PATENT SPECIFICATION

Convention Date (Germany): Sept. 19, 1927. **295,537**

Application Date (in United Kingdom): Dec. 16, 1927. No. 34,153/27.

Complete Accepted: Aug. 16, 1928.

COMPLETE SPECIFICATION.

Improvements in and relating to Rotary Slide Valve Packing for Internal-combustion Engines.

I, ALFRED BAER, of German nationality, of Eosanderstrasse 29, Berlin-Charlottenburg, Germany, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to a new rotary slide-valve packing for internal-combustion engines. As is known, the main difficulty in the employment of rotary slide-valve gears in internal-combustion engines, particularly in those which are directly supported in the cylinder head, resides in the fact that in consequence of the high temperatures to which such slide valves are exposed when in operation, it is impossible to grind in the slide valves in a gas-tight manner, as is done for example in steam engines. It is therefore necessary for the diameter of the slide valve in a cold condition to be kept a certain amount smaller than the diameter of the bore in which it works, in order that when in use it may be able to expand according to its temperature, so as to close in a fluid-tight manner in this condition. Since, however, such slide valves, in consequence of the unfavourable working conditions, are subject to very rapid wear, even very well fitted slide valves are not successfully kept gas-tight for a very long time. Leakages, however, involve losses of energy. The practice of fitting such slide valves into fixed bores has therefore been abandoned, and they are now built into bores which consist of two relatively movable halves, which can be so adjusted relatively to one another by wedge pressure, springs or the like, so that a satisfactory co-operation of the packing surfaces can be obtained, unhampered by temperature influences or wear. Since, however, in consequence of the high working pressures occurring, the slide-valve friction is very great and absorbs a comparatively large part of the energy generated, a search has had to be made for means for diminishing or obviating this disadvantage. This has been effected by supporting the rotary slide valves in roller bearings. With such a fixed bearing, however, it is now necessary to arrange the elements which co-operate directly with the rotary slide valve in an individually movable manner and to fit each individually to the rotary slide valve. Such devices have already become known, only these valves showed the disadvantage that it has hitherto not been found possible to keep the co-operating elements so fluid-tight that the motor works in a satisfactory manner at every speed of revolution; for at an increasing speed of revolution it has been found by experience that the output of the motor does not rise approximately proportionally to the speed of revolution, but much less quickly. This is due to the fact that at high speeds of revolution a continually greater and greater percentage of the residues of combustion is not correctly expelled from the cylinder space, or recombines with the fresh gaseous mixture in side passages which have arisen owing to the working surfaces not being kept fluid-tight, thereby impairing the mixture.

The present invention relates to a rotary slide valve packing for slide valve gears of the kind described above, which obviates the disadvantages indicated, and renders it possible, notwithstanding fixed supporting of the rotary slide valve, which is not ground in, to establish at the desired instant a completely satisfactory packing between the slide valve and the corresponding seating surfaces, both at the inlet and at the outlet ports. There is also the further advantage that the slide valve is to a substantial extent relieved of load, so that the output of work necessary for driving it is greatly reduced. The risk of the relatively working surfaces seizing is completely eliminated. The main advantage of the new arrangement, however, resides in the fact that in consequence of the satisfactory packing, all loss of fresh gas, and also at the same time all contamination of the fresh gases by exhaust gases is completely obviated.

The invention consists in a rotary slide valve packing for internal combustion engines of the kind having a movable packing piece arranged between the rotary valve and the working cylinder and a resilient diaphragm ring arranged between

the packing piece and the cylinder head, which packing piece is pressed at its outer edge by means of a clamping ring against a shoulder-like projection on the cylinder head and which permits the packing piece to move freely in relation to the periphery of the rotary slide valve, but prevents mixture from escaping from the working cylinder through the gap between the packing piece and the cylinder head, and is characterised in that the resilient diaphragm ring consists of a flat sheet metal ring having an annular projection impressed in it, the inner edge of which ring is connected to the packing piece by means of a second clamping ring in such a manner as to be easily removed therefrom.

