April 8, 1947. J. WILLIAMS 2,418,741

EXHAUST PORT ASSEMBLY

Filed June 2, 1944 2 Sheets-Sheet 1

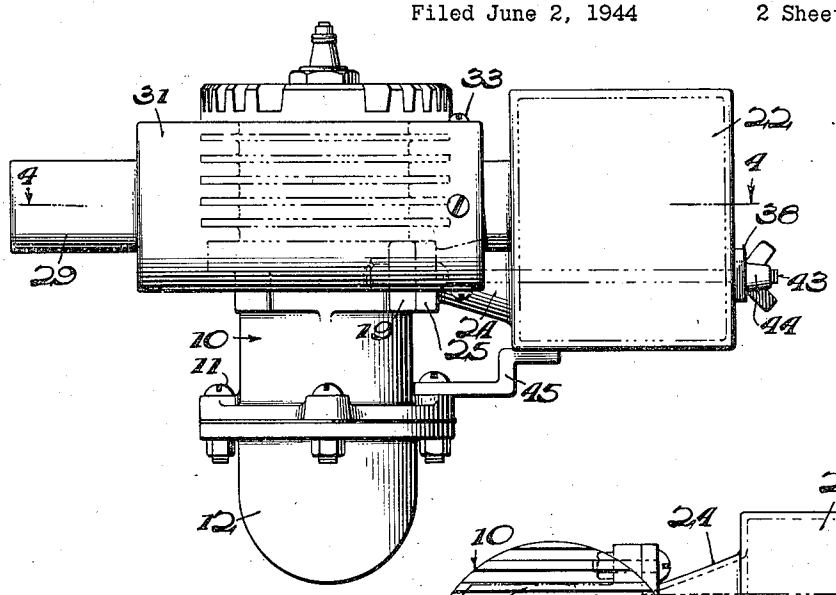


FIG. 1.

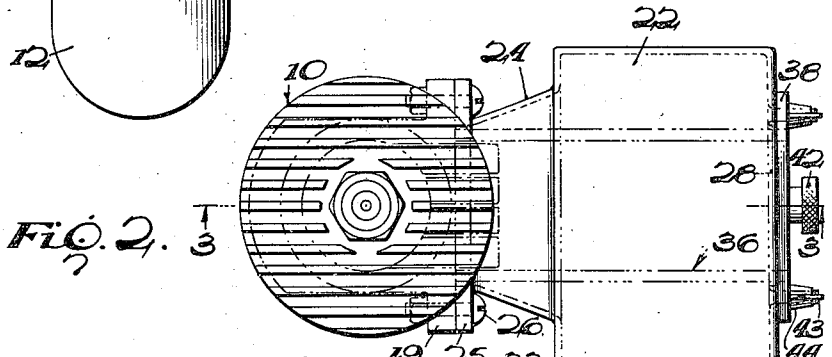


FIG. 2.

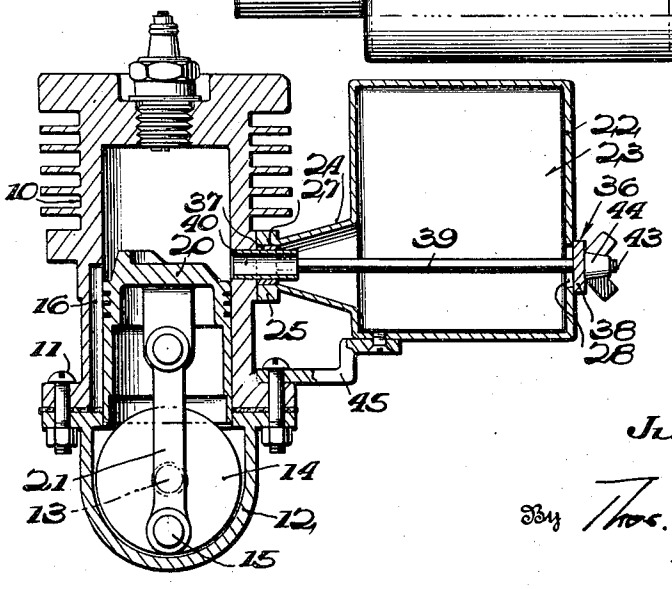


FIG. 3.

