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MULTIPLE CARTRIDGE LAUNCHER

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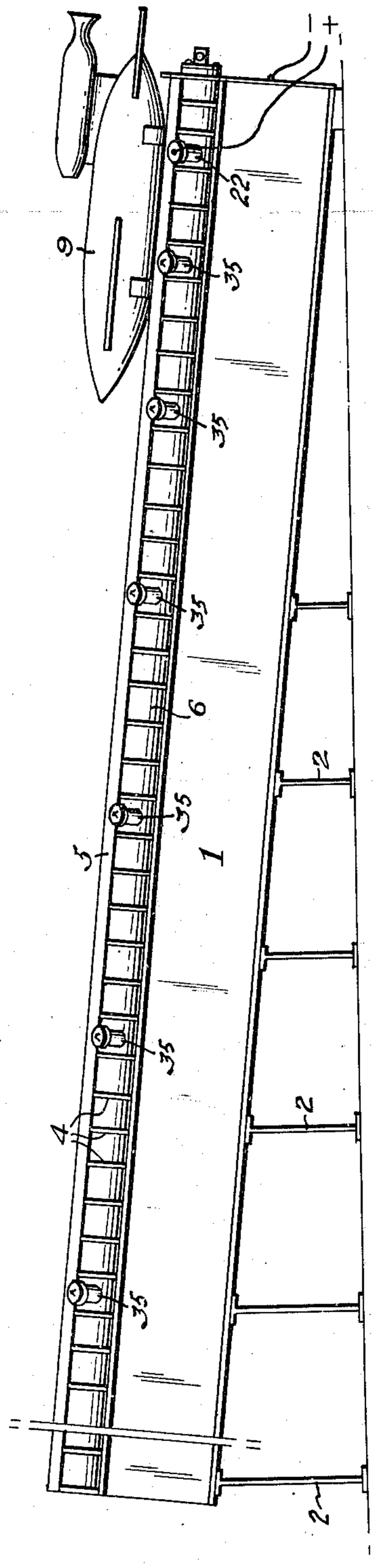

Fig. 1.

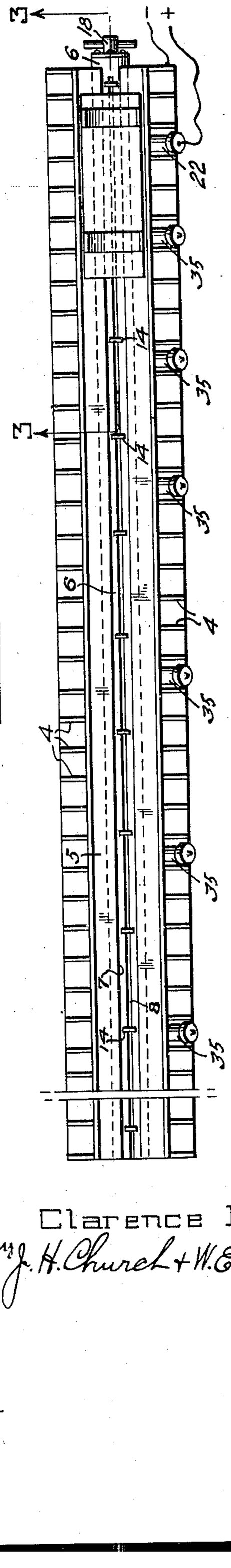

Fig. 2.

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Fig. 3.

