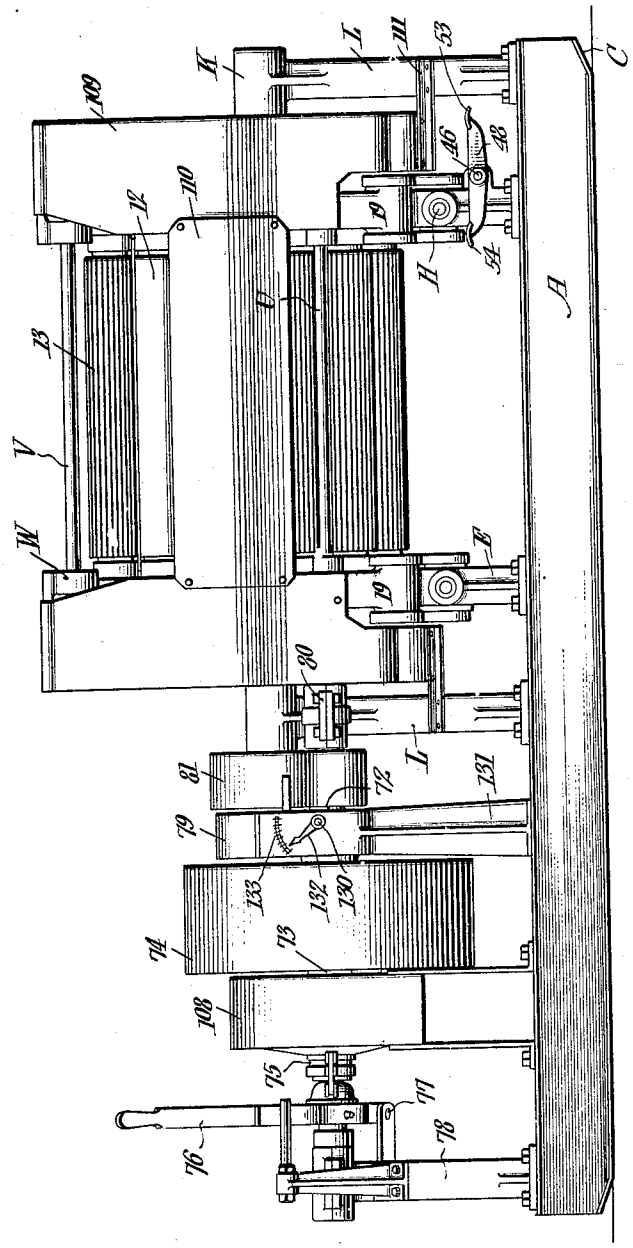
Dec. 1, 1931. A. S. MACKENZIE 1,834,466

BALING PRESS

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Fig. 1.



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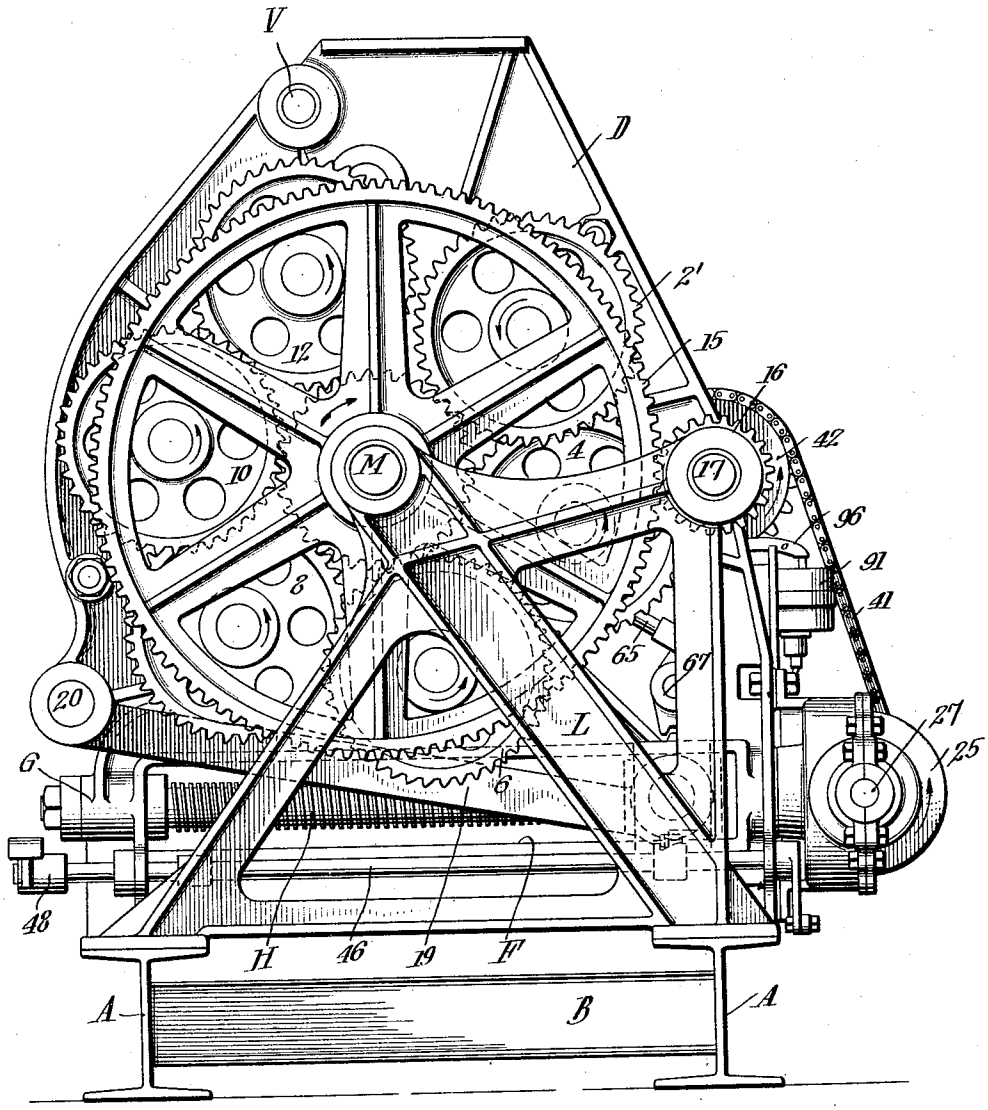
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Fig. 2.



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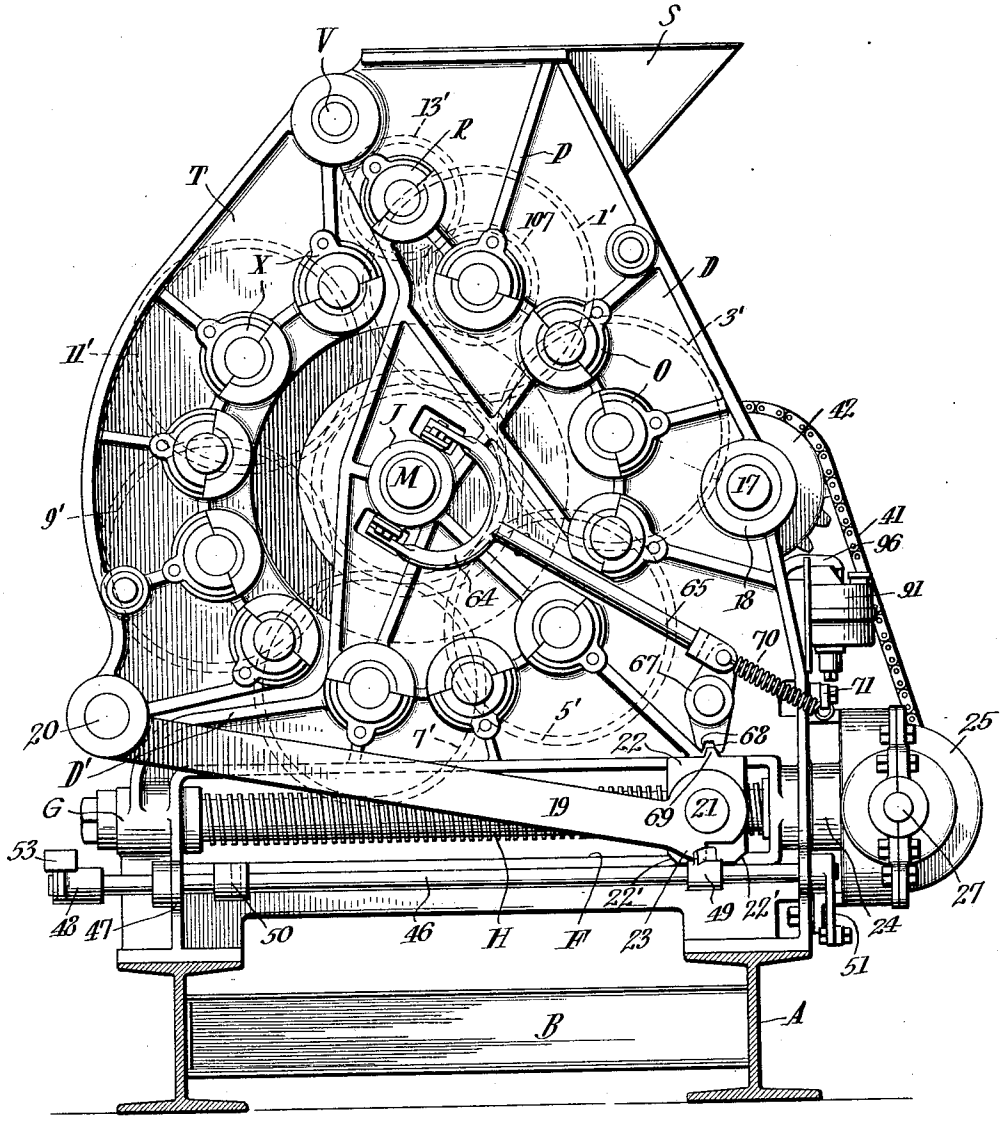
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BALING PRESS

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Fig. 3.



