

Jan. 14, 1964

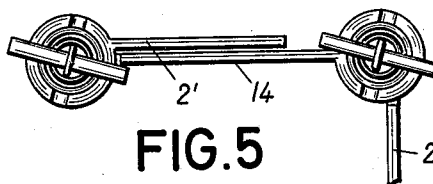
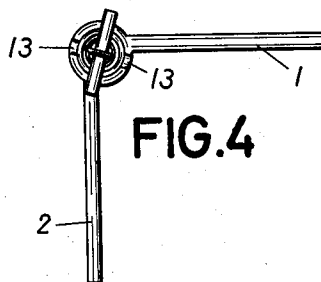
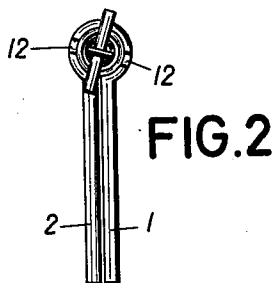
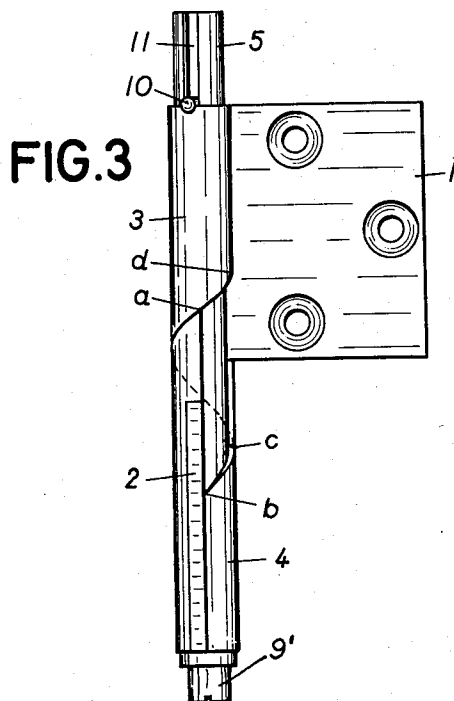
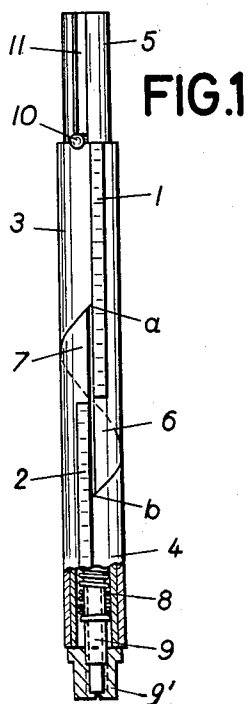
R. E. A. ARBÖLL

3,117,340

DOOR HINGE

Filed June 1, 1960

3 Sheets-Sheet 1



INVENTOR
Rolf Erling Alfred Arböll
BY
Furness, Edmonds, Morton, Barrow & Taylor
ATTORNEYS