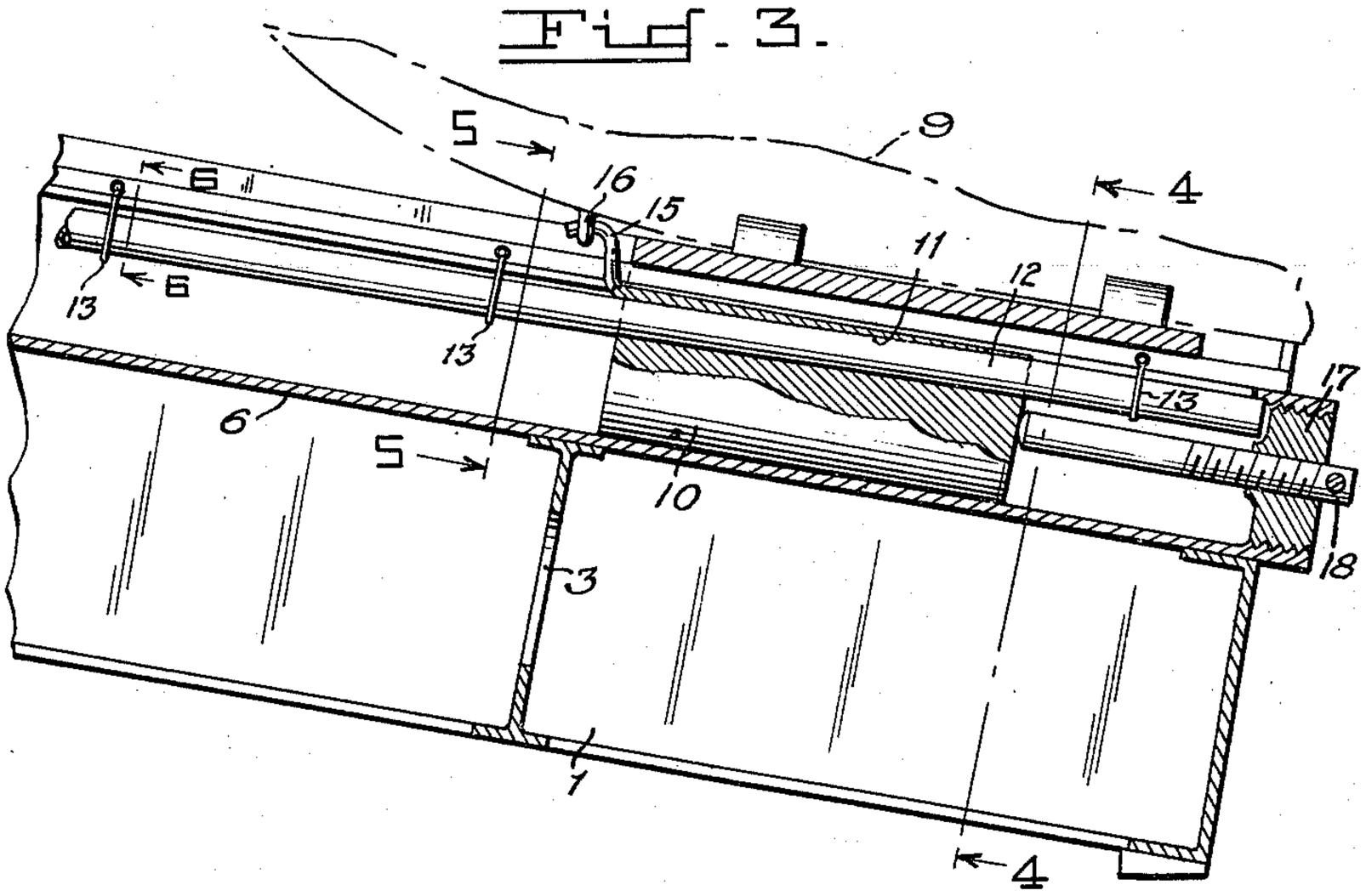

Fig. 4.

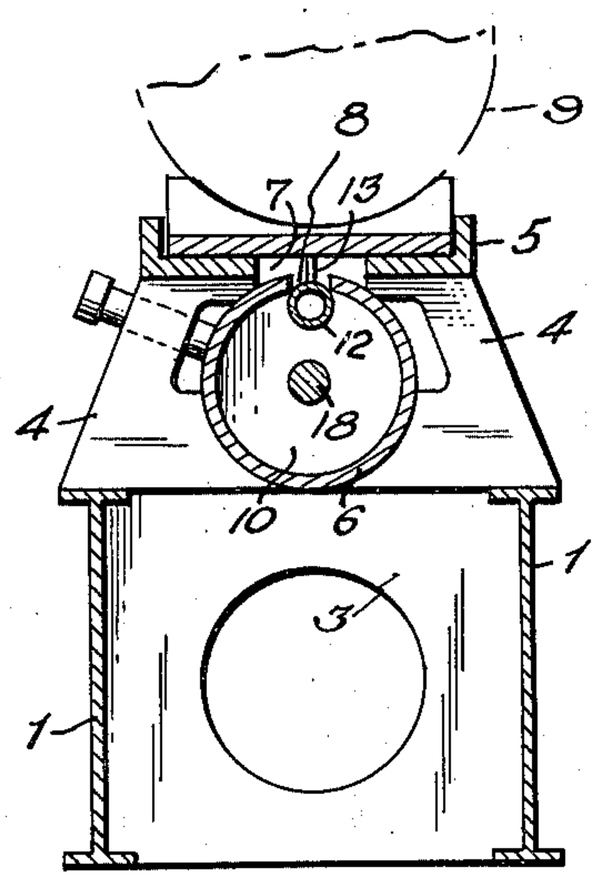

Fig. 5.

