

No. 677,803.

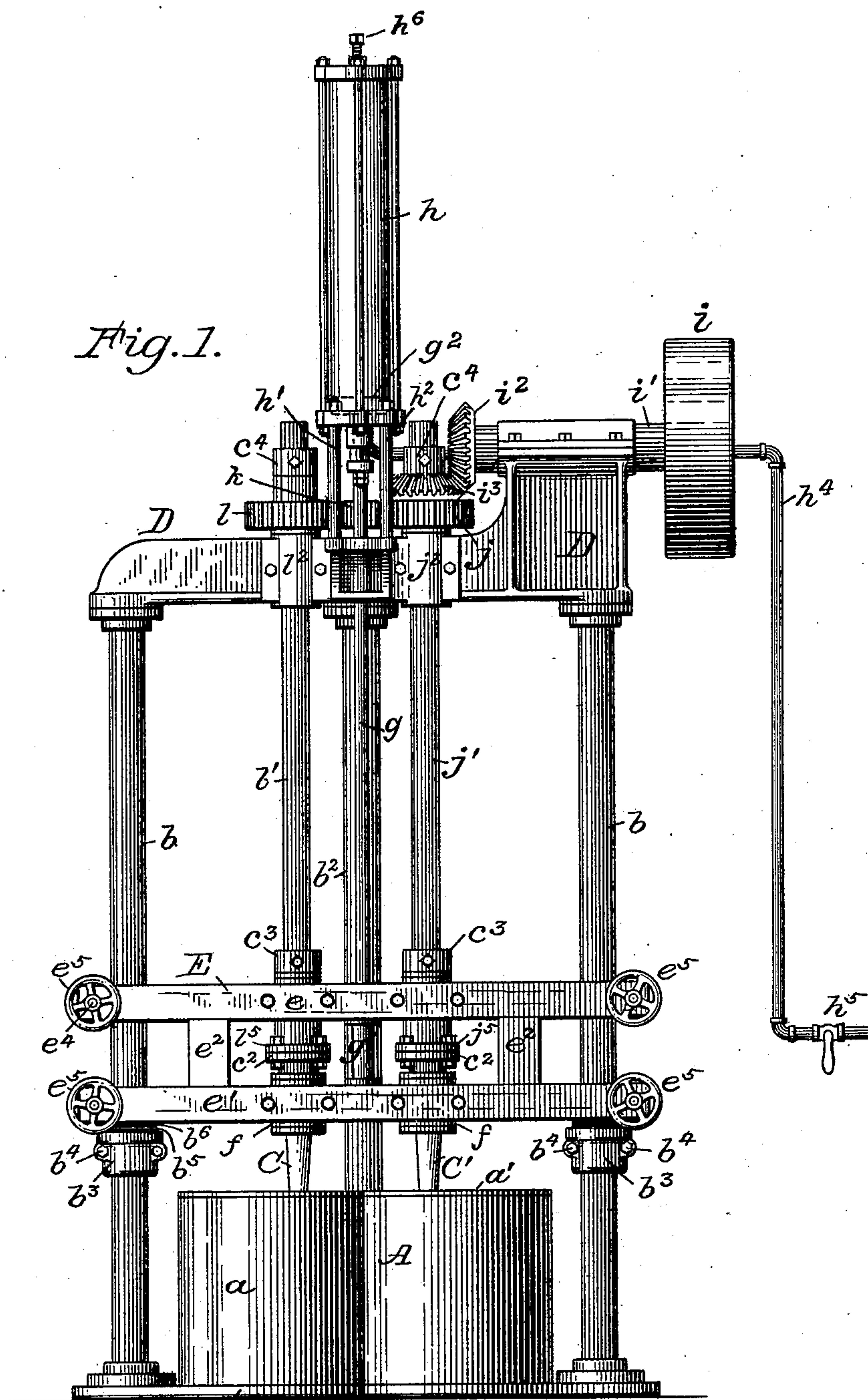
Patented July 2, 1901.

J. C. SCHRADER.
MACHINE FOR MIXING EXPLOSIVES.

(Application filed July 9, 1900.)

(No Model.)

5 Sheets—Sheet 1.



Attest:
Wm. Keale
C. H. Fowler

Inventor:
John C. Schrader,
By *Howell Zittle*
Attorney.

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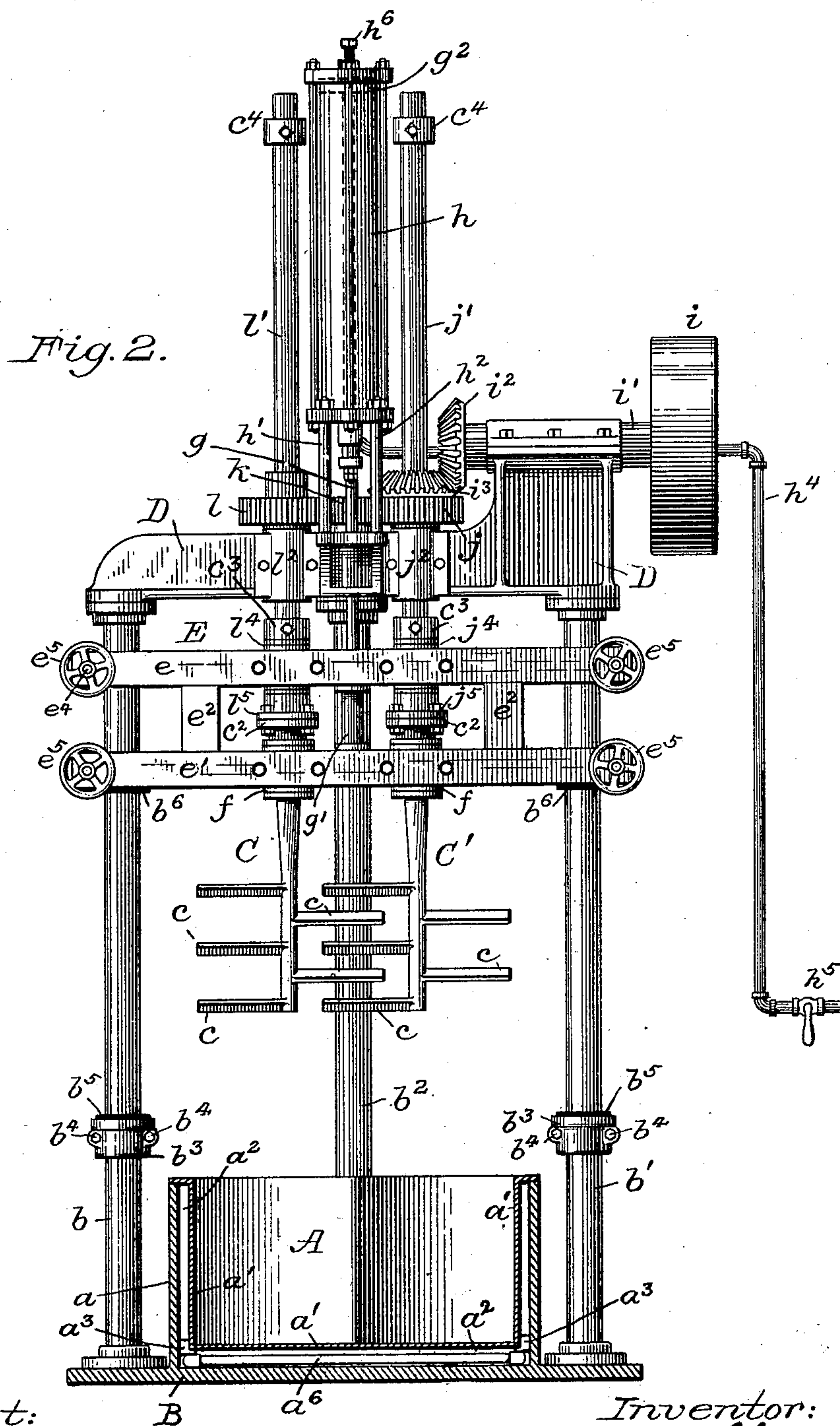
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5 Sheets—Sheet 2.



