Sept. 21, 1971 G. DRACH, JR 3,606,776

LOCK ASSEMBLY

Filed April 17, 1970

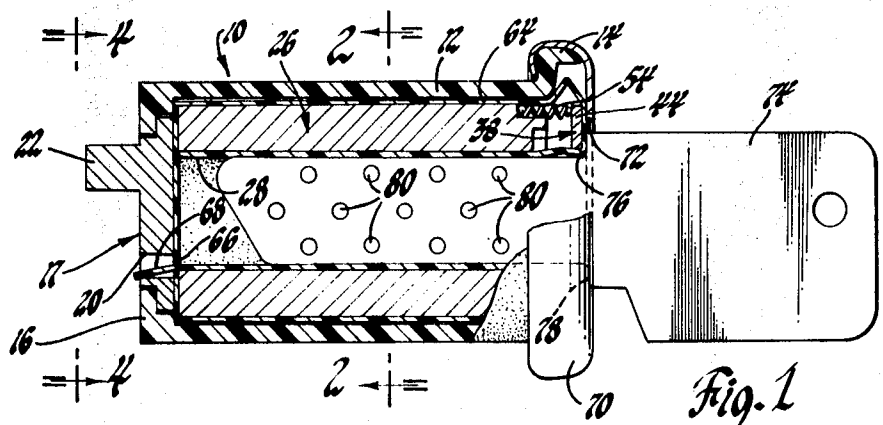


Fig. 1

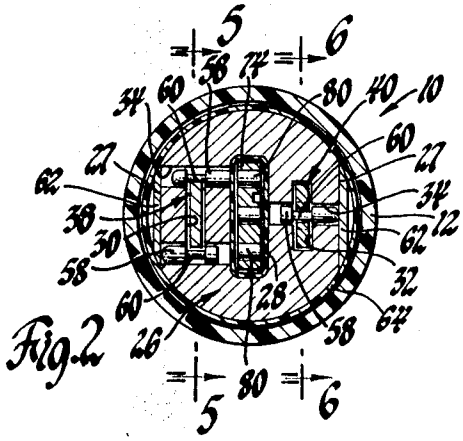


Fig. 2

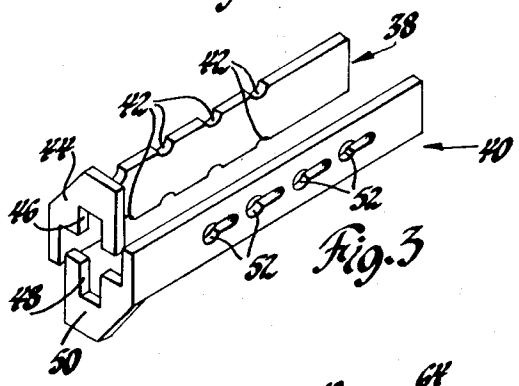


Fig. 3

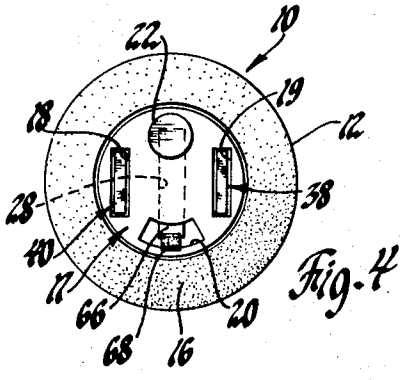


Fig. 4

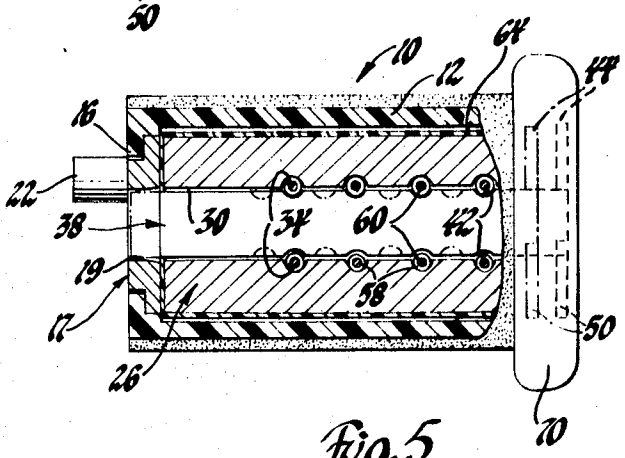


Fig. 5

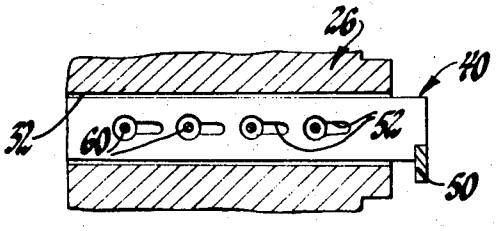


Fig. 6

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LOCK ASSEMBLY

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U.S. Cl. 70—276 4 Claims

ABSTRACT OF THE DISCLOSURE

A lock assembly secure against unauthorized manipulation and against the intrusion of foreign matter and moisture, the assembly including a generally cylindrical non-magnetically sensitive core having a key slot therein and slidably carrying a pair of non-magnetically sensitive locking bars and a plurality of magnetic tumblers operable to impede bodily shiftable movement of the locking bars. The core is enclosed in a magnetically pervious jacket fabricated from a moisture resistant material such as Teflon which jacket lines the key slot. A magnetically coded key is operable to bodily shift the tumblers to release the locking bars and is subsequently operable to bodily shift the locking bars into coupling engagement with an operating member so that the core and the operating member are unitarily rotatable.

This invention relates generally to lock assemblies and in particular to a magnetic type lock assembly including means for preventing moisture-initiated operating difficulties.

Lock assemblies, particularly ones adapted for use on automobile doors, are often subjected to rapidly changing climatic conditions and to abusive treatment and possibly to attempted unauthorized manipulation. The advent of modern automobile washing facilities using high powered jets of water has added new difficulties since moisture may be forced into the lock assembly which moisture, in winter, may freeze to prevent normal operation of the lock assembly. Prior art lock designs addressed to the moisture and foreign matter problem typically employ mechanical devices such as spring biased key slot covers. These mechanisms, because of their size, are expensive to manufacture and may be prone to operational failures when physically abused.

