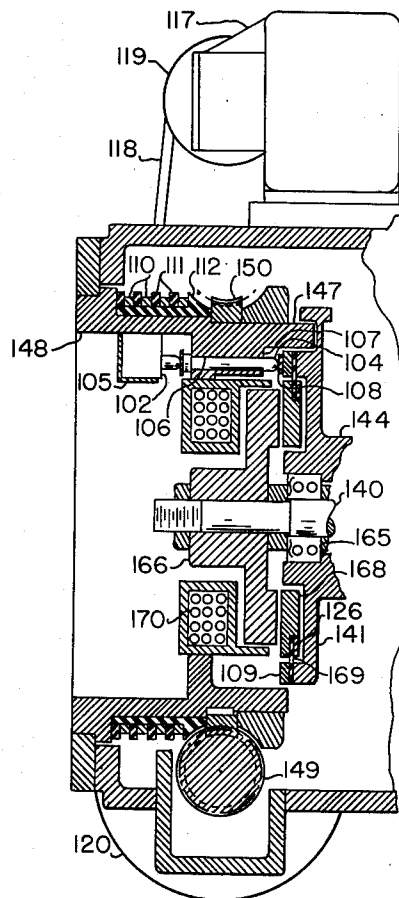


Fig. VIII

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2,984,012

STOCK METERING DEVICE

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Filed June 18, 1959, Ser. No. 821,329

11 Claims. (Cl. 33—132)

This invention relates to metering equipment for use with strip stock feeders and in particular to a device that may be accurately adjusted to deliver a given length of material for each operation of the device. This is a continuation-in-part of my application Serial No. 676,024, now abandoned, for Stock Metering Device, which was filed August 2, 1957.

Strip stock feeders are often used to feed stock into a mechanically operated shear, into a punch press, or other device that operates on the sheet material. When these devices are operated automatically it is desirable to feed a given length of strip stock into the machine for each cycle of operation. To keep the waste of scrap material to a minimum and yet insure that there is always a sufficient quantity of material fed during each cycle requires that the feeding mechanism operate with high precision. If the mechanism of a press falls short portions of the article being stamped from the sheet metal may be missing. If too much material is fed the excess goes into the scrap and is lost.

The principal object of this invention is to provide metering equipment for a strip stock feeder that may be set to any reasonable prescribed length of material and which will control the operation of the feeder so as to deliver precisely the desired amount of material for each operation.

Another object of the invention is to provide a metering device that is operated directly by the material being fed and which is arranged to meter a prescribed length of material at each operation.

A still further object of the invention is to provide a compact mechanism operated directly by the strip stock being fed which mechanism incorporates limit switches and a cam for operating the switches according to the feed of the material.

A still further object of the invention is to provide a metering device which may be quickly and easily adjusted for different lengths of material and which, when adjusted, will accurately control a press feeder to deliver the prescribed lengths of material.

Additional objects are to enable the metering device to be adjusted by a motor drive to meter a prescribed length of material, to supplement a motor driven adjusting means with a manually operated adjustment of high precision, to correlate the adjusting functions with the operation of the feeding mechanism for the material being metered, and reduce the interval between the feed of successive lengths of metered material to the minimum necessary for the proper functioning of the metering device, the feeding mechanism, and the equipment utilizing the metered lengths of material.

More specific objects and advantages are apparent from the following description of an apparatus constructed according to the invention.

According to the invention a roll is arranged to run directly on the strip stock being fed and this roll, either directly or through gearing, drives a main shaft in the metering device. A cam journaled on the shaft and clutched thereto during a feeding operation starts from an adjustable stop and rotates until it operates a slow-down switch which causes the feeder to change from high speed to low speed operation and then as the feed length is reached a stop switch that stops the feeding operation entirely. After the operation is stopped the clutch is released and the cam, under the influence of a

2

strip, returns to its position against the adjustable stop in readiness for another cycle of operation. The invention further contemplates means for minimizing or eliminating the effects of backlash in the gearing in the equipment so as to enhance the accuracy of the metering operation.

