

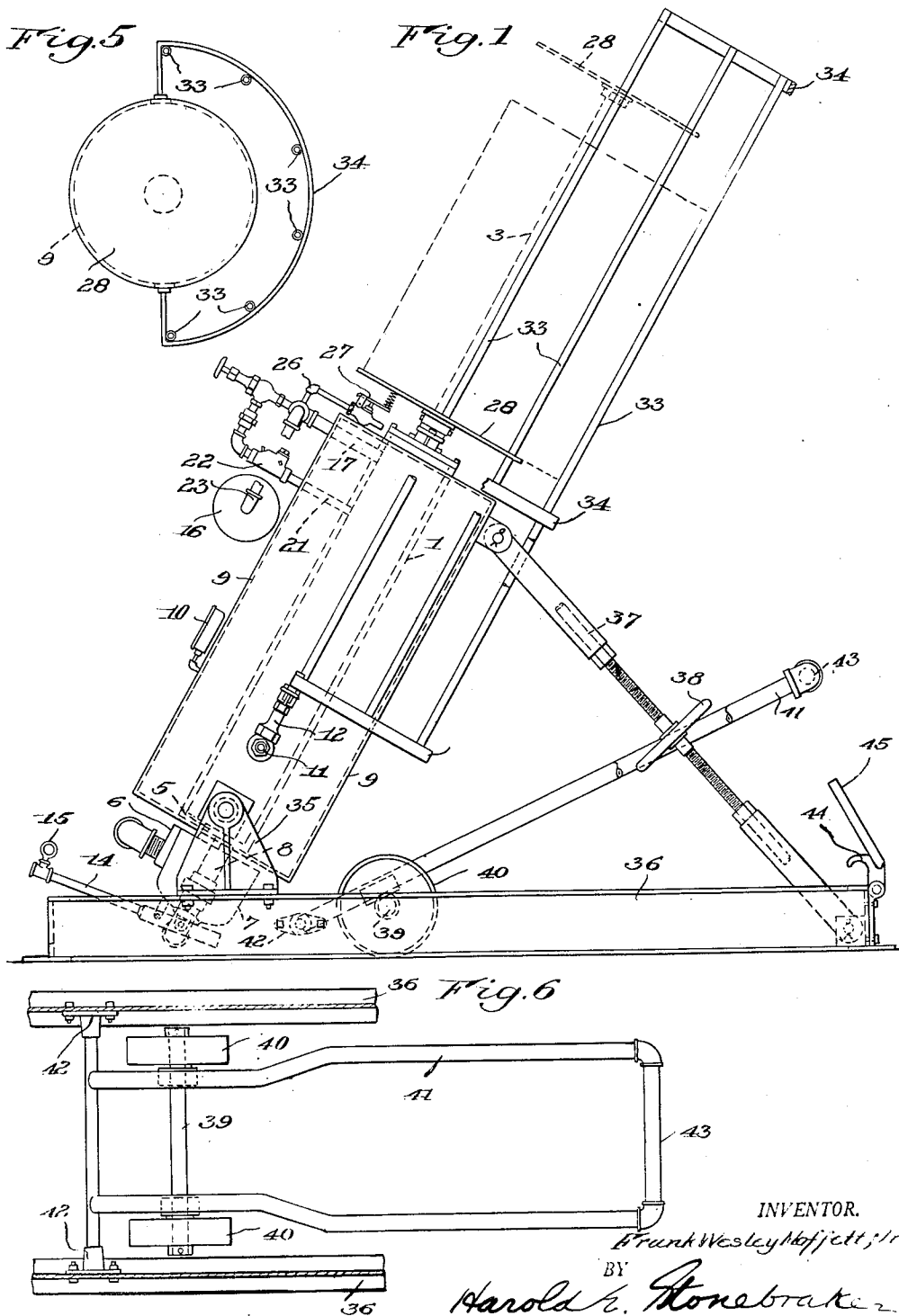
April 10, 1951

F. W. MOFFETT, JR
PRESSURE FLUID OPERATED APPARATUS
FOR THROWING HEAVY OBJECTS

2,548,439

Filed Jan. 19, 1948

3 Sheets-Sheet 1



