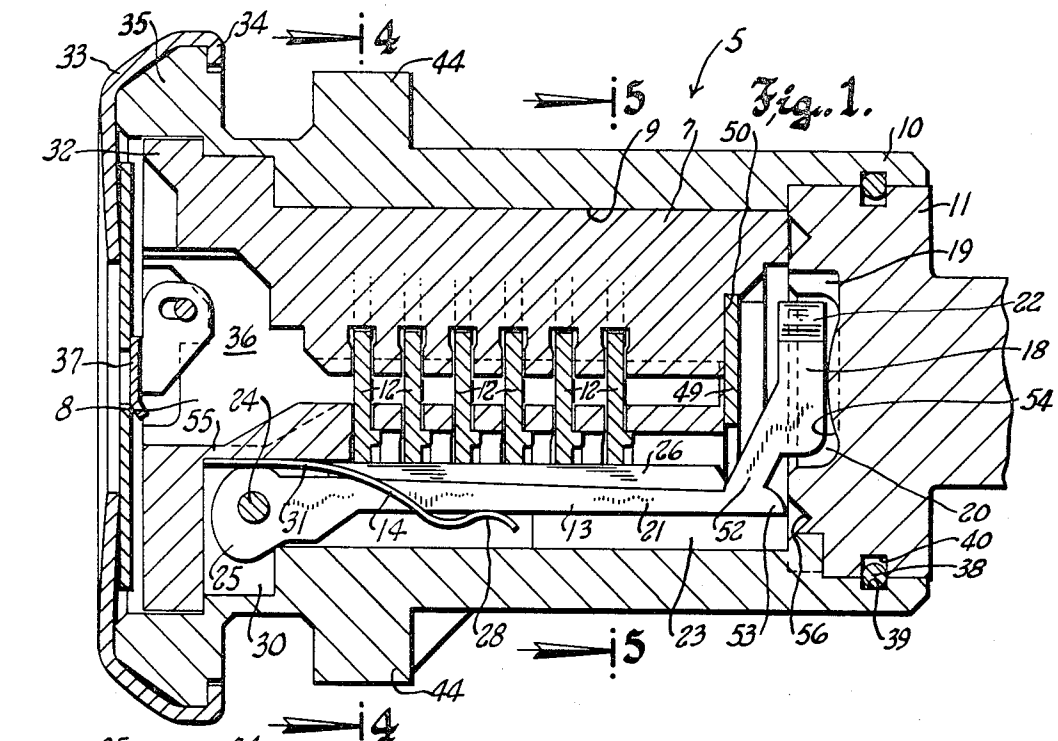
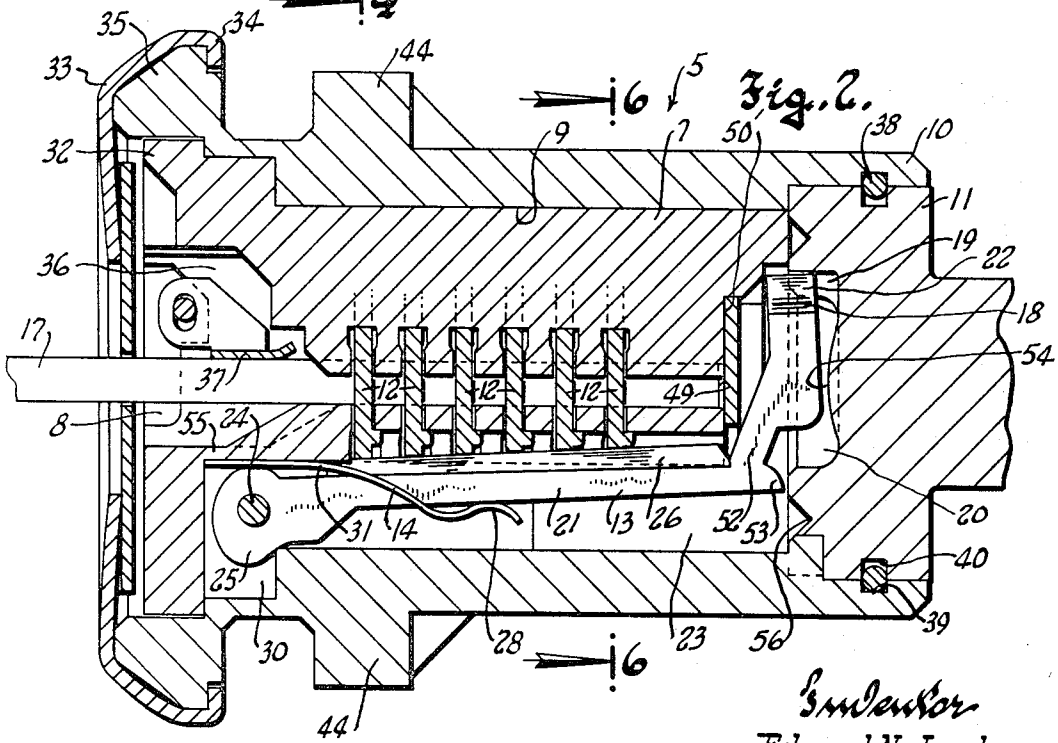
Nov. 12, 1968 E. N. JACOBI 3,410,123

DISCONNECTING SIDE BAR LOCK

Filed Sept. 12, 1966 5 Sheets-Sheet 1





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DISCONNECTING SIDE BAR LOCK

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Fig. 3.

