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[56]

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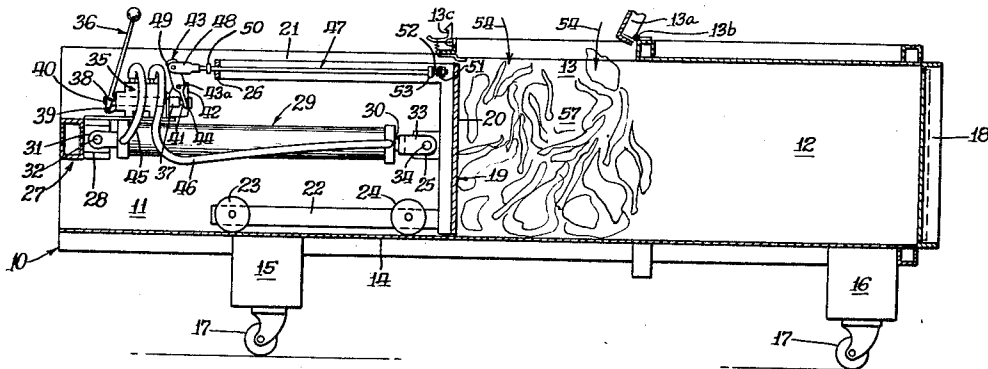
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[54] CONTROL FOR THE OPERATION OF THE RAM
OF A BALER
2 Claims, 5 Drawing Figs.

[52] U.S. Cl. 100/53,
100/218, 100/245, 100/250, 100/256, 100/269
[51] Int. Cl. B30b 15/00
[50] Field of Search 91/355;
100/256, 179, 137, 188, 232, 240, 245, 100, 218,
52, 246, 256, 247, 269, 250, 251, 53

ABSTRACT: A control mechanism for balers providing for the full cycling of a baler ram through a compression stroke, through a retraction stroke, and to a stop, upon a single initial manual actuation of a hand control on the control mechanism.



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3,577,911

2 Sheets-Sheet 1

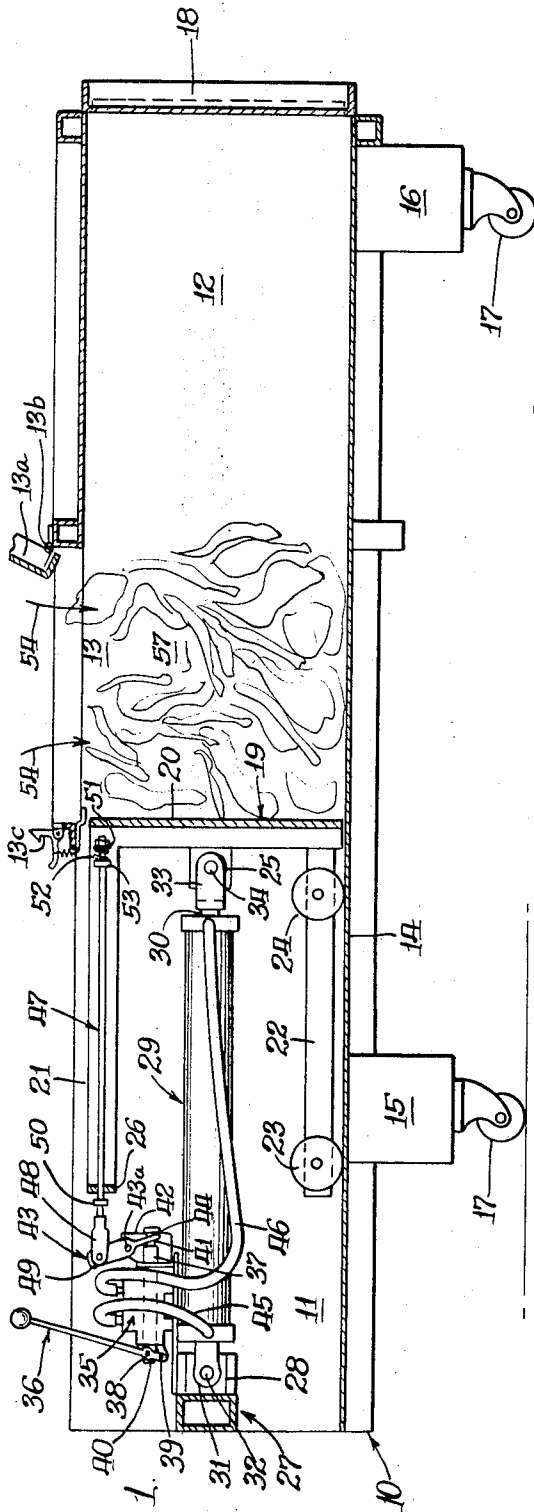


Fig. 1.

