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F. HUBER ET AL

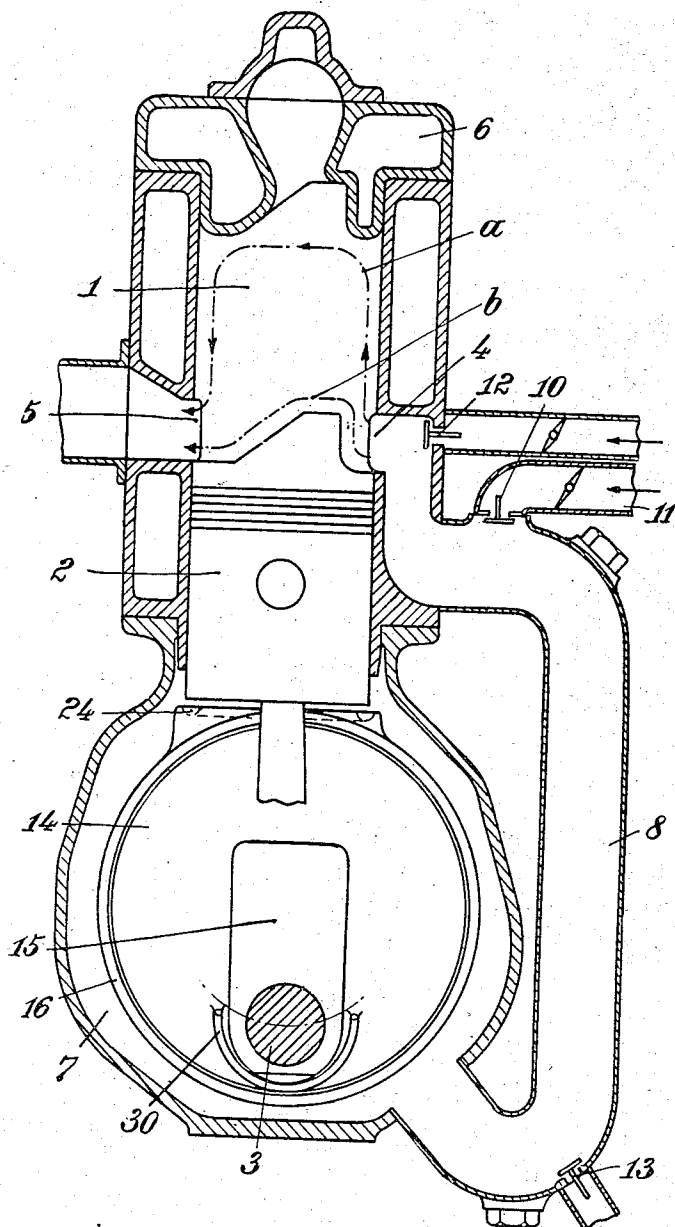
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INTERNAL COMBUSTION ENGINE WITH SCAVENGING PUMP

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2 Sheets-Sheet 1

Fig. 1



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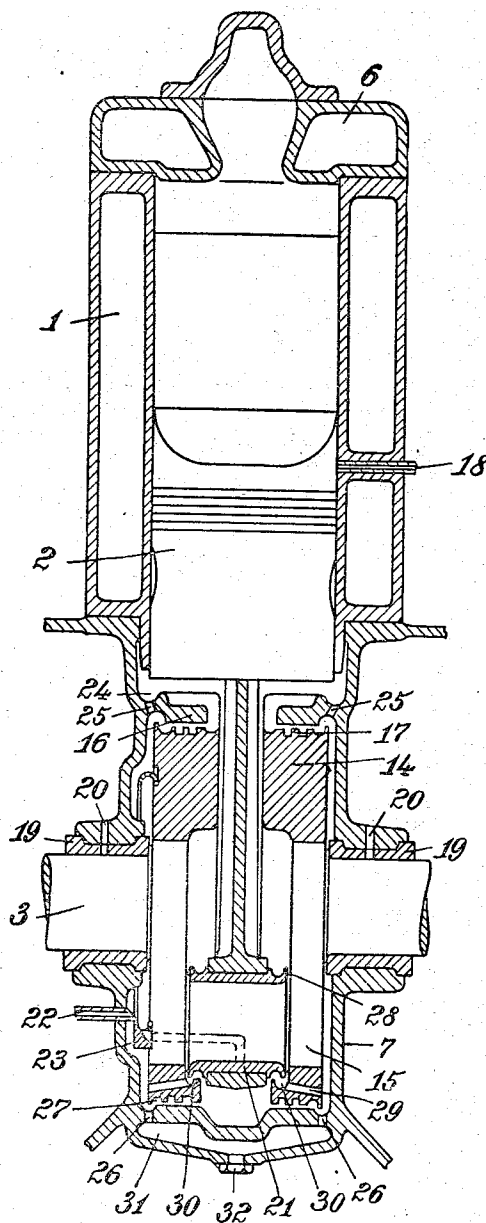
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Fig. 2



