

Aug. 10, 1926.

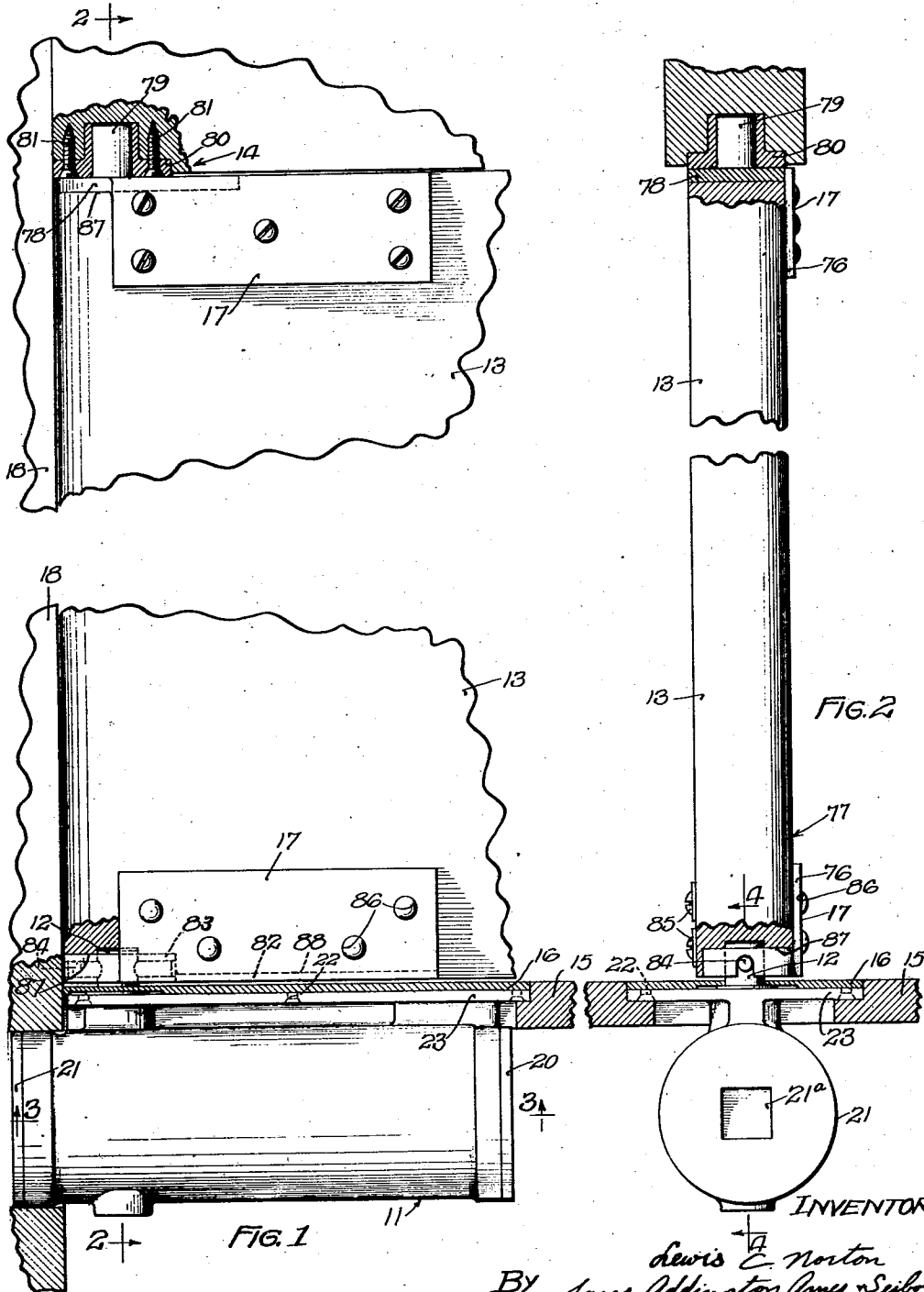
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L. C. NORTON

