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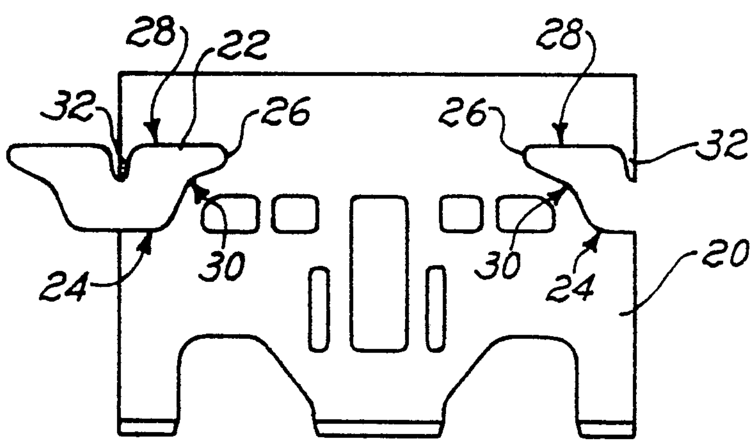
(54) An exhaust ports for a two-stroke internal combustion engine.

(57) The invention concerns the exhaust ports of a two-stroke internal combustion engine, comprising one or more overhanging protruberances which serve to support the piston rings, allowing a larger area exhaust port without the engine seizing or other inconveniences.

Fig. 7



EP 0 272 646 A2

"AN EXHAUST PORTS FOR A TWO-STROKE INTERNAL COMBUSTION ENGINE"

The present invention appertain to the technical sector of the motor construction industry and refers to an exhaust port for the combustion chamber of a two-stroke internal combustion engine.

As is known, in the engine field the configuration of the intake - exhaust complex is very important, especially for two-stroke internal combustion engines, insofar as this configuration is one of the parameters that determine the performance of the same engines.

Referring to the exhaust trunks, the presence in them of low-pressure areas around the exhaust helps the expulsion of the combustion gases from the cylinder, reducing the back-pressure. This is how the performance of the engine is improved: the amount of pumping work required to clear the exhaust gases is reduced.

As a result of this, various ways of increasing the size of the exhaust ports were adopted, all tending to enlarge the exhaust port circumferentially to the cylinder, to which the exhaust same trunk is connected.

In this way the expulsion of the gases is improved and therefore, as described, the performance of the engine too.

However, increasing the exhaust ports circumferentially creates functional and costruction problems. Indeed, in increasing the port size, certain limits cannot be exceeded in as much as too large a circumferential port on the cyclinder wall would lead to breaking of the piston rings and/or the seizure of the piston.

To avoid this drawback, always with the aim of imcreasing the size of the exhaust ports, various technical solutions were proposed.

One solution suggested increasing the aperture of the exhaust, (Figs. 1 and 2) with a very convoluted course and without sharp corners, so as to open and close the wall section in a not brusque way. But in this case the limits are in the difficulty of producing this on an industrial scale, since if every product is not faithfully made and in an established way, sooner or later the piston will seize because the wall section has broken.

A second proposal consists in having at least one vertical central crosspiece across the exhaust port, so that there are two openings in the cylinder wall, which afterwards come together in an single exhaust pipe (Figs. 3 and 4). This solution, despite being adopted in competition engines, is no longer mass produced. Indeed, it is still possible for the piston to seize on the crosspiece, because the latter is subjected to very high temperatures and is also subjected to a thermal gradient along the line of the cylinder, since there are higher temperatues in the upper part of the cylinder than in the lower. This causes a difference in expansion and therefore a deformation of the crosspiece, which can cause seizure. In the case of competition engines, this effect is minimized because every cylinder, after it has been lapped, is manually corrected in diameter in the area of the crosspiece by an exact amount, depending on craft principles, all to reduce the effect of the thermal gradient and the expansion of the crosspiece inside the cylinder.

