Feb. 26, 1963 C. M. WIIG 3,078,734

PROGRAMMING DEVICE FOR ROLL FEED BRAKE

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Fig. 8.

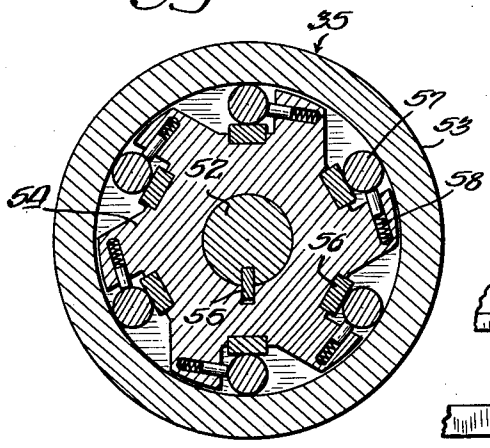

Fig. 1.

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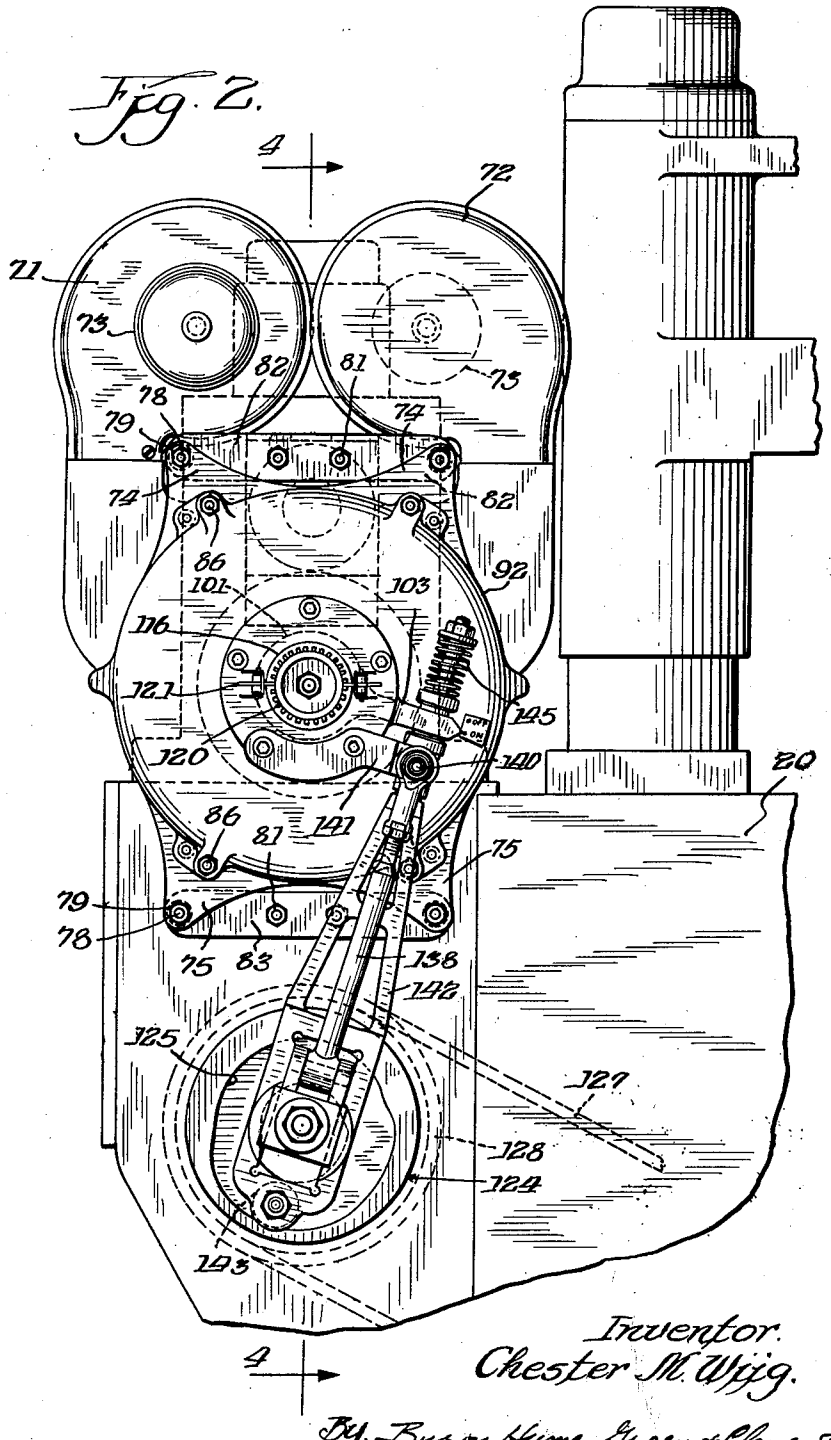
Fig. 2.



