

No. 873,840.

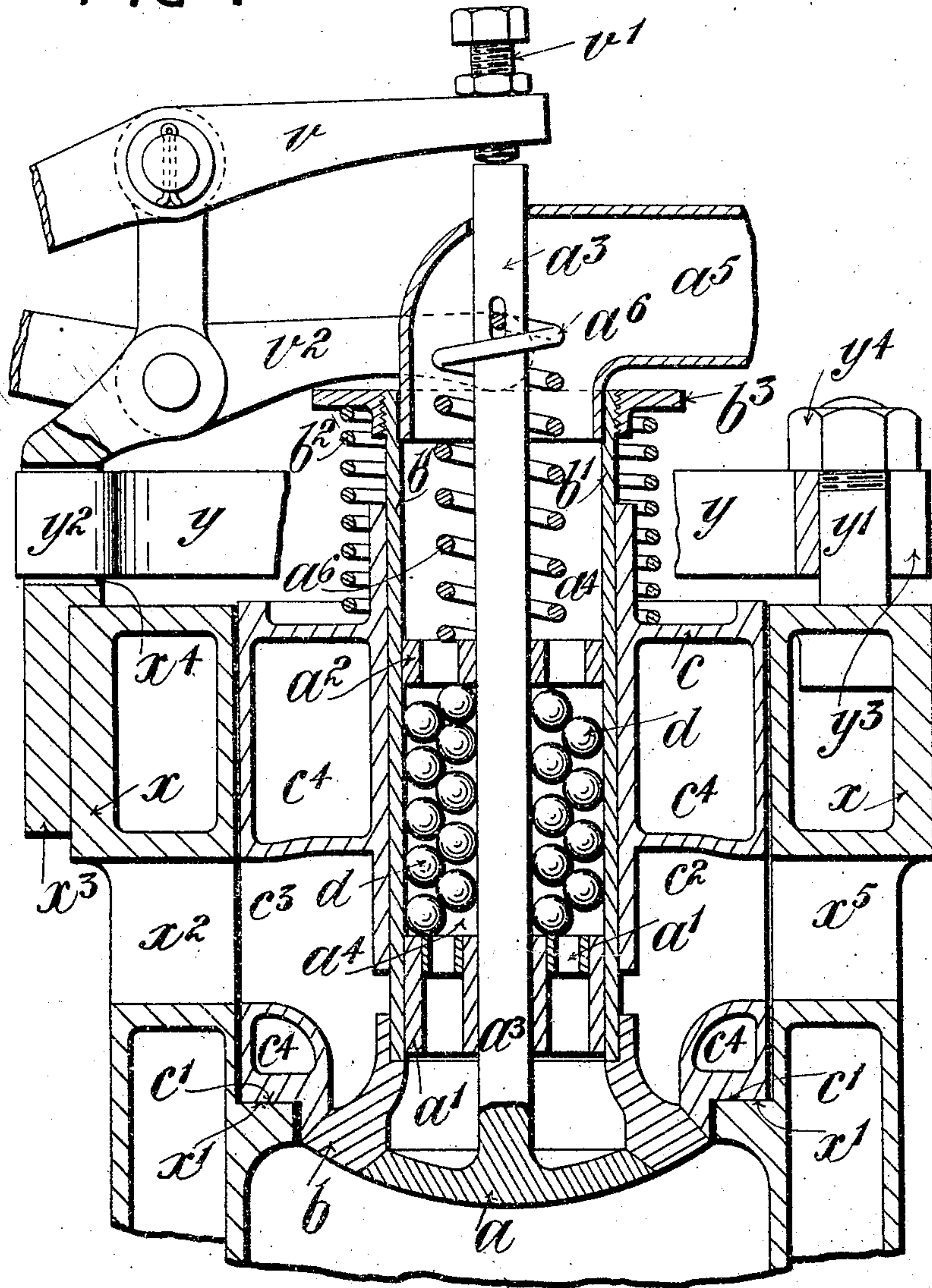
PATENTED DEC. 17, 1907.

E. H. CLIFT.  
INTERNAL COMBUSTION ENGINE.

APPLICATION FILED MAR. 26, 1907.

