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COMBINATION LOCK

This invention relates to a combination lock having a plurality of dial-driven sleeves for controlling a locking member dependent on the rotational position of the sleeves.

5 In order to change the combination of the lock, a lock is provided as set out in Claim 1 of the claims of this specification.

In this specification, the term "Hasp" is used to describe the element engaged by a latch, an embodiment of which is illustrated at 43 in the drawings.

10 This application is divided from co-pending application 8129885 (specification 2088942), which describes and claims a latching system for a luggage article and includes a description of an embodiment of a combination lock according to the present invention.

15 An example of the invention will now be described with reference to the accompanying drawings, in which:

Figure 1 is an exploded perspective view of a latching system for use on a luggage article incorporating a combination lock.

Figure 2 is a sectional plan view of parts of the latching system;

Figure 3 is a sectional plan view, on an enlarged scale, of one of the latch assemblies and hasps of the latching system, with a latch shown in its hasp-engaging position;

Figure 4 is a view similar to Figure 3 with the latch shown in its hasp-disengaging position;

Figure 5 is a sectional view on line 5-5 of Figure 3;

Figure 6 is a sectional plan view, part broken away, of the combination lock and camming member used in the latching system;

Figure 7 is a sectional view on line 7-7 of Figure 6 with the lock shown in the unlocked condition;

Figure 7A is a view similar to Figure 7 showing parts of the lock in the locked condition;

Figure 8 is a sectional view on line 8-8 of Figure 7;

Figure 9 is a sectional view on line 9-9 of Figure 6;

Figure 10 is a sectional view on line 10-10 of Figure 7;

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Figure 11 is a view similar to Figure 7 showing parts of the lock in a combination-changing position;

Figure 12 is a perspective view of the lock bolt;

Figure 13 is a perspective view of the lock shift lever; and

Figure 14 is a composite end view of a combination dial and combination sleeve.

Referring initially to Figure 1, the invention is illustrated within a latching system for a luggage article such as a soft-sided suitcase or the like. The case may, for example, have a body section with a somewhat flexible wooden front wall, part of the upper portion of which is shown in phantom at reference 10, and a hinged lid with a similar front wall, part of the lower portion of which is shown in phantom at reference 12. The latching system includes a relatively flat elongate latch console 14 for attachment interiorly to wall portion 10, a combined lock and actuator assembly 16 exposed on the exterior of wall portion 10 and a relatively flat elongate hasp assembly 18 for attachment interiorly to wall portion 12.

Latch console 14, illustrated in detail in Figures 1-5, includes a channel-shaped base plate 20; two left-hand latch assemblies 22A, 22B; two right-hand latch assemblies 24A, 24B; interfitting slide rods 26

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and 28 forming drive means for operating the left-hand latch assemblies; similar interfitting slide rods 30 and 32 forming drive means for operating the right-hand latch assemblies; top plate 34, and end covers 36.

5 Each of the latch assemblies is made up of identical components, notably a latch holder 38, a pivotal latch 40, a latch spring 42, a hasp ejector 44, and an ejector spring 46. Holders 38 are of generally rectangular shallow box-like form having a depth substantially corresponding to the depth of base plate 20 and the holders
10 fit in the base plate, being located by suitably spaced cutouts 48 in one upright wall of the base plate. Projections 50 on the sides of each holder fix the holder in position laterally of the base plate, with an upper
15 portion of the holder protruding therefrom. Base plate 20 may, for example, be an extrusion of a metal, such as aluminum, and the holders may be plastics mouldings

 Holders 38 each have a rear wall 52 (see Figures 3 and 4), a base wall 54, and side walls 56, and each
20 holder is formed symmetrically about a center line extending transversely of base plate 20. On each side of the center line, the holder has a circular latch-receiving opening 58 in rear wall 52, and an ejector mounting plug 60. Side
 walls 56 each terminate in a head portion 62 providing
25 ejector stop shoulders 64 and inclined hasp lead-in surfaces 66. At their lower ends, side walls 56 each have a locating projection 68 for latch spring 42. Rear wall 52

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terminates at the bases of plugs 60 and side walls 56 have notches 70 (see Figure 1) so that a transversely extending open channel or slot is formed at the base of the holder for receiving part of one of the slide rods 26-32, as will be described.