Two embodiments of the invention as summarized above are disclosed to illustrate its principles. The more refined embodiment includes a motor drive for rapidly presetting the length of material to be measured in a metering cycle. This form of drive enables a precise degree of adjustment since, as in the case of a screw advancing means, fine threads can be employed without unduly reducing the speed with which adjustments can be made. Supplementing the motor drive is a fine manual adjustment which can be operated as a suitable micrometer drive. Interlocks are provided to avoid a feeding operation while the motor driven adjustment is being effected and selectively to disable the feeding operation during manual adjustment.

In the more refined embodiment of the metering device means is provided for sensing the completion, its reset following completion of a metering cycle. This means can be integrated with the feeding and material utilizing equipment to avoid unnecessary dwell time between metering cycles by conditioning the metering device to initiate the feed operation as soon as it is reset. Advantageously, this means is combined with means on the utilization equipment and/or the feeding equipment to institute a new feed cycle only when all elements of the system are conditioned to perform their assigned functions.

A preferred embodiment of the invention is illustrated in the accompanying drawings.

In the drawings:

Fig. I is a side elevation in schematic form showing a strip stock feeder equipped with the improved metering device.

Fig. II is a diametric view, with parts broken away, of the operating mechanism only of the improved metering device.

Fig. III is a side elevation, with parts broken away, of the improved metering device.

Fig. IV is an end elevation, with parts broken away, to show the mechanism of the improved metering device.

Fig. V is a fragmentary detail taken substantially along the line V—V of Fig. III.

Fig. VI is a side elevation as seen from the line VI—VI of Fig. IV.

Fig. VII is a side elevation of a second embodiment of the metering device with portions broken away to reveal details thereof.

Fig. VIII is a section of portions of the second embodiment taken along the line VIII—VIII of Fig. VII.

Fig. IX is an enlarged portion of the region of the reset limit switch actuator taken along line IX—IX of Fig. VII.

Fig. X is a circuit for the metering device of Fig. VII.

These specific figures and the accompanying description are intended merely to illustrate the invention but not to impose limitations on its scope.

Referring now to Fig. I, apparatus for feeding strip stock 1 from a stock reel 2 may comprise a pair of power driven reel supporting rollers 3 and 4 and a feeding and straightening device 5 that draws the strip stock 1 from the reel 2 and delivers it past the metering device 6 to a punch press, power driven shears, or other similar machinery.

The reel support rolls 3 and 4, the straightening device 5, and mechanism for driving these elements are mounted in a frame 7.

Power for driving the reel supporting rolls 3 and 4 is obtained from a motor 8 operatively connected by means, not shown, to a speed reducer 9 having a pair of sprockets 10 and 11 on its output shaft. (In Fig. I the sprocket 11 is located immediately behind the sprocket 10.) The sprocket 11 drives through a chain 12 to a clutch 13 rotatably mounted in the central part of the frame 7. Power from the clutch 13 is taken through a pair of direction reversing gears 14 and a chain 15 to a sprocket 16 on the reel support roll 3. In this arrangement driving power is delivered from the motor 8 to the reel support roll 3 as long as the clutch 13 is engaged. If desired, the second reel support roll 4 may be connected by a chain drive 17 to the reel support roll 3 so that both rolls are power driven and turn at the same speed.

The speed reducer 9, driven by the motor 8, also supplies power for the feeder and straightener device 5 by way of the sprocket 10, a chain drive 18, a second clutch 19 mounted on a common shaft 20, a chain sprocket 21, and a chain 22 driving sprockets 23 and 24 mounted on rolls 25 and 26 of the feeding device 5. The additional feed rolls may be gear driven from the feed rolls 25 and 26 which are driven by the motor 8 as long as the second clutch 19 on the shaft 20 is engaged. A pressure roller 27 forces the stock against the roller 25 so that the stock is positively fed as long as the rolls turn.

A second clutch is carried on the common shaft 20 and is driven through a chain 29 from a drive sprocket 30 on a second motor, not shown. The drive from the sprocket 30 through chain 29 and the second clutch is arranged to turn the shaft 20 at a slow speed when it is engaged and the clutch 19 is disengaged.

This much of the structure and the controls for operating the clutches are shown and described in Patent No. 2,729,447, issued January 3, 1956. As shown in the patent a pair of limit switches positioned in the path of the strip stock after it leaves the feeding device and passes through a power shear are arranged to control the clutches that control the flow of power from the drive motors to the drive roll. When the first of the limit switches is contacted by the strip stock the feeder changes from high speed to low speed and then feeds at the low speed until the second of the limit switches is contacted.

