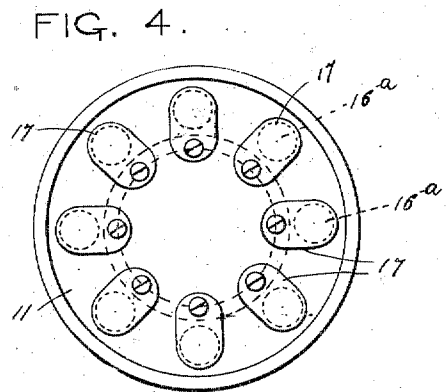
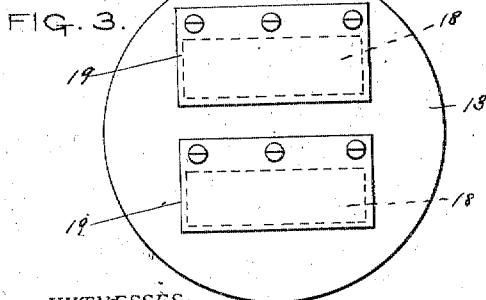
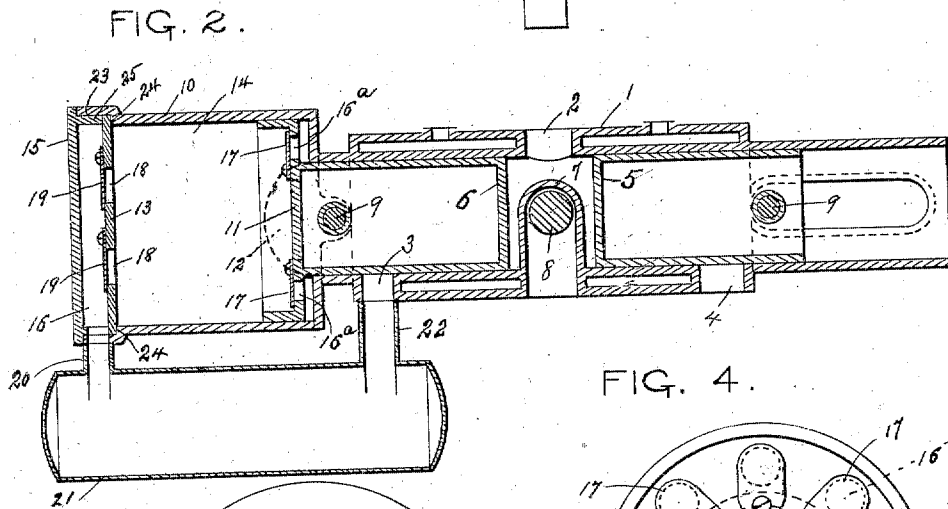
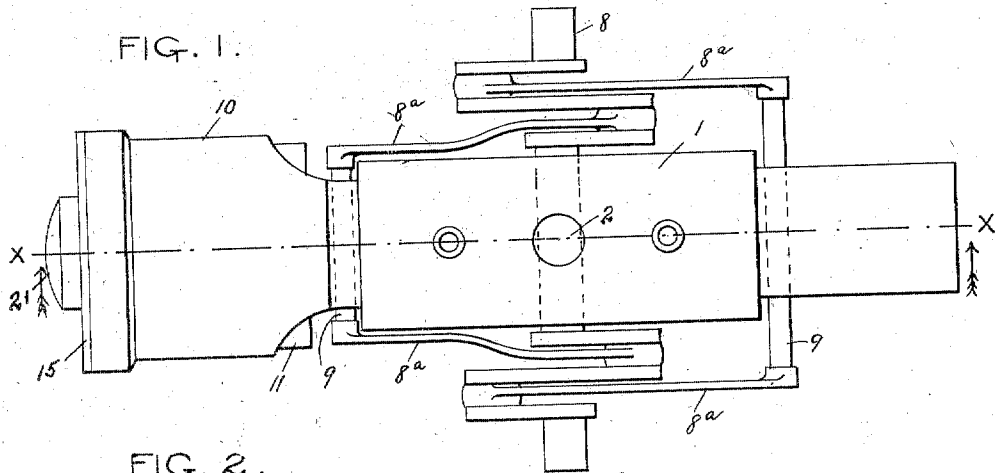


R. P. THOMPSON & E. KOEB.
EXPLOSIVE ENGINE.

APPLICATION FILED OCT. 16, 1905. RENEWED APR. 22, 1908.

Patented Mar. 22, 1910.

952,483.



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RALPH P. THOMPSON AND EMIL KOEB, OF SPRINGFIELD, OHIO.