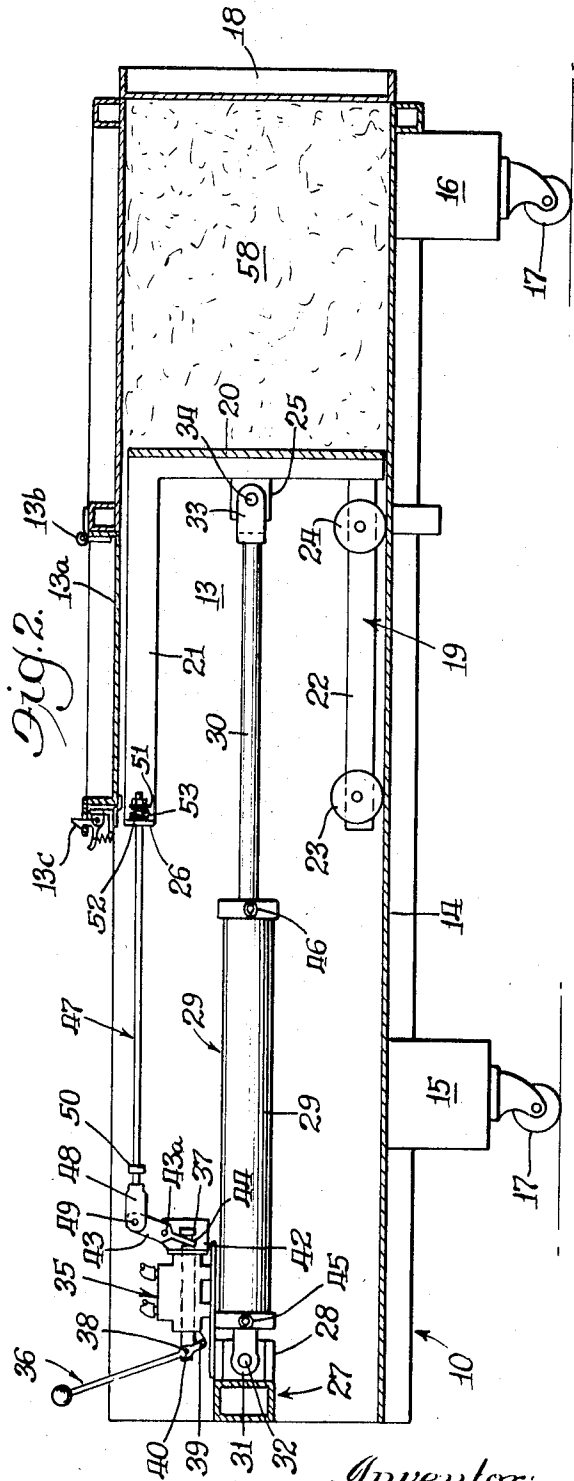
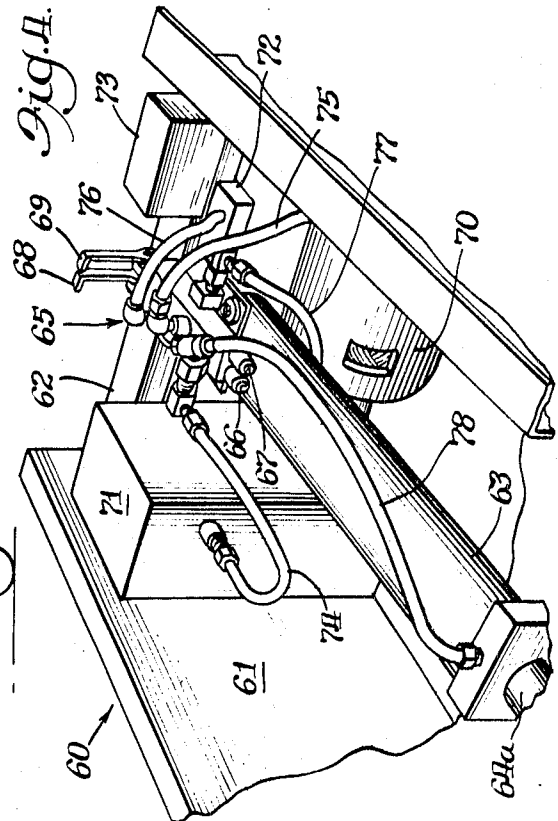