2 SHEETS—SHEET 1.

FIG 1



WITNESSES:

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E. H. CLIFT.  
INTERNAL COMBUSTION ENGINE.  
APPLICATION FILED MAR. 25, 1907.

2 SHEETS—SHEET 2.

FIG. 2.

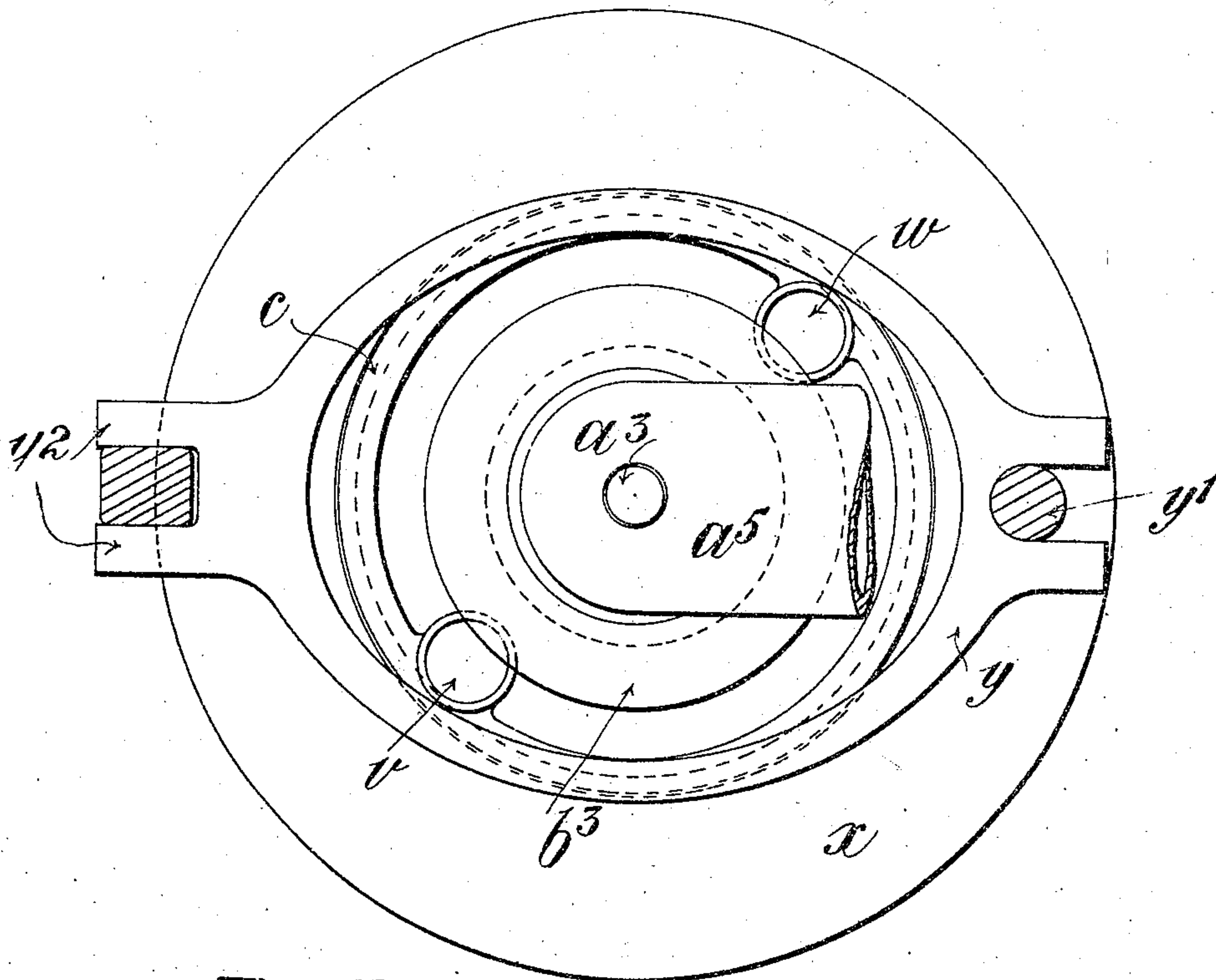
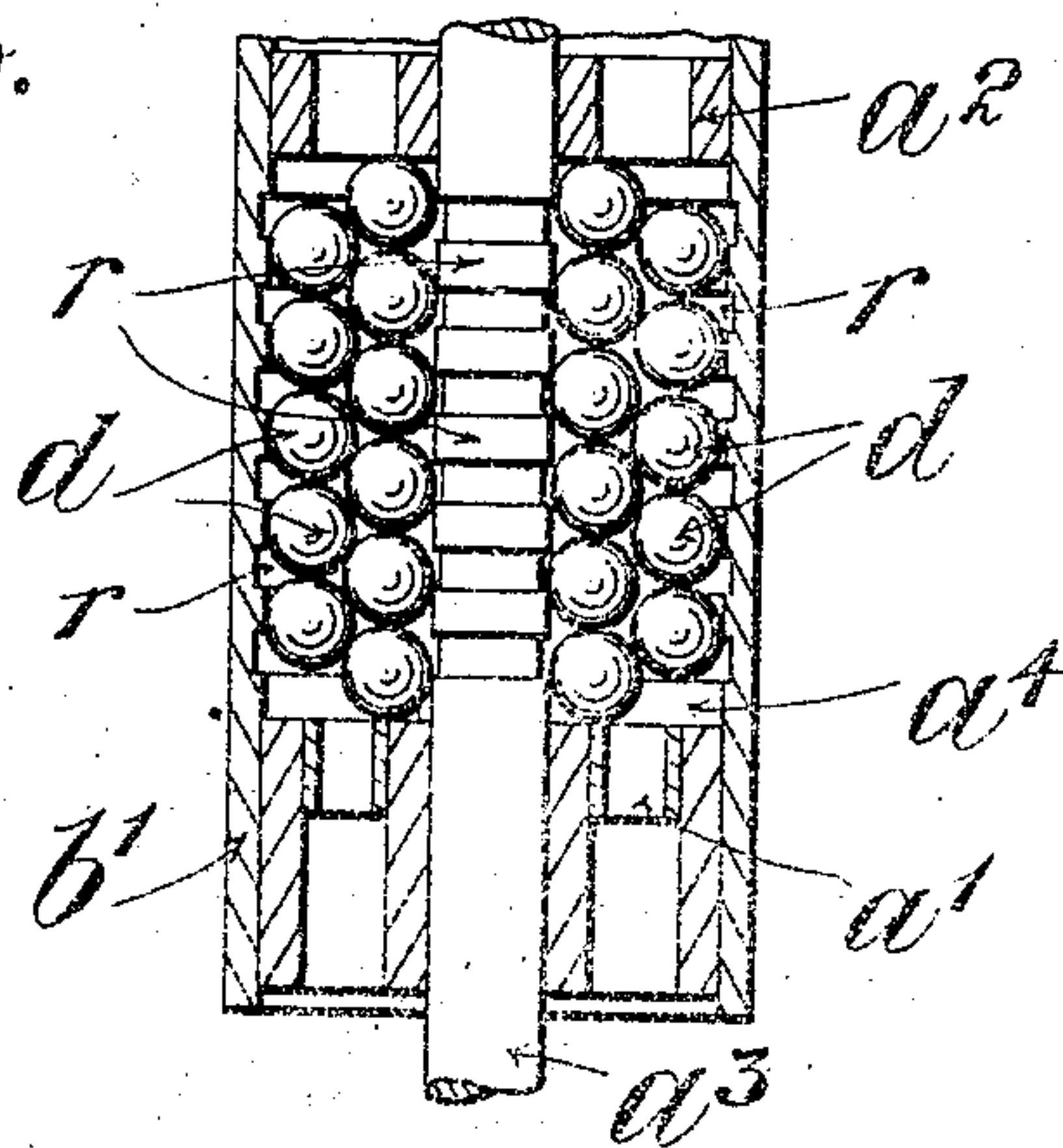


Fig. 3.



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# UNITED STATES PATENT OFFICE.