DOUBLE ACTING HYDRAULIC DOORCHECK

Filed Nov. 10, 1922

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

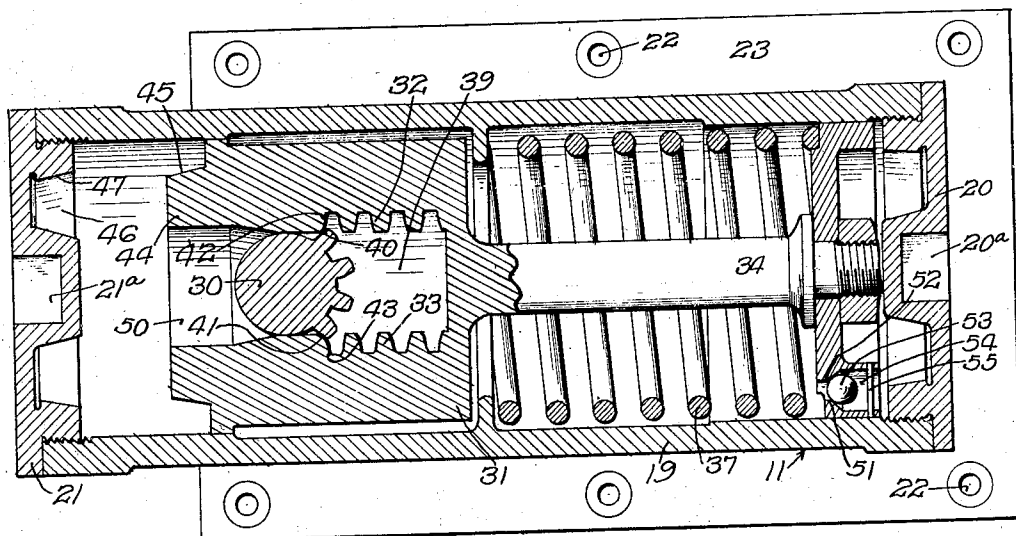


FIG. 3

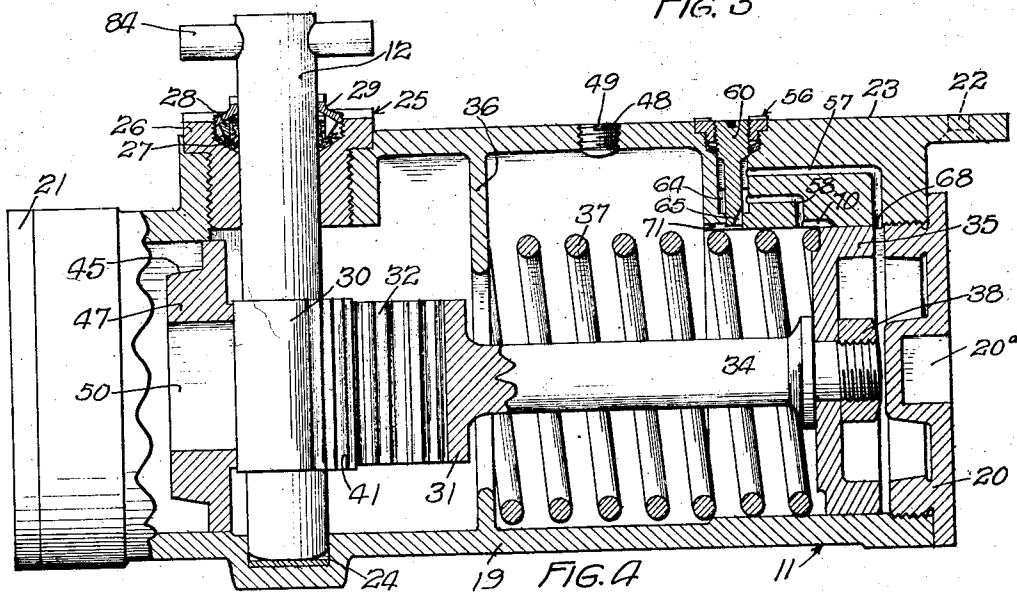


FIG. 4

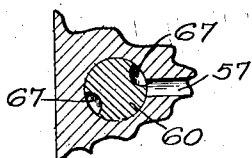


FIG. 8

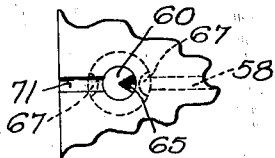


FIG. 7

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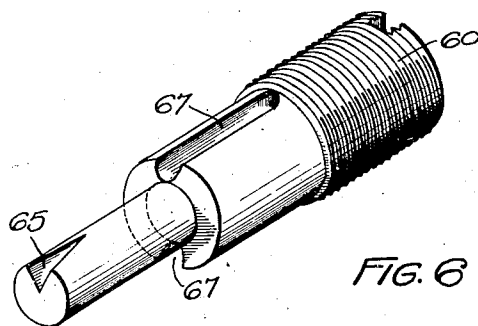
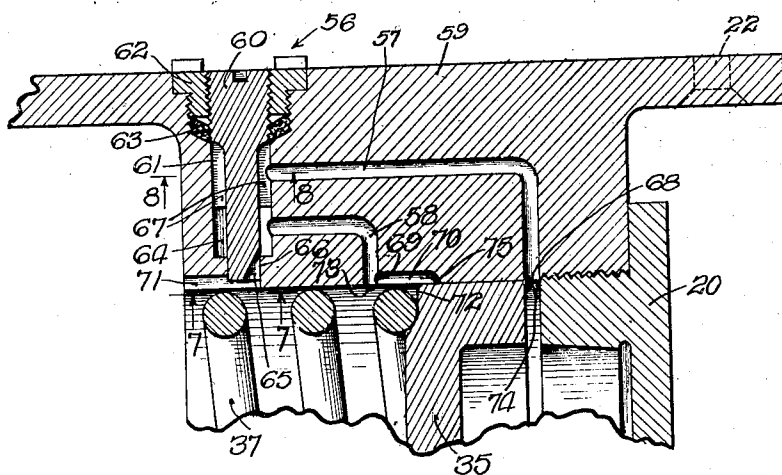
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE.

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DOUBLE-ACTING HYDRAULIC DOORCHECK.

Application filed November 10, 1922. Serial No. 600,148.

My invention relates to improvements in hydraulic door checks used in connection with double-swinging doors, the type commonly used as pantry doors that swing or open in either direction. Such doors as usually hung are easily opened by drafts or slight impulses and often remain ajar when it is desirable that they be closed. Furthermore, when the more common types of door checks are used in connection with double-swinging doors it is difficult or impossible to obtain any adjustment of the closing speed, or to obtain desirable differences in speed for various portions of the closing movement. Further difficulties with such pivoted double-swinging doors having the usual form of hinges and door checks arise in fitting such doors in the casings.

One object of my invention is to provide an improved door check which will serve to hold more securely the double-swinging door in its central or closed position than when in any of its open positions.

A further object of my invention is to provide an improved construction in which the speed of closing the door can be closely regulated and in which the final closing movement can be adjusted to a speed, either faster or slower than the normal closing movement. It is desirable that the main closing movement be adjustable to suit the individual and to be suitable for the particular