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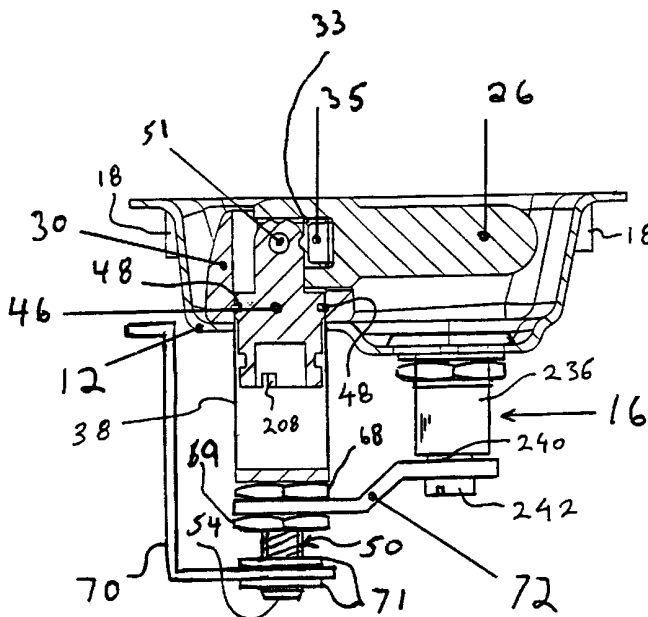
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- (71) Applicant: SOUTHCO, INC. [US/US]; 210 N. Brinton Lake Road, Concordville, PA 19331 (US).
- (72) Inventors: WYTCHERLEY, Roger; 2 Rough Leasow, Suckley, Worcestershire WR6 5EG (GB). SORIN, David; 1 Duke Way, Tewksbury, Gloucester GL20 5FG (GB).
- STORER, David; 4 Post Office Row, Aston Somerville, Broadway, Worcestershire WR12 7JF (GB).
- (74) Agents: OJAN, Ourmazd, S. et al.; Paul & Paul, 2900 Two Thousand Market Street, Philadelphia, PA 19103 (US).
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(54) Title: LATCH



(57) Abstract: A latch (10) includes a cup (12), a latch assembly (14) mounted in the cup (12) and having a pivotal handle (26) and a lock (16) having a lock pawl (72) selectively rotatable to a locked position to prevent operation of the latch assembly (14).

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LATCH**TECHNICAL FIELD**

5 The present invention relates generally to latching devices and more particularly to latching devices for securing a first member such as a door, panel or the like in a closed position relative to a second member such as a corresponding door, panel or frame.

BACKGROUND ART

10

 Various types of latching devices for use in securing a first member such as a door, panel or the like in a closed position relative to a corresponding second member such as a door, panel or frame are known.

 Some types are termed "compression latches" in that a pawl or similar member is
15 moved in order to compress first and second members together in a latched position. Examples of compression latches are disclosed in U.S. Patent Nos. 4,583,775 and 4,556,244, each to Robert H. Bisbing and assigned to Southco, Inc, the assignee of the present application.

 The present invention discloses a modified latch for securing first and second
20 members.

DISCLOSURE OF THE INVENTION

An object of the present invention is to provide a compression latch sufficiently robust in design for a variety of applications.

5 Another object of the present invention is to provide a latch having a low profile so as to not extend out from the surface of the member in which the latch is mounted.

Still another object of the present invention is to provide a latch having a lock to prevent unwanted operation.

10 In accordance with the objects set forth above, the present invention discloses an embodiment comprising a latch of the compression type and with the latch being housed within a flush mounted cup and including a foldable handle and integral lock.

These and other objects of the present invention will become more readily apparent from a review of the following description and attached drawings.

15 **BRIEF DESCRIPTION OF THE DRAWINGS**

Fig. 1 is a perspective view of a latch in accordance with an embodiment of the present invention and illustrating a handle of a latch assembly in an open position and a lock in a locked position.

20 Fig. 2 is a perspective view of the latch of fig. 1 and illustrating the handle in a closed position.

Fig. 3 is a sectional right side elevational view of the latch of fig. 2, slightly enlarged, and taken along the line 3-3 of Fig. 2.

Fig. 4 is a slightly enlarged isolated perspective view of a cup of the latch of fig. 1.

25 Fig. 5 is a top plan view of a panel prepared for mounting of the latch of fig. 1.

Fig. 6 is an isolated perspective view, slightly enlarged, of the handle of fig. 1.

Fig. 7 is an isolated perspective view, slightly enlarged, of an insert of the latch assembly of fig. 1.

Fig. 8 is an isolated perspective view, slightly enlarged, of a housing of the latch
5 assembly of fig. 1.

Fig. 9 is an isolated top plan view, slightly enlarged, of a driver of the latch assembly
of fig. 1.

Fig. 10 is a front elevational view of the driver of fig. 9.

Fig. 11 is a sectional front elevational view of the driver of fig. 9 taken along the line
10 11-11 of fig. 9.

Fig. 12 is an isolated top plan view, slightly enlarged of a lock pawl of the lock of fig.
1.

Fig. 13 is a view of an example of a compression latch mechanism usable with the
present invention, shown in the fully latched position, and with the housing broken away to
15 show internal details.

Fig. 14 is a view of an example of a compression latch mechanism usable with the
present invention, shown with its shaft fully extended, and with the housing broken away to
show internal details.

Fig. 15 is a view of an example of a compression latch mechanism usable with the
20 present invention, shown in the unlatched position, and with the housing broken away to
show internal details.

BEST MODE FOR CARRYING OUT THE INVENTION

Illustrated in the figures is an embodiment of a latch in accordance with the present invention. As will be described in more detail herein, the latch 10 illustrated in the present embodiment incorporates the aspects that the latch is of the compression type, includes
5 means for locking as well as includes means for low profile mounting and operation. As should be understood, however, a latch in accordance with the present invention can be provided in other configurations as well, for example, having fewer than all of the aspects noted above or having the same or similar aspects but in different combinations.
10 Notwithstanding, there are certain unique benefits and advantages in the configuration of the latch 10 in the illustrated embodiment, which will be described in detail in the following paragraphs. In accordance with the present embodiment, the latch 10, includes as portions thereof, a housing 12, a latch assembly 14 and a lock 16.