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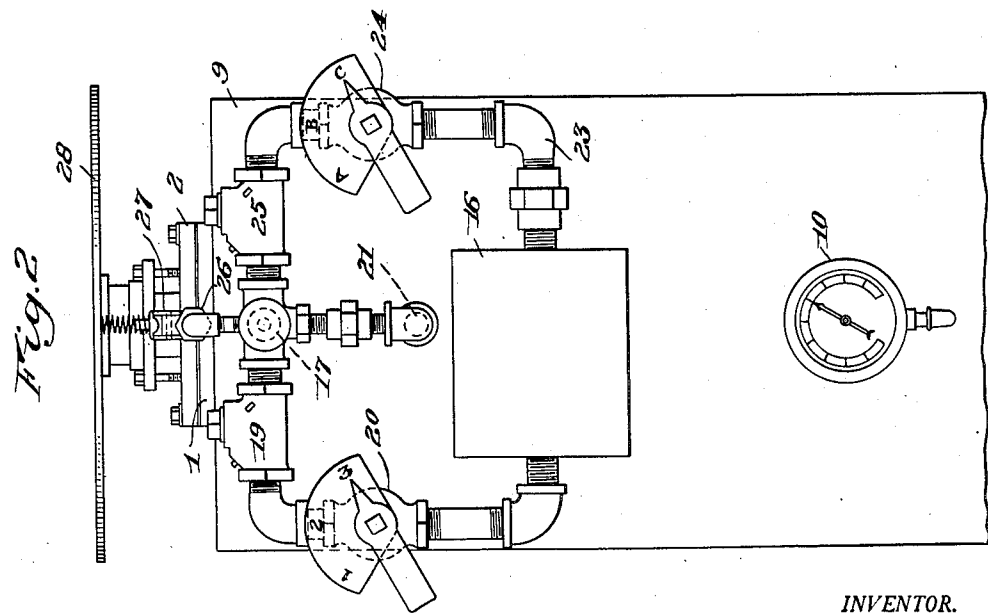
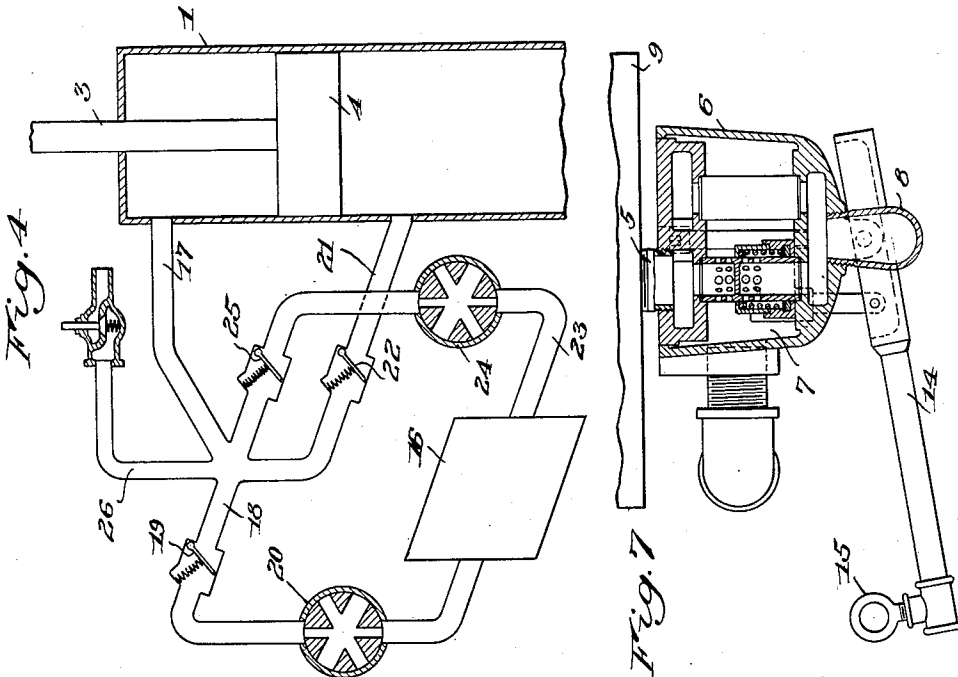
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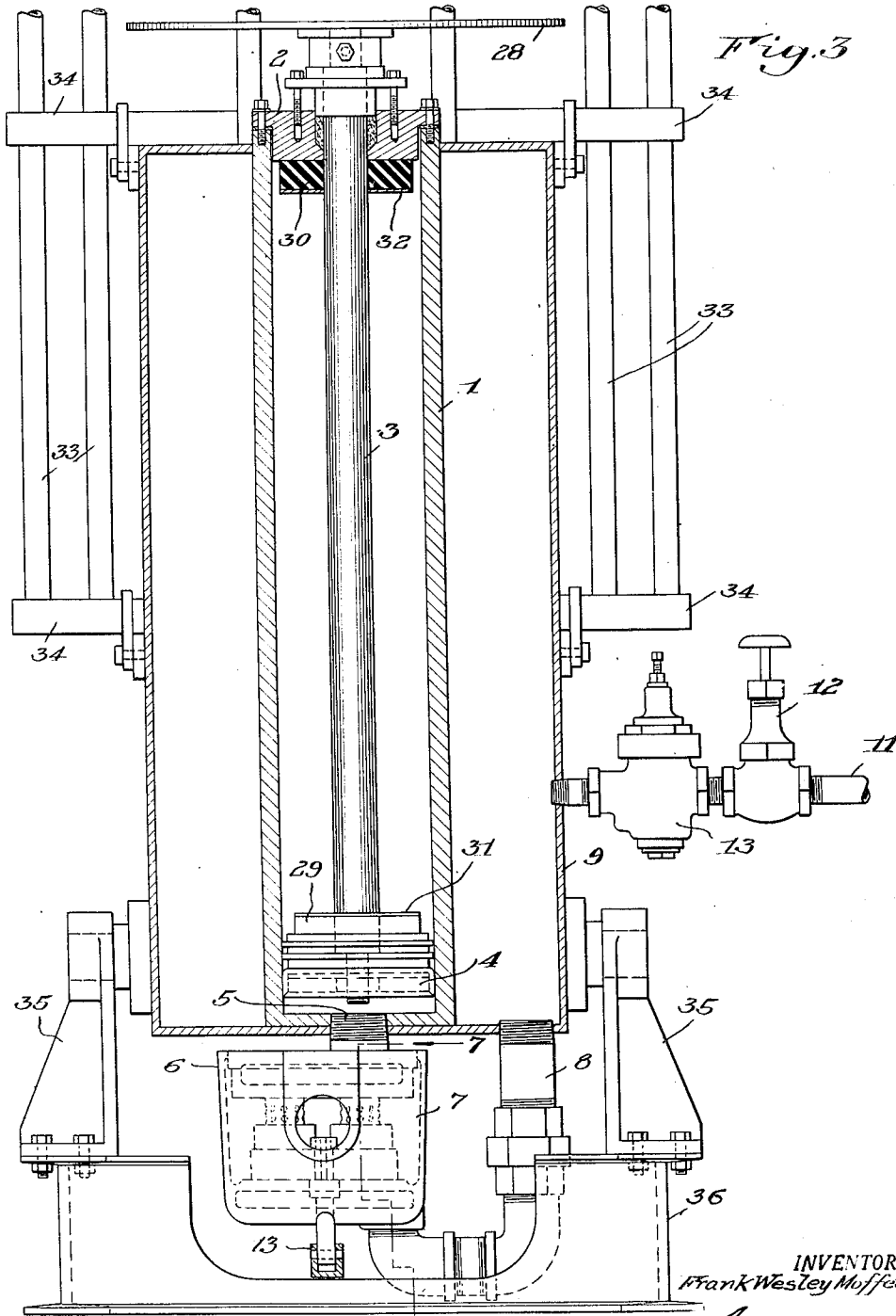
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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PRESSURE FLUID OPERATED APPARATUS FOR THROWING HEAVY OBJECTS