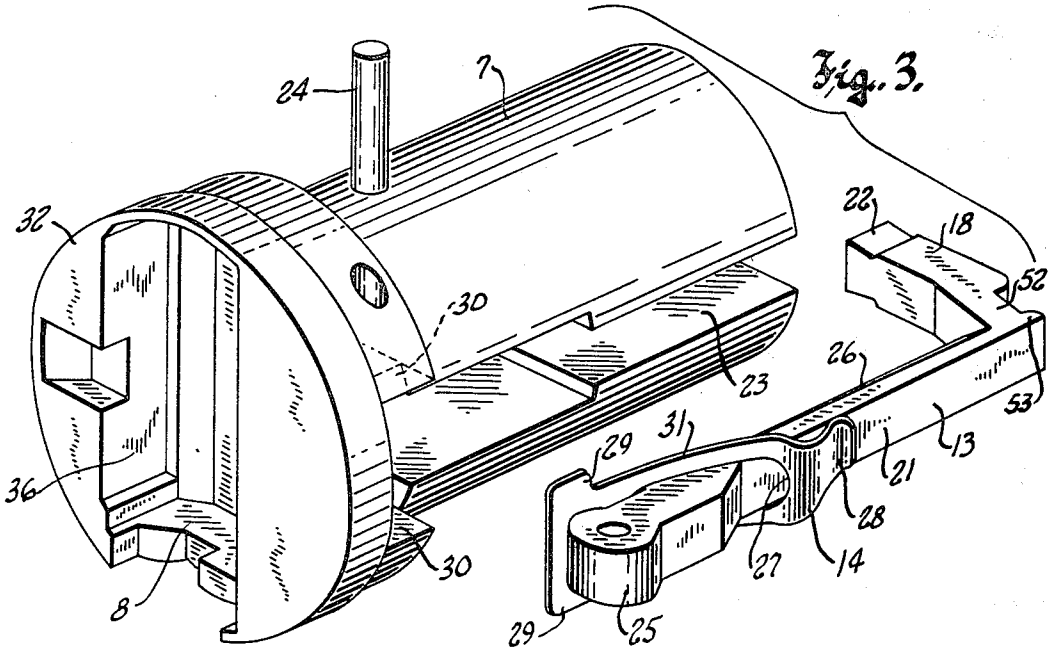
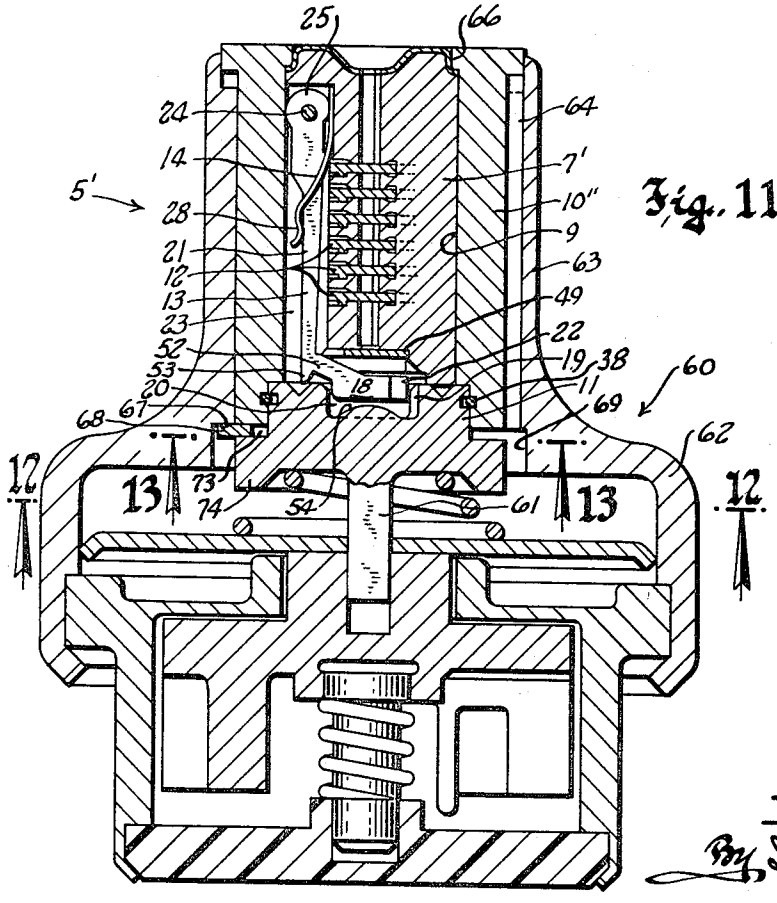


Fig. 11.



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DISCONNECTING SIDE BAR LOCK

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Fig. 4.

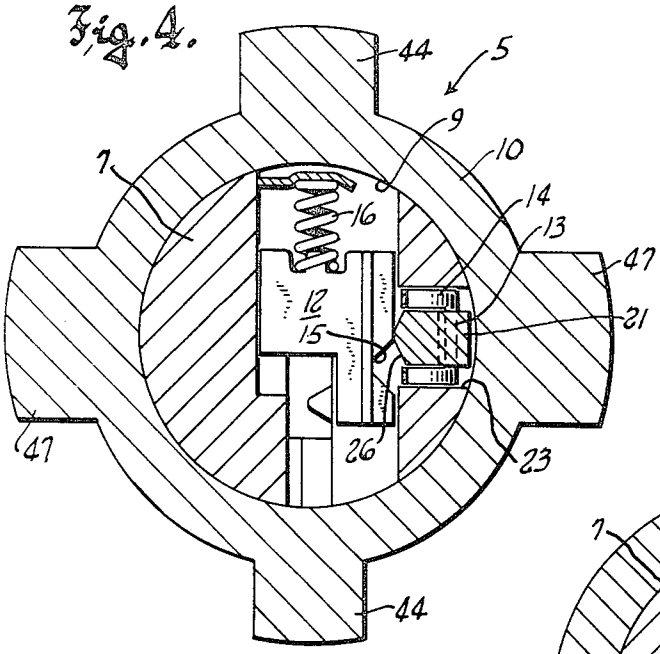


Fig. 5.

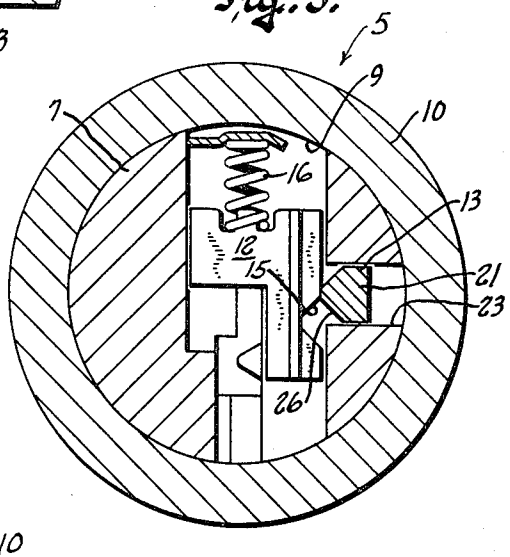
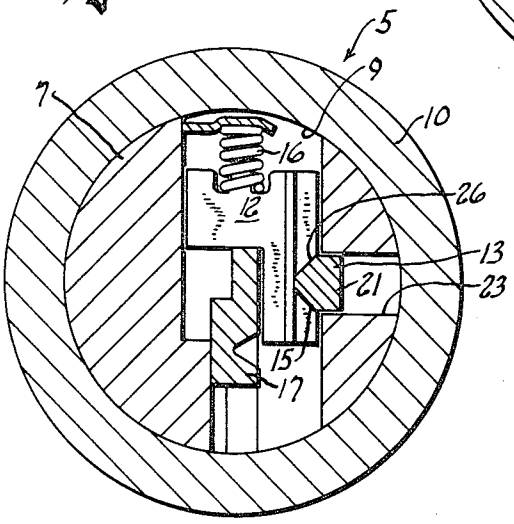


Fig. 6.



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DISCONNECTING SIDE BAR LOCK

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Fig. 7.