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INTERNAL COMBUSTION ENGINE WITH
SCAVENGING PUMPFritz Huber, Mannheim, and Anton Lentz,
Heidelberg, Germany; vested in the Alien Prop-
erty CustodianApplication May 16, 1941, Serial No. 393,720
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13 Claims. (Cl. 123-73)

The present invention relates to two-cycle internal combustion engines with scavenging pump. The object of the invention is, to prevent admission of scavenging air and of combustible mixture into the cylinder of the scavenging pump or into the crank chamber to avoid fouling of the pump or the crank chamber by dust-laden air or dust containing combustible mixture and to prevent that lubricating oil is drawn along into the cylinder and burnt therein.

According to the present invention the scavenging air, the gas and/or the combustible mixture, at the suction stroke of the scavenging pump, are sucked-in together or separately into one or several channels connecting the scavenging pump with the cylinder of the engine and serving merely as sluice. With this arrangement, the scavenging air, the gas and/or the combustible mixture do not enter the crank chamber because the scavenging pump forces the air, the gas and/or the mixture from the connecting channels directly into the engine cylinder. The air in the crank chamber acts upon the scavenging air, gas and/or combustible mixture like an air piston. The channel according to the invention extends preferably from the admission ports in the cylinder to the lower part of the crank chamber. Its volume preferably corresponds approximately to the stroke volume of the engine cylinder or is greater. The admission valve for the admission of the fuel mixture is arranged in the channel preferably near the cylinder admission ports. The introduction of the scavenging air into the channel is effected according to whether it is desired to be introduced in front of or behind the fuel air mixture.

If it is desired that the scavenging air is introduced in front of the combustible mixture, it is fed to the channel through an air valve inserted between the admission valve for the mixture and the admission ports to the cylinder, preferably directly to the admission ports of the cylinder. The mixture valve is located at some distance from the admission ports. With this arrangement pure air flows first into the cylinder which scavenges the residue from combustion, whereas the combustible mixture flows into the cylinder space afterwards. In order to prevent that at the next following compression stroke lubricating oil flowing out of the admission ports can flow up to the mixture admission valve and soil the same, the volume of the channel between the admission valve for the mixture and the admission ports is selected, according to the invention, about so great, that it corresponds to the volume of the

cylinder in the range of its admission ports. Any oil which might enter into this part of the channel is sucked back together with the air in front of the piston bottom and is deposited in front of the combustible mixture. The configuration of the channel connecting the scavenging pump and the cylinder ports is such that there is no sharp diversion of flow in the vicinity of said ports and the fuel-air mixture admission valve so that there are no dead spaces in which lubricating and/or fuel oil may accumulate.

If, however, directly in front of as well as directly behind the combustible mixture scavenging air has to be conducted into the cylinder, an air valve may be inserted, for instance between the mixture admission valve and the scavenging pump, and preferably near the scavenging pump.

According to the invention, crank discs are provided which are tightly embraced at their cylindrical outer faces by accordingly constructed parts of the crank chamber and are packed against these parts preferably by means of labyrinth packings.

The arrangement according to the present invention leads, however, to a full success only, if the mixture quantity sucked into the channel or the quantity of scavenging air does not come into contact with the lubricating oil in the crank chamber. The present invention has therefore also for its object to provide means which effectively prevent lubricating oil from penetrating from the crank chamber into the channel. This is attained according to the invention by collecting and removing oil from the crank bearing. According to the invention an oil groove is arranged underneath the piston in the crank chamber which collects the oil dropping off and conducts the oil through channels into collecting grooves in the crank chamber. The oil coming from the connecting rod bearing flows to oil centrifuging edges arranged at the outer ends of the bearings wherefrom it is squirted into catching grooves of approximately semi-circular shape and arranged in the cheeks of the crank shaft. These collecting grooves bring the oil also into the lower part of the crank chamber, where it flows through passages into the collecting groove into which also the oil from the piston is conducted.

The invention is illustrated, by way of example in the accompanying drawings, in which

Figs. 1 and 2 show each one a section, these sections being displaced by 90°.

