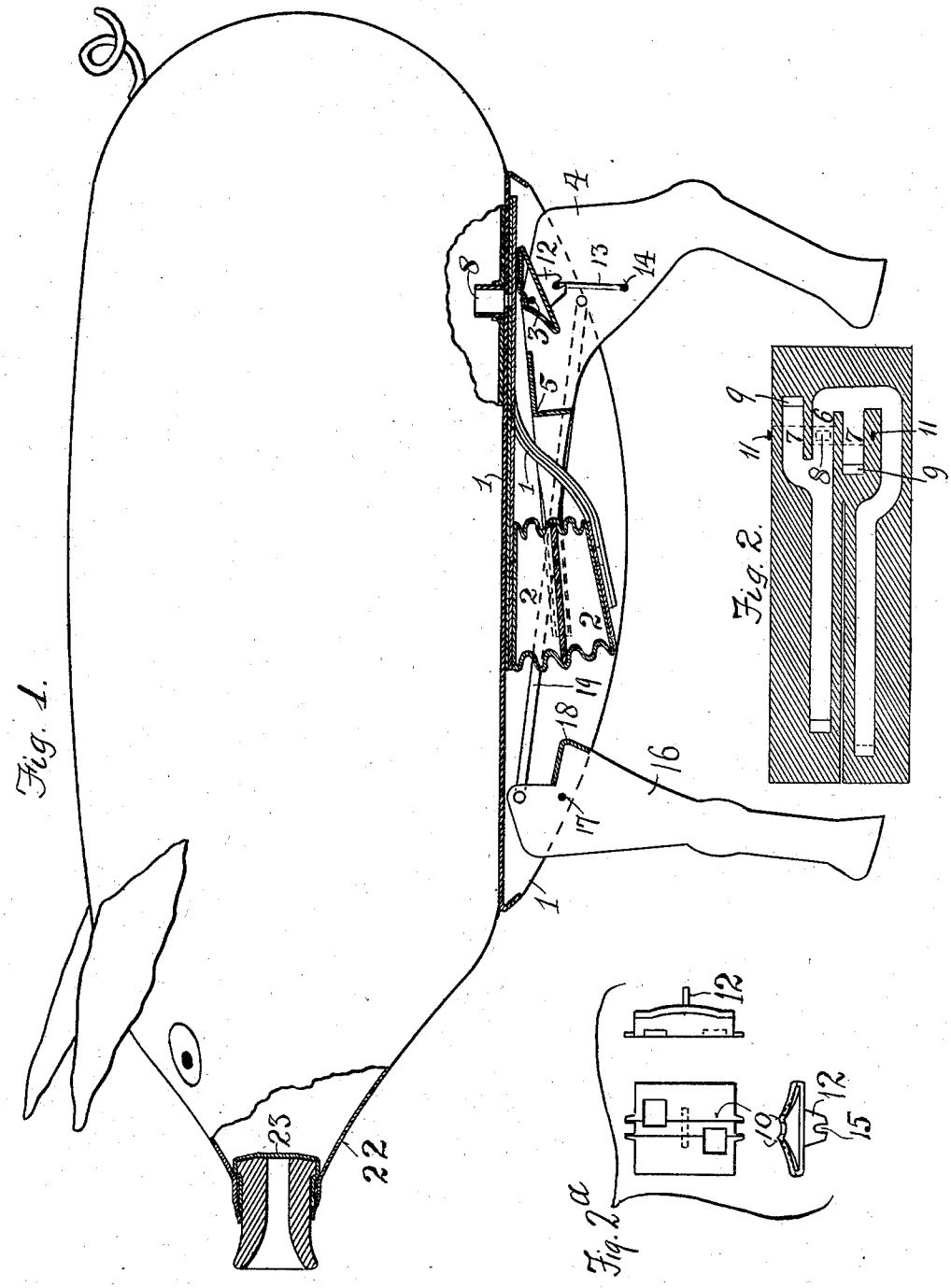
No. 712,601. Patented Nov. 4, 1902.

E. S. SAVAGE.

FLUID PRESSURE ENGINE.