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PROGRAMMING DEVICE FOR ROLL FEED BRAKE

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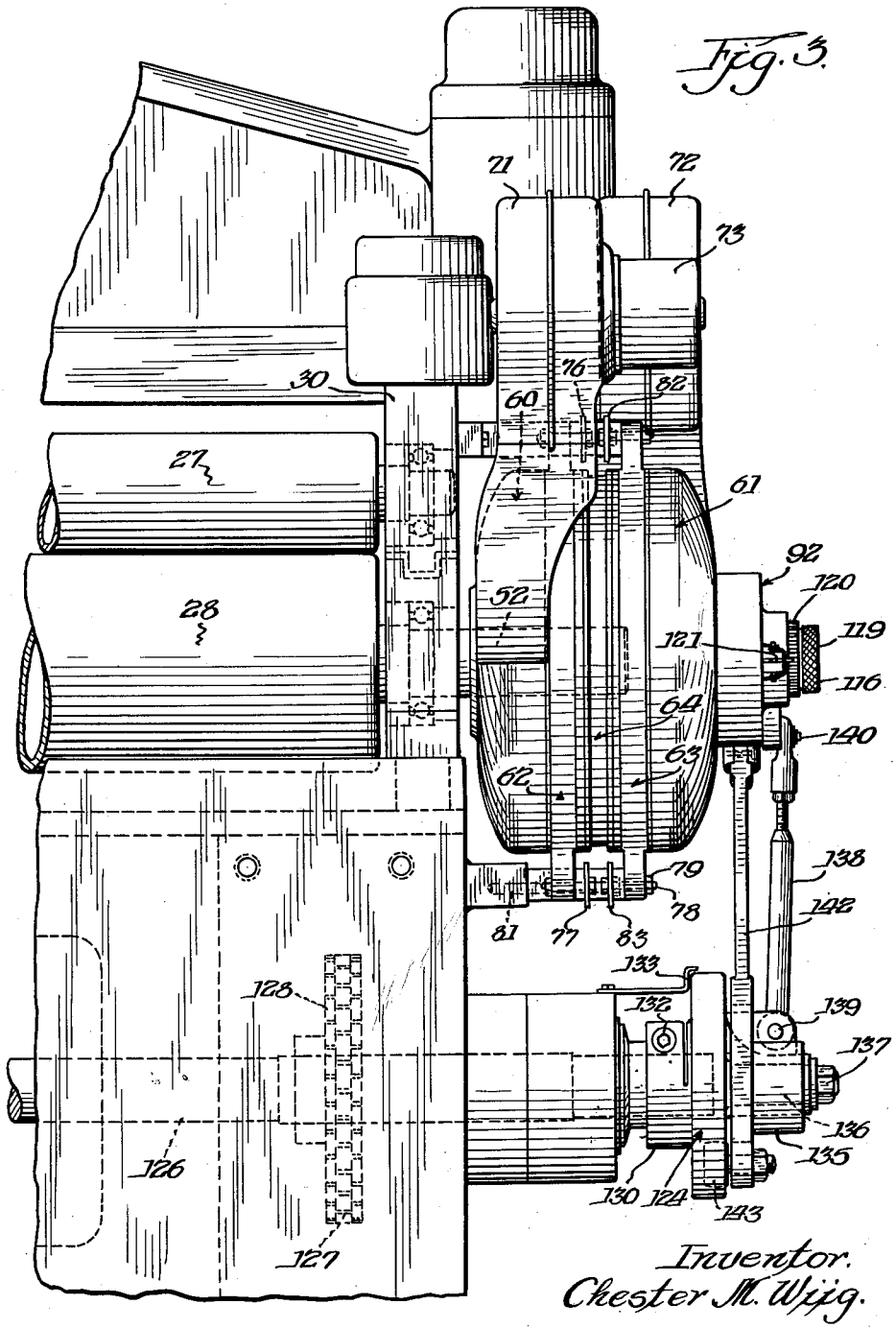
Fig. 3.



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PROGRAMMING DEVICE FOR ROLL FEED BRAKE

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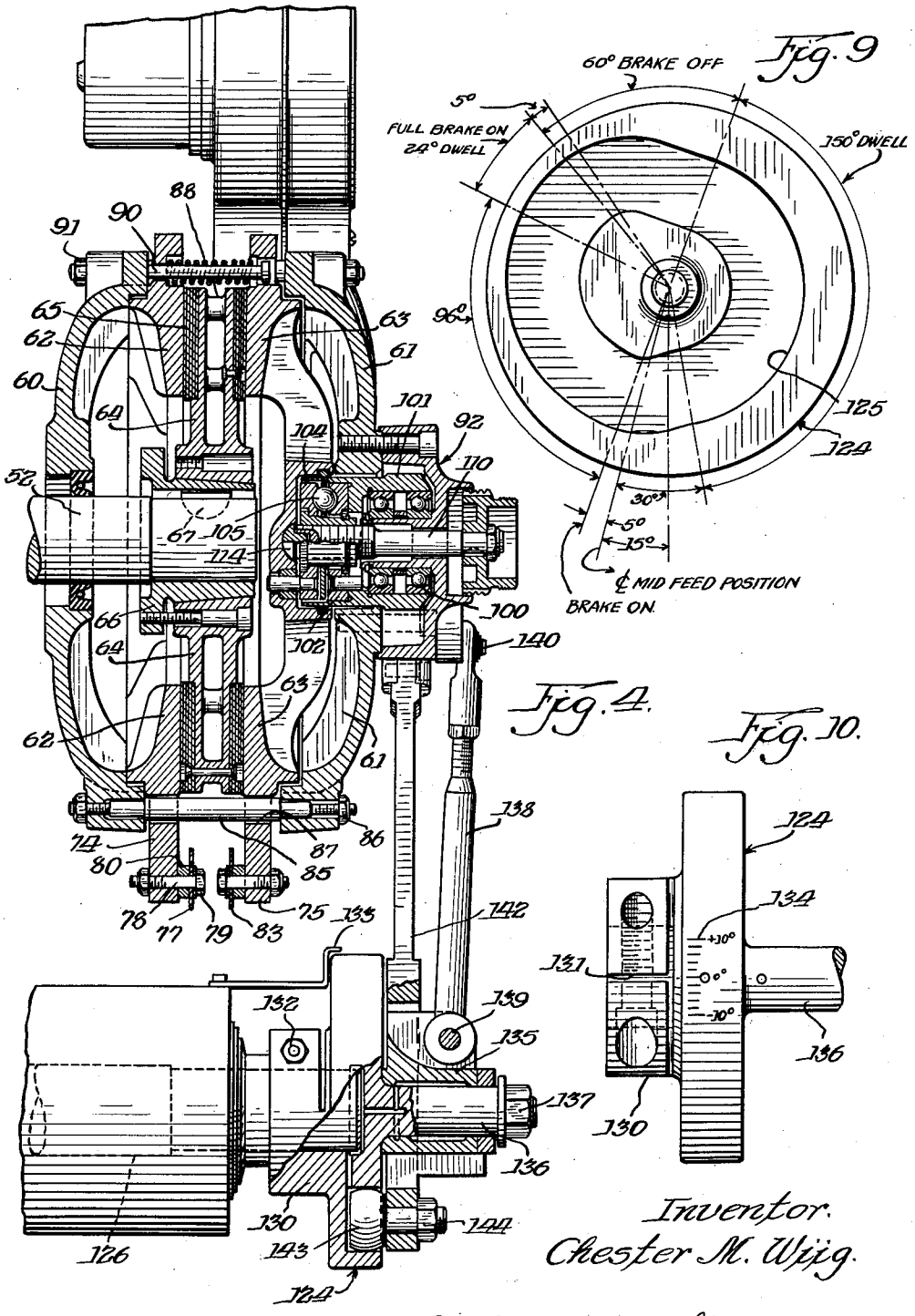