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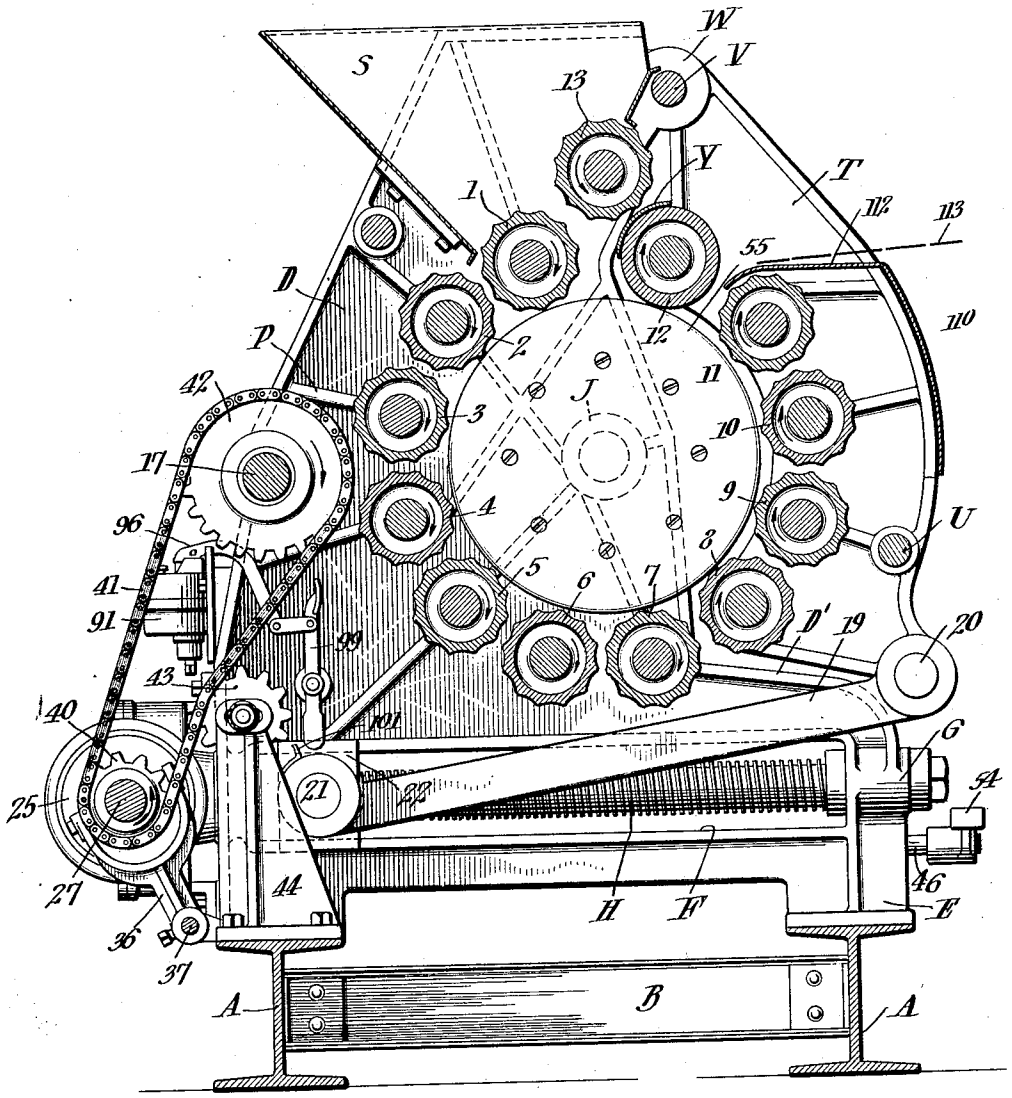
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Fig. 4.



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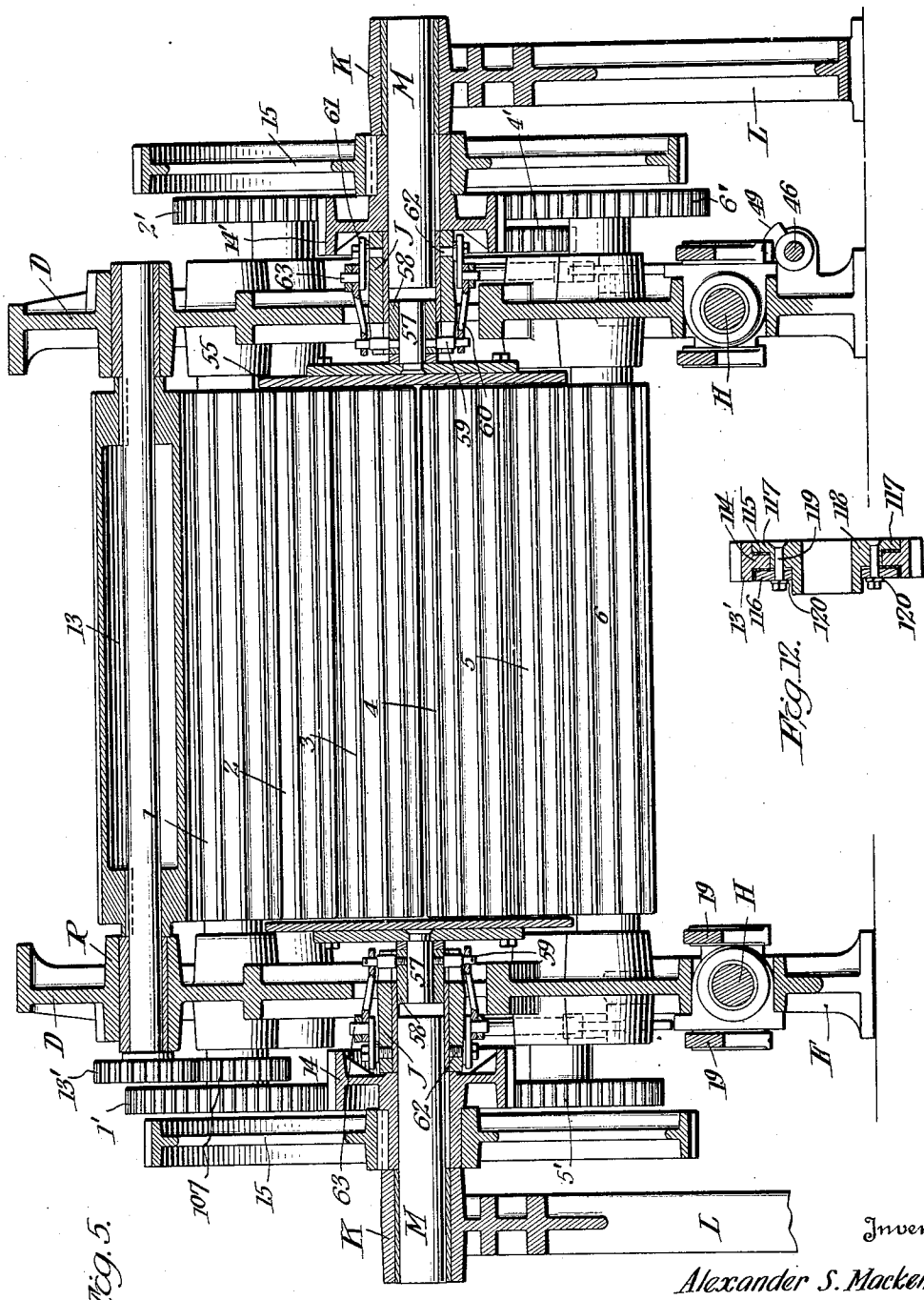


Fig. 5.

Fig. 12.