The invention is illustrated in one constructional form by way of example in the accompanying drawings, wherein

Figure 1 shows a cross-sectional elevation through the central axis of an internal-combustion engine perpendicular to the axis of the rotary slide valve.

Figure 2 is a cross section through the cylinder head on the line 2—2 in Fig. 1 on an enlarged scale,

Figure 3 a cross section through the lower part of the cylinder head and rotary slide valve according to Figure 1 on an enlarged scale,

Figure 4 a cross section perpendicular to the central axis of the rotary slide valve,

Figure 5 a side elevation of the rotary slide valve partly broken away,

Figure 6 a plan of the movable packing piece in the lower part of the cylinder head,

Figure 7 a plan of the diaphragm ring,

Figure 8 a cross section through the diaphragm ring on the line 8—8 in Figure 7,

Figure 9 a cross-sectional elevation through the longitudinal axis of the upper packing shoe,

Figure 10 a plan of the packing shoe according to Figure 9, and

Figure 11 a side elevation of the packing shoe, looking in the direction of the arrow 11 in Figure 9.

As will be seen from the drawings, 1 denotes the working cylinder, 2 the working piston, and 3 the cooling jacket of the cylinder, 4 is a cylinder head, which extends over the entire cylinder block and which is packed against the cylinder block by a packing plate 5. On the cylinder head 4 are located in a bore the rotary slide valves 6, 6^1, and so forth, which are united in pairs for each two cylinders and are supported in roller bearings 7. The joints shown in Figure 2 between each two rotary slide valve parts 6, 6^1, and so forth are kept coaxial by sheath rings 7^1, and united to form a whole by pins 8 engaging a hole in each valve part. Between the rotary slide valves 6, 6^1, and so forth and the corresponding bore in the cylinder head sufficient clearance is provided. The rotary slide valves are made hollow, and comprise on the periphery two diametrically opposite apertures 9 and passages 10, which penetrate through the slide valve. The apertures 9 and also the apertures of the passages 10 serve as controlling elements for the admission of fresh gas and the discharge of burnt gases respectively. In the lower part of the cylinder head 4 and opposite to the rotary slide valve there is a packing piece 11, as can be seen particularly clearly in Figure 3. This packing piece forms the upper closure of the working cylinder and contains in its surface apertures 9^1 and 10^1, which cooperate with the corresponding apertures in the rotary slide valve. The packing piece 11 is axially movable and is kept in its place by a nickel diaphragm 12, shown in Figures 3, 7 and 8. The nickel diaphragm 12 receives a certain preliminary stress, in order that the packing piece may be permanently pressed against the slide valve with a certain pressure. As will be seen, the diaphragm consists of a ring of sheet nickel, into which is pressed an annular projection 12^1. The flange-like ring elements located on both sides of this annular projection serve for the clamping of the diaphragm, and, as will be clear from Figure 3, the inner flange is secured to the packing piece 11 by means of a screwed clamping ring 13, while the outer flange is pressed by a screwed clamping ring 14*a* and a plain clamping ring 14 against a corresponding bearing surface on the cylinder head 4. In this manner the packing piece 11 is axially movable owing to the elasticity of the diaphragm 12, and it will be recognised that the packing piece 11 is pressed against the rotary slide valve when excess pressure prevails in the working cylinder.

In the upper part of the cylinder head, opposite to the apertures 9 and 10 in the rotary slide valve, are located packing shoes 15 and 15^1, shown in Figures 1, 9, 10 and 11. These packing shoes consist of a shoe-like member 16, which is fitted to the periphery of the rotary slide valve, and of a supply passage 17 or an exhaust passage 17^1 opening on opposite sides of the cylinder head. In the direction of the central axis of the slide valve they carry a projection 18, which serves as a bearing surface for compression springs 20, which are lodged in the cylinder head in special guides 19. At the end of the

duct-like part 17 or 17[1] is turned an annular projection 21, upon which is pressed a packing diaphragm 22, similar to the packing diaphragm 12. Facing the passage 17 is located the connecting pipe 23 to the carburetter.