The latches 40 may be identical plastics mouldings each in the form of a crank having a notched latching portion 72 and an actuating portion 74. Between portions 72 and 74 the latch has a mounting section with bosses 76 and 78 on its opposite surfaces so that, by reversal of the latch, it may be pivotally mounted in either of the holder openings 58 by way of the respective bosses. On the actuating portion 74, the latch has a locating projection 80 for the latch spring.

Hasp ejectors 44 comprise yoke-like members adapted to fit over the respective plugs 60 with springs 46 interposed therebetween, so that the ejectors are urged toward shoulders 64. The ejectors have projecting hasp-engaging tongues 82 (see Figures 3 and 4).

In the left-hand latch assemblies 22A, 22B, latches 40 are mounted in holders 38 in the right-hand openings 58 for counterclockwise pivoting movement from the hasp-engaging positions (shown in Figure 2) to the hasp-disengaging positions. The ejectors in these assemblies are fitted on the right-hand plugs 60 and hasp springs 42 are fitted between the latches and the right-hand projections 68 so as to bias the latches toward their hasp-engaging positions.

In the right-hand latch assemblies 24A, 24B, on the other hand, latches 40 are reversed and mounted in holders 38 in the left-hand openings 58 for clockwise pivoting movement from the hasp-engaging positions (Figures 2 and 3) to the hasp-disengaging positions (Figure 4). The ejectors in the right-hand assemblies are fitted on the left-hand plugs 60 and the hasp springs are located correspondingly.

Slide rod 26 has at its right end an up-turned projection 84 providing a transverse tab 86. Towards its left end, rod 26 has a further up-turned projection 88 providing a transverse tab 90, the length and configuration of the rod being such that projection 88 fits in the open channel of latch holder 38 of latch assembly 22A with tab 90 constituting a latch-engaging element engaging the actuating portion 74 of latch 40, as shown in Figure 2. At its left end, rod 26 has a T-shaped coupling element 92 coupled with a complementary cutout at the right end of rod 28. Rod 28 terminates in an upstanding transverse tab 96 fitting in the open channel of holder 38 of latch assembly 22B and constituting a further latch-engaging element engaging the actuating portion of latch 40. Rod 28 has upstanding side walls 98 fitting between assemblies 22A and 22B and limiting longitudinal movement of rods 26 and 28.

Slide rod 30 has at its left end an upstanding projection 100 providing a transverse tab 102 and towards

its right end a further upstanding projection 104 providing a transverse tab 106. Projection 104 fits in the open channel of holder 38 of latch assembly 24A with tab 106 constituting a latch-engaging element engaging behind the actuating portion of latch 40. At its right end, rod 30 has a T-shaped coupling element 108 coupled to a corresponding cutout in the left end of rod 32. Rod 32 at its right end has an upstanding transverse tab 112 fitting in the open channel of holder 38 of latch assembly 24B and forming a latch-engaging element engaging behind the actuating portion of latch 40. Rod 32 has upstanding side walls 114 fitting between latch assemblies 24A and 24B and limiting the longitudinal movement of rods 30 and 32.

Top plate 34 has depending side walls 35 (Figures 1 and 10) which interfit with the upstanding side walls of base plate 20 and the plates have corresponding openings whereby they are assembled together with suitable attachment means (not shown). Additionally, the top plate has a central rectangular opening 37 to accept the casing of the lock and actuator assembly 16 and cutouts 39 may be provided in the top plate, if required, to fit the terminal portions of a central carrying handle of the luggage article. The latch console may conveniently be supplied to a luggage manufacturer in a fully assembled state for direct attachment to the interior of the relevant wall section of a luggage article, with the lock

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and actuator assembly fitting into place from the exterior of the article. (The wall section of the article will have an opening corresponding to opening 37.) The end covers 36, which may be plastic moldings, fit in opposite ends of base plate 20 and may be secured by any suitable attachment means.

