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Lamorte et al.

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[45] **Feb. 12, 1974**

[54] **APPARATUS FOR COMPACTING MATERIAL**

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[21] Appl. No.: **120,609**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 818,332, April 22, 1969, abandoned.

[52] **U.S. Cl.** **100/179**, 100/49, 100/256, 100/257, 100/295

[51] **Int. Cl.** **B30b 15/18**

[58] **Field of Search** ..... 53/124 B, 124 E; 141/313–317, 81, 249; 425/145, 381, 4 GS; 100/49, 215, 295, 179, 257, DIG. 5

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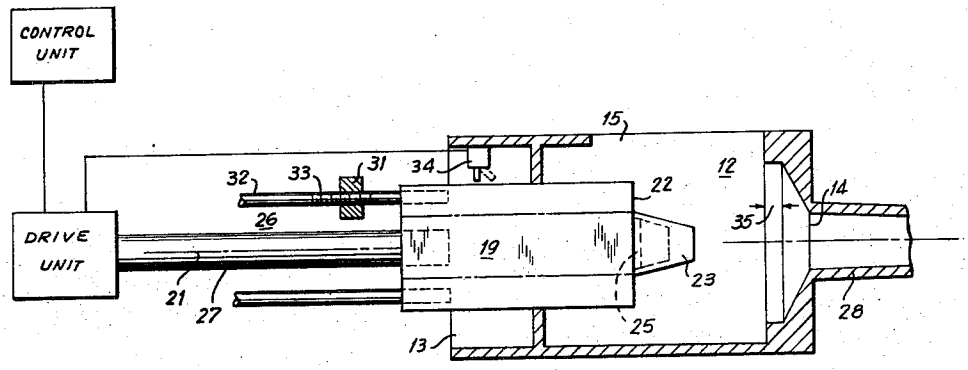
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[57] **ABSTRACT**

The ram of apparatus for compacting material has a head surface movable into proximity with an outlet duct of a receptacle for the material and a nose coaxially positioned on the head surface and extending forward ahead of the head surface for passing into the outlet duct. An adjustable switch controls the driving movement of the ram and thereby varies the compaction ratio.

