Sept. 19, 1939. J. K. MARSHALL ET AL 2,173,720

COMBINATION PADLOCK

Filed April 24, 1939

Fig. 1.

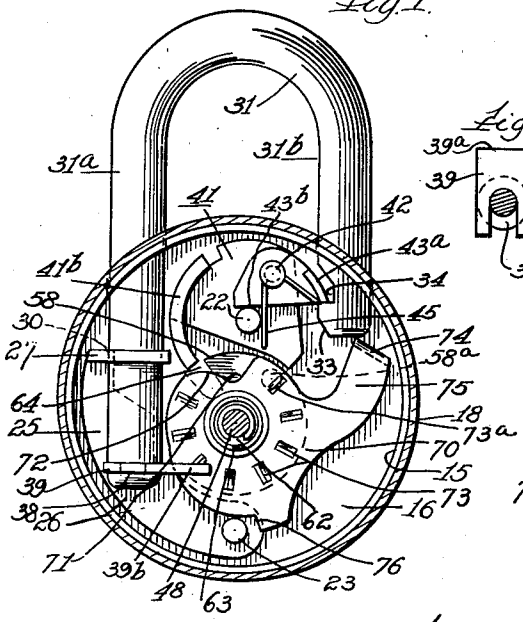


Fig. 8.

Fig. 2.

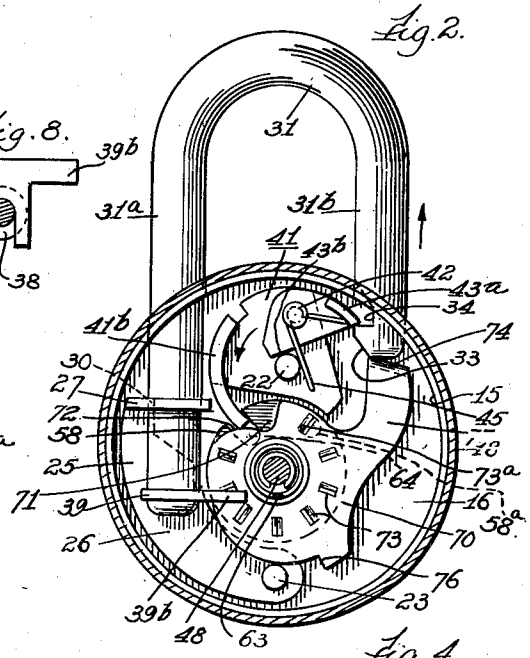


Fig. 3.

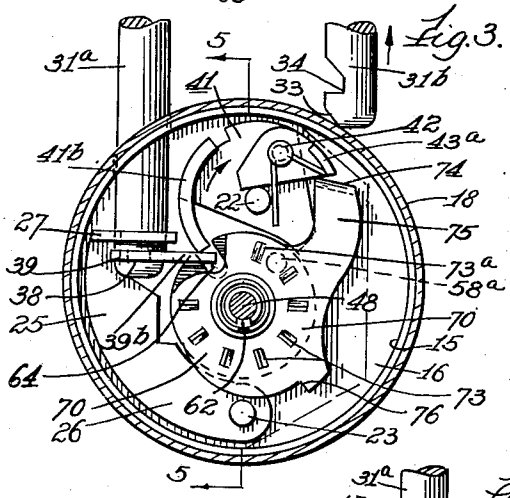


Fig. 4.

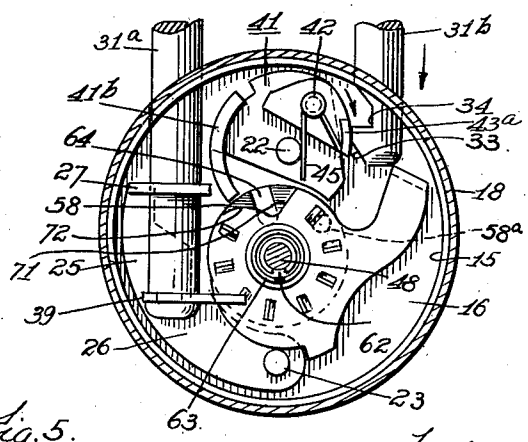


Fig. 5.

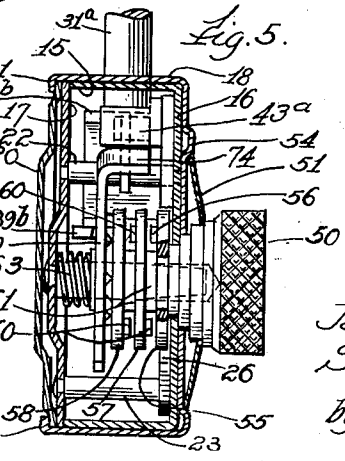


Fig. 6.