The housing 12 in this embodiment comprises a cup receptacle preferably of
15 pressed steel manufacture and having means for mounting the cup 12 to a closure member, such as a door, lid, panel, drawer, etc. The cup 12 is normally mounted in an aperture or cavity provided in the closure member. The cup 12 also includes means for mounting the latch assembly 14 and means for mounting the lock 16, which allow the latch assembly 14 and the lock 16 to be mounted to the cup 12. The means for mounting the cup
20 12 to a closure member in the present embodiment comprises at least one and preferably four mounting studs 18 secured to a rear wall of the cup 12, such as by welding. In the illustrated example the mounting studs 18 are in the form of cylindrical projections having threaded holes or bores for the engagement of well-known threaded fasteners used to secure the cup 12 to the closure member. As an alternative, the mounting studs may be
25 externally threaded and be engaged by nuts on the backside of the closure member to

secure the cup 12 to the closure member. More preferably, the hole pitch of the studs 18 are symmetrical, which allows the mounting of the latch 10 in the vertical and horizontal positions. In the illustrated example, the outside of the cup 12 is of a stylized, curved design which follows the shape of the concave inner surface of the cup 12. Referring to Fig. 5, a closure panel 200 prepared to receive the cup 12 can be seen. The closure panel 200 is prepared by having an aperture 202, sized to receive the cup 12, formed therein. The aperture 202 has flat sides for ease of manufacture. Four small holes 204 are provided about the aperture 202. The holes 204 register with the mounting studs 18 and allow fasteners to engage the mounting studs 18 for the purpose of securing the cup 12 to the closure member 200. The means for mounting the latch assembly 14 comprises an aperture 20 preferably corresponding in configuration to the outer boundary of a cross-section of the housing of the latch assembly 14. In the illustrated example, the aperture 20 generally has four flat sides joined by four arcuate sides, each arcuate side extending between a pair of flat sides. Similarly, the means for mounting lock 16 comprises an aperture 22 configured so as to receive lock 16. The aperture 22 is substantially circular with opposing square notches in the present embodiment.

Latch assembly 14 of the present embodiment is preferably of the type known as a compression latch. An example of a compression latch suitable for use as part of the present invention is described and claimed in U.S. Patent No. 4,583,775 ('775 Patent) referenced above and entitled "Latch Assembly Having Pull-Up Action", which is incorporated by reference herein. For the sake of brevity, the portions of latch assembly 14 corresponding to that set forth in the '775 patent will not be described in detail herein, and instead, the description will focus on the specific differences. The latch assembly 14 similar to the latch of the '775 Patent comprises a housing 30, a shaft 50 and latching means such as a latching pawl 70 mounted on the shaft 50.

The latching pawl 70 is movable rotationally by shaft 50 and is also moveable by shaft 50 axially in the longitudinal direction of the shaft. To latch a closure member to a frame member, such as a door frame, the latching pawl 70 is first rotated to a position such that it is in line with the frame member. The latching pawl 70 and the shaft 50 are then
5 moved longitudinally as a unit in order to bring the latching pawl 70 into engagement with the edge of the frame member. The shaft 50 is moved rotationally and also longitudinally by means of a rotatable actuator. In the present embodiment, the rotatable actuator comprises a handle 26, which is described in detail below. References to longitudinal movement and axial movement are used interchangeably herein and refer to the
10 translational movement of the latching pawl, or the translational movement of the shaft to which the latching pawl is attached, in a direction parallel to or coincident with the longitudinal axis of the shaft to which the latching pawl is attached. References to rotational movement or motion as used herein refer to the rotational movement of the latching pawl, or the rotational movement of the shaft to which the latching pawl is attached, with the axis
15 of rotation being coincident with the longitudinal axis of the shaft to which the latching pawl is attached.

The handle 26 in this embodiment is pivotally connected to the latch assembly 14 and preferably includes detent means to retain the handle 26 in defined positions through its range of pivotal motion. In the illustrated embodiment, the handle 26 is a T-handle and
20 includes a rectangular cavity 31 in its terminating end which is distal from the grasping portion of the T-handle 26. Opposing mounting holes 32 are provided on either side of the cavity 31 and extend through the walls of the cavity 31. The mounting holes 32 are in alignment with one another. An insert 33 preferably of resilient plastic is mounted in the rectangular cavity 31 of handle 26. The insert 33 is in the form of a hollow rectangular
25 parallelepiped that is open on at least one side, preferably open on three sides for added

flexibility, so as to form a rectangular cavity 34. A elongated rib 36 projects from the side of the insert 33 opposite the cavity 34. In this embodiment, biasing means preferably comprising an elastomer slug 35 is positioned within the rectangular cavity 34 of insert 33. The handle 26 is then pivotally connected to the cap or driver 46 of the latch assembly 14.

5 The latch assembly 14 includes a cap or driver 46 which is rotatably supported by the central bore of the housing 30 such that at least a portion of the driver 46 lies within the bore of the housing 30. Housing 30 is generally mushroom-shaped in this embodiment comprising an elongate body 38 having an outer surface preferably corresponding in shape to aperture 20 in cup 12 and a head 40 having a cavity 42 in its side wall 44. Driver 46 in

10 the present embodiment is preferably prevented from movement in the axial direction of shaft 50, such as by a retaining ring 48 received within grooves located in registered positions in driver 46 and housing 30. The end of the driver 46 distal from the head 40, is connected with a sleeve-like cam 206 in the manner shown in Figs. 13-15. A pair of notches 208 formed in the driver 46 receive ears 210 projecting axially outward from the

15 end of the sleeve-like cam 206 closest to the driver 46. The driver 46 has at its outward end a mounting hole 56 and at least one, and in this embodiment, two depressions 58, and with each depression 58 being generally radiused and at spaced separation, which is at approximately 90 degree separation in the present embodiment. The handle 26 is then pivotally coupled with the driver 46 by a conventional pivot pin 51 extending through the

20 opposing mounting holes 32 of handle 26 and mounting hole 56 of driver 46. Thus, when handle 26 is in an extended position and is rotated, the sleeve-like cam 206 is also rotated.