Such a system is inconvenient to use and not commercially practical because of the difficulty of properly mounting the limit switches and adjusting them for various lengths of stock to be fed. For example, if the stock is to be fed into a punch press it is desirable that the leading edge of the stock just pass the far side of the die with very little overtravel. However, it is practically impossible to locate a limit switch in such a position.

According to the invention, the switches for controlling the feeding device are located in the metering device 6 which has a drive roll 35 running in contact with the strip stock 1 as it is fed from the feeding and straightening device 5. In order that there may be no slippage between the roller 35 and the strip stock 1 a backing roller 36 is provided so that considerable pressure may be maintained between the rolls and the stock.

The drive roll 35 is connected either directly or through gearing or other transmission means to an input shaft 37 (Fig. III) that carries a worm 38 meshing with a worm wheel 39 (Fig. II) on a main shaft 40 of the metering device. Thus the shaft 40 is turned as long as the strip stock 1 is being fed.

A cam 41 rotatably journaled on the main shaft 40 is continually urged in a clockwise direction as seen in Fig. II by a cable 43 wrapped around a hub 44 (Fig. IV) of the cam 41 and attached to a spring 45 mounted outside the case of the metering device.

The clockwise movement of the cam 41 under the influence of the cable 43 and the spring 45 is limited by engagement of a surface 46 of the cam 41 with a stopping lug 47 carried on a manually rotatable index ring 48. The index ring 48 is adjusted in position by a screw 49

engaging a threaded groove 50 in the periphery of the ring 48 for positioning the stopping lug 47 according to the desired length of material to be fed.

When it is desired to feed a length of material and the feeding device indicated in Fig. 1 is energized it also energizes an electromagnetic clutch 51 to couple the cam plate 41 to the shaft 40 so that the cam plate 41 turns with the shaft in proportion to the amount of stock being fed. This drives the cam 41 in a counterclockwise direction (Fig. II) against the tension of the spring 45 as the material is fed at high speed. Shortly before the desired length of material is fed a circumferential cam surface 52 of the cam 41 engages a switch roller 53 to actuate a first or slow-down limit switch 54. The limit switch 54, which corresponds in function to the limit switch 36 shown in the above-mentioned patent, causes the feeder to change from high to low speed and thus feed the material at a slow rate for the final increment of travel. As the feed continues the cam 41 moves counterclockwise at a rate proportional to the feeding rate until its forward surface 55 strikes an actuating rod 56 of a second limit switch 57 serving as a stop control. This switch 57 corresponds to the switch 37 of the above-mentioned patent. As soon as the press feeder is stopped or deenergized by action of or in response to operation of the limit switch 57 the electromagnetic clutch 51 is deenergized, thus allowing the cam 41 to return to its clockwise position under the influence of the spring 45. The system is then ready for the next cycle of operation.

Referring now to Figs. III and IV, the operating mechanism of the metering device 6, as illustrated in Fig. II, is housed in a housing 60 that is provided with flanges 61 by which it may be bolted or otherwise secured to the housing of the feeder with which it is to be used. The main shaft 40 of the device is carried in a pair of ball bearings 62 and 63 the bearing 62 being mounted in a central web of the housing 60 while the bearing 63 is mounted in an end cap 64 that fits into an end of the housing.

The cam 41 including its hub 44 rotates on a double row ball bearing 65 mounted on the end of the shaft 40 protruding through the bearing 62.

The shaft 40 is extended beyond the bearing 65 far enough to carry a rotatable portion 66 of the electromagnetic clutch 51. This rotatable portion 66 includes a pole face 67 that is in light rubbing engagement with an armature 68 connected through a spider 69 to the cam plate 41. The spider 69 may be made of a neoprene or other rubber-like material or it may be made of metal in the form of a plurality of fingers that provide for axial movement of the armature 68 without permitting any relative rotation between the armature 68 and the cam 41. The electromagnetic clutch 51 includes an energizing coil 70 that is mounted directly on a plate 71 attached to the index ring 48. Leads for the coil 70 are brought out through a flexible cable 72 that permits the required movement of the index ring 48 without requiring the use of slip rings or other rotatable connections. The magnetic circuit of the clutch 51 includes the rotatable portion 66, the armature 68 and a return pole piece 73 that is non-magnetically supported on the rotatable member 66. Air gaps are provided between the rotatable member 66 and the return pole piece 73 so that the coil 70 may be stationarily mounted and not be required to rotate with the rotatable members 66.