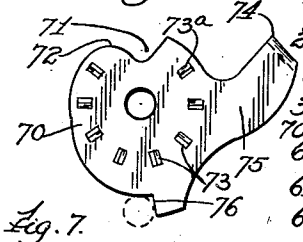


Fig. 7.

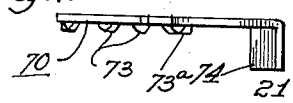


Fig. 9.

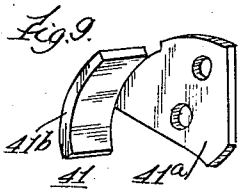
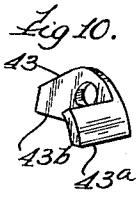


Fig. 10.



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COMBINATION PADLOCK

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Application April 24, 1939, Serial No. 269,562

13 Claims. (Cl. 70—25)

This invention relates to locks, particularly of the permutation padlock type. One object of the invention is to provide a mechanism to be automatically actuated for dispersing or disarranging the tumbler permutation in connection with the movement of the shackle. Another object is to provide a locking bolt or lever adapted to cooperate with the tumblers in releasing the shackle, but having a yieldable latch portion which permits closing the shackle after the locking lever has been moved into locking position. It is also an object of the invention to combine the various features of the padlock in a simple and sturdy construction adapted for economical manufacture and reliable operation. The invention consists in certain features and elements of construction in combination, as herein shown and described and as indicated by the claims.

In the drawing:

Fig. 1 is a rear view of a permutation padlock embodying this invention taken substantially as a section at a plane just inside the back wall of the case to reveal the internal mechanism and showing the shackle in locked position, but with the tumblers set at release position.

Fig. 2 is a similar view showing the shackle partially withdrawn in its unlocking movement.

Fig. 3 is also a rear view with the rear wall of the case removed, and showing the shackle fully withdrawn and the locking bolt or lever returned to locking position.

Fig. 4 is a rear view similar to Fig. 3, but showing the shackle partially inserted in the case in locking operation.

Fig. 5 is a transverse sectional view taken substantially as indicated at line 5—5 on Fig. 3 for showing the relative arrangement of the various parts in the casing.

Fig. 6 is a detail face view of the tumbler upsetting plate.

Fig. 7 is an edge view of the same.

Fig. 8 is a detail face view of a forked plate associated with the shackle.

Fig. 9 is a detail perspective view of the locking bolt or lever with the latch removed therefrom.

Fig. 10 is a detail perspective view of the latch.

In the drawing, 15 designates a lock casing which may be of any suitable shape, but which is illustrated as of cylindrical form comprising a front wall, 16, and a back plate, 17, the front wall being integral with the cylindrical portion of the casing. The casing may be enclosed in a cup-shaped shell, 18, preferably of light sheet metal which fits snugly over the casing, and includes a front cover plate, disposed against the front wall, 16, of the casing. An embossed rear cover plate, 20, bears marginally against the back plate, 17, and both said plates are secured in place by a flange, 21, formed by spinning over the rear edge of the shell, 18. Preferably, the front wall, 16, and the back plate, 17, are further secured together by riveted pins or posts, 22 and 23.

A guide member, 25, which may be formed as a sheet metal stamping, is rigidly mounted within the casing and includes a flat portion, 26, disposed against the inner surface of the front wall, 16, and secured thereto by the riveted post, 23. Bent up from one end of the member, 25, is a flange, 27, extending transversely between the front and rear plates, 16 and 17, and formed with a round opening, 30, in which the shackle, 31, is guided.

The legs of the U-shaped shackle, 31, extend slidably through openings, formed in the cylindrical portions of the casing, 15, and shell, 18. The longer leg, 31a, of the shackle fits slidably and rotatably in the opening, 30, in the guide flange, 27, and the shorter leg, 31b, has a beveled end, 33, and a locking notch, 34, near this end. In the construction illustrated the shackle is free for rotation about the axis of its longer leg when the shorter leg is withdrawn clear of the shell, 18, but this freedom for rotation is not essential to the purposes of the present invention. At its inner end the longer leg, 31a, of the shackle is formed with an annular groove, 38, to receive a forked plate, 39, which is retained on the shackle leg by engagement of its straight edge, 39a, with the flat inner surface of the back plate, 17; this also prevents the plate, 39, from rotating about the shackle within the casing, but allows it to travel with the shackle leg whenever the shackle is reciprocated in the casing. The plate, 39, also serves to limit the outward movement of the shackle by engaging the guide flange, 27, when the shackle is fully withdrawn.