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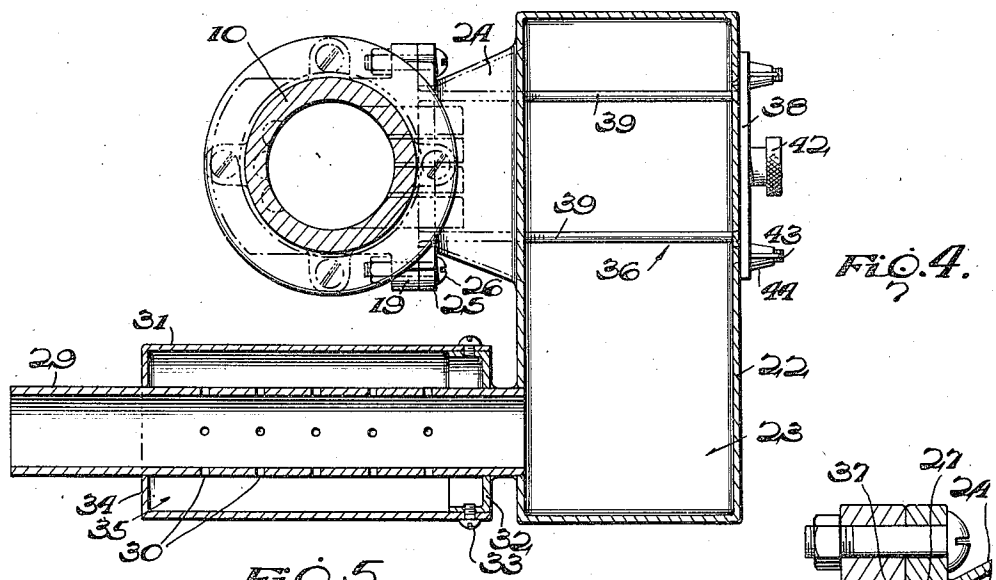
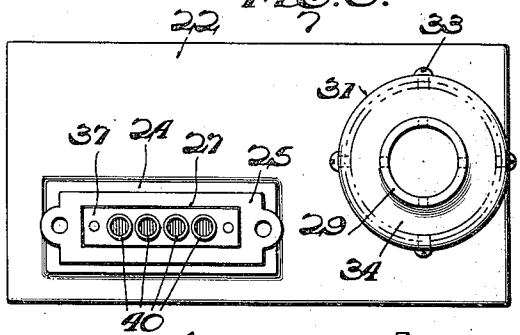
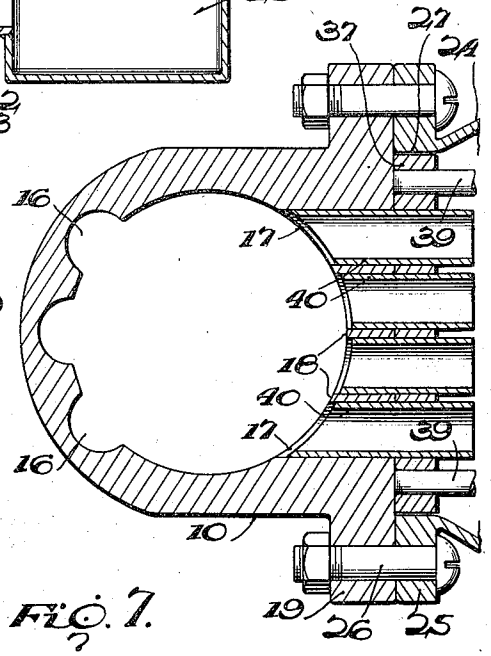


Fig. 4.

Fig. 5.





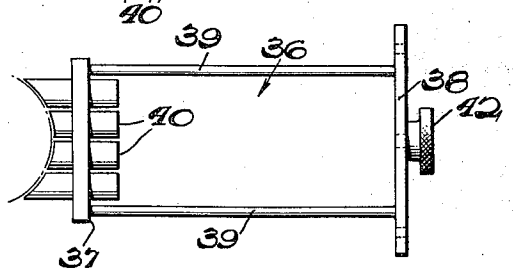


Fig. 7.

Fig. 6.