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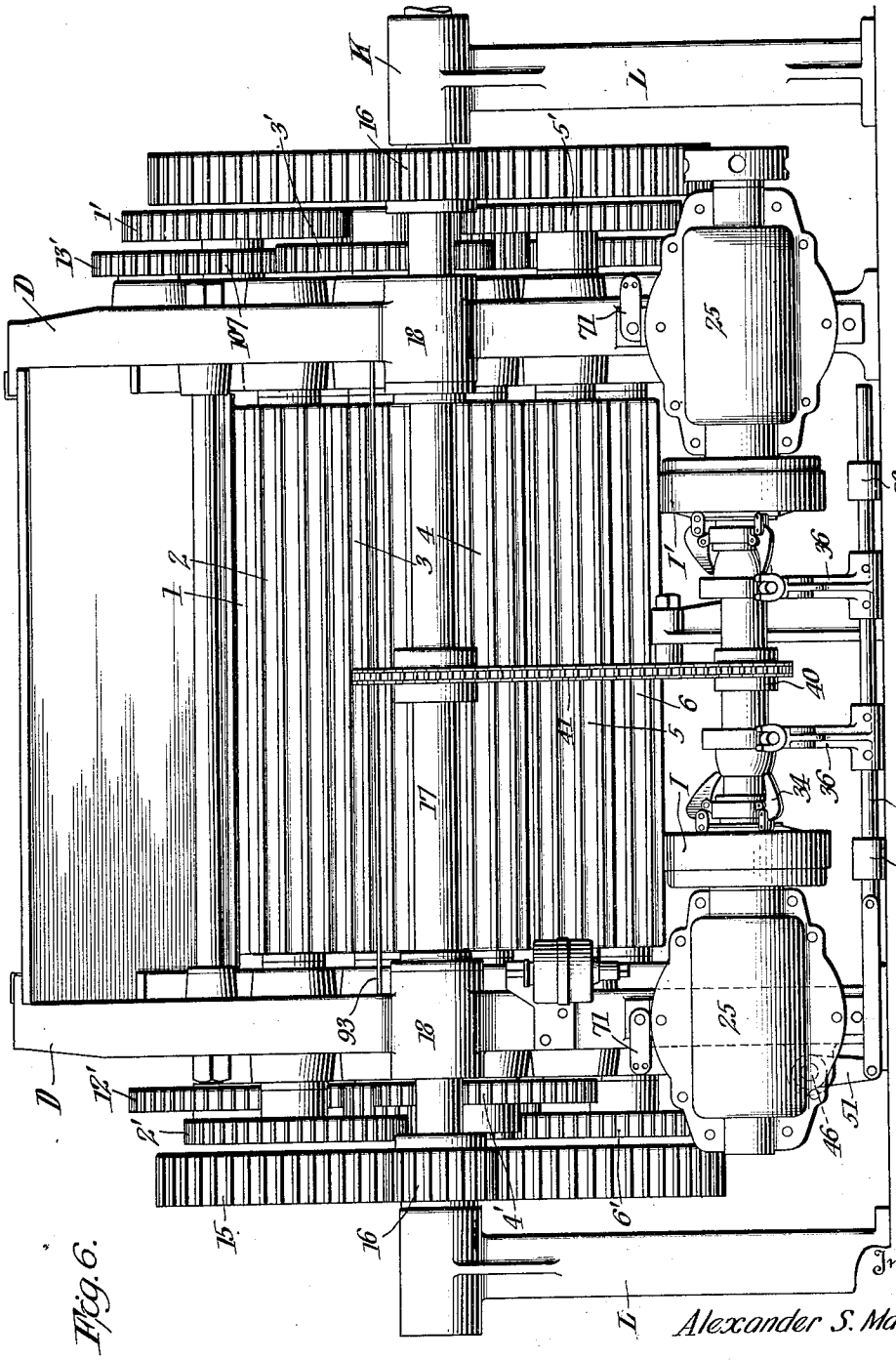


Fig. 6.

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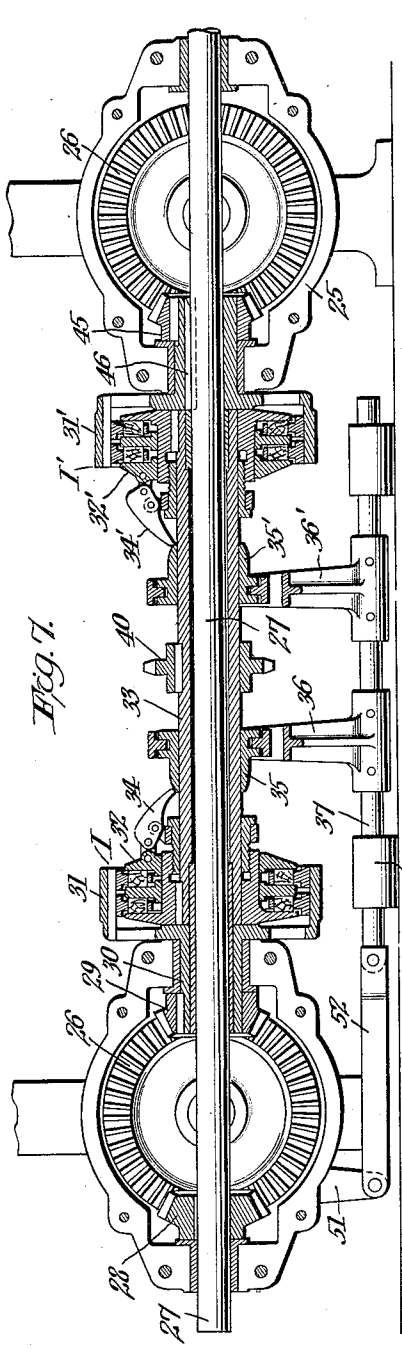


Fig. 7.

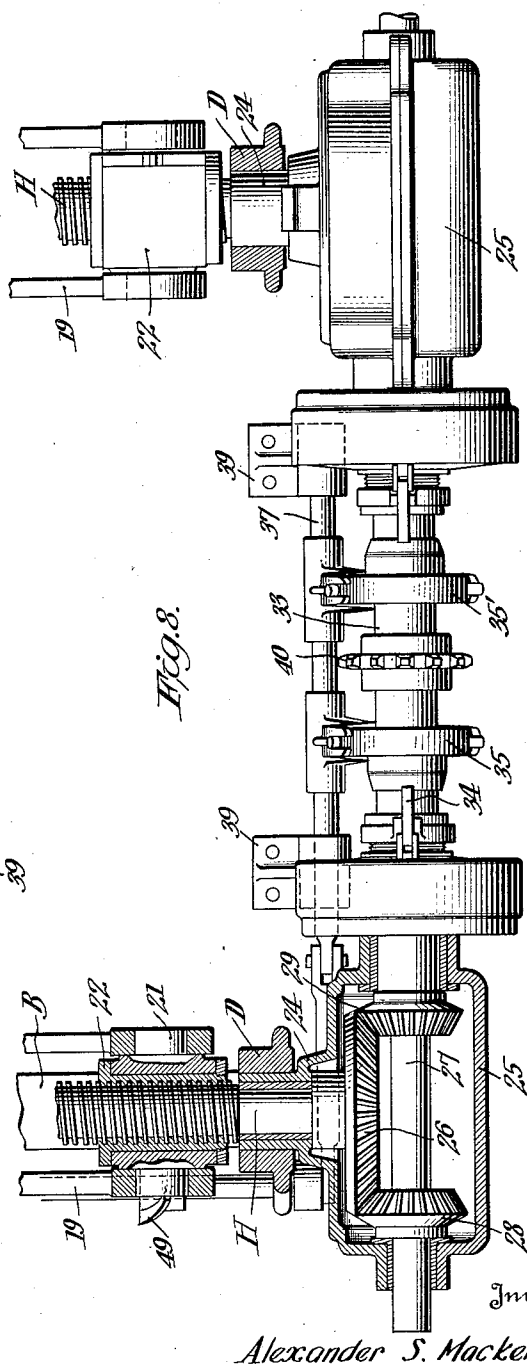


Fig. 8.

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Fig. 9.

