No. 632,702. Patented Sept. 12, 1899.

H. F. DUNHAM.

APPARATUS FOR EXTINGUISHING FIRES.

(Application filed Apr. 5, 1894. Renewed Aug. 18, 1897.)

(No Model.) 2 Sheets—Sheet 1.

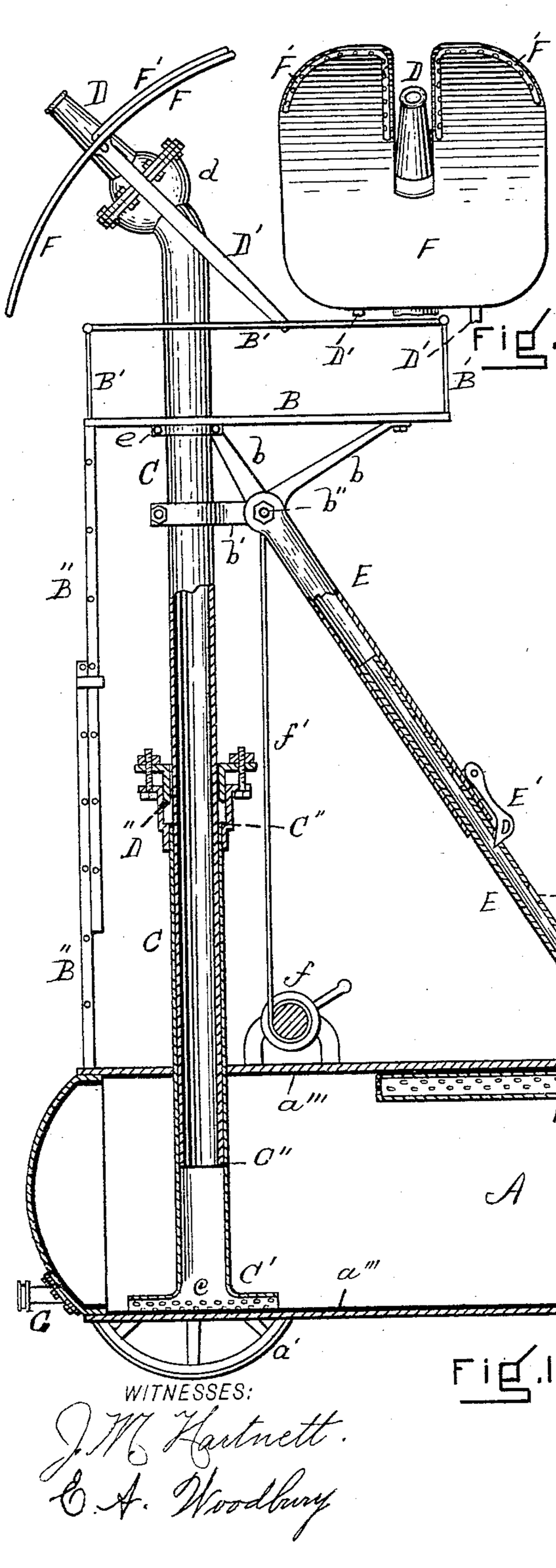

Fig. 1.