Fig. 9

Fig. 4.

Fig. 10.

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PROGRAMMING DEVICE FOR ROLL FEED BRAKE

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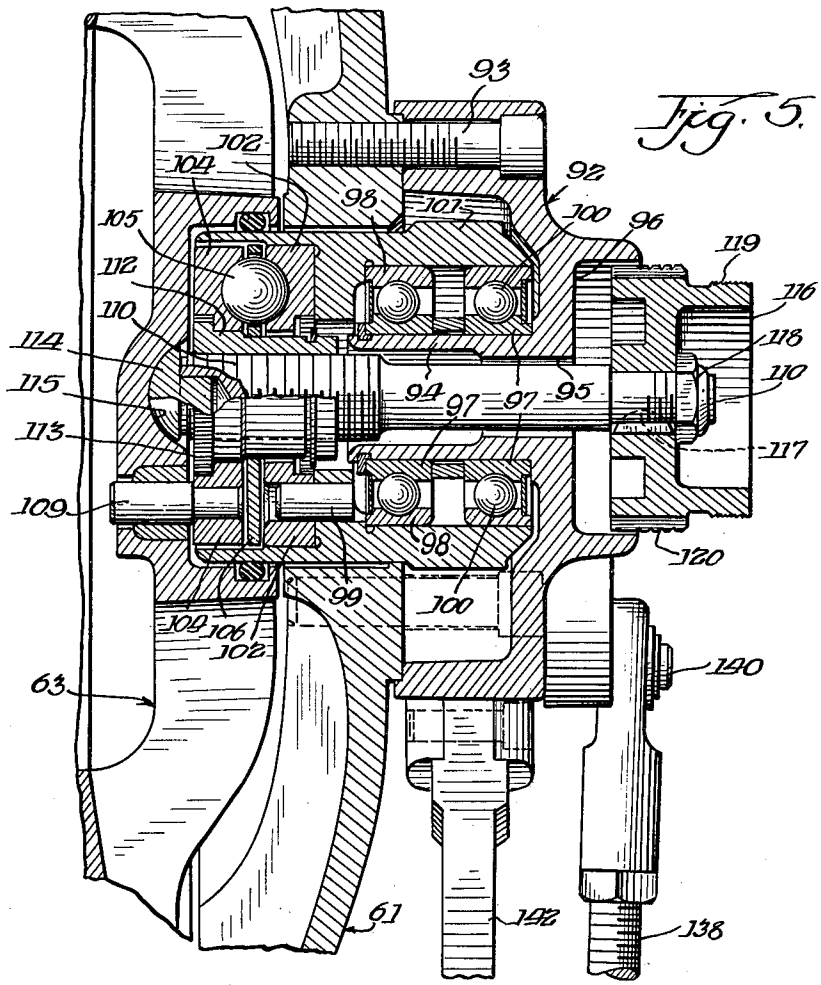

Fig. 5.

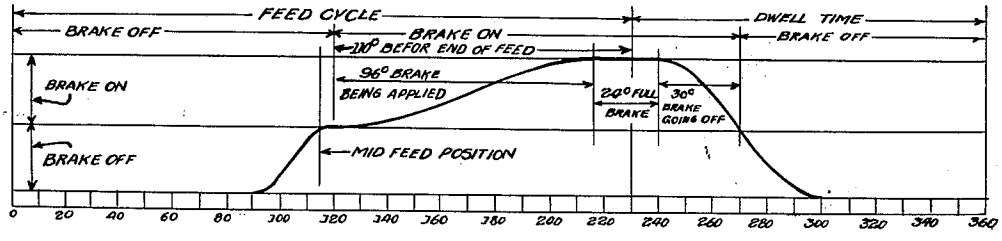

Fig. 11.