EXPLOSIVE-ENGINE.

952,483.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that we, RALPH P. THOMPSON and EMIL KOEB, citizens of the United States, residing at Springfield, in the county of Clark and State of Ohio, have invented certain new and useful Improvements in Explosive-Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to explosive engines, and more particularly to that class of engines known as two cycle engines, employing an air pump to positively supply air to the power cylinder for the double purpose of sweeping or clearing out therefrom the products of the preceding explosion and supplying the air for the explosive mixture for the next explosion.

The invention is in the nature of an improvement upon what is disclosed in United States Letters Patent No. 729,700, granted to us June 2, 1903, and has for its object to improve the construction and operation of the structure in certain respects which will be hereinafter more fully pointed out.

To this end our invention consists in certain novel features which we will now proceed to describe, and will then particularly point out in the claims.

In the accompanying drawings, Figure 1 is a plan view of an engine embodying our invention in one form; Fig. 2 is a vertical, central longitudinal section through the same, taken on the line *x x* of Fig. 1 and looking in the direction of the arrows; Fig. 3 is a front elevation of the air pump cylinder head or diaphragm and its check valves; and Fig. 4 is an end elevation of the air pump piston.

In its main structural features, our present construction is similar to that set forth in our prior Letters Patent hereinbefore referred to, and therefore requires no detailed description. In this construction, 1 indicates the main power cylinder, having the fuel inlet 2 through which the mixture of gas and air is drawn upon the outward movement of the pistons, the air inlet port 3 and exhaust port 4.

5 and 6 indicate the power pistons, operating in opposite directions in said main cylinder on opposite sides of the central arch 7, and connected to the crank shaft 8 by connecting rods 8^a, the cross heads being indicated by the numeral 9.

10 indicates an air pump cylinder, which

is preferably formed in one piece with the main cylinder 1, of which it forms an extension, and 11 indicates the air pump piston, which is preferably formed in one piece with the power piston 6, in unison with which it moves. The air pump cylinder is of greater diameter than the power cylinder, the pistons being correspondingly proportioned, and said cylinders have formed in their sides openings 12, shown in dotted lines in Fig. 2. These openings are in the form of slots for the passage of the cross head 9 through the side walls of the power cylinder 1, while the sides of the air pump cylinder 10 are cut away so as to accommodate the ends of the connecting rods 8^a which are connected to the ends of the cross head. It will be noted that these connecting rods are deflected inward toward each other, so that the extreme length of the cross head, and the distance between the outer sides of the ends of the connecting rods connected thereto, is less than the internal diameter of the air pump cylinder, into which latter the cross head and connecting rods enter as they follow the air pump piston. The cut-away portions of the air pump cylinder accommodate the vertical vibrations or oscillations of the connecting rods, but these cut-away portions do not extend sufficiently far along the side walls of said cylinder to permit the air pump piston to pass clear of the same. It will therefore be seen that no air enters the cylinder 10 through the openings in the side wall thereof, the body of the piston being of sufficient length to keep the openings 12 closed when the piston is at the limit of its stroke at that end of the cylinder.

13 indicates the air pump cylinder head, or a diaphragm forming the outer end of the air pump cylinder chamber 14, the outer end of said cylinder being closed by a cap 15, which constitutes an outer or false cylinder head and forms a chamber 16 between it and the cylinder head proper or diaphragm 13.

As already stated, the air pump piston 11 is of greater diameter than the power piston 6 with which it moves, and the annular body portion of said air pump piston which extends radially beyond the power piston is provided with a plurality of air inlet openings 16^a, by means of which communication is established between that part of the air pump cylinder in which the openings 12 are formed, and which lies on one side of the piston 11, and that part of the air pump

cylinder lying on the other side of said piston, and in which the air supply is compressed during the working stroke of said piston. These air inlet openings 16^a are controlled by flap valves 17, which are closed during the outward or working stroke of the piston, and which open during the moving of the piston in the opposite direction.

The cylinder head or diaphragm 13 is provided with one or more openings 18, by which communication may be established between the chambers 14 and 16, said openings being controlled by flap valves 19, which constitute check valves opening during the outward or working stroke of the piston to permit the air to pass from the pump cylinder to the power cylinder, but closing automatically to prevent passage of air in the opposite direction. The chamber 16 is connected through a conduit or pipe 20 with a receiver 21, this latter being in turn connected by a pipe or conduit 22 with the air inlet port 3.