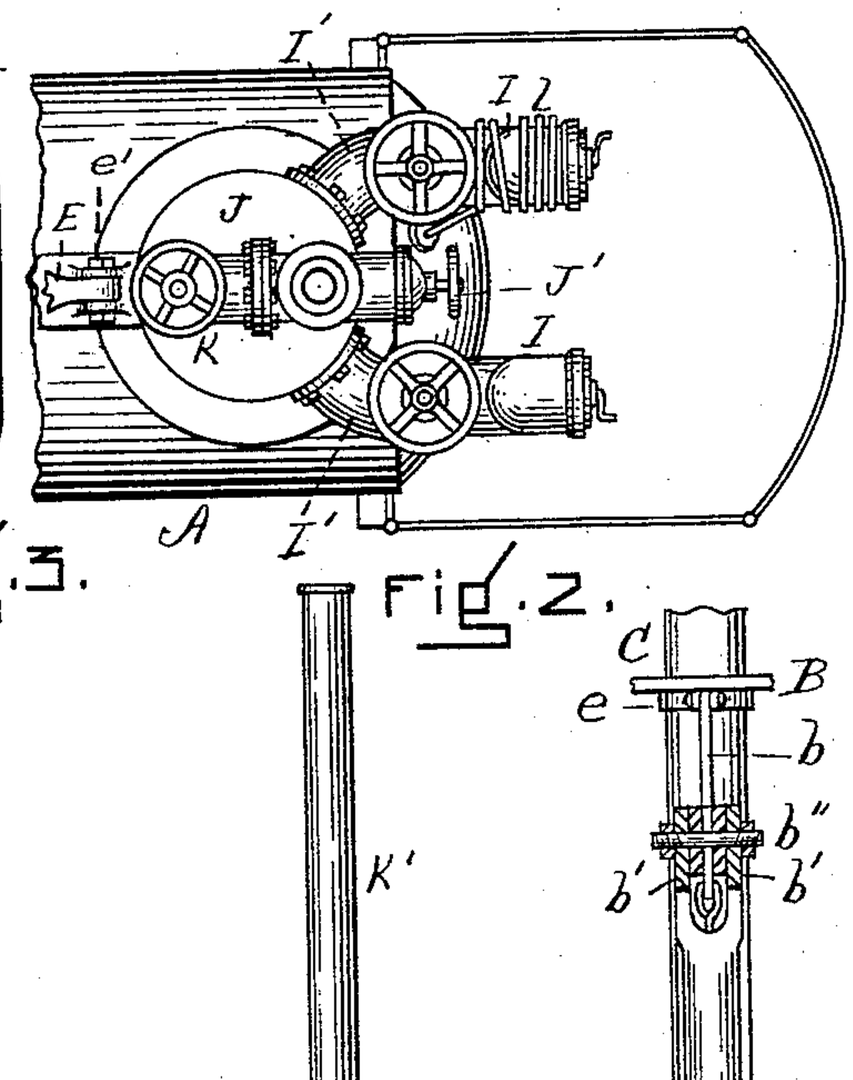

Fig. 3.

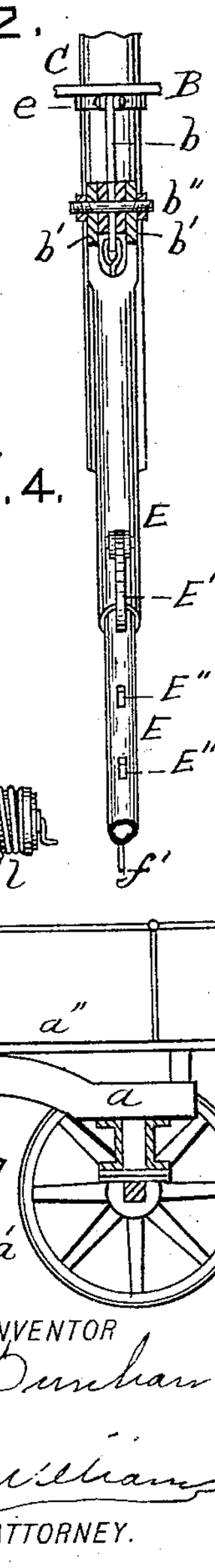

Fig. 2.

Fig. 4.

WITNESSES:

J. M. Hartnett.

C. A. Woodbury

INVENTOR

Herbert F. Dunham

BY

Henry Williams.

ATTORNEY.

No. 632,702. Patented Sept. 12, 1899.

H. F. DUNHAM.

APPARATUS FOR EXTINGUISHING FIRES.

(Application filed Apr. 5, 1894. Renewed Aug. 18, 1897.)

(No Model.) 2 Sheets—Sheet 2.