Attest:
C. W. Fowler

Inventor:
John C. Schrader.
By Lowell Zaitz
Attorney.

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Fig. 3.

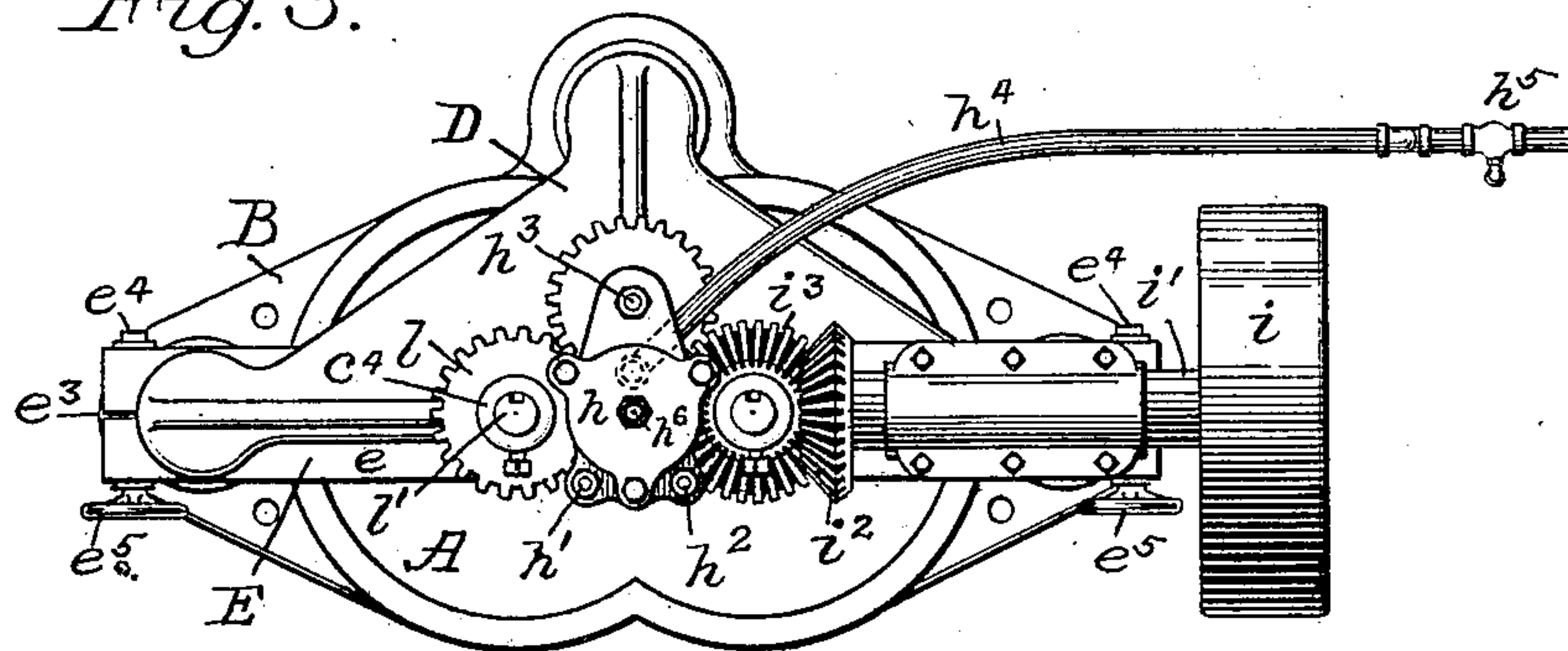


Fig. 4.