The general operation of the engine is as set forth in our prior Letters Patent hereinbefore referred to. During the outward stroke of the power pistons after the ignition of the charge, the air in the pump cylinder 10 is compressed in front of the piston 11, and passes through the openings 18 into the chamber 16, the check valves 19 opening for said purpose, said air passing out of the chamber 16 through the pipe 20 into the receiver 21, and from this latter, through pipe 22 and through the inlet port 3, into the power cylinder, through which it sweeps so as to carry the products of the explosion through the exhaust port 4, at the same time supplying to the said cylinder the necessary amount of air for the next explosion. At the beginning of the next or inward stroke of the pistons, the check valves 19 instantly close, and prevent any possible reflux of air back from the power cylinder through the port 3 and the connections between said port and the air pump cylinder. By reason of this construction, the delivery of the predetermined amount of air to the main cylinder is assured, and all connection between the pump cylinder and main cylinder is cut off except when the pressure in the pump cylinder exceeds that in the main cylinder. As soon as the air pump piston 11 begins its inward movement, the valves 17 open and admit air to the space between said piston and the cylinder head or diaphragm 13, thus preventing the establishment of a vacuum between the two.

It will be observed that the air inlet valves are so located that they are entirely inclosed and protected, and that the air supply is drawn through the practically open end of the air pump cylinder and through the valved openings in the air pump piston. The check valves 19 are also properly in-

closed and protected, being readily accessible, however, upon the removal of the cap 15.

To facilitate access to the interior of the parts of the air pump, we have devised the construction shown, in which the outer end of the cylinder 10 is of larger diameter, as indicated at 23, thus forming a seat or shoulder 24, against which the cylinder head or diaphragm 13 rests. The cap 15 is provided with an annular flange 25, which fits within the enlarged portion 23 of the cylinder and bears against the head of diaphragm 13 to hold it in its seat. After the cap has been removed, the diaphragm or inner head may be also readily removed to give access to the interior of the cylinder and to the piston therein.

It will be noted that we have done away with the provision made in our prior patent hereinbefore referred to for the escape of air from in front of the air pump piston during the early part of its compression stroke, and have provided a receiver between the air pump cylinder and air inlet port of the power cylinder, to provide for the storage of air under pressure, the compression of which begins as soon as the compression stroke begins, until the opening of the air inlet port permits the air thus stored to enter and sweep through the power cylinder in the manner already described, while the check valve between said receiver and the air pump cylinder prevents any reflux or back pressure from the receiver to the cylinder. It will further be noted that by interposing the receiver into the conduit between the air compressor and the power cylinder and arranging the same near the air inlet to the power cylinder, the air is stored close to the point of discharge into that cylinder and will be discharged into the power cylinder during the short interval that the inlet is uncovered; and that, by reason of this construction, we secure a quicker and more complete discharge of the air into the power cylinder than is the case where the compressor is connected to the power cylinder by the conduit only and the air is, for the most part, stored in the compression cylinder.

We do not wish to be understood as limiting ourselves to the precise details of construction hereinbefore described and shown in the accompanying drawings, as it is obvious that these details may be varied without departing from the principle of our invention.

Having thus fully described our invention, what we claim as new and desire to secure by Letters Patent is:—

1. In an explosive engine of the character described, the combination, with a main cylinder having inlet and exhaust ports, and a power piston, of an air pump comprising a cylinder of greater diameter than the main

cylinder, arranged at one end of said main cylinder and connected with the inlet port thereof, a piston traveling in said air pump cylinder and connected with the power piston to move in unison therewith, the power piston being provided with a cross head of less length than the diameter of said air pump cylinder, a crank shaft, and means for connecting said crank shaft to said cross head, the sides of said cylinders being slotted or cut away to receive said cross head and said connecting means.

2. In an explosive engine of the character described, the combination, with a main cylinder having inlet and exhaust ports and a power piston, of an air pump comprising a cylinder of greater diameter than the main cylinder, arranged at one end of said main cylinder and connected with the inlet port thereof, the sides of said cylinders being

slotted or cut away as described, a piston traveling in said air pump cylinder and connected with the power piston to move in unison therewith, the power piston being provided with a cross head of less length than the diameter of the air pump cylinder and adapted to enter said slotted or cut away portion of said cylinders, a crank shaft, and connecting rods having their ends deflected toward each other and connected with the ends of the cross head so as to enter the air pump cylinder along with said cross head, substantially as described.

In testimony whereof, we affix our signatures in presence of two witnesses.

RALPH P. THOMPSON.
EMIL KOEB.

Witnesses:

IRVINE MILLER,
T. J. McCORMICK.