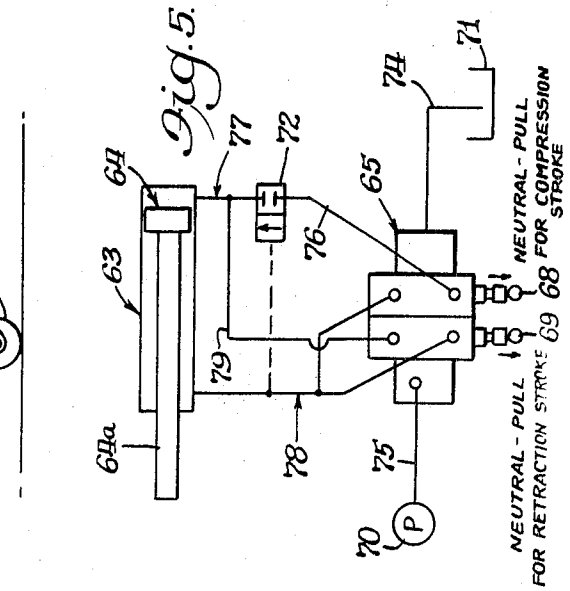
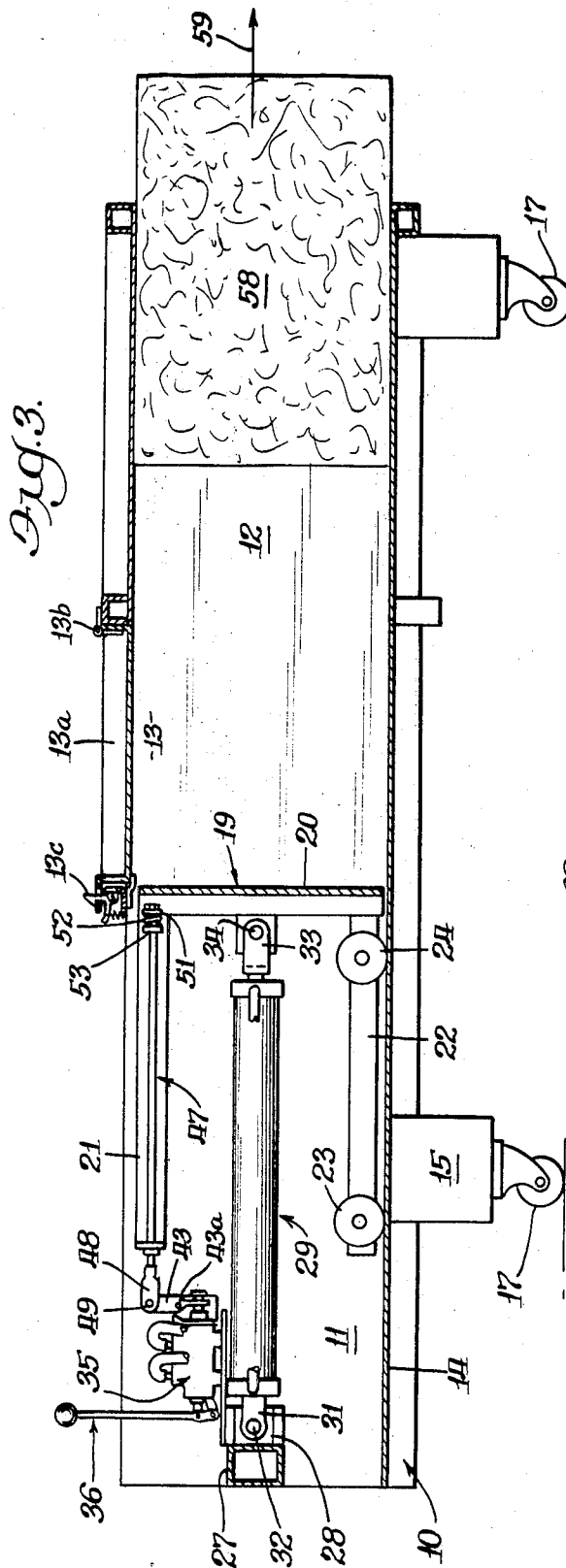