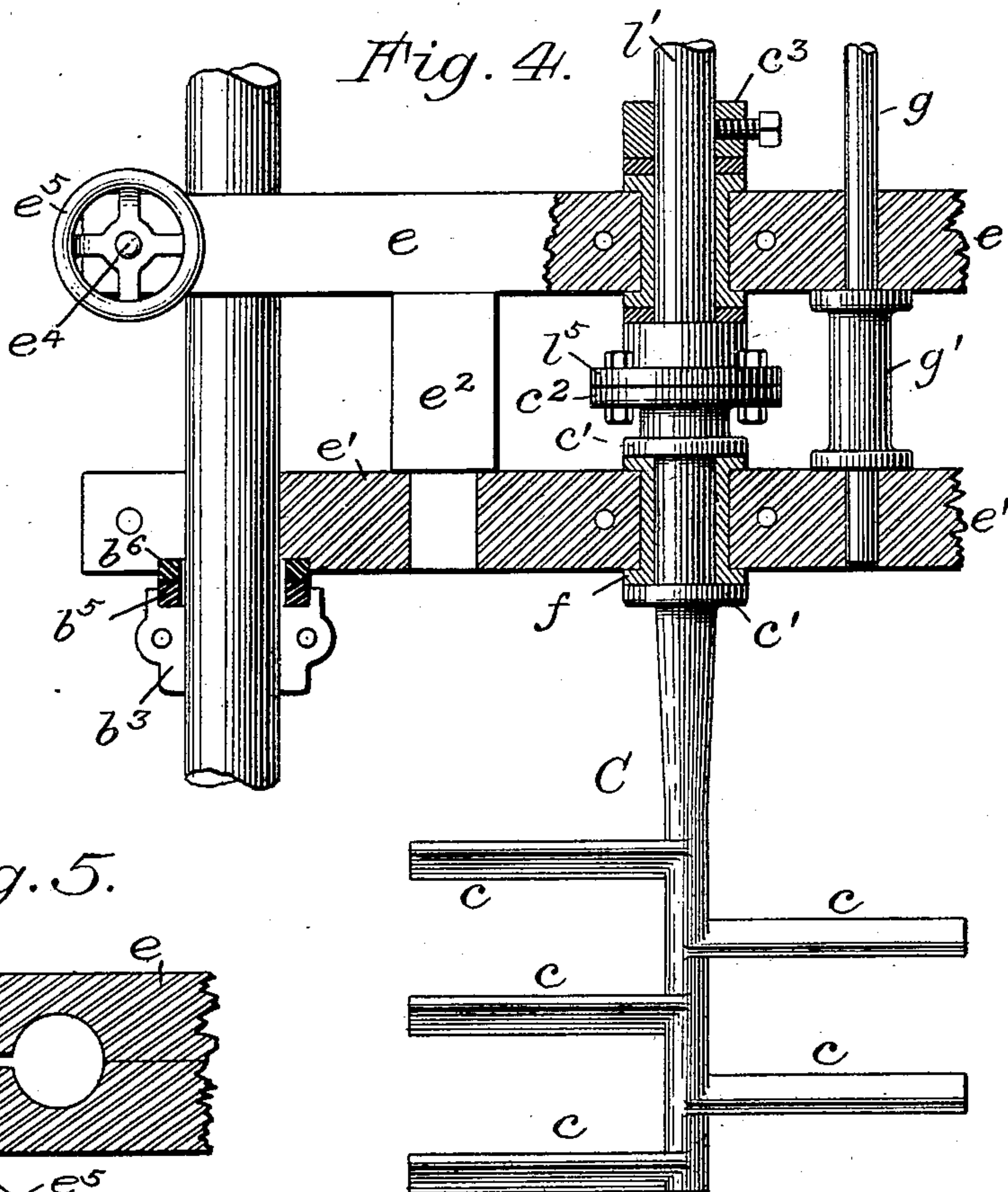
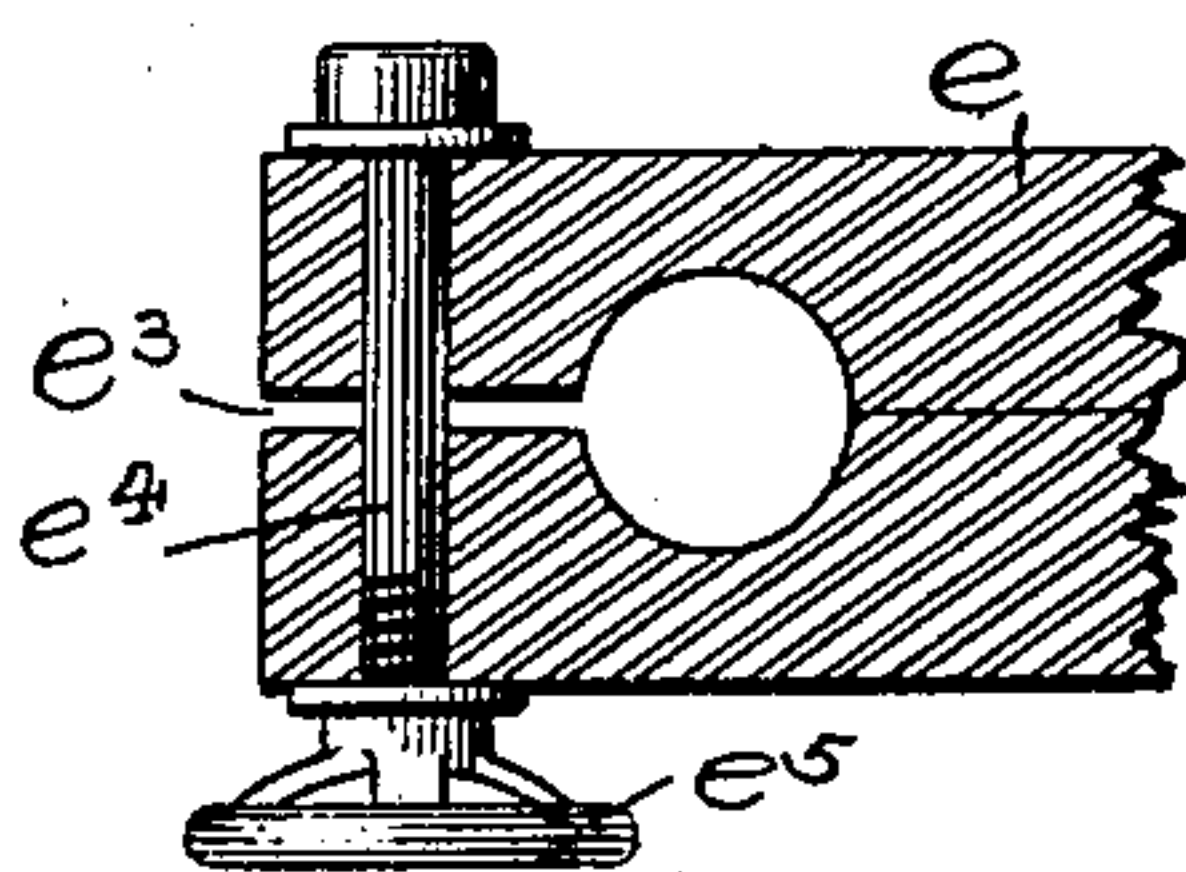


Fig. 5.



Attest:
C. N. Fowler

Inventor:
John C. Schrader,
By Howell G. Little
Attorney

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Fig. 6.