ERIC HOLLOCOOMBE CLIFT, OF WEST KENSINGTON, ENGLAND.

## INTERNAL-COMBUSTION ENGINE.

No. 873,840.

Specification of Letters Patent.

Patented Dec. 17, 1907.

Application filed March 25, 1907. Serial No. 364,556.

*To all whom it may concern:*

Be it known that I, ERIC HOLLOCOOMBE CLIFT, a subject of the King of Great Britain and Ireland, residing at 51 Sinclair road, West Kensington, in the county of London, England, have invented a new and useful Improvement in Internal-Combustion Engines, of which the following is a specification.

10 This invention relates to internal combustion engines, and it consists in mounting the inlet and exhaust valves concentrically, the former being within the latter so that the hollow stem of the exhaust valve forms part 15 of the induction pipe and being hot acts as a vaporizer for the incoming charge and in providing means for regulating the temperature of said vaporizer.

In the accompanying drawing:—Figure 1, 20 Sheet No. 1, is a view in side elevation—partly in section—of one method of carrying the present invention into effect, Fig. 2 Sheet No. 2 is a view in plan showing the inlet and outlet to the jacket of the valve box and an 25 alternative construction of the clamping ring, and Fig. 3, Sheet No. 3, is a broken view in sectional elevation showing an alternative construction.

Throughout the views similar parts are 30 marked with like letters of reference.

The inlet valve  $a$  and the exhaust valve  $b$  are arranged concentrically with respect to one another, the inlet valve being within the exhaust valve the stem  $b^1$  of which has a passage  $a^1$  through it. This stem is mounted in a detachable annular box  $c$  adapted to be 35 fixed in the cylinder head  $x$  in any convenient manner, preferably by forming a seating  $x^1$  within the cylinder head with which a seating  $c^1$  on the box  $c$  engages. The box is 40 held in position by means of a clamping ring  $y$  which may either be formed with a tongue  $y^2$  on one side and a forked or slotted part  $y^3$  on the opposite side as shown in Fig. 1 or 45 with a fork at each end as shown in Fig. 2. The tongue  $y^2$  is adapted to engage a slot or recess  $x^1$  formed in a bracket  $x^3$  carried by the cylinder head  $x$  and the slotted part  $y^3$  is engaged by a nut  $y^4$  on a stud  $y^1$  fixed 50 in the cylinder head. This box is formed with an annular chamber  $c^4$  which forms an independent water jacket round the valves. This chamber has a suitable inlet  $v$  and outlet  $w$  provided with means, such as a stop 55 cock, whereby the flow of water through the said chamber can be regulated so as to vary

the temperature in the vaporizer. In the cylinder head  $x$  and valve box  $c$  are openings  $x^5$  and  $c^2$  through which a lamp or other means of initially heating the vaporizer can be introduced for starting when heavy oils are employed. Similar openings  $x^2$  and  $c^3$  are provided for the escape of the exhaust gases. In the hollow stem  $b^1$  of the exhaust valve  $b$  are mounted perforated guides  $a^1$   $a^2$  for the 65 stem  $a^3$  of the inlet valve  $a$ . The external diameter of the stem  $a^3$  of the inlet valve and the internal diameter of the hollow stem  $b^1$  of the exhaust valve are such that there is an annular passage or chamber  $a^4$  between 70 the stem of the inlet valve and the inner wall of the hollow stem of the exhaust valve which forms a vaporizer which is in communication with the fuel supply by means of the pipe  $a^5$  which is a sliding fit in the hollow 75 stem  $b^1$  of the exhaust valve. In the part of this annular passage or chamber between the guides  $a^1$  and  $a^2$  are placed a series of metal balls  $d$  or their equivalents which operate to thoroughly break up and atomize the incoming 80 charge as being loosely packed in the chamber they are moved or agitated each time the valves open and close.

In some cases provision may be made for further agitating or imparting movement to 85 the balls by forming ridges or recesses  $r$  on or in the stems of one or both of the valves.

