June 3, 1952 J. R. GATES ET AL 2,599,054

RETRACTABLE DOOR HANDLE

Filed Oct. 26, 1948 2 SHEETS—SHEET 1

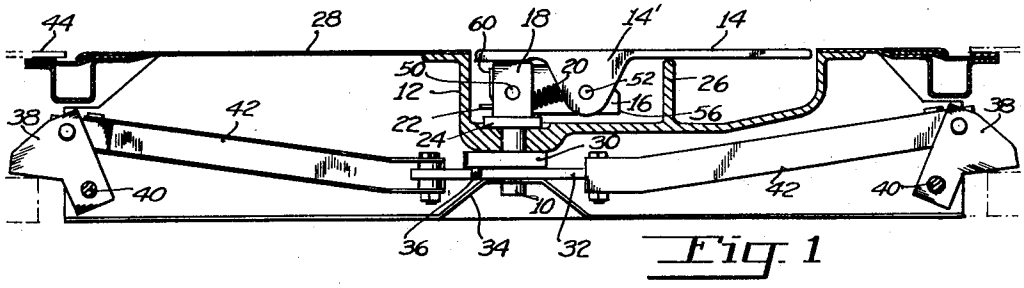


Fig. 1

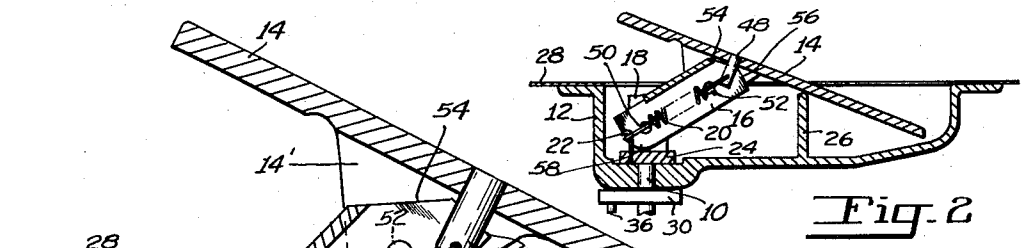


Fig. 2

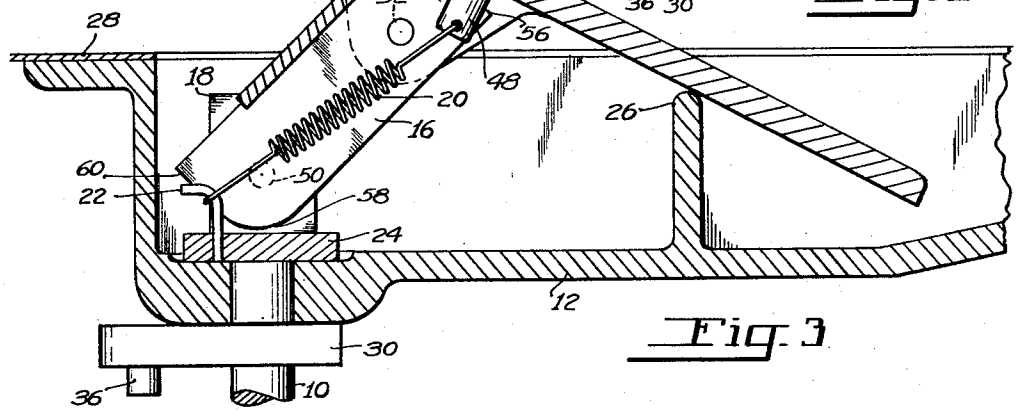


Fig. 3

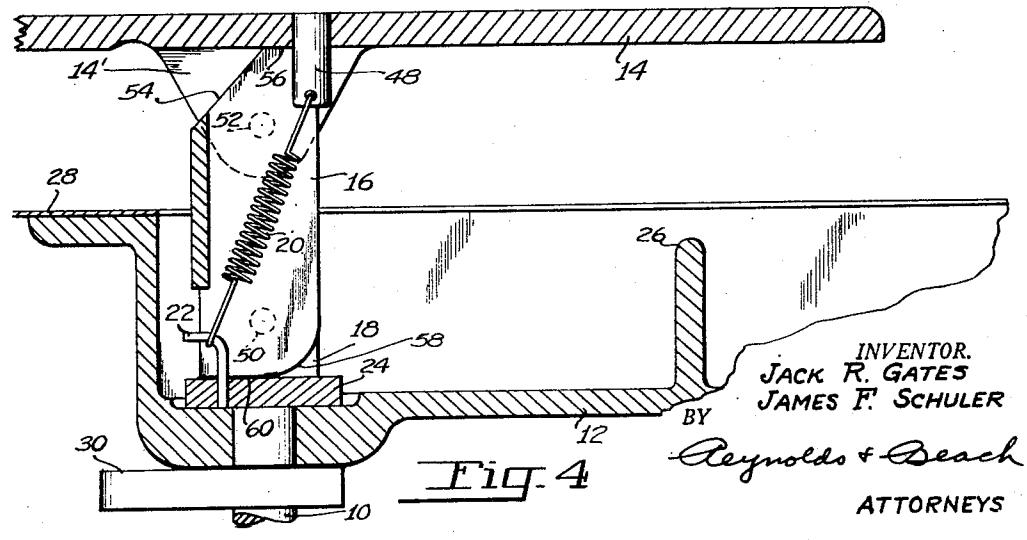


Fig. 4

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RETRACTABLE DOOR HANDLE

Filed Oct. 26, 1948 2 SHEETS—SHEET 2

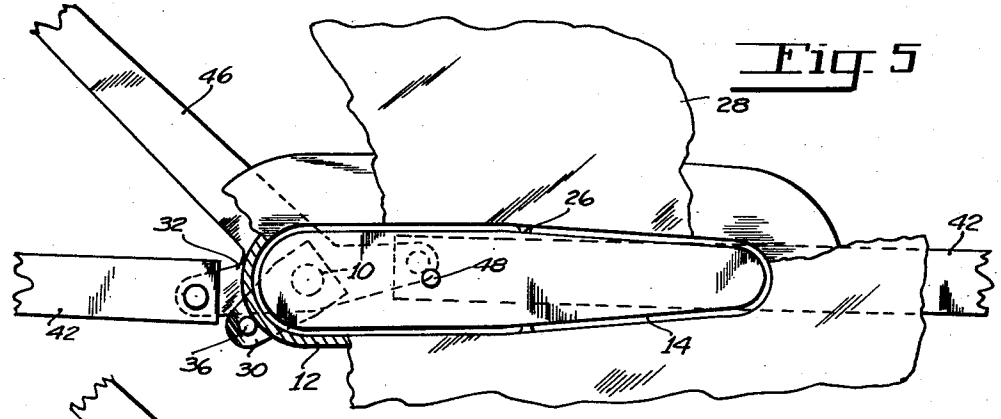


Fig. 5

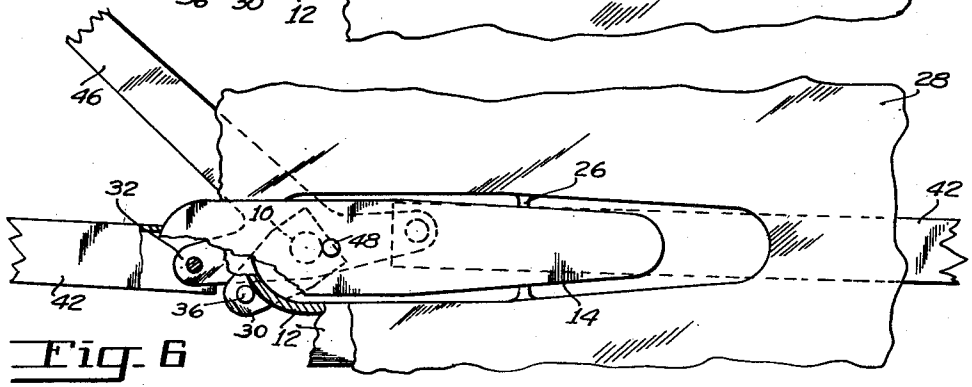


Fig. 6

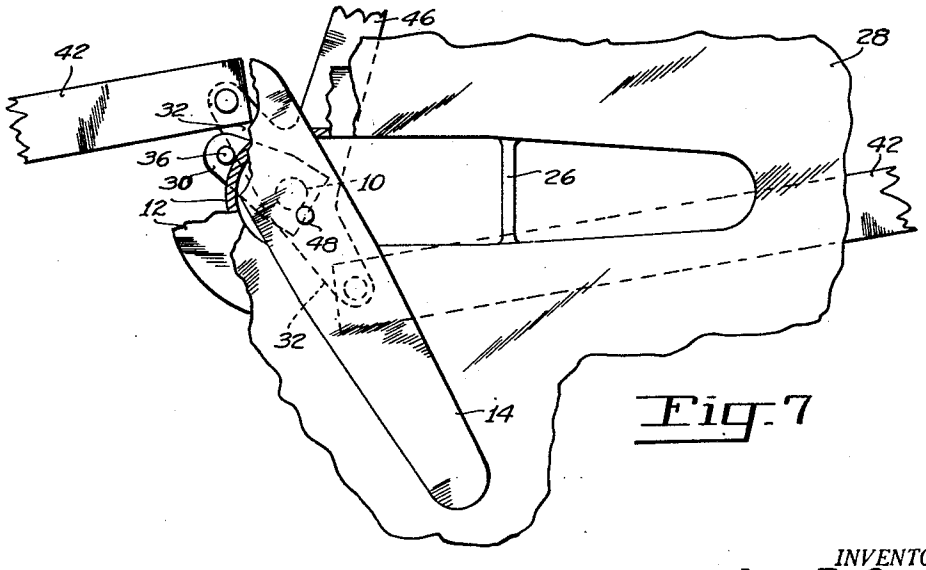


Fig. 7

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RETRACTABLE DOOR HANDLE

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Application October 26, 1948, Serial No. 56,655

14 Claims. (Cl. 292—348)

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This invention relates to retractable door handles and is herein illustratively described by reference to its application to escape hatch doors in aircraft. In such cases the