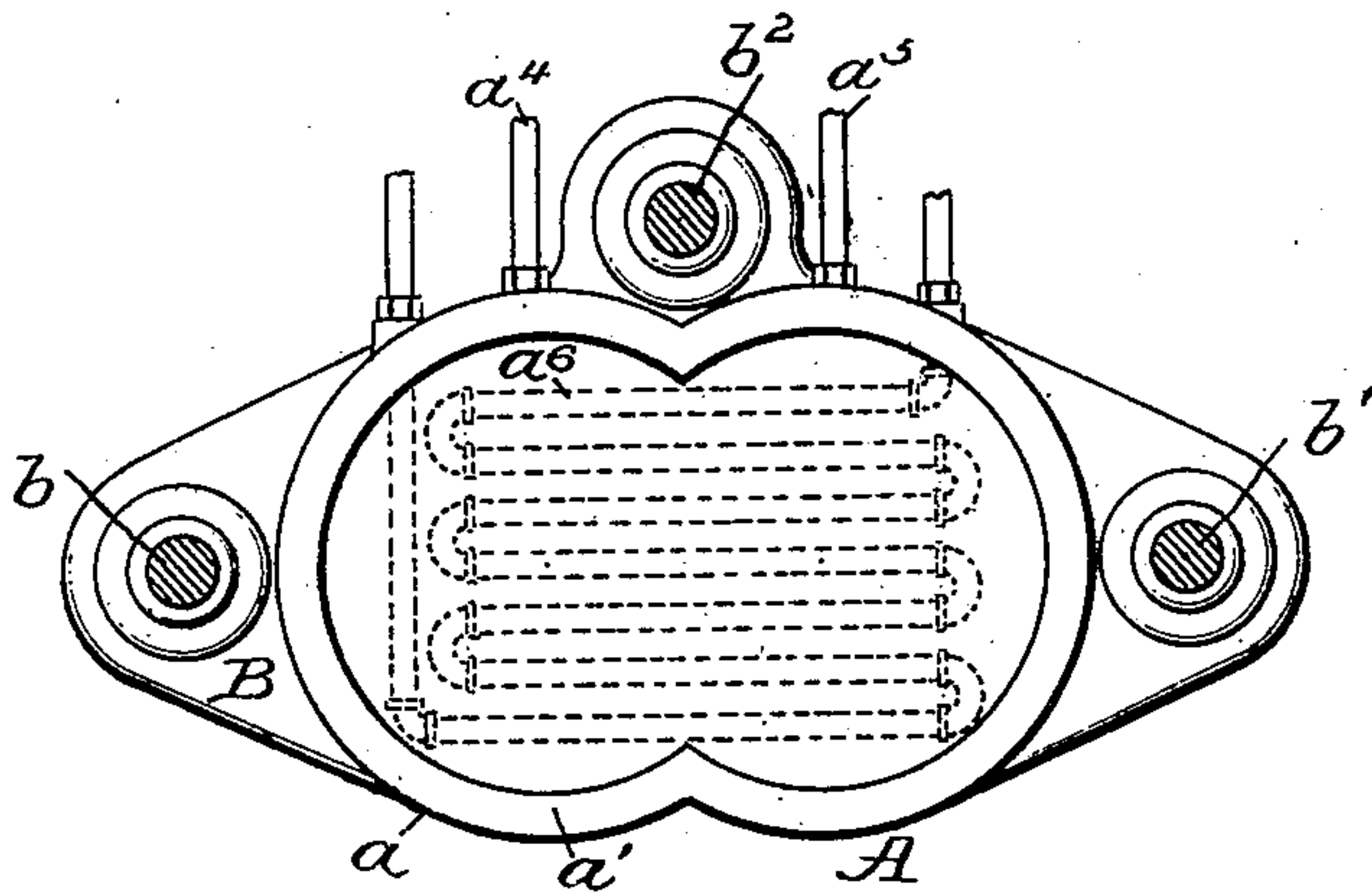


Fig. 8.

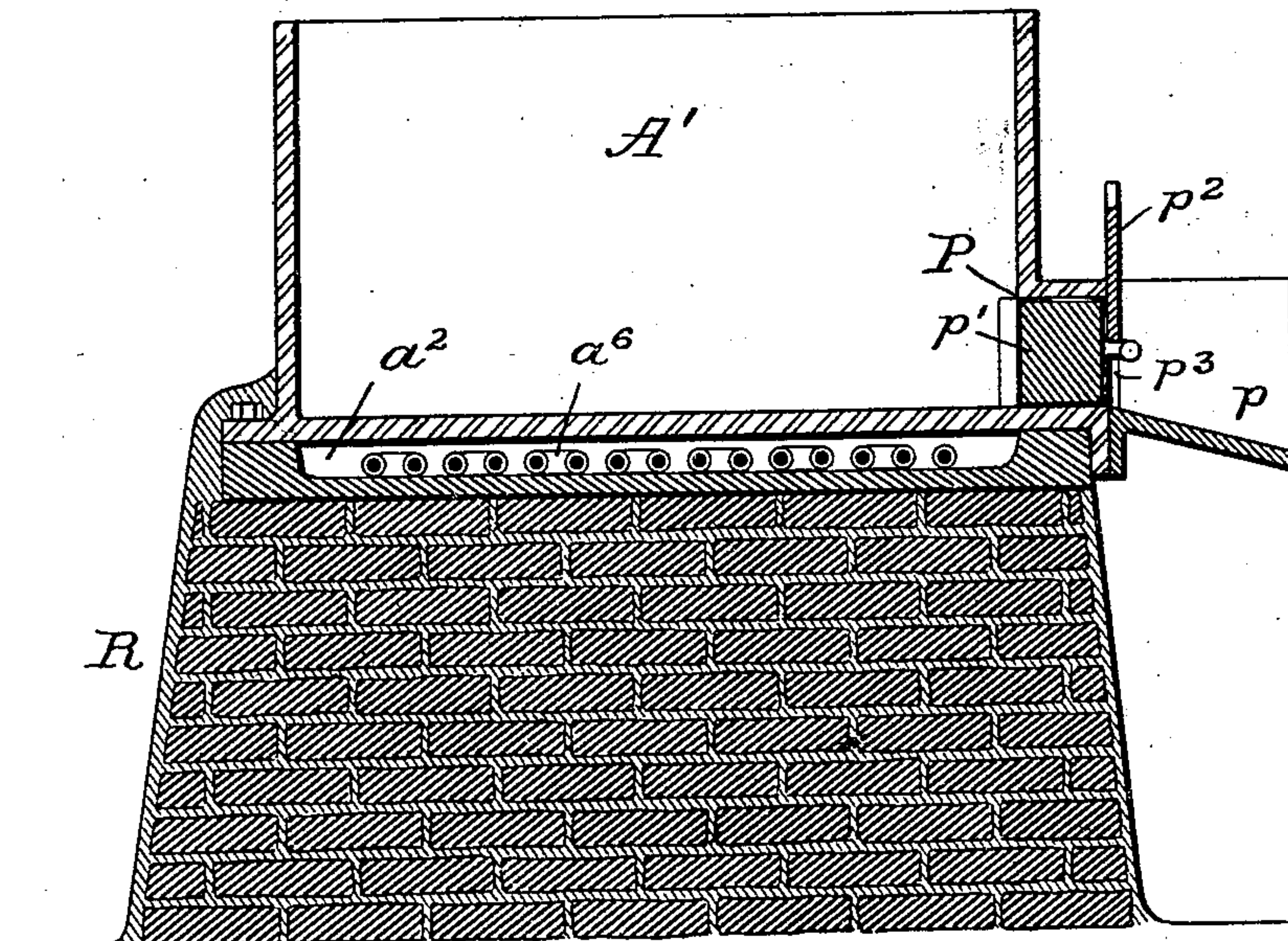
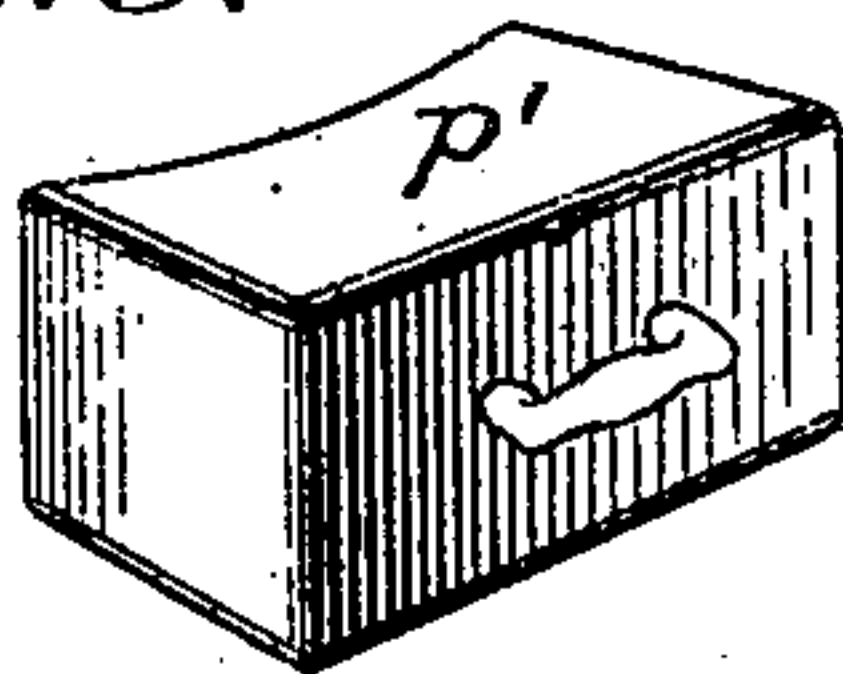