A locking lever, 41, preferably formed of sheet metal, comprises a web, 41a, pivotally carried on the post, 22, and an arcuate flange, 41b, through which the tumblers control the locking lever, as hereinafter more fully described. The web, 41a, carries a pivot stud, 42, upon which there is mounted a latch member, 43, whose flange, 43a, normally engages in the notch, 34, of the shackle for holding the latter locked in the case. At the opposite side of the pivot, 42, from the flange, 43a, the edge, 43b, of the latch abuts the post, 22, which limits its swing in one direction and cooperates with the latch, 43, in holding the shackle in locked position. And a spring, 45, coiled about the pivot stud, 42, reacts to hold the latch yieldingly in its locking position with the edge, 43b, abutting the post, 22.

The stud, 48, is rigidly secured, as by riveting, to an embossed portion of the back plate, 17, of the casing and projects forwardly through centrally apertured portions of the front wall, 16, and the cover plate. The tapered front end of the stud, 48, as seen in dotted outline in Fig. 5, fits loosely in the bore of an operating knob, 50,

which is rotatably mounted in the front wall, 16. A dished dial plate, 51, is carried rigidly on the knob for rotation therewith, and, preferably, the front cover plate of the shell is embossed with an annular bead, 54, surrounding the dial. It may be understood that the bead, 54, carries an index mark (not shown), and that the dial, 51, carries suitable scale markings (not shown), as is customary in permutation locks of this general type.

A driving tumbler or disk, 55, is concentrically and rigidly secured to the inner end of the knob and carries the usual transfer lug, 56, for cooperation with the other tumblers. Additional tumblers or disks, 57 and 58, are shown rotatably carried on the stud, 48, with their transfer lugs, 60, projecting from adjacent faces for cooperative engagement in the usual manner. The tumblers are separated by washers, 61, which are preferably formed to inter-engage with a key-way, 62, in the stud, 48, so that they are held against rotation and thus prevented from transmitting any rotative movement from one tumber to the next. The entire assembly is subjected to limited friction by means of a compressed coil spring, 63, surrounding the rear end portion of the stud, 48, adjacent the back plate, 17.

Each of the tumblers, 55, 57 and 58, has a peripheral slot or notch, 64, formed to admit the flange, 41b, of the locking lever or bolt, 41, when these slots are registered with each other and with said flange, 41b, by adjusting the knob, 50, alternately in opposite directions, and to successive predetermined positions, the tumblers being thus rotated to predetermined positions by inter-engagement of the lugs, 56 and 60, in a well understood manner. In Fig. 1 the tumblers are thus shown as adjusted in registered position, ready to receive the end of the flange, 41b. As soon as the tumblers have been thus registered, with their notches, 64, opposite the flange, 41b, of the locking lever, 41, the shackle, 31, can be pulled out; the notch, 34, in the shorter leg, 31b, of the shackle, being inter-engaged with the flange, 43a, of the latch on the locking lever, 41, will rock the locking lever bodily into the position shown in Fig. 2, with its flange, 41b, entering the notches, 64, of the tumblers.

Adjacent the rear tumbler 58, the stud, 48, carries a rotatable plate member, 70, having a rather wide notch, 71, with divergent edges; this plate stands normally with said notch slightly out of registration with the flange, 41b, of the locking lever, and with the position at which the notches, 64, of the permutation tumblers are registered for unlocking the shackle. When the notches have been so registered, and the shackle is partly pulled out, as shown in Fig. 2, the movement of the flange, 41b, into the notches, 64, produces a camming action against the curved edge, 72, of the notch, 71, and forces the plate, 70, to rotate about its axis until its notch, 71, is substantially registered with the notches, 64, of the tumbler disks so that the bolt flange, 41b, may enter said notches to their full depth, allowing the bolt or locking lever, 41, to swing far enough to release the short end, 31b, of the shackle. Projecting from the face of the tumbler, 58, which is adjacent the plate, 70, is a lug, 58a, similar to the transfer lugs, 60. The opposing face of the plate, 70, is provided with a plurality of projections or teeth, 73, having oppositely inclined faces so that one of these projections, indicated at 73a, in Fig. 1, will be caused to ride over the lug, 58a, as the plate, 70, is forced around for registration of its notch, 71, with the notches, 64, at which position it is shown in Fig. 3. The tooth, 73a, is able to ride over the lug, 58a, because the plate, 70, is held yieldingly against the tumbler, 58, by the spring, 63, and the inclined formation of the tooth, 73a, facilitates this action. In the process of manufacturing the tumblers the transfer lugs may be variously positioned to insure that different locks will have different controlling permutations; and, as a matter of convenience, the tumbler 58, may be similar in construction to the tumbler, 57,—that is, to the extent of having transfer lugs on both its faces. Hence, the lug, 58a, may be variously located in different locks, and to meet this situation the plate, 70, is provided with several inclined teeth or projections, 73, one of which will be positioned to function with such a lug as 58a, wherever it may be located around the axis.