Fig. 2.

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CONTROL FOR THE OPERATION OF THE RAM OF A BALER

BACKGROUND OF THE INVENTION

1. Field of the Invention

There are many types of balers which have many different uses. The present invention is primarily concerned with stationary scrap balers. A baler includes a compression chamber to which material to be compressed is inserted. Usually a reciprocating plunger or ram is movable through the compressing chamber to compress material into bale formation. When there is sufficient material under compression to constitute a bale it is tied with encircling strands. Quite often balers are arranged for continuous plunger reciprocation. However, in the use of many scrap balers the making of bales is relatively slow with charges of material to be compressed inserted irregularly. In most instances the power used in scrap balers is hydraulic. In balers of this type there is usually provided a manually operable control valve for effecting each movement of the compressing ram. After a charge of scrap is fed to the chamber the operator acts to start the ram on its compressing stroke. After the ram has reached its maximum extension and the scrap has been compressed the operator must then act to start the ram on its return stroke. This is necessary to bring the baler into recharging condition. The operator of such a baler is thus required to remain at the baler site for a considerable time during the compression of each charge of scrap. In the past these balers have been actuated manually to effect each forward or reverse movement of the ram. It is with this background in mind that the inventor conceived of a means to save the time of the operator in feeding and compressing scrap materials.

2. Description of the Prior Art

A prior hydraulically operated baler ram or plunger is shown in the U.S. Pat. No. 2,396,720 to Nolt.

SUMMARY OF THE INVENTION

This invention relates to a new and improved control for the operation of the ram of a baler.

An important object of this invention is to provide a novel control for hydraulically operable baler rams to cause movement of the ram through a full forward and reverse cycle and then have the ram come to rest.

Another important object of this invention is to provide a novel control for baler rams in which mechanical means is superimposed on hydraulic operator means whereby upon a single manual setting of the control mechanism will automatically cause the ram to make a compression stroke, then a retraction stroke, and come to a halt without further manual manipulation of the control mechanism.

A still further important object of this invention is to provide a novel control for the ram of a scrap baler in which automatic mechanism is built into the control valve of a hydraulic circuit whereby the ram may be independently operated through either its compression stroke or its retraction stroke or may by a single movement send the ram through its compression stroke, through its retraction stroke, and then bring it to rest at its starting position for a succeeding cycle.

Other and further important objects and advantages will become apparent from the disclosures in the following specification and accompanying drawings.

IN THE DRAWINGS

FIG. 1 is a longitudinal sectional view of the scrap baler of this invention with the baler ram starting forward on its compressing stroke.

FIG. 2 is a longitudinal sectional view similar to that of FIG. 1 with the baler ram having completed its compression stroke and starting on its retraction stroke.

FIG. 3 is another longitudinal sectional view similar to that of FIGS. 1 and 2 with the baler ram returned to its starting position.

FIG. 4 is a perspective view of a portion of a scrap baler showing a modified form of the present invention.

FIG. 5 is a hydraulic circuit diagram of the baler ram operator of FIG. 4.