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PROGRAMMING DEVICE FOR ROLL FEED BRAKE

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Fig. 6.

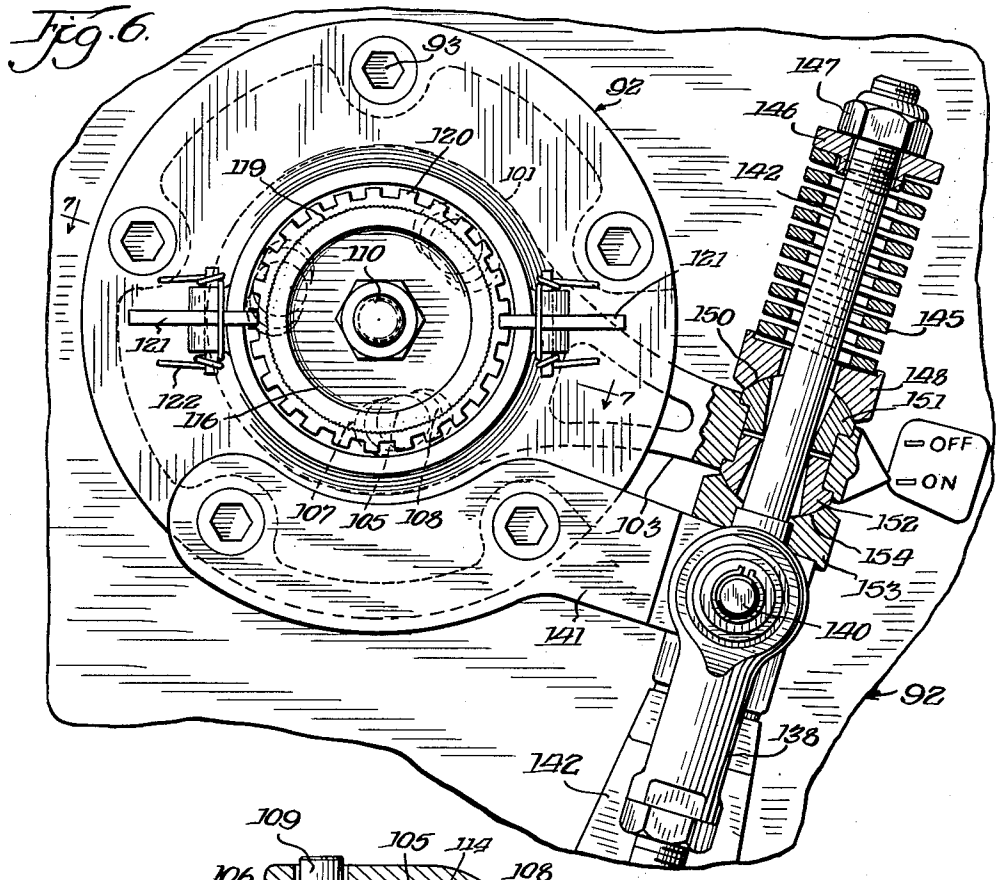
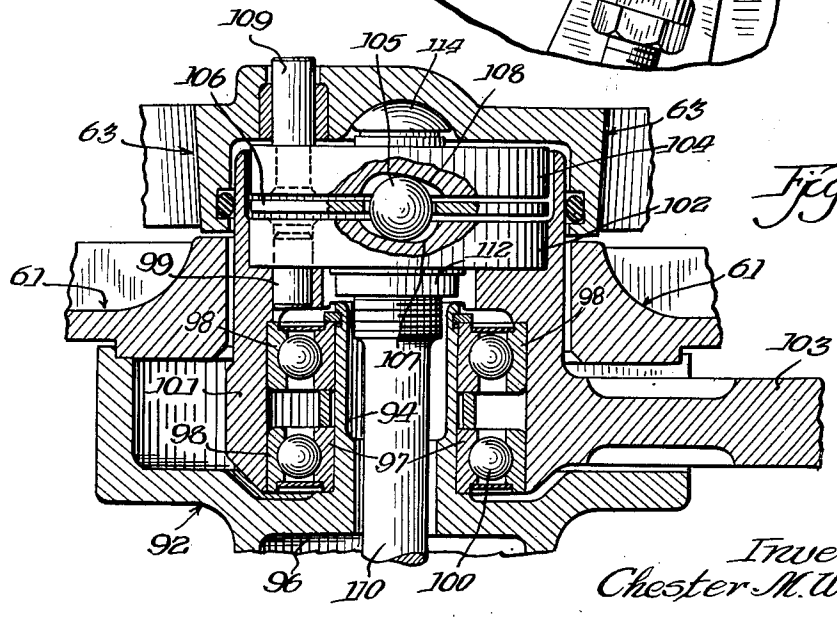


Fig. 7.



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3,078,734

PROGRAMMING DEVICE FOR ROLL FEED BRAKE

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Filed May 31, 1960, Ser. No. 32,642
5 Claims. (Cl. 74—130)

The invention relates to material feeding mechanism for feeding metal and other material in continuous strip form and has reference in particular to programming apparatus for such feeding mechanism for controlling the braking pressures applied to the feed rolls whereby to insure proper functioning of the feed roll drive mechanism.

