

April 29, 1930.

W. NOBLE
EXHAUST VALVE
Filed May 6, 1927

1,756,796

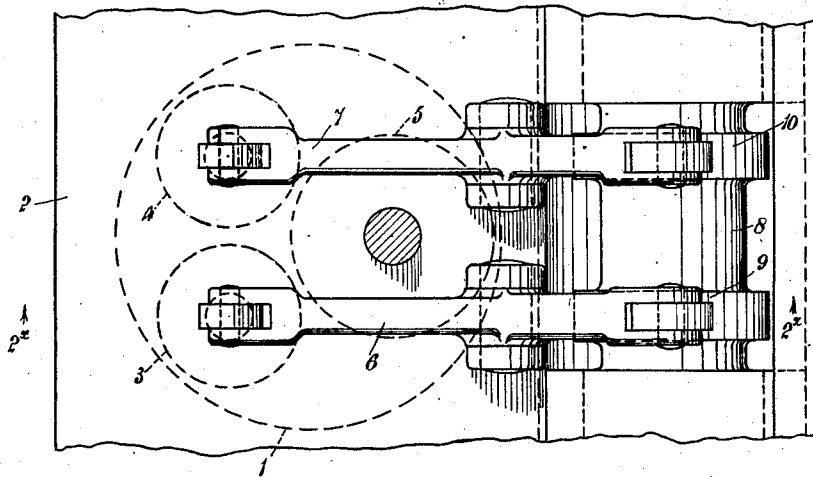


Fig. 1.



Fig. 3.



Fig. 4.

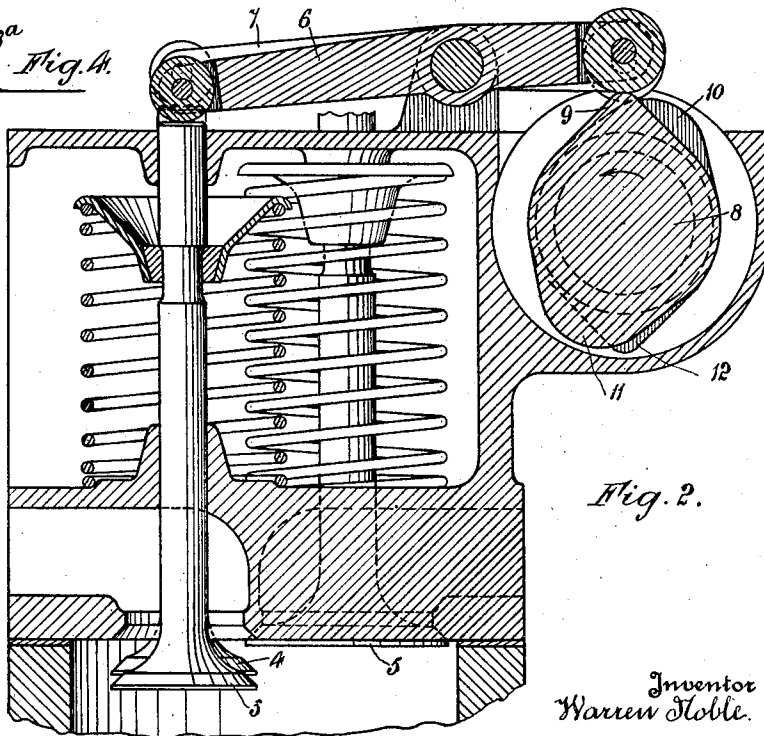


Fig. 2.

Inventor
Warren Noble.

By

Butcher & Butcher

Attorney

UNITED STATES PATENT OFFICE

WARREN NOBLE, OF DETROIT, MICHIGAN

EXHAUST VALVE

Application filed May 6, 1927. Serial No. 189,228.

This invention relates to the exhaust valves of internal combustion engines, and has for its object to provide a greater period for the dispersing of heat from an exhaust valve through its seat to surrounding metal than is ordinarily afforded in exhaust valves as they are usually constructed and operated.