retractable door handle, on the exterior side of the fuselage, is normally disposed within a well or recess in the fuselage outer wall, thereby avoiding air drag, so important in modern highspeed aircraft. When the door handle is to be used to open the door it is simply moved from its recess outward into an accessible, projecting position where it may be easily grasped and turned or otherwise manipulated to operate the door latch. The invention generally considered is not restricted to such aircraft installations, however, but is advantageously useful in a variety of different types of vehicle installations. It is also applicable to door installations set in floor and wall surfaces in buildings, especially under conditions requiring elimination of normally projecting door handle parts which might interfere with the movement of objects or individuals past them.

An important object of the invention is to devise a retractable door handle which can be moved easily and quickly between its normally retracted and its projecting or operative positions, and further a door handle which will be urged by resilient means into either of such positions, yet be readily movable at will into the other position. In its described form the retractable door handle illustrating the invention is normally moved from retracted position to operative position by the simple conditioning operation of pressing one end of the handle through a short distance until the handle mechanism quickly snaps resiliently into projected position ready for use. Thereafter the resilient means employed to effect such erecting action continues to hold the handle in its projected position until it is later pressed inward by hand for effecting its retraction. When the handle is pressed back toward its retracted position a short distance, a point is reached at which the same resilient means formerly urging the handle outward into projected position now acts reversely and impels the handle quickly the remaining distance into its fully retracted position.