11 Claims, 7 Drawing Figures

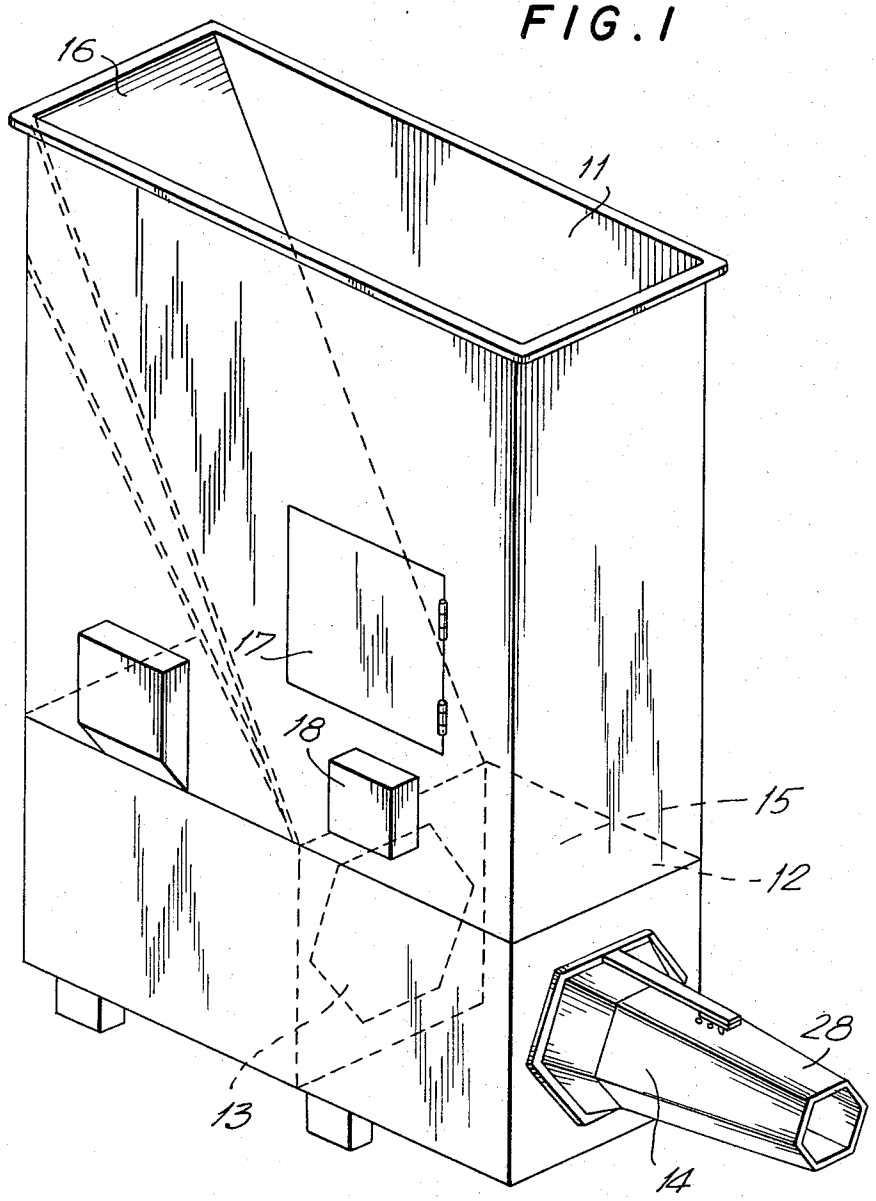


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SHEET 1 OF 2

FIG. 1



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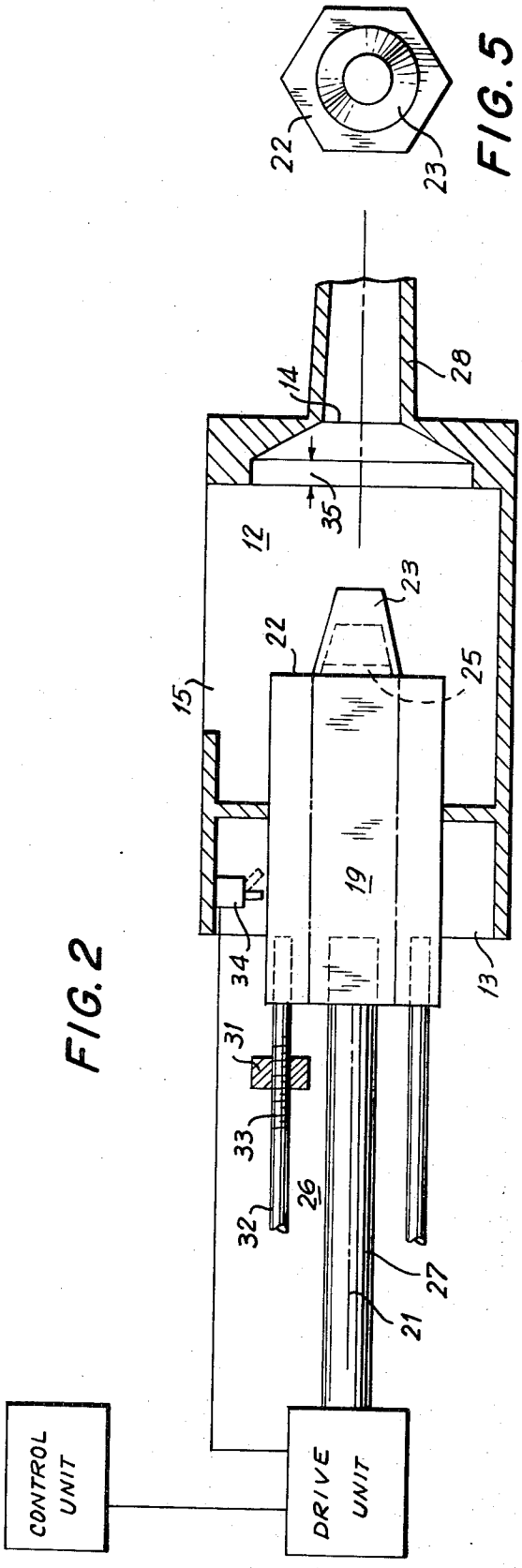