Frank Wesley Moffett, Jr., Gates, N. Y.

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6 Claims. (Cl. 121—38)

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This invention relates to a catapult, with more particular reference to mechanism for throwing a bale of hay upwardly or laterally at a selected angle and in a selected direction, as for instance into a barn or loft or tossing other heavy objects upwardly or laterally, and it has for its purpose to afford a practical and efficient mechanism that can be easily controlled and operates to project a bale of hay or other object upwardly or laterally with little effort on the part of the operator.

More specifically the invention is intended to afford a mechanism operated by air under pressure and so designed that the pressure operates almost instantly to project a bale or other object for the desired distance at sufficient velocity to insure a quick and satisfactory operation.

A further purpose of the invention is to provide a machine in which the vertical angle and direction in which the bale or other object is delivered can be readily varied and the required adjustments can be easily made while operating with different air pressures.

More specifically the invention includes a bale or object carrier mounted on a piston rod which carries a piston that travels in a cylinder and is movable under air pressure, and an additional purpose of the invention is to afford a means whereby the piston is moved quickly in the cylinder against the resistance of the load and is effectively cushioned at the end of its operative stroke, the piston being also completely restored automatically to its initial position after the bale has been delivered.

A further purpose of the invention is to afford in conjunction with a cylinder and piston operated by air pressure, an air-balancing chamber in communication with the cylinder and acting during the operative stroke of the piston to receive from the cylinder a charge of air under pressure which functions to cushion the movement of the piston at the end of its operative stroke and also to return the piston to initial position when the air pressure supply has been cut off from the cylinder upon completion of an operative stroke of the piston, while an additional purpose is to insure return of the piston quickly and completely to its initial position.

Another object of the invention is to afford a structure that can be manufactured at a reasonable cost and involves comparatively few parts, the entire assembly being of compact form, and lending itself readily for use as a portable apparatus that can be moved about from place to place to enable farmers rapidly to load bales of hay from the ground or from a truck into a

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barn or higher level, or from the floor of a barn to a loft or higher elevation where the bales are to be stored, and to deliver bales accurately to any selected position without the use of endless or other types of conveyors traveling with the object to its destination point.

To these and other ends, the invention consists in the construction and arrangement of parts that will appear clearly from the following description when read in conjunction with the accompanying drawings, the novel features being pointed out in the claims following the specification.

In the drawings:

Fig. 1 is a view in side elevation illustrating a preferred embodiment of the invention and showing the object carrier in lowered position;

Fig. 2 is a view in front elevation of the same;

Fig. 3 is a transverse vertical sectional view taken centrally of Fig. 2, with parts broken away;

Fig. 4 is a diagrammatic view illustrating the relation between the cylinder and air-balancing chamber which governs cushioning of the piston and effects its return to initial position;

Fig. 5 is a plan view of the upper end of the apparatus, showing the bale supporting and guiding frame and carrier;

Fig. 6 is a plan view of the wheeled frame with the remaining mechanism broken away, and

Fig. 7 is a detail sectional view of the valve.

Referring more particularly to the drawings in which like reference numerals refer to the same parts throughout the several views, the mechanism herein disclosed, which is intended only as illustrative of one practical embodiment of the invention, includes an air cylinder 1 closed at the top by means of the cylinder head 2, while 3 designates a piston rod extending through the cylinder head 2 and movable in the cylinder 1, the piston rod being provided at its lower end with a piston 4 that is moved in the cylinder 1 by air pressure, as will appear presently.