AS SHOWN IN THE DRAWINGS

The reference numeral 10 indicates generally an elongated scrap baler. The baler includes at one end of its elongated housing a power mechanism portion 11. The opposite end of the elongated baler 10 constitutes a bale-forming chamber 12. Intermediate the power mechanism portion and the bale-forming chamber is a loading chamber 13 with an opening in the top thereof whereby scrap to be compressed and ultimately baled is inserted into the baler. It is preferable that the opening be covered with a hinged door 13a to give an initial precompression of the material to be baled and also to provide the ram with a smooth surface in its reciprocation through the bale chamber. The door is hinged at 13b on one end to the baler housing and is provided with a latch 13c at its other end to hold the door closed during compression of the scrap to be baled. The elongated baler 10 includes a floor or bottom 14 extending throughout the length thereof. Beneath the floor or base 14 are spaced-apart supporting members 15 and 16 which have a plurality of caster wheels 17 mounted thereon to enable the baler to have portability. The end of the baler adjacent the forming chamber 12 has a discharge of bale ejection door 18 which is hingedly mounted along one vertical edge thereof. The other vertical edge is releasably latched to the end of the bale chamber and provides resistance to the passage of material through the bale-forming chamber. It is the reactance against this door 18 that causes the scrap in the bale-forming chamber to be compressed. When it is desired to release the formed bale the discharge door 18 is opened.

As best shown in FIGS. 1, 2 and 3 the elongated baler 10 has a ram or plunger designated generally by the numeral 19. This ram is reciprocated within the elongated baler causing the intermittent compression of scrap or other material which may be inserted through the feed opening to the chamber 13. The ram 19 includes a front face 20 which directly engages the scrap in its compression. In FIG. 1 the front face 20 of the ram is disposed on the outer side of the loading chamber 13. In this position scrap or other materials to be baled may be freely inserted into the baler for subsequent compression into bales. The ram 19 further includes a rearward extension 21 located at the top thereof. The extension 21 is of sufficient length so that when the face 20 of the ram is in its fully extended compression position the rearward extension 21 acts to completely bar entry of further material into the baler whether or not the hinged door 13a is closed or open. This condition is shown in FIG. 2. A second rearward extension 22 is provided at the bottom of the ram 19. This lower rearward extension 22 is provided with spaced-apart rollers 23 and 24 which are adapted to roll on the floor or bottom 14 of the elongated baler. The rollers 23 and 24 provide for the smooth relatively frictionless movement of the ram 19 in its reciprocation through the elongated bale chamber. The rear surface of the front compressing portion 20 of the ram 19 is provided with a generally central support 25 which is used to receive the mount for the hydraulic equipment employed to effect reciprocation of the ram. A further structure of the ram 19 comprises a vertical flange 26 on the end of the upper rearwardly extended portion 21. It is against this flange 26 that the limit mechanism of this invention operates to actuate the hydraulic mechanism.

The baler 10 also includes an end cross support 27 which as shown comprises a rectangularly shaped tubular member. However, it should be understood the member 27 could be some other shape such as U-shaped and perform the same function. The support 27 is disposed opposite the bale discharge door 18. The inside of the cross support 27 has a center portion 28 which is in general axial alignment with the central support 25 on the ram 19. A hydraulic cylinder 29 is disposed in generally horizontal position in the power mechanism portion 11 of the baler. The cylinder 29 with its extending and retracting piston rod 30 is disposed between the cross support 27 and the ram 19. A clevis 31 is affixed to the

end of the cylinder 29 and by means of a transversely disposed pin 32 the clevis 31 is joined to the central portion 28 of the cross support 27. Similarly a clevis 33 is mounted on the outer end of the piston rod 30 and by means of a pin 34 the piston rod clevis 33 is affixed to the ram center support 25. As shown in the successive FIGS. 1 and 2 an extension of the piston rod 30 causes the ram to be moved forwardly through the feed chamber 13 and into the bale forming chamber 12.

A hydraulic control valve 35 is mounted above the cylinder 29 and is employed to deliver fluid under pressure from a pump or the like (not shown) to the hydraulic cylinder 29 to accomplish the ram movements required in the device of this invention. The control valve includes a manually operable hand lever 36. The inner construction of the valve has not been shown because it does not form an integral part of the present invention. However, the valve 35 does contain a generally longitudinally disposed valve spool 37 which in various longitudinal positions within the housing causes the incoming hydraulic fluid under pressure to be delivered to or exhausted from the cylinder 29 as required for the proper operation of the scrap baler of this invention. The valve spool 37 has a transverse pin 38 near the end thereof adjacent the hand lever 36. A hinge pin 39 joins the lower end of the hand lever 36 to the housing of the valve 35. A yoke 40 forming part of the hand lever 36 at a position above the hinge 39 provides the means for receiving the transverse pin 38. Movement of the hand lever 36 thus causes concurrent movement of the spool. The valve spool 37 is also equipped with an annular groove 41 near the end of the spool remote from the hand lever 36. A support plate 42 is affixed to the valve 35 and provides the means for hingedly supporting a lever 43. The lever 43 is hingedly carried by a pin 43a which passes through the lever and into or through the plate 42. The lower end of the lever 43 is bifurcated in the manner of a yoke as shown at 44. This bifurcated end 44 engages the annular groove 41 in the valve spool 37 and thus when the lever 43 is swung about its hinge pin 43a the valve spool 37 is concurrently moved longitudinally within the body of the valve 35. The valve spool 37 thus may be moved by either the hand lever 36 or the lever 43.