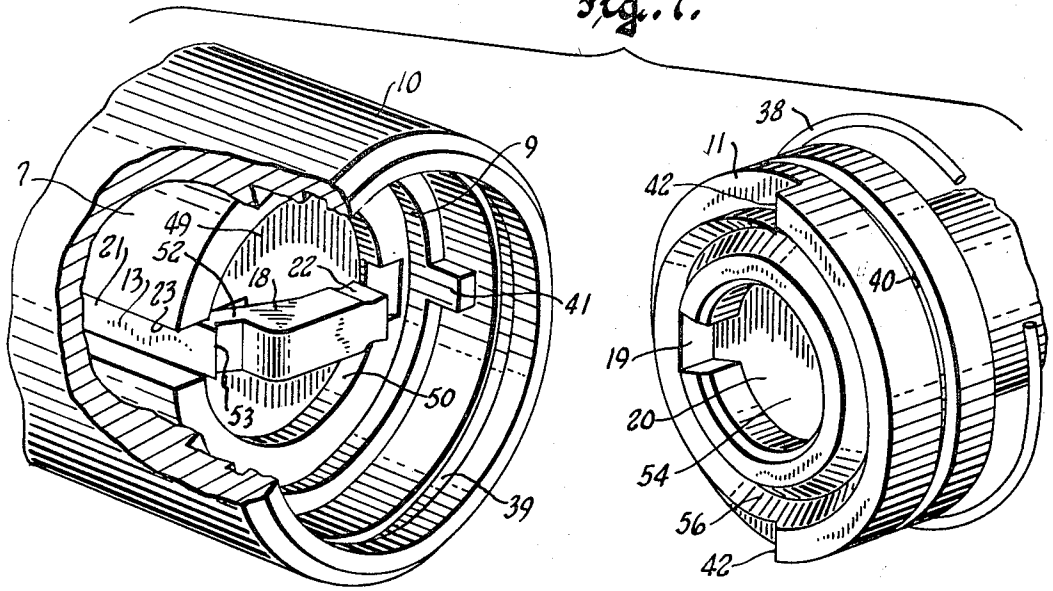


Fig. 9.

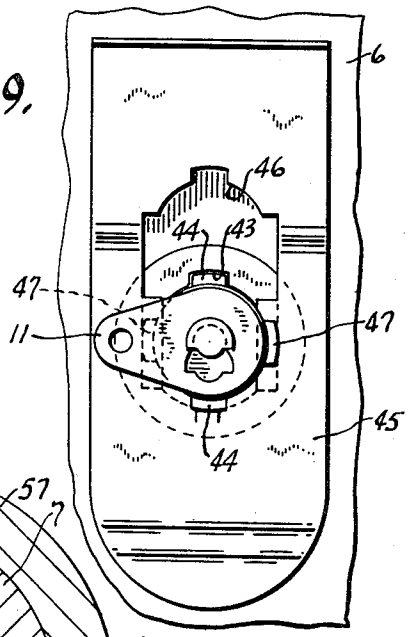


Fig. 8.

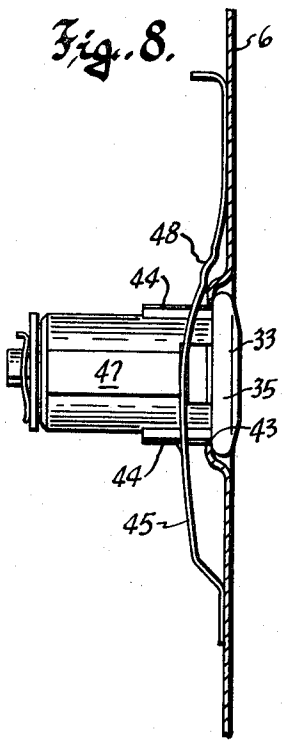
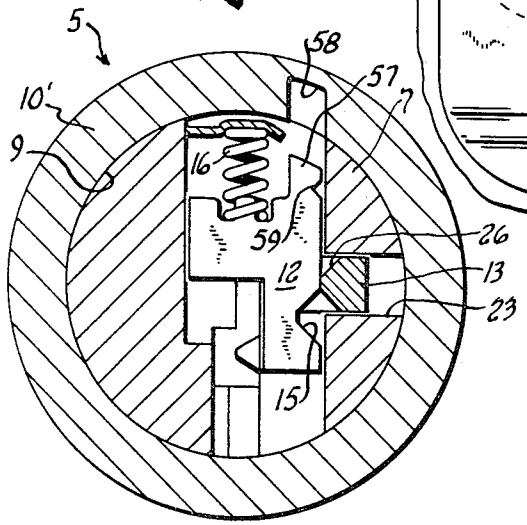


Fig. 10.



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DISCONNECTING SIDE BAR LOCK

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Fig. 13.

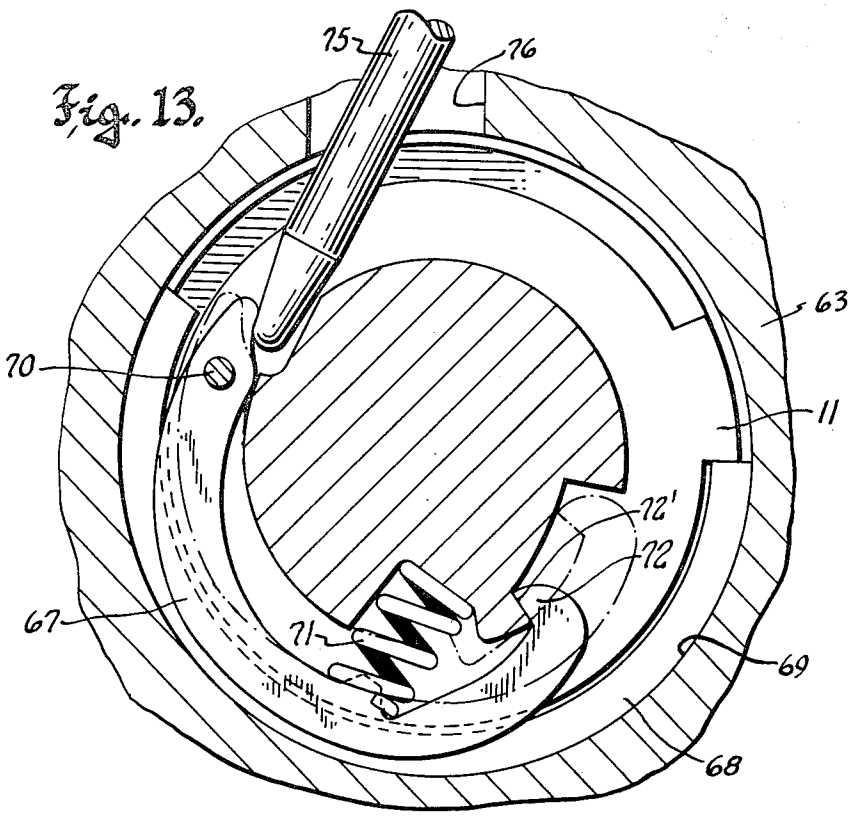
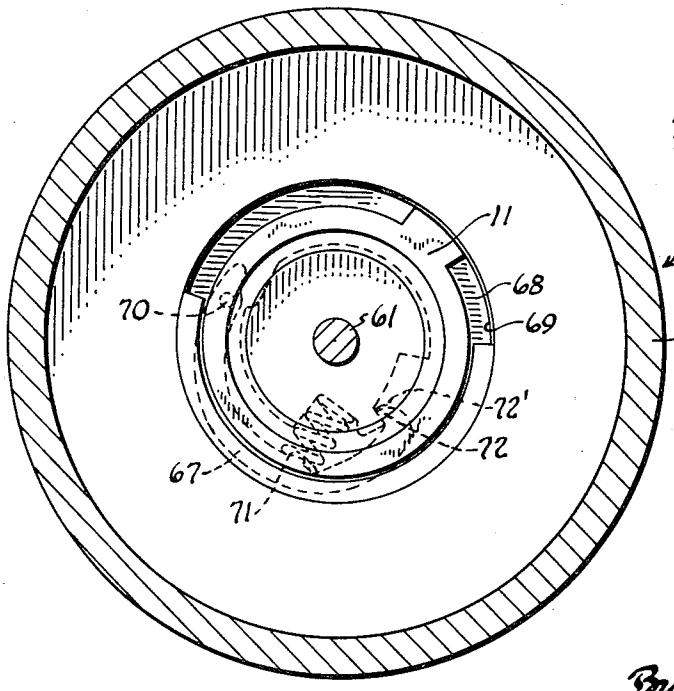