As set forth in the '775 Patent, the sleeve-like cam 206 within housing 30 is provided with at least one and, in the present embodiment, a pair of cam slots 212 spaced 180° apart circumferentially. Each of the slots runs in a direction which has both circumferential

25 and axial components. Further, preferably positioned coaxially between shaft 50 and the

sleeve-like cam is a fixed motion-control sleeve 214 having a pair of axial slots 216 and a pair of lateral or circumferential slots 218. In the present embodiment, one slot of each pair is spaced 180° from the other. The end of each axial slot 216, which is farthest from the head 40, connects with one end of a respective one of the circumferential slots 218 to form an L-shaped motion-control slot. The motion-control sleeve 214 is prevented from moving rotationally relative to housing 30, such as by a pair of ears 220 projecting from the end of the motion control-sleeve 214 farthest from the head 40, which are received in a pair of slots 222 in the second end 224 of the housing 30. The pair of L-shaped slots in the motion-control sleeve 214 function to permit rotational motion and axial motion of the shaft 50 in sequence.

As best illustrated in the figures, shaft 50 is an elongated shaft and projects out from the opening 226 through the second end 224 of the housing 30. The shaft 50 lies at least in part within the bore of the housing 30 and is supported such that the center axis of the shaft coincides with the center axis of the motion-control sleeve 214 and the sleeve-like cam 206. Alternatively, the sleeve-like cam 206 may be positioned intermediate the shaft 50 and the motion-control sleeve 214 without affecting the function of the latch assembly 14.

A portion of shaft 50 is threaded adjacent the end 54 of the shaft 50 which is located outside the housing 30. The threaded portion of shaft 50 has a pair of flats 228 provided on either side thereof. The threaded portion of the shaft 50 passes through a hole at one end of the pawl 70. The pawl 70 is prevented from axial movement relative to the shaft 50 by a pair of nuts 71 which are engaged to the threaded portion of the shaft 50. The nuts 71 allow the position of the pawl 70 along the shaft 50 to be axially adjustable. The nuts 71 may be tightened to grip the pawl 70 between the nuts 71 with sufficient frictional force such that the shaft 50 and the pawl 70 move as a unit. More preferably, the hole through

the pawl 70 has flat sides which match the flats 228 of the threaded portion of the shaft 50 such that greater torque can be applied to the pawl 70 without any relative rotational motion between the pawl 70 and the shaft 50. Retaining means comprising spaced apart nuts 68 and 69 are also included in this embodiment. Preferably, the nuts 68 and 69 are of the type
5 that is self-locking. The nuts 68 and 69 are secured on shaft 50 in spaced-apart relationship to one another. The nuts 68 and 69 interact with lock 16 in operation, as will be described below. Further, mounted on the shaft 50 is a cross-pin 230, which projects laterally in both directions from the shaft 50 and functions as both a cam follower and as a motion-control pin.

10 The end of shaft 50 closest to the driver 46, can further be provided with a center bore in which a coil compression spring is placed. In one embodiment, an end of the compression spring can bear against the driver 46. In this manner, the compression spring operates to bias shaft 50 toward projecting outward from the second end 224 of the housing 30. This biasing force maintains the ends of the cross pin 230 in close contact
15 with the sides of the cam slots farther from the driver 46. The biasing spring is desirable but not essential since even without the spring, the ends of the cross pin 230 would follow the cam slots. The cross pin 230 controls whether, in response to rotation of the driver 46, the shaft 50 and pawl 70 will move only axially or only rotationally. This is determined by whether the opposite ends of the cross pin are within the axial motion-control slots 216 or in
20 the lateral motion-control slots 218.

The lock 16 in this embodiment is a conventional cylinder lock having a key-operated lock plug or lock cylinder supported in a cylinder lock housing. The cylinder lock housing 236 is externally threaded and is mounted in the aperture 22 in cup 12. The cylinder lock housing 236 has external projections which fit into slots 238 of the aperture 22
25 and prevent relative rotation between the lock housing 236 and the cup 12. Lock 16 further

comprises means for engaging the latch assembly 14 comprising a lock pawl 72. In this embodiment, the lock pawl 72 is generally elongated and has a mounting hole 232 at one end and a U-shaped opening 234 proximate its opposite end. The lock pawl 72 is attached to the lock plug of the lock 16 such that the lock pawl 72 and the lock plug of the lock 16 rotate as a unit. The lock pawl 72 is fixed to the lock plug of the lock 16 using its mounting hole 232 and an appropriate fastener. As an example, a screw may be passed through the mounting hole and engaged to a threaded hole provided in fixed relationship to the lock plug of the lock 16. Tightening the screw would frictionally hold the lock pawl 72 in place such that the lock pawl rotates with the lock plug of the lock 16. Alternatively, a projection 240 integral with the lock plug of the lock 16 may pass through the mounting hole 232. The projection 240 may have an externally threaded portion for engagement by a nut, or the projection 240 may have a threaded hole for engagement by a screw. The nut or screw would then frictionally hold the lock pawl 72 in place such that the lock pawl rotates with the lock plug of the lock 16. As another example, the projection 240 may have a non-circular shape which matches the non-circular shape of an alternative form of the mounting hole 232, thus causing the lock pawl 72 and the lock plug of the lock 16 to rotate as a unit. A nut or screw 242 may then be used as previously described to keep the lock pawl 72 from falling away from the lock plug of the lock 16. The pawl 72 may be mounted to the lock plug of the lock 16 in any suitable way so as to fix the lock pawl for rotation with the lock plug of the lock 16 on operating the lock plug by an appropriate key.

Preferably, the lock plug of the lock 16 is operated by a conventional blade-type key. Alternatively, the lock plug may be operated by a binary key or other tool, such as a hex key or other similar tool not shown.