The apparatus operates in the following manner. If the working piston is on the suction stroke, that is, if a partial vacuum prevails in the cylinder, the valve elements will be in the position shown in Figure 1, so that from the suction pipe 23 the path for the fresh gas through the hollow rotary slide valve into the working cylinder is open, and fresh gas flows freely into the interior. During the compression and expansion strokes which now follow, the rotary slide valve revolves in a clockwise direction, so that the passageway 10 is located in its vertical position at the moment when the exhaust begins. The aperture 10 of this passageway then stands opposite to the aperture 10[1] (Figure 6) in the packing piece 11. In consequence of the pressure prevailing in the working cylinder the packing piece is pressed against the rotary slide valve so that the exhaust of the combustion residues proceeds with fluid-tight closure, in which case in particular no combustion residues can go astray laterally. This is ensured firstly by the fact that the surface of the packing piece is pressed against the periphery of the rotary slide valve, and secondly by the presence of the diaphragm 12, which completely closes the annular space between the packing piece 10 and the cylinder 4 that surrounds it, so that no combustion gases can remain in this gap. These are in fact immediately discharged through the passage 10 into the packing shoe 15[1] facing it, and then, as will be seen from Figure 1, laterally to the left into the exhaust passage 17[1]. The shoes 15 and 15[1] resting upon the upper part of the rotary slide valve are kept fluid-tight by the springs 20, the stress in which is so dimensioned that they only exert upon the packing shoes as much pressure as is absolutely necessary in order to prevent the packing shoe from lifting. Since the rotary slide valve works with ample clearance in its bore all unnecessary frictional resistances are eliminated. Also the reactions exerted in consequence of the pressure in the cylinder are not taken up by the opposite rubbing surfaces of the rotary slide valve but by the roller bearings. During the compression, expansion and exhaust periods, the packing piece 11 is pressed against the periphery of the rotary slide valve. The driving of the rotary slide valve is effected from the main shaft of the engine in the known and customary manner.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A rotary slide valve packing for internal combustion engines having a movable packing piece arranged between the rotary valve and the working cylinder and a resilient diaphragm ring arranged between the packing piece and the cylinder head, which packing piece is pressed at its outer edge by means of a clamping ring against a shoulder-like projection on the cylinder head and which permits the packing piece to move freely in relation to the periphery of the rotary slide valve, but prevents mixture from escaping from the working cylinder through the gap between the packing piece and the cylinder head, characterised by the feature that the resilient diaphragm ring consists of a flat sheet metal ring having an annular projection impressed in it, the inner edge of which ring is connected to the packing piece by means of a second clamping ring in such a manner as to be easily removed therefrom.

2. A rotary slide valve packing as claimed in Claim 1, characterised by the feature that the movable packing piece projects considerably into the interior of the working cylinder, so that it is continually pressed against the rotary slide valve by the gas pressure.

3. A rotary slide valve packing as claimed in Claim 1 or 2, characterised by the feature that the packing piece is provided with separate inlet and outlet openings, which coact with openings suitably provided on the periphery of the rotary slide valve.

4. A rotary slide valve packing as claimed in Claims 1 to 3, having for the supplying of fresh gas and discharging of the combustion residues, packing shoes fitted to the side of the valve opposite to the cylinder which are pressed by springs against the periphery of the valve, characterised by the feature that the packing shoes are resiliently connected to the suction pipe by means of a diaphragm which is secured to the shoe by an annular projection.

5. A rotary slide valve packing, substantially as hereinbefore described in reference to the accompanying drawings.

Dated this 15th day of December, 1927.

MARKS & CLERK.

[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 1.

