June 29, 1943. F. NEUGEBAUER ET AL 2,323,074

PISTON HEAD

Filed July 21, 1941 2 Sheets-Sheet 1

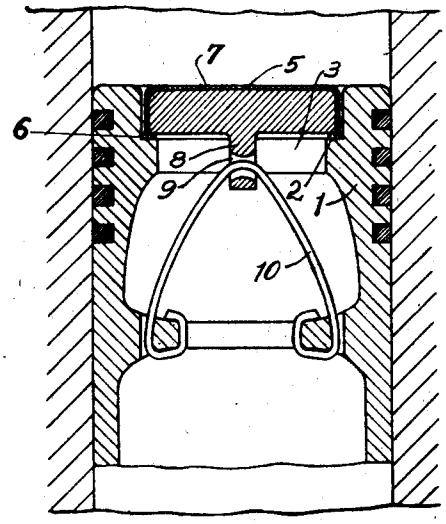


Fig.1

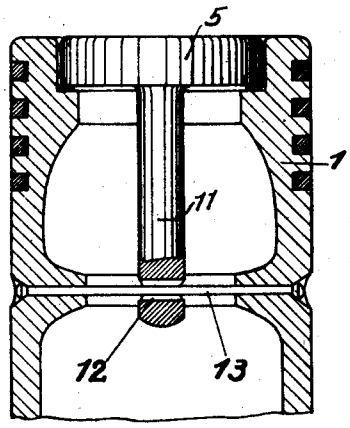


Fig.2

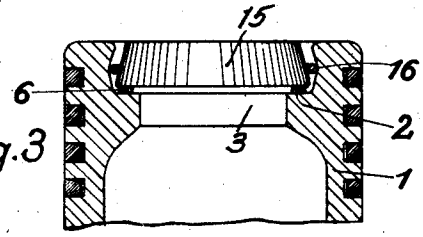


Fig.3

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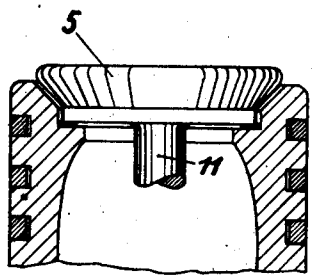


Fig.4

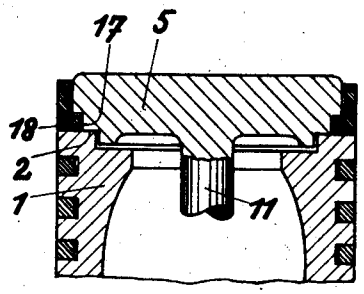


Fig.5

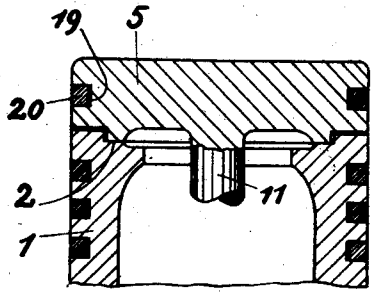


Fig.6

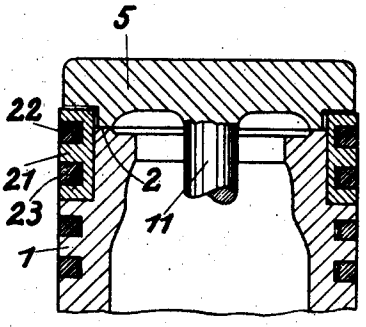


Fig.7

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UNITED STATES PATENT OFFICE

2,323,074

PISTON HEAD

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Application July 21, 1941, Serial No. 403,430
In Germany August 29, 1940

8 Claims. (Cl. 309—9)

This invention relates to means for protecting the piston of two-stroke internal combustion engines against the action of the intense heat of the combustion gases. For this purpose one has proposed to provide a separate head of suitable material and to keep it permanently pressed against a tightly fitting surface of the piston body by means of separate tie members (f. i. screws). This construction entails the drawback of the head being liable to warp or to form a vault under the influence of the intense heat, whereby the connecting members arranged between the head and the piston body are often extremely stressed or even break. To avoid this inconvenience one has proposed to use elastic connecting members, long and relatively thin bolts, or to insert additional resilient elements into the connecting members. This however involves wearisome and intricate structures, renders the manufacture difficult and increases the weight and the cost of the pistons.