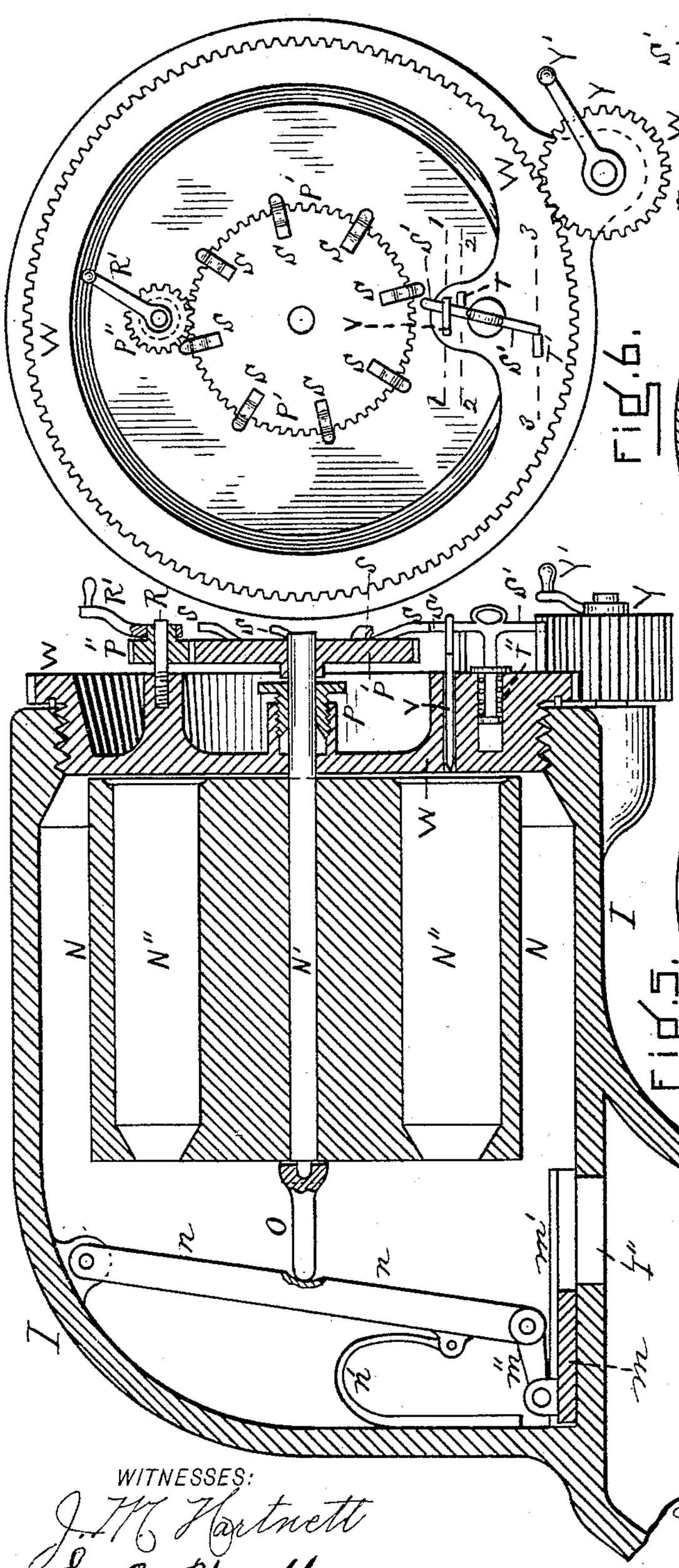

Fig. 6.

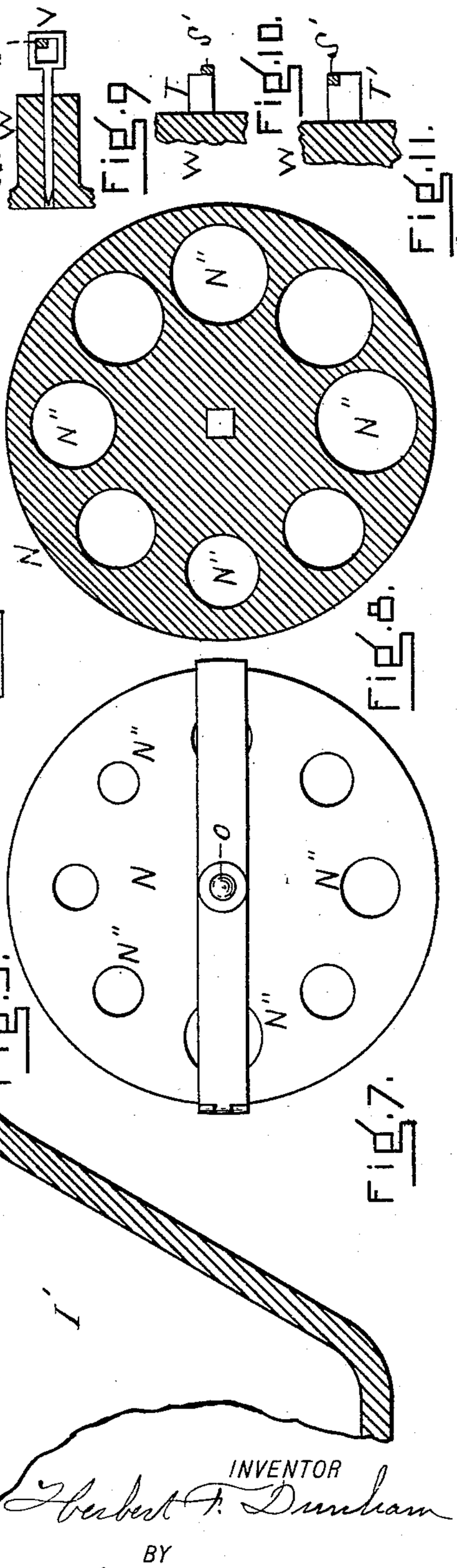

Fig. 5.

Fig. 9.

Fig. 11.

Fig. 7.

WITNESSES:

J. W. Hartnett

E. A. Woodbury

INVENTOR

Herbert F. Dunham

BY

Henry Williams

ATTORNEY.

UNITED STATES PATENT OFFICE.

HERBERT F. DUNHAM, OF NEW YORK, N. Y.

APPARATUS FOR EXTINGUISHING FIRES.

SPECIFICATION forming part of Letters Patent No. 632,702, dated September 12, 1899.

Application filed April 5, 1894. Renewed August 18, 1897. Serial No. 650,556. (No model.)

To all whom it may concern:

Be it known that I, HERBERT F. DUNHAM, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented a new and Improved Apparatus for the Extinguishment of Fires, of which the following is a specification.

This invention relates to fire-extinguishing apparatus, the object thereof being to provide an improved means simple in construction and operation whereby fires and conflagrations can be quickly and easily extinguished and by means of which also large or small quantities of water or other fluid can be delivered onto a fire under a pressure substantially equal to that generated at the apparatus.