FIG. 2

FIG. 5

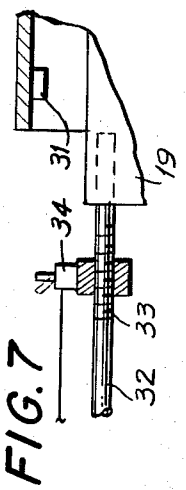


FIG. 7

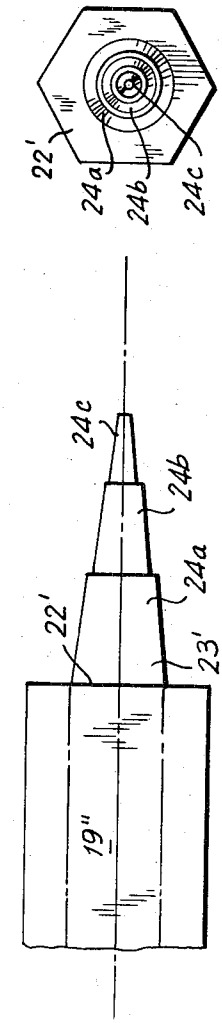


FIG. 4

FIG. 6

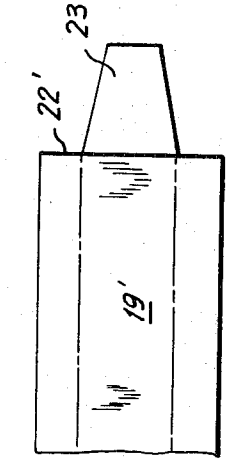


FIG. 3

APPARATUS FOR COMPACTING MATERIAL

DESCRIPTION OF THE INVENTION

The present invention relates to apparatus for compacting material and is a continuation-in-part of copending patent application Ser. No. 818,332, filed Apr. 22, 1969 for Apparatus for Compacting Material, and now abandoned. More particularly, the invention relates to apparatus for compacting waste material such as, for example, garbage, refuse, and the like.

The principal method of disposal of garbage, trash, refuse, waste, and the like in large apartment buildings is by burning in incinerator plants in such buildings. The incinerators create problems of fire hazard, air pollution, mischievous destruction of valuable items by children and constant maintenance of the incinerator equipment especially due to the feeding of noncombustible material to said incinerators. When garbage and the like is not incinerated on the premises, it is hauled to incinerating sites by truck. The waste material is bulky and occupies considerable space in the trucks, although each truck usually includes general compacting equipment which reduces the bulk of the trash to about one third.

The receptacle or compaction area or chamber decreases in cross-sectional area toward the outlet duct, so that the amount of refuse in the conical portion of the receptacle is directly proportional to the magnitude of force required to extrude the refuse via said outlet duct. Therefore, the more the material in the conical portion of the receptacle, the greater the pressure requirements and the greater the compaction.

The principal object of the present invention is to provide new and improved apparatus for compacting material.

An object of the present invention is to provide apparatus for compacting material, which apparatus provides greater compacting force due to a smaller forward compacting area.

An object of the present invention is to provide apparatus for compacting material, which apparatus controls the density of compaction.

An object of the present invention is to provide apparatus for compacting material, which apparatus controls the density of compaction by regulating the depth to which the ram penetrates the receptacle.

An object of the present invention is to provide apparatus of simple structure for compacting material with efficiency, effectiveness and reliability.

An object of the invention is to provide apparatus for compacting waste material to facilitate trucking without the hazards of fire or air pollution.

In accordance with the present invention, apparatus for compacting material comprises a receptacle having inlet and outlet ducts. A supply arrangement opening into the receptacle supplies material to be compacted to the receptacle. A ram having an axis is movably mounted for movement through the inlet duct of the receptacle and in the receptacle in directions along the axis to and from the outlet duct of the receptacle. The ram has a head surface movable into proximity with the outlet duct for compacting material into the receptacle and a nose coaxially positioned on the head surface and extending ahead of the head surface. Driving apparatus coupled to the ram drives the ram in axial direction until the nose thereof passes into the outlet duct and withdraws the ram in opposite axial direction to the inlet duct. A penetration control adjusts the extent of movement of the ram in the receptacle to vary the compaction ratio of the material compacted by the ram. An outlet at the outlet duct is for the material compacted by the ram.