Fig. 12.



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United States Patent Office 3,410,123
Patented Nov. 12, 1968

3,410,123

DISCONNECTING SIDE BAR LOCK

Edward N. Jacobi, Milwaukee, Wis., assignor to Briggs & Stratton Corporation, Milwaukee, Wis., a corporation of Delaware

Filed Sept. 12, 1966, Ser. No. 578,629
14 Claims. (Cl. 70—364)

This invention relates to so-called disconnecting locks wherein a lock cylinder having a key receiving aperture is drivingly connectable with a coaxially rotatable driven member in consequence of insertion of a proper key into the key receiving aperture and establishment of the cylinder in a predetermined position of rotation relative to the driven member, but wherein the cylinder is otherwise freely rotatable.

A disconnecting lock is desirable in many installations because it is not readily defeated by certain types of forceful attack. For example, the conventional lock having a cylinder which is normally held in a locked position by tumblers can sometimes be forced by inserting a screw driver or the like into the key aperture of the cylinder and applying sufficient torque to shear the tumblers; but unless the proper key is engaged in the cylinder of a disconnecting lock, the cylinder turns freely without harm to the mechanism.

The general object of the present invention is to provide a disconnecting lock of a novel type having a number of important advantages, among the foremost of which are a high degree of security and relatively low cost.

More specifically, it is an objective of this invention to provide a disconnecting side bar lock having a cylinder which is normally freely rotatable and having a side bar which is carried by the cylinder for rotation therewith and for substantially radial in and out motion relative thereto, and wherein insertion of a proper key into the cylinder permits the side bar to move radially inwardly in response to bias thereon so that in a predetermined rotational position of the cylinder relative to a coaxially rotatable driven member therebehind, the side bar can drivingly engage the driven member and couple it to the cylinder.

Another specific object of this invention is to provide a disconnecting type lock of the character described having a cylinder rotatable in a fixed sleeve or casing and in which it is not necessary that there be a close or accurate fit between the cylinder and the sleeve.

A further specific object of this invention is to provide a side bar lock wherein the side bar is pivotally connected to the cylinder for rotation therewith and for substantially radial in and out swinging motion relative to the cylinder, and wherein the side bar is biased radially inwardly relative to the cylinder by means of a very simple and inexpensive leaf spring which is held in place by its engagement with the cylinder and the side bar, so that the cylinder with its tumblers, the side bar, and the side bar spring comprise a unitary subassembly.

It is also a specific object of this invention to provide a side bar type of disconnecting lock wherein the side bar has a lateral projection which extends across the rear of the cylinder to provide a driving connection between the cylinder and a coaxially rotatable driven member therebehind, which connection is operative when a proper key is received in the cylinder and the cylinder is in a predetermined rotational position relative to the driven member.

Another of the specific objects of this invention resides in the provision of a disconnecting side bar lock of the character described which is sufficiently compact to be suitable for automotive door and rear deck applications, which can readily accommodate a weather seal or dust cover in such installations, and which can be mounted with its cylinder flush with a panel surface, or even recessed slightly therebeneath, so that no portion of the lock projects forwardly of the panel to be readily gripped and pulled forwardly out of its mounting.

It is a further specific object of this invention to provide a disconnecting side bar lock of the character described which is so arranged that attempts to defeat the lock by force are most likely to disable it from providing a driving connection between the cylinder and the member intended to be driven thereby, so that the lock tends to fail safe when broken or forced.

Still another specific object of this invention is to provide a side bar type of disconnecting lock which by simple modification can be made either with a cylinder having no defined key receiving and withdrawing position, or with a cylinder which must be brought to a predetermined rotational position to permit insertion or withdrawal of a key.

With the above and other objects in view which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes may be made in the precise embodiments of the herein discolsed invention as come within the scope of the claims.

The accompanying drawings illustrate several complete examples of physical embodiments of the invention constructed according to the best modes so far devised for the practical application of the principles thereof, and in which:

FIGURE 1 is a longitudinal sectional view of a lock mechanism embodying the principles of this invention, shown in its normal condition with its key removed;

FIGURE 2 is a view similar to FIGURE 1 but illustrating the lock mechanism with its key in place and its cylinder drivingly connected with its driven member;

FIGURE 3 is a separated perspective view of the lock cylinder, side bar and side bar spring of the mechanism of this invention, the cylinder being illustrated somewhat schematically without showing the tumblers;

FIGURE 4 is a cross-sectional view taken on the plane of the line 4—4 in FIGURE 1;

FIGURE 5 is a cross-sectional view taken on the plane of the line 5—5 in FIGURE 1;

FIGURE 6 is a cross-sectional view taken on the plane of the line 6—6 in FIGURE 2;

FIGURE 7 is a disassembled fragmentary perspective view of the rear portion of the lock mechanism, with a part of the casing broken away;

FIGURE 8 is a side view of a lock mechanism of this invention mounted on a panel (shown in section) by means of a one-piece spring clip;

FIGURE 9 is a rear view of the spring clip shown in FIGURE 8, in assembled relation to the lock mechanism;

FIGURE 10 is a view generally corresponding to FIGURE 5 but illustrating a modified embodiment of the invention wherein the cylinder has a defined key receiving and withdrawing position of rotation;

FIGURE 11 is a longitudinal sectional view illustrating a lock mechanism of this invention incorporated in an automotive ignition switch;

FIGURE 12 is a cross-sectional view on an enlarged scale taken on the plane of the line 12—12 in FIGURE 11;

FIGURE 13 is a cross-sectional view on an enlarged scale taken on the plane of the line 13—13 in FIGURE 11 and showing use of a tool to release the lock mechanism from the remainder of the switch assembly.