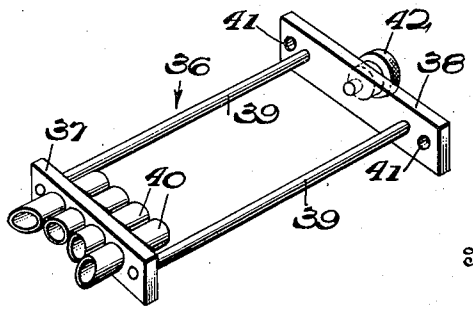


Fig. 8.

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Patented Apr. 8, 1947

2,418,741

UNITED STATES PATENT OFFICE

2,418,741

EXHAUST PORT ASSEMBLY

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Application June 2, 1944, Serial No. 538,459

9 Claims. (Cl. 60—29)

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This invention relates to internal combustion engines and more particularly to an improved exhaust port assembly to function in connection with the exhaust openings in the cylinder wall of such an engine.

In the operation of small two-cycle engines functioning at high speeds, difficulty is experienced by reason of the progressive choking of the exhaust port or ports, as the case may be, by the formation of carbon therein, with the result that the speed of the engine is caused to progressively decline. In fact, the effect is so pronounced and actively progressive as to require periodic cleaning of said ports.

The small engine which I have shown herein has been especially developed to form a part of a motor-generator unit which will be compact and light in weight and thus adapted to be incorporated in a portable radio set which may be carried on the back of the user and set up in the field. The importance of providing some means whereby the exhaust ports of the engine may be cleaned and thus keeping the engine speed relatively constant will therefore be appreciated, as any decline in engine speed would be reflected in current output of the generator with the result that the functioning of the radio set would be hampered and impaired. Furthermore, as will be appreciated in view of the foregoing, it has been necessary to provide a means whereby the exhaust ports of the engine may be cleaned while the engine is in operation. In fact, to satisfy this requirement has been found imperative to practical use of the motor-generator unit by the armed forces. Obviously, the engine cannot, during a time of great need of a field radio set, be shut down and taken apart in order to permit the exhaust ports of the engine to be cleaned. Therefore, any means installed in the exhaust openings of the engine to receive the carbon deposits must be removable while the engine is in operation and the success of any such provision in the exhaust openings will revolve about this single point.

It is therefore an object of the present invention to provide an exhaust port assembly embodying a unit which may be withdrawn by hand while the engine is in operation, cleaned and replaced.

Another object of the invention is to provide a unit which will serve in the exhaust openings of the engine the purpose of a drawer to receive the carbon deposits which otherwise would collect directly on the walls of said openings, and wherein the drawer will slidably fit in said openings and

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may be pushed into place or pulled out and removed and cleaned.

Still another object of the invention is to provide a unit wherein the tubes employed to fit in the exhaust openings of the engine will, instead of the walls of the exhaust openings, as is usual, themselves define the exhaust ports located in timed position as regards the cycle of the engine.

And a still further object of the invention is to provide a support for the unit whereby the unit may be secured in place, and wherein the support for the unit will provide an expansion chamber and hood fashioned to shield the hands of the operator while the unit is being removed or replaced.

Other and incidental objects will appear during the course of the following description of the invention, and in the drawings:

Figure 1 is an elevation showing a small two-cycle engine with the present improvements installed thereon.

Figure 2 is a plan view of the structure seen in Figure 1.

Figure 3 is a vertical section on the line 3—3 of Figure 2.

Figure 4 is a horizontal section on the line 4—4 of Figure 1.

Figure 5 is a rear elevation showing the hood and associated parts removed.

Figure 6 is an enlarged, fragmentary, horizontal section particularly showing the disposition of the exhaust port tubes of the removable port unit.

Figure 7 is a plan view of the removable port unit.

Figure 8 is a perspective view of the removable port unit.

In order to better bring out the purpose and advantages of the present improvements, I have shown the invention in conjunction with a small two-cycle engine of the character and for the purpose heretofore mentioned. However, as a complete showing and description of the engine is unnecessary to an understanding of the present improvements, only such parts of the engine as tend to afford a better grasp of the invention will be taken up in detail. In this connection, it may be noted that all of the figures of the drawings are actual size, with the exception of Figure 6 which is an enlarged view.