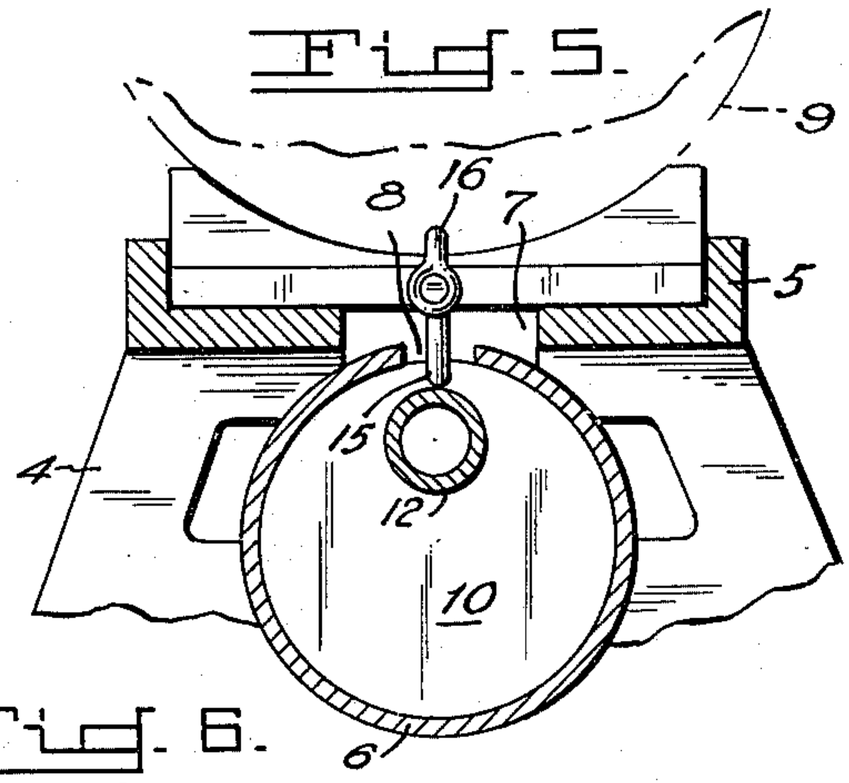

Fig. 6.

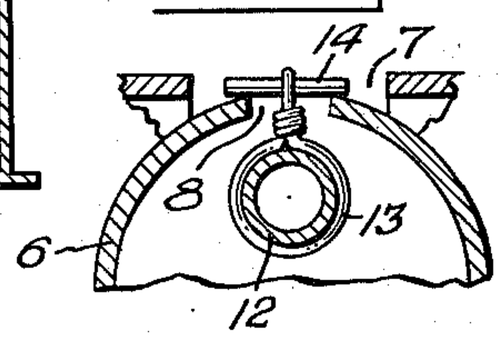

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Fig. 6.

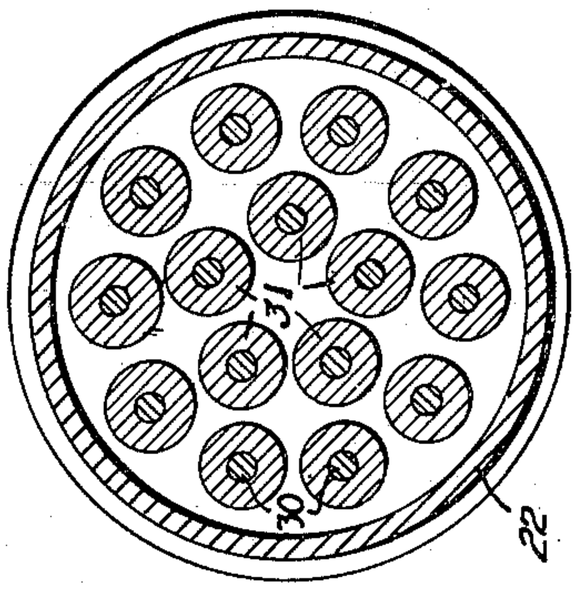


Fig. 7.