A control system connected to the supply arrangement, the driving apparatus and the outlet controls the driving apparatus to withdraw the ram to the inlet duct, controls the supply arrangement to supply material to the receptacle while the ram is withdrawn, controls the driving apparatus to move the ram into the receptacle to the outlet duct when the receptacle has a determined amount of material in it and controls the outlet to provide the compacted material at the outlet duct upon withdrawal of the ram.

The penetration control comprises an adjustable switch having an actuating component coupled to the ram and a switch component mounted in the receptacle, or vice versa. The actuating component of the adjustable switch comprises a cam movable in directions parallel to the axis of the ram and the switch component of the adjustable switch controls the operation of the driving apparatus.

The compaction requirements are met, because of the difference in waste material disposed in each type of building, by varying the stroke of the ram and therefore varying the rate of compaction required. Although a timing cam controls the forward and return strokes by cycles, the adjustable switch of the invention controls the distance of movement of the ram into the receptacle.

In order that the present invention may be readily carried into effect, it will now be described with reference to the accompanying drawings, wherein:

FIG. 1 is a perspective view of an embodiment of the apparatus of the present invention for compacting material;

FIG. 2 is a view, partly in section, of an embodiment of a ram of the apparatus of the present invention for compacting material;

FIG. 3 is a view of another embodiment of a ram of the apparatus of the present invention for compacting material; and

FIG. 4 is a view of still another embodiment of a ram of the apparatus of the present invention for compacting material.

FIG. 5 is an axial end view of the ram **19**, showing the head surface **22** and nose **23** of FIG. 2;

FIG. 6 is an axial end view of the ram **19''**, showing the head surface **22'** and noses **24***a*, **24***b*, and **24***c* of FIG. 4; and

FIG. 7 is a view of the switch with the cam **31** mounted in the receptacle and the electrical switch **34** mounted on the ram.

In FIG. 1, a cabinet or housing **11** includes a receptacle **12**, as shown in FIG. 2. The receptacle **12** has an inlet duct **13** and an outlet duct **14**, as shown in FIG. 2. A supply arrangement opens into the receptacle **12** through the top **15** of said receptacle (FIG. 2) to supply material to be compacted to said receptacle.

The supply arrangement may comprise any suitable equipment for supplying material, under control, to the receptacle **12**. Thus, the supply arrangement of the embodiment of FIG. 1 comprises a chute **16** (FIG. 1) which may be varied in elevation, as shown by broken lines, by any suitable control means, not shown in the

FIGS. The material to be compacted may be supplied to the receptacle 12 by any suitable supply arrangement such as, for example, a side door 17.

A photosensitive control device 18 (FIG. 1) of any known type may be utilized to actuate the operation of a ram 19 (FIG. 2) when the receptacle contains a suitable amount of material. The ram 19 is movably mounted (FIG. 2) for movement through the inlet duct 13 of the receptacle 12 and in the receptacle in directions along its axis 21 to and from the outlet duct 14 of said receptacle.

The ram 19 has a head surface 22 movable into proximity with the outlet duct 14 for compacting material in the receptacle 12. The head surface 22 is of conical configuration, but may be of planar configuration, such as in the embodiments of FIGS. 3 and 4. In the embodiment of FIG. 4, the head surface 22' is of planar configuration, as is that of the embodiment of FIG. 3, but may be of conical configuration, as shown by broken lines 22''.

The head surface 22 of the ram 19 is thus of axially symmetrical geometrical configuration. The head surface 22 also has a periphery of axially symmetrical geometrical configuration. The periphery of the head surface 22 is circular, triangular, square pentagonal, hexagonal, or the like. Thus the periphery of the head surface 22 of the ram 19 of the embodiment of FIG. 1 is hexagonal and fits snugly through the hexagonal inlet duct 13 of the receptacle 12.

A nose 23 is coaxially positioned on the head surface 22 of the ram 19 and extends ahead of said head surface (FIG. 2). The nose 23 is of frustoconical configuration, but may be of any sutable axially symmetrical polygonal geometrical configuration such as, for example, cylindrical or pyramidal configuration.