Hasp assembly 18 includes an elongate channel 41 and four identical reversible hasps 43 having notched portions complementary to the latch portions of latches 40. The hasps may also be plastics mouldings. Channel 41 has cutouts 47 (Figure 1) spaced to conform to the spacing of latches 40. The hasps are fastened in channels 41 by suitable fastening means and the two left-hand hasps are reversed with respect to the two right-hand hasps to complement the operation of the respective latches. End caps, as 45, are provided for the ends of channel 41. When the hasps are in engagement with the respective latches, i.e., the luggage article is closed, the hasps depress ejectors 44 by engagement with tongues 82 as shown in Figure 2.

Tabs 86 and 102 of rods 26 and 30, respectively, engage a central camming member 116 connected to a swiveling actuator 118, the actuator and camming member forming part of assembly 16. Camming member 116 is attached to actuator 118 by fastening means, such as screws 120 (see Figures 6 and 7) received in depending actuator posts 122. The camming member has opposed downwardly extending tangs 124, 126 behind which

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tabs 86 and 102 engage (see Figures 2 and 6). Thus, when the camming member 116 is swiveled counterclockwise, by swiveling movement of the actuator from the rest position shown in Figures 2 and 6, rods 26 and 28 are drawn to the right while rods 30 and 32 are drawn to the left. The camming member thus constitutes a drive member for the slide rods and the tabs 86 and 102 form drive formations by which the rods are moved.

Movement of rods 26 and 28 to the right causes tabs 90 and 96 to effect counterclockwise pivoting movement of the left-hand latches 40 against the action of latch springs 42, while movement of rods 30 and 32 to the left causes tabs 106 and 112 to effect counterclockwise pivoting movement of the right-hand latches. The latches are thus moved from their hasp-engaging positions to their hasp-disengaging positions responsive to swiveling movement of the actuator from the rest position. Figure 4 shows right-hand latch assembly 24B in the hasp-disengaging position and it will be seen that the right-hand plug 60 and head portion 62 provide stop surfaces for the latch. Further, release of the latches from the hasps causes the ejectors to urge the hasps outwardly with respect to the holders (Figure 4) thereby facilitating opening of the luggage article.

When actuator 118 is released, the latch springs 42 act as biasing means which return the latches to their respective hasp-engaging positions and, through tabs 90,

96, 106 and 112 return the slide rods to their initial positions. Tabs 86 and 102 acting on tangs 124 and 126 return the camming member 116 and the actuator 118 to the rest position.

5 It will be appreciated, as seen particularly in Figure 3, that when the hasps are disengaged, the latches can be pivoted against springs 42 away from their hasp-engaging positions independently of the slide rods. Thus, downward pressure exerted on inclined surfaces 72a
10 of the illustrated latch by the inclined hasp surface 41a produces a camming action, pivoting the latch away from the hasp-engaging position and allowing the hasp to be re-engaged without having to move the actuator and slide rods from their rest positions. When the surface 41a
15 clears surface 72a, the latch is snapped back into hasp engagement by spring 42. The design of the hasps and latches and the specific angles of the respective camming surfaces (preferably about 45° in each case) facilitates closing of the case even if there are slight misalignments
20 between the respective hasps and latches.

 Actuator and lock assembly 16 includes a body member 140 which, as previously indicated, fits in opening 37 in the top plate of the latch console, through a corresponding opening in wall 10 of the luggage article
25 (see Figure 7). Body member 140 includes depending posts 142 by which it may be attached to base plate 20, by screws 144, or other suitable fastening means may be

used. The body member further includes an opening 146 in which actuator 118 is rotatably mounted and the body member also forms part of a housing for a combination lock 130. Opening 146 includes a cross member 148 straddled by actuator posts 122, thereby limiting swiveling movement of the actuator, and the camming member 116 prevents the actuator from being withdrawn upwardly from opening 146.

