Sept. 19, 1933. M. HIRAKAWA 1,927,778

DOOR HINGE

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Fig. 8.

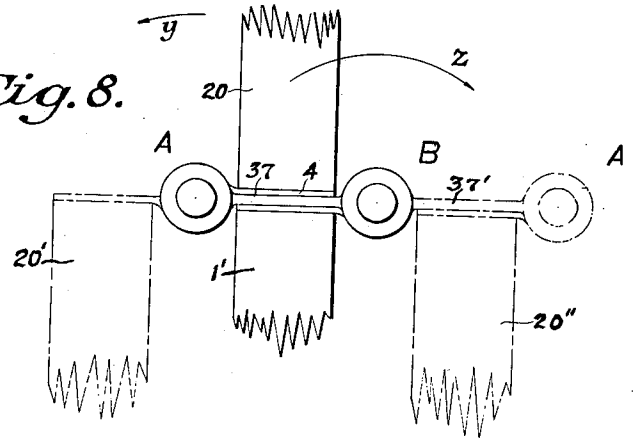
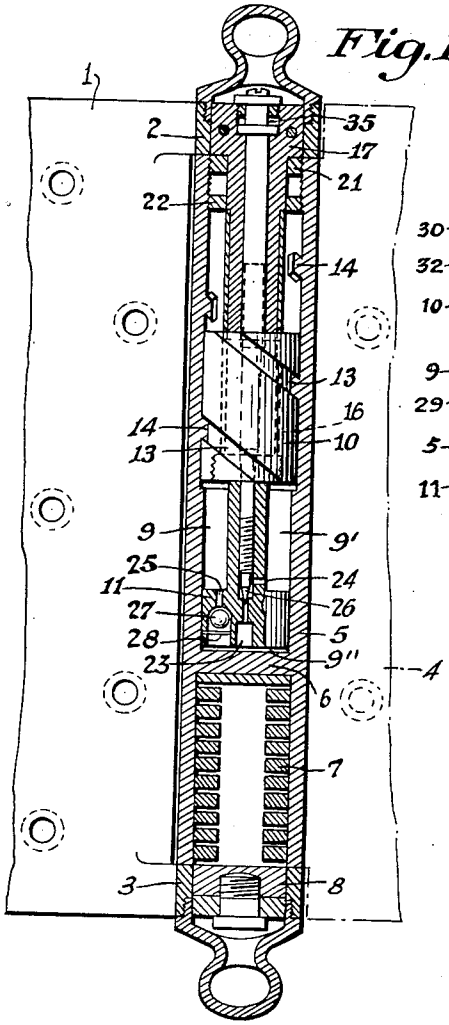


Fig. 1.



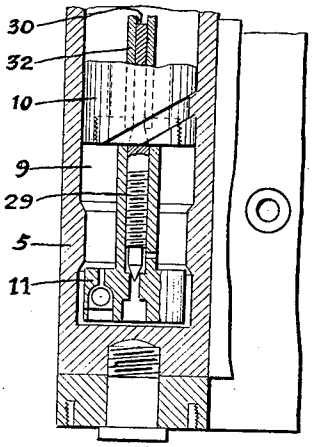


Fig. 9.

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Fig. 2.

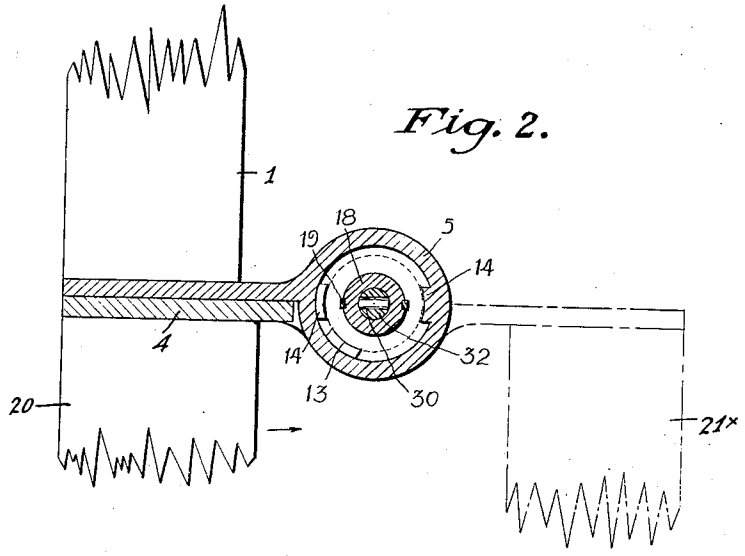


Fig. 5.