As indicated in Fig. III the index ring 48 is provided with indicia 75 extending around its periphery so that its position relative to the housing may be accurately determined. As mentioned before, the index ring 48 provides the starting position for the cam 41.

The slow-down switch 54 is carried in a bracket 76 that is movable along a track 77 formed in the housing 60. This track 77 is concentric with the shaft 40 and comprises a triangular shaped groove 78 (Fig. V) cut into a radially extending wall of the housing 60 and a

similar V-shaped groove 79 formed between a cylindrical portion of the housing 60 and a gib 80 fitted onto such cylindrical portion to match the groove 78. The bracket 76 has toe portions extending into the triangular groove much in the manner of a dove-tailed way. The bracket 76 may be adjusted along the track 77 by an adjusting screw 81 and nut 82 that is pivotally mounted on the housing and engages the bracket 76. Preferably the fit between the gib 80 and the toe-like portions of the bracket 76 are such that screws 83 attaching the gib to the housing must be loosened to permit adjustment of the bracket.

Thus once the bracket is brought to adjusted position and the gib is tightened by tightening the screw 83 the bracket is rigidly held in position and will not be easily disturbed from that position.

As shown in the drawings, the roller 53 cooperating with the actuator of the slow-down switch 54, is carried on a leaf spring 84 attached to the bracket 76 in position so that the roller is normally held slightly spaced from the switch and yet such that it may easily ride over the surface 52 of the cam as the cam approaches the slow-down position.

The stopping switch 57 is mounted in a housing recess 86, as seen in Fig. IV, in position to cooperate with its actuating rod 56 which slides in a bushing 87 in the housing and is resiliently urged away from the switch 57 by a coil spring 88 sleeved over the upper part of the rod 56. As was mentioned previously, the actuating rod 56 is driven downwardly against the switch 57 when engaged by the leading face 55 of the projection of the cam 41.

One source of error in this type of equipment is in the backlash in the gearing causing an uncertainty in the positioning between the cam 41 and the rollers 35 contacting the strip of sheet material. In order to reduce this backlash to a minimum a friction brake 90 is connected to the main shaft 40. The brake comprises a brake plate 91 sandwiched between rotatable brake shoes 92 and 93. The brake shoe or brake disk 92 is fixedly keyed to the shaft 40 while the brake shoe or disk 93 is slidably keyed to the shaft and resiliently urged into gripping engagement with the brake plate 91 by a plurality of coil springs 94 held compressed by a washer 95 and nut 96 threaded onto the shaft 40. The brake plate 91 has a tail end 97 which, as illustrated in Fig. VI, may move between a pair of stop pins 98 and 99.

A spring 100 connected between the tail end 97 of the brake plate 91 and a fixed point on the housing 60 continually urges the brake plate 91 toward the stop pin 98 and away from the pin 99. Since, as viewed in Fig. VI, the rotation of the shaft 40 is clockwise and since the tension of the springs 94 of the brake 90 is adjusted so that the friction on the brake overcomes the spring 100 the brake arm 91 normally lies against the stop pin 99 when the shaft 40 is being turned by the metering rolls 35. The drag produced by the brake causes all of the gear backlash to be taken up in the driving direction so that the shaft 40 and cam 41 clutched thereto turn accurately with respect to the drive roll 35 running on the strip stock. During a stopping operation, when the machine first slows down and then stops, there may be a tendency for some of the mechanism to overrun. This may cause a very short temporary error but the backlash is immediately taken up even though the roll 35 may turn in reverse a small distance as the tension in the spring 100 drives the worm wheel 39 in reverse direction. This reverse drive is possible because the pitch of the worm 38 meshing with the worm wheel 39 is so steep that the spring 100 can easily turn the worm 38 so as to take up all the backlash in the gearing from the drive roll 35.