At its lower end, the cylinder 1 is provided with an inlet pipe 5 that connects with a valve housing 6 and a quick-opening valve 7 that may be of any conventional form suitable for supplying a large volume of air under pressure quickly such as a "Quick-As-Wink" valve manufactured by C. B. Hunt & Son, Inc., Salem, Ohio. The valve housing 6 communicates by means of the pipe 8 with the air pressure chamber 9 located in close proximity to the cylinder 1 and preferably formed by a cylindrical housing surrounding and spaced from the cylinder 1, as shown. It is important that the valve 7 be adjacent to the lower end of the cylin-

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der 1 and also that the air pressure chamber 9 be in close proximity to the cylinder 1 and valve 7, so that when the control valve is opened, the required pressure will be transferred instantly to the cylinder 1 and effect a high velocity quick movement of the piston and piston rod on which the bale carrier is mounted.

While the air pressure chamber 9 is shown as surrounding the cylinder 1 affording a practical and compact arrangement, this disposition is not indispensable to the operation of the invention as long as the compressed air chamber 9 is adjacent to or in such close proximity to the cylinder 1 as to insure instantaneous transfer of the required air pressure to the cylinder when the valve is opened. 10 designates a pressure indicator, see Fig. 2, connected to air chamber 9 and operating to show the air pressure and thereby to indicate the distance through which the object can be projected. 11 designates a pipe leading from the air pressure chamber 9 to any suitable air compressor, 12 designates a manual control valve in the air line 11, and 13 is a pressure regulating valve disposed in the air line 11 and operative to maintain any desired pressure in the pressure chamber 9.

The control valve 7 carries and is operated by a weighted handle 14 which is normally in lowered position, as in Fig. 7, to hold the valve 7 closed and is manually elevated to open the valve and thereby permit movement of air into the cylinder 1 and consequent operation of the piston 4 upwardly. To effect this, the weighted handle 14 may be provided with a ring 15 at its outer end to which a rope can be fastened, the other end of the rope being carried over a suitable elevated support and arranged with its free end accessible to the operator, who by pulling on the rope raises handle 14 and opens the valve to operate the mechanism, and upon release of the handle 14, the latter is restored to initial position by its own weight and thereby closes the valve, permitting the piston and bale carrier to be restored to their initial positions, as will now be described.

When the piston is moved upwardly under a pressure sufficiently high to project or throw a bale upwardly the required distance, which may be forty feet or more with a bale weighing from sixty to one hundred and twenty-five pounds, it is important to provide means for cushioning the upward movement of the piston at the end of its operative stroke and also for returning the piston to initial position when the air pressure supply is cut off, and this is accomplished by an air-balancing chamber in communication with the upper end of the cylinder 1.

This air-balancing chamber which functions both to absorb the shock of the piston on its upstroke and to store a supply of air under pressure that will return the piston, is designated at 16, being preferably supported on the front of the housing 9, and 17 designates a conducting pipe leading from a point adjacent to the upper end of the cylinder 1 to an inlet pipe 18, which contains a check valve 19, adjustable port valve 20, and connects with the air-balancing chamber 16. As a consequence of this arrangement, as the piston 4 travels upwardly and approaches the upper end of the cylinder 1, the air pressure in front of piston 4 is forced through pipes 17 and 18, past the check valve 19 and port valve 20 into the air-balancing chamber 16 where a pressure is built up which cushions the final movement of the piston and returns it at the proper time.