When fitting the latch console and assembly 16 to a luggage article, for example, the latch console may be attached to the interior of the relevant wall section of the article and assembly 16 may then simply be fitted into place from the exterior of the article through opening 37, the slide rods and camming member being suitably adjusted such that tabs 86 and 102 interfit behind the tangs 124 and 126. Assembly 16 may then be fixed in place by the aforementioned screws 120 or the like.

Combination lock 130 (see particularly Figures 7-14) is adapted to releasably lock the actuator 118 and camming member 116 in the rest position, so that when the luggage article is closed, the latches cannot be disengaged from the hasps unless the lock is released. Lock 130 is of the type in which dial-driven cams control the movement of a movable locking member, in the form of a pivotal bolt 132, between locking and unlocking positions. In the locking position, the bolt blocks movement of

camming member 116, as will be described, and in the unlocking position it releases the camming member for operation by the actuator. Lock 130 may conveniently be of a similar type to locks described in British Patent 5 Specification 2047788. The entire disclosure of that specification is incorporated herein by reference.

Lock 130 includes a shaft 148 supported at its opposite ends between suitably shaped surfaces of body member 140 and a dished cover plate 150 suitably secured 10 by screws, rivets or the like to the body member. Combination sleeves 152, 154, 156 are rotatably mounted on shaft 148 between a coil spring 158 and an integral shaft collar 160. On the other side of collar 160 the shaft carries a shift lever 162, and spring 158 engages 15 a washer 164 to urge the assembly of shaft, sleeves and shift lever to the left, as shown in the drawings.

Sleeves 152-156 carry encircling combination dials 166, 168, 170 and the sleeves have enlarged end flanges 172, 174, 176 constituting cams for the lock 20 bolt, as will be described. The periphery of each cam is circular except for a substantially V-shaped notch 178, as shown in Figure 14. The sleeves are coupled for rotation to the respective dials in conventional manner by teeth 180 on the sleeves which mesh with corresponding 25 openings 182 in the dials. The dials have conventional

circumferentially disposed indicia, with portions of the dials protruding through suitable slots in a portion 138 of body member 140 constituting the lock faceplate, for manual rotation of the dials and sleeves. A dial spring 184 on the base of cover plate 150 has arms 186 (Figure 10) engaging detents between the respective dial indicia, so that the dials are rotated in equal increments between successive indicium-displaying positions.

The lock bolt 132 has projecting tongues 188 by which the bolt is pivotally mounted in suitable openings (not shown) in cover plate 150. Openings 190, 192, 194 in the bolt (see Figure 12) accommodate the respective dials and the bolt has cross-bars 196, 198, 200 positioned to engage against the peripheries of cams 172-176, respectively. The bolt is urged upwardly into engagement with the cam peripheries by coil springs 202, 204 (see Figures 6 and 10).

As seen particularly in Figures 10 and 12, cross-bars 196-200 of the bolt are shaped to provide ridge portions 206, 208, 210, having converging planar surfaces. When all the sleeves 152-156 are rotated into a particular alignment, as shown in Figure 10, corresponding to particular indicium-displaying positions of the respective dials (i.e., the on-combination setting of the lock), the ridge portions engage in the respective cam notches 178 and the bolt assumes an upper unlocked condition under the influence of springs 202, 204. When,

however, any one or more of the dials is rotated by one or more increments from the aligned position, to move the lock off-combination, a camming action is effected between the respective notch and ridge portion whereby the bolt is moved down against springs 202, 204 into a locked position in which the relevant ridge portion is disengaged from the respective notch and brought into tangential contact with the dial periphery.

Specific design requirements for the notches and ridge portions and the advantages obtained with this type of construction are referred to in greater detail in the copending application referred to above.