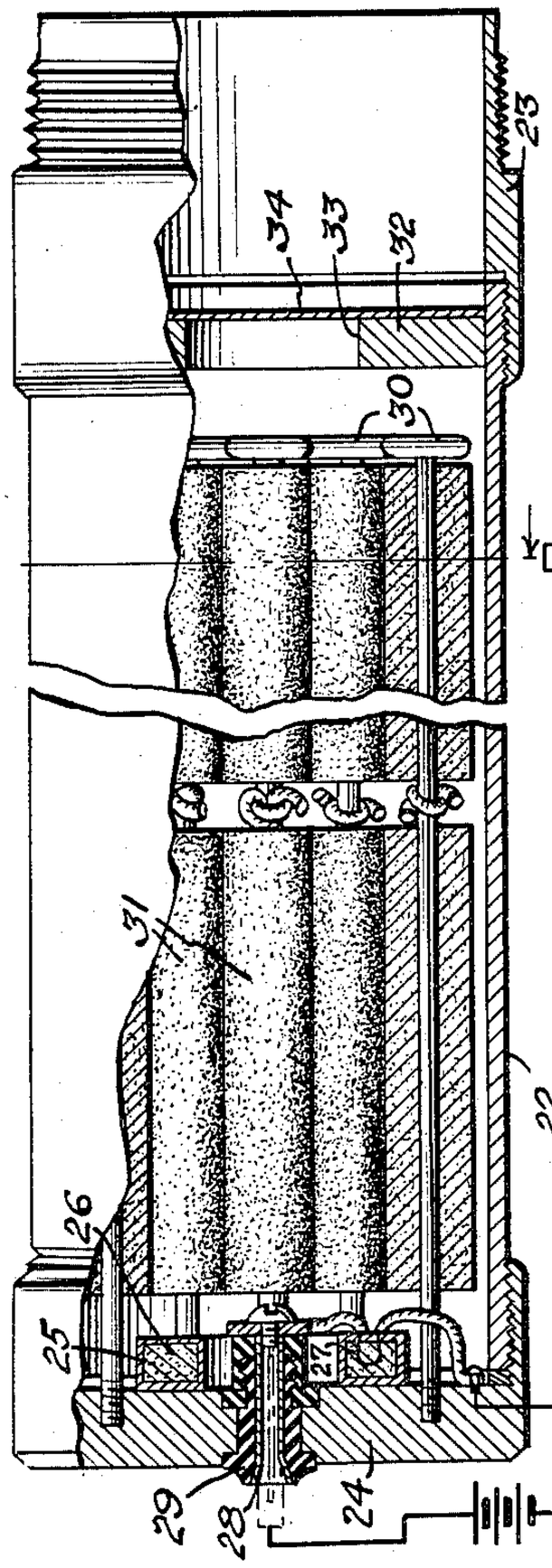
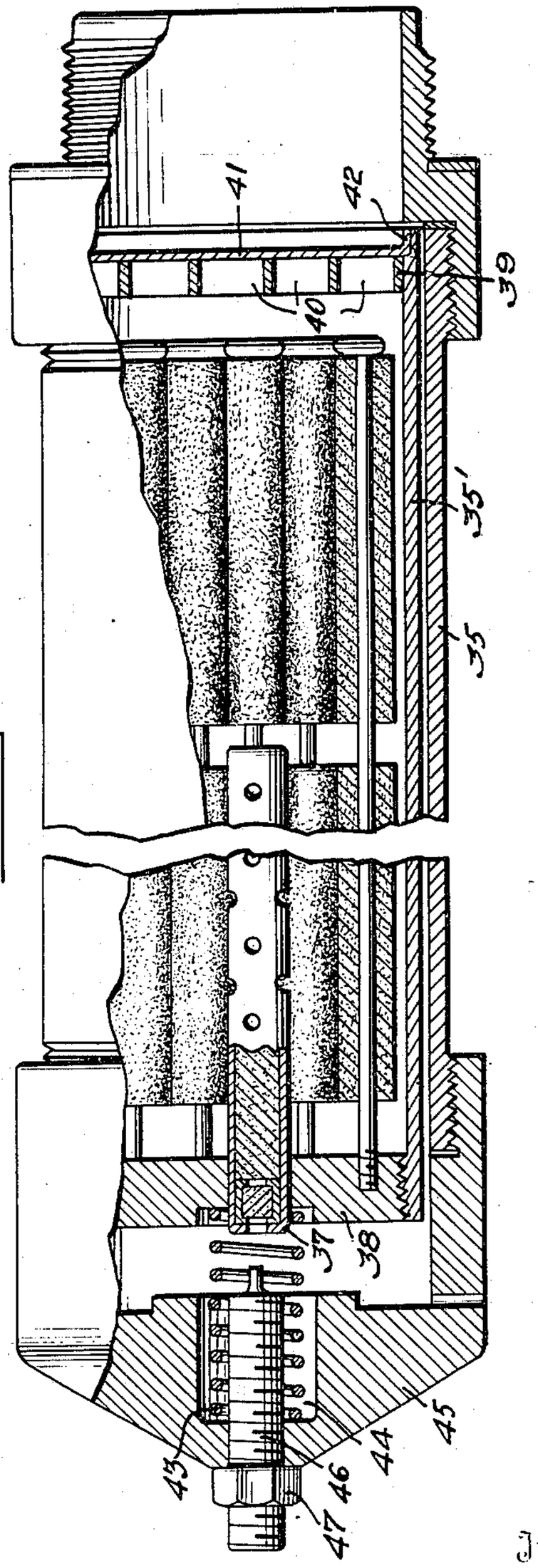