(Application filed Feb. 7, 1902.)

(No Model.) 2 Sheets—Sheet 1.



Witnesses
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[illegible]

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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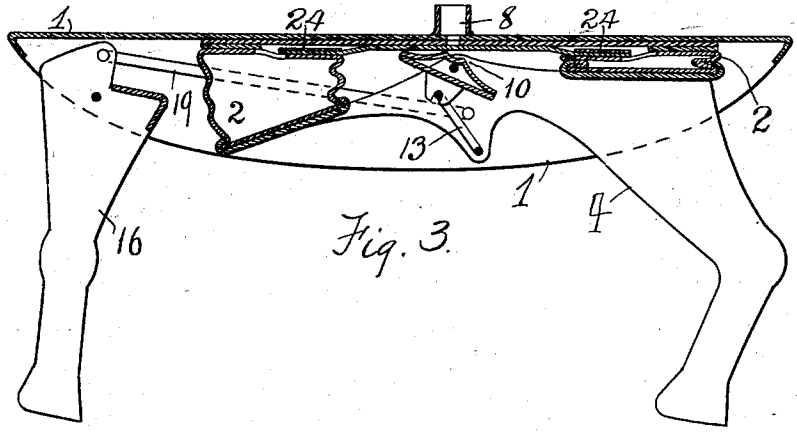


Fig. 3.

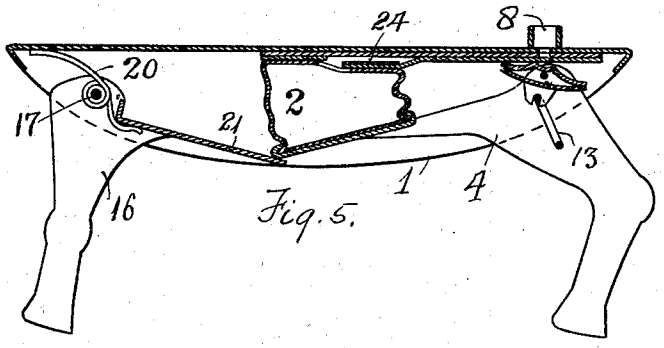


Fig. 5.

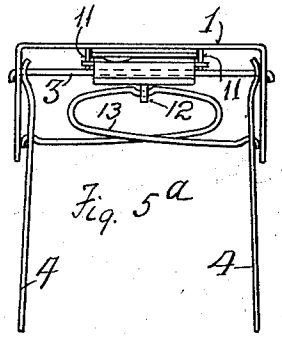


Fig. 5a

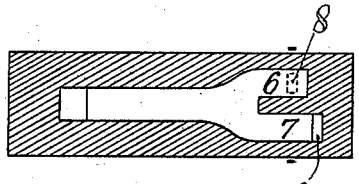


Fig. 6

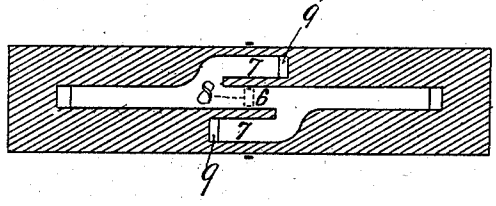


Fig. 4.

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UNITED STATES PATENT OFFICE.

EDWARD S. SAVAGE, OF NEW YORK, N. Y.

FLUID-PRESSURE ENGINE.

SPECIFICATION forming part of Letters Patent No. 712,601, dated November 4, 1902.

Application filed February 7, 1902. Serial No. 92,973. (No model.)

To all whom it may concern:

Be it known that I, EDWARD S. SAVAGE, a citizen of the United States, and a resident of New York city, in the county of New York and State of New York, have invented a certain new and useful Improvement in Fluid-Pressure Engines, of which the following is a specification.

The present invention relates more particularly to fluid-pressure engines, and has for its main object the automatic control of the inlet and exhaust by simple means.

Another object is to quickly cut off and turn on the pressure by which the engine is operated.

Other objects of the invention will be apparent from the subjoined description of the embodiment of the invention shown in the drawings, and hereinafter more particularly described.