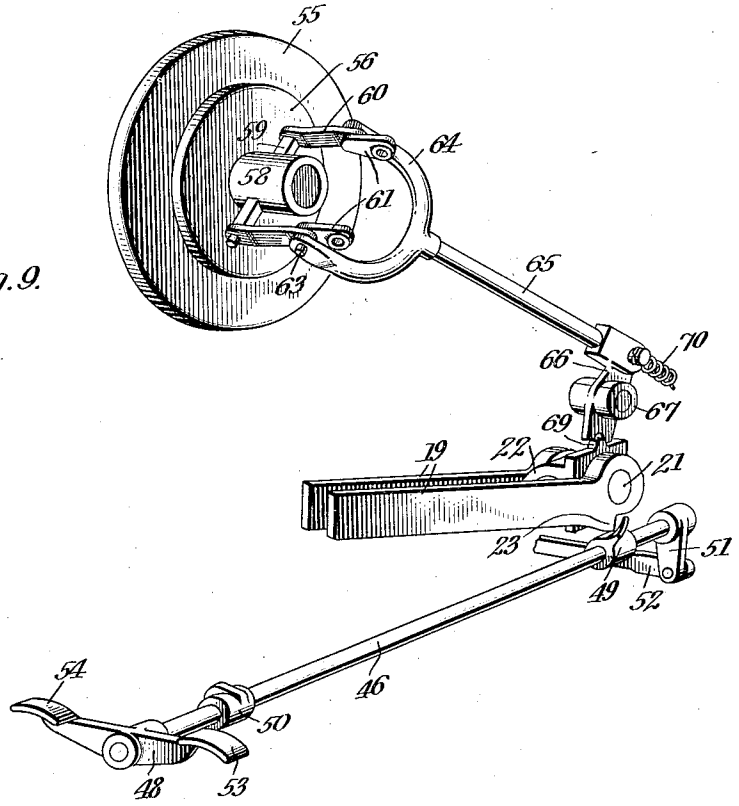
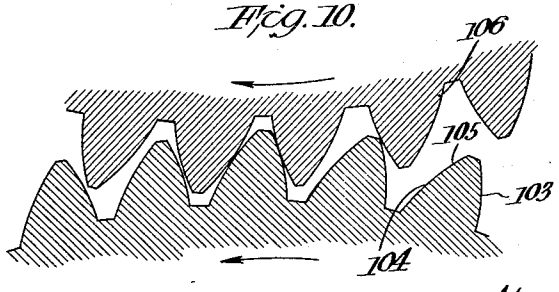


Fig. 10.



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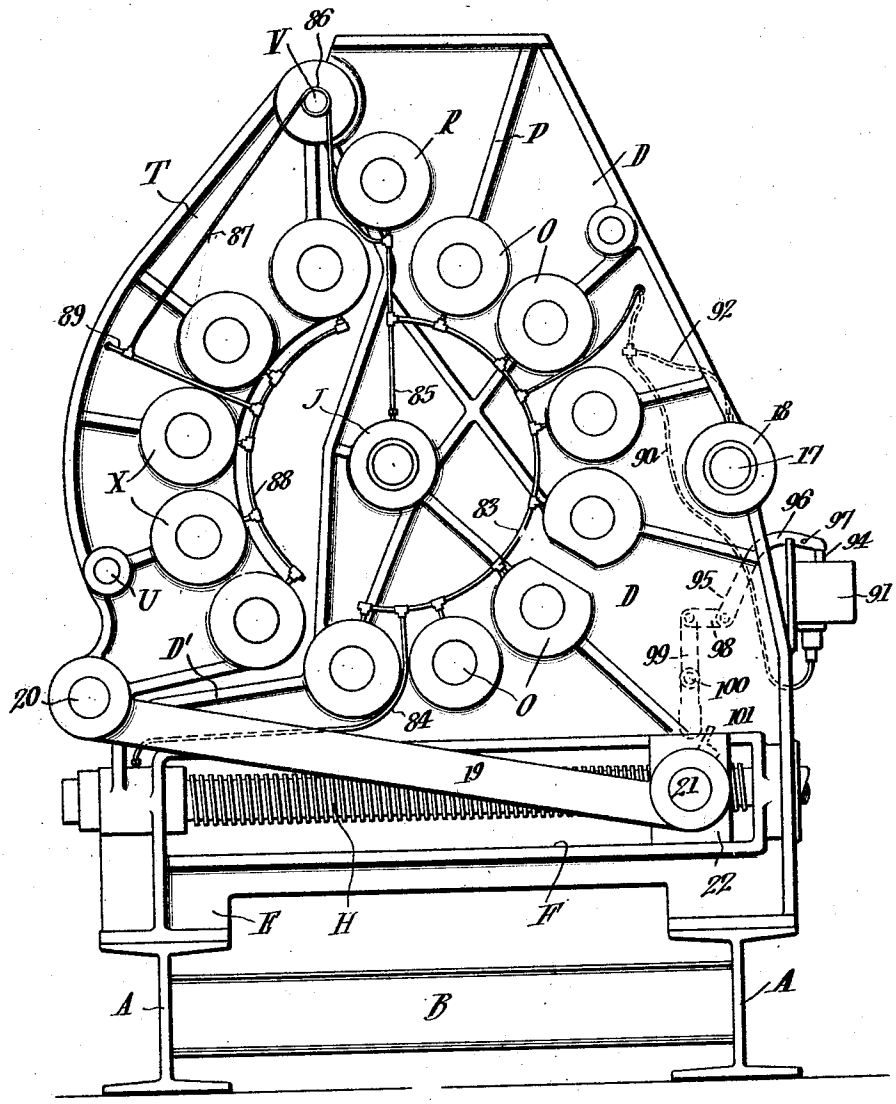
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BALING PRESS

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Fig. 11.



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UNITED STATES PATENT OFFICE

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BALING PRESS

Application filed January 13, 1928. Serial No. 246,491.

This invention relates to improvements in baling presses of the type in which a baling chamber is formed by a plurality of circumferentially arranged baling rolls, some of which are carried by a movable frame section which when swung outwardly permits the finished bale of material to be delivered from the press.

Among the principal objects of the invention are: The provision of a balanced drive for the baling rolls whereby stress and friction in the roll bearings are minimized and the frame is relieved of twisting stresses ordinarily imposed thereon by twisting of the rolls and shafts; the provision of improved means for controlling the opening and closing of the press; the provision of improved means for holding and moving the heads of the press so that they can be positively held against the expansive action of the bale and positively caused to recede as a bale is being delivered from the press; the provision of means for stretching the bale binder around the bale to maintain the density of the latter; the provision of means for allowing slippage of any of the baling rolls whenever they meet excessive resistance to their rotation; the provision of automatic force feed lubrication for all bearings of the mechanism; the introduction of a new form of gear tooth which is especially adapted for heavy duty gears and which will eliminate crashing and riding of the gears under heavy stresses; and finally the provision of indicator means which will apprise the operator of the amount of resistance being offered to the action of the baling rolls and which beside being used to indicate the density of the bale of material being formed, is also employed as a check upon the operation of the machine so that in case of excessive resistance being indicated, the operator can immediately stop the mechanism and cure the cause.

Other objects and advantages of the invention will become apparent during the course of the following description.

In the drawings forming a part of the description and where like numerals are employed to designate like parts throughout the several views:

Figure 1 is a front elevation of the mechanism.

Figure 2 is an enlarged side elevation of the right hand side of the mechanism.

Figure 3 is a similar view with the driving gears removed.

Figure 4 is a vertical transverse section substantially through the center of the baling press.

Figure 5 is a vertical, longitudinal section through the press looking toward the front thereof.

Figure 6 is a rear elevation of the press mechanism.

Figure 7 is a vertical longitudinal section through the reversing mechanism for the press.

Figure 8 is a top plan of the same, parts thereof being shown in section.

Figure 9 is a perspective view of the head plate operating mechanism and the operator for the reversing mechanism.

Figure 10 is an enlarged detail section of the gear tooth construction employed in all of the driving gears.

Figure 11 is a side elevation of the press with parts removed to illustrate the lubricating system of the device, and

Figure 12 is a vertical section of a friction drive for the feeding roll.

Referring now more particularly to the drawings, it will be seen that the base of the entire mechanism is formed by a pair of spaced parallel I-beams A connected at suitable intervals by transverse I-beams B secured to the webs of the beams A in any suitable manner. Opposite ends of the beams A at their lower edges are provided with upwardly inclined portions C so transportation may be facilitated when the beams A are employed as skids for moving the mechanism. It will be apparent that this base A provides a stable support for the mechanism when resting upon a flat surface, and will serve for supporting the mechanism upon rolls or the like for moving the same from place to place.

The frame of the baling press comprises a pair of stationary side frames D having legs E resting upon and bolted to the horizontal top flanges of the two beams A. Each of

these side frames is equipped adjacent its lower portion with an elongated, horizontal slot or guideway F extending from front to rear of the press to form a guide for a press opening and closing mechanism which will be later described. The end walls of each of these slots is equipped with bearings C for the mounting of right hand screw shafts H. These side frames are each provided with a forward extension D' above which a movable frame T is disposed when in closed position.

These end frames are provided with central bearings J which cooperate with the bearings K of standards L rising from the base in providing supports for stub shafts M arranged in alignment with each other. A plurality of bearings O are formed in each side frame D concentric with the bearings J, there being seven of such bearings in the present illustration to mount the axles of corrugated baling rolls 1, 2, 3, 4, 5, 6 and 7 which form part of the circular baling chamber. Reinforcing ribs P are formed upon the end walls D of the frame and extend for the majority of the roll bearings, some of these ribs extending from the roll bearings to the central bearing J, as clearly shown in Figure 4, to rigidify the frame and bearing portions.