The handle generally includes a handle member or handle proper and a handle supporting link upon which the resilient means acts to swing the mechanism in the manner just described. Preferably the handle proper is mounted to swing on its supporting link so that

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it may occupy parallel positions at the extreme ends of its translatory movement carried by the link as above described, into and out of its recess. Consequently the depth of the well or recess into which the handle is retracted need not be great since the handle is then substantially parallel to the surrounding wall or door surface in which received. Such a feature in addition to the close folding relationship of the handle parts results in a compact, retractable handle which may be installed readily in a small space or in a thin door. In addition to the foregoing described operation of the double-acting resilient means to swing the link, and thereby the handle proper bodily, such resilient means is also so arranged with relation to the handle proper and the link as to effect relative swinging thereof and urge the handle proper into parallel positions at the opposite ends of its translatory movement. The same resilient means thereby performs the several described functions attributed to it, swinging both the link and handle proper during both retraction and erection of the handle mechanism.

Further important objects of the invention include simplicity, ruggedness and durability of construction, economy of manufacture, and ease of installation and maintenance of the retractable door handle. The invention, including its various features and the details of its preferred form and mode of operation are hereinafter described by reference to the accompanying drawings. While the invention is described specifically in this manner, it is to be kept in mind that numerous modifications incorporating its broader features are possible; accordingly, various equivalent arrangements and forms may be devised readily by those skilled in the art to meet different installation requirements, and such adaptability of the retractable handle to different types of installations is one of its important advantages.

Figure 1 is a sectional side view of a downwardly opening hatch door located in the wall of an aircraft fuselage and accessible for opening from the outside, showing door operating means and the preferred form of my retractable door handle in its retracted position.

Figure 2 is a sectional side view of the door handle and only those surrounding door parts which cooperate more directly therewith, the handle being illustrated in a partly retracted position corresponding to the cross-over point of the resilient means; Figure 3 is an enlarged view corresponding to Figure 2 but with the

handle moved further outward toward its projected position; Figure 4 is a view similar to Figure 3 with the handle now fully extended into its operative position.

Figure 5 is a plan view of the door handle in its retracted position mounted in the hatch door installation of which only fragmentary portions are shown; Figure 6 is a similar view, showing parts of the door handle broken away, with the door handle in its projected or operative position; and Figure 7 is a similar view, with the projecting door handle rotated a predetermined amount to operate associated door latch release mechanism.

As viewed in the several figures the retractable door handle herein illustrated is adapted to operate door latch mechanism by rotation of a short shaft 10 journaled in the base of a housing 12 defining a recess in the door for receiving parts of the retractable door handle. The primary elements of the retractable door handle include the handle proper 14, the handle-projecting link 16 pivotally carrying the handle 14, the mounting lug 18 fixed to the upper end of the shaft 10 and pivotally supporting the base end of the link at 50, and the actuating spring 20 interconnecting a point, such as post 48, on the handle proper and an anchor 22 mounted on the bracket base 24. Cooperating with the movable parts of the retractable door handle is a stationary fulcrum such as the rib or transverse element 26 shown as an integral part of the housing 12.

As will appear from the more detailed description which follows, pressure applied to the end of the door handle proper 14 which overhangs the fulcrum 26 causes the handle to tilt away from its position shown in Figure 1 to its critical position shown in Figure 2 at which point the line of force of the actuating spring 20 crosses over the axis of the pivot pin 50 of the handle-projecting link 16 on the lug 18; and when the handle passes the critical position or point, as it has in Figure 3, it then, by force of spring 20 acting effectively outwardly on the link 16 about pivot 50, quickly snaps into its projected position shown in Figure 4. Retraction of the handle is effected at will by applying a reverse pressure to the handle in such manner that the link 16 is swung downward toward the recess to the spring's critical point beyond which the spring again reverses its force application from counter-clockwise to clockwise, as seen in Figure 4, and snaps the handle the remaining way to fully retracted position. As will be seen, therefore, whereas the spring is directly connected to the handle proper 14, actually in effect the connection is as if made to the swinging end of the link 16 insofar as inwardly and outwardly urged movements of the latter are concerned. As will later appear the spring is connected to the handle member 14 instead of to the link to serve the further purpose of swinging the handle relative to the link.

Considering the illustrative structure in further detail, the retractable door handle is shown installed in the door itself, 28, the exterior side of which appears at the top of Figure 1, although it will be evident that various types of door operating mechanisms would permit installing the handle directly in the fuselage at one side of the door instead of directly in the door. In the latter case other means would be provided, if desired, for grasping the door in moving it open and shut after unlatched by using the retractable handle in this even to operate the latch mechanism securing the door.