To these ends the invention consists of features of construction, devices, arrangements, and combinations of devices hereinafter described, and more particularly pointed out in the appended claims.

Several forms of the invention are illustrated in the accompanying drawings, forming part hereof, in which—

Figure 1 is a view, partly in side elevation and partly in section, of one embodiment of the invention. Fig. 2 is a view from underneath of the inlet and exhaust for the form shown in Fig. 1. Fig. 2^a is a detail view of the compressors shown in Fig. 1. Fig. 3 is a view similar to Fig. 1 of another embodiment of the invention. Fig. 4 is a view from underneath of the inlet and exhaust for the form shown in Fig. 3. Fig. 5 is a view similar to Fig. 1 of still another embodiment of the invention, and Fig. 6 is a view from underneath of the inlet and exhaust of the form shown in Fig. 5.

Upon a body or frame 1 of suitable material and conformable to the particular purpose in view I arrange one or more expansion-chambers 2 of a form and construction suited to the particular object in view. Thus in the case of the mechanical toy in connection with which I have elected to illustrate my invention the body 1 may be formed of cardboard or sheet metal and is provided with a flat top and depending side flanges, and the expansion-chambers 2 may be formed of kid, soft rubber, or other suitable material, care being taken when extensible material is used to so confine it that power is not wasted in stretching it in any direction. It would be no departure from this invention, however, to permit such undesirable stretching. In other applications of the present invention the expansion-chamber may be made of appropriate material and form—that is, I have here elected to show an expansion-chamber of a nature such that no piston is needed, the end of the chamber constituting the piston in effect.

Fulcrumed at 3 is a lever 4, with one arm of which the expansion-chamber is suitably connected, Fig. 5, or with which the expansion-chambers are suitably connected at opposite sides thereof, Figs. 1 and 3. In the mechanical toy illustrated the lever 4 comprises two similar parts, which are united by a cross-bar 5 to form one rigid structure and the lower ends of which form the legs of the animal or the like.

The inlet and exhaust for the chamber 2 may be formed in any way suitable to the particular case in hand. Thus in the case illustrated in the drawings the inlet and exhaust are formed from strips of sheet-rubber cemented together to form inlet 6 and exhaust 7, there being an opening at 8 through the top of the body 1 for the admission of the fluid supplying the pressure and an opening in the soft rubber at 9 for the escape of the fluid on the exhaust. 24 represents metal plates arranged to keep the exhaust permanently open at the chambers 2.

The means used to open and close the inlet and exhaust vary with the particular cases; but in the case shown the inlet and exhaust are closed and opened by compressors, which act upon the compressible walls of the passages. It will be understood, of course, that this compressibility need only exist at the particular places where the compressors are to act. In the cases shown the compressors 10 are in the form of ribs on a sheet-metal plate, which is bent or cut away to avoid closing the inlet and exhaust at undesired times and which is extended beyond the said ribs in order to form stops by striking some part of the body 1. The compressors 10 may have

the same axis of motion as the lever 4, or they may be loosely held in place by pins 11, which extend downward from the body 1 and pass loosely through holes in ears at the ends of the plate from which the compressors are formed.

The compressors are actuated at the desired times by means of a toggle device, having one member 12 thereof rigidly attached to the plate from which the compressors 10 are formed and the other member 13 thereof in the shape of a spring whose ends engage with holes 14 in extensions on the pair of levers 4 and whose central part engages with a notch 15 in the member 12. The fulcrum 3 or the other axis of motion thereabout of the compressors, the holes 14, and the notch 15 are so arranged that the to-and-fro motion of the lever 4 carries the holes to each side of the line joining the axis of motion of the compressors and the notch 15, whereupon the spring member of the toggle quickly throws or tumbles the compressors. While I have shown a particular form of the spring-toggle, a particular form of means for controlling the inlet and exhaust, and a particular lever for operating the toggle, it is to be understood that the combination may be embodied in other specific forms of the elements thereof. Thus what is known as a "spring-rod" may replace the spring 13 shown, the rod passing through an eye on the lever and the spring abutting on said eye and against a stop on the rod.

