Feb. 9, 1954 A. SCHNEGG 2,668,433

COMBINATION LOCK

Filed Nov. 25, 1950 2 Sheets-Sheet 1

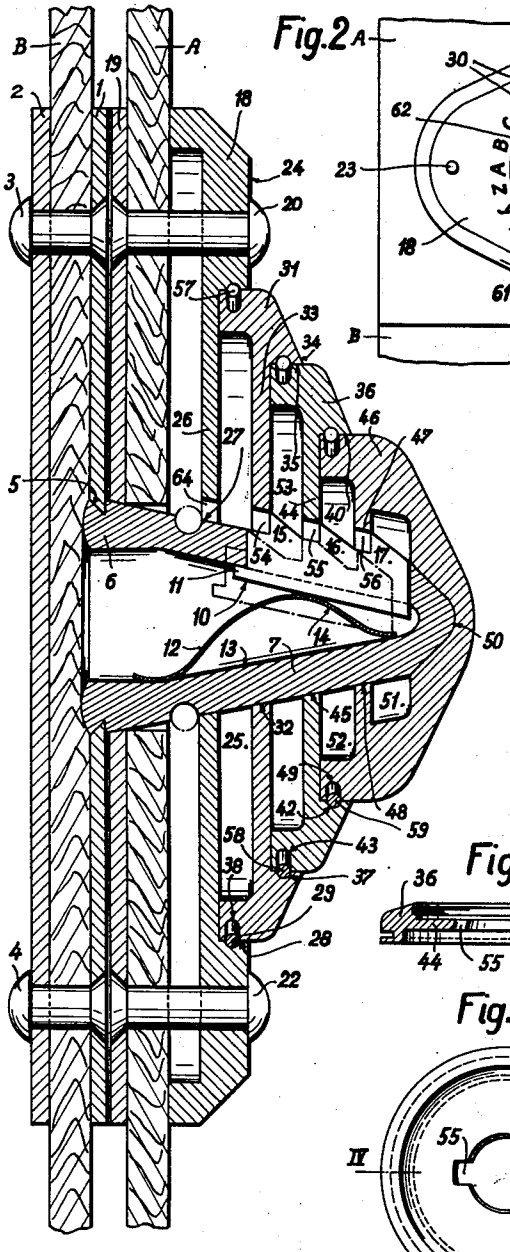

Fig. 1

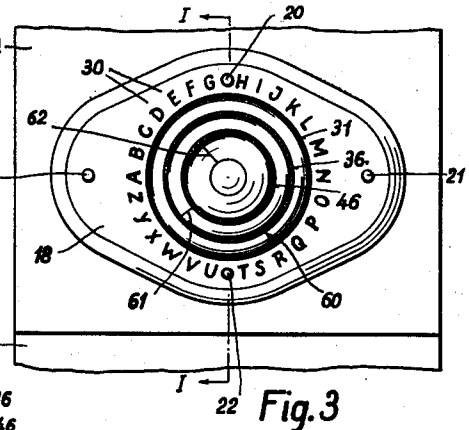

Fig. 2

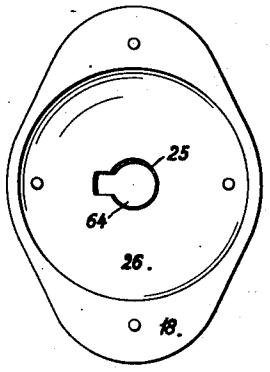

Fig. 3

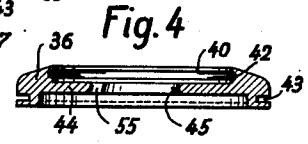

Fig. 4

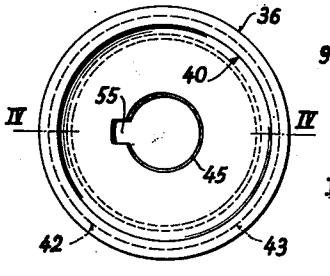

Fig. 5

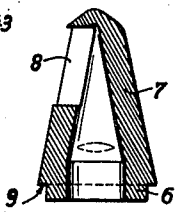

Fig. 6

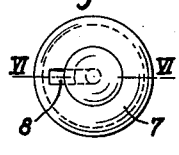

Fig. 7

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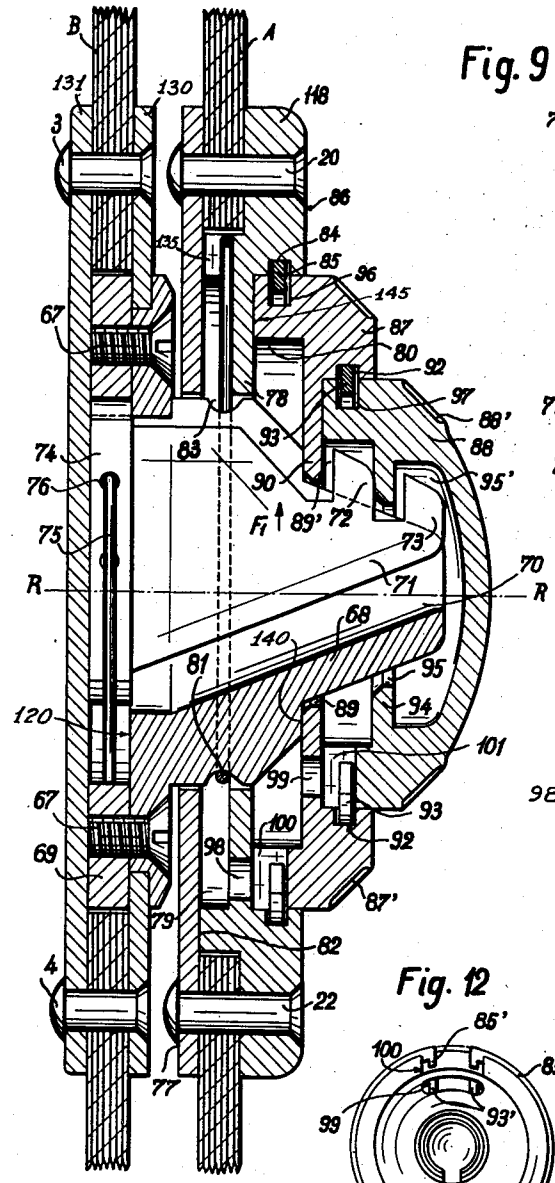


Fig. 8

Fig. 9

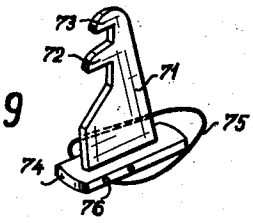


Fig. 10

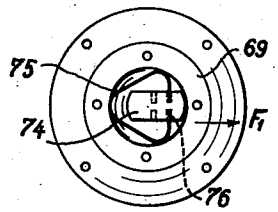


Fig. 11

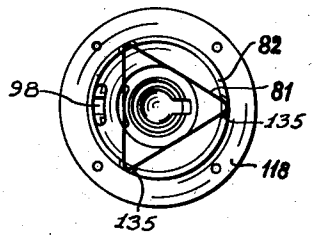
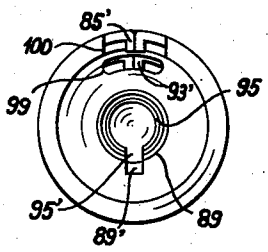


Fig. 12

Fig. 13



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2,668,433

UNITED STATES PATENT OFFICE

2,668,433

COMBINATION LOCK

Auguste Schnegg, Pieterlen, by Bienne, Switzerland

Application November 25, 1950, Serial No. 197,530

Claims priority, application Switzerland July 19, 1950

2 Claims. (Cl. 70—4)

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This invention relates to a combination lock adapted to connect two separable parts, this lock comprising on the one hand a plurality of coaxial discs capable of turning independently of one another about their axis and on the other hand a toothed locking device, these discs being formed with circular grooves on the inside, provided with radial notches which, when brought into a given position, permit the said teeth to pass, thus allowing the lock to be unlocked.

It is an object of the present invention to provide in a combination lock of the above class, an upstanding core over which the discs slide axially when the lock is being opened or closed and which carries a sliding latch provided with the above mentioned teeth in the form of dissymmetrical teeth corresponding, in number and in arrangement, with the