In plan, the handle and housing opening substantially conform and the outline dimensions of the housing recess preferably only slightly exceed the outline dimensions of the handle proper 14, leaving only ample operating clearance for the handle. This provides a neat appearing installation from outside the door; when the handle is in its retracted position the link 16, lug or bracket 18 and actuating spring 20 are hidden beneath the handle member 14.

Link 16 is conveniently formed as a channel which gives it strength and rigidity. Handle 14 has a pair of laterally spaced ears 14' embracing the channel sides of link 16, through which the pivot pin 52 passes defining the axis about which the pin 52 of such handle swings relative to the link. Similarly, lug 18 has parallel ears projecting upward which embrace the channel sides of link 16, and through which a pin is passed pivoting the link on the bracket for swinging about pin 50 generally parallel to pin 52.

Shaft 10 is fixed to the mounting lug 18 upon which the channel shaped link 16 is mounted, and turns with the link about the shaft axis when the handle 14 is grasped and rotated. The shaft fixedly carries a latch operating arm 30 beneath the base of housing 12, and loosely carries the independently rotatable double crank 32 beneath the arm. The lower end of the shaft is journaled in a guiding aperture in the base portion of a depression 34 formed in the inner side part of the door. Any suitable securing means may be provided to retain the shaft 10 against withdrawal from the several coaxial parts by pulling outwardly on the door handle.

Arm 30 has a downwardly projecting pin 36 which is adapted to bear against one lateral edge of one extension of the double crank 32 to effect rotation of such crank on shaft 10 as the door handle is rotated in the proper direction (Figure 7). As may be seen from Figure 1, this movement of the double crank 32 retracts the latch dogs 38 at opposite sides of the door from latch abutments 39 which they engage on the fuselage, to unlatch the door, the dogs pivoting on pins 40 in the door and being pivotally connected to the ends of the crank 32 by the pair of links 42. The pivot axes at the respective ends of the links 42 are disposed substantially perpendicularly to permit swinging of one end of each link in one plane, as by rotation of the crank 32, while its other end, such as that connected to the latch dogs 38, swings in a plane generally at right angles thereto. In order to enable opening the door from the inside of the aircraft fuselage a lateral extension 46 is provided on the double crank 32, which may be grasped to rotate the crank manually and withdraw the latch dogs 38 from their cooperating abutments independently of rotation of the shaft 10 or of the door handle fixed thereto. This is seen most clearly in Figure 5. This particular latch mechanism described is primarily background for the description of the retractable door handle and is not to be regarded as an essential part of the invention, it being understood that the retractable door handle may be used to operate door mechanisms varying in type and form.

With further reference to the details of the retractable door handle mechanism, it will be seen that the hook-like anchor element 22 projecting upward from the base 24, the lower end of the actuating spring 20 is fastened, and the inwardly projecting post 48 carrying the opposite end

of the spring, are so disposed with relation to the pivot axis **50** of the link and the pivot axis **52** of the handle member **14** on the link to achieve the spring urged movements of the handle parts, previously set forth. That is, the pivot pin **50** is located above anchor **22** and at the side of the pivot remote from pivot **52** and pin **48** is located at the side of pivot **52** remote from pivot **50** and outward from pivot **52**, as seen in Figure 3, for example.