In a lock assembly according to this invention magnetically pervious jacket means are provided to seal the operating elements of the lock assembly and to sealingly line the key slot. The jacket means prevent moisture from penetrating the lock assembly to disturb the operation thereof yet permit operation of the sealed lock assembly by a magnetically coded key in the key slot.

The primary feature of this invention is that it provides an improved lock assembly, specifically of the magnetically actuated type, having jacket means therein operable to prevent jamming of the lock assembly by moisture and other types of foreign matter. Another feature of this invention is that it provides a magnetic type lock assembly including a lock cylinder, an operating member rotatably mounted on the lock cylinder and a jacketed core assembly rotatably mounted on the lock cylinder and magnetically operable to permit coupling of the jacketed core to the operating member for unitary rotation. Yet another feature of this invention resides in the provision of a core assembly including a core member having a key slot therein and carrying locking bars bodily shiftable by a key into coupling engagement with the operating member, the core member and locking bars being sealingly enclosed in magnetically pervious jacket means which also sealingly line the key slot. A still further feature of this invention resides in the provision of a

plurality of magnetic tumblers in the jacketed core member which tumblers normally impede movement of the locking bars but which are movable by a magnetically coded key in the key slot into positions permitting unimpeded bodily shiftable movement of the locking bars. These and other features of this invention will be readily apparent from the following specification and from the drawings wherein:

FIG. 1 is a partially broken away view of a lock assembly according to this invention;

FIG. 2 is a sectional view taken generally along the plane indicated by lines 2—2 in FIG. 1;

FIG. 3 is a perspective view of a pair of locking bars of a lock assembly according to this invention;

FIG. 4 is a view taken generally along the plane indicated by lines 4—4 in FIG. 1;

FIG. 5 is a sectional view taken generally along the plane indicated by lines 5—5 in FIG. 2; and

FIG. 6 is a fragmentary sectional view taken generally along the plane indicated by lines 6—6 in FIG. 2.