location of the door. Thus a person may desire the closing movement to be fairly slow so that he will have time to pass through the door before it becomes shut. If it is not desired to leave an opening between two rooms, such as kitchen and dining room, longer than necessary, then a fairly rapid closing movement is more satisfactory.

A further advantage of the slow final closing movement, particularly for double-swinging doors, is that such a movement will prevent the door swinging back and forth to each side of its central position after closing. In other cases, such as where quiet operation of the door is important, a slow final movement of the door is desirable. My invention provides means for rendering a single form of door check adaptable to any of these situations, by the adjustment of but one valve member.

Another object of my invention is to provide, in connection with my improved door check, a suitable hinge structure, permitting

very accurate and rapid fitting and hanging of the door in its casing.

Another object of my invention is to provide a very simple, durable and easily constructed door check attachment for holding the door in either open position.

Further objects will appear from the following detailed description from the appended claims.

One embodiment of my invention is shown in the accompanying drawings, forming a part of my application and in which—

Figure 1 is an elevation view showing a complete door check assembled in connection with the improved door mounting attached to a double-swinging door.

Fig. 2 is an end view of the structure shown in Fig. 1.

Fig. 3 is a sectional view taken on line 3—3 of Fig. 1, looking in the direction of the arrows.

Fig. 4 is a sectional view taken on line 4—4 of Fig. 2.

Fig. 5 is a detailed sectional view of the valve mechanism.

Fig. 6 is a perspective view of the adjustable valve member.

Fig. 7 is a sectional view taken on line 7—7 of Fig. 5.

Fig. 8 is a sectional view taken on line 8—8 of Fig. 5.