Thus with the door handle in its retracted position and its parts **14** and **16** folded generally parallel to the plane of the door, the line of force of the spring passes somewhat over the pivot axis **52** and somewhat under the pivot axis **50**, this being the result of the respective effective projecting lengths of the anchor **22** and post **48**, and the relative heightwise locations of the axes **50** and **52**. With the handle retracted, the lower face of the handle member **14** at one end preferably rests against an abutment or stop which is formed by the upper end edges of the bracket or lug **18**, thereby restricting relative folding movement of the handle and link, **14** and **16**. On the side of pins **52** away from the handle's end just mentioned the handle's lower face rests upon fulcrum element **26** which, cooperatively with the bracket stop **18**, acts as a stop to limit downward swinging of the link **16** and handle member **14** under influence of the actuating spring **20**. The upper outer corner of link **16** is mitered at **54** for clearance of the link by handle member **14** as these parts are swung into and out of folded relationship. The link is mitered in this manner, rather than cutting back its entire upper or outer end, because it is desired to leave a flat transverse end abutment edge **56**, as a stop against which the lower face of the handle **14** between ears **14'** may bear with the handle in its projected position, thereby limiting relative unfolding movement of the link **16** and handle **14** preferably when such members reach the point of perpendicularity, as shown in Figure 4. The spring **20** urges such members into this angular relationship by exerting a force on the handle tending to rotate it clockwise on pivot pin **52**, as seen in Figures 1 to 4.

In order to raise the retractable door handle from its retracted position into its operative position, as viewed in Figures 1 to 4, inclusive, downward pressure is first exerted on the end of the handle proper **14** which overhangs the partition fulcrum **26**. This tilts the handle on the fulcrum **26** to swing its link-connected end outward or upward, as shown in these figures. Such movement, accompanied by upward swinging of the link **16** about its pivot pin **50** and relative unfolding movement of the members **14** and **16** takes place initially against the force of actuating spring **20**, which force persists until the critical or cross-over point is reached, at which the spring line of force passes through axis **50** of the link and preferably also axis **52** of the handle **14**, as shown in Figure 2. Then as the handle is pressed further in the same direction and beyond the cross-over point, the reversely applied spring force quickly erects the link **16** toward its projecting position substantially normal to the door. The inner corner **58** of the link **16**, on the diagonal with the mitered corner **54** previously described, is rounded to clear the base **24** as the link swings in this manner. The unrounded corners of the link channel sides constitute an abutment **60** which bears flatly against the upper side of the bracket base **24** to stop outward swinging of the link **16** when the link is fully erect.

It will be evident that the cross-over point of the spring **20** with respect to both of the two pins **50** and **52** need not occur simultaneously, although it is preferably made to do so, as illustrated in Figure 2, since the spring-urged unfolding movement of handle and link and erecting movement of the two together are then initiated practically simultaneously.

It will be observed that as the handle's end is being pressed inward to pivot on the fulcrum partition **26** and swing link **16** outward, certain lengthwise sliding of the handle member **14** on the fulcrum **26** occurs. For this reason the upper fulcrum edge is rounded to enable the member **14** to slide freely thereover and facilitate erecting the handle.

In its projected position, ready for use, the handle stands out a distance from the outer surface of the door such that it may be grasped conveniently, this distance being determined by the spacing, inward from the handle member, of pin **52**, the length of the handle-projecting link **16** between pins **50** and **52** and the location of the axis **50** inwardly from the door's outer surface, dimensions which are subject to variation in design. Because of the arc of swing of the end of the link **16** carrying the handle member **14**, it will be evident that the latter is displaced lengthwise or in a direction parallel to the plane of the door at the same time it is elevated, so that it no longer directly overlies the entire length of the recess in the housing **12**.

When it is desired to retract the handle into the housing recess, as when the aircraft is ready for flight, it is merely necessary to press on the handle member **14** at such a point that the link **16** swings downward at the same time the members **14** and **16** tend to fold together by the continued application of such pressure. Pressure inwardly and to the right, as seen in Figure 4, is preferably applied to the handle at the side of a vertical line passing through the pins **50** and **52** away from the fulcrum **26** to cause the handle member **14** to swing readily counterclockwise on link **16**, and such link clockwise about pin **50**. When, during such movement, the cross-over point of the spring **20** is reached with respect to the pins **50** and **52**, both folding and retracting of the handle parts occur automatically by force of the spring. As previously stated, the spring then holds the parts in retracted position against moderate forces which may happen to be applied to the handle tending to elevate it accidentally.