The two side frames D are also each provided with aligned bearings R for mounting a feeding corrugated roller 13 above and slightly to one side of the uppermost feeding and baling roll 1 in a manner that these two rolls act as feeding rolls for feeding the material into the baling chamber as it passes through the hopper structure S mounted between the two side frames as shown in Figure 4.

The other part of the baling chamber is formed by a pair of movable side frames T, in the nature of jaws which are connected in spaced parallel relation by means of a tie rod U, the upper ends of the movable frames being pivotally mounted upon a transverse hinge shaft V supported in overhanging bearing knuckles W formed upon the end frames D. Each of these movable frames T is provided with a plurality, five in the present instance, of bearings X to provide mountings for the corrugated baling rolls 8, 9, 10 and 11 and a smooth-faced roll 12, all of which are arranged concentric with the central bearing J and to complete a circle with the baling rolls of the stationary frame when the movable frame T is arranged in closed position as shown in Figure 4. It will, therefore, be apparent that the circular baling chamber is constituted by the baling rolls 1 to 12 inclusive and that when the movable frame is swung on its pivot B the press is opened to discharge a completed bale from the chamber as is well understood in the art.

An arcuate guard plate Y is disposed above, and partially around the smooth baling roll 12, as shown, in order to prevent the material fed to the hopper from feeding out between the rolls 12 and 13. Reinforcing ribs are also provided upon the movable frames T extending from the roll bearings as is the case with the ribs of the stationary frame.

A shield or guard 110 is extended across a space between the two movable side frames T in front of the machine, and is provided at its upper edge with an inwardly extending horizontal shelf 112, having its inner end projecting between rolls 11 and 12 in order to facilitate the feeding of a fabric binder, such as is indicated in dash lines as 113, and which is usually a piece of burlap, around the formed bale in the baling chamber. This roll 12 is made smooth for two reasons; first, so that it will not have so much of a tendency to retard the material being fed between the feeding rolls 1 and 13, and second, so that the distance around its surface is slightly less than the distance around the irregular contour of the grooved or corrugated roll 1, which retards the burlap binder or bale covering which is fed into the press over the shelf 112, between rolls 11 and 13. This tends to stretch the burlap binder between rolls 1 and 12 and assists materially in maintaining the density of the completed bale of material.

In order to provide a well balanced drive for the baling rolls and to prevent twisting of the frame and roll shafts with consequent damage and excessive friction in the bearings O and X of the movable and stationary frames, the power transmission elements of the baling rolls are divided into two equal sets arranged on opposite sides of the frame. The ends of the roll shafts, successively around the baling chamber are alternately extended beyond the bearings on opposite sides of the stationary and movable frames and the projecting ends of the shafts on each side are alternately long and short, so that the power transmission elements in the form of gears 1' to 12' inclusive, which are numbered with prime coefficients to correspond with their respective baling rolls, are arranged in nested relation in each set on both sides of the press. Thus it will be seen that the drive for the press rolls is not located on one side only where it would provide a one-sided application of power resulting in a tendency for the drive to twist the side frames and mis-align the bearings of the shafts, but the drive is equally divided and applied to opposite sides of the press where it will not subject the frames and shafts to the detrimental stresses which would be present in a drive on one side only of the press.

In Figures 5 and 6 it will be noted that the extended end of the shaft for roll 1 is equipped with a gear 107 adapted to mesh with the gear 13' of the feed roll 13, for driv-

ing the same in a counter clockwise direction.

This gear 13′ is frictionally connected to the shaft of roll 13 so that in case the material being fed between the feeding rolls 1 and 13 is in excess of their capacity and chokes them, the roll 13 and the gear 13′ can move relatively or slip and prevent damage to the bearings, rolls and shafts. This is accomplished, as shown in Figure 12, by providing the gear 13′ with an internal annular flange 114 arranged between a pair of friction rings or washers 115, which may be of fibre or of any other material or construction and which are normally held in frictional driving contact with opposite sides of the flange 114 by a movable clamping ring or plate 116, normally urged against one washer 115 and forcing the other against an annular peripheral flange 117 of a hub 118, secured to the shaft of the roll 13. The ring 116 is slidably mounted upon the hub 118 and is rotatable therewith by reason of its being connected to the hub by bolts 119, extending through the hub and ring and having spring washers 120 mounted upon the bolts and engaging the ring 116. In case of the material becoming choked up between rolls 1 and 13, the gear 13′ will continue to be driven by gear 107, but will slip upon the hub 118, due to yielding of the spring washers 120, and movement of the ring 116 with consequent release of pressure upon the friction washers 115 upon the flange 114 of the gear. The press is then stopped and the excessive material removed. When the press is again started, the roller 13 will be driven by a gear 107 due to the pressure of the spring washers 120 against the ring 116, which, in turn, clamps the washers 115 to the flange 114 of the gear 13′. This same friction grip device, shown in Figure 12, may be applied to any of the gears of the mechanism so that any or all of the rollers may be made to slip whenever they encounter excessive resistance to their rotation.

The roll gears on one side of the mechanism are adapted to mesh with a master gear 14 while those on the opposite side mesh with a master gear 14′. Both drive gears are loosely mounted upon the stub shafts M between the bearings J and K and are provided with hub extensions to which are keyed the relatively large drive gears 15. These drive gears derive power from a pair of pinions 16 keyed to a countershaft 17 extending transversely of the rear of the mechanism through aligned bearings 18 formed in the stationary side frames D through which power is derived from a source to be later described.

The drive gears 15 are extraordinarily large in diameter, it being noted that they are substantially three times as large as the roll and master gears.

Guard housings 109 are supported upon the side frames D and by brackets 111 secured to the stands L over both sets of drive and roll gears as best seen in Fig. 1, and are connected in front of the press by the transversely extending relatively broad guard plate 110 which shields the baling rolls in the movable frame T.

In order to swing the movable frames T on their axis V to open and close the press, a pair of links or pitmen 19 are pivotally connected as at 20 to opposite sides of the lower end of each frame T, and the opposite ends of these links are pivotally connected as at 21 to the outwardly extending trunnions of a nut or crosshead 22 mounted in the slot F and upon the screw shaft H to be moved by the latter forwardly and rearwardly in a manner to be presently described to open and close the movable frame. As best seen in Figure 3, the lower portion of the nut or cross-head 22 is bevelled off at each end as indicated by the numeral 22′, for a purpose which will later appear. A nut and a pair of such links 19 are, of course, provided at each side of the machine to cooperate with the screw shafts H in opening and closing the movable frame T. In Figures 3 and 9, it will be noted that the outside link 19 on the right hand side of the machine is provided with a depending nose or cam surface 23 for a purpose which will be presently described.

The rear ends of the screw shafts H are extended back and journaled in bearings 24 of gear housings 25 at opposite sides of the press, a bevelled gear 26 being keyed to each screw shaft within the gear casing 25. Journaled at both ends within the two gear cases 25 is a transversely arranged shaft 27 which has keyed thereto, a bevelled gear 28 arranged in one of the gear boxes to mesh with one side of the bevelled gear 26. Within the same gear box is a second bevelled pinion 29 which is loosely mounted upon a bushing of the shaft 27 and is provided with a sleeve portion 30 journaled in the gear box to terminate in the normally idle part 31 of a friction clutch I. The normally rotating part 32 of his clutch is keyed to a rotating sleeve 33 loosely mounted upon the shaft 27. The part 32 of the clutch is equipped with the usual clutch dogs 34 which are adapted to be actuated by a sliding cam collar loosely mounted upon the sleeve 33 and controlled by a yoke 35 secured to a reciprocatory rod 37 mounted in brackets 38 extending rearwardly from the base of the frame.

Power is transmitted to the sleeve 33 through a sprocket 40 keyed thereto, a sprocket chain 41 trained thereover and over a sprocket 42 keyed to the power shaft 17. An idler sprocket 43 is adjustable horizontally in an upstanding bracket 44 secured to the base of the mechanism as best shown in Figure 4, to engage the sprocket chain 41 between the two sprockets 40 and 42. Thus, it will be seen

that as long as the power shaft 17 is rotating the sleeve 33 will be continuously rotated.

In the gear box 25 at the opposite side of the mechanism, a bevelled pinion 45 is journaled and is keyed as at 46 to the shaft 27. This bevelled pinion 45 has its hub extension secured to a relatively stationary part 31′ of a second friction clutch I′, which is identically the same as the friction clutch I, previously described, and embodies a relatively movable part 32′ keyed to the sleeve 33 and adapted to be coupled to the part 31′ by means of the dogs 34′ and sliding cam collar 35′ which is actuated by a yoke 36′ secured to the reciprocatory rod 37.