As best shown in FIG. 1 a conduit 45 joins the outer end of the cylinder 29 with the control valve 35. A conduit 46 joins the inner end of the cylinder 29 with the valve 35. Thus when the valve spool is in one position it delivers fluid under pressure to the outer end of the cylinder causing an extension of the piston rod 30 and simultaneously fluid is exhausted from the inner end of the cylinder 29 through the conduit 46 and thence back to the valve 35. Conversely, when the valve spool 37 is in another position fluid under pressure is directed to the inner end of the cylinder and exhausted from the outer end causing a retraction of the bale compressing ram within the elongated baler 10. As shown in FIG. 1 the hand lever is inclined toward the discharge end of the bale-forming chamber and in such position the valve 35 is directing fluid under pressure to the outer end of the cylinder 29 through the conduit 45 and causing the ram to move in its compression stroke. In fact, unless the hand lever is shifted the ram will continue to move in this compression stroke to its maximum extended position such as shown in FIG. 2.

The present invention in addition to being capable of separate operations is concerned with a scrap baler being capable of automatic operation of the ram through a full compression stroke, a successive retraction stroke, and thereafter a stopping of the ram. The cycling of the ram is initially energized by manually inclining the hand lever 36 as shown in FIG. 1. When the hand lever 36 is moved to its position as shown in FIG. 2 the fluid under pressure is rerouted through the conduit 46 to the inner end of the cylinder 29 through the conduit 46 and an exhausting of the fluid from the outer end of the cylinder through the conduit 45. The ram 19 as shown in FIG. 2 is commencing its retraction stroke. The mechanism for causing the hand lever 36 to be shifted from its inclination of FIG. 1 to an opposite inclination of FIG. 2 is accomplished by the mechanically operated lever 43. Longitudinally disposed

control rod 47 is carried in the power mechanism portion 11 of the elongated baler 10 at a position above and generally parallel with the hydraulic cylinder and piston rod 29 and 30. The outer end of the control rod 47 is provided with a fork or clevis 48 which is joined by means of a transverse pin 49 to the upper end of the lever 43. An adjustably positioned collar 50 is provided on the rod 47 for abutting engagement with the outer side of the vertical flange 26. The rod 47 is journally mounted for sliding movement through a suitable aperture in the flange 26. However, the collar 50 is of such a size as not to be permitted movement through the flange but rather is barred from passage by its greater diameter. A fixed collar 51 is mounted on the inner end of the rod 47 at a distance considerably spaced from the collar 50. A coil spring 52 is carried around the rod 47 and has one end thereof in abutting engagement against the face of the fixed collar 51 directed toward the adjustably positioned collar 50. A yieldable collar or sleeve 53 is mounted over the rod 51 and engages the other end of the coil spring 52. The yieldable collar 53 thus is spring extended away from the stationary or fixed collar 51. When the yieldable collar 53 engages the inner face of the vertical flange 26 it causes a compression of the spring 52 thus providing a force accumulator to cause the lever 43 to be completely swung through its necessary movement to cause a reversal of the baler ram when the rod is fully extended in the direction as shown in FIG. 2. The use of the spring 52 avoids a gradual swinging of the lever 43 which could be undesirable.