In the drawings, 1 designates the cylinder of a slit-controlled two cycle gas engine, 2 the pis-

ton, 3 the crank shaft, 4 the scavenging slits, 5 the exhaust slit, 6 the cylinder cover, and 7 the crank chamber. The cylinder 1 or the scavenging slits 4 and the crank chamber 7 are connected by a channel 8, the upper end of which is connected, for instance, below the scavenging slits 4 with the cylinder 1 and the lower end of which is connected with the lower part of the crank chamber 7. The remaining part of the channel 8 leading to the scavenging slits 4 is formed by the cylinder itself. Near the connecting point to the cylinder the admission valve 10 for the air-gas mixture is arranged in the channel 8 and connected with the gas mixture conduit 11. The volume of the channel 8 between the mixture admission valve 10 and the scavenging slits 4 corresponds approximately to the cylinder space in the range of the scavenging slits. Above the mixture admission valve 10, approximately in the height of the scavenging slits 4, the admission valve 12 for fresh air is arranged on the channel 8 and mounted, in the form of construction shown, on the cylinder wall. At the lower end of channel 8, near its point of connection with the crank chamber 7, an air valve 13 is provided. The channel 8 can also be connected with the cylinder wall directly at the elevation of the scavenging slits 4. In this case the air valve 12 may also be mounted on the channel 8. The channel 8 need not be connected with the lower part of the crank chamber 7 but evidently may be connected also with another point thereof. Dash and dot line *a* in Fig. 1 indicates the travel of the scavenging air or of the residues from combustion respectively, line *b* the path of the fresh air following behind the mixture at the end of the scavenging step at much reduced scavenging pressure in the scavenging pump.

14 designates the filling weights fixed on the cheeks 15 of the crank shaft 3, which, together with the cheeks, are in the form of discs. These discs are tightly embraced by the correspondingly constructed part 16 of the crank chamber 7 and sealed against the same by labyrinths 17.

The gas engine has fresh oil lubrication, piston 2 being lubricated from point 18, main bearings 19 from point 20 and connecting rod bearing 21 through oil pipe 22 and oil centrifuging rings 23. The arrangement for collecting and discharging the lubricating oil separating from the path along which the piston travels consists of an oil catching groove 24 arranged underneath the path along which the piston moves, for instance in the crank chamber 7, oil passages 25 and 26 and oil centrifuging rings 27 provided on the crank discs. The arrangement for draining excess lubricating oil from the connecting rod bearing consists of oil centrifuging edges 28 provided on the outer ends of the connecting rod bearing 21, passages 29 and semi-circular collecting grooves 30 arranged on the cheeks 15. 31 designates an oil collecting groove provided in the lower part of the crank chamber 7, which groove can be opened by an oil discharging screw 32.

The invention can be applied to gas engines as well as to engines which work with liquid fuel. It is immaterial whether into the channel only air- or gas mixture or a mixture of air and power fluid is sucked.

We claim:

1. A two cycle internal combustion engine including, in combination, a scavenging pump, an engine cylinder, admission ports in said cylinder, a conduit connecting said pump and said ports, a fresh air inlet means disposed in said conduit

in the immediate vicinity of said ports, and a fuel-air mixture admission means disposed in said conduit and spaced from said fresh air inlet means and from said ports.

2. A two cycle internal combustion engine including, in combination, a scavenging pump, an engine cylinder, admission ports in said cylinder, a conduit connecting said pump and said ports, a fresh air inlet valve disposed in said conduit in the immediate vicinity of said ports, and a fuel-air mixture admission means disposed in said conduit and spaced from said fresh air inlet valve and said fuel-air mixture admission means are connected being substantially continuously directed and so designed that there is no sharp diversion and reversal of flow, a substantial part of said portion and also said fresh air inlet valve being disposed in the wall of said engine cylinder.

3. A two cycle internal combustion engine including, in combination, a scavenging pump, an engine cylinder, admission ports in said cylinder, a conduit connecting said pump and said ports, a fresh air inlet means disposed in said conduit in the vicinity of said ports, a fuel-air mixture admission means disposed in said conduit and spaced from said fresh air inlet means, and an air inlet valve disposed in said conduit in the vicinity of the outlet of said pump.

4. A two cycle internal combustion engine including, in combination, a scavenging pump, an engine cylinder, admission ports in said cylinder, a conduit connecting said pump and said ports, a fresh air inlet means disposed in said conduit in the vicinity of said ports, a fuel-air mixture admission means disposed in said conduit and spaced from said fresh air inlet means, the volume of said conduit between said mixture admission means and said pump amounting to at least the stroke volume of said cylinder.

5. A two cycle internal combustion engine including, in combination, a scavenging pump, an engine cylinder, admission ports in said cylinder, a conduit connecting said pump and said ports, a fresh air inlet means disposed in said conduit in the vicinity of said ports, a fuel-air mixture admission means disposed in said conduit and spaced from said fresh air inlet means, the volume of said conduit between said mixture inlet means and said ports amounting to substantially the volume of said cylinder up to said ports.