In the feeding of metal strip material for cutting, punching and similar operations, it is conventional procedure to employ coacting feed rolls which are preferably actuated intermittently from a main drive shaft through a ratchet or over-running type of clutch. The feed rolls are accelerated from an idle position to maximum speed during the operative stroke of a reciprocating rack and braking means are employed to assist in decelerating the rolls and in causing the rolls to stop at the end of the operative stroke and before the inoperative stroke of the rack begins. It is necessary to apply braking pressures to such intermittent type of drives since otherwise the inertia of the rotating parts would cause the feed rolls to overrun and such action would, of course, destroy the accuracy of the measured feed lengths.

An object of the invention is to provide programming apparatus for friction brake means and which may be incorporated in intermittent drive mechanism of the type described for controlling the braking pressures applied to the feed rolls.

A further object of the invention resides in the provision of programming apparatus for friction braking mechanism such as may be applied to intermittently operating feed rolls and which will actuate the friction brake mechanism automatically and in predetermined timed relation to the main driving shaft for the said feed rolls.

Another and more specific object of the invention is to provide a programming cam for controlling friction brake mechanism and wherein the cam can be adjustably positioned on the main drive shaft for the feed rolls whereby the entire programming action can be varied with respect to the feeding operation of the feed rolls.

A further object is to provide improved and highly efficient friction brake mechanism for the feed rolls of an intermittent strip feeding machine and to further provide programming apparatus in combination therewith for automatically actuating in a controlled manner the said friction brake mechanism.

With these and various other objects in view, the invention may consist of certain novel features of construction and operation, as will be more fully described and particularly pointed out in the specification, drawings and claims appended thereto.

In the drawings which illustrate an embodiment of the device and wherein like reference characters are used to designate like parts—

FIGURE 1 is an end elevational view of a continuous strip feeding mechanism of the intermittent type, the same incorporating the improved friction braking apparatus and programming means of the invention;

FIGURE 2 is a fragmentary end elevational view showing the improved friction braking apparatus and programming means in operative relation on the continuous strip feeding mechanism;

FIGURE 3 is a fragmentary front elevational view of

the friction braking apparatus and programming means as shown in FIGURE 2;

FIGURE 4 is a vertical sectional view taken longitudinally of the friction braking apparatus and programming means substantially along line 4—4 of FIGURE 2;

FIGURE 5 is a fragmentary sectional view on an enlarged scale illustrating in detail the operating structure for effecting the application and release of the braking mechanism;

FIGURE 6 is a fragmentary end elevational view of the structure illustrated in FIGURE 5, with parts being shown in section;

FIGURE 7 is a fragmentary sectional view taken substantially along line 7—7 of FIGURE 6;

FIGURE 8 is a sectional view showing a type of overrunning clutch such as may be employed in the intermittent feeding mechanism of the continuous strip feeding machine;

FIGURE 9 is an end elevational view of the programming cam of the invention;

FIGURE 10 is a top plan view of the programming cam showing the indicia for predetermining the adjustment of the cam on its drive shaft; and

FIGURE 11 is a schematic view diagrammatically illustrating a brake timing curve.

Referring in particular to FIGURES 1 and 3 of the drawings wherein the invention is illustrated as applied to a continuous strip feeding machine of the intermittently operating type, it will be observed that the machine generally designated 20 includes a frame consisting of a base portion 21, side walls 22 and 23, and a top wall 24. The frame journals the main drive shaft 26, and the top wall supports the feeding rolls 27 and 28 which are, in turn, suitably journalled by the supports 30 as best shown in FIGURE 3. The feeding rolls are geared to rotate in unison and with the strip material located between and gripped by the feed rolls, said strip material will be fed in the desired manner as the rolls are caused to rotate.

The intermittent feeding mechanism of FIGURE 1 is characterized by a feeding action for the major portion of the cycle and by a quick return. The main shaft 26 is provided with a collar 31 having a stud shaft 32 for oscillating the member 33. Oscillating movement of member 33 in turn produces reciprocating motion of the rack arm 34 which drives the lower feed roll 28 through the overrunning clutch, indicated generally by numeral 35 in FIGURE 8. The stud shaft 32 coacts with a block 36 which rides within the passageway 37 provided by the member 33. Said member 33 is journalled for oscillating movement by the eccentric 38 located on the shaft 40. Accordingly, the pivot axis of the oscillating member 33 is variable, depending on the rotated position of the shaft 40.

The rack arm 34 has pivotal connection as at 41 with the member 33 through the instrumentality of a block 42 which is adapted to ride in a guideway 43 provided by member 33. The said block is suitably threaded to the threaded adjusting rod 44 which is journalled at its opposite end by the part 45. By applying a suitable tool to the squared end 46 of the adjusting rod, the said rod can be rotated in either direction to change the position of the block 42 and thus the pivot axis of the rack arm 34. However, for any particular basic stroke as determined by the rotated position of the adjusting rod 44, it is possible to vary the length of the stroke within narrow limits by adjusting the position of the eccentric 38.