Fig. 9.

Attest:
Edw. Keate
C. H. Fowler



Inventor:
John C. Schrader,
By *Howell Garth*
Attorney.

No. 677,803.

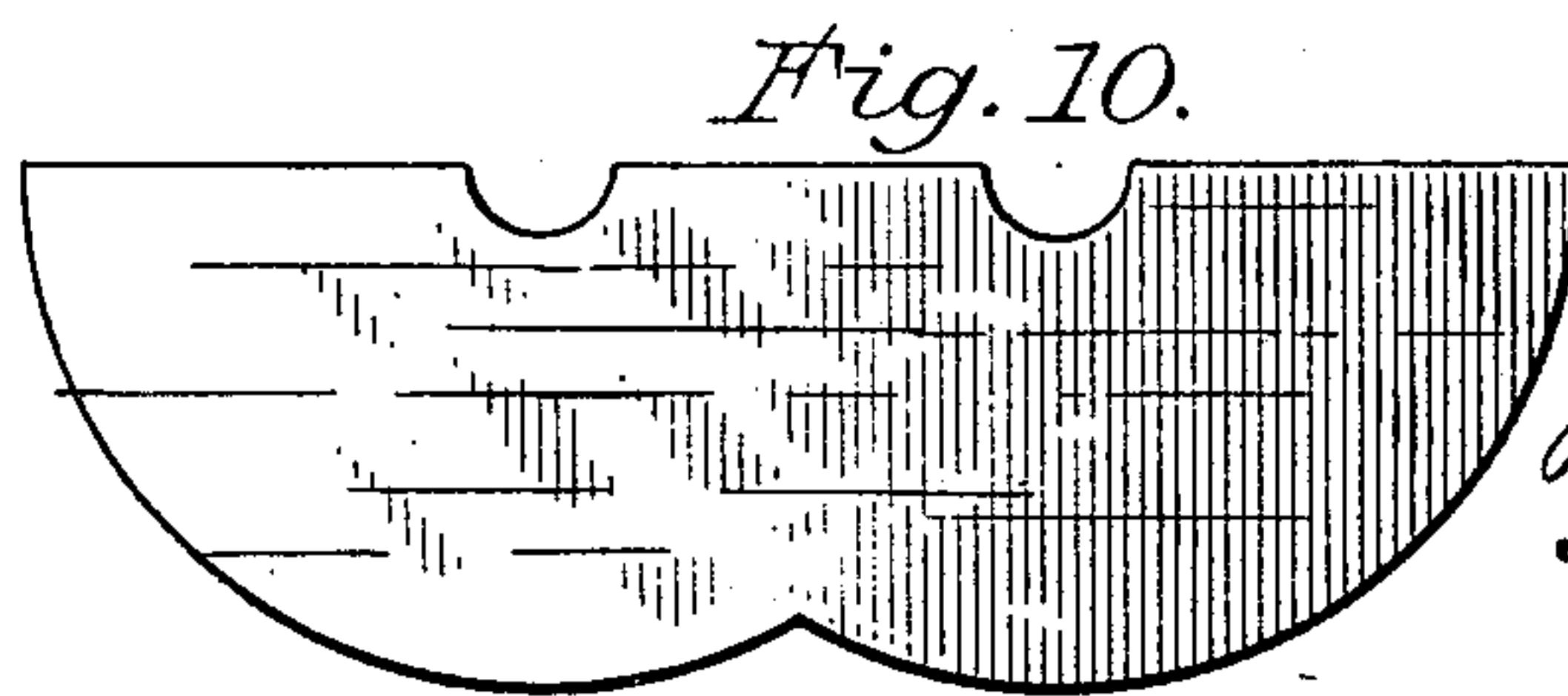
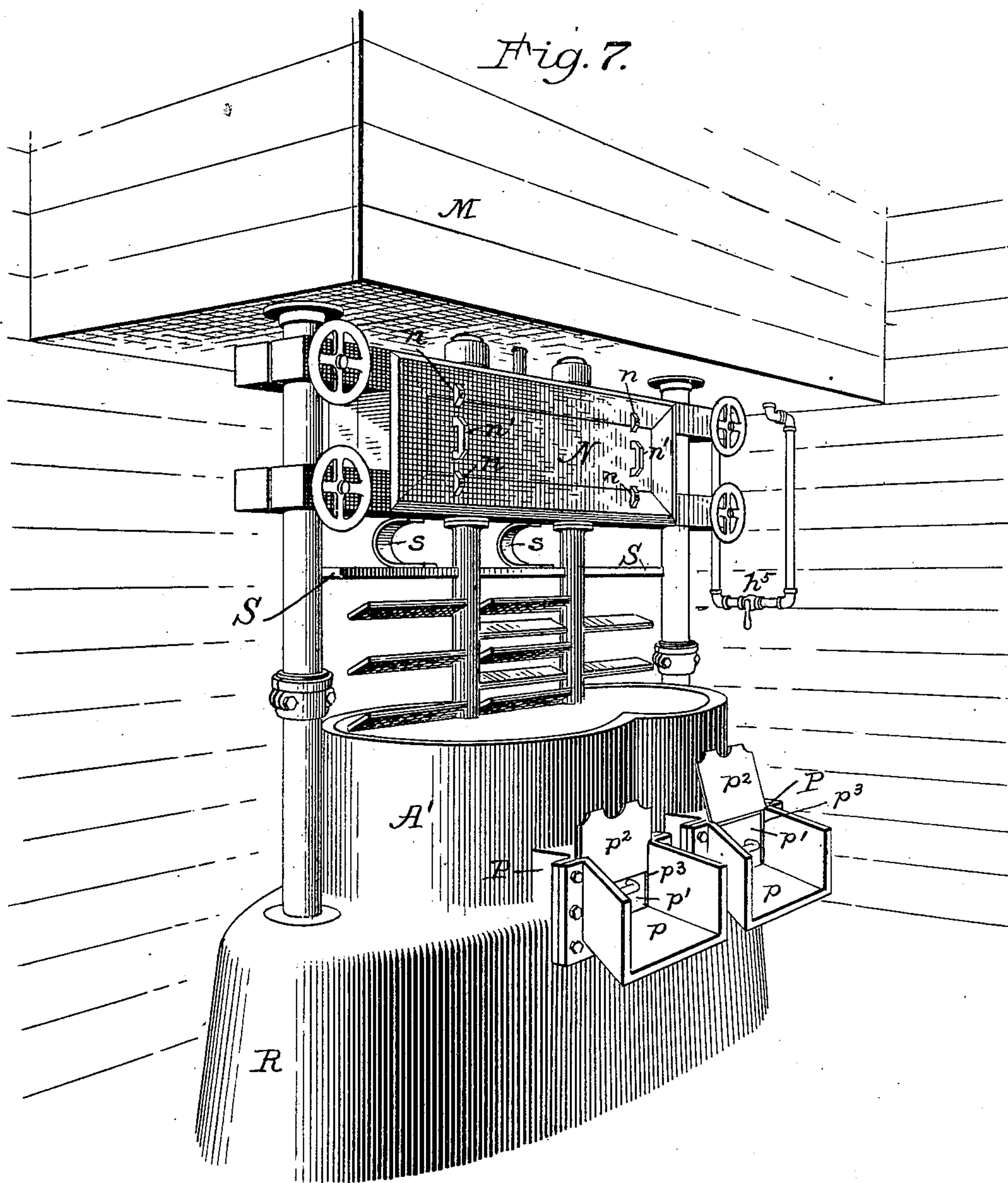
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5 Sheets—Sheet 5.