The preferred form of construction as shown in the accompanying drawings comprises in a general way a plunger housing member 11, a lower door pivoting shaft 12, double-swinging door 13 and an upper door pivoting means 14. The plunger housing 11 is mounted on the under side of the floor 15 and is attached to the floor plate 16. The double-swinging door 13 is mounted in the usual form of casing 18, and the lower pivoting shaft 12 extends from the lower door hinge 17 through floor plate 16 and into plunger housing 11.

The plunger housing 11 comprises a cylindrical shell member 19, which encloses a special form of dash-pot mechanism. The shell 19 is closed at one end by screw plug 20 and at the other end by a special form of screw plug 21 to be hereinafter further described. Square recesses 21^a and 20^a at the centers of screw plugs 21 and 20 respectively may be engaged by suitable wrenches for removal of the plugs. The cylindrical shell 19 is attached to the under side of floor plate

16 by means of screws passing through holes 22 in flanges 23.

The pivoting shaft 12 is mounted in suitable bearings 24 and 25 located in the plunger housing 11, the lower bearing 24 being at the lower side of the shell 19 and being of any suitable construction to withstand the thrust of a considerable portion of the weight of the door. The upper bearing 25 is located in the upper side of the shell 19 of housing 11 and must include a special form of stuffing box in order to prevent the leakage of fluid from the dash-pot mechanism in housing 11, since this fluid at times is under very high pressure. The stuffing box forms no part of this invention but may be briefly described as follows. The body portion of the stuffing box comprises a threaded gasket 26, which at once serves as a bearing for shaft 12 and as a packing retaining means. The upper inner edge of the gasket 26 is provided with an annular recess containing a leather or other packing ring 27, formed with the V-shaped cross section shown. Into the interior of the V-shaped portion is forced a split washer 28 of triangular cross section. The split washer 28 is forced against the packing 27 by means of the threaded bushing 29. My experience has shown that this is a very satisfactory form of stuffing box for this location.

Between the two bearings 24 and 25 within the housing 11, the pivoting shaft is provided with a mutilated pinion 30 having a group of teeth for engagement with a double rack member 31 having a row of rack teeth 32 and 33 on either side of the pivoting shaft 12.

The double rack 31 is formed integral with a piston rod 34, attached to piston 35. Approximately midway in the plunger housing 11 is located an annular flange 36, cast integral with the interior of shell 19, which serves as a spring stop against which bears a stiff, helical spring 37, the other end of which bears against the periphery of piston 35. The spring 37 provides the force for closing the door. Piston 35 is attached to the piston rod 34 by any usual method such as by the screw threaded stem and nut 38, or by other suitable means.

The double rack member 31 is provided with a suitable slot 39 of sufficient width to allow pivoting shaft 12 to pass freely between the two racks, but of insufficient width to permit the teeth of pinion 30 thereon to pass through except when the pinion teeth mesh and work with one or the other of the groups of rack teeth, 32 or 33. The end teeth 40 and 41 on the mutilated pinion 30 normally rest in partial engagement, but not in full mesh with the end teeth 42 and 43 respectively of the groups of rack teeth 32 and 33, the spring 37 normally firmly retaining the double rack 31 in this position in respect

to the teeth of pinion 30. Further it will be seen that the pinion 30 and shaft 12 are quite firmly held in this mid position. Consequently, the door is also retained in its central or closed position. To dislodge the pinion from this position a force of four or five pounds in excess of that ordinarily required to open the door is necessary. It will be observed that this arrangement of the rack and pinion members forms a simple means for retaining a double-swinging door in its mid-position without the use of any additional working parts.

When the pivoting shaft is turned in either direction as the door is opened, tooth 40 or 41 will come into full mesh with either tooth 42 or tooth 43, depending upon which direction the door is opened. As the door is further opened the teeth of pinion 30 will continue in normal mesh with either rack 32 or 33. Rack member 31 and piston 35 will be drawn toward the center of the cylinder and spring 37 will become compressed, thus storing up energy for closing the door when released.

When the door is swung to either fully open position, the end of double rack 31 will engage screw plug 21 and check any further movement in this direction. The end of double rack 31 is provided with a cylindrical extension 44, the outer surface 45 of which is provided with a slight taper.