Finally, another solution (Figs. 5 and 6) consists in the use of lateral boosters which connect with the exhaust trunk through appropriate channeling. With this solution, the exhaust port is enlarged exactly where it is necessary, in the upper part of the exhaust, avoiding or mitigating the negative effects of the thermal gradient and getting, as was described, an increase in the performance of the engine. However, although that solution looks positive, there are limits from another point of view because a complicated core for the exhaust would have to be made in special sand, and a particular and expensive mould would have to be made for the casting of the block. Moreover, it is not possible to reach the same power as with the crosspiece, since it is not possible to build boosters beyond a certain size. Finally, the shape of the channelling is quite complicated and small in size and leads to losses of charge, cancelling for the most part the advantages of the greater exhaust opening. Moreover, in all traditional systems of exhaust porting for high-revving, high-performance engines, it is necessary to fit piston rings constructed from highly elastic and high flexibility resistent materials, otherwise the rapid movement of the ring over the exhaust port (the largest in the traditional cylinders) would cause it to break.

In the light of the drawbacks listed above, related to the technique of enlarging the exhaust ports of internal combustion engines, the principal aim of the present invention is to provide an exhaust port which will structurally enlarge the exhausting of the chamber of cylinders of two-stroke engines, without causing difficulties to mass production and without the risk of the piston seizing or the piston rings breaking, and guaranteeing high performance to any regime. For low performance engines, without the need for very large exhaust openings, the invention could eliminate the ring stop-pins used up to now in the traditional pistons to prevent the rings from turning and entering the exhaust port.

The above mentioned object and other objects that are outlined hereafter, are achieved by an exhaust port for two-stroke internal combustion engines, characterized in that it comprises one or more overhanging protuberances, which descend and/or rise from the edge of the exhaust port, giving the same a "V" or "W" or multiple side-by-side "V" shape, the protuberances extending above and below an ideal line from which the port increases upwards. In this way, the desired enlargement of the exhaust port is obtained, especially in the upper part, guaranteeing sufficient support to the piston rings, because the apertures of the individual openings thus created are limited, as are the spaces between the edges and the protuberances. The latter do not risk causing seizure because they expand freely, being overhanging, in the same way as the full walls in which they are anchored. Moreover, the rings run definitively over large-size apertures, but in which there are bridges which prevent the rings from entering the ports.

Other characteristics and advantages of the exhaust port according to the present invention will be more evident from the following detailed description of a preferred embodiment, illustrated in an indicative but not limiting way in which:

-Figs. 1 - 6 show plan and transverse section of known embodiments.

-Fig. 7 shows a sketch of the flat projection of the exhaust port according to the present invention, with only one protuberance.

-Fig. 8 is a transverse section of the embodiment in Fig. 7.

-Fig. 9 shows a flat projection of an exhaust port with two protuberances which descend from above and one which rises from below and extends between the other two, giving a "W" form to the port itself.

-Fig. 10 is a transverse section of the embodiment in Fig. 9.

-Fig. 11 is the same as that in Fig.9, but where the protuberances, while co-penetrating and while deriving partly from above and partly from below, could be of any number.

-Fig. 12 is a transverse section of the embodiment in Fig. 9.

-Figs. 13 and 14 show variations on Figs 9 and 10.

In Figs. 7 - 14, the sidewalls 20 of a cylinder of a two-stroke internal combustion engine have an exhaust port, 22 which, when developed on the flat, shows roughly as a "T", with a foot 24 and arms 26 which extend over the foot 24 and which are bounded above by the line 28 and below by the line 30 of the foot opening. Centrally with respect to the arms 26 and extending into the port 22 there are one or more protuberances 32 (one in the case of Figs. 7 and 8, two or more in Figs. 9 - 14) which overhang, i.e. they are connected mechanically only to the upper edge 22 of the port and penetrate into the port itself, extending longitudinally to a point beyond the lower edge 30, to guarantee sufficient support for the piston rings when the port is enlarged by the arms 26, support which follows perfectly any modifications to the dimensions due to heat variations.