The operation of the latch when mounted to a closure member will now be described. The handle 26 can be rotated into a down position so that latch assembly 14

and handle 26 are both received within the cup 12. In this embodiment, the handle 26 is prevented from being folded down in all but the latched position of latch assembly 14, which is due to the position of the cavity 42 in the side wall 44 of the head 40 of housing 30. In this embodiment, the rib 36 of insert 32 is positioned in the first of the two depressions 58 of the driver 46 when handle 26 is in the down or retracted position. For operation of latch assembly 14, the handle 26 is pivoted to its open or extended position, which is approximately 90 degrees from the retracted position in this embodiment. In the present embodiment, the rib or boss 36 of insert 32 is positioned in the second of the depressions 58 when the T-handle 26 is in the extended position. The slug 35 acts as a spring biasing the rib 36 into engagement with the depressions 58 so as to provided a detent feature which holds the T-handle 26 in either the extended or retracted position. Assume for the moment that the lock plug of the lock 16 is in the unlocked position. Then the latch assembly 14 can be operated by rotation of handle 26. As the extended T-handle 26 is rotated to the unlatched position, the shaft 50 and the pawl 70 first move axially away from the keeper or frame member 244, and then the shaft 50 and the pawl 70 move rotationally to move the pawl 70 out of alignment with the frame member to thereby allow the closure member to be opened. The closure member can be latched after closing the closure member, by reversing the rotation of the T-handle 26. During the latching operation, the shaft 50 and the pawl 70 first move rotationally into alignment with the frame member, and then the shaft 50 and the pawl 70 move axially bringing the pawl 70 into engagement with the frame member. Once rotated to the latched position the T-handle 26 may be pivotally moved to the retracted position inside the cup 12, however, the lock 16 can only be accessed with a key with the T-handle 26 in the extended position. With the T-handle 26 in the retracted position inside the cup 12, the latch assembly 14 cannot be operated because

of the interference of the head 40 of the housing 30 and/or the walls of the cup 12 with the T-handle 26.

With the T-handle rotated to the latched position but with the T-handle extended, a user can use a key to rotate the lock plug of the lock 16 to the locked position. With the lock
5 plug of the lock 16 in the locked position, lock pawl 72 is positioned between the nuts 68 and 69 of the retaining means and the portion of the shaft 50 intermediate the nuts 68 and 69 is received in the U-shaped opening 234. Thus the nuts 68 and 69, in cooperation of the lock pawl 72, operate to prevent axial movement of the shaft 50 and consequently the rotation of the T-handle 26 out of its latched position. Thus an unauthorized user will not
10 be able to move the T-handle 26 to the unlatched position even after moving the T-handle to the extended position. When an authorized user rotates the lock plug of the lock 16 to the unlocked position using a key, the lock pawl 72 will move out from between the nuts 68 and 69 and the T-handle 26 can then be rotated to the unlatched position. As an alternative to the nuts 68 and 69, the shaft 50 may have a reduced diameter portion which
15 defines a groove for receiving the end of the lock pawl 72 having the U-shaped opening 234, or the shaft 50 may be provided with any type of abutments in spaced apart relationship so as to receive the end of the lock pawl 72 having the U-shaped opening 234. In addition, when the latch assembly 14 is of a type which operates by rotation only, the lock pawl 72 may operate by having the sides of the U-shaped opening 234 engage the
20 flats 228 of the shaft 50 which would prevent rotation of the shaft 50. This can be achieved by appropriately sizing the U-shaped opening 234. Further, having the sides of the U-shaped opening 234 engage the flats 228 of the shaft 50 can advantageously be used in combination with the nuts 68 and 69, or the other similar means enumerated above, in order to make it more difficult for an unauthorized user to defeat the latch 10 by over-
25 torquing the T-handle 26.

It will be recognized by those skilled in the art that changes may be made to the above-described embodiments of the invention without departing from the broad inventive concept thereof. For example, the latch assembly 14 can be of other designs, such as the compression latch disclosed in U.S. Patent N. 4,556,244. Also, the elements of the latch
5 can be provided in other configurations as well and/or at other positions. For example, lock 16 can provided on the handle 26. It is understood, therefore, that this invention is not limited to the particular embodiments disclosed, but it is intended to cover all modifications which are within the scope and spirit of the invention as defined by the appended claims.

CLAIMS

We claim:

1. A latch comprising:
5 a cup;
a latch assembly mounted to the cup and having a pivotal handle, the latch assembly being operable when the handle is in an extended position and inoperable when the handle is in a retracted position; and
a lock having a lock pawl selectively rotatable to engage the latch assembly in a
10 locked position to prevent operation of the latch.
2. A latch according to claim 1 wherein said handle is a T-handle.
3. A latch for use with a closure member and an associated frame member, the
15 latch comprising:
a housing adapted for installation to the closure member;
a latch assembly mounted to the housing and operable between a latched configuration and an unlatched configuration;
a lock mounted to said housing, said lock being selectively operable between a
20 locked and unlocked configuration; and
means for selectively retaining said latch assembly in said latched configuration when said lock is in said locked configuration.

4. A latch according to claim 3 wherein said lock is a cylinder lock and said means for selectively retaining said latch assembly in said latched configuration is a lock pawl attached to said lock, and said lock pawl is rotatable between a locked position and an unlocked position responsive to operation of said lock between said locked and
5 unlocked configurations.

5. A latch according to claim 4 wherein said lock pawl is engageable with said latch assembly when said lock pawl is in said locked position.

10 6. A latch according to claim 4 wherein said latch assembly includes a latching pawl movable between latched and unlatched configurations, and a shaft, said latching pawl being attached to said shaft and being movable responsive to movement of said shaft, and wherein said lock pawl has a U-shaped opening proximate an end thereof distal from said lock, and wherein a portion of said shaft is received within said U-shaped opening
15 when said lock pawl is in said locked position.

7. A latch according to claim 6, further comprising means engageable with said lock pawl for preventing movement of said shaft when said lock pawl is in said locked position.

20

8. A latch according to claim 7, wherein said means engageable with said lock pawl for preventing movement of said shaft comprises flats formed on either side of said shaft which engage said U-shaped opening when said lock pawl is in said locked position.

9. A latch according to claim 7, wherein said means engageable with said lock pawl for preventing movement of said shaft comprises at least one nut supported by said shaft and abutting said lock pawl when said lock pawl is in said locked position.

5 10. A latch according to claim 7, wherein said means engageable with said lock pawl for preventing movement of said shaft comprises a pair of nuts supported by said shaft in spaced-apart relationship, said pair of nuts being located on either side of said lock pawl when said lock pawl is in said locked position.