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21 designates an additional conducting pipe leading from a point below the pipe 17, as indicated, past a check valve 22 and thence into inlet pipe 18 and to the air-balancing chamber 16 in the manner previously described, so that after the piston 4 during its operative travel passes the point where pipe 21 connects with the cylinder 1, the air pressure in the cylinder 1 below piston 4 will travel through pipe 21, past check valve 22 to the conducting pipe 18 and to the upper end of the cylinder above the piston and also to inlet pipe 18 and to the air-balancing chamber 16 in the manner already described. Thus the pressure from pipe 21 assists in building up the necessary pressure in the air-balancing chamber 16, cushioning the upward travel of the piston and assisting in returning the piston 4 when the control valve 7 is closed and the pressure below piston 4 thus relieved and reduced below the pressure of the balancing chamber 16. Thereupon the air pressure in balancing chamber 16 returns through pipe 23, adjustable port valve 24, and past check valve 25 to pipe 17 into the cylinder 1 at a point above the piston and the pressure thus effective from the air-balancing chamber 16 is sufficient when the control valve 7 is closed to force the piston 4 downwardly and restore it to initial position.

The port valves 20 and 24 are provided with a plurality of ports of varying size and are adjustable to regulate the amount of air passing there-through depending on the air pressure in the pressure chamber 9, and as the pressure is increased, the valves 20 and 24 may be adjusted to restrict the amount of air by smaller ports as required.

When the piston 4 approaches and reaches the limit of its downward travel, it is desirable to prevent a vacuum forming above the piston so as to insure its complete return to initial position and also insure reducing any pressure above the piston to atmospheric pressure, and this is accomplished by a pipe 26 leading from the pipe 17 and communicating with the atmosphere, the pipe 26 being provided with a valve that is normally closed and is operated by a pivoted lever 27 lying in the path of the object or bale carrier 28 that is mounted at the upper end of the piston rod 3, so that when the object carrier 28 reaches its lowermost position, it engages and operates the lever 27 to open the valve in pipe 26 to the atmosphere. This reduces any pressure above the piston to atmospheric pressure and if any vacuum exists in the cylinder 1 above piston 4 that is not automatically broken, the valve can be operated by hand to break such vacuum, and thus insure complete return of the piston to its initial position.

The final contact between piston 4 and the cylinder head 2 is cushioned by means of resilient or rubber disks or elements 29 and 30 mounted on the piston and cylinder head respectively and preferably provided with metal plates 31 and 32 on their opposed surfaces to prevent sticking of the rubber disks when they come in contact with each other.

When a bale is positioned on the carrier 28, it is maintained by means of a supporting and guiding frame consisting of a series of parallel rods 33 partially surrounding the path of movement of carrier 28 and suitably attached to semi-circular supporting bars 34 which are rigidly secured to the housing forming chamber 9 in any suitable manner.

The parts thus far described are preferably

mounted for vertical adjustment on a portable carrier, and to this end the housing 9 is pivotally mounted on trunnions 35 carried by a frame 36, while 37 designates an adjustable turn-buckle connected at its lower end to the frame 36 and at its upper end to the housing 9, and by turning the hand wheel 38, the vertical angular position of the housing and bale carrier can be varied to meet any particular requirements.

To provide portability of the frame 36 and permit horizontal adjustment, the frame is pivotally supported on an axle 39 which carries ground wheels 40, and 41 is an adjusting frame pivotally attached at 42 to the front end of the frame 36 and extending over and resting upon the axle 39. Thus by pressing downwardly on the handle 43, the forward end of the frame 36 can be lifted slightly from the ground and the mechanism can then be moved along on the wheels 40 to any desired position. The handle 43 and frame 41 can be held in such lowered position by means of the latch member 44 pivoted to the frame 36 and controlled by the operating portion 45 to retain the handle 43 in its lowered position.

It will be understood that when the mechanism is positioned at the desired point, the pipe 11 may be connected with the air compressor by a flexible hose or otherwise and the air compressor may be arranged or mounted on a truck for conveniently transporting it, as desired.