The screw plug 21 is provided with an annular slot 46, the outer wall 47 of which is also of tapered form, corresponding with the taper of cylindrical portion 45. A taper of approximately two degrees is ordinarily satisfactory on these members. When the cylindrical extension 44 is thrust into engagement with the slot 46, the surfaces 45 and 47 firmly frictionally engage each other and serve to hold the door in open position against the thrust of spring 37 and any slight forces exerted to close the door. However, when it is desired to close the door, the surfaces 45 and 47 are readily disengaged by a positive thrust on the door. This mechanism constitutes a single, durable and simple means for holding the door in either of its open positions. The tapered surfaces 45 and 47 are constantly immersed in the oil or like fluid used in the dash-pot mechanism and hence are kept in clean working condition.

The space within the cylindrical shell 19 around spring 37, around double rack 31 and to the screw plug 21 is normally filled with a suitable fluid, such as oil or glycerin. This fluid may be poured in and drawn off through hole 48 in shell 19, which is provided with plug 49, accessible from the upper side of floor plate 16. Opening 50 in the double rack member provides for circulation of the fluid into the space around screw plug 21. Upon opening the door as piston 35 is

drawn in, the fluid is permitted to pass freely to the other side of the piston by means of ball check-valve 51 of a usual type and which forms no part of my present invention. Briefly, the check-valve 51 comprises a small passage 52 through the piston. At the outer end of passage 52, a ball 53 is seated. The ball 53 is forced out of its seat into chamber 54 by the fluid when the piston is moved in opening the door. The ball may be retained in its chamber 54 by means of pin 55. On the return stroke of the piston, the ball is again firmly seated and closes the passage 52.

When it is desired to close the door, it is necessary to provide adjustable means for allowing the oil to pass by piston 35 again into the space surrounding spring 37. For this purpose an adjustable valve structure 56 is provided. The closing speed of the door is reduced substantially in proportion to the rate of flow of the fluid through valve structure 56. The valve structure 56 and connecting passages 57 and 58 are contained in the cast portion 59, formed integral with and between flanges 23 and shell 19. A valve member 60 is provided in a valve chamber 61 at the inner end of the cast portion 59, the valve member 60 having a threaded and slotted outer end providing for endwise and angular adjustment in reference to the chamber 61. This threaded outer end is engaged by the threaded gasket 62, which is provided with packing 63 for preventing the leakage of fluid at this point.

The valve member 60 is made of somewhat smaller diameter on the inner end than is the outer threaded portion, thus providing an annular space 64 around the lower end of the valve member, which serves as a communicating means between the various passages. On the inner end or periphery of the inner end of valve member 60, a V-shaped notch 65 is cut as appears in Fig. 6. This notch is cut at an angle with the axis of the valve member in order to provide an adjustable opening when co-acting with the flange 66 at the base of valve chamber 61. As the valve member 60 is screwed into the chamber 61, the opening through the V-shaped notch becomes more and more restricted. Similarly if a larger opening is desired at this point, the valve member 60 is screwed outward. Oppositely disposed slots 67 are provided midway of the valve member 60 in the sides thereof. Either of these slots 67 may provide an adjustable opening between passage 57 and space 64. Such an opening may be accurately adjusted by turning the valve member 60 through a small angle as is indicated in Fig. 8. It should be noted in the adjustment of the opening through slots 67 that the adjustment of the opening at notch 65 will only be slightly altered. This is because of the nature of

the openings, the lower one requiring several turns of the valve member to effect a substantial change of adjustment, while the upper one merely requires a small fraction of a turn (approximately five degrees), to effect a complete closing or opening. It is therefore obviously possible with this structure to give independent adjustments to each of these openings by merely turning the single valve member 60 a proper amount. Hence it is possible to make either of these openings small or large in respect to the other, as necessary in the adjustments hereinafter to be described.

Two or even more slots 67 are made in the valve member 60 in order that the adjustment of the opening from passage 57 will interfere as little as possible with the adjustment at notch 65. The slot 67 is used which happens to be positioned nearest the opening of passage 57 after the approximate adjustment at notch 65 is accomplished.