10 11. A latch according to claim 4 wherein said latch assembly includes a latching pawl movable between latched and unlatched configurations, and a shaft, said latching pawl being attached to said shaft and being movable responsive to movement of said shaft.

15 12. A latch according to claim 11, further comprising means engageable with said lock pawl for preventing movement of said shaft when said lock pawl is in said locked position.

20 13. A latch according to claim 12, wherein said means engageable with said lock pawl for preventing movement of said shaft comprises at least one nut supported by said shaft and abutting said lock pawl when said lock pawl is in said locked position.

25 14. A latch according to claim 12, wherein said means engageable with said lock pawl for preventing movement of said shaft comprises a pair of nuts supported by said shaft in spaced-apart relationship, said pair of nuts being located on either side of said lock pawl when said lock pawl is in said locked position.

15. A latch according to claim 10, wherein said housing is in the form of a cup, said latch assembly includes a driver which moves rotationally to move said latching pawl between said latched and unlatched positions, and the latch further comprises a T-handle
5 pivotally attached to said driver, said T-handle being pivotally movable between extended and retracted positions, and said T-handle being received within said cup when in said retracted position.

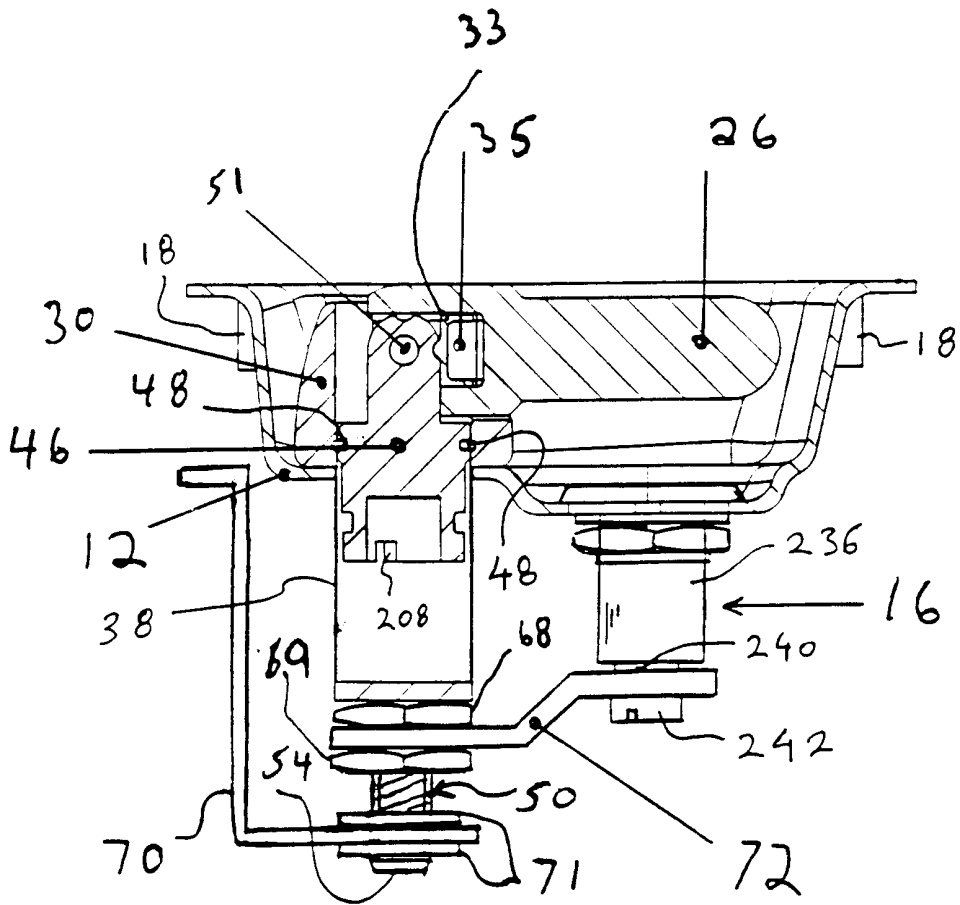
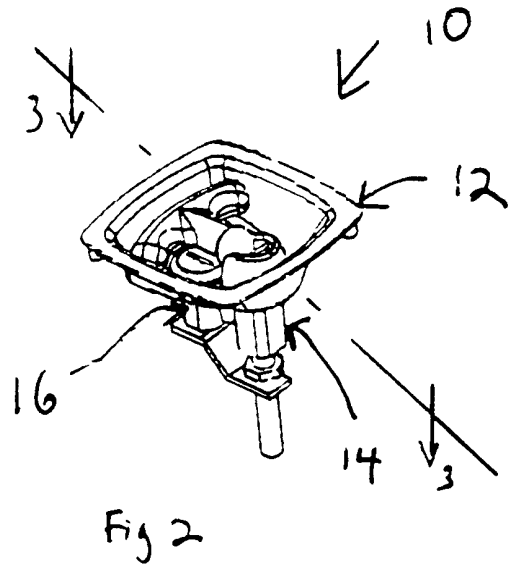
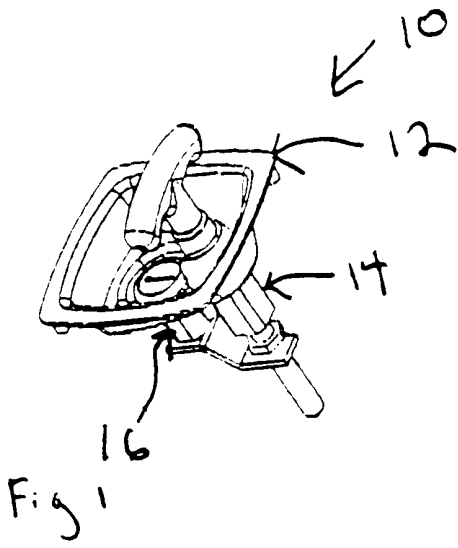