When the pins 11 are used to retain the compressors 10 in place and to form centers of motion therefor, (said motion being in a plane parallel to said pins,) the member 12 is cut away to clear the rod 3.

The motion communicated to the lever 4 may be used for a variety of useful purposes. In the cases illustrated in the drawings this motion is utilized for the purpose of communicating a progressive forward motion to the toy in a step-by-step manner, there being a pair of levers or legs 16, pivoted to the body 1 at 17 at what is the fore part of the animal shown, said levers 16 being connected by a cross-bar 18, so as to move together. It is preferred in the cases illustrated in Figs. 1 and 3 that the expansion-chambers should act on but one pair of levers or legs, the pair 4 being selected by preference for this purpose, wherefore the pairs of levers are connected by a link or rod 19 in such wise that the pairs 4 and 16 move in reverse directions. By pointing the rear corners of these legs where they rest on the floor (carpet) the animal is made to walk forward, squealing at every step. In the case shown in Fig. 5 there is but one expansion-chamber 2 for actuating the pairs of levers 4 and 16, said chamber moving them each in in its own direction, while a spring 20, which is loosely coiled about the pin or rod 17 and which bears at its ends underneath the body and an extension 21 of levers 16, acts to move said pairs of legs 4 and 16 each in the direction the reverse of that in which the chamber 2 moves it.

The fluid-pressure may be supplied from any suitable source and in any appropriate way. In the cases illustrated there is fixed on the top of the body 1 a soft-rubber gas-holder 22, having an inlet or valve 23, whereby the holder may be distended by blowing through the valve. The said valve forms a seal to prevent the escape of the air or gas. Unless it is held against motion the engine begins to work as soon as the pressure in the holder 22 is sufficiently great. Assuming that the holder 22 is blown up to about the practical limit of pressure therein and that the toy is resting on its four feet on a suitable surface, the operation is as follows:

Owing to the nature of the toggle means shown, the compressors 10 are normally at one or the other extreme of their motion, thus leaving open the inlet and closing the exhaust of one of the expansion-chambers and closing the inlet and leaving open the exhaust of the other expansion-chamber, Figs. 1 and 3. The fluid therefore passes to the chamber whose inlet is open and causes the same to operate the lever 4 and through the link 19 the levers or legs 16. As soon as lever 4 carries the point 14 beyond the line joining the axis of the compressors and the notch 15 the spring member of the toggle, which is put under greater tension by the movement of the lever 4 up to that point, throws the compressors, and thereby reverses the opening and closing of inlet and exhaust, whereupon pressure is admitted to the chamber which was previously in the exhausted condition and the chamber just expanded is exhausted, exhaustion in each case meaning reduction of pressure to that of the atmosphere. The exhaust through the holes 9 in the soft rubber causes a squealing at every exhaust. Both the step-by-step motion and the squealing continue until the pressure in the reservoir is reduced to such an extent that it will no longer overcome the resistance.

While I have illustrated the embodiment of my invention hitherto used, I do not limit myself either to the use of the invention in mechanical toys or to the precise forms thereof shown in the drawings and above described, since there are other uses and other embodiments of the invention coming within the scope of my claims; nor do I limit myself to the particular form or location of the reservoir illustrated in the drawings and above described, for the energy may be stored wholly in the gas employed instead of partly in the gas, but mostly in the elastic reservoir shown, without departing from my invention. It will be observed also that the lever 4 is merely a particular instance of a part having a reciprocatory motion which is operated mediately or immediately, an expansion chamber or chambers, and that parts reciprocating in some other manner may be substituted therefor without departing from my invention; nor

is it essential to the mechanical toy that more than one pair of legs be capable of moving to and fro.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The combination of a body or frame, a lever fulcrumed on the same, a lever-actuating expansion-chamber, inlet and exhaust for said chamber, means for controlling the opening and closing of said inlet and exhaust, and spring-toggle means operated by said lever and actuating said controlling means.