The rack arm 34 has meshing relation with a pinion 50, the said pinion having trunnions which support the body portion of the rack and the pinion housing 51. The pinion 50 is located on the lower feed roll shaft 52, and the pinion is free to rotate on said shaft. The trunnions provide an annular casing 53, FIGURE 8, within which

is located the structure of the overrunning clutch as generally identified by the numeral 35. Said clutch structure includes an inside body member 54 which is suitably keyed at 55 to the shaft 52. The member 54 provides a plurality of hardened steel inserts 56 on which are supported the gripping rollers or balls 57, the same being backed by the coil springs 58. Accordingly, a one way clutch is provided whereby reciprocating strokes of the rack 34 in one direction only will be transmitted to the feed rolls. The action of the oscillating arm 33 on the rack 34 is to produce an operative stroke in the downward direction and which may occupy approximately 230 degrees of each revolution of the main drive shaft 26. Since the shaft and thus the collar 31 are rotating in a clockwise direction, it will be seen that this downward operative stroke of the rack for rotating the feeding rolls will be relatively slow as compared to the upward inoperative stroke of the rack which is relatively fast. Thus a long feeding stroke with a quick return is achieved with resulting greater accuracy in the measured lengths as fed by the rolls. Reference is made to the Wiig Patent 2,756,994 granted July 31, 1956 for a more particular description of the intermittent feeding mechanism of FIGURE 1.

In accordance with the invention the lower feed roll shaft 52 is provided with friction braking means for braking the feed rolls to prevent overrun and thereby maintain greater accuracy in the measured feed lengths of the strip material fed by the machine. The friction braking mechanism, as best shown in FIGURE 4, includes a pair of outer housing members 60 and 61, and a pair of inner members 62 and 63, all concentrically disposed with respect to shaft 52. The members 60, 61, 62 and 63 comprise the static elements of the present brake device, since they do not rotate, whereas the rotating or dynamic element is provided by the center member 64 having the brake discs 65 suitably secured thereto. The center member 64 is mounted on and secured to the hub part 66, which is in turn keyed at 67 to the shaft 52. The center member 64 is generally termed the brake disc, whereas the inner members 62 and 63 comprise pressure plates or brake shoes, since they contact the brake discs 65 and apply pressure thereto to brake the rotating action of the shaft 52. The outer member 60 and 61 provide blower housings for the present friction brake mechanism, and it will be observed from FIGURE 2 that the outer housings 60 and 61 are, respectively, associated with the centrifugal blowers designated by the numerals 71 and 72. An electric motor such as 73 is associated with each of the centrifugal blowers and air under pressure is supplied to within the present brake structure for cooling the operating parts thereof.

The mounting of the outer housing members 60 and 61 on the pressure plates 62 and 63, and the mounting of the pressure plates on the frame of the feeding machine is unique, and the same contributes materially to the successful operation of the present brake device. For said mounting purposes the pressure plates are each provided with spaced extensions such as 74 and 75, respectively, the same being located at the top and at the bottom of each pressure plate, as best shown in FIGURES 2 and 3. The pair of extensions 74 at the top of pressure plate 62 have secured thereto the flexible metal strap 76 FIGURE 3 and the pair of extensions 75 at the bottom of the same pressure plate have secured thereto the flexible metal strap 77. In each case the securing means includes a bolt 78 and nuts 79, and which resiliently retain the parts in secured relation by means of the interposed resilient washer 80 of rubber or other similar material, see FIGURE 4. Each flexible metal strap is fastened to the frame of the machine by screws 81 which are located centrally of the metal strap. The said flexible metal straps provide torque anchoring connections which permit limited movement of the pressure plate toward and from the brake disc 64. In a similar manner pressure plate 63, having extensions 75, is anchored to the machine frame by the flexible metal straps 82 and 83 at the top and bottom, respectively, of the plate. With the pressure plates of the present braking device thus flexibly supported on the machine frame, it will be seen that the outer housings 60 and 61 are in turn supported on said plates by the bolts 85. Said bolts are threaded at each end, and by means of the nuts 86 and a shoulder provided by the bolts at each end thereof, the said outer housings are secured together to form a unit, and said housings are maintained in precise spaced relation with each other. The bolts 85 pass through openings 87 in the pressure plates, as best shown in FIGURE 4. It will also be understood that said pressure plates are normally held in spaced apart relation by the coil springs 88 located on the bolts 90 and which are suitably fastened to the outer housings 60 by the nut 91. Thus, when the parts of the brake assume their normal positions, the pressure plates 62 and 63 are spaced from the brake disc 64 a sufficient distance to free the disc, and accordingly, the brake is inoperative in that no braking pressure is applied to the rotating shaft 52.

The structure for applying the brake consists of camming mechanism which effects a separating action between pressure plate 63 and the outer housing member 61. The pressure plate 63 is moved to the left, FIGURES 4 and 5, into frictional contact with the brake disc 64 and simultaneously and to substantially an equal extent the outer housing 61 is moved to the right. Since the outer housings are connected by the bolts 85 for movement as a unit, it will be seen that the outer housing 60 is also moved to the right, and in so moving it forces the pressure plate 62 into frictional contact with the disc 64.

The hub member 92, as best shown in FIGURES 5 and 7, is fixedly secured to the outer housing 61 by the bolts 93, and said hub member is recessed to provide the center support 94 which is cored to form the through passage 95. The exterior of the hub member 92 is recessed at 96 providing a circular well in concentric relation with the cored passage 95. The ball bearing structure fixedly secured to the center support 94 includes the inner ball bearing race 97, the outer ball bearing race 98 and the plurality of balls 100, having location between and engaging the inner and outer races. The outer sleeve 101 is fixed to the outer races 98 and said sleeve projects to the left of the ball bearing structure where the same is recessed to receive, as by a press fit, the cam ring 102. The outer races 98, the sleeve 101, and the cam ring 102 comprise a unit which is thus journalled to rotate on the center support 94. For this purpose the sleeve is integral with a laterally extending arm 103 as clearly evident from FIGURE 6, and which is actuated by a programming cam as will be presently explained in detail. A pin 99 located in aligned openings in the sleeve and cam ring prevents relative rotation of the elements.