In the use of the ordinary fire-engine and analogous sources of power the same is usually located at a considerable distance from the fire and involves the use of steam-generating mechanism which is delicate and complex, difficult to operate, and extremely liable to get out of order. Moreover, the capacity of the apparatus is limited by its weight and construction, while the energy developed is necessarily transmitted through long lines of hose, which are at times liable to burst under the pressure necessary to overcome the frictional resistance of the flow of water, and, furthermore, when the water is delivered it is under much less pressure than at the engine and is delivered through nozzles of small diameter (one and one-half inch being regarded as large) in streams that on account of their small size cannot be made to reach to a great height or distance and are often dissipated by the heat before coming into contact with the combustible material. In the use of this improved apparatus the same can be located comparatively close to the fire, protection from such fire being afforded the firemen by a special construction of the apparatus, while any desired number of connections, large or small in diameter, can be made with the source of water-supply. The energy developed is used to throw water directly onto a fire and is not retarded by the friction of a line of hose (which is entirely dispensed with except in those cases where it is deemed desirable to use the same—for instance, at the early stages of a fire) nor is the capacity of the apparatus appreciably limited by weight, speed of moving parts, or frictional resistance, while the water is delivered onto a fire under pressure substantially equal to that generated at the apparatus. In this improved apparatus the discharge is preferably not continuous, the object being to deliver the greatest quantity of water when it will do the most good in a given interval of time, and hence a continuous stream is not necessary, as is the case where long lines of hose are used.

In the drawings accompanying and forming a part of this specification, Figure 1 is a side view, partly in section, of one construction of this improved apparatus. Fig. 2 is a top view of a part of a fluid receiver or reservoir and the mechanisms for producing explosions. Fig. 3 is a detailed front view of a fire-shield with the fluid-nozzle projecting through it. Fig. 4 is a detail partly-sectional view of an extension-brace for supporting the water-tower or main discharge-conduit and nozzlemen's platform. Fig. 5 is an enlarged vertical sectional view taken centrally through one of the firing-chambers. Fig. 6 is an end elevation of the same. Fig. 7 is an end view of a cartridge-cylinder. Fig. 8 is a cross-sectional view of the same. Fig. 9 is a detail sectional view taken in line 1 1, Fig. 6; and Figs. 10 and 11 are also detail sectional views taken in lines 2 2 and 3 3, respectively, Fig. 6.

Similar characters of reference designate like parts in all the figures of the drawings.

In a general way this improved fire-extinguishing apparatus comprises a fluid-receiver or reservoir, which may be in the nature of a working chamber, and means for forcing fluid therefrom under pressure, whereby in practice it may be delivered onto a fire under approximately the same pressure as that which forces the same from the receiver.

As a preface to a further description of this improved fire-extinguishing apparatus it will be understood that the various details of the same may be more or less varied without departing from the general scope of the invention.

In one form thereof herein shown and described the fluid receiver or reservoir or working chamber, designated in a general way by

A, which may be of any suitable and desired construction adapted for the purpose and lined, if desired, with some suitable protecting material a''', whereby it is protected from the injurious effects of the explosive gases, is mounted on a suitable carriage provided with running-gear, shown herein, embodying wheels a' a'. This receiver, which, if desired, may be of relatively small diameter as compared with the length thereof, is provided with a fluid inlet or supply means, such as a relatively large supply-nozzle A', for taking, as shown in this construction, water from a water-plug or hydrant or other source of supply, and which nozzle is provided with a suitable check-valve A''. Suitable outlet means is provided for permitting the discharge of the water onto the fire, which means is shown having connected therewith a relatively large water-tower or upright discharging conduit or pipe C, the lower end of which opens into the receiver, preferably by means of perforations *c* in the base or flange C' of said pipe C. This tower is shown as an extensible one, and for this purpose is preferably made telescopic—as, for instance, at C''—but may be constructed in as many sections as desired, and is provided at its upper end with a nozzle D, which is capable of being turned as occasion may require by some suitable universal joint or connection, such as a ball-and-socket joint *d*, suitable means, such as handles D', preferably two in number, being used to swing such nozzle. If desired, suitable stuffing-boxes D'' may be provided for the telescopic joint of the discharge-pipe. For the use of the nozzlemen the upper section of the telescopic tower C is shown herein having secured thereto at some suitable point—as, for instance, at *e*—a platform B, furnished with a suitable railing B', said platform being accessible by an extensible ladder B''. Supporting-braces *b b* are shown herein extending from the platform, and a brace *b'* from the discharge-pipe, all of which are illustrated in the drawings as uniting at *b''*, at which point is pivotally secured the upper end of one section of an inclinedly-disposed extensible brace E, shown herein as telescopic, the lower end of said brace being pivotally connected, as at *e'*, with the receiver A, and by means of which brace the water-tower and platform are supported. The platform and discharge-nozzle may be raised to any desired height by any suitable means for the purpose of delivering the stream most effectively, this being easily accomplished in one way, if desired, by the water-pressure, and which adjustment is permitted by the extensible ladder, telescopic water-tower, and brace. To sustain the platform in such raised position, the brace E is preferably provided with some suitable locking means, herein shown embodying a pawl E', carried by one as the upper section of the brace, while the lower section is provided with perforations or openings E'', Figs. 1 and 2, into which the free end of said pawl drops, so that the platform can be maintained at any desired height. For the protection of the firemen or nozzlemen from the heat under certain conditions, as in the event of a large conflagration, the nozzle D may be provided with a shield F, behind which the firemen can stand, and this shield may be kept wet by means of perforated pipes F', extending from the nozzle D along the upper edges of the shield, thus allowing the water to flow over its surface. (See Figs. 1 and 3.) A windlass *f* and cable *f'* may be used, if desired, to return the discharge-pipe and platform to their original positions after they have been raised, and when such a device is used the cable constitutes a tie or additional means of holding the tower in position against the force of the stream. The windlass in practice may be provided with some suitable locking means, such as a pawl-and-ratchet device, thereby to insure the proper adjustments to the adjustable devices. Small hose connections or outlets G may be used, if desired, for extinguishing fires in their incipient stages.