2. The combination of a body or frame, a lever-actuating expansion-chamber, a lever actuated thereby, inlet and exhaust for said chamber, said inlet and exhaust having compressible walls, compressors for said compressible walls, and means operated by said lever for actuating said compressors.

3. The combination of a body or frame, a lever fulcrumed on the same, a lever-actuating expansion-chamber, inlet and exhaust for said chamber, said inlet and exhaust having compressible walls, compressors for said compressible walls, and spring-toggle means operated by said lever and actuating said compressors.

4. The combination of a body or frame, a lever fulcrumed on the same, two lever-actuating expansion-chambers, inlet and exhaust for said chambers, means for controlling the opening and closing of said inlet and exhaust, and spring-toggle means operated by said lever and actuating said controlling means.

5. The combination of a body or frame, a lever fulcrumed on the same, two lever-actuating expansion-chambers, inlet and exhaust for said chambers, said inlet and exhaust having compressible walls, compressors for said compressible walls, and means, operated by said lever, for actuating said compressors.

6. The combination of a body or frame, a lever fulcrumed on the same, two lever-actuating expansion-chambers, inlet and exhaust for said chambers, said inlet and exhaust having compressible walls, compressors for said compressible walls, and spring-toggle means, operated by said lever, for actuating said compressors.

7. The combination of a body or frame, a lever fulcrumed on the same, a lever-actuating expansion-chamber, inlet and exhaust for said chamber, spring-toggle means having substantially the same axis of motion as said lever for one of its members and the other member of which is connected with an extension of said lever, and means, operated by said toggle means, for opening and closing said inlet and exhaust.

8. The combination of a body or frame, a lever fulcrumed on the same, a lever-actuating expansion-chamber, inlet and exhaust for said chamber, said inlet and exhaust having compressible walls, compressors therefor, and spring-toggle means for actuating said compressors and one member thereof having substantially the same axis of motion as said lever and the other member thereof being connected with and operated by said lever.

9. The combination of a body or frame, a lever fulcrumed on the same, two lever-actuating expansion-chambers, inlet and exhaust for said chambers, spring-toggle means one member of which has substantially the same axis of motion as said lever and the other member of which is connected with said lever, and means, operated by said toggle means, for opening and closing said inlet and exhaust.

10. The combination of a body or frame, a lever fulcrumed on the same, lever-actuating expansion-chambers, inlet and exhaust for said chambers, said inlet and exhaust having compressible walls, compressors therefor, and spring-toggle means for actuating said compressors, one member of said toggle means having substantially the same axis of motion as said lever and the other member thereof being connected with said lever.

11. The combination of a body, a lever fulcrumed thereon between its ends, lever-actuating expansion-chambers, one for each side of said lever, inlet and exhaust for said chambers, spring-toggle means connected to and operated by said lever, and means, operated by said toggle means, for opening and closing said inlet and exhaust.

12. The combination of a body, a lever fulcrumed between its ends thereon, lever-actuating expansion-chambers, one for each side of said lever, inlet and exhaust for said chambers, said inlet and exhaust having compressible walls, compressors therefor, and spring-toggle means for actuating said compressors and connected with and operated by said lever.

13. The combination of an expansion-chamber, a lever operated thereby, inlet and exhaust for said chamber, a tumbler for controlling the opening and closing of said inlet and exhaust, and a spring-toggle connected to said lever and actuating said tumbler.

14. The combination of an expansion-chamber, a lever operated thereby, inlet and exhaust for said chamber, said inlet and exhaust having compressible walls, compressors therefor, said compressors having substantially the same axis of motion as said lever, and a spring-toggle connected to and operating said compressors and itself operated by said lever.

15. The combination of an expansion-chamber, a lever operated thereby, inlet and exhaust for said chamber, said inlet and exhaust having compressible walls, a tumbler for controlling the opening and closing of said inlet and exhaust, said tumbler having substantially the same axis of motion as said lever, and a spring-toggle connected to said lever and actuating said tumbler.

16. The combination of expansion-chambers, a lever moved in reverse directions thereby, inlet and exhaust for said chambers, a tumbler controlling the opening and closing

of said inlet and exhaust, and spring-toggle means connected to said lever and actuating said tumbler.