In the embodiment of FIG. 4, the nose 23' comprises a plurality of sections 24*a*, 24*b* and 24*c*. Each of the sections 24*a*, 24*b* and 24*c* is of regular geometrical configuration and said sections are affixed to and extend from each other in stepped relation. The section 24*a* has the largest dimensions and the section 24*c* has the smallest dimensions of the three sections, said sections being in telescopic relation to each other.

The nose 23 is removably affixed to the head surface 22 of the ram 19, so that a selected one of any number of different dimensioned heads may be utilized as desired. The nose 23 is removably affixed to the head surface 22 by any suitable means. The nose 23 has a hollowed-out interior section, shown by broken lines in FIG. 2. The nose 23 is preferably affixed to the head surface 22 by four bolts which are threadedly coupled in tapped holes formed in the head surface. The nose 23 may be affixed for example, by an externally threaded cylindrical base member 25 (FIG. 2) affixed to said head surface and cooperating internal threading at the base of said nose.

The ram 19 is driven by driving apparatus 26 (FIG. 2) which is coupled to said ram and drives said ram in axial directions until the nose 23 thereof passes into the outlet duct 14 and withdraws said ram in the opposite axial direction to the inlet duct 13. The driving apparatus 26 may comprise any suitable power source such as, for example, a hydraulic system which imparts great pressure to the ram 19 via a piston 27.

In accordance with the present invention, the extent of movement of the ram 19 in the receptacle 12 is adjusted to vary the compaction ratio of the material compacted by said ram. The adjustment of the movement of the ram 19 in the receptacle 12 may be accomplished by any suitable means. Thus, for example, an adjustable switch may be utilized to control the driving movement of the ram 19. The switch may comprise, for example, a movable actuating cam 31 mounted on a part 32 of the ram 19. The cam 31 may be of annular configuration, with threading provided on the inner cylindrical surface thereof. The part 32 may be threaded on a portion 33 of the cylindrical surface thereof. The cam 31 is threadedly coupled to the portion 33 of the part 32 and is therefore adjustable in position along the axis of said part and thus in directions along an axis parallel to that of the ram 19.

The switch further comprises an electrical switch 34 mounted in the receptacle 12 near the inlet duct 13. The electrical switch 34 is connected in the electrical circuitry which controls the operation of the ram-driving hydraulic system. The cam 31 may, of course, be mounted in the receptacle and the electrical switch 34 may be mounted on the ram.

An outlet sleeve 28 (FIGS. 1 and 2) extends from the outlet duct 14 and conveniently and facilely provides the material compacted by the ram 19.

A control system of any suitable type such as, for example, a system controlled or actuated by photosensitive control devices, is utilized to control the supply arrangement, the driving apparatus and the outlet. The control system is an interconnecting electrical system utilizing suitable, simple, known circuit components and known circuitry to control the ram-driving hydraulic system 26 to withdraw the ram 19 (to the left in FIG. 2) to the inlet duct 13. The control system controls the supply arrangement to permit the supply of material to the receptacle 12 while the ram 19 is withdrawn. This is accomplished by any suitable means (not shown in the FIGS.). Either an actual physical barrier may be removed to permit such supply of material, or a loading signal may be energized.

The control system controls the driving apparatus 26 to move the ram 19 into the receptacle 12 (to the right in FIG. 2) to the outlet duct 14 when said receptacle has a predetermined amount of material in it. The amount of material in the receptacle 12 is readily determined by the photosensitive device 18. The supply of material to the receptacle 12 while the ram 19 is moving in its compacting direction is prevented by any suitable means. This is accomplished by either imposing a physical barrier to prevent such supply of material, or a non-loading signal may be energized.

The density of compaction is controlled by regulating the depth to which the ram 19 penetrates the receptacle 12 by means of the adjustable switch 31, 34. The cam 31 of the switch 31, 34 is rotated into a desired axial position thereby regulating the extent of penetration of the ram 19 into the receptacle 12, since when said cam strikes the switch 34, the switch 34 controls the control circuit of the ram-driving hydraulic system to halt the movement of said ram into said receptacle. The position of the cam 31, as adjusted, determines the distance 35 of penetration.