Referring now more particularly to the accompanying drawings, the numeral 5 designates generally a lock embodying the principles of this invention, comprising in

general a cylinder **7** having a forwardly opening key aperture **8** and which is mounted for rotation in the bore **9** of a fixed tubular sleeve or casing **10**. The sleeve **10** also carries a coaxially rotatable driven member **11** which is mounted behind the cylinder and which is intended to be rotated through a predetermined angle, between defined locked and unlocked positions, by means of a proper key **17** engaged in the key aperture of the cylinder. It will be understood that the driven member is suitably connected with a mechanism (not shown) such as a latch which is to be operated by the lock and which may be located behind the driven member.

The cylinder carries a plurality of axially spaced apart plate tumblers **12**, six such tumblers being shown in the present case. The tumblers, as is customary, are disposed normal to the cylinder axis and are confined to rotation with the cylinder and to edgewise motion in opposite directions transverse to the cylinder axis. The term "plate tumblers" is used generically herein to designate both conventional plate tumblers and lever tumblers. Conventional plate tumblers, as is well known in the lock art, are confined to substantially translatory edgewise motion relative to the cylinder, whereas lever tumblers are constrained to edgewise swinging motion relative to the cylinder, being pivoted about a common axis which lies at one side of the cylinder and extends parallel to the cylinder axis. As will be apparent from the following description, either type of plate tumbler is well adapted to a lock embodying the principles of the present invention, but for purposes of illustration the herein disclosed embodiments are shown and described as having conventional plate tumblers.

At one side of the cylinder there is an elongated side bar **13** which extends generally parallel to the cylinder axis and which is constrained to rotation with the cylinder and to substantially radial in and out motion relative to the cylinder. The side bar is biased radially inwardly by means of a spring **14** that reacts between it and the cylinder. Each of the tumblers has a side bar notch **15** in one side edge thereof, which notch is of such size and shape that the side bar is part way receivable therein in one position of the tumbler.

Normally each tumbler is biased out of said one position by means of a tumbler spring **16** that reacts between the tumbler and the cylinder (see FIGURES 4 and 5); but when a proper key **17** is inserted all the way into the key receiving aperture **8** in the cylinder, it establishes every tumbler in its position just mentioned (see FIGURES 2 and 6), so that the side bar can move to a retracted or radially inner position in which it is received in the aligned side bar notches **15** of the several tumblers, being propelled into said position under the biasing force of the side bar spring **14**.

However, the side bar does not move to its retracted position unless and until the cylinder is in a predetermined rotational position with respect to the driven member **11**, whereupon the side bar establishes a driving connection between the cylinder and the driven member. If the key is then withdrawn from the cylinder, the tumblers move in response to the bias of their springs **16** and cammingly propel the side bar radially outwardly to its extended position (FIGURES 1, 4 and 5) at which the side bar is ineffective to connect the cylinder with the driven member and leaves the cylinder freely rotatable.

The above mentioned driving connection between the cylinder and the driven member is established by means of a novel lateral projection or foot **18** on the rear of the side bar which extends across the rear end of the cylinder. When the side bar is in its retracted position (FIGURES 2 and 6) the tip portion **22** of its foot **18** is engaged in a notch or groove **19** in the driven member **11** that comprises a radial extension of a coaxial forwardly opening well **20** in the driven member.

It will be seen that the side bar is substantially L-shaped, with its stem portion **21** extending along one side of the cylinder in the general position occupied by a heretofore conventional side bar, and with its laterally projecting foot portion **18** defining the base of the L. The well **20** in the driven member is of such size that the foot portion **18** of the side bar is freely rotatable therein at times when its tip portion **22** is not engaged in the radial groove **19**, i.e., when the side bar is in its extended (FIGURE 1) position. Preferably the tip portion **22** of the side bar foot **18** is dovetail shaped (see FIGURES 3 and 7), and the groove **19** in the driven member has its side surfaces at corresponding radially inwardly convergent angles, so that when the side bar is retracted its foot portion tends to cam itself securely into the groove **19** in response to torsional forces acting between the cylinder and the driven member.

The stem portion **21** of the side bar is received in a radially outwardly opening groove **23** in the cylinder that extends along most of its length but terminates a distance short of its front end. The side surfaces of this groove afford guidance to the side bar in its radial in and out motion.

It is a feature of the lock of this invention that the connection between the side bar and the cylinder is a pivotal one, so that the substantially radial motion of the side bar is a swinging motion. Specifically, this pivotal connection is provided by a pin **24** which spans the side bar groove **23** in the cylinder near the front end thereof and which extends through a boss-like enlargement or head **25** on the front end of the stem portion of the side bar.

For optimum security of the lock, any one of the tumblers, when released from the position in which it is established by a proper key received in the key aperture, should be capable of propelling the side bar to its extended or radially outermost position at which the driving connection between the cylinder and the driven member is disrupted. To this end the side bar notch **15** in each tumbler **12** is substantially V-shaped, having its side edges disposed at opposite substantially equal inclinations to a plane through the cylinder axis and the side bar, and the face **26** of the side bar stem that is nearest the cylinder axis has a V-shaped profile which corresponds generally to the shape of the notches **15**, so that the edges of the notches **15** and the V-shaped face **26** of the side bar comprise cooperating camming or wedging surfaces.

Further to insure that any one of the tumblers alone will be capable of maintaining the side bar in its extended position, each of the tumbler springs **16** is strong enough to be individually capable of overcoming the biasing force of the side bar spring **14**.

As the side bar swings radially inward and outward, its rear end portion of course moves through greater distances than the portions of its stem **21** that are nearer the pivot axis of the pin **24**. This motion difference between the front and rear ends of the side bar must be accommodated in the camming relationship between the side bar and the edges of the side bar notches **15** in the tumblers. However, for reasons of manufacturing economy it is preferred that the side bar notches **15** in the several tumblers be uniform in size and shape; and therefore the inclined surfaces of the radially inner V-shaped face **26** of the side bar vary in pitch or steepness along the length thereof, the interior angle between said surfaces being greatest near the front of the side bar stem and smallest near the rear end thereof, as may be seen from comparison of FIGURES 4 and 5.

Because the side bar is pivotally connected to the cylinder as described above, the spring **14** that biases the side bar radially inwardly can be a bowed leaf spring which is confined between the side bar and the cylinder in a novel manner. A notable feature of this spring is a hole **27** in its medial portion through which the stem portion **21** of the side bar extends, so that the rear end portion **28** of the spring overlies and bears against the surface of

the side bar that is remote from the cylinder axis, while the front portion of the spring lies at the bottom of the side bar groove **23** in the cylinder.

At its front end the side bar spring projects a distance forwardly of the pivot pin **24** and has laterally projecting ears **29** which are received in substantially close fitting pockets **30** in the cylinder that comprise lateral extensions of the side bar groove **23**. The close fit of the ears **29** in the pockets **30** confines the spring against edgewise motion both fore-and-aft and laterally. Between its front end portion and the hole **27** there is a part **31** of the side bar spring which is closely confined in the space between the boss **25** on the side bar and the bottom surface of the side bar groove **23** in the cylinder, the boss **25** being so curved on a uniform radius about the axis of the pivot pin **24** that the space between it and the bottom of the groove **23** is of uniform width in all positions of swinging motion of the side bar and is just sufficient to accommodate the thickness of the spring **14**.