The engine cylinder is indicated at 10, and detachably secured thereto by bolts 11 is a crank case 12 journaling a crank shaft 13 carrying a fly wheel 14 on which is mounted a crank pin 15. The usual passages for the transfer of fuel

gas from the crank case to the lower end portion of the cylinder are indicated at 16 and formed through the wall of the cylinder opposite the upper ends of said passages, as particularly seen in Figure 6, is a number of spaced parallel exhaust openings 17 which all lie in the same plane. Bridge pieces 18 are thus defined between said openings and at the outer ends of the openings 17, the cylinder is provided with a flat plate 19, the purpose of which will presently appear. Slidably fitting in the cylinder 10 is a piston 20, shown as provided with suitable piston rings, and coupling the piston with the crank pin 15 is a connecting rod 21.

In carrying the present invention into effect, I provide, as shall presently appear, a removable exhaust port unit, in connection with which I also provide a support therefor and for convenience of description it would seem expedient to first take up the support in detail. This support is fashioned to provide a hood 22 which, in the present instance, is shown as an oblong box rectangular in cross section. However, the hood may be of any approved shape and provides an expansion chamber 23 which, as compared with the combined capacity of the exhaust openings 17 for the flow of exhaust gases into the hood, is very large. Formed on the inner side wall of the hood or otherwise fixed thereto near one end of the hood and close to the bottom thereof is an inlet neck 24, the side and end walls of which flare toward the hood, and formed on said neck at its outer end is an end plate 25 which seats flat against the plate 19 of the engine cylinder 10 and is detachably secured thereto by bolts 26.

As particularly brought out in Figures 5 and 6 of the drawings, the end plate 25 of the neck 24 is formed with a rectangular opening 27 therethrough at the outer end of said neck and this opening is of a size to extend longitudinally beyond the group of exhaust openings 17 as well as of a width to extend above and below said exhaust openings. Formed in the outer side wall of the hood 22 opposite the opening 27, as particularly seen in Figure 3, is a like opening 28 which, however, is preferably somewhat larger than the former opening.

Suitably fixed to the inner side wall of the hood 22 near the top thereof and close to the end remote from the neck 24 is an outlet pipe 29 in which is formed a group of longitudinally spaced breather openings 30 disposed in rows spaced around the pipe, and enclosing said group of openings is a sleeve 31. Fixed to the pipe is a head 32 closing the sleeve at one end thereof, and detachably connecting the sleeve with said head are cap screws 33. At the opposite end of the sleeve is a head 34 which slidably fits over the pipe so that, as will be appreciated, the sleeve may be removed and cleaned. The pipe 29 and sleeve 31 provide a muffler.

Associated with the hood 22 is a removable exhaust port unit seen in detail in Figures 7 and 8 of the drawings and indicated as a whole at 36. This unit includes rectangular forward and rear parallel end plates 37 and 38 respectively, and rigidly connecting said plates to form a frame are parallel rods 39. The plate 37 is somewhat smaller than the plate 38, and fixed through the plate 37 is a group of exhaust port tubes 40 corresponding in number and spacing to the exhaust openings 17 in the engine cylinder 10. Formed in the plate 38 of said unit near the ends thereof are openings 41, and fixed to the plate midway between said openings is a suitable knob 42.

It is now to be noted that the opening 28 in the outer side wall of the hood 22 is of a size to freely receive the forward end plate 37 of the unit 36 therethrough while the opening 27 in the end plate 25 of the neck 24 is of a size to slidably accommodate the plate 37. Furthermore, the exhaust port tubes 40 of said unit are of a diameter to slidably fit in the exhaust openings 17 of the engine cylinder 10. Thus, by grasping the knob 42 of said unit, the plate 37 may be inserted through the opening 28 in the hood, when the tubes 40 may be engaged in the outer ends of the exhaust opening 17. By then pushing forwardly on the knob, the exhaust tubes may be forced into said exhaust openings until the end plate 37 abuts the plate 19 of the engine cylinder, fitting in the opening 27 of the end plate 25 of the neck 24, when the end plate 38 of said unit will abut the outer side wall of the hood 22 covering and sealing the opening 28 in said wall. Fixed to said wall are studs 43 which extend freely through the openings 41 in the plate 38, and screwed on said studs are wing nuts 44 removably securing the unit 36 in operative position.