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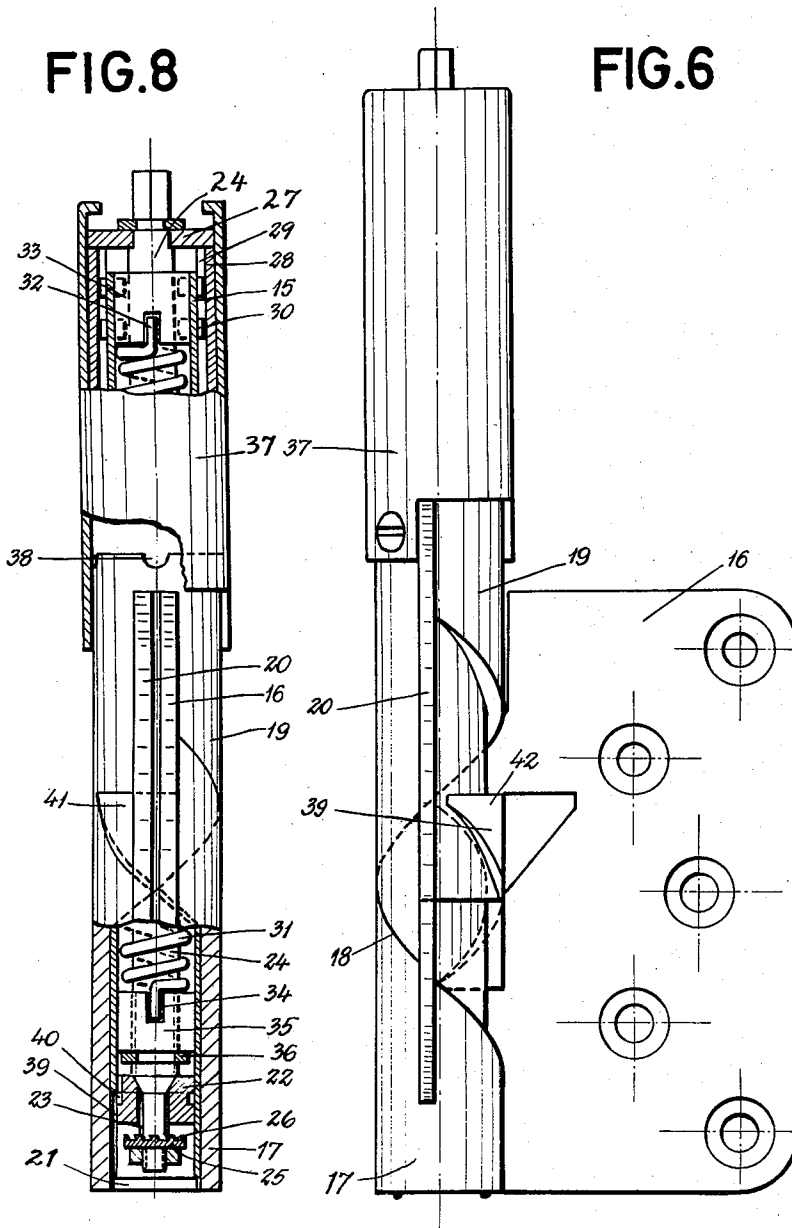
R. E. A. ARBÖLL

3,117,340

DOOR HINGE

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INVENTOR
Rolf Erling Alfred Arböll
BY
Terrie, Edmunds, Martin, Barrows & Taylor
ATTORNEYS

Jan. 14, 1964

R. E. A. ARBÖLL

3,117,340

DOOR HINGE

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3 Sheets-Sheet 3

FIG. 9

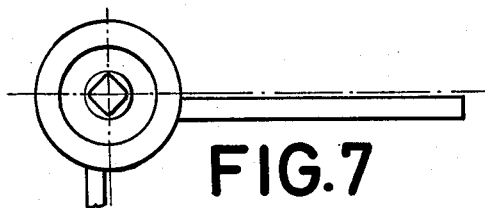
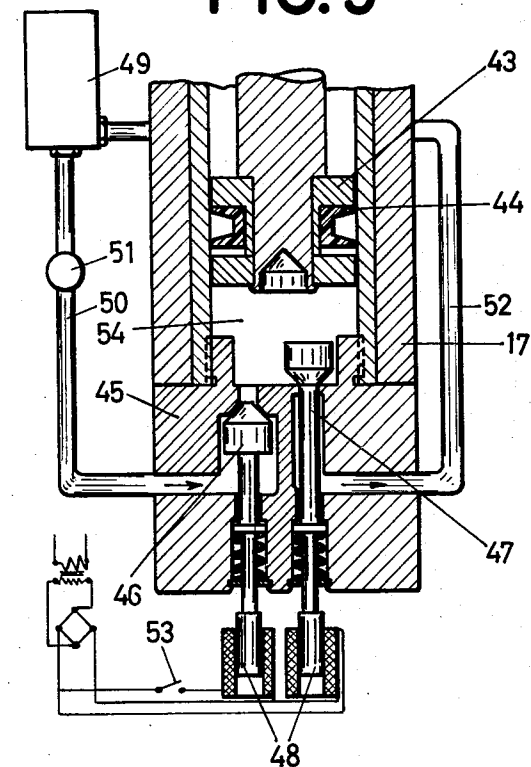


FIG. 7

INVENTOR
Rolf Erling Alfred Arböll
BY *Fennie, Edmondo, Morton, Duenes & Taylor*
ATTORNEYS

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3,117,340

DOOR HINGE

Rolf Erling Alfred Arböhl, Ammerudveien 6B, Grorud,
Oslo, Norway

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The present invention relates to an improvement in door hinges which, according to desire, may be constructed to be self-closing or as hinge for automatic opening.