It will be appreciated by those skilled in the art that the particular form of the handle components or the particular means by which they are interconnected and operated, are matters subject to considerable variation within the principles involved, and that by varying the spring constant and the locations of the several pivots with relation to each other and with relation to the spring and the location of the fulcrum **26** different effects relating to the forces and movements required to retract and elevate the handle may be obtained. Likewise, although the handle proper has been shown mounted flush with the door's outer surface in its handle-retracted position, it may as readily be set further within the door or may even be constructed to project outward therefrom a short distance when retracted.

We claim as our invention:

1. A retractable handle installation compris-

ing a housing defining a recess, a handle member turnable about an axis of rotation and retractable into such recess, mounting means rotatable about said turning axis, a link pivotally connected to said mounting means and said handle member, by pivots spaced apart along the link, for swinging of said link relative to said handle member and said mounting means, spring means operatively connected at one end to said handle member, and at its opposite end to said mounting means, the spring connections being located such in relation to the link and handle member that the line of force of said spring intersects an imaginary line extending between the axes of said spaced pivots and swings through varying angles of intersection with said line, passing through the zero angle, with swinging of said link between its projected and retracted positions.

2. The retractable handle installation defined in claim 1, the link having stop means cooperating with the handle member to limit swinging of one relative to the other at mutually parallel and perpendicular positions, respectively, and further stop means comprising a stationary element mounted within the housing and disposed to be engaged by the handle member when such handle member is disposed parallel to the link as the latter is swung inwardly into retracted position, such stationary element constituting a fulcrum for the handle member, which fulcrum, when the link is in retracted position, is engaged by the handle member generally intermediate the pivotal connection of the handle member with the link and one end of the handle member so that such handle member end thereby overhangs such fulcrum, said fulcrum enabling swinging of the link outward from the housing to be initiated by pressing inward at will on such overhanging end of the handle member.

3. The retractable handle installation defined in claim 2, and additional stop means comprising cooperating abutments carried by the link and the mounting means, limiting outward swinging movement of the link at a position thereof substantially parallel to the handle turning axis of the mounting means.

4. A retractable handle comprising handle means having an elongated member formed to be grasped by hand and turned about an axis, means rotatable about said turning axis and supporting said handle means for swinging of said member about an axis at right angles to said turning axis, between projected and retracted positions, and double-acting spring means cooperating with said handle means and handle supporting means operatively to urge said elongated member toward projected position or retracted position when such member is swung bodily a predetermined distance toward either such position, respectively.

5. A retractable handle comprising an elongated handle member formed to be grasped by hand and turned about an axis generally at right angles thereto, a link connected at one end to said handle member for pivoting relative thereto about an axis transverse to the length and also transverse to the turning axis of said handle member, means mounting said link for swinging about an axis generally parallel to said pivot axis, between handle-projecting position generally parallel to said turning axis, and handle-retracted position at a substantial angle thereto and resilient means tending to maintain said link and handle member carried thereby in handle-projected position, said mounting means being rotatable about said handle turning axis.

6. The retractable handle defined in claim 5, and resilient means tending to maintain the link and handle member carried thereby in handle-retracted position.

7. The retractable handle defined in claim 6, wherein the resilient means tending to maintain the link in handle-projected position and the resilient means tending to maintain the link in handle-retracted position comprise a single double-action spring connected at one end to the mounting means and at its opposite end to the handle member, such connected ends being so located, for achieving the double action, that the line of spring force, in handle-projected position of the link, intersects at an acute angle the plane containing both the pivot axis of the handle on the link and the link's axis of swing, and, in handle-retracted position, intersects the same plane at an opposite acute angle, both intersections occurring between such axes.

8. A retractable door handle comprising an elongated handle member formed to be grasped by hand and rotated about a turning axis, a link connected pivotally at one end to said handle member for relative swinging thereof substantially between mutually perpendicular and mutually parallel relationship, mounting means pivotally connected to the opposite end of said link for swinging thereof between positions generally parallel and generally perpendicular to such handle turning axis, to move said handle member between projected and retracted positions, respectively, and means guiding said mounting means for rotation about the handle turning axis.