Fig. 9.



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MULTIPLE CARTRIDGE LAUNCHER

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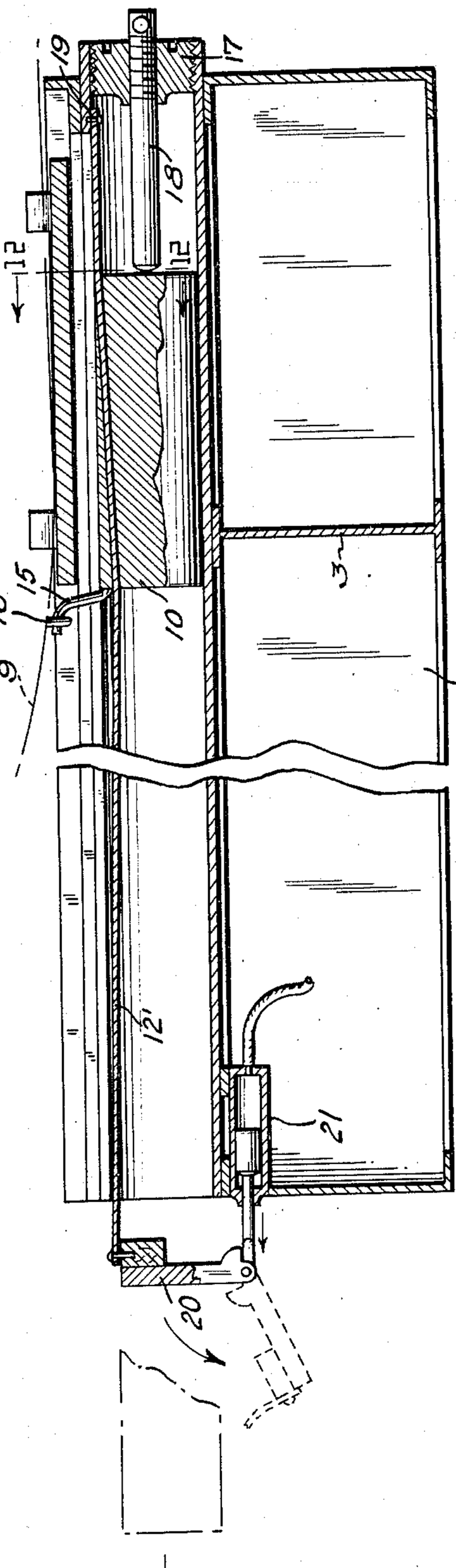

Fig. 10.

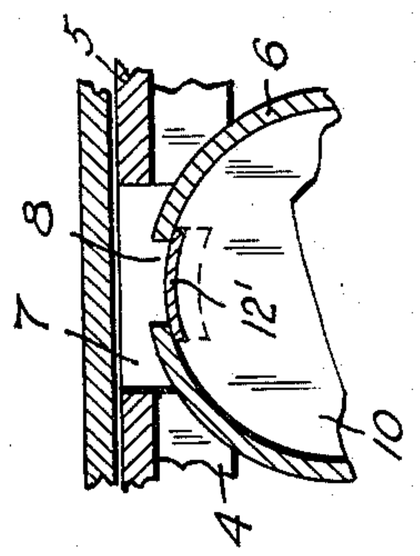

Fig. 12.