For convenience in use the equipment is adjusted so that each of the indicia 75 on the index ring 48 indicates five inches of travel of the sheet material. With convenient sized rolls running on the sheet material a 12½:1 reduction between the worm and worm wheel is

suitable. This may be obtained with a fifty tooth worm wheel and a quadruple thread worm. Such a worm is amply steep so that the drive is reversible thus permitting the spring to take up the backlash in all of the gearing.

The embodiment of Figs. VII through X includes the same type drive mechanism between the fed material and a main shaft 140 for the metering device, the same type slow-down and stop limit switch mountings, the same type of anti-backlash drag brake and generally the same principles of operation as in the embodiment of Figs. I through VI. Accordingly, only certain details of this more refined embodiment are disclosed, it being understood that those elements which are undisclosed are so similar to those of the preceding embodiment as to be readily appreciated and incorporated therein from those preceding drawings and disclosure.

In order to render the cycle of the metering device completely automatic and to place it in condition to perform a following cycle as rapidly as possible upon completion of a metering operation a limit switch 102 has been incorporated in the embodiment of Figs. VII through X to operate upon the return of surface 146 of the cam plate 141 generally corresponding to cam plate 41 against backstop stopping lug 147. This limit switch energizes electromagnetic clutch solenoid 170 to couple the cam 141 to drive shaft 140 and conditions the feeding mechanism for operation so that it begins a metered feed as soon as all other conditions are met. Since the index ring 148 bears the stopping lug 147 and is rotated around its axis to establish a metered length proportional to the spacing around the circumference of the path of the cam protuberance bearing surfaces 146, 152 and 155 of stopping lug 147 from stop limit switch 157, the reset limit switch 102 must be actuated from a position which moves with the ring 148. Advantageously, reset limit switch 102 together with its actuating plunger 104 is mounted upon ring 148. In this arrangement switch 102 is suspended within ring 148 by a bracket 105 and plunger 104 is journaled for reciprocation parallel to the axis of ring 148 in a bore 106 in an internal lug 107 integral with the ring. The end of plunger 104 is displaced to the left in Fig. VIII to actuate switch 102 when the stopping shoulder 146 of cam 141 abuts the stopping lug 147 on ring 148 by means of a cam face 108 on ring 109 clamping diaphragm or spider 169 to cam plate 141.

Index ring 148 supports four collector rings 110 separated by insulating spacer rings 111 on an insulator ring 112. Rings 110 cooperate with brushes 113 (Fig. VII) mounted in suitable brush holders 114 in the meter housing 160 and are electrically connected to respective terminals of the stop limit switch 102 and the clutch solenoid 170 by leads which are not shown.

Adjustment of the circumferential position of stopping lug 147 and limit switch 102 is afforded by means of a worm 149 engaging a worm ring 150 keyed to index ring 148. The worm 149 is driven from a shaft 115 mounted in bearings 116 in housing 160. Rapid change of the metered lengths is accomplished by driving shaft 115 from reversible electric motor 117 through a belt 118 trained over pulleys 119 on the motor shaft and 120 on shaft 115. Once the general length setting has been attained by operation of motor 117, precise adjustment of the position of index ring 148 can be accomplished by the knob 121 on the right hand end of shaft 115 in Fig. VII. This knob is provided with indicia on its outer circumference to form a micrometer dial which can be adjusted with respect to one or more index points on the stationary flange 122 of the housing against which it abuts. Knob 121 is secured to the shaft 115 by means of a hub 123 keyed at 124 to the shaft and secured to the knob by retainer 125.

The form of solenoid actuated clutch is much the same as described with respect to Figs. II through IV. Cam plate 141 has a hub 144 upon which a cable (not shown) is wound and biased to urge the hub counter clockwise

in Fig. VII. Cam plate 141 is journaled for rotation on main shaft 140 by bearings 165. A circumferential surface of cam plate 141 intercepts the roller actuator 153 of the slowdown limit switch 154 and surface 155 of cam plate 141 intercepts the actuator 156 of stop limit switch 157 as it is rotated about its axis and against the resetting force of the cable on hub 144. As previously described stop limit switch actuator 156 is fixed in position on the housing 160 and all other positions are adjusted with respect thereto. Limit switch 154 is mounted on an adjustable bracket 176 so that it can be located an appropriate and metered slow-down distance from the stop position. Reset limit switch 102 moves with index ring 148 and is the full distance from the stop limit of the metering proportion being employed. That distance is established in setting the index ring.