Previously door hinges are known, which are made self-closing e.g. thereby that the lower hinge member has a stud, roller or the like which abuts against the lower edge of the upper hinge member, where said under edge forms a curve helix, so that the door is raised when it is opened and is closed by its own weight when the door is released.

Such a stud or roller is subjected to a rather great stress, because it carries the door, and it often happens that the door is not automatically closed, due to too great friction between the stud and the inclined plane, or because the door is too light.

The object of the present invention is to obviate this drawback.

According to the invention both the sleeve of the lower hinge member and the sleeve of the upper hinge member, where they abut, are formed along the same curve helix, so that the upper hinge rests upon the lower hinge with a relatively large abutment surface. Further the upper hinge member may be acted upon a spring, preferably an adjustable spring, which counteracts the raising movement and, accordingly, accelerates the closing movement of the door. Thus the pivot of the hinge may have the form of a tube having a longitudinal slot at one end thereof, and in this tube is placed the spring, which in this case is a helical spring, into the lower end of which is screwed a pin screw which is secured to a nut on the under side of the sleeve of the hinge leaf, the top end being attached to a pin which is slidable in the sleeve and rests upon the top edge of the upper hinge member sleeve and accompanies the upwards and downwards movements of said sleeve.

Further it has been found advantageous to brake the closing movement of the door by means of an air or fluid brake provided within the hollow hinge pivot.

Such an air or liquid brake may e.g. take the shape of a piston provided in the hollow pivot, near the bottom thereof, and having a piston rod the top end of which is fixed to the sleeve of the upper hinge leaf, so that when the door is opened the piston is raised, and when the door is closed the piston is lowered; said piston has a through passage which is opened when the piston is raised, whereby air or liquid may stream through the passage from the top to the under side of the piston, and the passage is closed when the piston is lowered, since the air or liquid then streams through relatively narrow channels in the side surface of the piston and/or the inner wall of the hinge pivot, so that the closing movement of the door is braked. At its lower end the piston rod is conically turned off, and a corresponding conical turn-off is provided at the opening at the top side of the piston, so that that part of the piston rod which is situated below the conical turn-off extends through the through passage with clearance and at its lower end has a star disc, so that the through passage is open when the piston is moved upwards and is closed when the piston is moved downwards. The piston rod is enclosed by a helical spring the top end of which enters a groove on the under side of a plug which is fixed at the top of the hinge pivot and is provided with a through passage, and the lower end of which rests in a groove provided at the top side of a nut which is screwed

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on to the piston rod, so that the tension of the spring may be controlled by turning of the piston rod. The sleeve of the hinge leaf attached to the door preferably consists of two parts, viz. of a lower part which rotates and is raised respectively lowered by the opening respectively closing movement of the door, and an upper part which is not rotated but is raised and lowered during these movements, the edges of said parts being provided with cut-outs and corresponding extensions, e.g. at 90° distance therebetween, thereby forming "snaps" which maintain the door in distinct, easily releasable positions.

When the hinge is provided with piston and piston rod an arrangement for automatic opening of doors may easily be obtained by making the piston tight and providing the piston cylinder, which is formed by the hollow pivot, with inlet and outlet for some suitable pressure medium, e.g. air or oil, which when admitted to the cylinder raises the piston which in its turn acts upon the upper hinge leaf. The upper hinge leaf will then be guided along the curve helix previously described, and the door is opened. The door will remain open until the pressure medium admitted is released, whereafter the door is closed due to the shape of the curve helix, the weight of the door and, in case, the spring action.

As regards automatic opening of the door it is important that a so-called double interaction exists between the two parts of the hinge, which is obtained thereby that the two parts, which have curve helix surfaces, are so long that they overlap each other.

Other features of the invention will appear from the following, with reference to the drawings, where:

FIGS. 1 and 2 show a side view and a plan view respectively of a closed door hinge, having no air or liquid brake, with the hinge leaves adjacent to each other, thus corresponding to closure position of the door.

FIGS. 3 and 4 are side view and plan view respectively of the same door hinge, where the hinge leaves are swung 90° in relation to each other.

FIG. 5 is a plan view of a double hinge for a door adapted to be opened in opposite directions.

FIGS. 6 and 7 disclose in side view and plan view respectively a door hinge with air or liquid brake in open position.