Attest:
C. H. Keale
C. H. Fowler

Inventor:
John C. Schrader,
By *Howell Zittle*
Attorney.

UNITED STATES PATENT OFFICE.

JOHN C. SCHRADER, OF DOVER, NEW JERSEY.

MACHINE FOR MIXING EXPLOSIVES.

SPECIFICATION forming part of Letters Patent No. 677,803, dated July 2, 1901.

Application filed July 9, 1900. Serial No. 22,985. (No model.)

To all whom it may concern:

Be it known that I, JOHN CHRISTIAN SCHRADER, a citizen of the United States, residing at Dover, in the county of Morris and State of New Jersey, have invented new and useful Improvements in Machines for Mixing Explosive Compounds, of which the following is a specification.

My invention relates to machines for mixing nitroglycerin with soluble guncotton in the manufacture of explosive gelatin or the ingredients of gelatinated dynamite, dynamite, or other explosive compounds.

In the manufacture of compounds containing nitroglycerin machinery has been used to a very limited extent because of the great danger of explosions liable to result from small particles of the compound accidentally falling upon or coming in contact with bearings or other moving or movable parts where friction is liable to be generated. For this reason nitroglycerin and nitrocellulose have been and are now to a very large extent mixed wholly by hand, and as the operation is one requiring great thoroughness its performance by hand is necessarily slow and expensive.

The object of my invention is to provide a machine in which the entire operation of mixing nitroglycerin and nitrocellulose or other explosive ingredients in large quantities may be safely performed, and thus avoid the labor and expense involved in performing the operation wholly or partially by hand and in the latter case avoiding the danger incident to transferring the explosive from one receptacle to another.

My invention consists in an organization of parts whereby all bearings or moving elements liable to generate friction are remotely located above the contents of the mixing-receptacle and in certain novel features of construction to be hereinafter fully described.

After a detail description of my invention in connection with the drawings furnished the features deemed novel will be specified in the claims hereto annexed.

Referring to the drawings, Figure 1 is a front elevation of a machine embodying my invention specially designed for the manufacture of explosive gelatin and gelatinated dynamite. Fig. 2 is a similar view of the

same machine, showing the mixing-receptacle in section and the mixing-blades or stirrers in their elevated position. Fig. 3 is a top or plan view of the machine of Figs. 1 and 2. Fig. 4 is a detail view illustrating the mode of mounting the stirrer-blades. Fig. 5 is a detail of one end of the cross-head. Fig. 6 is a plan view of the mixing-receptacle. Fig. 7 is a perspective view of a complete machine organized for the manufacture of dynamite. Fig. 8 is a sectional view of the mixing-receptacle of the machine of Fig. 7. Fig. 9 is a perspective view of one of the blocks used for closing the discharge-apertures of said receptacle, and Fig. 10 is a plan view of one-half of the cover for closing the mixing-receptacle.

I have illustrated my invention as applied to a machine for mixing explosive gelatin and gelatinated dynamite and also to a machine for mixing the ingredients of ordinary dynamite. The two machines are identical in all essential respects, except as to the mixing-receptacle. In the dynamite-mixing machine the mixing-receptacle is provided with apertures through which the finished compound may be automatically discharged. In the gelatin-mixing machine it is absolutely necessary that the mixing-receptacle be without joints or cracks of any character, through which the liquid nitroglycerin might find its way, and for this reason no discharge-apertures are provided.

The receptacle A of the gelatin-machine (illustrated in Figs. 1 to 6, inclusive) is composed of an outside casting a and an interior shell a' , forming an outer and inner wall, between which is a water-space a^2 entirely surrounding the interior shell. The outer casting is preferably cast integral with a base B, which affords support for the entire machine; but it may be bolted or otherwise secured thereto. The inner shell a' is made of gun-metal or phosphor-bronze and firmly united to the outer casting in any suitable manner, and it is supported and braced at its lower edge by metal blocks a^3 , as shown in Fig. 2. The interior walls of the receptacle are made to conform to the paths of two sets of vertically-suspended stirrers or mixers C and C', so that every particle of material within the receptacle may be reached by said stirrers

during the mixing operation, and hence said receptacle is made in the form of two upright cylinders joined together to form a single receptacle having two overlapping spaces 5 whose axes are coincident with the axes of the rotating blades. The water-space a^2 is provided with cold-water inlet and outlet pipes, as at $a^4 a^5$, Fig. 6, and also with a steam or hot-water coil a^6 , provided for heating the 10 water and keeping the contents of the receptacle to the required temperature. By means of suitable cocks in both the steam and cold-water pipes the receptacle may be kept at an even heat or the temperature quickly raised 15 or lowered, as occasion may require.