In Figs. 9 and 10, protuberances 34 are provided extending from below to above, giving the port the appearance of "W" or multiple side-by-side "V"s. The lower protuberances 34 rise to above the line 30 in such a way that there is continuity of support for the piston ring so that when, on its downward stroke, it leaves the support of the two upper protuberances it is already bearing against the lower, and vice versa in the ascending stroke. There is a moment when each ring is touching all the protuberances. Also in the cases of Figs. 11 and 12, there is always continuity of movement of the rings and piston on the upper and lower protuberances, so that the rings themselves do not enter the port.

The variants of Figs.13 and 14, correspond to that of Figs. 9 and 10 but without the lower protuberance. Definitively, there is an enlargement of the exhaust port on the upper cylinder wall, where it is most needed, without the danger of pistons seizing and rings breaking, in a way which is simple to construct and easily reproduced. Similar considerations apply to multiple protuberances.

The innovation is useful even for engines of modest performance, where large exhaust ports are not much needed. If the port is small enough, adopting a "V" or "W" or multiple side-by-side "V", it is possible to restrict the area between one protuberance and the next to the point that the ring can run on the exhaust port itself and turn freely on the piston, without it being necessary to keep it in one fixed position with the stop-pins, which are ever-present in all traditional two-stroke engines.

Claims

1. An exhaust port for two-stroke internal combustion engines, characterized in that it comprises one or more overhanging protuberances, which descend and/or rise logitudinally from the upper or lower edge of the port, giving it a substantially "V", "W" or multiple side-by-side "V" shape.

2. An exhaust port according to Claim 1, characterized in that it has an essentially "V" shape, with upper arms extended circumferentially, and an overhanging protuberance from the upper edge extending axially at least to the height of the arms.

3. An exhaust port according to Claim 2, characterized in that it has two or more protuberances derived from the upper edge of the arms.

4. An exhaust port according to Claim 1, characterized in that it has a "W" or multiple side-by-side "V" shape, with two or more overhanging protuberances derived from the upper edge of the port and one or more protuberances deriving from the lower edge of the port, the upper protuberances extending axially downwards beyond the upper limit line of the one or more lower protuberances.