The object of our invention is to provide a simple and safely working piston for two-stroke internal combustion engines consisting of a piston body and a head separably attached thereto. The invention is based upon the fact that at the head of a working two-stroke motor piston a force acts to press the head permanently against the piston body. In the first part of the working stroke (away from the inner dead center) the high pressure of the combustion gases prevails during this part of the stroke; in the second part of this stroke (toward the dead center) it is true that this force diminishes, but the inertia of the retarded head is added thereto. In the first part of the inside stroke (away from the exterior dead center) it is again the inertia of the accelerated head which is acting; in the second part of the inward stroke (toward the inner dead center) the permanently increasing pressure acts on the piston head. According to the invention the piston of a two-stroke internal combustion engine is covered with a separable head one side of which is exposed to the pressure of the combustion space so that the head is attached to the piston body, without the aid of any tie member, only by the pressure existing in the combustion space or by its own inertia.

With a piston equipped in this manner deformations of the head may take place without any restriction. Therefore nowhere excessive forces can arise and the risk of connecting members getting broken is entirely avoided. The formation and therewith the manufacture of the head becomes, owing to the suppression of tie members engaging it, extremely simple. Owing to this simplicity and the facility of exchanging worn heads against new ones said members need not be constructed from a high-valuable, especially heat-resisting metal, but a less refractory and cheaper material may be employed. We prefer to make the head of a less resistant cheap metal and to coat it on the side facing the combustion space with a firmly adhering thin layer, for instance welded thereon, of a heat-resistant metal. Furthermore the suppression of especial tie members permits of making the head entirely of ceramic material which is cheaper than a metal well resistant to heat. Owing to its low heat-conductivity such head during the working of the engine assumes a very high temperature, whereby the combustion of cheap but difficultly combustible fuels is considerably facilitated and the economy of the motor work is essentially improved.

To prevent the head from falling off, for instance when the motor is started by an exterior force, a holding member may be inserted between the head and the piston body so as to merely prevent the falling-off without impeding the movability of the head or exerting forces thereon. The diameter of the head is preferably chosen a little smaller than that of the piston so that only a small annular front face of the piston remains uncovered and the heat may readily flow off from the annular face to the cylindrical skirt of the piston and excessive heating of this annular zone is avoided.

The head may also be formed to wholly or partially overlap the front face of the piston thereby protecting it against the action of the hot gases. Such head may itself contain one or more piston rings, or it may serve for retaining the utmost piston ring or a carrier of a piston ring.

The head should be disposed in such a manner that during the working the force acting on its outside is always greater than the force acting on its inside; this means that the inside must be exposed only to a small pressure (for instance, the pressure existing in the gear box). The head therefore should tightly join the piston body. This may be attained either by an intermediate, preferably elastic layer, for instance a ring of soft metal (copper, aluminum) or also by grinding the head upon the piston body.

The invention applies most advantageously to the motor pistons of free piston engines because in the motor part of these engines excessively high pressures and temperatures occur and therefore

the thermical stresses upon these pistons are extraordinarily high.

The invention will now be more fully described with reference to the annexed drawings showing by way of example some modifications in longitudinal axial cross-section.

Fig. 1 is a sectional view of a piston including a separate head.

Fig. 2 is a sectional view of a modified arrangement.

Fig. 3 is a modification of Fig. 3, the head being a flat truncated cone.

Fig. 4 is a to a modification.

Fig. 5 is to another modification.

Figs. 6 and 7 are to further modifications of a piston and a separate head.

In Fig. 1 a separate head 5 forming a circular plate is loosely inserted into a circular opening 3 of the bottom part of the piston body 1 provided with a shoulder or step 2. A ring 6 of soft metal is placed as a packing between the member 5 and the shoulder 2. The head consists, for instance, of a piece of metal having a moderate heat resistance which is coated on the side facing the combustion space and also at its cylindrical circumference with a thin layer 7 of a well heat-resistant metal. Between the inner surface of the opening of the piston and the cylindrical surface of the head 5 a narrow gap is left so that the circular head is free to expand. On the side turned toward the interior of the piston the head carries a projection 8 provided with a transverse bore 9. A wire 10 is loosely conducted through this bore, and the ends of the wire are connected to the piston body 1. Hereby the head is prevented from falling off.