The cam ring 102 is one member of an actuating device which includes a second similar cam ring 104 and camming balls 105 located between the rings and retained by the center disc 106. As best shown in FIGURE 7 each cam ring is recessed or grooved at 107 for ring 102, and at 108 for ring 104. Thus a pair of grooves are provided for each of the balls 105 and in order to produce the desired braking action by the pressure plates, the recesses 107 and 108 for each ball are opposed, with each recess having a varying depth in a circular direction and wherein the axis of the cam rings forms the center. In the present embodiment three balls 105 are employed, see FIGURE 6, and which are spaced around the cam rings at 120 degree intervals. Also in accordance with the invention, it will be observed that the three recesses 107 for cam ring 102 each have a maximum depth at the right hand side and a minimum depth on the left side. The three recesses 108 for cam ring 104 are reversed, having a maximum depth on the left and a minimum depth on the right. When one cam ring such as 102 is

rotated to align the areas of minimum depth, the cam rings are forced to move farther apart and this separating movement of the cam rings is imparted through the connecting elements to the pressure plates to cause the plates to move toward each other and thus frictionally engage the respective sides of the brake disc.

Whereas the cam ring **102** is adapted to be rotated by the arm **103**, the cam ring **104** does not rotate, since it is fixed in position on the pressure plate **63** by the pin or stud **109**. A shaft **110** is located centrally of the hub **92**, being disposed within the passage **95** and projecting beyond the hub member **92**. The inner end of shaft **110** is threaded into the collar **112**. The cam ring **104** is fixed to the collar **112** as by having a press fit, and the serrations **113** assure that the parts will not rotate relative to one another. This threaded inner end of shaft **110** is recessed to receive the rivet **114**, the rounded head of which is located in contact with the pressure plate **63**. Said pressure plate **63** provides an arcuate depression **115** for accommodating the rivet head.

The adjusting ring **116** is keyed at **117** to the projecting end of shaft **110** and the ring is held to the shaft by the nut **118**. Part of the exterior of the adjusting ring is knurled as at **119** with the remainder being formed with axial grooves providing the serrations **120** which coact with the indexing levers **121** as best shown in FIGURE 6. The coiled spring elements **122** maintain the levers in a selected groove. When it is desired to adjust the brake elements in the event of wear of the brake disc or for other reasons, the levers are released and the adjusting ring is rotated to thus rotate shaft **110** and thread the same farther onto the collar **112**. This will move the rivet to the left (FIGURE 5) and the same will decrease the spacing between the pressure plates. When a desired adjustment has been effected, the levers **121** are returned to an aligned groove in the serrated part **120** of the adjusting ring and the parts are thus effectively held in adjusted position.

The programming cam **124**, FIGURES 9 and 10, is formed with a cam race **125** havivng a contour of a particular design and which programs the braking action of the brake device. Said cam **124** is fixed to the shaft **126** which is journalled in the frame of the feeding machine. The endless belt or chain **127** provides the drive for shaft **126** and it will be observed that said chain passes over the sprockets **128** located on the shafts, respectively. The rear hub **130** of the programming cam is split as at **131** and the said hub is recessed for receiving the end of shaft **126**. By means of the securing bolt **132** it is possible to position the programming cam on the shaft in a desired adjusted position and which can be varied within limits so as to vary the entire program for the brake device with respect to the intermittent feeding of the feed rolls. The adjusted position of the programming cam **124** on shaft **126** is visually indicated by the pointer **133** which is located with respect to the indicia **134** on the cam. A collar **135** is located on the extending shaft **136** of the cam and the said collar is held in place by the nut **137**. A strut or tension bar **138** is secured at **139** to the collar and the said strut at its opposite end is suitably secured at **140** to the hub member **92** through the connecting part **141**.

The actuating rod **142** for the programming cam joins the lever arm **103** with the cam race **125**. For this purpose the rod carries at its cam end the roller **143** having location within the race and which is fixed to the rod by the securing nut **144**. The upper or lever end of the actuating rod extends through the lever arm **103** and projects beyond the same to receive on its extending end the coil spring **145**. The upper end of the said coil spring seats on the washer **146** which is held to the threaded end of the actuating rod by the nut **147**. The lower end of the coil spring seats on the washer **148** having an undersurface which is arcuately recessed at **150**. The arcuate recess assists in connecting the rod with the lever through a ball and socket joint which is provided by the separate ball sections **151** and **152**. The ball section **151** has contact with washer **148**, being seated within the arcuate recess **150**. The ball section **152** in a similar manner contacts the part **153** formed integral with the rod **142** and which is received in the arcuate recess **154** for seating the ball section. The end of lever **103** is pointed for association with the "on" and "off" indicia located on the hub member **92**.

By way of explanation and not to be considered as limiting, it may be explainied that the programming cam selected for illustration is provided with a contour which actuates the rod **102** a total distance of approximately five-eighths of an inch. It is necessary for the actuating rod to move about one-half of this distance before the brakes are applied and for the next five-sixteenths of movement of the rod, brake action is applied to the shaft **52** in a manner which progressively increases in intensity until full brake pressure is attained. In referring to the brake timing curve as shown in FIGURE 11, it will be seen that the brake device is initially applied when approximately one-half of the 230 degree feed cycle has taken place. At this point in the feed cycle, the rotation of the feed rolls is a maximum. For the remainder of the feeding cycle the feed rolls are gradually decelerated until rotation is stopped at the end of the feeding stroke. As evident from the brake timing curve of FIGURE 11 the programming cam gradually applies a braking action to shaft **52** until full braking pressures are effected just before the ending of the feeding cycle. Full brake pressure continues for about ten degrees after the feeding cycle has ended and then for about thirty degrees the brakes are gradually released.