FIG. 8 shows the same hinge in closed position, and

FIG. 9 is a diagrammatical embodiment of a hinge according to the invention constituting a modification of the construction shown in FIGS. 6–8 provided with means for automatic opening and closing of a door.

On FIGS. 1–4 the upper hinge member, which is secured to the door, is designated by the numeral 1, and the lower hinge member, which is secured to the door frame, is designated by the numeral 2. The hinge member 1 comprises a sleeve 3 and the hinge member 2 comprises a sleeve 4, which sleeves are supported, one above the other, on a common stud 5 attached to the sleeve 4 and projecting above the sleeve 3. As shown the sleeves 3 and 4, where they abut against each other, are formed along a common curve helix, so that the upper sleeve 3 has a downwardly directed flap 6, which extends somewhat below the top portion of the hinge member 2, and the sleeve 4 has a corresponding, upwardly directed flap 7, which extends somewhat above the lower edge of the hinge member 1.

In position of closure the upper sleeve 3 thus rests upon the lower sleeve 4 along the helix from *a* to *b*. If the hinge member 1 is swung 90°, to the position illustrated on FIGS. 3 and 4, the door to which the hinge member 1 is secured is raised a distance corresponding to ¼ of the incline of the helix *a–b*, which means that the point 6 is displaced from *b* to *c*. Hereby a portion of the stud 5 corresponding to the cylinder surface *a–b–c–d* is uncovered. Within the stud 5, which is hollow, is pro-

vided an adjustable helical spring 8, into the lower end of which is screwed a pin screw 9, which is secured to a nut 9' at the under side of the sleeve of the lower hinge leaf; the top end of said spring is attached to a pin 10, which rests against the top edge of the sleeve 3 and extends through a longitudinal slot 11 in the wall of the stud, so that the pin 10 may accompany the upward and downward movements of the upper hinge member during exertion of a downwardly directed pressure thereagainst. Accordingly the spring, together with the weight of the door, helps the automatic closing of the door, and the rate of the closing movement may be adjusted by adjusting the tension of the spring 8. In order to maintain the door in certain open positions the top edge of the upper sleeve 3 is provided with diagonal notches into which the top pin 10 may engage, so that the door is automatically closed only if the door has first imparted a small motion thereto, so that said pin goes out of the notches. The drawing shows two sets, 12 and 13, of such notches, adapted to fix the door at 90° and 180° opening.

FIG. 5 is a plan view of a double hinge, known per se, for use in connection with double acting doors, that is doors adapted to be opened in both directions.

The two sleeves with hinge member 2 and 2' respectively for attachment to the door or doors respectively are interconnected by means of the member 14.

Also FIGS. 6-8 show an embodiment where the tubular bolt 15 is fixedly connected with the lower leaf 16, which is screwed on to the door frame. The sleeve-formed portion 17 of the leaf 16, which encloses the bolt 15, is formed with a curve helix surface 18, which forms abutment for the enclosing part (sleeve) 19 of the leaf 20, which is screwed on to the door and has a curve helix corresponding to that of the sleeve 17, so that the door is raised respectively lowered when it is opened respectively closed.

At its lower end the bolt 15 is closed by a disc 21. Within the bolt and near the lower end thereof is provided a piston 22, having a through opening 23 the top portion of which is of conical shape. A piston rod 24 extends with clearing through the opening 23 and carries at its lower end a star disc 25 having radial channels 26. Further the rod 24 has a conical turn-off, corresponding to the conical shape of the opening 23 in the piston, which upon downward movement of the rod closes the opening 23 and moves the piston downwards, and when the piston rod moves upwards uncovers the through opening and takes with it the piston 22 with the star disc 25 abutting against the under side of the piston. The piston rod 24 extends through and is rotatably attached to a disc 27, which rests upon a sleeve 28 which in its turn rests upon the sleeve 19 of the upper hinge leaf. In contradiction to the sleeve 19 the sleeve 28 is not rotatable about the stud 15, since it has longitudinal internal grooves 29 into which extend studs or screws 30 on the studs. Thus the sleeve 28 accompanies the upwards or downwards movements of the sleeve 19.