By the arrangement of the gears 28, 29 and 45, and the two clutches, a reversing mechanism is provided by which motion of the screw shafts H in either direction may be controlled at will to open and close the press. In order to open the press and swing the movable frames T outwardly, the clutch I′ is engaged with the shaft 27 which will cause the sleeve 33 to rotate the bevelled gear 45, permitting the bevelled gear 29 to idle in view of its being disconnected from the sleeve 33. The bevelled gear 28 being also keyed to the shaft 27 will rotate in unison with the gear 45 and turn the bevelled gears 26 and screw shafts in a counter clock-wise direction thereby causing the nuts 22 to move forwardly upon the screw shafts and elevate the movable frames T through the pitmen 19.

By disengaging the clutch I, the bevelled gear 45 will be disconnected from the sleeve 33 while the bevelled gear 29 will be clutched thereto through the clutch I, and being engaged with the side of the bevelled gear 26 opposite the gear 28 will rotate both gears 26 and screw shafts in a clock-wise direction to cause the reverse movement of the nuts 22 which will swing the movable frames T of the press inwardly to a closed position at which time automatic means will disengage both clutches I and I′ to cause cessation of the rotary motion of the two screw shafts H. Obviously, the nuts 22 cooperate with the screws H when idle, in providing means for positively and unyieldingly holding the movable frame T in open and closed positions thereby dispensing with the necessity of providing latches for this purpose heretofore employed.

The automatic means for placing the reversing mechanism in neutral when the movable frame T has reached both its open and closed positions consists of cam means associated with the reciprocatory rod 37. This cam means is constituted by a cam shaft 46 journaled at the right hand side of the mechanism in laterally extending bearings 47 of the leg portions of the side frame D, as best shown in Figure 3. This shaft extends fore and aft and is provided with a two-way foot treadle 48 at the front end of the mechanism whereby the reversing mechanism may be manually controlled. This cam shaft is arranged directly below the path of movement of the cam surface 23 formed on the pitman 19, as best seen in Figure 9, and is provided adjacent opposite ends with cams 49 and 50 adapted to be alternately arranged in the path of movement of the cam 23, and beveled ends of the nut 22 respectively. The rear end of the cam shaft 46 is provided with a depending crank 51 pivotally connected to a link 52 which in turn is connected at its opposite end to the end of the reciprocatory rod 37. The cam shaft 46 is shown in neutral position so that both of the clutches I and I′ are disengaged as shown in Figure 9, and to cause opening of the press the foot treadle 53 is depressed to move the cam 50 up into the path of movement of the beveled ends of nut 22. This movement of the cam shaft causes the reciprocatory rod 37 to move to the right in Figure 7 and engage the clutch I′ so as to rotate the friction shafts H in a manner to cause the nuts 22 to travel forwardly and elevate the movable frame section T. When the nuts approach the forward ends of the screw shafts, the forward beveled end of the nut 22 engages cam 50 and causes just sufficient turning of the cam shaft to disengage both clutches I and I′ from the drive sleeve 33, so that rotation of the screw shafts is stopped with the movable frame sections in open position whereby the baled material can be discharged from the bale chamber.

Upon depression of the foot treadle 54, the cam shaft 46 is turned so as to dispose the cam 49 in the path of movement of the cam 23, which movement of the cam shaft moves the reciprocatory rod 37 to the left in Figure 7 to engage the parts 31 and 32 of the clutch I thereby causing reverse rotation of the screw shafts H and rearward movement of the nuts 22 to cause closing of the movable frame section. When this frame section has been closed, the cam 23 engages the cam 49, causing turning of the cam shaft 46 and disengagement of the clutch I to permit the reversing mechanism to remain in neutral position.

As is customary in this type of press, the ends of the baling chamber formed by the baling rolls, are constituted by a pair of head plates 55 which are detachably secured, as by bolts, to a carrier 56 which is revolvably mounted upon a stub shaft 57. Since the construction of the head plates at both ends of the chamber is identical as well as the means for operating the same, a description of one will suffice for both. Each stub shaft 57 is mounted in a bushing 58 which is slidable in the bearing J of the stationary frames for movement inwardly and outwardly of the baling chamber. This bushing 58 is provided with diametrically extending polygonal studs 59 which operate in diametrically

disposed slots of the bearing J as best shown in Figure 5. This construction prevents rotation of the bushing while permitting its rectilinear movements. The outer ends of the two studs 59 are reduced and made cylindrical for the pivotal connection of the inner ends of toggle links 60, the outer ends of the pair of links being pivotally connected to a second pair of toggle links 61 thereby forming the knees of the toggle joints. The outer ends of the links 61 are pivotally connected to studs 62 threaded in opposite sides of the extended bearings J. The pins 63 forming the knee joints of the toggles are extended as best shown in Figures 5 and 9 to pass through the arms 64 of a yoke which is arranged parallel to the side of the press frame as best seen in Figure 3. The other end of the yoke rod 65 is pivotally connected to one end 66 of a fulcrumed lever 67 and the opposite end of this lever is provided with a pair of spaced depending teeth 68 between which a detent tooth 69 formed on each nut 22 is adapted to be disposed when the press is closed in order to maintain the toggle links 60 and 61 straightened out to positively hold the head plates 55 in their innermost positions. It is to be noted that the front tooth 68 is shorter than its companion. A coiled spring 70 is connected to the end of the yoke rod 65 and to a stationary laterally extending plate 71 of the stationary frame and normally tends to swing lever 67 to a position in which the longer tooth 68 is in the path of the tooth 69. The normal action of the coiled springs 70 is unleashed when the nuts 22 are moved forwardly upon the screw shafts and the short tooth 68 is engaged by the tooth 69 to swing the lever 67 with consequent positive downward movement of the yoke bars 65 and breaking of the toggle links to positively move the head plates outwardly of the baling chamber. In prior devices, wedges of various sorts have been resorted to for retaining the head plates in baling position. With the toggle-link construction disclosed herein, the head plates are positively retained in baling position since the toggle links are held straightened out by the lever and tooth construction just described and against the tremendous expansive forces imposed thereon by the baled material while undergoing tremendous pressure of the baling rolls. It will, therefore, be seen that the head plates 55 are positively caused to recede and move outwardly of the baling chamber immediately upon the initial opening of the press so as to permit a rapid discharge of the baled material when the movable frame is moved to an open position to permit the baled material to roll out of the press. The movement of the lever 67 in the opening of the press is only to the extent of freeing the lug 69 of the nut so that the longer tooth 68 of each lever 67 remains in the path of movement of the lug 69; the spring 70 serving to retain the lever in this position, so that upon closing of the press the nut lug 69 will engage the longer tooth 68 and positively move the lever together with the toggle mechanism into such position as to place the head plates 55 inwardly of the baling chamber and in position for carrying out the next baling operation.

Power is delivered to the press mechanism by a shaft 72 which is connected to and disconnected from a power shaft 73, driven by a pulley 74, by a manually controlled clutch 75 operated by a hand lever 76 fulcrumed as at 77 upon a standard 78 carried by the base of the mechanism. A guard or shield 108 covers the clutch 75. A combined torque dynamometer and indicator is indicated in general by the numeral 79 and is positioned between the driving pulley 74 and a driven sprocket loosely mounted upon the shaft 72 and enclosed in a housing 81. The inner end of the driven shaft 72 is journaled in the inside stand L as at 80, as clearly shown in Figure 1. A sprocket chain is engaged with the sprocket within the housing 81 and also with a sprocket keyed to the power shaft 11.

The combined torque dynamometer and indicator is fully described in my copending application, Serial No. 251,625, filed February 3, 1928, and it will suffice here to say that it comprises driving and driven plates, connected together by coil springs which transfer the power from the driving plate to the driven plate. The driving plate is secured to the driven shaft 72, while the driven plate is secured to the driven sprocket enclosed within the housing 81. Obviously, the driving and driven plates of the dynamometer may move relatively, and in order to record this relative movement, an annular member is mounted for rotation with the driven plate so as to have sliding movement longitudinally of the shaft 72. This annular member is provided with arcuate slots through which extensions of the spring connections with the driving plate extend so as to cause this annular member to move longitudinally of the shaft whenever there is relative movement between the driving and driven plates of the dynamometer. This annular member is also provided with a peripheral circumferential extending groove in which operates a shoe connected to a crank arm of the shaft 130 journaled in an indicator stand 131. A recording pointer 132 is secured to the shaft 130, externally of the stand, to cooperate with a vernier 133 indication on the stand to indicate the relative movement of the driving and driven plates of the dynamometer so as to indicate the amount of resistance being offered to the baling rollers at all stages of the baling operation. Consequently, it will be seen that this indicator can be employed to designate the amount of resistance being offered the baling rolls as well as to indicate

the density of the material being baled. This latter indication can be relied upon to give accurate information as to the density of the baled material since there is a normal torque in baling cotton in which bales of certain poundage will turn the indicator to a certain point. This torque varies with different grades of cotton and under different atmospheric conditions. Some days it will be higher and some days lower. Having once determined within reasonable limits the position assumed by the indicator when baling particular cotton under existing atmospheric conditions, it is possible to keep an accurate check on the press, for, if after having turned out one bale, it has been found that as the baling proceeds the indicator turns over considerably beyond the reasonable range of limits, it can then be assumed that there is something wrong with the press, and excessive friction being created in some of the bearings. The press can then be stopped and the cause of the excessive torque remedied.