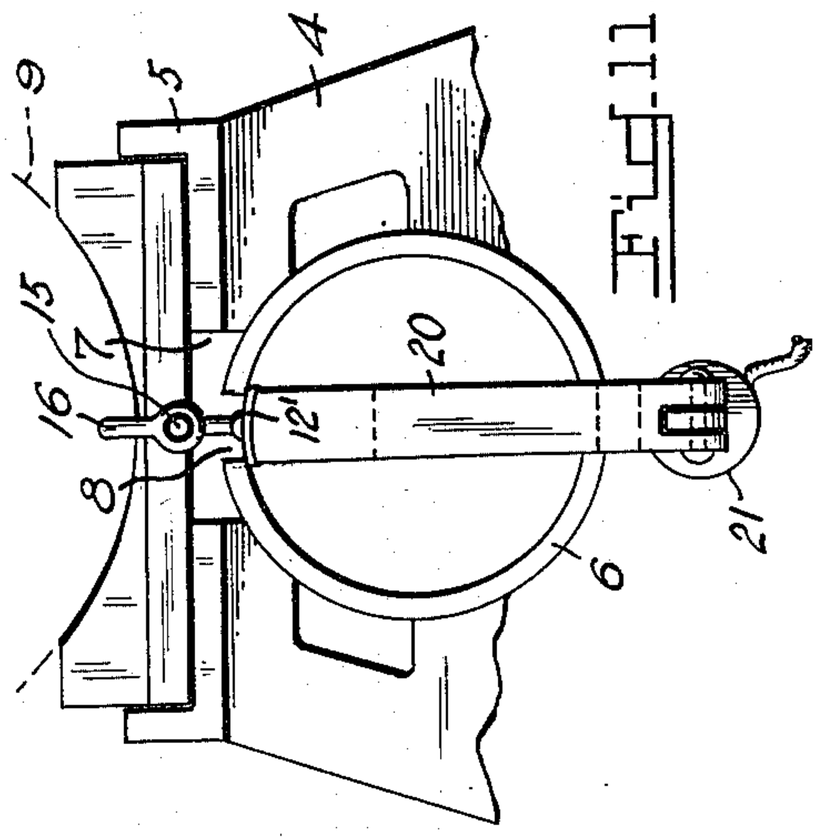

Fig. 11.

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UNITED STATES PATENT OFFICE

2,485,601

MULTIPLE CARTRIDGE LAUNCHER

Clarence N. Hickman, Jackson Heights, N. Y., assignor to the United States of America as represented by the Executive Secretary of the Office of Scientific Research and Development

Application September 26, 1947, Serial No. 776,391

3 Claims. (Cl. 244—63)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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The invention described herein may be manufactured and used by the Government for governmental purposes without the payment of any royalty thereon.

This invention relates to a launching device for rocket projectiles, and in particular for winged rockets of the type having a wing loading too great for self-launching due to the inability to obtain, by jet propulsion alone, a speed greater than its stalling speed. In such a case external power must be lent for the take off.

Such devices, broadly, have been known and used, and in particular, rockets have been powered for take off by the use of concentrated hydrogen peroxide in the catapult.

The present invention is concerned with a method and means for catapulting missiles wherein a conventional propellant, such as smokeless powder, is employed, and the necessary energy is supplied stepwise as the missile proceeds along the launcher, the release of energy being occasioned by the missile itself in passage.

It is, therefore, an object of the invention to provide a launching device wherein propulsive energy is supplied in increments, further objects being to provide novel means for communicating propulsive energy in a launching tube to an external projectile, utilizing available energy to the maximum degree and with optimum acceleration performance of the projectile.

To these and other ends, reference is had to the accompanying specification and claims, and to the drawings, in which:

Fig. 1 is a side view of a launcher with rocket in place,

Fig. 2 is a top plan view of Fig. 1 without the rocket,

Fig. 3 is a section taken on the line 3—3 of Fig. 2,

Fig. 4 is a section taken on the line 4—4 of Fig. 3,

Fig. 5 is a section taken on the line 5—5 of Fig. 3,

Fig. 6 is a section taken on the line 6—6 of Fig. 3,

Fig. 7 is a side view in partial axial section of an electrically actuated cartridge and holder,

Fig. 8 is a section taken on the line 8—8 of Fig. 7,

Fig. 9 is a side view in partial axial section of a percussion cartridge and holder,

Fig. 10 is a longitudinal section of a launcher with modified sealing means,

Fig. 11 is a partial end view of Fig. 10, and

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Fig. 12 is a section taken on the line 12—12 of Fig. 10.