Fig.1

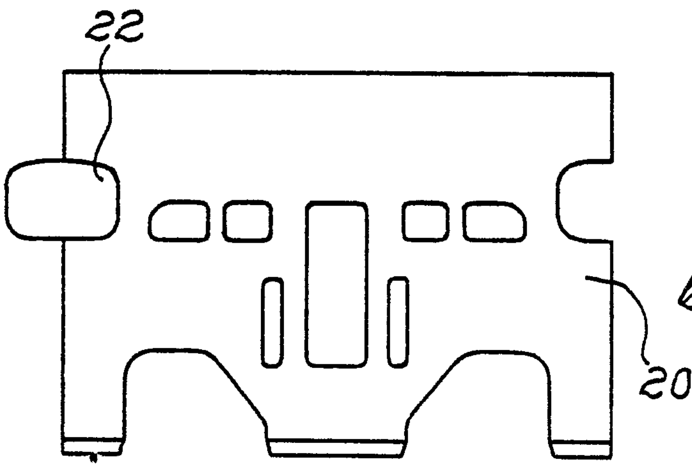


Fig.2

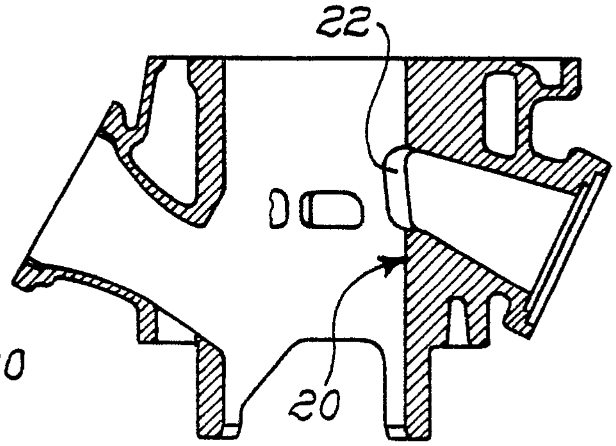


Fig.3

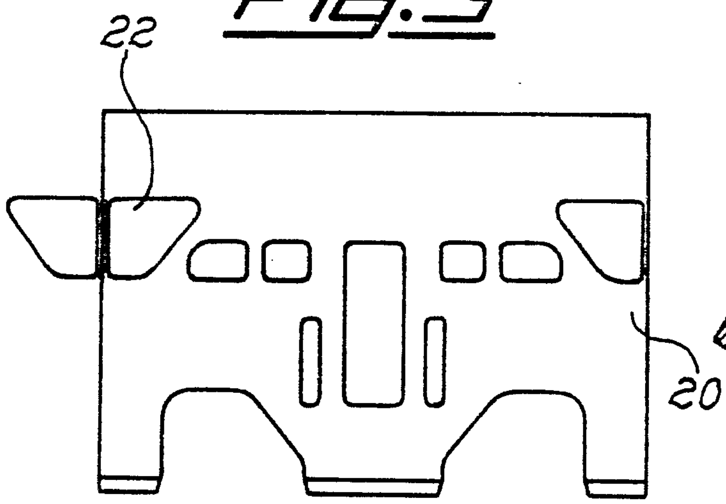


Fig.4

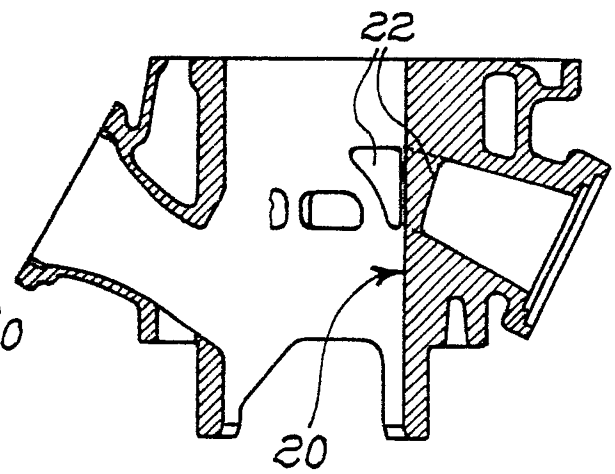


Fig.5