The ram 19 serves a dual purpose. In the initial stages of completion of the stroke of the ram 19, it is compacting lightly and shearing the refuse so that a free and unattached amount of refuse is pushed through the compaction chamber. As the ram 19 continues to move forward, into the receptacle, it continues to compact

the newly cut off material to a desired compaction ratio. The compaction ratio is thus varies by the adjustable stroke of the ram **19.**

The control system controls the egress of material at the outlet sleeve **28** by any suitable physical or signal means to provide the compacted material at the outlet duct **14** upon the initiation of the withdrawal of the ram **19.**

The material in the tapered section in the receptacle **12** next adjacent the outlet duct **14,** up to the boundary line between such tapered section and the outlet duct, offers resistance to compaction. The resistance to compaction is in direct proportion to the volume of material. Thus, if the volume of material in the tapered section is reduced, this reduces the density of compaction. The volume of material may be reduced or increased by adding or subtracting plates to the head surface **22.** Although cones, as shown in the FIGS., may be utilized to vary the volume of material in the area of the outlet duct **14,** plates are preferred. The plates are preferably one half inch thick, and one or a plurality of stacked plates are removably affixed to the head surface **22.**

The switch **31, 32, 33, 34** controls the point of stoppage of the ram **19** along its axis, thereby controlling the volume of material in the area of the outlet duct **14** and thereby controlling the density of compaction.

While the invention has been described by means of specific examples and in specific embodiments, we do not wish to be limited thereto, for obvious modifications will occur to those skilled in the art without departing from the spirit and scope of the invention.

We claim:

1. Apparatus for compacting material, comprising

a receptacle having inlet and outlet ducts;

supply means opening into said receptacle for supplying material to be compacted to said receptacle;

ram means having an axis movably mounted for movement through the inlet duct of said receptacle and in said receptacle in directions along said axis to and from the outlet duct of said receptacle, said ram means having a head surface movable into proximity with said outlet duct for compacting material in said receptacle and a nose coaxially positioned on said head surface and extending ahead of said head surface;

driving means coupled to said ram means for driving said ram means in axial direction until the nose thereof passes into said outlet duct and withdrawing said ram means in opposite axial direction to said inlet duct;

penetration control means connected to the ram means and the receptacle for adjusting the extent of movement of said ram means in said receptacle to vary the compaction ratio of the material compacted by said ram means; and

outlet means at said outlet duct for the material compacted by said ram means.

2. Apparatus as claimed in claim **1,** wherein the nose of said ram means is of conical configuration.

3. Apparatus as claimed in claim **1,** wherein the head surface of said ram means is of axially symmetrical geometrical configuration and has a periphery of axially symmetrical geometrical configuration.

4. Apparatus as claimed in claim **3,** wherein the nose of said ram means is of axially symmetrical polygonal geometrical configuration and has a periphery of axially symmetrical geometrical configuration and is removably affixed to said head surface.

5. Apparatus as claimed in claim **1,** wherein the nose of said ram means is of frustoconical configuration.

6. Apparatus as claimed in claim **1,** wherein the nose of said ram means is of axially symmetrical polygonal geometrical configuration.

7. Apparatus as claimed in claim **1,** wherein the nose of said ram means is removably affixed to the head surface of said ram means.

8. Apparatus as claimed in claim **1,** wherein the nose of said ram means comprises a plurality of sections each of axially symmetrical polygonal geometrical configuration affixed to and extending from each other in stepped relation.

9. Apparatus as claimed in claim **1,** wherein the penetration control means comprises a switch having an adjustably positioned actuating component coupled to one of the ram means and the receptacle, and a switch component coupled to the other of the ram means and the receptacle and electrically connected to the driving means.

10. Apparatus as claimed in claim **9,** wherein the actuating component of the switch comprises a cam movable in directions parallel to the axis of the ram means and the switch component of the switch controls the operation of said driving means upon abutment by said actuating component.

11. Apparatus as claimed in claim **1,** wherein the penetration control means comprises a switch having an adjustably positioned actuating component coupled to the ram means and a switch component mounted in the receptacle and electrically connected to the driving means.

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