Fig. 5a

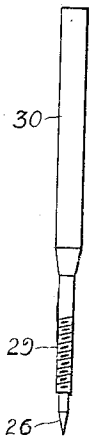
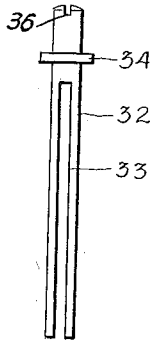


Fig. 6.



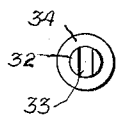


Fig. 6a

Fig. 3.

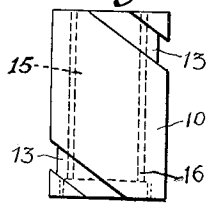


Fig. 3a

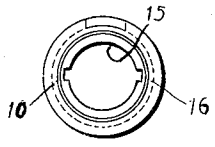


Fig. 4.

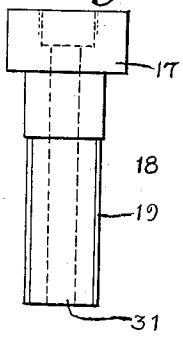
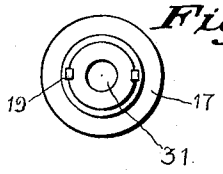


Fig. 4a



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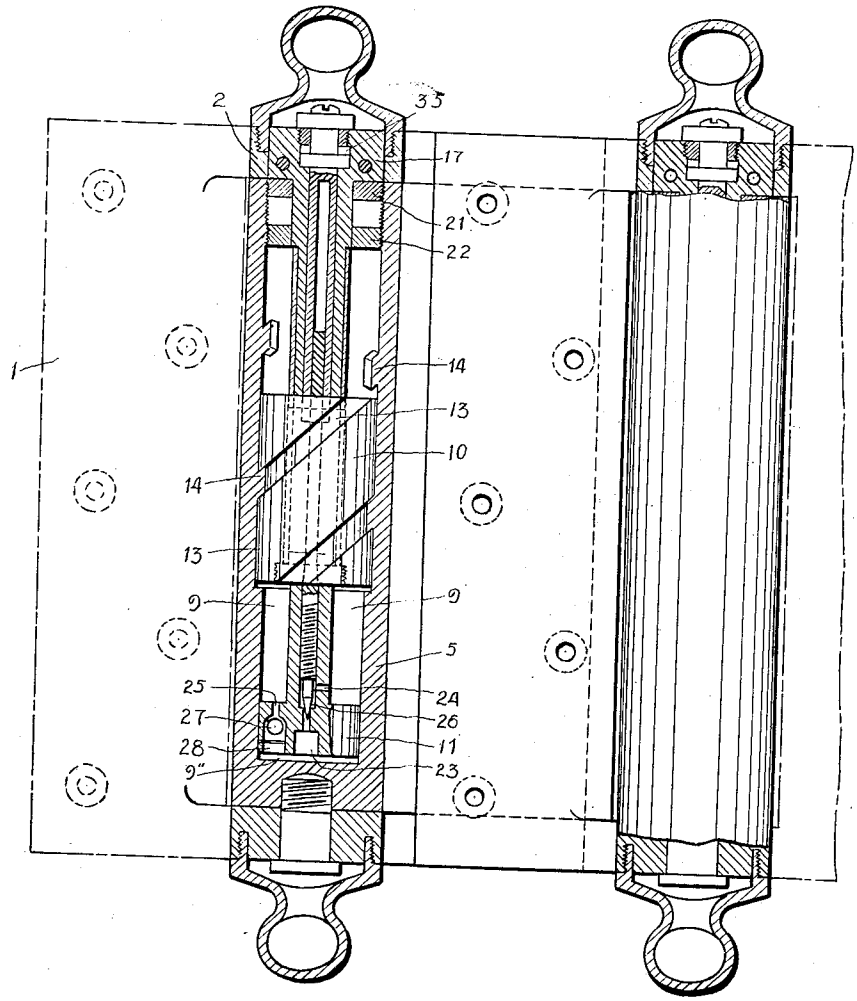
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Fig. 7.