In the operation of the baler of FIGS. 1, 2 and 3 the hand lever 36 of the hydraulic control valve 35 is manually inclined as shown in FIG. 1 causing the ram 19 to be extended and moved in its compression stroke. As the ram moves into the bale-forming chamber 12 it, of course, carries with it its upper rearward extension 21 and the vertical flange 26 at the end thereof. When the ram is nearing its fully extended position the vertical flange 26 strikes the force accumulating yieldable collar 52 causing the control rod 47 to be moved concurrently with the ram during the last portion of its compression stroke. This causes the lever 43 to be suddenly swung about its hinge mounting 43a. This in turn causes the valve spool 37 to be moved in a longitudinal direction toward the end 27 of the baler thereupon overriding the previously manually positioned hand lever 36 and as the lever 43 is now inclined toward the discharge end of the baler the hand lever 36 is automatically swung so that it is inclined toward the power-supplying end of the baler. In this position of the valve spool the valve 35 is delivering fluid under pressure to the cylinder 29 through the conduit 46 thereupon causing the ram to return to its starting position in a retracting stroke. When the ram is just about to reach its fully retracted position the vertical flange 26 strikes the previously adjusted collar 50 and causes the lever 43 to be moved to an upright or neutral position. This simultaneously puts the hand lever 36 in a neutral position with the sliding spool 37 in a position where there is no fluid under pressure delivered to the hydraulic cylinder 29 but rather the fluid under pressure is bypassed by the control valve in this neutral position back to its source. It will thus be apparent that a single initial inclination of the hand lever 36 is all that is necessary to effect movement of the ram 19 through its compression stroke, through its retraction stroke, and finally coming to rest with all of the mechanism in a neutral condition until such time as operation is again manually effected.

In further explanation of the operation of the baler of FIGS. 1, 2 and 3 scrap material is delivered through the loading opening to chamber 13 in the direction of the arrows 54. The scrap designated by the numeral 57 in an uncompressed condition is thereby positioned forwardly of the vertical front face 20 of the ram 19. When the uncompressed scrap 57 is compressed by the movement of the ram 19 it is thereafter designated by the numeral 58 in the bale-forming chamber 12 as shown in FIG. 2. When this compressed scrap material 58 is sufficient to constitute a bale the operator may tie the bale with encircling strands whereafter the discharge gate 18 may be released permitting the tied bale to move out the end of the

bale-forming chamber in the direction of the arrow 59 as a succeeding bale is started.

A modified form of the invention is shown in FIGS. 4 and 5. In this modification the entire single cycle of operating the ram through a compression stroke, continuing through a retraction stroke, and coming to a complete stop thereafter has been accomplished with merely a hydraulic control valve rather than a combination of a control valve with a mechanical limit-actuating device such as shown in FIGS. 1, 2 and 3. The elongated baler shown in FIG. 4 is identified by the numeral 60 and although it is not shown completely as is the baler of FIGS. 1, 2 and 3, it should be understood that in overall appearance it is substantially identical to that form of the baler shown in FIGS. 1, 2 and 3. The numeral 61 identifies that portion of the baler 60 which houses the power mechanism. An end positioned cross support 62 is provided for the baler 60 at a position opposite to the discharge end of the baler. The cross support 62 corresponds to the cross support 27 of FIGS. 1, 2 and 3. A hydraulic cylinder 63 is disposed in a generally horizontal position having its outer end fastened to the cross support 62 in the same manner as the cylinder 29 is fastened to the cross support 27. The hydraulic cylinder is provided with a piston 64 which is best shown in FIG. 5. The piston 64 has a piston rod 64a extending outwardly therefrom for fastening to a reciprocating ram used in the baling operation.

A special hydraulic control valve 65 is mounted over the cylinder 63 at a position near the end wall 62. It is this control valve that directs fluid under pressure to cause each movement of the reciprocating ram individually, or provides for the movement of the ram through a full cycle prior to coming to a halt merely upon an initial actuation of the control valve by an operator. The control valve 65 includes a pair of side-by-side longitudinally disposed valve spools 66 and 67. A first hand lever 68 is in engagement with the valve spool 66 and a manual movement thereof causes corresponding longitudinal movement of the spool 66. A second hand lever 69 is connected to the spool 67 and when that hand lever 69 is arcuately shifted the spool 67 is correspondingly moved in a longitudinal direction.