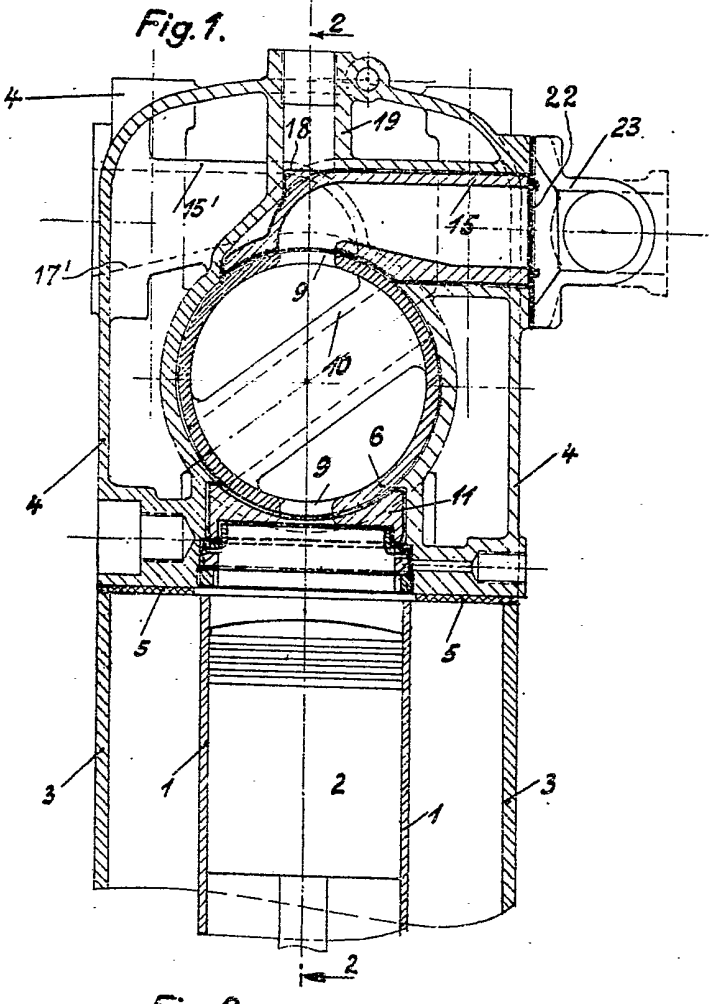


Fig. 2.

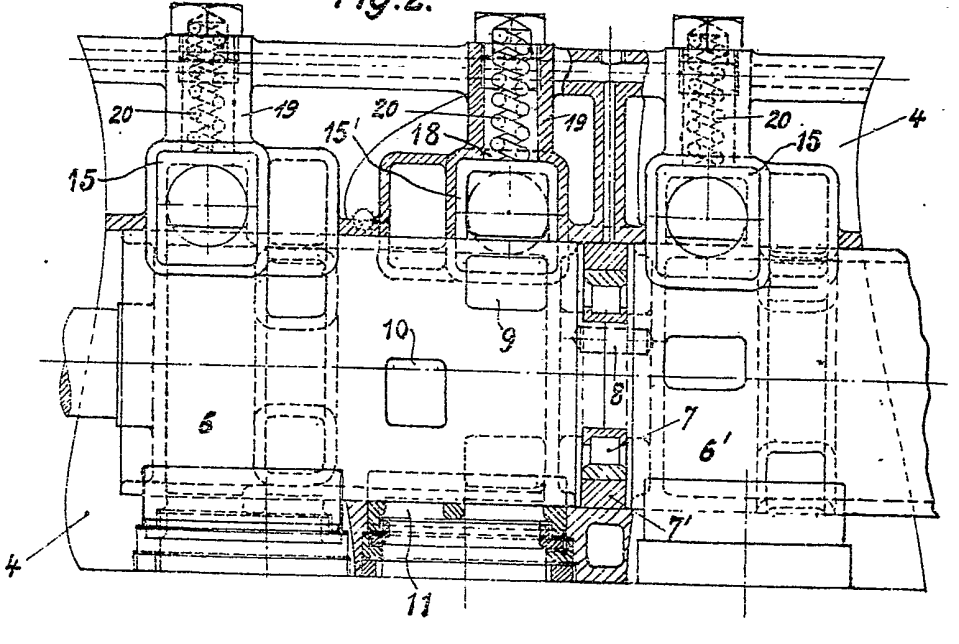


Fig.3.