Secured to the base B are three columns or uprights $b, b',$ and b^2 , which afford support for a casting D, overlying the mixing-receptacle at a considerable distance therefrom. 20 This casting D with its supports and the base B constitute the frame of the machine and form one practically integral structure, of which the receptacle A forms a part.

The stirrers C and C' are solid castings of 25 phosphor-bronze, having blades c projecting radially therefrom from opposite sides, the blades on one side projecting from points between the blades on the other side, and each blade is angularly disposed, as shown, so as 30 to force the material down or up, according to the direction of their rotation. The two stirrers are exact counterparts, and they are so set with reference to each other that the blades on one will pass between the blades 35 on the other. The stirrers are journaled in a vertically-movable cross-head E, composed of two wooden cross-bars $e e'$, separated from each other and firmly united by blocks e^2 near each end, as clearly shown. The ends 40 of the cross-bars are bored to receive the circular columns $b b'$, by means of which the cross-head is accurately guided in its up and down movements, and said ends are split, as shown at e^3 , and provided with a screw e^4 and 45 hand-wheel e^5 for clamping the cross-head to the columns b and b' in a manner well known.

On each of the columns b and b' are adjustable stops b^3 , constructed in halves united by bolts b^4 , so that they may be securely clamped 50 to the columns at any desired point. The upper or bearing ends of said stops are provided with rubber cushions b^5 , which contact with similar cushions b^6 in the under side of the cross-bar e' . These stops serve to limit 55 the downward movement of the cross-head E and are made adjustable to permit of accurate adjustment of the stirrer-blades with reference to the bottom of the mixing-receptacle. The lower cross-bar e' of the cross- 60 head is bored to receive bushings $f f'$, in which the stirrers C and C' are journaled, the latter being held and supported by integral collars c' . At the center of the cross-head is an upright rod g , secured thereto by means of a 65 sleeve g' , integral with or made fast to said rod between the two cross-bars e and e' , as clearly shown. The rod g projects through

the casting D and at its upper end it carries a piston g^2 , which works in a cylinder h , the latter being supported on the casting D by 70 rods $h' h^2 h^3$ and provided with a screw h^6 for adjusting the height to which the piston can rise and preventing the cross-head from coming in contact with the casting D. Entering 75 the lower end of cylinder h is a compressed-air pipe h^4 , which is connected with a suitable source of supply and provided at a convenient point with a three-way cock h^5 . The upper end of the cylinder being provided 80 with a vent, it will be readily seen that by opening the cock h^5 for the admission of compressed air the cross-head E will be lifted by the piston g^2 to the position shown in Fig. 2 and raise the stirrers out of the mixing-receptacle and leave the latter free for the re- 85 moval of its contents. The ingredients to be mixed are usually inserted while the stirrers are in their elevated position, and the latter are sometimes raised for special purposes before the mixing operation is completed. It 90 is therefore of the utmost importance that the downward movement of the cross-head, which descends by gravity alone, be slow and gradual and without producing the least shock. With the arrangement shown when 95 the stirrers are to be lowered the compressed air in the cylinder h is permitted to escape through the three-way cock h^5 , which may be regulated to permit the descent of the cross-head as slowly as may be necessary or desirable, the compressed air in the cylinder acting as an effective cushion against shock at the completion of the downward movement. 100

The stirrers are rotated by means of a belt-pulley i , mounted on a short horizontal shaft 105 i' , carrying a bevel-gear i^2 and supported in a suitable bearing on the casting D. Meshing with the gear i^2 is a bevel-gear i^3 , secured to the upper side of a pinion j , the latter being splined to a shaft j' , which rotates in a bearing j^2 in the casting D and in a bearing j^4 in 110 the upper cross-bar e of the cross-head E. At the lower end of this shaft, between the bars e and e' of the cross-head, is secured a flange j^5 , which is bolted to a similar flange c^2 , integrally cast on the upper end of the stirrer C'. Pinion j meshes with a pinion k , mounted on 115 the rod h^3 , and pinion k in turn meshes with a pinion l , splined to a shaft l' , corresponding to shaft j' , and similarly secured to the stirrer C. Both shafts j' and l' are provided with adjustable collars c^3 for holding them securely to the cross-head, and similar collars c^4 are provided at their upper ends to guard 120 against accident should the stops b^3 slip or break. As thus organized all bearings where friction may be created are outside of and above the mixing-receptacle, where there is no possibility of the explosive reaching them. The mixing-blades should not of course 125 touch the walls or bottom of the mixing-receptacle, but should be sufficiently close to insure a proper working of every particle of the compound. Both stirrers are revolved in 130

the same direction and the blades on each pass each other in opposite directions. The faces of the blades are angular, as shown, and during the operation of mixing they are
 5 revolved in a direction for forcing the materials down or toward the bottom of the receptacle, the materials being thereby forced up at the sides of the receptacle and over upon the blades continuously until the operation is
 10 completed, the rotation of the stirrers being then reversed for lifting and loosening the material preparatory to its removal, as will be readily understood.

The cross-head E is locked to the columns
 15 bb' only for special purposes—as, for instance, for holding it in its elevated position independently of the raising and lowering cylinder. The stirrer-blades are thus free to rise during the mixing operation, this being an im-
 20 portant feature for the reason that no greater pressure can be put upon the material than the combined weight of the stirrers and cross-head, and should the compound become extra stiff the stirrers will be forced up and all dan-
 25 ger avoided.

Another important feature is the mode of mounting the stirrers, by which they are independently supported by the cross-head, so that should the connections between the
 30 driving-shafts and stirrers break the latter cannot drop into the mixing-receptacle.

The location of the driving mechanism and the form of the cross-head admit of all moving parts being readily inclosed, as illustrated in Fig. 7. The machine there shown
 35 is designed for the manufacture of dynamite, and all parts are as already described except the mixing-receptacle A'. The upper portion of the machine is entirely inclosed by a suitable box or casing M, and the space between
 40 the upper and lower bars of the cross-head is also closed by side covers N, held in place by turn-buttons n and provided with handles n' , all bearings and moving elements being thus
 45 effectively closed.