The present device is characterized by efficient and positive brake pressure and which is applied and released with the minimum of movement of the actuating rod. When said rod is moved upwardly the brake is released and when moved downwardly the brake is applied. The coil spring **145** is an essential element as regards the actuating rod **142** since the compressive force of the said coil spring is effective in actuating the camming mechanism to apply full brake pressures. The programming cam will move the rod **142** for a total of five-eighths of an inch. For the first five sixteenths of this movement the lever **103** is moved from "off" to an "on" position. Accordingly the camming mechanism will produce an application of the brakes. The next five sixteenths of down movement of the rod **142** will take place by compressing the coil spring **145** since further movement of lever **103** is not possible. Thus the spring in effect locks the camming mechanism in operative position since the mechanism is resiliently held in a manner preventing any separation of the cam rings. This eventually results in full application of the brakes and which is clearly shown in the diagram of FIGURE 11 wherein full brake pressure exists from about 215 degrees to 240 degrees. Upon upward movement of the rod **142** the spring tension is first released and then the lever **103** is moved to the "off" position.

What is claimed is:

1. In a machine of the class described, the combination with a feed roll drive shaft, of a reciprocating rack and connections between the rack and the drive shaft whereby the drive shaft is rotated intermittently, the improvement which includes a brake device in associated relation with the feed roll drive shaft, said brake device including a center brake disc fixed to rotate with the feed roll drive shaft, a non-rotatable pressure plate on each side of the center brake disc and mounted for axial movement to and from the brake disc, means normally maintaining the pressure plates out of frictional contact with the center brake disc, camming mechanism including a hub member operatively connected to one pressure plate and journalling a cam ring, a second cam ring fixed to the other pressure plate, camming balls between the

said cam rings and having contact therewith, a lever arm fixed to the journalled cam ring for rotating the same relative to the other cam ring whereby to cause the cam rings to separate and effect movement of each pressure plate towards the other for frictionally engaging the center brake disc, a programming cam having rotation in timed relation with the reciprocating movements of the rack, and an actuating rod operatively connecting the programming cam with said lever arm for effecting oscillating movement of the lever arm.

2. In a machine of the character as defined by claim 1, wherein the cam rings are each provided with recesses for receiving the camming balls respectively, and wherein the recesses vary in depth in a manner which is reverse to that of the recess opposite thereto, whereby rotation of one cam ring relative to the other produces a camming action causing the cam rings to separate or move towards each other depending on the direction of rotation.

3. In a friction brake device, the combination with a rotating drive shaft, of a center brake disc fixed to rotate with the drive shaft, a pressure plate located on each side of the center brake disc for frictionally contacting the said brake disc, resilient means normally maintaining the pressure plates out of frictional contact with the center brake disc, a housing member on each side of the center brake disc and having enclosing relation with the pressure plate on its side, connecting bolts joining the housing members to form a unitary structure and said bolts passing through openings in the pressure plates and fixedly maintaining the housing members in predetermined spaced relation, camming mechanism including a hub member fixed to one housing member and journalling a cam ring, a second cam ring fixed to the pressure plate enclosed by the said one housing member, means located between the cam rings for producing a camming action when the journalled cam ring is rotated relative to the other cam ring to thereby cause the cam rings to separate or move toward each other depending on the direction of rotation, and means for oscillating the journalled cam ring to actuate the camming mechanism and effect movement of the pressure plates towards and from the center disc.

4. In a friction brake device, the combination with a feeding machine, of a feed roll drive shaft journalled by said machine, a center brake disk fixed to rotate with the drive shaft, a pressure plate located on each side of the center brake disk for frictionally contacting the said brake disk, flexible metal straps fixed to each pressure plate and to the feeding machine for non-rotatably mounting the pressure plates on the machine in a manner permitting limited movement of each plate in an axial direction, a housing member on each side of the center brake disk and having enclosing relation with the pressure plate on its side, connecting bolts joining the housings to form a unitary structure and said bolts passing through openings in the pressure plates to thereby fixedly maintain the housing members in predetermined spaced relation, camming mechanism for effecting movement of the pressure plates in an axial direction, whereby braking action is applied to the drive shaft when the pressure plates are moved into frictional contact with the brake disk and is released when the pressure plates are moved out of frictional contact with the brake disk, said camming mechanism including a hub member fixed to one housing member and journalling a cam ring, a second cam ring fixed to and carried by the pressure plate which is enclosed by the said one housing member, and cam elements between the cam rings and in contact therewith whereby to cause axial movement of the cam rings upon rotation of the journalled cam ring relative to the other ring, said axial movement of the cam rings producing axial movement of the pressure plates respectively to effect said braking action and release thereof.

5. In a friction brake device as defined by claim 4, additionally including a collar disposed concentrically and extending axially through the said cam rings, an adjusting shaft located centrally of the hub member and extending axially through the collar, said adjusting shaft having threaded relation with said collar, and said adjusting shaft having contact with the pressure plate to which the second cam ring is fixed.

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