Fig. 2 shows an essentially similar arrangement except that the device for preventing the head 5 from falling off is modified. It carries an extension 11 extending into the interior of the piston and provided with a transverse boring 12 through which a pin 13 is freely passed which is positioned and fastened diametrically in the wall of piston body.

In the modification shown in Fig. 3 the head 15 consisting, for instance, of ceramic material has the form of a flat truncated cone positioned with its larger base on the shoulder 2 with the insertion of a packing ring 6. The outer edge of the opening in the head of the piston which substantially corresponds in diameter to that of the separable head is somewhat contracted so that a circular gap of plan-convex cross-section remains between the bottom member 15 and the annular end of the piston, into which gap an expansible ring 16 is inserted so as to prevent the separable head from falling off, the latter however remaining freely movable in view of the body of the piston.

In Fig. 4 the annular front part of the piston body 1 is inwardly beveled and the separable head outwardly projects so as to overlap the beveled front part of the piston and thereby to protect the latter against direct corrosion by heat.

In the modification shown in Fig. 5 the piston body ends with the seat-face 2 extending as far as to the periphery of the piston body. The head 5 is provided at its periphery on the side turned toward the piston with a recess 17 forming together with the face 2 a circular groove into which enters the inner leg of an L-shaped piston ring, so that this ring is only held by the head 5 freely adjoining the piston body 1. The annular seat of the bottom member immediately adjoins the face 2 of the piston body.

In the case shown in Fig. 6 the head 5 entirely overlaps the piston body 1 and is carried in a groove 19 cut into its cylindrical surface a piston ring 20.

In the modification shown in Fig. 7 the head 5 overlaps a piston ring carrier 21 shifted over the piston body 1 and bearing the piston rings 22, 23. This piston ring carrier is, in the same manner as the piston ring 18 in Fig. 5, only retained in its position on the piston body by the head 5 freely adjoining the piston body 1.

We claim:

1. A piston for a two-stroke internal combustion engine, comprising a piston body and a separable head consisting of a plate having a moderate resistance to heat and being coated with a firmly adhering layer of a highly heat-resisting metal, said plate freely adjoining the piston body in an airtight condition, and being devoid of any fastening member.

2. A piston for a two-stroke internal combustion engine, comprising a piston body and a ceramic separable head freely adjoining the piston body in an airtight condition, and being devoid of any fastening member.

3. A piston for a two-stroke internal combustion engine, comprising a piston body, a separable head freely adjoining this body in an airtight condition and devoid of any fastening member, an eye at the back side of said head, and a pin loosely passing through said eye and secured with its ends to the piston body.

4. A piston for a two-stroke internal combustion engine, comprising a piston body having a circular central opening enlarged in the middle, a conical head placed in said opening, and an expansible ring inserted between the piston body and the conical head.

5. A piston for a two-stroke internal combustion engine, comprising a piston body, an annular body adjoining the piston body in an airtight condition, a number of piston rings on said annular body, and a separable head freely adjoining and overlapping said annular body in an airtight condition.

6. In a single-acting two-stroke internal combustion engine, a piston consisting of a piston body and a separable piston head provided with a cavity opening toward both front sides, the side turned toward the combustion space being provided with an annular abutment face surrounding the mouth of the cavity positioned at this side, said head having at the side turned toward the piston body a corresponding abutment face adapted to join in an airtight condition said abutment face of the piston body under the action of the gas pressure in the combustion space, said head being devoid of any fastening member.

7. In an internal combustion engine equipped in accordance with claim 6, means for loosely keeping together the piston body and the piston head permitting the piston head to be lifted only a short distance from its seat upon the piston body.

8. In an internal combustion engine equipped in accordance with claim 6, an annular body adjoining the piston in an air-tight condition arranged to be overlapped by the peripheral part of the head turned toward the piston body.

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