Fig 3

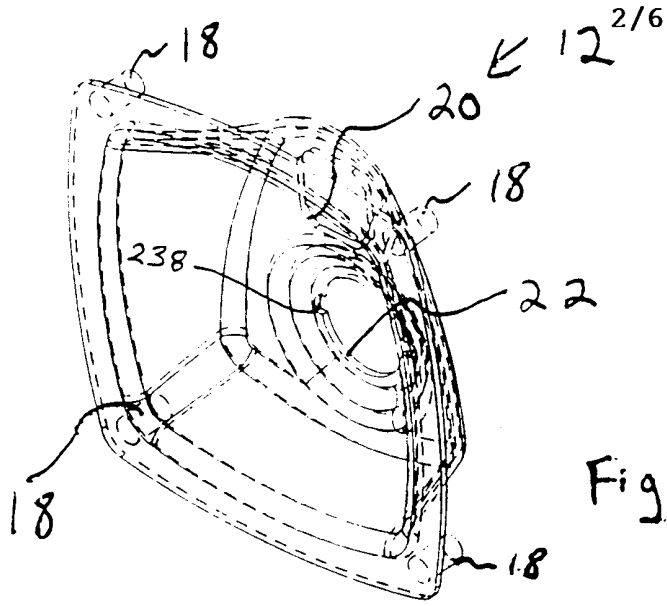


Fig 4

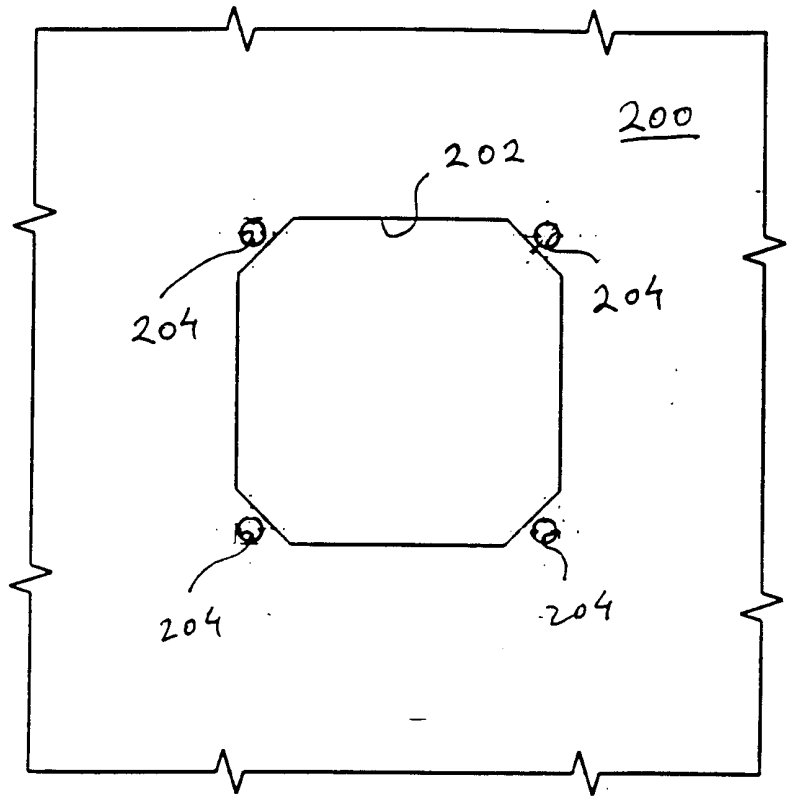


Fig 5

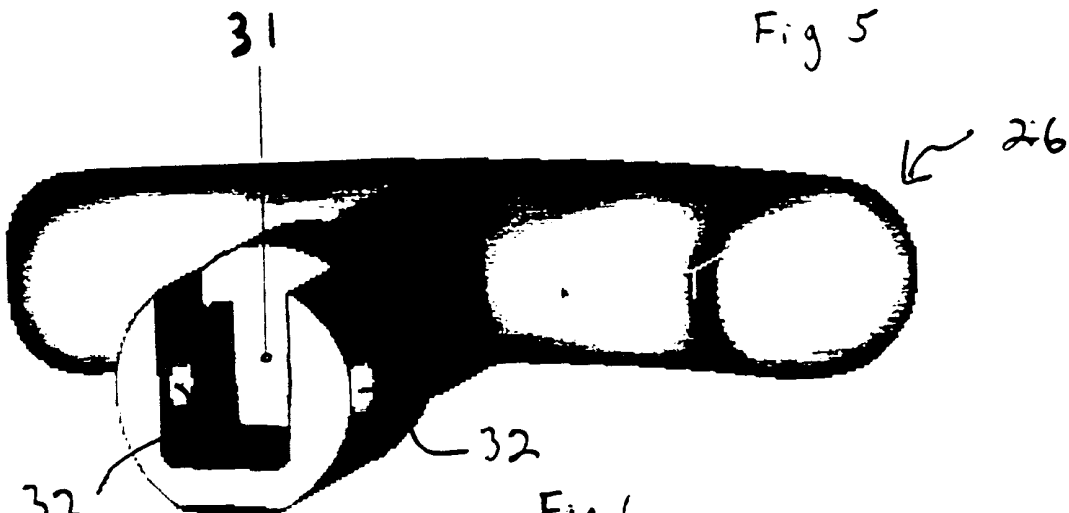
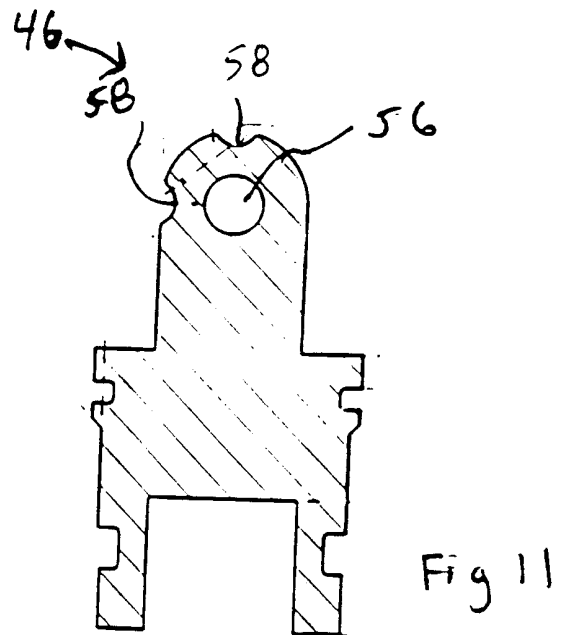
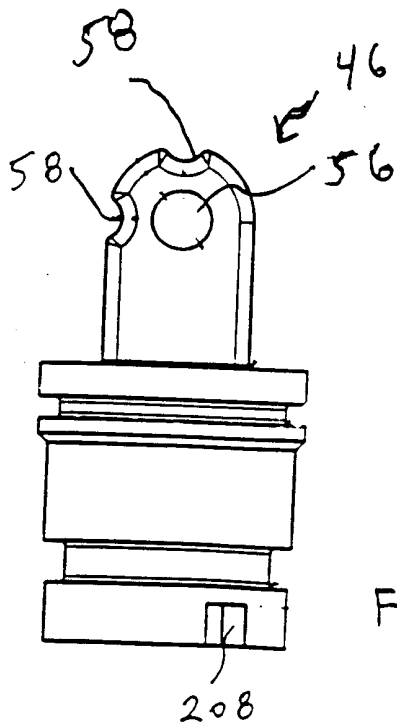
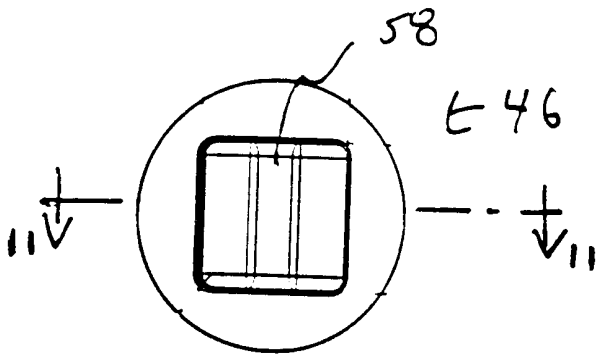