The piston rod 24 extending through a helical screw spring 31, the top end of which extends into a notch 32 at the under side of a plug 33, which is screwed into the upper end of the stud 15 and a bore for free passage of the piston rod 24, whereas the lower end of the spring 31 extends into a notch 34 in a nut 35, which is screwed onto the piston rod 24. Accordingly the tension of the screw spring 31 may be adjusted by turning the piston rod, since the spring prevents the nut from turning. A horse-shoe disc 36 prevents the nut 35 from tightly abutting against the piston 22. As shown the studs or screws 39 also serve to secure the plug 33 in the stud 15. A sleeve 37 having an inwardly directed edge at the top is by means of two screws secured to the sleeve 19. When the door is opened the sleeve 19 and the leaf 20 are raised, so that the door is lifted to above the floor. At the same time are lifted the upper sleeve 28 and thus also the piston rod 24 and the piston 22, and the through opening of the

piston 22 is uncovered, so that air or liquid flows through the opening from the top side to the under side of the piston. At the same time the spring 31 is compressed. The upper and the lower sleeves, 28 and 19 respectively, are provided with cooperating engaging means including extensions 38, respectively with corresponding cut-outs, e.g. with 90° interdistance, so that the extension on the non-rotative sleeve 28 falls into a cut-out in the rotating sleeve 19 when the door is opened e.g. 90° and may by a light pressure upon the door be brought out of engagement, whereby the door is automatically closed thereby that the sleeve 19, due to the weight of the door, pulls the disc 27 downwards so that the piston rod, helped by the action of the spring, is moved downwards so that the through opening 23 in the piston is closed, and the air or liquid at the under side of the piston is then pressed upwards through the narrow channel 39 at the inner wall of the stud 15 and the channel 40 at the outer side of the piston.

In the example shown the two channels 39 and 40 correspond first, for a certain period of time, so that air below the piston is compressed and acts as a pillow below the piston 22, before the door reaches its position of closure, and the extension 38 of the upper sleeve 28 enters into the notch of the sleeve 19 corresponding to this position (FIG. 8). In order to prevent that the door, if closed violently, shall not follow the curve helix there is in both hinge leaves provided flaps 41, 42, so that so-called double engagement is obtained between the sleeves of the hinge leaves, for guiding the movements of the hinge leaves.

Such double engagement between the helical surfaces of the hinge leaves may further, as shown on FIG. 9, be used in a suitable manner for automatic actuation of doors, e.g. in factory buildings, where goods are to be transported from one division to another, and where automatic opening and closing of doors may be controlled e.g. from pads in the floor, over which cars or other transport means are passing. On FIG. 9 the hinge leaves and their curve helixes are not shown, since the action thereof has been described previously in connection with FIGS. 6-8. The lower hinge leaf sleeve is also here designated by the numeral 17 and is attached to e.g. a door frame. The door is connected to the hinge leaf, not shown, which controls the piston 43. In this case the piston 43 is solid and provided with a suitable packing 44. At the lower end of the hinge leaf sleeve 17 is according to the invention provided a valve housing comprising two valves 46 and 47. The valves 46, 47 may in a manner known per se be controlled by electromagnetic devices, which on the drawing are generally designated by the numeral 48. From a tank 49 an e.g. hydraulic medium is under pressure passed through a conduit 50 via a pump 51 to the valve 46. From the valve 47 a conduit 52 extends back to the tank 49. If switch 53 in the circuit of the electromagnetic device 48 is so operated that the valve 46 opens and the valve 47 closes, pressure medium will flow through the conduit 50 into the cylinder chamber 54 below the piston 44, which latter is thereby moved upwards. Due to the cooperation of the curved helix surfaces of the two hinge members the latter will then rotate in relation to each other, and the door is thereby opened. If the door is to be closed the valve 46 is closed and the valve 47 is opened, whereby the hydraulic pressure medium escapes through the conduit 52 back to the tank 49. Control of the electromagnetic devices may take place by means of pillows or contacts, e.g. placed in the floor, or by means of photo cells, ultraviolet light or the like, which needs no further description since the main object of the invention, as regards automatic opening and closing of doors, is to provide an arrangement which does not need too much space and which has no unattractive appearance. The objects of the invention are obtained by means of a hinge, with which the door must in any case be provided.

The invention does not comprise only the shown em-

bodiments, in which the curved helix has one flight only; the abutment between the upper and the lower sleeve may also comprise several flights, in which case the sleeve takes the form of two helical bands which are inter-screwed.

Since the door is raised and lowered upon opening and closing, the threshold may be placed at level with the floor. In order that the door shall be tight, a strip of felt may be placed in a groove at the under edge of the door and extend, e.g. 5 mm. below the same.