To force the extinguishing fluid—such, for instance, as water—from the reservoir to any desired height and onto the fire, suitable mechanism is provided. The energy for this work is preferably obtained by the use of explosive materials of certain quality and quantity appropriate for the purpose in position and operative, preferably, to directly act on the material in the working chamber or fluid-reservoir, and in the present construction this explosive material is preferably contained in or adjacent to one or more explosion or firing chambers, and preferably in a number of separate cartridges with provision for igniting or exploding each cartridge separately, and a given number of cartridges in quick succession, if desired, so as to produce, in effect, one prolonged explosion, whereby the necessary or required pressure from the gases resulting from the explosion is thus preferably brought to directly bear upon the water or other fluid in the receiver, which is prevented by the sides thereof and the check-valve A'' from escaping, except through the water-tower C and nozzle D thereof, from which it is projected in a solid stream with a force varying, as may be desired, from that due to a moderate pressure up to that required to empty the receiver in a few seconds. In this construction of mechanism the explosive gases coming into direct contact with the fluid are absorbed thereby and carried off therewith. The mechanism for producing this explosion in its preferred form thereof herein shown and described comprises one or more explosion or firing chambers, herein shown as two in number, I I, each connected by a passage I' with an air-chamber J, the object of which is to equalize and reduce the pressure of the gases substantially at the instant of the explosion. A valve J', represented in the drawings as a gate-valve, is provided,

through which gases may be permitted to escape, and also air, while the receiver A is being filled with water. A relief-valve K is provided to prevent the pressure from exceeding the number of pounds per square inch required. An escape-pipe K′ is also provided for the valve J′ and relief-valve K. Suitable valves L L, likewise represented in the drawings as gate-valves, are shown for closing all connection, when necessary, between the receiver A and the explosion or firing chambers I. A platform a'', Fig. 1, is shown carried at the forward end of the receiver for the use of the firemen when charging and discharging the explosion or firing chambers. One or more pipes l lead from the interior of the receiver and conveys water at each discharge to the firing-chambers for cooling purposes and is provided at its lower end with a check-valve l' and adjacent to its upper end with a small opening for the escape of a slight quantity of water at each discharge. The air-chamber J communicates with the receiver, preferably by means of a perforated conduit or tube M, which extends down into the receiver A, the object thereof being to distribute the gases from the chamber J when the cartridges are discharged, so as to more thoroughly equalize the pressure upon the water in the receiver. The firing or explosion chambers being shown herein in duplicate, a description of one is deemed sufficient, which in the preferred form thereof is constructed substantially as follows, although it will be obvious that the details of the same may be more or less varied without departing from the general scope of the invention. By the use of a plurality of explosion or firing chambers it will be seen that as soon as the operation of one has ceased another may be operated, thereby to permit the first to be placed in condition for work and in this manner keep up a continuous discharge.

Each firing or explosion chamber I, Fig. 5, has an opening I″, which connects with the passage I′, and thence, by means of the air-chamber J and conduit M, with the receiver A. This opening is shown herein closable by a suitable cut-off or valve, such as a slide m, moving in ways m' and operated by suitable valve-actuating means, represented herein as a link m'', pivotally secured to the lower end of a lever n, which is pivoted at its upper end to the upper wall of the chamber I and held normally back against the spring n' by suitable means. Within this chamber I a cartridge-carrier, represented herein as a cylinder N, rotates on a shaft or spindle N′ and is provided with cartridge-chambers N″, which may be, if desired, of differential diameters, alternating with each other, if preferred. To maintain the passage I″ open when the cartridge-carrier is in position and to permit the same to be closed on the removal of such carrier, thereby to prevent the escape of the gases, the carrier is shown provided with an inwardly-extending member O, adapted to engage the lever n and hold said lever, and thereby the valve m, back against the pressure of its spring n, whereby the passage will be kept open until the cartridge-carrier is removed, when the spring n' causes the slide m to close it. The firing-chamber is provided with a suitable closer, shown herein as a removable head W, adapted to be screwed into the firing-chamber and constructed to support suitable firing mechanism, hereinafter described. This closer is provided with a suitable stuffing-box P, through which the spindle N′ passes.