In the final portion of the opening movement the projecting lug, 39b, of plate, 39, carried on the end of the longer shackle leg, 31a, strikes the flange, 41b, which has entered the notches, 64, of the tumblers and forces it out of the notches, as shown in Fig. 3. This leaves the tumbler disks free to be rotated; but the locking bolt or lever, 41, is thus swung back to locking position, with the latch member, 43, extending in the path along which the short leg, 31b, of the shackle must return as it enters the casing.

Thus, in the closing movement of the shackle, the beveled end, 33, of the shackle leg, 31b, strikes the flange, 43a, of the latch member, and forces the latch to rotate yieldingly about its pivot stud, 42, to a sufficient extent to permit the end of the shackle to pass it, as seen in Fig. 4. At the same time, this end of the shackle engages a flange or lug, 74, on the arm, 75, of the plate, 70, so that inward movement of the shackle rotates the plate and causes its tooth, 73a, to engage the lug, 58a, and rotate the tumbler, 58, by a substantial angle, more than sufficient to carry its notch, 64, out of registration with the bolt flange, 41b. Thus the bolt or locking lever, 41, is blocked by the circular portion of the tumbler, 58, and is held in locking position so that when the shackle has been fully entered, and the spring-pressed latch has snapped back to its normal position, with its flange, 43a, engaging in the notch, 34, the shackle will be retained in locked position. It can then be released only by resetting the entire group of tumblers, 55, 57 and 58, since the tumbler, 58 which has been displaced from registered position can only be registered again through the intermediate action of the other two tumblers adjusted by the knob, 50. To limit the swinging movement of the plate, 70, and keep the plate within a proper range at all times, it may be provided with a radially extending stop lug, 76, which will encounter the post, 23, when the shackle is fully depressed in the closing movement.

It will be evident that the construction herein shown and described is comparatively simple and involves no structure which is likely to break or get out of order in normal use. The provision of the spring, 63, pressing axially upon the tumbler-upsetting plate, 70, affords a spring ratchet effect in the engagement between the teeth, 73, of the plate and the lug, 58a, of the adjacent tumbler; the faces of the teeth, 73, being inclined in both directions, permit the tumbler, 58, to be rotated in either direction relatively to the plate, 70, for adjustment in accordance with the permutation which brings the notches, 64, of the

several tumblers into alignment. And this inclined formation of the teeth, and particularly of the tooth, 73a, allows the camming action of the bolt flange, 41b, against the curved edge of the notch, 71, to shift the tooth, 73a, over the lug, 58a, so as to prepare the plate to rotate the tumbler, 56, through a maximum angle in shifting its notch, 64, out of its registered position. The extending arm, 39b, of the forked plate, 39, provides an extremely simple means for ejecting the bolt from the tumbler notches so as to permit disarrangement of the permutation, and the provision of the spring latch on the bolt itself permits reengagement of the notched leg of the shackle in a very simple manner after the bolt has already been shifted into locking position.

While there is shown and described herein certain specific structure embodying the invention, it will be manifest to those skilled in the art that various modifications and re-arrangements of the parts may be made without departing from the spirit and scope of the invention, and that the same is not limited to the particular form herein shown and described, except in so far as indicated by the appended claims.

We claim:

1. A padlock comprising a case having openings, a shackle having legs slidable in said openings, one of said legs being longer than the other, shackle-locking means in said case including a tumbler rotatably adjustable to release said shackle, and a member rotatable co-axially with said tumbler and so rotated by the shorter leg of the shackle in its locking movement, together with yielding means urging said member axially into engagement with said tumbler for turning the tumbler out of shackle-releasing position when the member is so rotated.