Referring now to FIGS. 1 and 2 of the drawings, a lock assembly according to this invention and generally designated **10** includes a lock cylinder **12** having an outwardly opening annular flange **14** at one end and an inwardly turned flange **16** at the other end. As best seen in FIGS. 1 and 4, a generally disc shaped operating member **17** is rotatably supported by the lock cylinder and is restrained against separation therefrom by flange **16**. The operating member **17** has a pair of rectangular apertures **18** and **19** and an arcuate aperture **20** therein and has an eccentrically located cam projection **22** extending generally perpendicularly thereto. In automotive applications, as on a vehicle door, lock cylinder **12** is rigidly secured to the outer door panel and cam projection **22** is connected by suitable linkage, not shown, to a typical door latch such that arcuate movement of the eccentric cam projection **22** in one direction about the axis of rotation of the operating member is operable to lock the door latch and in the other direction is operable to unlock the door latch.

A core assembly portion of the lock assembly **10** is rotatably supported in the lock cylinder **12**, as described hereinafter, and includes a generally cylindrical core member **26** fabricated from a non-magnetically sensitive material, such as brass, with an outer diameter slightly less than the inside diameter of lock cylinder **12** and having a pair of diametrically opposed milled surfaces or flats **27**, FIG. 2. As best seen in FIGS. 1 and 2, the core **26** has a generally rectangular key slot **28** therethrough extending parallel to flats **27** which key slot is flanked on opposite sides by a pair of parallel generally rectangular locking bar guide apertures **30** and **32**. A plurality of cylindrical tumbler bores **34** in the core **26** extend generally transversely of the latter and perpendicularly to the key slot **28** and to locking bar guide apertures **30** and **32** and interconnect the key slot and respective ones of the milled surfaces **27** while generally piercing the locking bar guide apertures.

Referring more particularly now to FIGS. 2 and 3, the locking bar guide apertures **30** and **32** slidably receive respective ones of a pair of locking bars **38** and **40** fabricated from a non-magnetically sensitive material such as brass. The locking bar **38** has a plurality of generally semicircular notches **42** in the upper and lower edges thereof and has a tab **44** at one end thereof extending generally perpendicularly thereto. The tab **44** has a generally rectangular downwardly opening groove **6** therein corresponding to a similar shaped upwardly opening groove **48** in a tab **50** integral with locking bar **40** and extending generally perpendicularly to the latter. Locking bar **40** has a plurality of generally key-hole shaped apertures **52** therein, FIG. 6.

Referring particularly to FIGS. 3, 5 and 6, the locking bar **38** is slidably received within guide aperture **30** with tab **44** thereon lying in generally parallel relationship to the upper portion of the front face of the core **26**. Similarly, locking bar **40** is slidably received in guide aperture **32** with tab **50** thereon lying in generally parallel relationship to the lower portion of the front face of the core. In the mounted positions of the locking bars on the core, the tabs **44** and **50** generally dove-tail to provide a flat surface wherein a rectangular aperture defined by grooves **46** and **48** overlies and is axially aligned with key slot **28** in the core **26**. A plurality of recesses are angularly spaced around the peripheral edge of the front surface of core **26** and have seated therein respective ones of a plurality of coil springs, such as indicated at **54** in FIG 1, which coil springs bear against the rear surfaces of respective ones of the tabs **44** and **50** of the locking bars **38** and **40** to bias the latter rightwardly.