A combined motor and pump 70 provides for the delivery of fluid under pressure to the hydraulic control valve 65. A reservoir 71 stores a supply of hydraulic fluid. The reservoir provides for delivery of fluid to the pump where it is placed under pressure and delivered to the control valve 65 for distribution in a particular manner to effect desired movements. The reservoir 71 also receives exhaust fluids from the control valve 65. A pilot operated check valve 72 is provided in the circuit closely adjacent the control valve 65 and insures the passage of fluid under pressure to the cylinder 63 but prevents unwarranted return of that fluid under pressure to the control valve once the fluid passes the check 72. The circuit includes an electrical switch 73 for energizing the motor 70 when the operator desires it to be placed in operation.

The control valve 65 is joined to the various operating parts by a plurality of flexible conduits. A conduit 74 joins the valve 65 to the reservoir 71. A conduit 75 joins the valve to the pump 70. A conduit 76 joins the valve 65 to the check valve 72. A conduit 77 joins the valve 65 to the outer end of the hydraulic cylinder 63. A conduit 78 joins the control valve 65 to the inner end of the hydraulic cylinder 63. As best shown in FIG. 5 a bypass conduit 79 joins the control valve to the conduit 77 beyond the check valve 72. A second bypass conduit 80 joins the control valve 65 to the conduit line 78.

In the operation of the modified device of FIGS. 4 and 5 the operator may optionally separately move either of the hand levers 68 and 69 to effect separate operations of the ram in its compression stroke or its retraction stroke. However, if the operator swings both hand levers 68 and 69 simultaneously to a ram-operating position the hydraulic circuit of FIGS. 4 and 5

is arranged and constructed so that the ram will proceed through its full compression stroke and at the finish of that stroke through the arrangement of the control valve, the hand lever 68 will automatically return to neutral and the previously inclined hand lever 69 will now cause the ram to move through its retraction stroke whereupon at the end of that stroke the hand lever 69 will automatically swing to a neutral position. It should thus be evident that the device of FIGS. 4 and 5 operates to produce the same result as that shown and described for the device of FIGS. 1, 2 and 3 but in the present modified device the shifting from compression stroke to a retraction stroke operation and from a retraction stroke operation to neutral or stop is accomplished entirely by the hydraulic control valve 65 and its accompanying arrangement of conduits and including the pilot-operated check valve.

Various details of construction may be made without departing from the principles of this invention. In both modifications of the invention as described in detail the operator may manually operate the ram through any portion of its operating cycle or bring the ram to a halt. In both modifications also the operator may, upon giving the device an initial actuation, have the ram move through the complete single cycle of compression stroke, retraction stroke, and stop.

I claim:

1. A baler having a reciprocating material compressing ram, A. hydraulic power means for effecting ram reciprocation, including

1. a hydraulic control valve,

a. hand-operated lever means on said hydraulic control valve

2. a hydraulic cylinder and piston arranged and constructed to cause movement of the baler ram upon changes in the relative positions of the cylinder and piston,

3. conduit means joining said hydraulic control valve and said hydraulic cylinder and piston,

whereby the hand-operated lever means may be manually actuated to effect separate operation of the ram through its compression stroke, or its retraction stroke, or bringing it to a complete halt, and

B. means associated with said hydraulic control valve automatically effecting a single complete cycle of ram operation after instigating initial operation of the hand-operated lever means,

whereby the ram will travel through its compression stroke, through its retraction stroke and come to a stop automatically,

1. mechanical linkage means superimposed on the operation of the hydraulic control valve,

a. a hinged lever on the control valve separate from the hand-operated lever means but acting on arcuate shifting movement to effect a change in the control valve setting in the same manner as with the hand-operated lever means, and

b. means associated with said hinged lever ((B-1-a) to effect automatic shifting movement thereof by movements of the baler ram,

1. a rod having one end fastened to the hinged lever (B-1-a) and the other end passing through a portion of the baler ram, and

2. first and second collar means on the rod disposed on each side of the portion of the baler ram through which the rod passes,

whereby the second collar means acts to shift the control valve from its compression stroke to its retraction stroke and the first collar means acts to shift the control valve from its retraction stroke to a neutral position.

2. A baler as set forth in claim 1 in which the means (B-1-b) includes a spring force accumulator with said second collar means to cause full and prompt swinging movement of said hinged lever.