Suitable actuating means for the cartridge-carrier is provided, and in the preferred construction thereof the spindle has fixedly secured to its outer end a gear-wheel P′, which is engaged by a pinion P″, carried by a stud R, supported on the closer and having secured thereto a crank R′, by means of which the pinion and gear are actuated. Extending from the wheel P′ are suitable projections or trips S, each having a known relation to the position of the chambers N″ in the cylinder N, so that on a partial rotation of the pinion P″ one of the trips engages a hammer S′, forming a part of the hammer mechanism, whereby said hammer is turned slightly and off the supports T T′, Fig. 6, whereupon a compressed spring T″, disposed in the head, Fig. 5, acting on said hammer, which is in engagement with a firing-pin V, constituting another part of said hammer mechanism, causes the explosion of a cartridge in a manner that will be readily understood. After each explosion the hammer is brought into its original position, carrying with it the firing-pin V, as shown in Fig. 9. Another partial rotation of the pinion P″ produces another explosion, and so on. The cartridges are preferably, but not necessarily, of different sizes, as indicated by the sizes of the chambers, Fig. 8, whereby varying pressures may be obtained to correspond with the position of the outlet conduit or pipe and also to the distance to which it is desired to project the fluid. The removable head W may be unscrewed for removing the cartridge-cylinder N, thereby to reload the same by some suitable means, such as a gear-wheel Y and crank Y′, said gear-wheel engaging teeth on the periphery of the head W.

It will be understood that in place of the firing mechanism herein shown any suitable mechanism operative to effect explosions may be used.

When it is desired to use lines of hose at small fires, the general manipulation would be the same as above described, except that a cap would be screwed over the nozzle D and the water permitted to escape intermittently through the outlets G instead of through the water-tower C.

It will be understood that usually the gases resulting from an explosion will follow the water through the main discharge-pipe as the receiver is emptied, thus permitting it

to be filled automatically through the supply-nozzle A′.

In conclusion, it will readily be seen that by the use of this improved apparatus the water will reach the fire under substantially the same pressure as that which forces it from the receiver and that it can be thrown to any desired height, and this without the use of hose; that, furthermore, the firing-chambers can be operated in alternation with each other or simultaneously to produce a decreased or augmented explosion, respectively, and that, moreover, owing to the construction of each firing-chamber varying degrees of pressure may be obtained in the operation thereof.

Having thus described my invention, I claim—

1. In an apparatus of the class specified, the combination of a working chamber adapted to contain fluid; and a plurality of means for producing explosions, either simultaneously, or independently of each other, thereby to produce an augmented or decreased pressure, respectively, on the fluid to force the same from its working chamber.

2. In an apparatus of the class specified, the combination of a working chamber adapted to contain fluid; and a plurality of means for producing explosions, either simultaneously, or independently of each other, thereby to produce an augmented or decreased pressure, respectively, on the fluid to force the same from its working chamber, and one or more of said means being adapted in turn to produce explosions of varying degrees of pressure.

3. In an apparatus of the class specified, the combination of a working chamber adapted to contain fluid; a plurality of cartridge-carriers in position adjacent thereto, means operative independently of each other, alternately or otherwise, and also operative simultaneously, thereby to produce a decreased or augmented pressure, respectively, on the fluid to force the same from its working chamber.

4. In a fire-extinguishing apparatus, the combination of a working chamber; an explosion-chamber; an equalizing-chamber in communication with said working chamber and explosion-chamber; and means for cutting off communication between said explosion-chamber and equalizing-chamber.

5. In a fire-extinguishing apparatus, the combination of a fluid-reservoir; a firing-chamber connected with said reservoir; a cartridge-carrier adjacent to the firing-chamber and mechanism for exploding a cartridge therein.

6. In a fire-extinguishing apparatus, the combination of a fluid-reservoir; a firing-chamber having a passage communicating with said reservoir; mechanism for producing explosions in said firing-chamber, whereby pressure is brought to bear upon the fluid in said reservoir, thereby to force such fluid out; and means for closing said communicating passage on the removal of the explosive-producing mechanism.

7. In a fire-extinguishing apparatus, the combination of a fluid-reservoir; a firing-chamber having a passage communicating with said reservoir; a removable cartridge-carrier in said chamber; mechanism for exploding a cartridge; and means for closing said communicating passage on the removal of the cartridge-carrier.

8. In a fire-extinguishing apparatus, the combination of a fluid-reservoir; a firing-chamber in communication with said reservoir; a cartridge-carrier removable from the firing-chamber; a valve for cutting off communication between the firing-chamber and reservoir; and valve-actuating means operative with the carrier on the removal of said carrier, thereby to permit the passage to be closed.

9. In a fire-extinguishing apparatus, the combination of a fluid-reservoir; a firing-chamber in communication therewith; a slide-valve for cutting off communication between the firing-chamber and the reservoir; spring-actuated means for operating said valve, and comprising a lever having one end thereof linked to said valve, and the opposite end thereof pivoted to the wall of the firing-chamber, and a spring in position to engage said lever; a removable cartridge-carrier disposed in said chamber; and means carried thereby and in position to engage said lever, thereby to maintain the valve in position to permit communication between said firing-chamber and reservoir, and adapted to permit the cutting off of such communication on the removal of said carrier.

10. In a fire-extinguishing apparatus, the combination of a fluid-reservoir; a firing-chamber in communication with said reservoir; a removable closer for said chamber; mechanism carried by said closer for producing explosions; and a cut-off operative on the removal of the closer to cut off communication between the firing-chamber and reservoir.

