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DEVICE FOR AIRPLANE LAUNCHING APPARATUS

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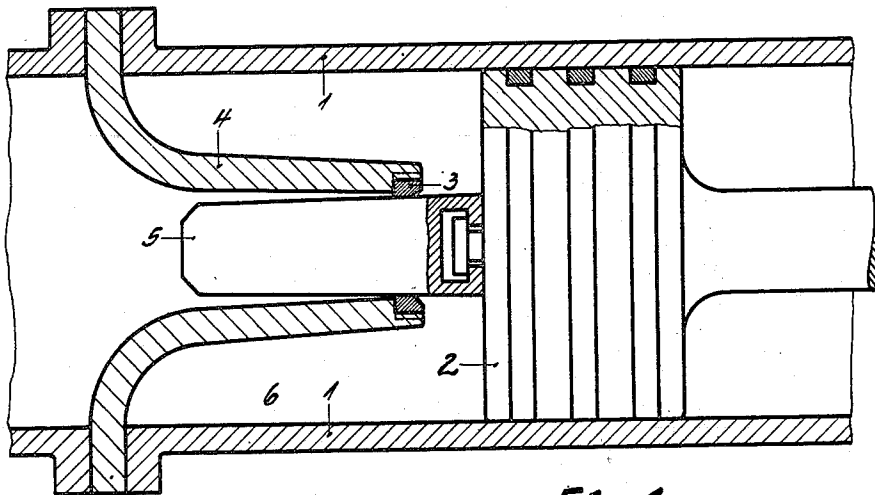


Fig. 1

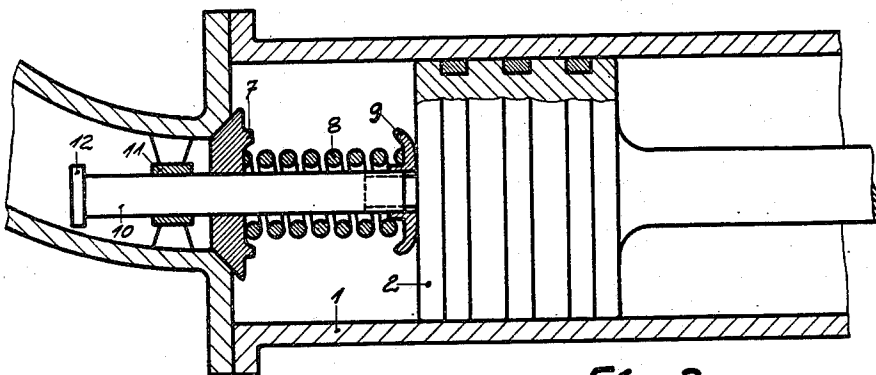


Fig. 2

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UNITED STATES PATENT OFFICE

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DEVICE FOR AIRPLANE-LAUNCHING APPARATUS

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The invention relates to launching apparatus for starting airplanes from the decks of ships, limited land areas, or like restricted areas, by means of a trackway on which the airplane is propelled by accelerating means, whereby the required speed is imparted to the airplane to enable it to rise into the air. The main object of the invention is to provide means whereby the initial acceleration can be so governed that highest reliability, utmost safety of operation and best comfort for the occupants of the airplane to be launched is obtained.

The invention more particularly relates to airplane launching apparatus comprising a cylinder and a piston which is operated by the expansive force of gases or an explosive entering the cylinder. The comfort of the occupants of the airplane and the influence on masses which are subject to the laws of inertia do not solely depend on the magnitude of the acceleration but more especially on the increase in acceleration during the beginning of the travel, inasmuch as a spontaneous increase in acceleration will manifest itself in the form of a shock. The object of this invention, therefore, is to provide means which, at the beginning of the travel, automatically ensure the increase in acceleration to be gradual from repose to highest magnitude.

It has been proposed to provide an expansion chamber if gun powder is used as a power agent. This, however, solely provides the reduction of the high initial pressure to a suitable working pressure, and the piston is acted upon with the full working pressure as soon as it starts on its stroke. It has, moreover, been proposed to gradually increase during the piston stroke the overflow section between the expansion chamber and the cylinder with the object of obtaining a uniform pressure. This, however, does not allow of reducing the initial pressure, on the piston owing to the fact that, as long as no motion is imparted to the piston or during its slow initial travel, the gases have no velocity and it therefore is impossible for them to create a difference in pressure between the expansion chamber and the cylinder.

In accordance with the present invention,

the initial acceleration actuated by the expansive forces of gases or an explosive is governed in such a way that the pressure exerted on the piston is reduced during the beginning of its stroke by means of a throttling device which is actuated by the piston itself.

In the annexed drawing, in which I have shown, by way of illustration, two embodiments of my invention, Fig. 1 is a longitudinal section through the cylinder of the propelling apparatus, showing the structural features of the invention; Fig. 2 is a similar section as Fig. 1 showing a modification.

Referring now more particularly to the drawing, 1 designates a cylinder in which a piston 2 is impelled along its stroke by the expansive force of gases, admitted at the end of the cylinder, such as compressed air, the gases of a gun powder charge or the like. The motion of the piston may be transmitted to the airplane in any suitable way, such as for example by means of ropes or cables and guide pulleys.