Ordinarily a single exhaust valve is utilized for each cylinder of an engine and is maintained unseated throughout the entire exhaust period, during which time it is subjected to all of the heating conditions resulting from the discharge of exhaust gases, both when first released in a highly compressed condition and while being exhausted by subsequent piston displacement, which results in the heating of the exhaust valve to a high degree. It is when the valve is again seated that the main dispersing of this heat takes place through the valve seat and surrounding metal, and it is obvious that the shorter the duration of opening the valve and the longer the subsequent seating thereof the cooler the valve may be maintained.

The present invention, therefore, has as an object to provide an exhaust valve arrangement wherein brief opening and extended seated conditions are obtained, and more particularly to provide for these conditions by the use of two exhaust valves for the same cylinder and the giving to one valve a rapid opening and closing operation during the early part of the exhaust period, and to the other valve a relatively extended open duration, closing at the end of the exhaust period.

Still further the said invention contemplates the utilizing in connection with the cylinder of an engine of dual exhaust valves, each adapted to alternately open for a relatively short time during the early part of the exhaust period and for a relatively extended time closing with the end of the exhaust period, so that during one exhaust stroke of an engine one of the valves operates quickly to relieve compressed exhaust gases and then closes on its seat, while the other valve opens and remains unseated during the entire exhaust period, the long and short periods of opening changing alternately from one valve to the other with each exhaust stroke of the

engine whereby, in continued operation, both valves are subjected to the same heating and cooling conditions.

Still further objects or advantages subsidiary or incidental to the aforesaid objects, or resulting from the construction or operation of the invention as it may be carried into effect, will become apparent as the said invention is hereinafter further disclosed.

In carrying the said invention into effect, I may adopt the novel construction and arrangement of parts hereinafter described, by way of example, having reference to the accompanying drawing, wherein:—

Figure 1 is a fragmentary plan of an engine having a dual exhaust valve arrangement embodying the said invention;

Figure 2 is a transverse section of the same taken on a plane indicated by the line 2^x—2^x in Figure 1; and

Figures 3 and 4 are graphs indicating the action of the said valves.

Similar characters of reference indicate similar parts in the several figures of the drawing.

1 is a cylinder and 2 the cylinder head of an engine, the said head having mounted therein two exhaust valves 3 and 4 common to the cylinder 1. 5 is an inlet valve, the arrangement of which, however, does not enter into the present invention and for that reason will not be further referred to herein. The combined areas of the two exhaust valves is ample for the purposes of proper exhaust, and the said valves are shown as being operated by rockers 6 and 7 which, in turn, are operated from a camshaft 8.

The form of the cams on this camshaft varies from the common practice, in that, the cams for operation of each of the two valves varies in form to give a different duration of lift to the two valves whereby one of them opens and closes quickly, whereas the other remains open until the end of the exhaust period. To this end the cam of the valve 3 is provided with a lobe 9 having a quick acceleration and short travel, and the cam of the valve 4 is provided with a lobe 10 having an easier lift and a longer travel extending throughout the full exhaust period. Thus,

the valves 3 and 4 are given the relative action indicated by the graph, Figure 3, wherein the vertical dimension is indicative of the valve lift and the length indicative of time, the dotted line 3^a representing the action of the valve 3 and the solid line 4^a the action of the valve 4. It will be seen from this graph that duration of the opening of the valve 3 under the influence of the cam lobe 9 is short compared with the full exhaust period so that it returns to its seat before the completion of that period, the valve 4 remaining open to permit the completion of the exhausting of gases from the engine cylinder by piston displacement, as will be well understood.

It is preferred, although not absolutely essential, that a 1 to 4 ratio of cam rotation to crank rotation be used and further lobes 11 and 12 provided on the cam shaft for operation of the valves at the required periods. It is also preferred in this case to vary the form of these lobes so that the lobe 12 of the valve 4 provides the rapid lift of short duration, and the lobe 11 of the valve 3 a lift of extended duration, as indicated, so that the action of the valves under the influence of these valves is that shown in the graph of Figure 4 from which it will be seen that the valve 4 opens and closes quickly returning to its seat before the expiration of the exhaust period, and the valve 3 remains open until the end of the exhaust period; this being the reverse of the operation previously described with reference to the lobes 9 and 10.