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Patented Sept. 19, 1933 1,927,778

UNITED STATES PATENT OFFICE

1,927,778

DOOR HINGE

Masanori Hirakawa, Ebara-Gun, Tokyo Prefecture, Japan

Application September 10, 1931, Serial No. 562,148, and in Japan January 23, 1931

2 Claims. (Cl. 16—54)

This invention relates to improvements in door hinges in which the part attached to the door is formed from a one piece cylinder adapted to receive oil and is provided with an internal helical projection. In the cylinder is a helically grooved body having an oil control piston connected thereto, the body being moved in opposite directions along an axial guide member rigidly fixed to the fixed part of the hinge which is attached to the door post. The piston is provided with an oil passage having a non-return valve which opens only when the door is opened and is further provided with a throttled passage regulated by a needle valve, so that the door is returned to its closed position at a reduced velocity due to the throttled flow of the oil. The invention also includes a set of such new door hinges connected together by means of a connecting plate. The object of the invention is to propose a new door hinge of great buffering action, while its construction is simple and the operation is very steady and accurate.

In the accompanying drawings:—

Fig. 1 is a vertical section of one embodiment of a hinge according to the invention for use in a door to be opened from one side;

Fig. 2 is a section along the line II—II of Fig. 1;

Figs. 3 and 3^a denote a helically grooved body, being an elevation and a plan thereof respectively;

Figs. 4 and 4^a show, respectively, an elevation in plan of a guiding element for the helically grooved body, located at the upper part of the hinge;

Figs. 5 and 5^a show, respectively, an elevation and side view of a needle valve;

Figs. 6 and 6^a show respectively, a side view and top view of an adjusting piece for the needle valve, A and B being an elevation and side view thereof respectively;

Fig. 7 is an elevation, partly in section, of a hinge for a door to be opened in two sides;

Fig. 8 is a plan view showing the position of the door when it is opened; and

Fig. 9 is a section showing a modification of a cylindrically shaped piston chamber employed in this invention.

Throughout all the drawings the same references denote the same or corresponding parts.

Referring to Figs. 1 to 6^a, 1 is a metal plate secured to the door post 1^x and provided with short cylindrical part 2 and short supporting part 3 at the upper and lower ends respectively. 4 is a movable metal plate to be secured to the body of a door and provided with a one piece cylinder 5 extending between the fixed parts 2 and 3. The fixed parts 2 and 3 and the rotatable cylinder 5 thus form together a hinge unit. The rotatable cylinder 5 is divided by a partition 6 into upper and lower chambers, the lower chamber having a coiled spring 7 contained therein, whose top end thereof is secured to the partition 6, while the lower end is secured to a locking plug 8 of the fixed part 3 formed integrally with the plate 1. This spring is, however, not an important part of the invention and may be fitted in a desired position outside the hinge if desired. In such case the lower chamber may be omitted. In the upper chamber 9 lying above the partition 6, there is arranged a helically grooved body 10 together with a piston 11 secured to the latter. The helical groove 13 of the body 10 engages with a projection 14 formed integrally with the cylinder, or suitably secured thereto. The bore 15 of the body 10 has opposed internal recesses 16.

The plug 17 is fixed in the upper short cylinder 2 and is formed with an extension or an axial guide member 18 provided with longitudinal ribs 19, which are adapted to engage with the said recesses 16 of the body 10, allowing the latter to move only axially relative to the locking plug 17. For this reason, if the door 20 secured to the plate 4 is turned by operating a handle (not shown) in the direction of an arrow x, to the position indicated by the dotted lines 20^x, the body 10 rises from the position shown in Fig. 1, and consequently the piston 11 secured to the body 10 ascends within the chamber 9.

21 and 22 are suitable packing rings.

The piston has a central oil passage 23, a transverse oil passage 24, and also a longitudinal oil passage 25. The extent of opening of the central passage 23 is regulable by means of a needle valve 26, and the oil passage 25 is opened and shut by a non-return valve or a ball valve 27. The bar 28 is for retaining the valve 27 in its valve chamber.

The valve spindle of the needle valve 26 consists of a helically threaded part 29 and a flat part 30, both of which pass through the central hole 31 of the locking plug 17, and the threaded part 29 engages internal threads of the central hole 31, and the flat part 30 is inserted into a flat longitudinal slit 33 of a needle valve regulating member 32 inserted in the locking plug 17. The member 32 has a collar 34, by means of which it is positioned in the dilated part 35 of the central hole 31, a recess 36 being provided at the head of the member 32.