2. A padlock comprising a case having openings, a shackle having legs slidable in said openings, one of said legs being longer than the other and being anchored within the case, the shorter leg being withdrawable therefrom in its unlocking movement, shackle-locking means in said case including a tumbler rotatably adjustable to release the shackle, a member rotatable co-axially with said tumbler and having an arm engageable by the shorter leg of the shackle in its return movement to locking position, means actuated by the shackle in its unlocking movement to swing said arm into the return path of said shorter leg preparatory to such engagement, and yielding means urging said member axially into driving relation with the tumbler to enable said member to turn the tumbler out of shackle-releasing position when the member is rotated by engagement of its said arm by the shorter shackle leg in its return movement to locking position.

3. A padlock comprising a case having openings, a shackle having legs slidable in said openings, one of said legs being longer than the other and being anchored within the case, the shorter leg being withdrawable therefrom in its unlocking movement, shackle-locking means in said case including a tumbler rotatably adjustable to release the shackle, a member rotatable co-axially with said tumbler and having an arm engageable by the shorter leg of the shackle in its return movement to locking position, a pivoted locking lever normally engaged with the shorter shackle leg in locking position and releasable by adjustment of the tumbler which permits said lever to swing about its pivot and disengage said shackle leg when the latter is withdrawn from the case, said lever having a part engageable with said member for swinging the arm of the latter into the return path of said shackle leg, and yielding means urging said member axially into driving relation with the tumbler, whereby the tumbler is shifted out of shackle-releasing position by the return movement of the shackle.

4. A padlock comprising a case having openings, a shackle having legs slidable in said openings, a shackle-locking bolt in the case formed to engage one leg of the shackle for locking it, a tumbler disk rotatably adjustable in the case and having a notch dimensioned to receive a portion of said bolt to permit its movement to shackle-releasing position, a tumbler shifting member pivoted co-axially with the tumbler and having a cam portion engageable by the bolt as it enters the tumbler notch, whereby the bolt, in its movement to release the shackle for withdrawal from the case, turns the shifting member while blocking rotation of the tumbler, said shifting member being rotatable by the shackle leg in its return to locking position, and yielding means urging said shifting member axially into driving rotation with the tumbler for shifting the tumbler with it as the shackle returns to locking position.

5. A padlock comprising a case having openings, a shackle having legs slidable in said openings, a shackle-locking bolt in the case formed to engage one leg of the shackle for locking it, a tumbler disk rotatably adjustable in the case and having a notch dimensioned to receive a portion of said bolt to permit its movement to shackle-releasing position, a tumbler shifting member pivoted co-axially with the tumbler and having a cam portion engageable by the bolt as it enters the tumbler notch, whereby the bolt, in its movement to release the shackle for withdrawal from the case, turns the shifting member while blocking rotation of the tumbler, means carried by the other leg of the shackle into direct engagement with the bolt for moving it out of the tumbler notch in the final portion of the unlocking movement, said shifting member being rotatable by the first-mentioned shackle leg in its return to locking position, and yielding means urging said shifting member axially into driving relation with the tumbler for shifting the tumbler with it as the shackle returns to locking position.

6. In a permutation lock, a locking member, a plurality of rotatable adjustable tumbler disks co-axially disposed and having alignable notches, a movably mounted bolt normally blocking unlocking movement of said locking member except when the notches of the tumblers are adjusted to register with a portion of said bolt for permitting such movement, means for adjusting the tumblers in registered relation, a portion of the locking member engaging the bolt and serving to move it into the notches in the initial portion of the unlocking movement, means carried by the locking member to engage said bolt and eject it from said notches in the final portion of the unlocking movement, a shifting member rotatable co-axially with the tumblers and movable by the locking member in its return to locking position, and yielding means urging said shifting member axially into driving relation with at least one of said tumblers for turning its notch out of registered position during said return of the locking member.

7. In a permutation lock including a case with an opening and a locking member movable therethrough, a shiftable bolt member engageable with

the locking member to hold it at locking position, a plurality of co-axially mounted rotatable tumbler disks having alignable notches to receive a portion of said bolt when the latter is moved to release the locking member, means carried by the locking member and engaging the bolt to eject it from the tumbler notches in the latter portion of the unlocking movement, and means including a plate rotatable co-axially with said tumblers and yieldingly urged axially into engagement with one of said tumblers, whereby rotation of the plate serves to rotate the tumbler for shifting its notch out of adjusted position, said plate including a portion engageable by the locking member for such rotation when the locking member moves to locking position.