Associated with the hood 22 is a bracket 45. This bracket is detachably secured to the engine by one of the bolts 11 and projects beneath the hood to sustain a portion of the weight thereof as well as brace the hood so that a casual blow against the hood will not serve to fracture the neck 24.

As will now be seen, the hood 22 provides a support for the unit 36 enabling said unit to be rigidly secured in place and in this connection attention is directed to the fact, as particularly brought out in Figure 6, that the forward ends of the tubes 40 stop short of the inner ends of the exhaust openings 17 in the cylinder wall and are provided with arcuate terminals conforming to the curvature of the inner surface of the cylinder. The distance which the inner terminals of the tubes stop short of the inner surface of the cylinder wall has been exaggerated in the drawings merely to better bring out the point. The purpose of the feature is merely to obviate scoring of the piston by the inner ends of the tubes and the ledge defined between the inner end edges of the tubes and the inner surface of the cylinder wall at the extreme inner end portions of the exhaust openings 17 are, in fact, inappreciable and in no wise sufficient to permit the formation of enough carbon thereon to choke said openings.

Attention is now directed to the fact that, as particularly brought out in Figure 3 of the drawings, the exhaust tubes 40 of the unit 36 are positioned to form the true exhaust ports of the engine located in relation to the travel of the piston to time the opening and closing of said ports by the piston. In other words, assuming the exhaust tubes to be absent, the piston would begin to uncover the exhaust openings 17 too early and likewise would begin to cover said openings too early as well as completely close said openings too late, with consequent loss of power. The exhaust tubes 40 are therefore accurately positioned in relation to the stroke of the piston so that the exhaust gases will be properly released through said tubes into the expansion chamber 23 to thence flow out through the pipe 29. Carbon which would otherwise collect in the openings 17 will thus, instead, collect in the tubes.

In the present instance I have shown the cylinder wall as provided with four of the exhaust openings 17 and the unit 36 with a like number of exhaust tubes 40 to fit therein. However, the exact number of exhaust openings employed and corresponding exhaust tubes may, of course, be varied. In any instance where more than one exhaust opening is present and the piston is provided with packing rings, one or more of the bridge pieces 18 will be present, as the case may be, to prevent the piston rings from jumping into the inner ends of the openings as said rings cross the openings with the travel of the piston. However, in any instance where the piston is not equipped with packing rings, a single widened exhaust opening in the shape of a slot may be provided in the cylinder wall, in which case the unit 36 would carry only a single exhaust tube fashioned to slidably fit in said slot. I do not, therefore, wish to be limited in this particular and the term "exhaust tube" as herein used shall not be construed to cover only a length of pipe of usual cylindrical contour but shall be deemed to comprehend a tube or shell of any shape.

As will now be appreciated, when the exhaust tubes 40 of the unit 36 become clogged sufficiently with carbon to cause a decline in engine speed, the wing nuts 44 are removed when the knob 42 is grasped and the unit withdrawn through the hood 22. Access to the tubes 40 may then, of course, be conveniently had so that said tubes may be easily cleaned, say with a small reaming bit, after which the unit 36 is replaced. As will be seen, this operation may be accomplished while the engine is running as the temporary absence of the tubes 40 in the exhaust openings 17 will not serve to affect the functioning of the engine sufficiently to cause a stoppage of the engine. Furthermore, removal of the unit 36 will serve to shift said unit wholly in a direction away from the interior of the cylinder so that any loose grains of carbon in the tubes 40 will be removed with the tubes while any grains of carbon at the inner ends of the tubes loosened by the withdrawal of the tubes will be provided with clearance as the tubes are withdrawn so that the latter grains will be blown out through the unobstructed exhaust openings by the exhaust gases. The pushing of any carbon from the exhaust openings 17 into the cylinder will thus be obviated and this feature is important as loose particles of carbon in the cylinder form a harsh abrasive between the piston and cylinder wall to soon ruin the engine. Also, the foregoing explains the reason why a reaming tool may not be introduced directly into the exhaust openings of an engine for removing carbon therefrom, as some of the carbon so loosened will be pushed into the engine cylinder.