6. A two cycle internal combustion engine including, in combination, a crank chamber, a scavenging pump of the crank chamber type, an engine cylinder, admission ports in said cylinder, a conduit connecting said pump and said ports, a fresh air inlet means disposed in said conduit in the vicinity of said ports, a fuel-air mixture admission means disposed in said conduit and spaced from said fresh air inlet means, crank discs, and individual sealing means disposed within said crank chamber adjacent to and extending around said crank discs for catching the lubricating oil thrown off therefrom.

7. A two cycle internal combustion engine including, in combination, a crank chamber, a scavenging pump of the crank chamber type, an engine cylinder, admission ports in said cylinder, a conduit connecting said pump and said ports, a fresh air inlet means disposed in said conduit in the vicinity of said ports, a fuel-air mixture admission means disposed in said conduit and spaced from said fresh air inlet means, crank discs, and individual sealing means disposed

within said crank chamber adjacent to and extending around said crank discs for catching the lubricating oil thrown off therefrom, said sealing means comprising oil catching means disposed in the vicinity of said engine cylinder for catching lubricating oil emerging from said cylinder.

8. A two cycle internal combustion engine including, in combination, a crank chamber, a scavenging pump of the crank chamber type, an engine cylinder, admission ports in said cylinder, a conduit connecting said pump and said ports, a fresh air inlet means disposed in said conduit in the vicinity of said ports, a fuel-air mixture admission means disposed in said conduit and spaced from said fresh air inlet means, crank discs, individual sealing means disposed within said crank chamber adjacent to and extending around said crank discs for catching the lubricating oil thrown off therefrom, and lubricating oil removing means in said crank chamber and connected for oil flow with said sealing means for removing the oil caught by said sealing means.

9. A two cycle internal combustion engine including, in combination, a crank chamber, a scavenging pump of the crank chamber type, an engine cylinder, admission ports in said cylinder, a conduit connecting said pump and said ports, a fresh air inlet means disposed in said conduit in the vicinity of said ports, a fuel-air mixture admission means disposed in said conduit and spaced from said fresh air inlet means, crank discs, and individual sealing means disposed within said crank chamber adjacent to and extending around said crank discs for catching the lubricating oil thrown off therefrom, said sealing means comprising an oil catching groove facing one end of said cylinder and collecting lubricating oil emerging from said cylinder.

10. A two cycle internal combustion engine including, in combination, a crank chamber, a scavenging pump of the crank chamber type, an engine cylinder, admission ports in said cylinder, a conduit connecting said pump and said ports, a fresh air inlet means disposed in said conduit in the vicinity of said ports, a fuel-air mixture admission means disposed in said conduit and spaced from said fresh air inlet means, crank discs, individual sealing means disposed within said crank chamber adjacent to and extending around said crank discs for catching the lubricating oil thrown off therefrom, said sealing

means comprising oil catching means disposed in the vicinity of said engine cylinder for catching lubricating oil emerging from said cylinder, and an oil catching groove in said crank chamber and connected for oil flow with said oil catching means.

11. A two cycle internal combustion engine including, in combination, a crank chamber, a scavenging pump of the crank chamber type, an engine cylinder, admission ports in said cylinder, a conduit connecting said pump and said ports, a fresh air inlet means disposed in said conduit in the vicinity of said ports, a fuel-air mixture admission means disposed in said conduit and spaced from said fresh air inlet means, a connecting rod bearing member comprising oil squirting edges, and crank discs comprising oil catching grooves disposed oppositely to said edges and collecting the oil squirted therefrom.

12. A two cycle internal combustion engine including, in combination, a crank chamber, a scavenging pump of the crank chamber type, an engine cylinder, admission ports in said cylinder, a conduit connecting said pump and said ports, a fresh air inlet means disposed in said conduit in the vicinity of said ports, a fuel-air mixture admission means disposed in said conduit and spaced from said fresh air inlet means, a crank disc having an oil centrifuging ring disposed at the outside thereof, and a crank having an oil conduit communicating for oil flow with said centrifuging ring and receiving oil therefrom.

13. A two cycle internal combustion engine including, in combination, a crank chamber, a scavenging pump of the crank chamber type, an engine cylinder, admission ports in said cylinder, a conduit connecting said pump and said ports, a fresh air inlet means disposed in said conduit in the vicinity of said ports, a fuel-air mixture admission means disposed in said conduit and spaced from said fresh air inlet means, crank discs having an oil squirting edge, and individual sealing means disposed within said crank chamber adjacent to and extending around said crank discs for catching the lubricating oil thrown off therefrom, said sealing means comprising an oil collecting groove disposed oppositely to said edge and collecting the oil squirted therefrom.

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