The launcher shown comprises a main supporting member 1 held on standards 2 of varying height to afford an angle of attack (or elevation) for the missile to be launched, and having cross webs 3. A series of ribs 4 atop the member 1 support a launching deck 5 and also serve to hold and strengthen against bursting the pressure tube 6.

The deck and tube have aligned slots 7 and 8 throughout their length for communication from the missile, such as 9 to the interior of the tube. A piston 10 is slidably fitted in the tube 6, and has a bore 11 (Fig. 3) receiving a pipe 12 the purpose of which is to seal the slot 8 against escape of gases in the region behind the moving piston. The pipe is preliminarily held near the slot 8 by means such as a wire loop 13 and cross member 14 which merely rests on the tube 6 (see Fig. 6).

The piston 10 carries a hook 15 which passes up through slots 8 and 7 in position to engage a portion of the missile, such as eye lug 16, to impart motion to the missile. The bore 11 of the piston is shown slanted to provide space on the front side of the piston for the hook. A sled is provided for the missile.

The rear end of the tube 6 is sealed, as by a plug 17, shown threaded therein, and an adjustment member is provided to vary the initial position of the piston. This member may comprise a rod 18 threaded through.

It will now be apparent that, upon development of pressure behind the piston, the latter will progress along the tube, carrying the missile with it. During this movement the tube is swept of hangers 13, and the sealing pipe 12 is laid up against the slot 8 where it is retained by the pressure in the tube until the piston has been ejected, after which it falls to the bottom of the tube. The pipe may be restrung for reuse.

In Fig. 10 is shown a modification wherein a sealing ribbon 12' is employed in place of the pipe. In this case the ribbon is attached as at 19 at the breech of the tube. It is maintained near the slot 8 by an articulated member 20 attached to the piston of a pneumatic jack 21 which serves to take up undue slack in the ribbon. The operation is similar to the other described modification except that in lieu of sweeping out hangers, the piston merely breaks the connection of the tape at 20 and rotates the member 20.

With the length of tube employed (160 feet in

a given case) and relatively small bore, ballistic theory as expressed by the equations of motion, state, energy and burning for explosive charges cannot provide for the propulsion of a considerable mass by a single charge. The propelling effort is therefore accomplished by a series of charges spaced along the tube and initiated only after passage of the projectile. For the first of these an electrically fired cartridge has been found to be satisfactory but, for all subsequent charges, percussion firing has been found to be of best advantage.

The electric cartridge is shown in Fig. 8. The container 22 is screw threaded into an adapter 23 which fits in the tube 6. It is closed by a cap 24 to which is attached a plastic toroidal-shaped member 25 containing an igniting composition 26 with embedded filament 27. Also in the cap is a plug contact 28 and insulator 29. The contact leads to the filament and through ground to a source of E. M. F. The cap 24 also bears wormhead wires 30 which carry tubular sticks of propellant 31 as in rocket chambers. A metal plate 32 with an opening 33 acts as a partial confinement to insure good ignition of the powder charge. A cover plate 34 to keep out moisture and dust normally seals the opening 33 but is rupturable by the propellant.

The percussion cartridge in Fig. 9 has an outer case 35 and an inner case 35', the latter being roughly similar to the electric cartridge, but having a conventional primer tube 36 with percussion igniter 37 carried in a head 38 which also carries trap wires and propellant. A plate 39 fixed in the forward end has numerous large through openings 40 normally covered by a thin magnesium plate 41 held temporarily in place as by a friction fit, for which purpose it may conveniently have a flange 42. The whole inner case is slidable in the outer case against the bias of a spring 43 contained in a well 44 in the head 45 of the outer case which also carries a fixed firing pin 46 threaded through the head for adjustability and having a locking nut 47.