In order to maintain proper lubrication of all of the bearings of the press mechanism, I provide each of the stationary side frames D with an arcuate lubricant conduit 83 which communicates with all of the bearings of the press rolls. A branch pipe 84 is connected to the conduit 83 and leads to the forward bearings of the screw shafts H while a second branch 85 leads to the bearings J and is extended vertically to be wound in a coil 86 concentric with the axis of the hinge shaft V of the movable frame T. This branch then extends downwardly as at 87 to feed lubricant to an arcuate conduit 88 supplying lubricant to all of the roll bearings of the movable frame, as well as to feed lubricant through a pipe 89 extended through the movable frame on one side of the press to the corresponding frame on the opposite side whereby the roll bearings of the frame on the opposite side may be lubricated with an arcuate conduit such as 88. Lubricant is supplied to the entire system by the pipe 90 which leads from a force-feed pump 91 and communicates with the arcuate conduits 83 on both side frames D. A branch 92 extends from the main line 90 to the bearings 18 of the counter shaft 17 and a pipe 93 extends across the back of the machine to the opposite stationary side frame D where lubricant is conveyed to the bearings of the various shafts in the same manner as described above.

The lubricant pump 91 is provided with a plunger actuator 94 which is operated by a system of levers 95 each time the press closes. A lever 96 is fulcrumed as at 97 to the lubricant pump and its free end engages the upper end of the pump plunger 91 as shown, while the opposite end of this lever is pivotally connected to a link 98 which in turn is pivotally connected to the upper end of a lever 99 fulcrumed to the inside of the frame as at 100 so that its depending portion is arranged in the path of movement of a lug 101 carried by the nut 22 on the right hand side of the machine.

As the nut 22 moves forward, the lug 101 strikes the lower end of lever 99 but does not operate the pump 91, as the press is now opening. However, when the nut 22 returns to a position where the press is closed, the lug 101 strikes the lever 99 and actuates the lever 96 to depress the pump plunger to force the lubricant through the supply pipe 90 and its various branches to all of the vital bearings of the machine.

The gears for operating the bearing rolls undergo terrific stresses due to the great amount of resistance offered by the baling rolls in baling material which must be compressed to a high degree of density and which naturally results in severe back-lash in the gears, causing them, if of the usual construction, to slip, ride and crash. Accordingly, a form of gear tooth is disclosed therein which eliminates the objectionable features of previously used gears for this purpose, and all of the gears of the baling rolls, as well as the power gears 14, 15 and 16 are constructed with this new form of tooth which is shown in detail in Figure 10. It will be noted that one side 103 of each tooth is the standard gear involute, while the opposite side 104 of the tooth profile is made more sloping. In other words, the flank of the side 104 slopes to a greater degree than the flank of the involute and the face of this side of the gear tooth likewise is more sloping in the same direction than the face of the involute. In other words, the flank and addendum of the face 104 are greater than the corresponding distances of the involute face 103 which results in the area of the flank and face of the side 104 being greater than the area of the involute side 103.

This special form of gear tooth may also be accurately described by stating that it is the ordinary involute gear tooth with one of its faces cut away at the corner as at 105 and its root or flank filled in as at 106. With this construction, the involute faces of the teeth of meshing gears are adapted to engage and transmit movement from one gear to the other, while the more sloping sides 104 of the teeth of the two gears work opposite each other and permit easy sliding of the teeth into and out of mesh. Furthermore, it will be seen that each tooth is rigidified at its root by the construction shown so as to withstand heavy stresses.

It is to be understood that various changes in the size, shape and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the appended claims.

What I claim is:—

1. In a bale mechanism having a bale form-

ing chamber, the combination of a series of rolls arranged around said chamber, stationary and movable frames whereon are mounted said rolls, rotary means at either side of said mechanism for moving said movable frame, power means constantly rotatable in the same direction for operating said rotary means in either direction and arranged transversely of said mechanism, and a reversing mechanism including a pair of clutches selectively engageable with said power means.

2. In a bale mechanism having a bale forming chamber, the combination of a series of rolls arranged around the chamber, a stationary frame, a movable frame whereon are mounted some of said rolls, a press opening shaft on each side of said mechanism having a power transmission element, a power shaft arranged transversely of said mechanism and constantly rotatable in one direction, a pair of power transmission elements mounted on said power shaft and engaging opposite sides of the power transmission elements of said press opening shafts, a third power transmision element mounted on said power shaft and engaging the power transmission element of one of said press opening shafts, and a pair of clutches coupled with a pair of said power transmission elements and selectively coupled with said power shaft.

3. In a bale mechanism having a bale forming chamber, the combination of a series of rolls arranged around the chamber, a stationary frame, a movable frame whereon are mounted some of said rolls, a press opening and closing shaft on each side of said mechanism and having a power transmission element, a power shaft arranged transversely of said mechanism, a pair of gear elements mounted on said power shaft and engaging opposite sides of said power transmission elements of said press operating shafts, one of said gear elements being keyed to said power shaft and the other being free thereon, a third gear element keyed to said power shaft and engaging the power transmission element of one of the press operating shafts, a drive sleeve loosely mounted on said power shaft, and a pair of clutches each having a part keyed to its respective gear element and a part selectively engageable with said drive sleeve.

4. In a bale mechanism having a bale forming chamber, the combination of a series of rolls arranged around the chamber, a stationary frame, a movable frame whereon are mounted some of said rolls, rotary means at either side of said mechanism for moving said movable frame, power means constantly rotatable in the same direction for operating said rotary means in either direction, a reversing mechanism including a pair of clutches selectively coupled with said power means, a clutch operating rod, an oscillatory cam shaft including cams arranged in the path of movement of said means for moving said movable frame and adapted to operate said clutches to prevent rotation of said rotary means.

5. In a bale mechanism, a baling chamber, means for opening and closing said chamber, a movable head plate in said chamber, and toggle means for operating said plate upon opening and closing of said chamber.

6. In a bale mechanism, a baling chamber, means for opening and closing said chamber, a movable head plate in said chamber, a toggle joint connected to said head plate and chamber, and means for operating said joint upon opening and closing of said chamber.

7. In a bale mechanism, a baling chamber, means for opening and closing said chamber, a movable head plate in said chamber, pairs of toggle links connected to said head plate and chamber, and a fork connected to said pairs of links for operating the same upon opening and closing of said chamber.

8. In a bale mechanism, a baling chamber, means for opening and closing said chamber, a movable head plate in said chamber, spring operated means for moving said plate upon opening of said chamber, and means cooperating with said opening and closing means for normally restraining the action of said spring means when said chamber is closed.

9. In a bale mechanism, a baling chamber, means for opening and closing said chamber including a detent, a movable head plate in said chamber, operating means for moving said plate upon opening of said chamber, and latch means cooperating with said detent to normally restrain the action of said operating means when said chamber is closed and permitting the action of said operating means when said chamber is opened.

10. In a bale mechanism, a baling chamber, a screw shaft, a nut operated by said screw shaft for opening and closing said chamber, a movable head plate in said chamber, spring operated means for moving said plate upon opening of said chamber, and fulcrumed latch means having a pair of spaced lugs cooperating with said nut for restraining the action of said spring means when the chamber is closed and permitting the action of said spring means when the chamber is opened.

11. In a bale mechanism having a bale forming chamber, the combination of a series of rolls arranged around the chamber, a stationary frame, a movable frame whereon are mounted some of said rolls, said stationary frame having a slotted bearing, a movable head plate in said chamber and having means operating in said bearing, studs projecting diametrically from said member and operating in the slots of said bearing, and means connected to said studs for moving said head

plate outwardly of said chamber upon opening of the latter.

12. In a bale mechanism, a frame, a baling chamber, a series of rolls arranged around the chamber, a power transmission element for each roll, said power transmission elements of one half of the rolls being arranged on one side of said frame and the power elements of the other half of the rolls being disposed on the opposite side of the frame with the power transmission elements of both sets of rolls disposed in alternation at opposite sides of the frame.

13. A bale mechanism, a frame, a bale chamber, a series of rolls arranged around the chamber, a drive element at each side of said frame, a power transmission element for each roll, the power transmission elements of one half of said rolls being arranged on one side of said frame and the power transmission elements of the other half of said rolls being disposed on the opposite side of the frame with the power transmission elements of both sets disposed in alternation at opposite sides of said frame, and the power elements of each set being disposed in nested staggered relation for engagement with their respective drive elements.