Except for a convexity of its rear end portion **28**, where it bears against the outer face of the side bar stem portion, the side bar spring **14** is normally substantially flat along most of its length, and is flexed to a rearwardly and outwardly curved condition by its assembly with the cylinder and the side bar as just described. Hence the front end portion of the side bar spring reacts radially inwardly against the cylinder, while the portion **31** of the spring that engages the boss **25** on the side bar reacts radially outwardly against the same, such reaction of course being taken by the pin **24**; and the flexing force of the spring is imposed upon its rear end portion **28** to exert a retracting bias upon the side bar. The side bar spring can be assembled onto the side bar from either end of the latter, prior to securement of the pivot pin **24** in the side bar and the cylinder.

At this point it will be apparent that the side bar, the cylinder and its tumblers, and the side bar biasing spring constitute a unitary subassembly.

It will also be noted that the side bar at no time needs to engage the sleeve **10** in which the cylinder rotates. Hence the cylinder subassembly need not fit the sleeve **10** with a close or accurate fit, so long as it is freely rotatable therein. This is desirable in the case of automotive installations, wherein the tubular sleeve **10** is often made by a manufacturer other than the one who produces the cylinder subassembly.

At its front end of the cylinder is formed with an enlarged diameter coaxial head **32** which is received in a forwardly opening counterbore in the sleeve **10** and which prevents rearward motion of the cylinder in the sleeve. Forward axial motion of the cylinder relative to the sleeve is prevented by means of a generally conventional bezel **33** having its marginal edge portion clinched, as at **34**, around the rear of an enlarged diameter coaxial head **35** on the sleeve and which serves as a front trim for the lock mechanism.

The mouth of the key aperture **8** in the cylinder can be forwardly enlarged to provide a chamber **36** for a generally conventional key hole seal or shutter assembly **37**.

The subassembly comprising the cylinder, tumblers and side bar is inserted into the sleeve or casing **10** from the front thereof, before the bezel **33** is attached to the sleeve. The driven member **11** telescopes part way into the rear end portion of the sleeve, which may have a rearwardly opening counterbore to receive it, and it is rotatably secured to the sleeve by means of a wire spring clip **38** that is confined in radially aligned circumferential grooves **39** and **40** in the sleeve and in the driven member, respectively. Cooperating circumferentially facing stop abutments **41** and **42** can be formed, respectively, on the sleeve **10** and on the driven member **11** to define limits of rotation of the driven member.

The sleeve **10** can be secured in any suitable manner to a panel **6** such as an automobile door or rear deck panel, through a closely fitting hole **43** in the panel, as illustrated in FIGURES 8 and 9. The sleeve can have circumferentially spaced lug-like protuberances **44** (best seen in FIGURES 1 and 2) a short distance behind the head **35** thereon, and it can be held in place by means of a spring clip **45** which reacts between the rear face of the panel and the front faces of said lugs **44** to confine the head **35** on the sleeve against the front surface of the panel under firm rearward bias. The spring clip **45** has a substantially keyhole-shaped aperture **46** through the wide portion of which the lugs **44** can pass. It is secured in place by sliding it edgewise in a direction lengthwise of its aperture **46**, as will be readily apparent from FIGURES 8 and 9.

The sleeve also has ribs or splines **47** which extend a distance rearwardly along it from directly behind its head **35** and which are received in closely fitting radial bays of the hole **43** in the panel to thus prevent rotation of the sleeve relative to the panel.

Preferably the marginal edge portion of the hole **43** in the panel is depressed below the remainder of the front surface of the panel to dispose the front face of the bezel **33** substantially flush with the front face of the panel, as illustrated in FIGURE 8, thereby making it difficult to grip the enlarged head **35** on the sleeve for the purpose of pulling the lock mechanism out of the panel in the course of an attempt to defeat the lock by force.

The spring clip **45** has a small "kink" or integral rib **48** which engages the depressed marginal edge portion of the hole **43** in the panel to interfere with edgewise displacement of the spring clip out of its lock retaining position. To reinforce the spring clip against forward pulling, the metal thereof is doubled upon itself along opposite side edges of the keyhole shaped aperture **46**.

In the further interests of security it is preferred that a small plate **49** of hard steel or the like be interposed between the rear end of the keyhole aperture in the cylinder and the foot portion **18** of the side bar. This plate is press fitted into a rearwardly opening well **50** in the cylinder that is large enough to receive the foot portion **18** of the side bar. The purpose of the plate **49** is to obstruct access to the radial groove **19** in the driven member **11** so that unauthorized rotation of the driven member cannot be effected by means of a hook-like tool inserted through the key aperture and engaged in the groove **19**.

Preferably, too, the side bar is formed with a slender neck portion **52** connecting its stem portion **21** with its foot portion **18**, and has a small rearwardly projecting spur **53** on the rear end of its stem portion.

If a slender tool is inserted through the key aperture **8** in the cylinder, and substantial rearward force is applied thereto, the plate **49** will first be dislodged rearwardly and then the neck portion **52** of the side bar will be fractured, breaking the foot portion **18** of the side bar off of its stem portion. The bottom surface **54** of the well **20** in the driven member is forwardly convex, and the neck portion **18** of the side bar is obliquely inclined to the cylinder axis, so that rearward force exerted upon the broken-off foot portion **18** through the small plate **49** will cause the tip portion of the foot to be tilted forwardly into the rearwardly opening well **50** in the cylinder in which the plate **49** is received. With the broken-off foot portion of the side bar thus tilted, it cannot be engaged in the notch or groove **19** in the driven member to couple the cylinder to the driven member, and such an attempt to defeat the lock by force will therefore fail.

The portion of the cylinder which comprises the wall **55** between the keyhole shutter chamber **36** and the side bar groove **23** is necessarily rather thin and therefore easily penetrated by a sharp tool. To some extent this wall is reinforced by the front portion **31** of the side bar

spring **14**, which overlies the bottom surface of the side bar groove **23** as above described, and the spring thus affords some protection against forcible access to the front end of the side bar. However, it may be possible, with the exertion of great force, to gain access to the head portion **25** of the side bar and break the pivot pin **24** by forcing the side bar rearwardly. In that case the small spur **53** on the rear end of the side bar stem would engage in an annular forwardly opening V-shaped groove **56** in the driven member, and cooperating inclined surfaces of the spur and the groove would cam the rear end of the side bar radially outwardly to carry the tip of the side bar foot portion **18** away from the notch or groove **19** in which it normally engages, while at the same time fracturing the slender neck portion **52** of the side bar to break off its foot portion.