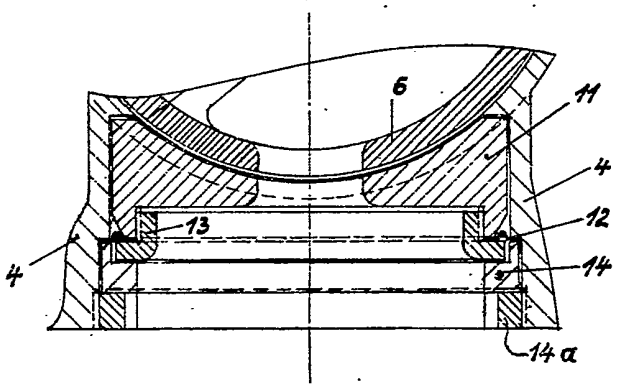
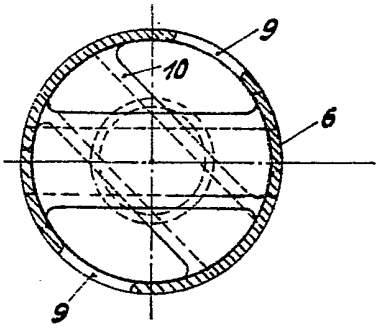


Fig.4.



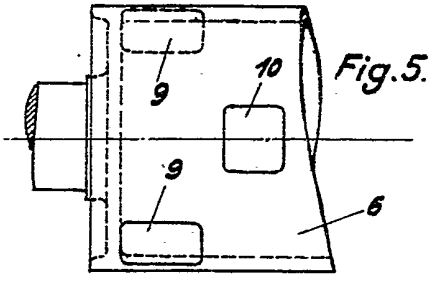


Fig.5.

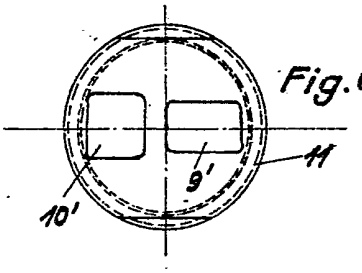


Fig.6.

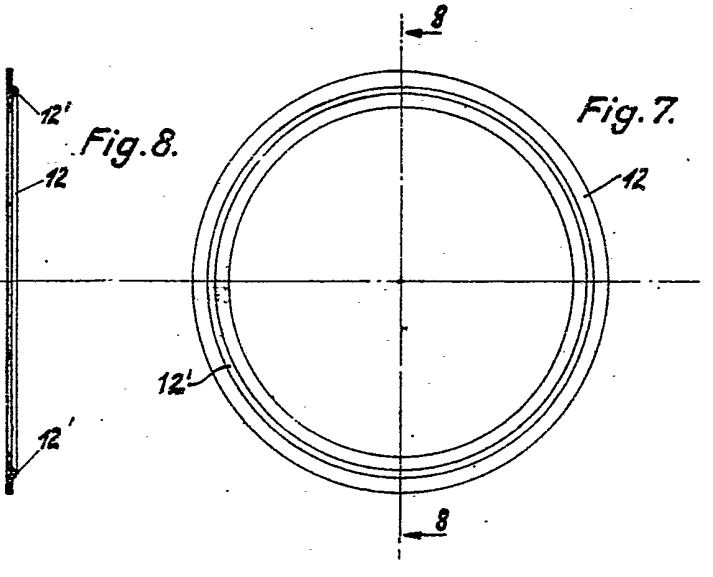


Fig.8.