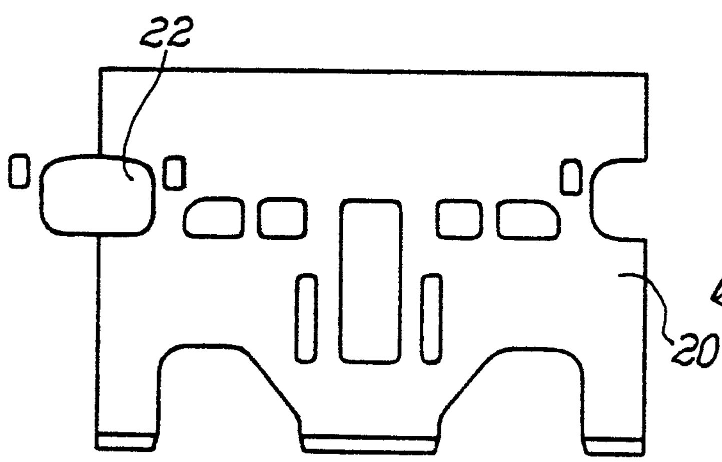


Fig.6

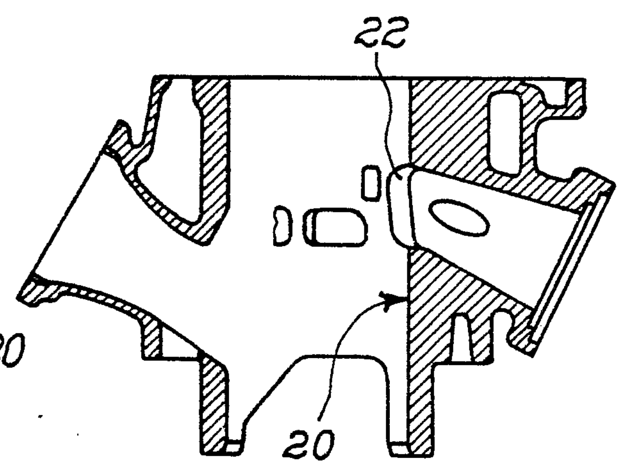


Fig. 7

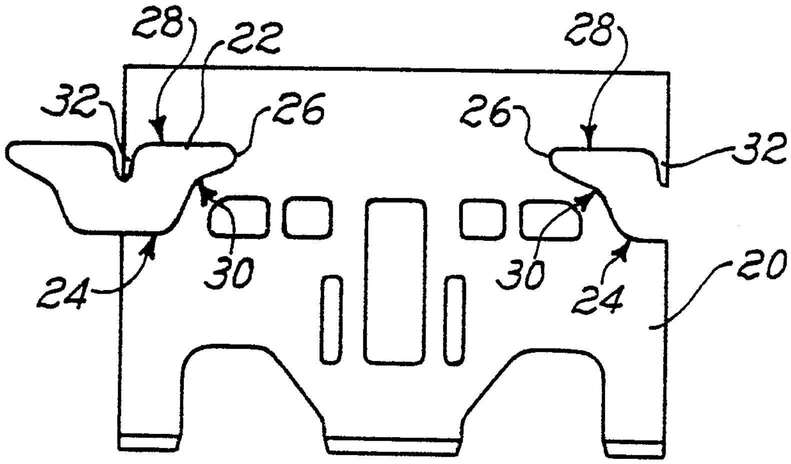


Fig. 8

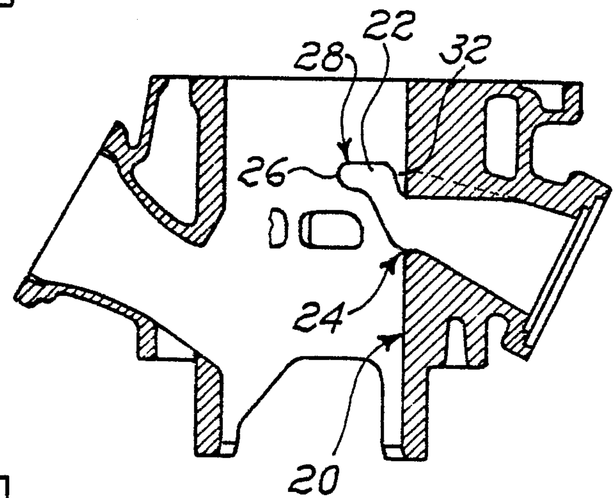


Fig. 9

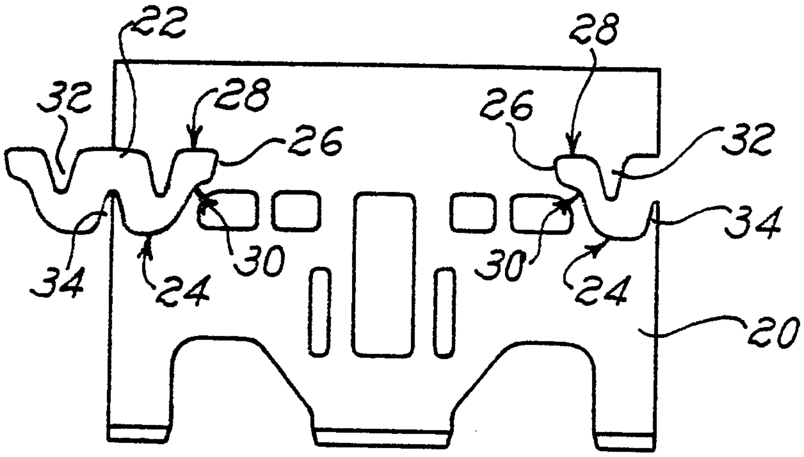