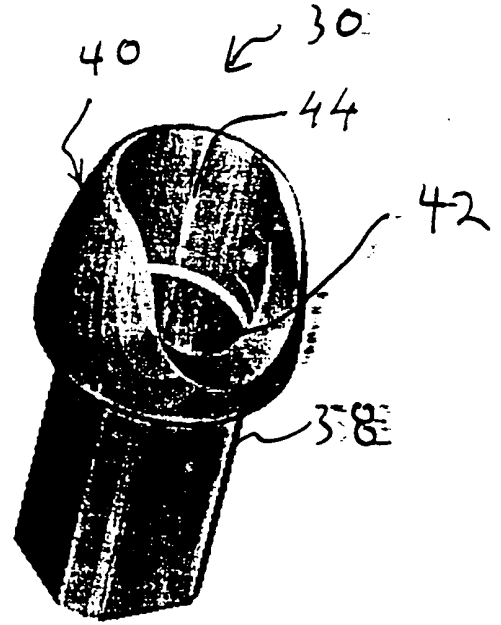
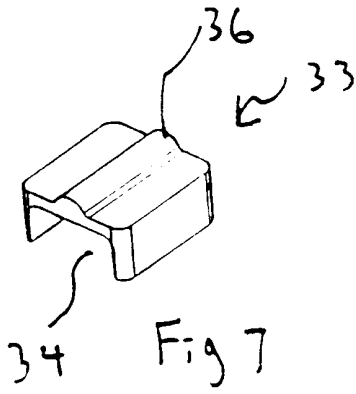
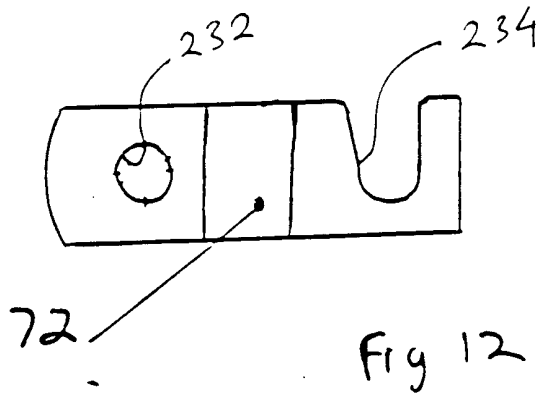
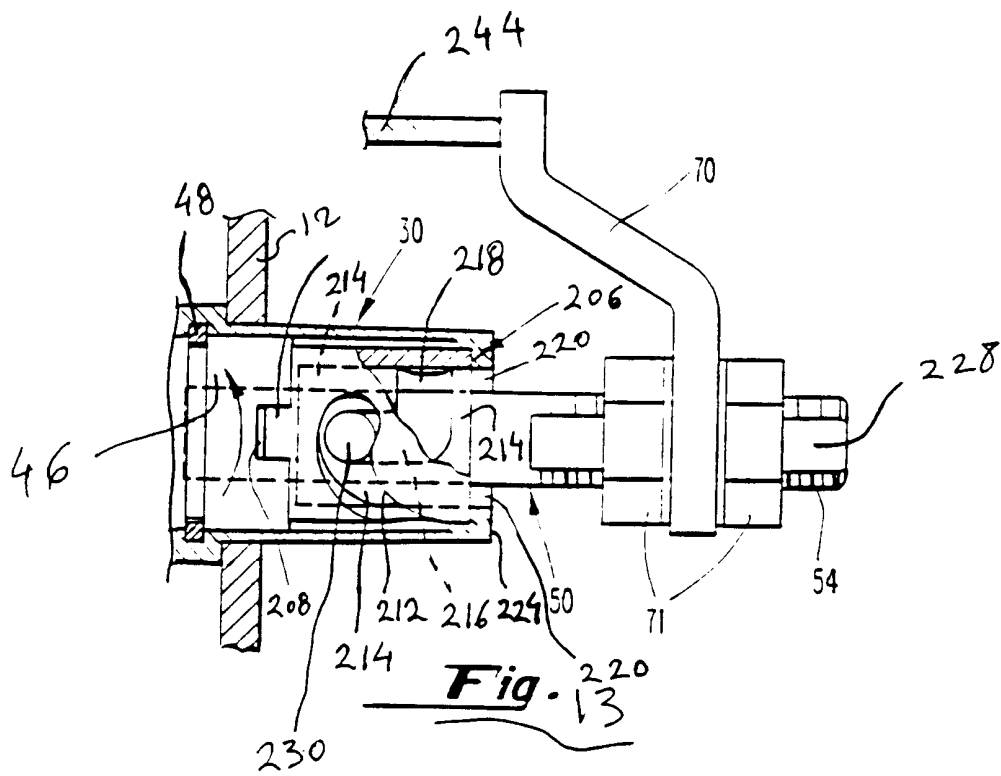
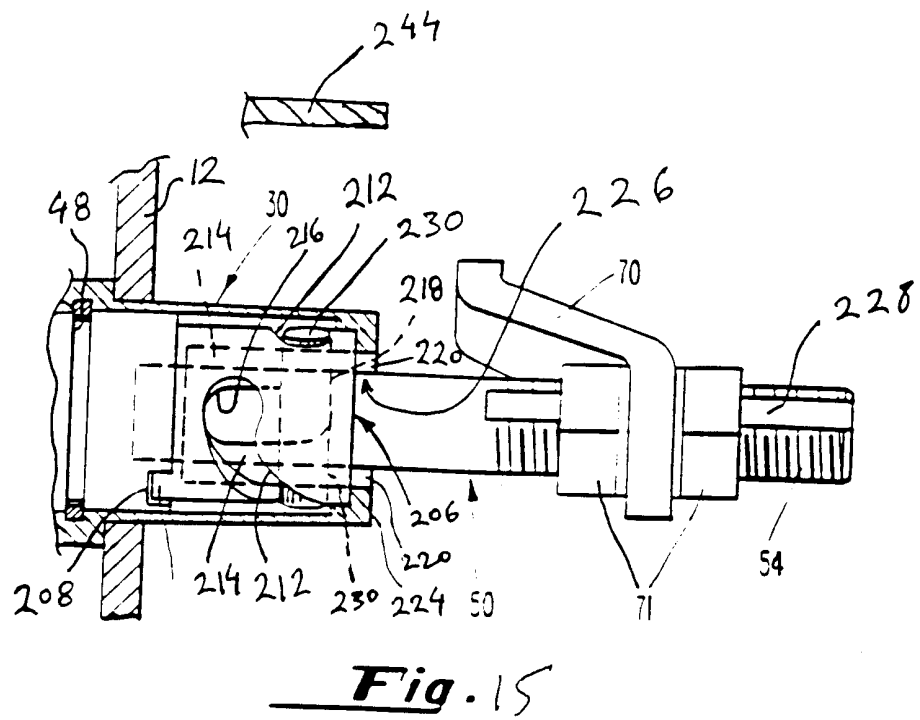
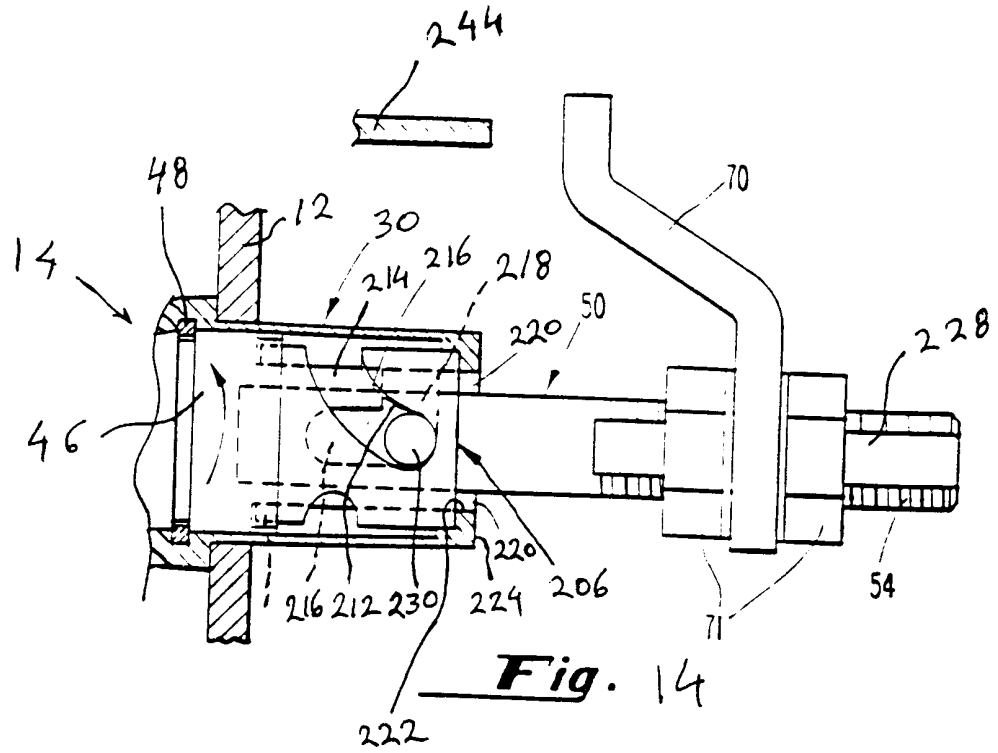