If, therefore, the member 32 is rotated by means of a suitable tool engaging the recess 36,

the parts 29 and 30 forming the valve spindle are also moved, and according to this movement the valve spindle slides up and down along the slit 33. By this means the upper and lower positions of the needle valve are determined and the extent of opening of the central hole 23 of the piston 11 is regulated.

The operation of the hinge for a door to be opened in one side—hereafter called one sided door—above explained with reference to Figs. 1 to 6, is as follows:

Referring to Fig. 2, when the door 20 is opened in the direction of the arrow x against the action of the spring 7, the piston 11 ascends, and the oil contained in the chamber 9' above the piston passes through the passage 25 and into the part 9'' of the chamber 9 beneath the piston, and on the maximum opening of the door the piston attains its highest position. When however the door is then left free from the force to open the door, the spring 7 acts to return piston to its original or lowest position so that the door returns also to its original position. During the descent of the piston the passage 25 is closed up by the ball valve 27, with the result that the oil of the chamber 9'' enters the chamber 9' through the throttled oil passages 23 and 24, and returns at a reduced velocity to its closed position buffered by the throttled flow of the oil. This oil throttling action of the passages 23 and 24 is regulable by means of the needle valve 26.

It is to be understood that in the example above shown, the extent of opening of the door will be determined by the length of the stroke of the helical body 10, and this extent shown in the embodiment is 180°.

Figs. 7 and 8 show one example of the hinge for use in a door to be opened in two sides. In the figures, 1 is a fixed plate, 1' a door post for securing the plate 1, and 20 a door. A is the first hinge, and B the second hinge. Both the hinges are connected by a member 37. The door attached to the plate 4 can be opened in a direction shown by an arrow y up to the position of the door shown in 20', around the axis of the hinge A. The door can also be opened in a reversed direction shown by an arrow z up to the position of the door shown in 20'', and indeed around the axis of the hinge B.

In the example shown in Figs. 7 and 8, the spring is not contained within the hinge. Here it is to be noted that the spring will be provided at a suitable place between the door and the fixed door post.

In Fig. 9 illustrating a modification of the piston chamber, the latter is not of a cylindrical shape of the same diameter throughout the length, but consists of a cylinder having upper and lower parts of a greater diameter than the middle part conforming to the piston. By this arrangement, the door, on returning to its original position, moves rapidly for a certain length of time. However, thereafter it receives a buffer action due to the oil throttling so that the movement is braked to a sufficient degree, and finally when the oil-flow is brought to zero, the door is shut up energetically impinging on the door-frame in a similar manner as if the door is shut up forcibly by the hand.

Briefly, the invention makes it possible to obtain a door hinge, which is of a very simple construction and capable of returning to the original position automatically in a reduced velocity, that is, under a braking or buffer action of adjustable or desired extent.

What I claim is:

1. A hinge for doors comprising a fixed plate, a one piece cylinder rotatably connected with the fixed plate, a plug fixed with the plate and having an extension depending into the cylinder, a cylindrical body slidably interlocked with the extension, interengaging means between the cylinder and body to slide the body in one direction upon swinging of the door to its open position, a piston fixed to and movable with the body, said piston having passages therein for by-passing fluid contained in the cylinder from one face of the piston to the other, a needle valve cooperative with one of the passages, a member disposed axially in the body, and slidably interlocked with the needle valve for adjusting the same, and yieldable means operating in opposition to the opening movement of the door to slide the body and thus the piston in an opposite direction.

2. A hinge for doors comprising a fixed plate, a cylinder rotatably connected with the plate, a plug fixed to the plate and having an extension depending into the cylinder, ribs on the extension, a cylindrical body in the cylinder having grooves therein for slidably engaging the ribs, said body having a helical groove formed therein, helical projections in the cylinder engaging the groove, a piston fixed to and movable with the body, said piston having oil passages to permit passage of oil contained in the cylinder from one face of the piston to the other, a needle valve extending axially through the body for controlling the flow of oil through one passage of the piston, a member rotatable in the plug and extension and having a longitudinal slot therein for slidably interlocking the needle valve and member, and means for rotating the member to adjust the position of the needle valve.

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