The inlet valve may be operated either atmospherically, or mechanically, by means of a screw  $v^1$  carried by a rocking lever  $v$  as 90 shown. The inlet valve  $a$  is controlled by the spring  $a^6$  located within the upper end of the passage or chamber  $a^4$  through the stem of the exhaust valve and taking a bearing on the upper side of the guide  $a^2$ . 95

The exhaust valve  $b$  is controlled by the spring  $b^2$  and is operated by a rocking lever  $v^2$ , the forked end of which contacts a flange  $b^3$  on the stem  $b^1$  of the valve.

It will be seen that with a multiple cylinder engine embodying the herein described 100 improvement access may be readily obtained to the interior of any one of the cylinders, or any one of the valve boxes may be removed while the engine is running, which construction is particularly useful for marine 105 purposes.

What I claim as my invention and desire to secure by Letters Patent is:—

1. In an internal combustion engine, the 110 combination of an exhaust valve having an enlarged stem with a centrally arranged pas-



sage through it forming an induction pipe, a detachable box having a seating for said valve, an inlet valve for closing the passage through the exhaust valve the stem of the  
 5 said valve being of a smaller diameter than the bore of the stem of the exhaust valve, guides in the hollow stem of the exhaust valve for the stem of the inlet valve, a seating for said inlet valve in the head of the ex-  
 10 haust valve, a water jacket in the detachable box carrying the seating for the exhaust valve and surrounding the guide for said valve, a feed supply pipe fitting within the end of the hollow stem of the exhaust valve,  
 15 springs operating to retain the valves on their respective seatings, and means for operating the said valves to open them by removing them from their seatings, as set forth.

20 2. In an internal combustion engine, the combination of an exhaust valve having an enlarged stem with a centrally arranged passage through it forming an induction pipe, a detachable box having a seating for said  
 25 valve, an inlet valve for closing the passage through the exhaust valve the stem of the said valve being of a smaller diameter than the bore of the stem of the exhaust valve,  
 30 valve for the stem of the inlet valve, a seating for said inlet valve in the head of the exhaust valve, a water jacket in the detachable box carrying the seating for the exhaust valve and surrounding the guide for the said  
 35 valve, a feed supply pipe fitting within the end of the hollow stem of the exhaust valve, springs operating to retain the valves on their respective seatings, and means for operating the said valves to open them by re-  
 40 moving them from their seatings, as set forth.

3. In an internal combustion engine, the combination of an exhaust valve having an enlarged stem with a centrally arranged pas-  
 45 sage through it forming an induction pipe, a detachable box having a seating for said valve, an inlet valve for closing the passage through the exhaust valve the stem of the said valve being of a smaller diameter than the  
 50 bore of the stem of the exhaust valve, guides in the hollow stem of the exhaust valve for the stem of the inlet valve, a seating for said inlet valve in the head of the exhaust valve, a water jacket in the detachable box carrying  
 55 the seating for the exhaust valve and surrounding the guide for said valve, a series of metal balls or spheres in the annular chamber in the hollow stem of the exhaust valve between the guides therein, a feed supply pipe  
 60 fitting within the end of the hollow stem of the exhaust valve, springs operating to retain the valves on their respective seatings, and means for operating the said valves to open them by removing them from their  
 65 seatings as set forth.

4. In an internal combustion engine, the combination of an exhaust valve having an enlarged stem with a centrally arranged pas-  
 sage through it forming an induction pipe, a detachable box having a seating for said  
 70 valve, an inlet valve for closing the passage through the exhaust valve the stem of the said valve being of a smaller diameter than the bore of the stem of the exhaust valve,  
 75 guides in the hollow stem of the exhaust valve for the stem of the inlet valve, a seating for said inlet valve in the head of the exhaust valve, a water jacket in the detachable box carrying the seating for the exhaust valve and surrounding the guide for said  
 80 valve, means for regulating the flow of water through said jacket, a series of metal balls or spheres in the annular chamber in the hollow stem of the exhaust valve between the guides therein, a feed supply pipe fitting  
 85 within the end of the hollow stem of the exhaust valve, springs operating to retain the valves on their respective seatings, and means for operating the said valves to open them by removing them from their seatings, 90  
 as set forth.