As best seen in FIGS. 2 and 6 and in solid lines in FIG. 5, in predetermined axial positions of the locking bars **38** and **40**, the notches **42** in the former and large diameter portions of apertures **52** in the latter register with respective ones of the tumbler bores **34** in the core **26**. Each of the bores **34** slidably receives a permanent magnet cylindrical lock tumbler **58** having a reduced diameter portion **60**. With the notches **42** and apertures **52** in register with corresponding ones of the bores **34**, the tumblers **58** are freely bodily shiftable within the bores **34** and across the locking bar guide apertures **30** and **32** between locking positions, not shown, wherein the large diameter portion of the tumbler lies directly within the corresponding one of the locking bar guide apertures and unlocking positions, FIGS. 2, 5 and 6, wherein the reduced diameter portion **60** of the tumbler registers to lie over or within the corresponding one of the locking bar guide apertures.

When the locking bars **38** and **40** assume the aforementoined predetermined axial positions relative to the core and a plurality of the tumblers **58** assume the aforementioned locking positions, attempted bodily shiftable movement of locking bar **38** initiates interference between the sides of the notches **42** and respective ones of the tumblers while attempted bodily shiftable movement of the locking bar **40** initiates interference between the narrow portions of apertures **52** and respective ones of the tumblers. The locking bars are thus restrained against bodily shiftable movement. In the unlocking positions of the tumblers, the reduced diameter portions **60** of the tumblers generally overlie the edges of locking bar **38** so that bodily shiftable movement of the locking bar **38** is substantially unimpeded and are generally aligned with the narrow portions of apertures **52** in locking bar **40** so that bodily shiftable movement of the latter is permitted subject to the limitation imposed by the lengths of the narrow portions of the apertures **52**.

As best seen in FIG. 2, a pair of magnetically sensitive metallic plates **62** are fixedly secured to the core **26** on the milled surfaces **27** thereof by conventional means, not shown, and close the outboard ends of tumbler bores **34**. The core **26** with the locking bars **38** and **40** thereon, the tumblers **58** therein, the metallic plates **62** thereon, and the springs **54** thereon, is sealingly enclosed in a magnetically pervious flexible jacket **64** fabricated from a conventional moisture resistant and low friction material such as Teflon. As best seen in FIG. 5, the portion of jacket **64** covering the rear surface of the core is perforated adjacent the locking bar guide apertures **30** and **32** so that leftward bodily shiftable movement, FIGS. 5 and 6, of the locking bars **38** and **40** is substantially unimpeded by the jacket **64**. The jacket **64** also lines the interior of the key slot **28** and closes the rear edge thereof except for a drain opening **66** having a lip **68**, FIG. 1.

The jacketed core assembly is rotatably supported within the lock cylinder with the core generally abutting operating member **17** and lip **68** projecting outwardly through arcuate aperture **20** in the operating member. As best seen in FIG. 1, a cap **70** having a central circular aperture **72** therein is received over outwardly opening annular flange **14** of the lock cylinder **12**. The cap **70** is secured to the lock cylinder through crimping of the marginal edge of the former over the annular flange **14** and in the secured position functions to retain the core assembly in the lock cylinder and to normally slightly compress the springs **54** and flex the jacket **64**, FIG. 1. By compressing the springs **54**, the tabs **44** and **50** of the locking bars **38** and **40**, respectively, are normally maintained in abutting relationship against the inside surface of the cap **70** and the axial positions of the locking bars thus defined are the aforementioned positions wherein the notches **42** and apertures **52** register with corresponding ones of the bores **34** in the core **26**. As shown in solid lines in FIG. 5, a further characteristic of the axial positions thus defined is that the distal ends of the locking bars **38** and **40** lie in substantially coplanar relationship with the rear surface of the core so as not to contact operating member **18**. The jacketed core assembly is rotatable within the lock cylinder and behind the collar **70** relative to the operating member **17** and the lip **68** traverses an arcuate path corresponding to arcuate aperture **20** in the operating member. When the locking bars are locked as described, rotation of the jacketed core **26** merely results in freewheeling rotation of the core and the locking bars as a unit relative to the operating member so that the latter remains inoperative.