Fig 6









INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/16676

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :E05B 13/00

US CL :70/208,210

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 70/208,210

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ----- Y	DE 834816 A (QUANTE) 08 July 1949 (08/07/49), see figs. 1 and 11.	1-5,11,12 ----- 6-10,13-15
Y	US 4,898,408 A (HAUBER) 06 February 1990 (06/02/90), see fig. 7.	6-8
P, Y	US 5,987,942 A (ICHINOSE) 23 November 1999 (23/11/99), see fig. 5.	6,7
P, Y	US 5,913,908 A (CZIPRI) 22 June 1999 (22/06/99), see figs. 3 and 5.	9,10,13-15
Y	US 4,706,478 A (SWAN ET AL) 17 November 1987 (17/11/87), see fig. 2.	15

 Further documents are listed in the continuation of Box C.
 See patent family annex.

* Special categories of cited documents	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
A document defining the general state of the art which is not considered to be of particular relevance	*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
E earlier document published on or after the international filing date	*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*G* document member of the same patent family
O document referring to an oral disclosure, use, exhibition or other means	
P document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

01 AUGUST 2000

Date of mailing of the international search report

14 AUG 2000

Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231

Facsimile No. (703) 305-3230

Authorized officer

LLOYD A. GALL

Telephone No. (703) 308-0828