I claim:

1. A self-closing door hinge comprising upper and lower hinge members having aligned sleeves for receiving a pivot stud, said sleeves having abutting curved helical surfaces, so that the upper hinge member is raised relative to the lower hinge member when it is rotated to the door opening position and lowered when it is rotated to the door closing position, a tubular pivot stud mounted in the sleeves of the hinge members with its lower end attached to the sleeve of the lower hinge member and its upper end projecting above the sleeve of the upper hinge member, an elongated helical spring located in the tubular stud, means connecting one end of the helical spring against movement relative to the sleeve of the lower hinge member, sleeve-engaging means resting on the upper edge surface of the sleeve of the upper hinge member and held against rotation therewith by the tubular pivot stud, and means operatively connecting the other end of the helical spring with said sleeve-engaging means, the helical spring acting on said sleeve-engaging means against the rising movement of the upper hinge member caused by said engaging helical surfaces when the upper hinge member is rotated in the door opening direction relative to the lower hinge member.

2. A self-closing door hinge as claimed in claim 1, in which the upper edge surface of the sleeve of the upper hinge member is provided with grooves and said sleeve-engaging means includes means for engaging in said grooves to hold the upper hinge member in predetermined positions with respect to the lower hinge member.

3. A self-closing door hinge as claimed in claim 1, in which the portion of the tubular pivot stud projecting above the sleeve of the upper hinge member is provided with a longitudinal slot, and in which said sleeve-engaging means is a pin connected to said other end of the helical spring and located in said slot with its respective end portions resting on the upper edge surface of the sleeve of the upper hinge member, said pin being slidable in said slot when said hinge members are rotated relative to each other.

4. A self-closing door hinge as claimed in claim 3, in which the upper edge surface of the sleeve of the upper hinge member is provided with grooves for receiving the end portions of said pin for holding the upper hinge member in predetermined positions with respect to the lower hinge member.

5. A self-closing door hinge as claimed in claim 1, including means providing a fluid brake for braking the closing movement of the door, said braking being located within the tubular pivot stud.

6. Self-closing door hinge according to claim 5, characterized by a piston with piston rod provided in the

tubular pivot stud near to the bottom thereof, the top end of which rod is securely connected to the sleeve of the upper hinge leaf, so that the piston is raised when the door is opened and is lowered when the door is closed, which piston has a through opening, which is opened when the piston is raised, so that air or liquid may pass through the opening from the overside of the piston to the under side thereof and is closed when the piston is lowered, when the air or liquid is passing through relatively narrow channels in the side surface of the piston and/or the inner wall of the pivot, so that the closing motion of the door is braked.

7. Door hinge according to claim 6, adapted for automatic opening of the door, characterized therein that the upper hinge member is connected with a tight piston adapted to slide within a cylinder, e.g. within a portion of the tubular pivot stud in the lower hinge leaf, where the cylinder chamber below the piston communicates, through suitable valves, with a source of pressure medium, so that admission of pressure medium to the cylinder chamber below the piston raises the piston and thereby the upper hinge leaf, whereby the curve helix interconnection causes the upper hinge leaf to swing in relation to the lower hinge leaf.

8. Door hinge according to claim 6, characterized therein that the piston rod at its lower end has a conical turn out and that a corresponding conical turn out is provided at the top end of the through opening through the piston, and that that portion of the piston rod which is situated below said conical turn out extends through the through opening with clearing, and at its lower end carries a star disc or the like, so that the through opening is open when the piston is moved upwards and is closed when the piston moves downwards.

9. Door hinge according to claim 6, characterized therein that the piston rod is enclosed by a helical spring the top end of which enters a groove in the under side of a plug which is fixed at the top end of the hinge pivot and has a through opening for the piston rod, and the lower end of which spring is screwed on to the piston rod, so that the tension of the spring may be adjusted by turning of the piston rod.

10. Door hinge according to claim 1, characterized therein that the sleeve of the hinge leaf attached to the door consists of two parts, viz. an under part which is rotated and raised respectively lowered during the opening movement and closing movement respectively of the door, and of an upper part which is not rotated but is raised and lowered during these movements, the abutment edges of said parts being provided with cut-outs or corresponding extensions, e.g. at 90° distance therebetween, which form "snaps" which maintain the door in distinct, easily releasable positions.

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