8. In a permutation lock including a case with an opening and a locking member movable therethrough, a shiftable bolt member engageable with the locking member to hold it at locking position, a plurality of co-axially mounted rotatable tumbler disks having alignable notches to receive a portion of said bolt when the latter is moved to release the locking member, means carried by the locking member and engaging the bolt to eject it from the tumble notches in the latter portion of the unlocking movement, and means including a plate rotatable co-axially with said tumblers and yieldingly urged axially into engagement with one of said tumblers, the adjacent faces of said tumbler and plate having mutually engageable projections whereby rotation of the plate serves to rotate the tumbler for shifting its notch out of adjusted position, said plate including a portion engageable by the locking member for such rotation when the locking member moves to locking position.

9. A padlock comprising a case having openings, a shackle having legs slidable in said openings, a shackle-locking bolt in the case formed to engage one leg of the shackle for locking it, a tumbler disk rotatably adjustable in the case and having a notch dimensioned to receive a portion of said bolt to permit its movement to shackle-releasing position, a tumbler shifting member pivoted co-axially with the tumbler and having a cam portion engageable by the bolt as it enters the tumbler notch, whereby the bolt, in its movement to release the shackle for withdrawal from the case, turns the shifting member while blocking rotation of the tumbler, said shifting member being rotatable by the shackle leg in its return to locking position, the adjacent faces of said shifting member and tumbler having mutually engageable projections whereby said rotation of the shifting member turns the tumbler out of shackle-releasing position, such engagement of the shifting member and tumbler being maintained by yielding means pressing said parts axially together, and one of said projections being inclined to permit forcing the other past it when the parts are rotated relatively to each other.

10. A padlock comprising a case having openings, a shackle having legs slidable in said openings, one leg of the shackle being notched, a shackle-controlling bolt member pivotally mounted in the case, and a spring latch pivoted on the bolt member and projecting therefrom normally for engaging the notch of the shackle, a plurality of tumbler disks co-axially disposed and having alignable notches to receive a portion of the bolt to permit movement of the latter about its pivot to shackle-releasing position, stop means limiting the pivotal movement of the latch upon the bolt in one direction whereby withdrawal of the shackle serves to swing the bolt on its pivot and release the shackle notch from the latch, means carried by the shackle acting to eject the bolt from the tumbler notches and return the bolt to normal position, and means thereafter shifting at least one of the tumbler notches out of aligned position and thus holding the bolt at normal position, said latch projecting in the return path of the shackle when the bolt is swung back to normal position but yielding to admit the shackle when the latter is returned to locking position.

11. A padlock comprising a case having openings, a shackle having legs slidable in said openings, one leg of the shackle being notched, a bolt member formed of sheet metal and comprising a flat web portion pivotally mounted in the case and a transversely extending flange, together with a latch member pivoted upon the web of the bolt and disposed for normally engaging the notch of the shackle, a plurality of tumbler disks co-axially disposed and having alignable notches to receive the flange of the bolt member for permitting movement of the latter about its pivot to shackle-releasing position, stop means limiting the pivotal movement of the latch upon the bolt in one direction whereby withdrawal of the shackle serves to swing the bolt on its pivot and release the shackle notch from the latch, said latch projecting in the return path of the shackle when the bolt is swung to normal position but yielding to admit the shackle when the latter is returned to locking position.

12. In the combination defined in claim 11, said latch member being also formed of sheet metal and including a flat web portion pivoted upon the web of the bolt and a transversely extending flange which is engageable with the notch of the shackle, a spring coiled about the pivot of the latch with one end engaging the latch flange and with the other end engaging the bolt pivot to yieldingly resist swinging of the latch in one direction, said bolt pivot serving also as the stop which limits pivotal movement of the latch in the other direction.

13. A padlock comprising a case having openings, a shackle having legs slidable in said openings, one leg of the shackle being notched, a shackle-controlling bolt member pivotally mounted in the case and comprising two parts hingedly connected, stop means limiting their angular movement about their hinge axis and spring means yieldingly resisting such movement away from the stop, a plurality of tumbler disks co-axially disposed and having alignable notches to receive a portion of one part of the hinged bolt for permitting the bolt to swing bodily about its pivot to shackle-releasing position, the other part of the bolt being engaged with the notch of the shackle and the stop means of the bolt causing withdrawal of the shackle to swing the bolt on its pivot, said other part of the bolt projecting in the return path of the shackle when the bolt is swung back to normal position and the spring permitting said part to yield about its hinge axis to admit the shackle and then swinging said part into the notch of the shackle as the latter returns to locking position.

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