In Fig. 1, the cylinder 1 comprises at its head end an aperture or port of reduced section which may be formed as an integral part of the cylinder or cylinder head or by an inserted separate body 4, having an exchangeable ring 3. The piston comprises an extension part 5 which protrudes into the said aperture or port, covering this partially or completely so that the compressed gases which enter the cylinder initially act upon only a part of the piston surface. It is only after the piston has proceeded on its stroke by a certain degree that the extension part 5 uncovers the aperture or port so that the full working pressure of the gas can act upon the complete piston surface. A conical shape may be given to the extension part 5 so as to ensure already at the beginning of the stroke a passing of the gases through the narrow slots thus opened in the aperture or port and thereby provide a gradual increase in pressure in the chamber 6. In view of the lateral play of the piston 2, the extension part 5 is preferably coupled to a crosshead in a movable fashion which ensures an exact fit and a good guide in the aperture or port and

prevents the transmission of lateral forces to the inserted body 4.

In the modified form of the invention in accordance with Fig. 2 a throttle valve 7 is actuated by the piston 2 and serves for governing the inflow of the power agent. A coiled spring 8 presses the valve plate against its seat so that a difference in pressure is created between the fore- and rear side of this valve, the magnitude of which is proportionate to the tension of the coiled spring 8. As the piston 2 advances on its stroke, the tension of the spring 8 is reduced so that the expansive force of the power agent which acts upon this piston gradually increases to full working pressure. During the progress of the piston travel, the washer 9 which supports the spring and which may be adjustably mounted on the valve stem 10, is released by the piston. The valve plate 7 may be slidden along the stem 10 which latter is guided in a bushing 11. The valve stem 10, moreover, comprises a stop 12 which serves for limiting its lift.

I wish it to be understood that the invention is not limited to the forms which are shown in the drawing but that in practice other suitable means for carrying it into effect may be used. So can, for example, the aperture or port, as well as the extension part which protrudes into the former and also the throttle valve be fixed to, or form part of the cylinder or of the piston in a number of different ways without departing from the spirit and scope of the present invention.

I claim:

1. In airplane launching apparatus, in combination with a cylinder and a piston working therein under the expansive force of gases, means for automatically governing the initial acceleration imparted to the piston, the gases being admitted into the cylinder in such a way as to ensure a reduced pressure onto the piston during the first part of its stroke.

2. In airplane launching apparatus, in combination with a cylinder and a piston working therein under the expansive force of gases, means for automatically governing the initial acceleration imparted to the piston, the gases being admitted into the cylinder in such a way as to ensure a pressure only onto a part of the piston surface during the first part of its stroke.

3. In airplane launching apparatus, in combination with a cylinder and a piston working therein under the expansive force of gases, an extension part connected with the piston protruding into an aperture or port of reduced section arranged at the head of said cylinder, for automatically governing the initial acceleration imparted to the piston, the gases being admitted into the cylinder in such a way as to ensure a pressure only onto

said extension part of said piston during the first part of its stroke.

4. In airplane launching apparatus, in combination with a cylinder and a piston working therein under the expansive force of gases, an extension part connected with the piston protruding into an aperture or port of reduced section arranged at the head of said cylinder, for automatically governing the initial acceleration imparted to the piston, the gases being admitted into the cylinder in such a way as to ensure a pressure only onto said extension part of said piston during the first part of its stroke, and means for gradually increasing the pressure exerted onto said piston during the first part of its stroke.

5. In airplane launching apparatus, in combination with a cylinder and a piston working therein under the expansive force of gases, an extension part connected with the piston protruding into an aperture or port of reduced section arranged at the head of said cylinder, for automatically governing the initial acceleration imparted to the piston, the gases being admitted into the cylinder in such a way as to ensure a pressure only onto said extension part of said piston during the first part of its stroke, the extension part being of conical shape as to gradually increase the pressure exerted onto said piston during the first part of its stroke.

6. In airplane launching apparatus, in combination with a cylinder and a piston working therein under the expansive force of gases, an extension part connected with said piston protruding into an aperture or port of reduced section arranged at the head of said cylinder for automatically governing the initial acceleration imparted to said piston, said extension part being connected with said piston in a movable way so as to ensure this extension part fitting said reduced section of the cylinder head in case of lateral play of said piston in said cylinder.

7. In airplane launching apparatus, in combination with a cylinder and a piston working therein under the expansive force of gases, an extension part connected with said piston protruding into an aperture or port of reduced section arranged at the head of said cylinder for automatically governing the initial acceleration imparted to said piston, said aperture or port of reduced section being formed by a separate body inserted into the head of said cylinder.

8. In airplane launching apparatus, in combination with a cylinder and a piston working therein under the expansive force of gases, means for automatically governing the initial acceleration imparted to said piston, a valve and a spring loading said valve for admitting the gases into the cylinder in such a way as to ensure a reduced pressure

onto said piston during the first part of its stroke.

9. In airplane launching apparatus, in combination with a cylinder and a piston working therein under the expansive force of gases, means for automatically governing the initial acceleration imparted to said piston, a valve and a spring loading said valve the tension of said spring being governed by the motion of said piston, for admitting the gases into the cylinder in such a way as to ensure a reduced pressure onto said piston during the first part of its stroke.

10. In airplane launching apparatus, in combination with a cylinder and a piston working therein under the expansive force of gases, means for automatically governing the initial acceleration imparted to said piston, a valve having a plate which may be bodily slidden along a valve stem, a spring loading said valve, a guide bushing and a washer mounted adjustably on said stem, for admitting the gases into the cylinder in such a way as to ensure a reduced pressure onto said piston during the first part of its stroke.

In testimony whereof I affix my signature.

ERNST HEINKEL.