In the modified embodiment of the invention illustrated in FIGURE 10 the cylinder **7** has a defined position of rotation in which it must be established to permit insertion or withdrawal of a key. To this end each tumbler has an integral tang **57** which projects therefrom in the direction opposite to that in which the tumbler is biased by its spring **16**; and the tang **57** is receivable in a closely fitting groove **58** in the sleeve **10'**, opening inwardly to the bore **9** in the sleeve. In the normal or key-withdrawn position of each tumbler (illustrated in FIGURE 10), its tang **57** lies wholly within the cylinder circumference and the cylinder is freely rotatable in the sleeve. However, as a key is inserted into or withdrawn from the cylinder, the cusps of its bitting cam the tumblers to positions in which their tangs project beyond the cylinder circumference, and unless the cylinder is in the rotational position at which the tangs **57** can enter the groove **58**, the tumblers obstruct axial motion of the key. This arrangement is particularly advantageous for ignition switch locks, from which, for safety reasons, it should not be possible to withdraw the key except in a switch-off position of the lock.

If an improper key is inserted into the cylinder when the latter is in its key receiving position of rotation, the bitting on such key will probably maintain at least one of the tumbler tangs **57** engaged in the groove **57**, thereby preventing rotation of the cylinder. Preferably each tang is connected with the body of its tumber by a slender neck portion defined by a notch **59**. If an improper key is inserted into the cylinder by inadvertence, and substantial torque is applied to it, the tang or tangs engaged in the groove will shear off at their necks and will probably not interfere with continued usefulness of the lock mechanism.

The groove **58** in the sleeve should be course be narrower than the stem portion **21** of the side bar to prevent the side bar from catching in said groove and interfering with cylinder rotation. In this connection it will be noted that the lock mechanism of this invention can be arranged to permit only limited rotation of its cylinder when their is no key therein by providing suitable abutments on the bore surface of the sleeve that engage the side bar stem portion when the side bar is in its extended position of swinging motion.

In the embodiment of the invention illustrated in FIGURES 11–13 the lock mechanism **5'** is adapted for the actuation of a more or less conventional ignition switch mechanism, designated generally by **60**, having an actuator **61** connected with the driven member **11** of the lock mechanism for rotation in unison therewith. The switch mechanism has a housing **62**, on the front of which is a coaxial forwardly projecting tubular portion **63** in which is received the fixed sleeve **10''** of the lock mechanism **5'**. Cooperating splines **64** on the sleeve **10''** and on the tubular front housing portion **63** confine the sleeve to limited axial motion relative to the housing, such motion being provided for because the actuator **61** must be inwardly depressed in order for the switch mechanism to be moved from its "off" position to its "accessories" position.

Since no weather seal is needed on an ignition lock, the cylinder **7'** has a uniform diameter along its entire length. The sleeve **10''** has a radially inwardly projecting circumferential shoulder **66** near its front end against which the front end of the cylinder **7'** rotataby abuts and the driven member **11** cooperates with the shoulder **66** to confine the cylinder to rotation in the sleeve. The cylinder is of course assembled into the sleeve from the rear thereof before the driven member is secured to the sleeve.

The sleeve **10''**, with the cylinder and driven member assembled to it, is inserted into the tubular front portion **63** of the switch housing **62** from the front thereof and is normally retained against forward displacement out of the housing by means of a horseshoe-shaped retaining member **67** which engages a rearwardly facing circumferential shoulder **68** on the switch housing defined by a rearwardly opening counterbore **69** in the tubular front portion of the housing. By means of a pin **70** near one end thereof the retaining member **67** is pivotally secured to the driven member for radially in and out swinging motion relative thereto. A small compression spring **71**, reacting between the driven member and the medial portion of the retaining member, biases the latter radially outwardly relative to the driven member, the limit of such outward motion of the retaining member being defined by a hook-like abutment **72** on its free end which normally engages an opposing circumferentially facing abutment **72'** on the driven member. The retaining member lies in a circumferential radially outwardly opening slot **73** that is conjointly defined by the rear end of the sleeve **10''** and by the front face of an enlarged rear end portion **74** on the driven member that has the same outside diameter as the sleeve.

When the retaining member **67** is retracted against the biasing force of its spring **71**, its radially outer surface is substantially flush with its adjacent circumferential surfaces of the sleeve **10''** and driven member **11**, and the lock mechanism can then be inserted into the tubular front portion **63** of the switch housing from the front thereof. As the retaining member passes the circumferential shoulder **68**, it is propelled by the spring **71** radially outwardly into the counterbore **69** where it slidingly engages said shoulder **68** to prevent forward axial displacement of the lock mechanism out of the switch housing.

For purposes of repair or replacement, however, the lock mechanism **5'** can be removed from the switch housing by the use of a slender tool **75** inserted through a hole **76** in the switch housing and wedgingly engaged between the driven member and the pivoted end portion of the retaining member **67** to retract the latter as indicated in FIGURE 13. The hole **76** is so located in the switch housing that the pivoted end portion of the retaining member is accessible therethrough only when the driven member is in its "accessories" position, to which it can only be rotated by means of a proper key engaged in the cylinder. In this manner unauthorized removal of the lock mechanism from the switch housing is effectively prevented.

From the foregoing description taken with the accompanying drawings it will be apparent that this invention provides a novel type of plate tumbler side bar lock wherein the side bar provides an element of a connection between the cylinder of the lock and a member to be rotatably driven thereby, which connection requires for its establishment the insertion of a proper key into the cylinder and disposition of the cylinder in a predetermined rotational position relative to the driven member; and it will be further apparent that the principles of his invention can be embodied equally well in a lock having a cylinder which is normally freely rotatable and which can receive a proper key in any position of its

rotation, and in a lock in which the cylinder has a defined key receiving and key withdrawing position of rotation.

What is claimed as my invention is:

1. In a disconnecting type lock having a cylinder which is rotatable in a sleeve and is adapted to be drivingly coupled with a driven member behind the cylinder when a key is inserted into a forwardly opening key aperture in the cylinder and the cylinder is in a predetermined rotational position relative to the driven member:

(A) a plurality of axially spaced plate tumblers carried by the cylinder for rotation therewith and for motion relative to the cylinder along paths transverse to its axis, each of said tumblers having a side bar notch in one side thereof which aligns axially with the side bar notches in the other tumblers when each tumbler is moved to a predetermined position in which it can be established by means of a proper key received in the key aperture;

(B) means biasing each of the tumblers away from its said position;

(C) a side bar having

(1) a stem portion which extends lengthwise along one side of the cylinder, said stem portion being receivable in said notches in the tumblers when the tumblers are in their said positions and having surfaces engageable with the edges of said notches to be cammed radially outwardly thereby in consequence of movement of the tumblers out of their said positions, and

(2) a rear portion disposed to the rear of the cylinder;

(D) means connecting the side bar with the cylinder for rotation therewith and for substantially radial motion relative to the cylinder between a connecting position in which the stem portion of the side bar is received in said notches in the tumblers and a disconnecting position to which the side bar is actuated by movement of the tumblers out of their said positions;

(E) abutment means on the driven member arranged to be engaged by the rear portion of the side bar when the side bar is in its connecting position and to clear the side bar when the latter is in its disconnecting position; and

(F) biasing means yieldingly urging the side bar radially inwardly relative to the cylinder, toward its connecting position.