Fig.7.

295,537 COMPLETE SPECIFICATION

3 SHEETS

SHEET 1

SHEET 2

[This Drawing is a reproduction of the Original on a reduced scale.]

Fig.1.

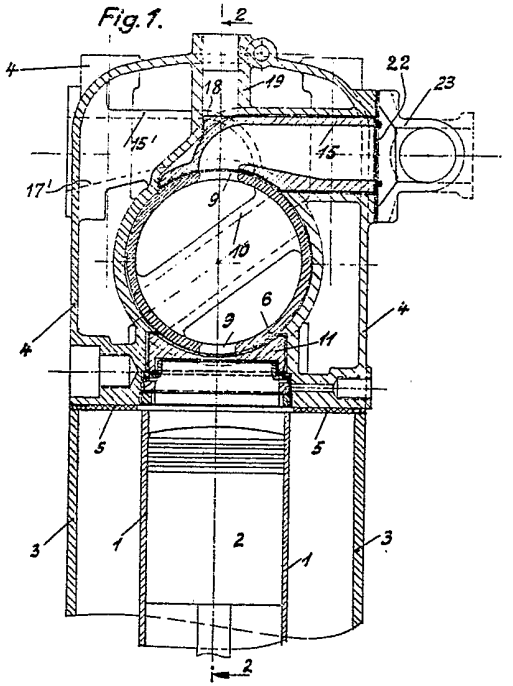


Fig.2.

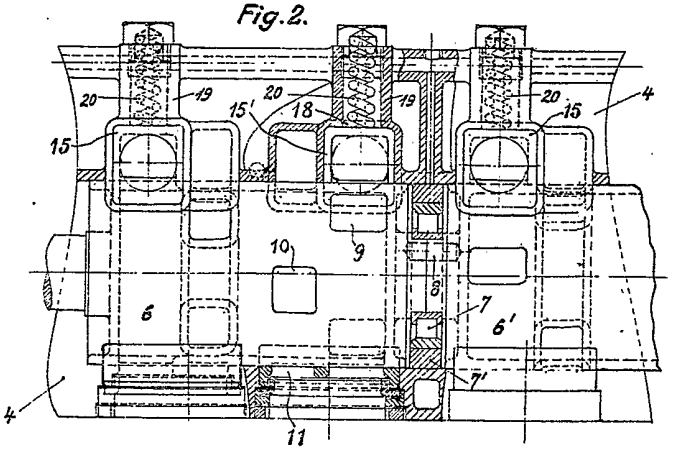


Fig.3.

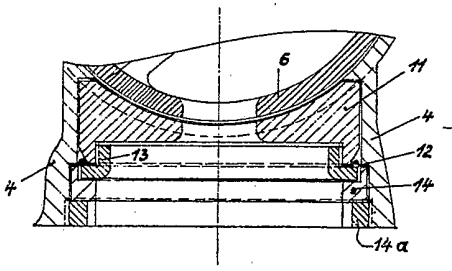


Fig.4.

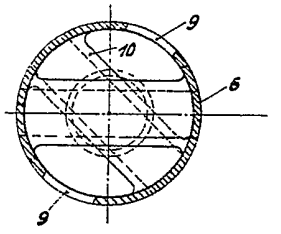


Fig.5.

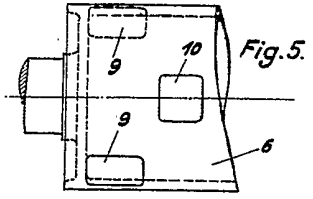


Fig.6.

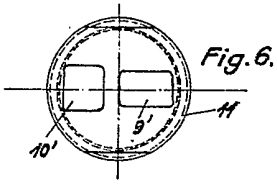


Fig.8.

Fig.7.