Referring more particularly now to FIGS. 1 and 2, the lock assembly is operated by inserting a key **74** into the lined key slot **28** in the core until respective ones of a pair of shoulders **76** and **78** thereon abut tabs **44** and **50** of the locking bars **38** and **40**, respectively. A plurality of permanent magnet slugs **80** are predeterminedly located on the key **74** to register with respective ones of the bores **34** in the core when the shoulders **76** and **78** just abut tabs **44** and **50**. The polar orientation of a plurality of the permanent magnet slugs **80** is predetermined to initiate bodily shiftable movement of a plurality of magnetic tumblers **58** toward the unlocking positions, FIG. 2. As best seen in FIG. 2, the polar orientation of several of the magnet slugs **80** are predetermined to prevent bodily shiftable movement of the corresponding tumblers. These particular tumblers continue to be magnetically attracted to metallic plates **62** and when abutting thereagainst permit unimpeded bodily shiftable movement of the locking bars. Should unauthorized manipulation be attempted, or by inserting a thin bar magnet into the key slot, some of the tumblers will be shifted to unlocking positions while the aforementioned particular tumblers will simultaneously be drawn away from the metallic plates **62** toward the lined key slot and into locking positions impeding bodily shiftable movement of the locking bars.

When the locking bars are unlocked, the shoulders **76** and **78** of the key **74** are operable under leftward bodily shiftable movement, FIG. 1, and through engagement on the tabs **44** and **50** to bodily shift the locking bars **38** and **40** into coupling engagement with apertures **19** and **18** in the operating member **17** as shown in broken lines in FIG. 5. With the key **74** held in the aforementioned leftwardly shifted position, rotation thereof and of the core **26** is accompanied by unitary rotation of the operating member **17** thus causing the cam projection **22** to traverse the aforementioned arcuate path and lock or unlock the door latch. Simultaneously with bodily shiftable movement of the locking bars **38** and **40** and the key **74**, the springs **54** are compressed and the jacket **64** is flexed. After the desired latch actuation has taken place, the key **74** is released and springs **54** bodily shift the locking bars **38** and **40** rightwardly, FIGS. 5 and 6, until tabs **44** and **50** abut the inside face of cap **70**. When the key **74** is removed from the key slot, those permanent magnet tumblers **58** bodily shifted to unlocking positions by magnet slugs **80** are again magnetically attracted toward re-

spective ones of the metallic plates **62** and into locking positions. The jacketed core assembly is then once again freely rotatable relative to the operating member **17**.

It will be apparent from the foregoing description that when the key **74** is removed from the lined key slot **28** the tumblers return to the locking positions and there is presented exteriorly of the lock assembly on the key entry side thereof only the fully lined key slot. Therefore, should moisture or other foreign matter be directed toward the entry side of the lock assembly, such moisture or foreign matter cannot find its way into the locking bar guide apertures **30** and **32** or the tumbler bores **34** to jam operation of the locking bars or tumblers. Should such moisture or foreign matter become lodged within the lined key slot **28**, insertion of key **74** therein merely forces such material through the drain opening **66** at the rear edge of the key slot and over lip **68** into the interior of the door wherefrom it is drained away.

Having thus described the invention what is claimed is:

1. A magnetic lock assembly comprising in combination, a lock cylinder, operating means mounted on said lock cylinder for movement relative thereto, a non-magnetically sensitive core member having a key slot therein, said core member being located within said lock cylinder for rotation relative thereto, coupling means on said core member movable relative to said core between an uncoupling position remote from said operating means and a coupling position in engagement with said operating means, said operating means with said coupling means in said coupling position being movable as a unit with said core member, magnetically sensitive locking means on said core member, said locking means being operable in a locking position thereof to impede movement of said coupling means and in an unlocking position thereof to permit unimpeded movement of said coupling means, magnetically pervious and moisture resistant jacket means sealingly enclosing said core member and said coupling means and said locking means and lining said key slot to prevent moisture penetration into said locking means and said coupling means, key means insertable into said core member within said lined key slot thereof and being operable upon insertion to rotate said jacketed core member relative to said lock cylinder, and magnet means on said key means operable with said key means in said lined key slot and through said magnetically pervious jacket means to move said locking means from said locking to said unlocking position, said key means thereafter being operable to move said coupling means from said uncoupling to said coupling position.