5. In an internal combustion engine, the combination of an exhaust valve having an enlarged stem with a centrally arranged pas-  
 sage through it forming an induction pipe, a  
 95 detachable box having a seating for said valve, an inlet valve for closing the passage through the exhaust valve the stem of the said valve being of a smaller diameter than the bore of the stem of the exhaust valve and  
 100 extending completely through said hollow stem, guides in the hollow stem of the exhaust valve for the stem of the inlet valve, a seating for said inlet valve in the head of the exhaust valve, a water jacket in the detach-  
 105 able box carrying the seating for the exhaust valve and surrounding the guide for said valve, a series of metal balls or spheres in the annular chamber in the hollow stem of the exhaust valve between the guides therein, 110  
 ridges or recesses on or in the stem of the inlet valve, a feed supply pipe fitting within the end of the hollow stem of the exhaust valve, springs operating to retain the valves on their respective seatings, and means for  
 115 operating the said valves to open them by removing them from their seatings, as set forth.

6. In an internal combustion engine, the combination of an exhaust valve having an  
 120 enlarged stem with a centrally arranged passage through it forming an induction pipe, a detachable box having a seating for said valve, an inlet valve for closing the passage through the exhaust valve the stem of the  
 125 said valve being of a smaller diameter than the bore of the stem of the exhaust valve and extending completely through said hollow stem, guides in the hollow stem of the ex-  
 haust valve for the stem of the inlet valve, a 130



seating for said inlet valve in the head of the exhaust valve, a water jacket in the detachable box carrying the seating for the exhaust valve and surrounding the guide for said valve, a series of metal balls or spheres in the annular chamber in the hollow stem of the exhaust valve between the guides therein, ridges or recesses on or in the stem of the inlet valve, a feed supply pipe fitting within the end of the hollow stem of the exhaust valve, springs operating to retain the valves on their respective seatings, and means for operating the said valves to open them by removing them from their seatings, as set forth.

7. In an internal combustion engine, the combination of an exhaust valve having an enlarged stem with a centrally arranged passage through it forming an induction pipe, a detachable box having a seating for said valve, an inlet valve for closing the passage through the exhaust valve the stem of the said valve being of a smaller diameter than the passage through the stem of the exhaust valve and extending completely through said hollow stem, guides in the hollow stem of the exhaust valve for the stem of the inlet valve, a seating for said inlet valve in the head of the exhaust valve, a series of metal balls or spheres in the annular chamber in the hollow stem of the exhaust valve between the guides therein, a feed supply pipe fitting within the end of the hollow stem of the exhaust valve, springs operating to retain the valves on their respective seatings, and means for operating the said valves to open them by removing them from their seatings, as set forth.

8. In an internal combustion engine, the combination of an exhaust valve having an enlarged stem with a centrally arranged passage through it forming an induction pipe, a detachable box having a seating for said valve, an inlet valve for closing the passage

through the exhaust valve the stem of the said valve being of a smaller diameter than the passage through the stem of the exhaust valve and extending completely through said hollow stem, guides in the hollow stem of the exhaust valve for the stem of the inlet valve, a seating for said inlet valve in the head of the exhaust valve, a series of metal balls or spheres in the annular chamber in the hollow stem of the exhaust valve between the guides therein, ridges or recesses on or in the stem of the inlet valve, a feed supply pipe fitting within the end of the hollow stem of the exhaust valve, springs operating to retain the valves on their respective seatings, and means for operating the said valves to open them by removing them from their seatings, as set forth.

9. In an internal combustion engine, the combination of an exhaust valve having a hollow stem, a detachable seating for said valve, an inlet valve having a stem passing through the hollow stem of the exhaust valve the exterior diameter of which is less than the internal diameter of the stem of the exhaust valve so as to leave an annular chamber within the stem of the exhaust valve which forms a vaporizer, a seating for said inlet valve in the head of the exhaust valve, a series of metal balls or spheres in the annular chamber within the stem of the exhaust valve, a connection between the feed supply pipe and the hollow stem of the exhaust valves, springs operating to retain said valves on their respective seatings, and means for operating the said valves to open them by removing them from their seatings as set forth.

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Witnesses:

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