9. Retractable handle mechanism comprising projecting handle means including an elongated handle member and a link pivotally connected by one end to said handle member, mounting means turnable about an axis of rotation, means pivotally connecting the opposite end of said link to said mounting means to permit swinging of said link thereon about an axis perpendicular to the mounting means turning axis and parallel to the pivot axis of said handle member on said link, between handle-projecting position of said link generally parallel to said turning axis and handle-retracted position generally perpendicular thereto, resilient means having one end connected to said mounting means in the vicinity of the link's pivotal connection thereon and an opposite end connected to said handle means in the vicinity of the pivotal connection between said handle member and link, positioning said resilient means in such relationship to the link's axis of swing that the line of force of said resilient means acting on said link swings across from one side to the other of said link's axis of swing on the mounting means during swinging of the link between handle-projected and handle-retracted positions in either direction, said link having stop means limiting swinging of the handle member on the link in one direction at substantially a right angle relationship between such link and handle member, in handle-projected position, and limiting such swinging in the opposite direction at substantially a parallel folded relationship between such link and handle member, in handle-retracted position.

10. The retractable handle mechanism defined in claim 9, wherein the stop means includes cooperating abutments on the handle member and the link, limiting relative swinging thereof in the first direction, and further cooperating abutments on such handle member and link, limiting relative swinging thereof in the opposite direc-

tion, a fixed stop engageable by the handle member in handle-retracted position, at a location thereon between the ends of such handle member but beyond the end of the link pivotally connected to such handle member, said fixed stop having an edge comprising a fulcrum for the handle member for pivoting of its link-connected end outward toward projected position by pressing inward at will on its opposite end overhanging the fulcrum.

11. Retractable handle mechanism comprising a link, link mounting means rotatable about a handle turning axis, first pivot means connecting one end of said link and said link mounting means for swinging of said link about an axis substantially perpendicular to the mounting means turning axis between retracted position generally perpendicular to said turning axis and extended position generally parallel to said turning axis, a handle member, second pivot means connecting said handle member and said link for swinging of said handle member relative to said link about an axis substantially parallel to the axis of said first pivot means between retracted position generally parallel to said link and extended position generally perpendicular to said link, and resilient means interconnecting said rotatable mounting means and said handle and normally maintaining said link and handle member in their retracted positions but yieldable to enable swinging of said link and handle member into their respective extended positions.

12. The retractable door handle mechanism defined in claim 11, in which the resilient means is a single spring having one end connected to the link mounting means offset from the first pivot means axis and farther from the second pivot means axis than the distance between the two pivot means axes in all swung positions of the link, and having its other end connected to the handle member offset from the second pivot means axis and farther from the first pivot means axis than the distance between the two pivot means axes in all swung positions of the link, for shifting of the line of spring force from a position inclined in one direction to a line joining the two pivot means axes through a position parallel to such joining line into a position inclined oppositely relative to such joining line

as the handle member swings between extended and retracted positions.

13. The retractable door handle mechanism defined in claim 12, and further comprising a stationary fulcrum spaced from the first pivot means axis a distance greater than that between the two pivot means axes and engageable by the handle member for outward swinging of the second pivot means by pressing inward on that portion of the handle member at the side of the fulcrum remote from the second pivot means.

14. A retractable door handle comprising an elongated handle member formed to be grasped by hand and turned about an axis generally at right angles to the general plane of a door carrying such handle, a link, first pivot means connecting one end of said link and said handle member for pivoting about an axis transverse to the length of the handle member and also transverse to the turning axis of said handle member, mounting means mounted for rotation about said handle turning axis, second pivot means connecting the other end of said link and said mounting means for pivoting of said link about an axis substantially parallel to the axis of said first pivot means between handle-projected position generally parallel to said turning axis and handle-retracted position generally perpendicular to said turning axis, abutment means limiting swinging of said link between said two positions, abutment means limiting swinging of said handle member relative to said link in mutually perpendicular relationship in handle-projected position of said link, and further abutment means limiting swinging of said handle member relative to said link in mutually parallel relationship in the handle-retracted position of said link.

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