It will be readily seen that this arrangement causes the valves to alternately change as to their duration of opening, so that in their continued operation they are subjected to the same alternating conditions of short and long unseated periods. The result of this is that during each exhaust period one of the valves is subjected to the main hot discharge of gases from the cylinder, while the other takes care of the general scavenging, and the valve which has first opened remains open for only a short time and then reseats before the exhaust period is completed so that it is given an extended length of time to dissipate its heat through the walls of the cylinder head while the other valve is still open, this condition changing alternately from one valve to the other as heretofore stated. As a consequence, although ample opportunity is afforded for the escape of the compressed gases, both valves being open during the early part of the exhaust period, each valve is actually afforded in actual continued operation a greater duration of seated time than is possible with a single valve which is required to remain open during the full exhaust period.

The invention admits of desirable modifications of valve design due to a more effective cooling thereof as a result of the action described, and solves many of the problems com-

monly met with in exhaust valve practice in a very effective manner as will be readily apparent to those skilled in the art to which this invention appertains.

This invention may be developed within the scope of the following claims without departing from the essential features of the said invention, and it is desired that the specification and drawing be read as being merely illustrative and not in a limiting sense, except as necessitated by the prior art.

What I claim is:—

1. In combination with an internal combustion engine cylinder, two exhaust valves, and timing means for each of said exhaust valves, said timing means operating to open both of said valves substantially simultaneously and to close one of said valves immediately after a substantial reduction in pressure within the cylinders is attained.

2. In combination with an internal combustion engine cylinder, two exhaust valves, a cam of short angular duration operating one of said valves, and a cam of longer angular duration operating the other of said valves, said cams being timed for substantially simultaneous opening of said valves.

3. In combination with an internal combustion engine cylinder, two exhaust valves, a quick lift cam of short angular duration operating one of said valves, and a slow lift cam of longer angular duration operating the other of said valves, said cams being timed for substantially simultaneous opening of said valves.

4. In combination with an internal combustion engine cylinder, two exhaust valves, valve-lifting means imposing a short valve-lifting impulse on one of said valves, and a long valve-lifting impulse on the other of said valves during an exhaust period of the engine, both impulses commencing substantially simultaneously, and valve-lifting means alternating in their operation with said first mentioned valve-lifting means and imposing impulses on said valves reversed as to duration during the succeeding exhaust period of the engine.

5. In combination with an internal combustion engine cylinder, two exhaust valves, a two-lobed cam operating one of said valves, one of the lobes being of short angular duration and the other of longer angular duration, and a further two-lobed cam operating the other of the said valves, one of the lobes being of short angular duration and the other of longer angular duration, the leading face of the lobe of long duration of one cam being operative substantially simultaneously with the leading face of the lobe of short duration of the other cam.

6. In an internal combustion engine means for cooling dual exhaust valves comprising extended dwell periods, said means being adapted to retain one of said valves on its

seat during substantially one half of one exhaust stroke of the engine and to retain the other of said valves on its seat during substantially half of the next exhaust stroke.

5 7. In combination in an internal combustion engine two exhaust valves, timing means to begin the opening of said valves substantially simultaneously, said means permitting one of said valves to attain its maximum lift
10 prior to the other of said valves.

8. In combination in an internal combustion engine, two exhaust valves, timing means for beginning the opening of said valves substantially simultaneously, said timing means
15 permitting each valve to alternately first reach its maximum lift.

9. The combination as set forth in claim 8, the first of said valves to reach its maximum lift being adapted to recede from said point
20 prior to attainment of said point by the other valve.

10. The combination as set forth in claim 8, said timing means being adapted to permit the closing of the first valve to reach its maximum point substantially at the time the other
25 valve reaches its maximum point of lift.

In testimony whereof I affix my signature.

WARREN NOBLE.

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