The passage 57 extends from a slot 67 to a point 68 at the extreme end of the cylindrical shell 19. The passage 58 extends from the space 64 to a point 69 spaced a short distance in from the extreme end of the cylindrical shell. The opening at 69 in passage 58 is somewhat elongated in the form of a slot 70. The slot 70 should be of a length less than the thickness of piston 35 in order that the fluid will not leak around the piston through this slot at any point in the travel of the piston. It is desirable, however, that this slot should be as long as possible with the above limitation. It is desirable that this slot 70 should be spaced from the opening 68 at a distance substantially equal to its length. Such spacing will provide a change in the closing speed when the edge of the door is in the neighborhood of three inches from its closed position.

A further slot 71 on the inner edge of the portion 59 serves to connect the opening at notch 65 to the main chamber around spring 37. This insures an opening for the fluid from notch 65 at all times regardless of the position of piston 35.

The operation of the adjustable valve mechanism will now be outlined.

If fast final closing movement of the door is desired, the opening by way of a slot 67 is made large in respect to the opening through notch 65. This is accomplished by turning valve member 60 so that one of the slots 67 is almost directly opposite the opening to passage 57, the whole valve member 60 having been previously adjusted in a vertical direction so that the greater part of the V-shaped notch 65 is within flange 66, making a small opening at this point. With this adjustment as the door is opened, piston 35 will be drawn into the cylinder and the fluid will escape through the check-valve 51, thus filling the space in back of the pis-

ton. As the door is released for closing, two outlets comprising passages 57 and 58 are available for the fluid to pass around piston 35. However, since the fluid from both of these passages must pass through the opening at 65, which is the smallest restriction with this adjustment, the main closing movement will be determined by this opening and will of necessity be comparatively slow. However, when the inner edge 72 of the piston 35 passes the inner edge 73 of the slot 70 then a by-pass around the opening at 65 is provided through the passage 58. At this stage the smallest restriction to the fluid occurs at slot 67, which is adjusted with a large opening. Hence from this point on, the final movement of piston 35 and closing movement of the door will be rapid in comparison to the initial main movement.

If a slow final movement of the door is required then the opening at slots 67 must be adjusted to be small in comparison with the opening at notch 65. Such an adjustment can be effected in an obvious manner by the steps previously described. With this adjustment, as the piston 35 travels on its return or closing stroke, the fluid can escape by way of both passage 57 and passage 58 and the opening at notch 65 now being comparatively large, a greater part of the flow through passages 57 and 58 is permitted to pass freely. However, as the outer edge 74 of piston 35 passes the outer edge 75 of slot 70, thus closing the slot, the only remaining means of escape for the fluid is through the small adjusted opening at slot 67. Hence from this point on the final movement of piston 35 and the closing movement of the door will be slow in comparison to the initial main movement.

Both the initial and final closing movements of the door can be made faster or slower in an obvious manner by adjusting both of the openings, either larger or smaller, without disturbing the relative closing speeds.

It will be readily seen that this valve mechanism constitutes a single, simple structure by which the speed of both the main and final closing movements can be adjusted and by which an independent relative adjustment of these two speeds can be obtained.

A special form of hinge 17 is shown in Fig. 1, which is particularly adapted for the form of door mounting and door check shown. With the usual form of pivoted double-swinging door hinges, which are adapted to be fastened to the upper and lower edge surfaces of the door, many trials and adjustments are required before the door is properly fitted and centered into position. In applicant's form of hinge structure, vertical flanges 76 are provided on each hinge for attachment to the easily accessible outer surface 77 of the door. The upper hinge is

provided with a horizontal body portion 78 from which flange 76 and pintle 79 extend. A socket member 80 is fastened in place in the door casing by screws 81 and receives the pintle 79. The lower hinge is provided with a horizontal body portion 82 from which its flange 76 and the bearing 83 for shaft 12 extend. The shaft 12 is secured in bearing 83 by means of locking pin 84. Suitable attaching screws or bolts insertable through holes 86 in flanges 76 may be used.

The door 13 is provided with notches 87 and 88 at the top and bottom edges of the door respectively, slightly longer than and affording space for the correspondingly shaped portions of the hinges. With this structure the door check, pivoting shafts and hinges may be first permanently mounted in place. The door may then be fitted into the casing and supported in the desired position by small wedges. The enlarged notches 87 and 88 provide ample clearance for adjustably mounting the door in respect to the hinges and pivots. Holes for bolts 85 may then be bored in the door and the bolts inserted through the door and flanges 76 and tightened in place. The wedges may then be removed. Thus it may be seen that the door, hinges and door check can be mounted permanently in place with but one assembly of these parts, thus avoiding the usual method involving repeated connection and disconnections of the hinges and pivots from the door and door check. Furthermore bolts 85 being always in an exposed position are easily removable if it is desired to remove the door. The door may be removed without disturbing the pivoting members or the door check.