The operation of the mechanism briefly is as follows: Assuming that the device has been moved to a particular location for convenient loading of bales of hay or other objects and adjusted to the desired vertical angle, with communication established to a source of air pressure at for instance from fifty to two hundred pounds per square inch, although higher pressures may be used, with the bale carrier 28 in lowered position, a bale is placed on the carrier resting against the rods 33 of the supporting and guiding frame. Thereupon the handle 14 is elevated to open valve 7, permitting a rush of air under pressure to move quickly from chamber 9 into the cylinder 1 below the piston 4, which is thereby quickly elevated. As the piston 4 moves upwardly under impulse of the high pressure, it throws the bale upwardly to a distance of forty feet or more to the desired point, depending on the air pressure used and upon the angle at which the mechanism is adjusted. During upward movement of the piston 4, the air thereabove is forced under pressure into the air-balancing tank 16 and pressure below the piston 4 also travels to a point above the piston and to the air-balancing tank 16 as the piston approaches its upper limit of travel, thus cushioning the movement of the piston 4 at the end of its upward stroke and preventing its striking the cylinder head with a destructive force. When the main control valve 7 is closed by release of the handle 14, air pressure below piston 4 is immediately exhausted and the greater pressure of air in the balancing chamber 16 passing to the upper side of the piston 4 returns the latter quickly to its initial position. As the carrier 28 reaches its lowermost position, the valve lever 27 is operated to open the valve and establish communication between the cylinder 1 at a point above the piston 4 and the atmosphere, thus insuring movement of the piston to its lowermost position and adjustment of pressure above the piston to atmospheric pressure.

While the invention has been described with reference to the particular arrangement herein disclosed, this application is not confined to the

details illustrated, and is intended to cover such modifications or departures as may come within the purposes of the invention and the scope of the following claims.

I claim:

1. Apparatus for throwing heavy objects comprising a cylinder, a compressed air operated piston and piston rod movable in the cylinder, an object carrier mounted on the piston rod above the cylinder, an air pressure supply pipe communicating with the lower end of the cylinder and affording a body of air under the piston, a compressed air chamber connected with said supply pipe, a control valve adjacent the lower end of the cylinder and operative to admit air pressure to said cylinder beneath the piston, the air pressure operating to move the piston instantly to the upper end of the cylinder when said control valve is opened, an air-balancing chamber in close proximity to the upper end of the cylinder, inlet and return pipes leading from the air-balancing chamber to the cylinder at a point adjacent the top thereof, a second inlet pipe leading to the air-balancing chamber from the cylinder at a point beneath the piston when the latter is approaching its uppermost position, and a check valve in said second inlet pipe permitting flow there-through from the cylinder to the air-balancing chamber.

2. Apparatus for throwing heavy objects comprising a cylinder, a compressed air operated piston and piston rod movable in the cylinder, an object carrier mounted on the piston rod above the cylinder, an air pressure supply pipe communicating with the lower end of the cylinder and affording a body of air under the piston, a compressed air chamber connected with said supply pipe, a control valve in said supply pipe operating to admit compressed air to the cylinder beneath the piston, an air-balancing chamber in close proximity to the upper end of the cylinder, a conducting pipe leading from the cylinder at a point adjacent the top thereof, an inlet pipe leading from said conducting pipe to the air-balancing chamber, a return pipe leading from the air-balancing chamber to said conducting pipe, check valves in said inlet and return pipes acting to permit flow toward and away from the air-balancing chamber respectively, and means for varying the rate of flow through said inlet and return pipes including a port valve in one of said pipes.

3. Apparatus for throwing heavy objects comprising a cylinder, a compressed air operated piston and piston rod movable in the cylinder, an object carrier mounted on the piston rod above the cylinder, an air pressure supply pipe communicating with the lower end of the cylinder and affording a body of air under the piston, a compressed air chamber connected with said supply pipe, a control valve located adjacent to the bottom of the cylinder in said supply pipe and acting to admit air pressure from said supply pipe to the cylinder beneath the piston, the air pressure operating to move the piston instantly to the upper end of the cylinder when said control valve is opened, an air-balancing chamber in close proximity to the upper end of the cylinder, a conducting pipe leading from the cylinder at a point adjacent the top thereof, an inlet pipe leading from said conducting pipe to the air-balancing chamber, a return pipe leading from the air-balancing chamber to said conducting pipe, means for varying the rate of flow to and from the air-balancing chamber including a port valve

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located in one of said inlet and return pipes, check valves in said inlet and return pipes permitting flow toward and from the air-balancing chamber respectively, a second inlet pipe leading to the air-balancing chamber from the cylinder at a point beneath the piston when the latter is approaching its uppermost position, and a check valve in said second inlet pipe permitting flow therethrough from the cylinder to the air-balancing chamber.