14. In a bale mechanism, a frame, a baling chamber therein, a series of rolls arranged around the chamber, a power transmission element for each roll arranged at the side of the frame, a relatively small power element engaging all of the roll power elements, the latter being disposed in nested staggered relation to said relatively small power elements, and a relatively large drive element mounted on the same axis as the relatively small power element and between which and the frame are arranged the power transmission elements of said rolls.

15. In a bale mechanism, a frame, a baling chamber therein, a series of rolls arranged around said chamber, a power shaft arranged transversely across the rear of said frame, relatively small drive pinions keyed to said shaft at opposite sides of said frame, relatively large drive gears mounted at opposite sides of said frame, relatively small master gears rotatable with said drive gears, and power transmission elements for the rolls arranged in sets disposed at opposite sides of said frame in engagement with said master gears.

16. In a baling mechanism, a bale forming chamber, a series of rolls arranged around said chamber, and a smooth roll and corrugated roll at the material receiving portion of said chamber having continuously different surface speeds.

17. In a baling mechanism, a bale forming chamber, a series of rolls arranged around said chamber, a corrugated roll and a smooth roll arranged at the feeding portion of said chamber, said smooth roll having a surface speed less than that of said corrugated roll.

18. In a baling mechanism, a bale forming chamber, a series of rolls arranged around said chamber, a pair of corrugated feeding rolls for delivering material to said chamber, and a third and smooth roll adjacent said pair of rolls having a surface speed different than that of said corrugated rolls.

19. In a baling mechanism, a bale forming chamber, a series of rolls arranged around said chamber, a pair of corrugated feeding rolls for delivering material to said chamber, a third smooth roll adjacent said pair of rolls having a surface speed less than that of said corrugated rolls, and a binder feed-shelf arranged adjacent said smooth roll for guiding a binder beneath the same and into said chamber.

20. In a baling mechanism having a bale forming chamber, the combination of a series of baling rolls arranged around said chamber, a feeding roll cooperating with one of said baling rolls to feed material into said chamber, drive means for positively rotating all of said rolls simultaneously, and means permitting slippage of said feeding roll upon creation of sufficient resistance to its rotation while the baling rolls continue rotation.

21. In a baling mechanism, a bale forming chamber, a series of rolls arranged around said chamber, a feeding roll cooperating with one of said baling rolls for feeding material to said chamber, drive means for positively rotating all of said rolls simultaneously, a shaft for said feeding roll, a hub secured to said shaft, a clamping ring mounted on said hub and normally urged in a predetermined direction, a driven gear having a flange disposed between said ring and hub, and a pair of friction rings arranged on opposite sides of said flange and normally urged into engagement therewith by said clamping ring.

22. In a baling mechanism, a bale forming chamber, a series of rolls arranged around said chamber, a feeding roll cooperating with one of said baling rolls for feeding material to said chamber, drive means for positively rotating all of said rolls simultaneously, a shaft for said feeding roll, a hub secured to said shaft and including an annular peripheral flange, a clamping ring slidably mounted upon said hub, bolts extended through said hub and ring and having spring washers for normally urging said ring toward said flange, a driven gear having an annular flange arranged between said hub flange and said ring, and friction washers arranged between said gear, flange, said ring and said hub flange.

23. In a baling mechanism, a baling chamber, means for opening and closing said chamber, a movable head plate in said chamber, and lever means operated by said first men-

tioned means for operating said plate upon opening and closing of said chamber.

24. In a baling mechanism, a baling chamber, means for opening and closing said chamber, a movable head plate in said chamber means for moving said plate independently of bale expansion upon opening and closing of said chamber, and means cooperatig with said opeing and closing means for preventing the action of said second named means when said chamber is closed.

25. In a baling mechanism, a baling chamber, means for opening and closing said chamber, a movable head plate in said chamber, means for moving said plate upon opening and closing of said chamber and including a link and actuating means, and a fulcrumed latch pivoted to said link and cooperating with said opening and closing means.

26. In a baling mechanism having a bale forming chamber, the combination of a series of rolls arranged around the chamber, a stationary frame, a movable frame whereon are mounted some of said rolls, said stationary frame having a slotted bearing, a movable head plate in said chamber and having means operating in said bearing, studs projecting diametrically from said member and operating in the slots of said bearing, toggle arms connected to said studs and to said bearing, and means for operating the joint of said toggle arms upon opening and closing movements of said movable frame.

27. A baling mechanism having a bale forming chamber including a movable frame having baling rolls forming part of said chamber and adapted to be opened and closed, a pair of movable head plates in said chamber, and means operated upon movement of said movable frame for simultaneously moving both of said head plates.

28. A baling mechanism having a bale forming chamber including a movable frame having baling rolls forming part of said chamber and adapted to be opened and closed, a pair of movable head plates in said chamber, and means operated upon movement of said movable frame for simultaneously moving both of said head plates as said frame opens and closes.

29. A baling mechanism having a bale forming chamber including a movable frame having baling rolls forming a part of said chamber and adapted to be opened and closed, frame actuating means at opposite sides of said chamber for opening and closing said frame, a pair of movable head plates in said chamber, and means cooperating with said plates and said frame actuating means for simultaneously operating said head plates upon operation of said frame actuating means to open and close said chamber.

30. In a baling mechanism, a series of corrugated rolls arranged to form a bale forming chamber, a smooth surfaced roll included in said series and forming with an adjacent corrugated roll a feeding throat, and said smooth surfaced roll having a surface speed less than an adjacent corrugated roll.

31. In a baling mechanism, a bale forming chamber, a series of rolls arranged around said chamber, a corrugated roll and a smooth roll adjacent the feeding portion of said chamber, said smooth roll having a surface speed less than the corrugated roll, and a binder shelf projecting between said smooth and corrugated rolls.

32. In a baling mechanism having a bale forming chamber, the combination of a series of rolls arranged around said chamber, stationary and movable frames whereon are mounted said rolls, means at either side of said mechanism for moving said movable frame, aligned bearings carried by the stationary frame and extending transversely of said mechanism, a shaft mounted in said bearings and extending transversely of said mechanism, power transmission means forming an operative connection between said shaft and said means at either side of said mechanism, and a reversing mechanism carried by said shaft and including a pair of clutches selectively engageable with said shaft for rotating said means at either side of said mechanism in either direction.

33. In a baling mechanism having a bale forming chamber, the combination of a series of rolls arranged around said chamber, stationary and movable frames whereon are mounted said rolls, means at either side of said mechanism for moving said movable frame, aligned bearings carried by the stationary frame and extending transversely of said mechanism, a shaft mounted in said bearings and extending transversely of said mechanism, power transmission means forming an operative connection between said shaft and said means at either side of said mechanism, a reversing mechanism carried by said shaft and including a pair of clutches selectively engageable with said shaft for rotating said means at either side of said mechanism in either direction, an oscillatory cam shaft extending longitudinally of said mechanism in bearings carried by said stationary frame for cooperation with one of said means at one side of said mechanism, and connecting means between said oscillatory cam shaft and said clutches for actuating the latter.

34. In a bale mechanism composed of a stationary frame and a movable frame, a series of baling rolls carried by each of said frames and forming a cylindrical baling chamber, said stationary frame having elongated slots in its side walls with bearings formed in the frame at the ends of said slots, a screw shaft extending longitudinally through said slots and journaled in said bearings, and means operated by said screw

shaft for opening and closing said movable frame.

35. In a baling mechanism composed of a stationary frame and a movable frame, said stationary frame comprising side plates and transversely extending braces connecting the same in spaced parallel relationship, a series of baling rolls carried by each of said frames and forming a cylindrical baling chamber, the side plates of said stationary frame having elongated slots with bearings formed in the plates at the ends of said slots, screw shafts extending longitudinally through said slots and journaled in said bearings, and means operated by said screw shaft for opening and closing said movable frame.

36. In a baling mechanism composed of a stationary frame and a movable frame, a series of baling rolls carried by each of said frames and forming a cylindrical baling chamber, said stationary frame having elongated slots in its side walls with bearings formed in the frame at the ends of said slots, screw shafts extending longitudinally through said slots and journaled in said bearings, nuts operatively associated with said screw shafts and movable therealong, and links substantially co-extensive with said stationary frame connected to said nuts and movable frame for moving the latter upon rotation of said screw shafts.

37. In a baling mechanism composed of a stationary frame having a base substantially co-extensive with the length of the mechanism, a movable frame, a series of baling rolls carried by each of said frames and forming a cylindrical baling chamber, a screw shaft journaled in the base of said stationary frame, a nut operatively associated with said shaft, and a link substantially co-extensive with the base of said stationary frame connected to said nut and to said movable frame for moving the latter upon rotation of said screw shaft.

In testimony whereof I have hereunto set my hand.

ALEXANDER S. MACKENZIE.