17. The combination of expansion-chambers, a lever moved in reverse directions thereby, inlet and exhaust for said chambers, said inlet and exhaust having compressible walls, tumbling compressors for said walls, and spring-toggle means connected to said lever and actuating said compressors.

18. The combination of a body, two pairs of levers or legs pivoted thereto, connection between said pairs to cause them to move in reverse directions, an expansion-chamber for operating one of said pairs of legs or levers, and means for moving said pairs of levers or legs reversely of the directions in which said chamber moves them.

19. The combination of a body, pairs of levers or legs pivoted thereto, connections for causing said pairs to move reversely to each other, two expansion-chambers for moving said pairs of levers in reverse directions, inlet and exhaust for said chambers, and means operated by certain of said levers or legs for controlling said inlet and exhaust.

20. The combination of a body, pairs of levers or legs pivoted thereto, connections between said pairs to cause them to move in reverse directions, expansion-chambers for moving said levers or legs in reverse directions, inlet and exhaust for said chambers, tumbler for controlling the opening and closing of said inlet and exhaust, and spring-toggle means operated by certain of said levers or legs and actuating said tumbler.

21. The combination of a body, pairs of levers or legs pivoted thereto, connections between said pairs for causing them to move in reverse directions, expansion-chambers for operating said pairs of levers or legs, inlet and exhaust for said chambers, said inlet and exhaust having compressible walls, compressors therefor, and means, operated by certain of said levers or legs, for actuating said compressors.

22. The combination of a body, pairs of levers or legs pivoted thereto, connections between said pairs for causing them to move in reverse directions, expansion-chambers for operating said pairs of levers or legs, inlet and exhaust for said chambers, said inlet and exhaust having compressible walls, compressors therefor, and spring-toggle means operated by certain of said levers or legs and actuating said compressors.

23. The combination of a body, an elastic gas-holder thereon, an expansion-chamber on said body, pairs of levers or legs pivoted on said body and connected together to move in reverse directions, and moved by said chamber, inlet and exhaust for said chamber, means connected to and operated by certain of said levers or legs for controlling said inlet and exhaust, and means for moving said pairs of levers or legs reversely of the directions in which said chamber moves them.

24. The combination of a body, an elastic gas-holder thereon, an expansion-chamber also thereon, pairs of levers or legs connected together to move in reverse directions and pivoted on said body, said chamber moving said pairs each in one direction, inlet and exhaust for said chamber, a tumbler for controlling the opening and closing of said inlet and exhaust, spring-toggle means operated by certain of said levers or legs and actuating said tumbler, and means for moving said levers or legs reversely of the directions in which said chamber moves them.

25. The combination of a body, an elastic gas-holder thereon, an expansion-chamber also thereon, pairs of levers or legs connected to move in reverse directions and pivoted on said body, said chamber moving said pairs each in one direction, inlet and exhaust for said chamber, said inlet and exhaust having compressible walls, compressors therefor, spring-toggle means operated by certain of said levers or legs and actuating said compressors, and means for moving said pairs of levers or legs reversely of the directions in which said chamber moves them.

26. The combination of a body, an elastic gas-holder thereon, expansion-chambers also thereon, connected pivoted levers or legs operated by said chambers, inlet and exhaust for said chambers, and means operated by certain of said levers or legs for controlling the opening and closing of said inlet and exhaust.

27. The combination of a body, an elastic gas-holder thereon, expansion-chambers also thereon, connected pivoted levers or legs also thereon and operated by said chambers, inlet and exhaust for said chambers, tumblers for controlling the opening and closing of said inlet and exhaust, and spring-toggle means connected to and operated by certain of said levers or legs and actuating said tumblers.

28. The combination of a body, an elastic gas-holder thereon, expansion-chambers also thereon, connected pivoted levers or legs also thereon and operated by said chambers, inlet and exhaust for said chambers, said inlet and exhaust having compressible walls, compressors for said walls, and spring-toggle means, connected to and operated by certain of said levers or legs, for actuating said compressors.