4. Apparatus for throwing heavy objects comprising a cylinder, a compressed air operated piston and piston rod movable in the cylinder, an object carrier mounted on the piston rod above the cylinder, an air pressure supply pipe communicating with the lower end of the cylinder and affording a body of air under the piston, a compressed air chamber connected with said supply pipe, a control valve located adjacent to the lower end of the cylinder and acting to admit air pressure from said supply pipe to the cylinder beneath the piston, the air pressure operating to move the piston instantly to the upper end of the cylinder when said control valve is opened, an air-balancing chamber, an inlet pipe leading from a point adjacent to the top of the cylinder to said air-balancing chamber, a return pipe leading from said air-balancing chamber to said inlet pipe, a second inlet pipe leading from the cylinder at a point beneath said first mentioned inlet pipe and communicating with said air-balancing chamber, check valves in said first mentioned inlet pipe and return pipe permitting flow to and from the air-balancing chamber respectively, means for varying the rate of flow to and from the air-balancing chamber including a port valve in one of said first mentioned inlet and return pipes, and a check valve in said second inlet pipe permitting flow therethrough from the cylinder to the air-balancing chamber.

5. Apparatus for throwing heavy objects comprising a cylinder, a compressed air operated piston and piston rod movable in the cylinder, an object carrier mounted on the piston rod above the cylinder, an air pressure supply pipe communicating with the lower end of the cylinder, a control valve located adjacent to the lower end of the cylinder, an air-balancing chamber, an inlet pipe leading from a point adjacent to the top of the cylinder to said air-balancing chamber, a return pipe leading from said air-balancing chamber to said inlet pipe, check valves in said inlet and return pipes permitting flow toward and from the air-balancing chamber respectively, a second inlet pipe leading from the cylinder at a point beneath said first mentioned inlet pipe and communicating with said air-balancing chamber,

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a check valve in said second inlet pipe permitting flow therethrough from the cylinder to the air-balancing chamber, a pipe leading from said first mentioned inlet pipe to the atmosphere, a normally closed valve in said last mentioned pipe, and means operated by said object carrier when it reaches its lowermost position acting to open said valve and permit communication of the cylinder above the piston with the atmosphere.

6. Apparatus for throwing heavy objects comprising a cylinder, a compressed air operated piston and piston rod movable in the cylinder, an object carrier mounted on the piston rod above the cylinder, an air pressure supply pipe communicating with the lower end of the cylinder, a control valve located adjacent to the bottom of the cylinder, an air-balancing chamber, an inlet pipe leading from a point adjacent to the top of the cylinder to said air-balancing chamber, a return pipe leading from said air-balancing chamber to said inlet pipe, a second inlet pipe leading from the cylinder at a point beneath said first mentioned inlet pipe and communicating with the air-balancing chamber, check valves in said first mentioned inlet and return pipes permitting flow to and from the air-balancing chamber respectively, a check valve in said second inlet pipe permitting flow therethrough from the cylinder to the air-balancing chamber, means for varying the rate of flow to and from the air-balancing chamber including a port valve in one of said first mentioned inlet and return pipes, a pipe leading from said first mentioned inlet pipe to the atmosphere, a normally closed valve in said last mentioned pipe, and means operated by said object carrier when it reaches its lowermost position acting to open said valve and permit communication between the cylinder above the piston and the atmosphere.

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