Fig. 10

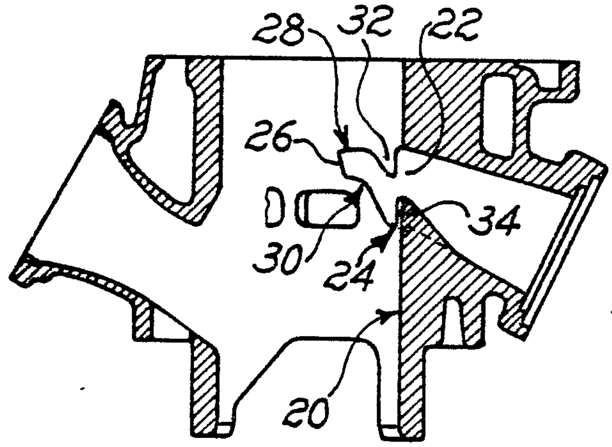


Fig. 11

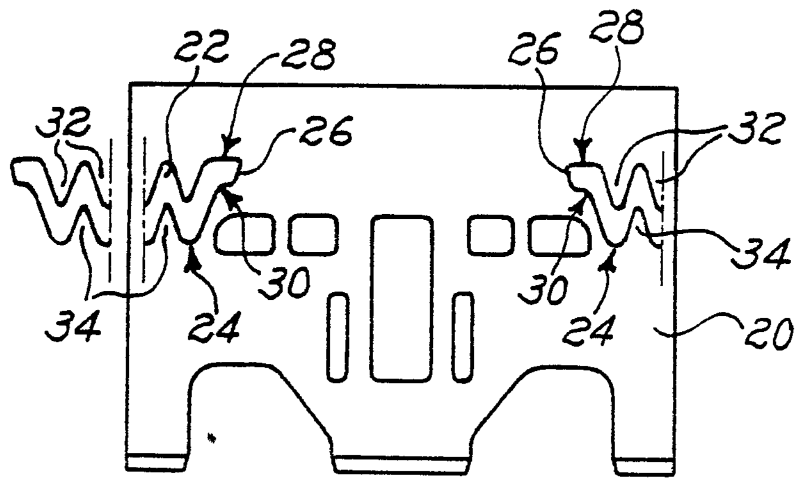


Fig. 12

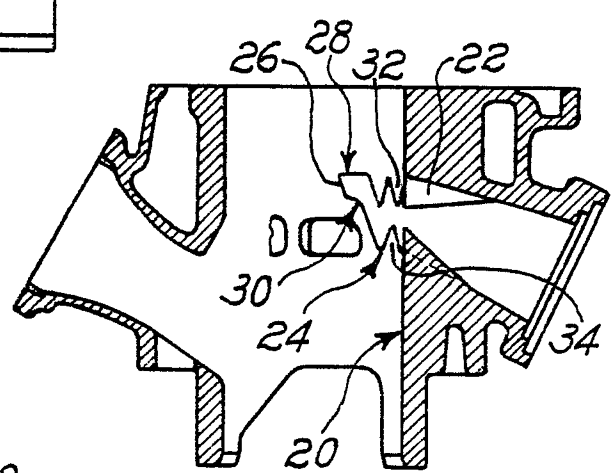


Fig. 13

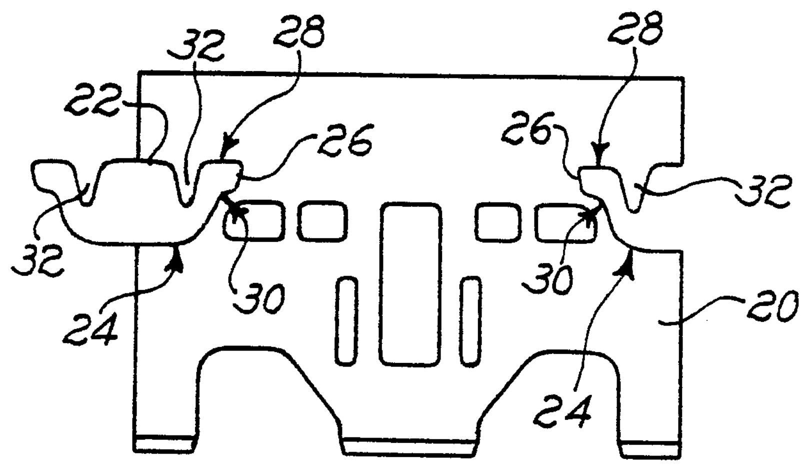


Fig. 14