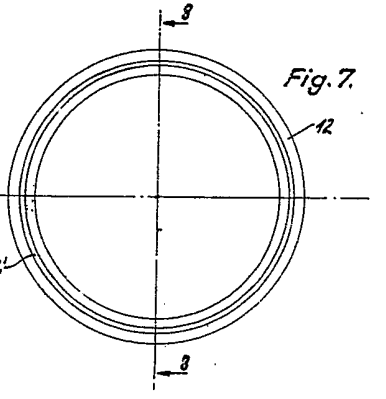


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Fig. 9.

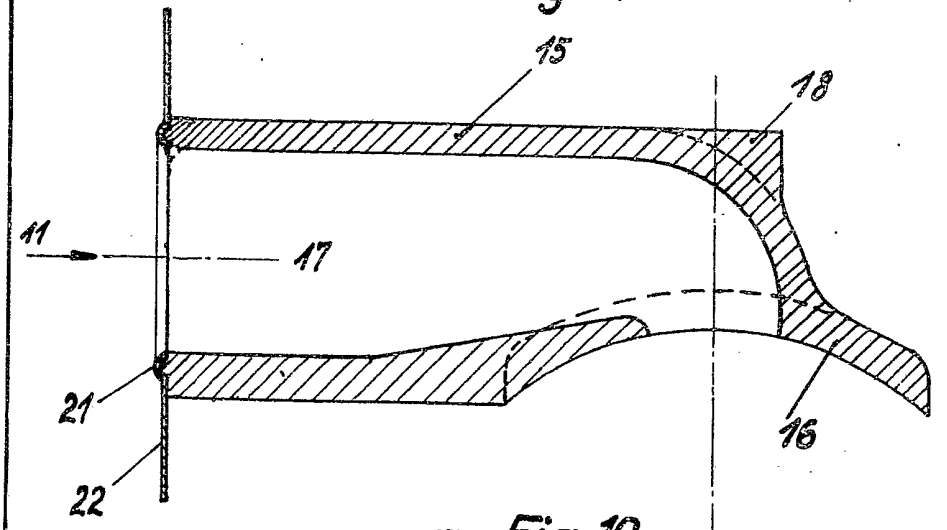
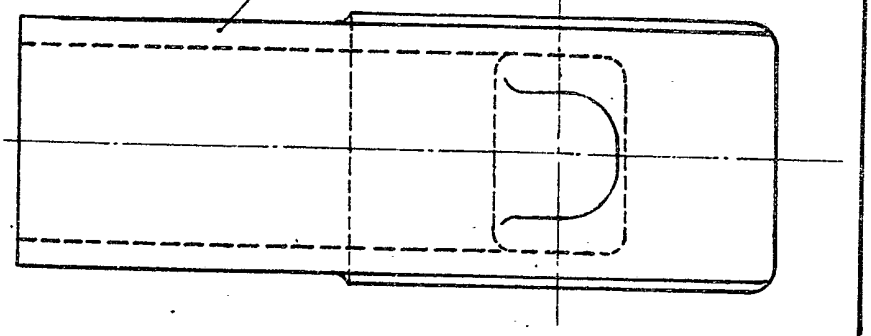


Fig. 10.



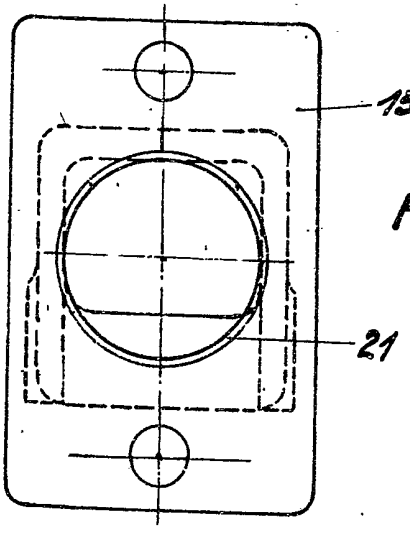


Fig. 11.

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