While I have illustrated and described the preferred form of construction for carrying my invention into effect, this is capable of variation and modification without departing from the spirit of the invention. I therefore do not wish to be limited to the precise details of construction set forth, but desire to avail myself of such variations and modifications as come within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. Means for closing a door and for holding it open against the action of the closing means, comprising a reciprocable member, power means acting on said reciprocable member urging it in one direction, and wedge means acting on said reciprocable member to hold it against the action of said power means.

2. A door check comprising a plunger, means operatively connecting the door to said plunger, a housing member for said plunger, a spring pressing said plunger toward its normal position, said plunger hav-

being provided with an external longitudinal rib extending throughout substantially the entire length of the section, the ribs of the sections being arranged in alignment and forming a key extending throughout substantially the entire length of the shell.

7. Means for forming piles or the like as claimed in claim 1 in which the shell is divided transversely into a number of sections arranged end to end, each of said sections being provided with an external rib extending longitudinally throughout substantially the entire length of the section, the ribs of the sections being arranged in alignment and forming a longitudinal key extending throughout substantially the entire length of the shell, and means connecting the ribs of adjacent sections.

8. Means for forming piles or the like as claimed in claim 1 in which the shell is substantially tubular and consists of longitudinal sections, each section being provided at its side edges with outwardly extending longitudinal flanges, the flanges of adjacent sections abutting against each other.

9. Means for forming piles or the like as claimed in claim 1 in which said groove in vertical section has a lower surface on which the thread exerts its force in the driving of said members, the surface opposite the mouth of the groove being substantially vertical and of greater height than the thickness of the thread to permit the tool to be readily lifted relatively to the shell member after the latter has been driven.

10. Means for forming piles or the like including a hollow rod-like tool member provided on its exterior surface with a spiral screw thread and provided interiorly with an anvil arranged a sufficient distance below the upper end of the tool to permit the upper portion of the tool to act as a guide for a hammer.

11. Means for forming piles or the like including in combination a shell member and a rod-like tool member having its upper portion hollow, an anvil arranged within the tool member below the upper end of the latter, a hammer guided by the tool member and arranged to strike said anvil, a collar in which the tool member is rotatably mounted, an external toothed wheel connected to and movable with said tool, and driving mechanism engaging said

toothed wheel for rotating the tool relatively to the shell.

12. Means for forming piles or the like including in combination, a substantially tubular shell member and a rod-like tool member, said members having cooperating contacting spiral surfaces to permit the tool member to force the shell member into the soil when pressure is exerted on the tool member, the spiral surface of one of said members being arranged upon a screw thread of less vertical thickness than pitch, and the portions of the members between the convolutions of said thread being plain and being spaced apart to reduce friction.

13. Means for forming piles comprising a concrete shell and a removable core, said shell and core being provided with cooperating spiral surfaces to force the shell into the ground, the external shape of the shell being different from its internal shape.

14. Means for forming piles or the like including in combination, a substantially tubular shell member and a rod like tool member, said members having cooperating contacting spiral surfaces to permit the tool member to force the shell member into the soil when pressure is exerted on the tool member, the spiral surface on one of said members being arranged on a screw thread of less vertical thickness than pitch, the portions of the members between the convolutions of said thread being plain and being spaced apart to reduce friction, said shell having a substantially cylindrical regular outer surface.

15. Means for forming piles or the like as claimed in claim 12 in which the shell is formed of concrete and has a substantially cylindrical plain outer surface.

16. In combination, a hollow concrete pile member sufficiently rigid to withstand without filling, the external pressure of the earth after it is driven, a removable core member arranged in the pile member and adapted to be driven with the latter, one of said members being provided with a spiral groove and the other with a thread engaging said groove to permit the core member to be unscrewed from the pile after the latter is driven.

In testimony whereof I hereunto affix my signature.

ALEXANDER G. ROTINOFF.