When the solenoid 170 of the clutch is energized it draws ferromagnetic clutch plate 168 against the rotatable portion or hub 166 of the clutch which is keyed to main drive shaft 140. Hub 166 has sufficient clearance from the pole piece of the casing for solenoid 170 mounted on index ring 148 that it can rotate freely with respect thereto. Clutch plate 168 is supported on a flexible spider or annular diaphragm 169 secured thereto by a clamp ring 126 engaging its inner peripheral portions. The outer periphery of the spider 169 is clamped between ring 109 and a flange on the cam plate 141. While clutch plate is held against hub 166 and material is being fed, main shaft 140 rotates in a clockwise direction as viewed in Fig. VII and the cam is carried from the back stop toward the slow-down and stop limits.

In Fig. X the electrical circuit for the meter and portions of the feed system is shown. This circuit integrates the control of the setting of the metering device with the primary control of feeding by that device.

In controlling feeding, the feed is initiated at a fast feed rate and continues at that rate until the slow-down point is reached. At that time, feeding is transferred to a slow speed and continued until the stop is reached. Consider leads 127 and 128 to be supplied with direct current, meter clutch solenoid 170 to be energized through back contacts R1a and R2a of the clutch control relay R1 and adjustment interlock relay R2, the cam to be reset against the backstop lug 147 on index ring 148 so that reset limit switch 102 is closed, and the utilization device to be conditioned for a feeding operation, as by retracting its parts from the feed path, to close limit switch 129. A circuit for fast feed control relay FF is completed from lead 127 through back contacts R1b and R2b, closed back contact 154a of the slow-down limit switch, closed front contacts 102a and 129, and coil FF to lead 128. Fast feed relay FF seals itself in by closing contact FFa to by-pass the reset and utilization device limit switches and actuates the motor 8 or clutch 13 to a fast feed drive.

When cam plate 141 is rotated to a position where the camming face 152 engages slow-down limit actuator 153 contact 154a is opened to interrupt the energization of relay FF and drop it out, and contact 154b is closed to energize slow feed relay SF whereby the motor controls or clutch 19 are set for slow feed by means not shown. The cam plate 141 surface 155 is ultimately driven to the stop limit such that switch 157 is closed. At the time cam plate moved from its backstop or reset position, switch 102 was deactuated thereby permitting contact 102b to close. With contacts 157 and 102b closed, clutch control relay R1 is energized from lead 127 through coil R1 and contacts 157 and 102b to lead 128 to pull itself in and complete a seal circuit around stop limit switch 157 through contact R1c. Pull in of clutch control relay R1 opens back contact R1a to de-energize clutch solenoid 170 whereby the clutch plate 168 is released from hub 166 and cam plate 141 is freed to rotate in a counterclockwise direction as viewed in Fig. VII until its stop surface 146 engages stopping lug 147

on the index ring and reset limit switch 102 is actuated. At that time the meter is conditioned for initiation of another metering cycle provided the utilization device is prepared to receive material as indicated by closure of switch 129 and the above cycle is automatically repeated.

Rapid alteration of the meter setting is accomplished by motor 117 having field windings 130 by appropriate manipulation of ganged control switch 131 having segmented sections 132 and 134 on common shaft 135 controlled by knob 136. Motor 117 is reversible through switch 131 by reversing the polarity of current applied to its armature. Switch 131 therefore has an off position and forward and reverse "on" and "run" positions. In shifting knob 136 clockwise one position to "on" the motor field is energized, the meter clutch is disabled, the feed control is disabled, and an indicator 158 is actuated. Thus, adjustment interlock relay R2 is energized when conductive segment 132a bridges contacts 132-1 and 132-2 from lead 128 through 132a to lead 159, relay coil R2 and lead 127. Relay R2, when pulled in opens back contacts R2a and R2b. When lead 159 is energized, neon indicator lamp 158 is illuminated to indicate the meter is inoperative and is conditioned for adjustment, field 130 is energized, and speed control potentiometer is energized. Armature 117 receives no current in this first position since segment 132b has not bridged contacts 132-3 and 132-4. Advancement of the switch to the "run" position maintains the circuits through segment 132a and completes a circuit through segment 132b to lead 133 thence through switch section 134 and armature 117 to leads 173 and 127. The circuit through 134 for "forward run" is from brush 134-4, segment 134b, brush 134-5 and the right hand brush of armature 117, through the armature to brush 134-1, segment 134a and brush 134-2 so that the right hand brush of armature 117 is positive. When the switch 136 is positioned to "reverse run," the same circuits as outlined are established through section 132 and the left hand brush of armature 117 is connected to positive lead 133 through brush 134-7, segment 134a, and brush 134-6 while the right hand brush of armature 117 is connected to negative lead 127 through brush 134-3, segment 134b and brush 134-2.