11. In a fire-extinguishing apparatus, the combination of a fluid-reservoir; a firing-chamber in communication therewith; a removable closer for said chamber; a cartridge-carrier supported by the chamber-closer; and a cut-off operative on the removal of the closer to cut off communication between the firing-chamber and reservoir.

12. In a fire-extinguishing apparatus, the combination of a fluid-reservoir; firing-chamber in communication therewith; a removable closer for said chamber; a shiftable cartridge-carrier supported by said closer and having chambers of differential diameters; a firing mechanism also carried by said closer; and a cut-off operative on the removal of the closer for cutting off communication between the firing-chamber and the reservoir.

13. In an apparatus of the class specified,

the combination of a firing-chamber; and a cartridge-carrier disposed therein and having chambers of differential diameters.

14. In an apparatus of the class specified, the combination of a firing-chamber; a removable closer therefor; and a cartridge-carrier supported on said closer and having chambers of differential diameters.

15. In a fire-extinguishing apparatus, the combination of a firing-chamber; a removable closer therefor; a cartridge-carrier disposed in said chamber, and supported by said closer; firing mechanism carried by said closer; and means for removing said closer.

16. In a fire-extinguishing apparatus, the combination of a firing-chamber; a removable closer therefor provided with external gear-teeth; a rotatable cartridge-carrier supported by said closer and adapted to carry a cartridge; means for rotating said carrier; and means for removing said closer and comprising a pinion meshing with the closer gear-teeth.

17. In a fire-extinguishing apparatus, the combination of a firing-chamber having internal screw-threads; a removable closer externally threaded to fit said internal screw-threads, and provided with gear-teeth; a cartridge-carrier supported on said closer; firing mechanism also carried on said closer; and means for removing said closer, and comprising a pinion meshing with said closer gear-teeth.

18. In an apparatus of the class specified, the combination of a firing-chamber having internal screw-threads; a removable closer externally threaded to fit said firing-chamber, and provided with gear-teeth; a cartridge-carrier supported on said closer; firing mechanism carried by said closer, and comprising a gear having a series of trips; hammer mechanism operative by said trips; and a pinion meshing with said gear for actuating said trips into position to engage said hammer; and means for removing said closer, and embodying a pinion meshing with said closer gear-teeth.

19. In an apparatus of the class specified, the combination of a firing-chamber; a cartridge-carrier supported within said chamber and having chambers of differential diameters; hammer mechanism, gear mechanism for rotating said carrier and a trip carried by said gear mechanism and adapted to engage said hammer mechanism, thereby to permit the same to operate.

20. In a fire-extinguishing apparatus, the combination with a fluid-reservoir and an extensible discharge-conduit connected therewith, of mechanism for producing explosions of varying degrees of pressure, whereby said pressure may be varied with the position of the conduit and the distance to which it is desired to project the fluid,

21. In a fire-extinguishing apparatus, the combination with a fluid-reservoir, an extensible water-tower and an extensible brace, of mechanism for producing explosions of varying degrees of pressure, whereby the pressure may be varied with the position of said water-tower and the distance to which it is desired to project the fluid.

22. In a fire-extinguishing apparatus, the combination with a fluid-reservoir and an extensible discharge-conduit connected therewith, of a chamber adapted to contain simultaneously a plurality of explosive charges of varying degrees of power; and means for exploding said charges, whereby the pressure obtainable may be varied with the position of said conduit and the distance to which it is desired to project the fluid.

23. In a fire-extinguishing apparatus, the combination of a fluid-reservoir; an extensible water-tower, the lower end of which is rigidly connected therewith; a telescopic brace composed of a plurality of members, one member thereof permanently connected with the tower, and the other member thereof permanently connected with said reservoir and at an angle thereto; means for locking said sections in position; and a tie connecting the upper end of said brace with a windlass, and constituting a means of lowering said tower.

24. In a fire-extinguishing apparatus, the combination of a fluid-reservoir; a water-discharge conduit connected therewith; an adjustable nozzle carried by said conduit; a shield carried by said nozzle, whereby an adjustment of the nozzle also effects an adjustment of the shield; and a water-distributing conduit carried by said shield for maintaining the same wet and having connection with said nozzle.

25. In an apparatus of the class specified, the combination of a firing-chamber; a removable closer therefor; a spindle journaled in said closer; a cartridge-carrier mounted on said spindle for rotation therewith; a gear-wheel fixedly secured to said spindle and provided with a plurality of trips; a firing-pin carried by said closer; a spring-actuated hammer also carried by said closer and in engagement with said firing-pin; supports for maintaining said hammer in its inoperative position; and a pinion in engagement with said gear-wheel for actuating said gear, thereby to rotate the cylinder and simultaneously disengage the hammer from its supports, thereby to permit the firing of a cartridge.

26. In a fire-extinguishing apparatus, the combination of a fluid-reservoir; a firing-chamber; and an equalizing or distributing chamber in communication with said reservoir and firing-chamber.

27. In a fire-extinguishing apparatus, the combination of a fluid-reservoir; a firing-chamber; an equalizing or distributing chamber in communication with said firing-chamber and reservoir; and means for cutting off communication between said firing-chamber and reservoir,

28. In a fire-extinguishing apparatus, the combination of a fluid-reservoir; a firing-chamber; an equalizing or distributing chamber intermediate said firing-chamber and reservoir; and means for producing explosions in said firing-chamber.