2. A magnetic lock assembly comprising in combination, a lock cylinder, operating means mounted on said lock cylinder for movement relative thereto, a non-magnetically sensitive core member having a key slot and a locking bar guide aperture therein, said core member being located within said lock cylinder for rotation relative thereto, a non-magnetically sensitive locking bar, said locking bar being received within said locking bar guide aperture for bodily shiftable movement relative to said core member and said operating member between an uncoupling position remote from the latter and a coupling position in engagement therewith, said operating member with said locking bar in said coupling position being movable as a unit with said core member, a plurality of magnetically sensitive tumblers, means mounting tumblers on said core member for movement between locking positions impeding bodily shiftable movement of said locking bar and an unlocking position permitting bodily shiftable movement of said locking bar, magnetically pervious and moisture resistant jacket means sealingly enclosing said core member and said locking bar and said tumblers and lining said key slot in said core member to prevent penetration of moisture to said locking bars and said tumblers, key means insertable into said core member within said lined key slot thereof and being operable upon insertion to rotate said jacketed core member relative to said lock cylinder, and magnet means on said key means operable with said key means in said lined key slot and through said magnetically pervious jacket means to move said tumblers from said locking to said unlocking positions, said key means thereafter being operable to bodily shift said locking bar from said uncoupling to said coupling position.

3. A magnetic lock assembly as recited in claim **2** further including means on said jacketed core member operable to bias said tumblers toward said locking positions, and resilient means on said jacketed core member operable to bias said locking bar toward said uncoupling position.

4. A magnetic lock assembly comprising in combination, a lock cylinder, operating means mounted on said lock cylinder for rotation relative thereto, a non-magnetically sensitive core member having a longitudinal key slot and a pair of longitudinal locking bar guide apertures therein and a plurality of transverse tumbler bores communicating between said key slot and respective ones of said guide apertures, said core member being located within said lock cylinder for rotation relative thereto, a pair of non-magnetically sensitive locking bars, respective ones of said locking bars being received within respective ones of said locking bar guide apertures for bodily shiftable movement relative to said core member and said operating member between uncoupling positions remote from the latter and coupling positions in engagement therewith, said operating member with said locking bars in said coupling positions being rotatable as a unit with said core member, spring means between said core and respective ones of said locking bars operable to resiliently bias said locking bars toward said uncoupling positions, a plurality of magnetized tumblers, each of said tumblers being received within a respective one of said tumbler bores for bodily shiftable movement between a locking position impeding bodily shiftable movement of said locking bars and an unlocking position permitting bodily shiftable movement of said locking bars, a pair of magnetically sensitive plate members, means mounting each of said plate members on said core member in communication with respective ones of said tumbler bores, said tumblers normally being magnetically attracted toward plate members and being normally located thereby in said locking positions, a magnetically pervious and moisture resistant jacket sealingly enclosing said core member and said locking bars and said tumblers and said plate members and lining said key slot to prevent moisture penetration into the lock assembly, a key insertable into said core within said lined key slot thereof and being operable upon insertion to rotate said core, and magnet means on said key operable with said key in said lined key slot and through said magnetically pervious jacket to bodily shift said tumblers from said locking to said unlocking positions, said key thereafter being operable to bodily shift said locking bars from said uncoupling to said coupling positions.

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ALBERT G. CRAIG, JR., Primary Examiner

U.S. Cl. X.R.

70—223, 364A