By means of switch 136 positioned at some point convenient to the machine attendant, the meter device can be adjusted to either increase or decrease the circumferential separation of reset limit switch 102 and stop limit switch 157 thereby proportionally increasing or decreasing the length of material passing the metering rolls during a feeding cycle. No feeding will occur during the motor driven adjustment of the metering device since relay R2 is energized. Further, feeding can be disabled for manual adjustment by turning the switch 136 to the "on" position since relay R2 is also energized under that condition.

The metering device illustrated serves very accurately to measure the desired lengths of strip stock as they are fed by the feeding mechanism 5.

Ordinary "Micro" switches are employed as the limit switches and these have a very close tolerance on their operating points. For example, ordinary "Micro" switches operate consistently within a fraction of a thousandth of an inch motion of the actuating rods. The precision type "Micro" switch operates on even less travel of its operating plunger. Thus the use of the precision switches and the brake with the spring 100 to remove the backlash in the gearing when the clutch 51 is engaged insures that precisely metered lengths of material will be fed for each cycle of operation. With the ordinary size of equipment in which the housing is approximately 10 inches each way and the cam is about 7 inches in diameter the equipment delivers lengths of stock which do not vary by more than a few hundredths of an inch from one cycle to the next. While the metering devices of this invention have been

shown in conjunction with electrical control circuits it is to be appreciated that certain aspects readily adapt themselves to pneumatic and hydraulic controls. Thus in the second illustrated embodiment the motor for presetting the limiting means or index ring 148 can be pneumatic or hydraulic and the conditioning means actuated by cam displacement can be valves which control the clutch, motor and feed controls either directly or indirectly. Similarly, the motor and clutch of the metering device and the feed mechanism or feed controls can be prevented from becoming operative by other than electrical circuit means while a manual or motor driven presetting operation is being performed although certain advantages do reside in the electrical control disclosed.

Various modifications in the improved metering mechanism may be made without departing from the spirit and scope of the invention.

Having described the invention, I claim:

1. In a sheet metal metering device, in combination, metering rolls in engagement with the metal to be metered, a shaft operatively connected to the metering rolls, a cam, a clutch for coupling said cam to said shaft to turn therewith, resilient means urging said cam in a direction counter to the rotation of the shaft, presettable means for limiting the resiliently urged movement of the cam, switches cooperating with the cam to be operated as the cam approaches and reaches a limit of its travel while clutched to said shaft, means controlled by said switches for feeding the sheet metal, a brake on said shaft, and means resiliently urging the brake in a direction counter to the rotation of the shaft.

2. In a sheet metal feeding system, in combination, means for feeding the sheet metal at selected speeds, metering rolls in contact with the sheet material, a shaft operatively driven by the rolls, a cam journaled on the shaft, clutch means for operatively connecting the cam to the shaft, a preset stop, resilient means urging said cam to a limit defined by the preset stop, switches controlling the feeding means actuated by the cam as it approaches and reaches its limit of travel while driven by said shaft, a friction brake continuously engaged with said shaft, and means resiliently urging said brake in a direction opposed to the motion of the shaft.