29. The combination of a body, an elastic gas-holder thereon, expansion-chambers also thereon, connected levers or legs mounted on said body and operated by said chambers, inlet and exhaust for said chambers, said inlet and exhaust having compressible walls, compressors therefor, and spring-toggle means having one member rigidly connected with said compressors and the other member connected to certain of said levers or legs.

30. The combination of an expansion-chamber, inlet and exhaust therefor, said inlet and exhaust having compressible walls, compressors therefor, a reciprocatory part oper-

ated by said chamber, and means whereby said reciprocatory part operates said compressors.

31. The combination of an expansion-chamber, inlet and exhaust therefor, a rocking member for controlling the opening and closing of said inlet and exhaust, a reciprocatory part operated by said chamber and a spring-toggle operated by said part and actuating said rocking member.

32. The combination of an expansion-chamber, inlet and exhaust therefor, said inlet and exhaust having compressible walls, rocking compressors therefor, a reciprocatory part operated by said chamber, and a spring-toggle operated by said reciprocatory part and actuating said compressors.

33. The combination of expansion-chambers, inlet and exhaust therefor, said inlet and exhaust having compressible walls, rocking compressors therefor, a reciprocatory part operated by said chambers, and means whereby said part operates said compressors.

34. The combination of expansion-chambers, inlet and exhaust therefor, rocking members for controlling the opening and closing of said inlet and exhaust, a reciprocatory part operated by said chambers, and a spring-toggle operated by said part and actuating said rocking members.

35. The combination of an expansion-chamber, inlet and exhaust therefor, said inlet and exhaust having compressible walls, rocking compressors therefor, a reciprocatory part operated by said chambers, and a spring-toggle operated by said part and actuating said compressors.

36. The combination of a body, an expansion-chamber thereon, pairs of legs mounted on said body and at least one of said pairs of legs being capable of moving to and fro, means whereby said chamber operates said movable pair of legs, inlet and exhaust for said chamber, rocking members for controlling the opening and closing of said inlet and exhaust, and means whereby said movable legs operate said rocking members.

37. The combination of a body, expansion-chambers thereon, pairs of legs mounted on said body, at least one of said pairs of legs being movable to an fro, inlet and exhaust for said chambers, rocking members for controlling the opening and closing of said inlet and exhaust, and means whereby said movable legs operate said rocking members.

38. The combination of a body, expansion-chambers thereon, pairs of legs mounted on said body, at least one of said pairs being movable to and fro, inlet and exhaust for said chambers, said inlet and exhaust having compressible walls, compressors therefor, and means whereby said movable legs operate said compressors.

39. The combination of a body, expansion-chambers thereon, pairs of legs mounted on said body, at least one pair thereof being movable to and fro, inlet and exhaust for said chambers, said inlet and exhaust having compressible walls, rocking compressors therefor, and a spring-toggle operated by said movable legs and actuating said compressors.

40. The combination of a body, an elastic gas-holder thereon, expansion-chambers, inlet and exhaust therefor, pairs of legs mounted on said body and at least one pair thereof being movable to and fro, rocking members for controlling the opening and closing of said inlet and exhaust, and means whereby said movable legs operate said rocking members.

41. The combination of a body, expansion-chambers thereon, an elastic gas-holder also thereon, inlet and exhaust for said chambers, said inlet and exhaust having compressible walls, rocking compressors therefor, and means whereby said movable legs operate said rocking compressors.

42. The combination of a body, an elastic gas-holder thereon, pairs of legs mounted thereon, one pair at least being movable, expansion-chambers also thereon, inlet and exhaust for said chambers, said inlet and exhaust having compressible walls, rocking compressors therefor, and a spring-toggle operated by said movable legs and actuating said compressors.

43. The combination of an elastic gas-holder, an expansion-chamber connected to the same, a reciprocating part operated by the chamber, and means, connected to and operated by said reciprocating part, for controlling the admission and exhaust of gas to and from said expansion-chamber.

Signed at New York city, in the county of New York and State of New York, this 6th day of February, A. D. 1902.

EDWARD S. SAVAGE.

Witnesses:

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