2. The lock of claim 1 further characterized by:

(A) said rear portion of the side bar comprising a foot which extends laterally from the stem portion across the rear of the cylinder; and

(B) said abutment means on the driven member being defined by opposite sides of a slot-like aperture in the driven member in which the tip portion of said foot is received when the side bar is in its connecting position.

3. The lock of claim 1, further characterized by:

said means connecting the side bar with the cylinder comprising a pivot through the front end portion of the side bar stem portion carried by the cylinder near the front thereof and providing for swinging motion of the rear portion of the side bar toward and from the axis of the cylinder.

4. The lock of claim 3 further characterized by:

said biasing means for the side bar comprising a bowed leaf spring having

(A) a medial hole through which extends a portion of the side bar stem rearwardly of said pivot;

(B) a portion forwardly of said hole confined between the cylinder and the side bar stem portion; and

(C) a portion rearwardly of said hole engaging the stem portion of the side bar at the side thereof that is remote from the cylinder axis.

5. The lock of claim 1 wherein said tumbler biasing means (paragraph B) urges all of the tumblers in the same direction radially of the cylinder, further characterized by:

a radially projecting tang on each tumbler, at a side thereof, which tang lies substantially within the cylinder periphery when the tumbler is in its said position but is adapted to be received in an inwardly opening groove in the sleeve when the tumbler is out of its said position to cooperate with the sleeve in defining a key receiving and withdrawing rotational position of the cylinder.

6. The lock of claim 2, further characterized by:

the driven member having a coaxial forwardly opening well in which said foot is disposed and in which said foot is freely rotatable when the side bar is in its non-driving position, said aperture in the driven member being a radially outward extension of said well.

7. The lock of claim 6, further characterized by:

a disc of hard material received in a rearwardly opening well in the rear of the cylinder, disposed substantially normal to the cylinder axis and across the key aperture, to block access to said aperture in the driven member through the key aperture.

8. The lock of claim 7 further characterized by:

(A) the side bar having a slender neck portion connecting said foot with its stem portion; and

(B) said well in the driven member having a forwardly convex bottom surface by which the tip portion of the foot is deflected forwardly away from the driven member in consequence of exertion of rearward force upon the side bar.

9. In a lock of the side bar type having a rotatable cylinder in which there is a forwardly opening key aperture, a side bar carried by the cylinder at one side thereof for rotation with the cylinder and for substantially radial motion relative thereto between defined inner and outer positions, said side bar being biased toward its inner position, and a plurality of biased tumblers carried by the cylinder and normally engageable with the side bar to maintain the same in its outer position but adapted to be propelled by a proper key inserted into the key aperture to positions in which they permit the side bar to move under its bias to its inner position, said lock being characterized by:

(A) a coaxially rotatable driven member behind the cylinder having a forwardly opening coaxial well and an aperture opening radially from said well; and

(B) a lateral projection on the rear of the side bar that extends across the rear of the cylinder and substantially parallel to the directions of side bar motion relative to the cylinder, said lateral projection being rotatable in said well when the side bar is in its outer position and having its tip portion engageable in said radially opening aperture when the side bar is in its inner position to drivingly couple the cylinder with the driven member.

10. The side bar lock of claim 9 further characterized by:

means providing a pivotal connection between the cylinder, near the front thereof, and the front end portion of the side bar, so that the substantially radial motion of the side bar relative to the cylinder is a swinging motion.

11. In a lock of the side bar type having a cylinder which is rotatable in a sleeve and which has a forwardly opening key aperture, a side bar extending along one side of the cylinder and carried by the same for rotation with the cylinder and for substantially radial motion relative thereto between defined inner and outer positions which afford locked and unlocked conditions, and a plurality of biased tumblers carried by the cylinder and

normally engageable with the side bar to maintain the same in its outer position but adapted to be propelled by a proper key inserted into the key aperture to positions in which the tumblers permit the side bar to move to its inner position, said lock being characterized by:

(A) means on the cylinder, near the front thereof, providing a pivotal connection between the cylinder and the front end portion of the side bar by which the side bar is mounted on the cylinder for radially in and out swinging motion; and

(B) a leaf spring reacting between the cylinder and the side bar to bias the latter toward its inner position, said spring having

(1) a front end portion engaging the cylinder forwardly of said pivotal connection,

(2) a medial portion confined between the cylinder and the side bar near said pivotal connection to transfer reaction thereto, and

(3) an aperture behind said medial portion through which a medial portion of the side bar extends so that the rear end portion of said leaf spring engages a surface of the side bar that is remote from the cylinder axis and is spaced behind said pivotal connection.

12. The lock of claim **11**, wherein each of the tumblers has a side bar notch that is adapted to align with the side bar notches in the other tumblers and to receive the side bar when the tumblers are established in their said positions by a proper key, further characterized by:

cam surfaces on the side bar, at the side thereof adjacent the cylinder axis, engageable with the edges of the side bar notches to effect radially outward camming of the side bar in consequence of bias propelled motion of the tumblers out of their said positions, the included angle between said cam surfaces being greatest near the front of the side bar and progressively decreasing toward the rear thereof to accommodate differences in lateral travel between the front and rear portions of the side bar that result from its swinging motion.

13. In a lock having a cylinder with a forwardly opening key aperture, and a plurality of substantially flat tumblers carried by the cylinder for rotation therewith and for movement relative thereto in opposite directions transverse to the cylinder axis:

(A) a substantially L-shaped side bar having an elongated stem portion and a foot portion;

(B) means providing a pivotal connection between the stem portion of the side bar near the end thereof remote from its foot portion, and the cylinder near its front end and at one side thereof, said connection disposing the side bar with its stem portion extending along said one side of the cylinder and its foot portion projecting across the rear end of the cylinder and providing for swinging motion of the side bar radially in and out relative to the cylinder; and

(C) spring means reacting between the cylinder and the stem portion of the side bar to bias to side bar radially inwardly for cooperation with said tumblers to afford locked and unlocked conditions.

14. As an article of manufacture, a side bar for a disconnecting lock of the character described, characterized by:

(A) an elongated stem portion having front and rear ends;

(B) a foot portion projecting to one side of the stem portion from the rear end thereof and having a slender substantially fragile connection with the stem portion;

(C) means near the front end of the stem portion providing for pivotal mounting of the side bar by which it can swing toward and from the direction in which said foot portion projects, said means comprising a head on the front end to the stem portion having, on said one side thereof, a uniform radius of curvature about the axis of said pivotal mounting; and

(D) the stem portion rearwardly of the head and at said one side thereof having a substantially V-shaped profile providing oppositely inclined camming surfaces, the included angle between said surfaces being greatest near the front end of the stem portion and decreasing toward the rear thereof.

References Cited

UNITED STATES PATENTS

2,217,047	10/1940	Fitzgerald	70—366
2,808,717	10/1957	Jacobi	70—366
3,287,944	11/1966	Crumb	70—364
3,367,155	2/1968	Kobrehel	70—366

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