Bolt 132 includes an elongate extension arm 206 extending through a suitable vertical slot (not shown) in cover plate 150 and terminating in a depending tab 208 adapted to cooperate with a corresponding tab projection 210 on camming member 116 (see Figures 6 and 9). When the bolt 132 is in its lowered, locked position, tab 208 engages behind projection 210 and prevents member 116 from being rotated by actuator 118 to operate the latching system. When, however, the bolt 132 assumes its upper unlocked position (the lock having been set on-combination) tab 208 clears projection 210 as seen in Figure 9, and camming member 116 is freed for rotation by the actuator to operate the latching system.

Lock 130 further includes means for changing the set combination by moving the dials out of engagement

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with the respective sleeves and allowing the dials to be rotated relative to the sleeves. To this end, when the lock is set on-combination, shaft 148 and sleeves 152-156 can be moved to the right against spring 158 by means of shift lever 162, from the Figure 7 position into a combination-changing position shown in Figure 11, thereby uncoupling the sleeves from the dials.

Shift lever 162 includes a manual actuating portion 212 projecting through an opening 214 in the lock faceplate, a body portion 216 abutting shaft collar 160, a blocking portion 218 and a follower 220. When the lock bolt 132 is in its lowered, locked position, blocking portion 218 is in blocking alignment with cross member 222 of the bolt (Figure 7A) thereby preventing the shift lever from being moved to the right. When the lock is set on-combination, however, and the bolt is lifted, cross member 222 clears blocking portion 218 (Figure 7) and allows the manual actuating portion 212 of the shift lever to be moved to the right in opening 214. This movement causes the assembly of shaft 148 and sleeves 152-156 to be moved into the Figure 11 position against spring 158.

Movement of the shift lever 162 to the right causes follower 220 to move along one leg 224 of an L-shaped opening 226 in cover plate 150 (see Figure 8). In the Figure 11 position, the shift lever can then be tilted on shaft 148 so that the follower 220 engages the other leg 228 of opening 226 behind a stop shoulder 230.

The shift lever can then be released and the stop shoulder holds the shaft and sleeves in the combination-changing position. Further, in the combination-changing position, blocking portion 218 of the shift lever engages under cross member 222 of the bolt as seen in Figure 11. This holds the bolt in the upper unlocked position, thereby precluding rotation of the sleeves and avoiding a loss of combination.

When the combination has been changed, shift lever 162 can be tilted back into its initial orientation on shaft 148 to bring follower 220 out of engagement with shoulder 230. Release of the shift lever then allows spring 158 to return the shaft, sleeves and shift lever to the Figure 7 position, thereby re-coupling the dials and sleeves and setting the new combination.



CLAIMS:-

1. A combination lock comprising a faceplate, a base-plate, a plurality of dial-driven sleeves mounted in axially abutting relation on a shaft for controlling a locking member dependent on the rotational position of the sleeves, the sleeves normally being coupled to the respective dials, and means for enabling the combination of the lock to be changed by uncoupling the sleeves from the dials, said means including a shift lever positioned adjacent an end one of the sleeves for moving the sleeves axially to uncouple them from the dials by movement of the shift lever in one axial direction, the shift lever having an actuating portion at one end by which the shift lever can be moved manually, the actuating portion projecting through an opening in the faceplate of the lock adjacent further openings in the faceplate through which portions of the respective dials project, and the shift lever further having a follower at its opposite end received in a guide opening provided in the baseplate of the lock, the guide opening allowing the shift lever to be tilted on said shaft when the sleeves are uncoupled from the dials and holding the shift lever, when tilted, against movement in the opposite axial direction.
2. A lock as defined in Claim 1, wherein the shift lever includes a blocking portion adapted to cooperate with the locking member for preventing the shift lever from being moved in said one axial direction to move the sleeves out of engagement with the dials except when the locking member is in an unlocked condition.
3. A lock as defined in Claim 2, wherein in the tilted position of the shift lever, the blocking portion holds the locking member in the unlocked condition.