The percussion cartridge is operated by gas pressure in the main tube 6. As the piston passes the inner end of a cartridge case, the propellent gas pressure operates on the thin plate 41 which is backed up by the plate 39. With obturation at this end, the entire inner case is urged toward the head 45 of the outer case and the igniter 37 is brought into firing engagement with the point of pin 46. The propellent blast which follows blows the thin plate 41 into the main tube 6 and the propellent gas pressure is superimposed on the pressure already existing in the tube. Thus the timing is automatically controlled by the spacing of the cartridges along the tube.

In one successful embodiment a total projectile load of 5400 lbs. was accelerated to a speed of 240 miles per hour with a maximum acceleration of about 17 g in a distance of 160 feet, the maximum tube pressure being 850 to 900 p. s. i. Total ejection time was about 0.85 second.

The ballistic conditions in a launcher as described herein are radically different from those obtaining in ordinary guns where a high velocity is attained in a very short time interval. Ordinary theory is not applicable in the launcher for two main reasons: (1) The rate of burning is not proportional to the pressures of less than 1000 p. s. i. as they are at pressures of 30,000 p. s. i. or above found in guns, and (2) in the launcher, powder surfaces are introduced at specific time intervals. In addition, heat losses are considerably greater in the launcher.

In the solution of the problem by entirely unconventional methods, a main objective was to obtain as nearly, as possible, a constant pressure in the launcher, and I have found that in order to accomplish this the powder burning surface must increase linearly with time. To this end I have found that a single-perforated grain such as employed in rockets and which has an almost constant burning surface had a favorable bearing on the result. Cartridges having such grains are introduced at various times so that the total burning surface, although not increasing exactly linearly with the time, increases stepwise in such a way as to approximate a linear rate. Such increments may be distributed in large number with small charge and narrow spacing or with larger charge and wider spacing. It was found that six charges were sufficient, for the 160 foot tube employed, to give a reasonably uniform pressure.

The charges may be introduced throughout the total time in which case much of the later charges will be unconsumed, and result in after-burning, chuffing, flash and smoke. For this reason it is preferable to introduce charges for only part of the time even though this results in the pressure falling off toward the end of piston travel. I have found that an adequate situation exists when charges are introduced for only about one-half the total time, using a web of powder that is completely consumed in one-half the total time.

I have further found that the weight of charges should be equal, except the first, which should have half the weight of the others, and that the charges should be spaced at intervals which in each case correspond to the total burning of the previous charge, and I have further found that the piston should have an initial position leaving a clear space of about one foot in the rear of the tube.

The employment of a rocket-type charge in the launcher is not obvious, and it was a matter of discovery that elicited the fact that the powder was erratic and subject to "cracking" and general "breakup" when not trapped, and it was further found that faster ignition in the later rounds occurred with percussion firing as compared with electrical firing.

Having now described my invention, what I desire to claim as new and secure by Letters Patent is:

1. A launcher for missiles comprising a ramp, there being a longitudinal slot in said ramp, a barrel member under said ramp and having a slot aligned with the slot in the ramp, sealing means for the slot in the barrel member, temporary suspension means for the sealing means, a piston in said bore surrounding said sealing means and urging the same into sealing engagement with the barrel slot, and means on the piston passing through both said slots for engagement with a missile on said ramp.

2. A percussion firing cartridge comprising an outer casing having an open end, an inner casing slidable in said outer casing and carrying a propellant charge, complementary ignition means on the respective casings constructed and arranged for actuation on relative sliding of said casings, a spring member biasing said casings to safe relation, valve means carried by said inner casing adjacent said open end and arranged to permit gas discharge from said inner casing through said open end but effecting piston action of said inner

casing in response to fluid pressure incident through said open end into said outer casing, said valve means comprising an end plate having an orifice and a cover plate releasably held externally of said end plate and covering said orifice.

3. In a launcher for a missile, a flat elongated deck, a barrel, means uniting and supporting said barrel and deck in closely-spaced parallel relation, there being a first longitudinal slot in said barrel and a second slot in said deck adjacent and parallel with said first slot, said slots extending throughout the length of said deck and barrel, respectively, a piston slidably fitting said barrel, means connected with said piston and extending through said slots for connection with a missile slidable on and along said deck, sealing means mounted within said barrel adjacent its slot for movement into sealing relation therewith, there being a connection between said piston and sealing means operable to move said sealing means into sealing position in response to passage

of said piston therealong, a plurality of longitudinally spaced cartridge casings spaced along said barrel and communicating therewith, each casing adapted to contain an explosive charge, and means responsive to the passage of said piston adjacent each said casing to fire the same.

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