3. In a sheet metal feeding system, in combination, means for feeding sheet metal at selected speeds, metering rolls in contact with the sheet material, a pair of limit switches controlling the feeding means, a cam for actuating the limit switches, a shaft driven by the metering rolls, a clutch for operatively connecting the cam to the shaft, a presettable cam stop, resilient means for resetting the cam between metering operations, means for adjusting a first of the limit switches independent of the second of the limit switches relative to the path of the cam, and resilient means frictionally connected to said shaft for opposing rotation of the shaft and minimizing backlash between the metering rolls and the shaft.

4. In a sheet metal feeding system, in combination, means for feeding sheet metal at selected speeds, a metering roll in contact with the sheet material, at least one limit switch connected to control the feeding means, a cam for operating the limit switch, means including gearing and a clutch for operatively connecting the cam to the metering roll during a feeding operation, an adjustable cam stop, means for returning the cam to the cam stop between feeding operations, a lever mounted for rotation about an axis of said gearing, a brake coupling said lever to said gearing, and resilient means urging said lever in a direction of rotation opposing the feeding rotation of said gearing for minimizing variations in positioning of said cam relative to said metering roll.

5. A device for metering lengths of material, comprising a metering roll in engagement with the material to be metered, a shaft operatively connected to the metering roll, a cam mounted for rotation on said shaft, a clutch for coupling said cam to said shaft for rotation

therewith, an electrical circuit for actuating said clutch, means biasing said cam in a direction counter to the rotation of said shaft, presettable means for limiting the movement of said cam counter to the metering direction of rotation of said shaft, a motor for presetting said limiting means, manual means for presetting said limiting means, means to disengage said clutch while a presetting means is operative, means conditioning said clutch actuating circuit for operation while said cam is restrained by said limiting means, and means to disable said clutch actuating circuit upon movement of said cam through a presettable distance.

6. In a sheet metal feeding system, in combination, means for feeding sheet metal, a metering roll in engagement with said sheet metal, a shaft operatively connected to the metering roll, a cam mounted for rotation on said shaft, a clutch for coupling said cam to said shaft for rotation therewith, a clutch actuating electrical circuit, means biasing said cam in a direction counter to the metering rotation of said shaft, presettable means for limiting the movement of said cam counter to the metering direction of rotation of said shaft, a motor for presetting said limiting means, manual means for presetting said limiting means, means actuated by the displacement of said cam a presettable distance from said limiting means to control the feeding means, means to disengage said clutch and disable said feeding means during the operation of said presetting means, means for conditioning said clutch actuating circuit for energization upon the restraining of said cam by said limiting means, and means positioned for actuation by said cam to deenergize said clutch actuating circuit and disengage said clutch upon movement of said cam through a presettable distance.

7. A device for metering lengths of material, comprising a metering roll in engagement with the material to be metered, a shaft operatively connected to the metering roll, a cam mounted for rotation on said shaft, a clutch for coupling said cam to said shaft for rotation therewith, means biasing said cam in a direction counter to the metering rotation of said shaft, presettable means for limiting the movement of said cam counter to the metering direction of rotation of said shaft, and means for insuring the disengagement of said clutch while said limiting means is being preset.

8. A device for metering lengths of material, comprising a metering roll in engagement with the material to be metered, a shaft operatively connected to the metering roll, a cam mounted for rotation on said shaft, a clutch for coupling said cam to said shaft for rotation therewith, means biasing said cam in a direction counter to the metering rotation of said shaft, presettable means for limiting the movement of said cam counter to the metering direction to define a reset position, and means for engaging said clutch upon the initiation of restraint of motion of said cam by said limiting means.

9. A device in accordance with claim 7, in combination, with a feed control means and means to disable said feed control to prevent a feeding operation while said limiting means is preset.

10. A device in accordance with claim 8, in combination, with feed control means and means to enable said feed control upon return of said cam to said reset position.

11. A device in accordance with claim 7, including an electrical motor for presetting said limiting means combined with a feed control, and means to energize said electrical motor and simultaneously disable said feed through said feed control.

References Cited in the file of this patent

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 2,984,012

May 16, 1961

Alvin F. Groll

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 1, for "strip" read -- spring --; column 5, line 8, for "he" read -- the --; column 10, line 60, before "preset" insert -- being --.

Signed and sealed this 3rd day of October 1961.

(SEAL)

Attest:

ERNEST W. SWIDER

Attesting Officer

DAVID L. LADD

Commissioner of Patents

USCOMM-DC