The mixing-receptacle A' is the same as the mixing-receptacle of the gelatin-mixing machine, except that it has a water-space at the bottom only and is provided with discharge-
 50 apertures P P. These discharge-apertures are provided with spouts p and are closed during the mixing operation by wooden blocks p' , one of which is illustrated in Fig. 9. Said blocks are made to snugly fit the
 55 apertures, with their inner surfaces flush with the interior walls of the receptacle, said surfaces being made to conform to the curvature of said walls. The interior surfaces of the blocks, as well as the sides where they
 60 come in contact with the edges of the apertures, are covered with pure gum rubber, so that in case any of the explosive should remain in the apertures the close-fitting rubber will sweep it into the machine, and should
 65 any thereafter remain it will come in contact with pure gum rubber, which will not create dangerous friction. The blocks p' are con-

finied in position by plates p^2 , which slide in grooves p^3 in the sides of the spouts, as clearly shown.

The dynamite-machine is built upon a raised foundation R, of masonry or cement, in order that suitable receptacles may be placed under the discharge-spouts for receiving the finished product. The discharge is
 70 effected by simply removing the blocks p' and continuing the rotation of the stirrers, the blades of which force the material through the openings and into the receiving-receptacles.
 80

It is desirable in some instances to keep the mixing-receptacle closed during the operation of the machine, and for this purpose I provide a cover which is secured to the cross-head and moves with it, so that the re-
 85 ceptacle will be opened and closed by the movements of the cross-head. As it is necessary to inspect the contents of the receptacle from time to time, I prefer to construct the cover in two halves, the rear half only being
 90 secured to the cross-head, as shown at S, Fig. 7. U-shaped springs $s s$ are employed for connecting the cover to the cross-head, so that the former will properly seat itself and rest lightly on the receptacle. The front
 95 half of the cover (shown in Fig. 10) is placed on the receptacle and removed by hand; but this may be hinged to the rear half, or the entire cover may be made in one piece, with a hinged door for inspecting the contents, as
 100 may be desired.

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

1. In a machine for mixing explosive com-
 105 pounds, the combination of a frame, a mixing-receptacle fixed with relation thereto, a vertically-movable cross-head above said receptacle guided and supported by said frame, stirrers independently journaled in said cross-
 110 head and supported thereby, and means for rotating said stirrers, substantially as described.

2. In a machine for mixing explosive compounds, the combination of a frame, a mix-
 115 ing-receptacle fixed with relation thereto, a vertically-movable cross-head above said receptacle guided and supported by said frame, rotating mechanism supported by said frame above said cross-head, and stirrers revolved
 120 by said mechanism suspended from said cross-head and independently journaled in and supported thereby, substantially as described.

3. In a machine for mixing explosive compounds, the combination of a mixing-recep-
 125 tacle, revoluble stirrers suspended therein but supported wholly outside of and above said receptacle, means for raising said stirrers, means whereby said stirrers will be permitted to descend by gravity, and means for
 130 retarding their descent, all of said means being located outside of and above said receptacle, substantially as described.

4. In a machine for mixing explosive com-

pounds, the combination of a frame, a mixing-receptacle fixed with relation thereto, stirrers suspended in said receptacle, means for rotating said stirrers, a vertically-movable cross-head in which said stirrers are independently journaled, and means for raising and lowering said cross-head, located outside of and above said receptacle, substantially as described.

5. In a machine for mixing explosive compounds, the combination of a frame, a mixing-receptacle fixed with relation thereto, a vertically-movable cross-head above said receptacle guided and supported by said frame, stirrers independently supported by said cross-head, means for raising and lowering said cross-head, and means fixed with relation to the main frame for rotating said stirrers, substantially as described.

6. In a machine for mixing explosive compounds, the combination of a frame, a mixing-receptacle, a vertically-movable cross-head above said receptacle guided by said frame, stirrers suspended from said cross-head, means for rotating said stirrers, and a cylinder and piston supported by said frame above said cross-head for raising and lowering the same, substantially as described.

7. In a machine for mixing explosive compounds, the combination of a mixing-receptacle, stirrers suspended therein from a point above said receptacle, and a cylinder and piston for raising and lowering said stirrers located above the same, substantially as described.

8. In a machine for mixing explosive compounds, the combination of a frame, a mixing-receptacle fixed with relation thereto, a vertically-movable cross-head above said receptacle guided by said frame, stirrers suspended from said cross-head, means for revolving said stirrers, means located above said cross-head for raising it, means whereby said cross-head will be free to descend by gravity, and means for retarding such descent, substantially as described.

9. In a machine for mixing explosive compounds, the combination of a frame, a mixing-receptacle fixed with relation thereto, a vertically-movable cross-head above said receptacle guided by said frame, stirrers independently supported by and suspended from said cross-head, means for rotating said stirrers, and adjustable means for supporting said cross-head, substantially as described.

10. In a machine for mixing explosive compounds, the combination of a mixing-receptacle, horizontally-revoluble stirrers suspended in said receptacle, and means permitting the automatic rising of the stirrers when the material offers sufficient resistance to the rotation thereof, substantially as described.

11. In a machine for mixing explosive compounds, the combination of a mixing-receptacle, stirrers suspended in said receptacle,

adapted to force material toward the bottom thereof, and means permitting said stirrers to be automatically raised for lessening the pressure upon the material when the latter offers sufficient resistance to the action of the stirrers, substantially as described.

12. In a machine for mixing explosive compounds, the combination of a frame, a mixing-receptacle fixed with relation thereto, a vertically-movable cross-head above said receptacle supported and guided by said frame, stirrers independently suspended from said cross-head and supported wholly thereby, means for raising and lowering said cross-head, rotating mechanism fixedly supported by said frame and suitable connections between said mechanism and stirrers whereby said cross-head may be raised and lowered independently of the rotating mechanism, substantially as described.

13. In a machine for mixing explosive compounds, the combination of a mixing-receptacle, a vertically-movable cross-head above said receptacle consisting of a pair of cross-bars arranged one above another and connected together to afford a space between, stirrers journaled in and supported by the lower cross-bar, and a rotatable shaft passing through the upper cross-bar and coupled to said stirrers in the space between the two cross-bars, substantially as described.

14. In a machine for mixing explosive compounds, the combination of a frame, a mixing-receptacle fixed with relation thereto, a vertically-movable cross-head above said receptacle guided and supported by said frame, stirrers suspended in said receptacle independently journaled in and supported by said cross-head, rotating mechanism supported by said frame above said cross-head, and slidable connections between said mechanism and stirrers, substantially as described.

15. In a machine for mixing explosive compounds, the combination with a mixing-receptacle, of stirrer-blades suspended therein having downwardly-inclined faces and adapted to revolve in horizontal planes, means for revolving said blades, and bearings which will permit the rising of the blades during their rotation, substantially as described.

16. In a machine for mixing explosive compounds, the combination of a mixing-receptacle, a vertically-movable cross-head above said receptacle, stirrers suspended from said cross-head, and a cover for said receptacle secured to said cross-head by yielding connections, substantially as described.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

JOHN C. SCHRADER.

Witnesses:

Mrs. I. R. ROCKWELL,
EDWARD L. GRAEFFE.