29. In a fire-extinguishing apparatus, the combination of a fluid-reservoir, a perforated conduit disposed in said reservoir; a firing-chamber; and an equalizing or distributing chamber into which said conduit and firing-chamber opens.

30. In a fire-extinguishing apparatus, the combination of a fluid-reservoir; a plurality of firing-chambers; and an equalizing or distributing chamber intermediate said reservoir and firing-chamber, and into which said reservoir and each firing-chamber opens.

31. In a fire-extinguishing apparatus, the combination of a fluid-reservoir; a firing-chamber in communication therewith, and adapted to contain simultaneously a plurality of explosive charges of varying proportions; and mechanism for exploding said charges to produce varying degrees of pressure, whereby pressure is brought to bear upon the fluid in the reservoir to force such fluid out.

32. In a fire-extinguishing apparatus, the combination of a fluid-reservoir; a firing-chamber in communication therewith; an equalizing-chamber in communication with said reservoir and firing-chamber; and a valve in position to permit the escape of air or gases from said equalizing-chamber.

33. In a fire-extinguishing apparatus, the combination of a fluid-reservoir; a firing-chamber; an equalizing-chamber in communication with said firing-chamber and reservoir; and a relief-valve for preventing excessive pressure.

34. In a fire-extinguishing apparatus, the combination of a fluid-reservoir; a firing-chamber in communication therewith; mechanism for producing explosions in said chamber; and a valve for closing communication between said reservoir and firing-chamber.

35. In a fire-extinguishing apparatus, the combination of a fluid-reservoir; a firing-chamber; means for producing explosions in said firing-chamber; an equalizing-chamber in communication with said firing-chamber and reservoir; means for cutting off communication between said firing-chamber and equalizing-chamber; and means for cutting off communication between said firing-chamber and reservoir.

36. In a fire-extinguishing apparatus, the combination with a fluid-reservoir and with an extensible water-tower carried thereby, of a firing-chamber connected with said reservoir and adapted to contain simultaneously a plurality of explosive charges; and means for exploding each of said charges, whereby pressure is brought to bear upon the fluid in said reservoir, thereby to force such fluid out.

37. In a fire-extinguishing apparatus, the combination, of a portable liquid-carrying working chamber adapted to contain liquid while in transit; means for supporting an explosive charge of solid material in position adjacent to said chamber; and means for exploding said material, whereby pressure is brought to bear upon the fluid in the working chamber, thereby to force such fluid out.

38. In a fire-extinguishing apparatus, the combination of a fluid-reservoir; a firing-chamber connected therewith and adapted to contain simultaneously a plurality of explosive charges; and means for exploding each of said charges, whereby pressure is brought to bear upon the fluid in the reservoir, thereby to force such fluid out.

39. In a fire-extinguishing apparatus, the combination with a working chamber of relatively small diameter as compared with the length thereof and adapted to contain fluid, said chamber having a fluid-discharge outlet adjacent to one end thereof and a fluid-inlet remotely disposed relatively to said outlet; a cartridge-chamber in communication with said working chamber; and means for firing a cartridge, whereby pressure will be brought to bear on the fluid in said working chamber intermediate said inlet and outlet, thereby to force the fluid from said working chamber.

40. In a fire-extinguishing apparatus, the combination of a portable working chamber adapted to contain liquid while in transit; means for supporting a cartridge in position adjacent to said chamber; and means for exploding said cartridge, whereby pressure is brought to bear upon the fluid in the working chamber, thereby to force such fluid out.

41. In a fire-extinguishing apparatus, the combination of a fluid-reservoir; means for supporting a plurality of cartridges of different efficiencies adjacent to said reservoir; and means for exploding in turn each of said cartridges, whereby pressure is brought to bear upon the fluid in the reservoir, thereby to force such fluid out.

42. In a fire-extinguishing apparatus, the combination of a fluid-reservoir; a firing-chamber in communication therewith; an equalizing-chamber in communication with said firing-chamber and reservoir; means for producing explosions in said firing-chamber; a relief-valve for preventing excessive pressure; and a valve for permitting the escape of air or gases.

43. In a fire-extinguishing apparatus, the combination of a fluid-reservoir; a firing-chamber in communication therewith; means for producing explosions in said firing-chamber; and means for admitting fluid to said chamber for cooling purposes, and comprising a conduit leading from said reservoir to said firing-chamber.

44. In a fire-extinguishing apparatus, the combination of a working chamber containing fluid; a cartridge-receiver having a cartridge-chamber in communication with said working chamber; a cartridge-firing device; and means for cutting off communication be-

tween said cartridge-chamber and said working chamber.

45. In an apparatus of the class specified, the combination of a working chamber adapted to contain fluid; mechanism for producing explosions, thereby to force the fluid from the working chamber; a valve for permitting the escape of air or gases; a relief-valve for preventing excessive pressure; and an outlet-conduit with which both of said valves communicate.

HERBERT F. DUNHAM.

Witnesses:
HENRY W. WILLIAMS,
J. M. HARTNETT.