When the hand of the operator is applied to the knob 42 of the unit 36 to either withdraw or re-seat said unit and is close to the opening 28 in the hood 22, the hood will, even though said opening is unsealed by the plate 38, nevertheless smother the blast of the exhaust gases issuing from the exhaust openings 17 and confine practically all of said gases to flow out the pipe 29. The exahust will thus be prevented by the hood from striking the hand to cause burning thereof. In this connection it may be observed that the ability of the hood, under the conditions noted, to shield the hand has been carefully checked, as the function is important due to the fact that the exhaust gases are not infrequently mixed with flame. Only a very small portion of the exhaust issues through the opening 28 so that upon release of the plate 38, flame will not spurt from the opening 28 to cause the operator to jump or jerk and possibly wrench the unit 36.

Having thus described my invention, what I claim is:

1. An exhaust port assembly for internal combustion engines including an exhaust port tube formed to frictionally fit in the exhaust opening of an engine cylinder engaged with the cylinder solely by the friction fit between the parts, and means connected with said tube and adapted to project externally of the engine in a position to be manually grasped for withdrawing the tube while the engine is in operation

2. In an internal combustion engine, an engine cylinder having an exhaust opening in the wall thereof, means inserted in said opening to form an exhaust port for said cylinder and unconnected with the cylinder to permit free withdrawal of said means while the engine is in operation, and a hood for said opening for diverting the flow of exhaust gases issuing from the opening while said means is being withdrawn.

3. In an internal combustion engine, an engine cylinder having an exhaust opening in the wall thereof, means inserted in said opening to form an exhaust port for said cylinder and unconnected with the cylinder to permit free withdrawal of said means while the engine is in operation, a hood for said opening for diverting the flow of exhaust gases issuing from the opening while said means is being withdrawn, and means connected with the former means and extending through the hood for access for withdrawing the former means.

4. In an internal combustion engine, an engine cylinder having an exhaust opening in the wall thereof, a hood for said opening for diverting the flow of exhaust gases issuing from said opening, said hood being provided with an aperture, and a removable exhaust port unit extending through the hood and including an exhaust port tube disposed in said opening and adapted to be withdrawn through the aperture in the hood with said unit while the engine is in operation.

5. In an internal combustion engine, an engine cylinder having an exhaust opening in the wall thereof, a hood for said opening for diverting the flow of exhaust gases issuing from said opening, said hood being provided with an aperture, a removable exhaust port unit extending through the hood and including an exhaust port tube disposed in said opening and adapted to be withdrawn through the aperture in the hood with said unit while the engine is in operation, and means detachably securing said unit to the hood.

6. In an internal combustion engine, an engine cylinder having an exhaust opening in the wall thereof, a hood for said opening, said hood forming an expansion chamber and being provided with an opening opposite said exhaust opening, an exhaust port unit extending through the opening in the hood and including an exhaust port tube disposed in the exhaust opening of the cylinder, said unit being adapted to be withdrawn through the opening in the hood while the engine is in operation, and means carried by said unit to normally seal the opening in the hood.

7. An exhaust port assembly for internal combustion engines including an exhaust port tube formed to frictionally fit in the exhaust opening of an engine cylinder engaged with the cylinder solely by the friction fit between the parts, a plate mounting the tube, and a rod extending from

said plate externally of the engine and providing an element upon which manual pull may be exerted for withdrawing the tube from said opening while the engine is in operation.

8. An exhaust port assembly for internal combustion engines including a hood for attachment to an engine cylinder having an exhaust opening therein for the discharge of exhaust gases into the hood, said hood being provided with an opening therein opposite said exhaust opening, a removable exhaust port unit including an exhaust port tube disposed in said exhaust opening of the cylinder, a plate mounting said tube, a rod extending from the plate through the opening in the hood, a second plate carried by said rod and normally closing the opening in the hood, and means detachably securing the latter plate to the hood.

9. In an internal combustion engine, an engine cylinder having an exhaust opening and provided

with an exhaust duct connected with said cylinder to communicate with said opening, means disposed in said opening to form a liner therefor, and means attached to said liner forming means whereby the liner is freely removable while the engine is in operation without displacing said duct.

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