circular grooves, this latch being capable of assuming an inoperative position in relation to the said grooves and a locking position towards which it is resiliently urged, so that when the lock is being closed the edges of the grooves act on the oblique sides of the teeth and thus displace the latch towards the inoperative position until the grooves proper reach a position opposite the corresponding teeth and thereby allow the latch to slide towards its locking position, it being thus possible to effect the closure of the lock with the discs in any relative angular position.

The attached drawing represents two embodiments of the invention, chosen by way of example.

Fig. 1 is a longitudinal section, on line I—I of Fig. 2, of the lock in the closed position, together with the two members which the lock is intended to fasten together.

Fig. 2 is a view in plan from above.

Fig. 3 is a view in plan, from below, of all of the coaxial discs together.

Fig. 4 is a diametrical section, on line IV—IV of Fig. 5, of a single disc.

Fig. 5 is a plan view of this disc, its lower surface being shown.

Figs. 6 and 7 are respectively an axial section on line VI—VI of Fig. 7, and a plan view from above, of the guiding core.

Figs. 8 to 13 relate to an alternative embodiment.

Fig. 8 is a longitudinal section of the lock in the closed position, along the axis of the guiding core.

Fig. 9 illustrates the latch in perspective view.

Fig. 10 is a view in plan, from below, of the base plate carrying the core and the latch.

Fig. 11 is a view in plan, from below, of all of the coaxial discs together.

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Figs. 12 and 13 show the mounting of two consecutive coaxial discs, on a larger scale than that of Figs. 10 and 11.

In Figs. 1 and 8 the reference letters A and B indicate the two separable parts or members to be fastened together by means of the combination lock.

In the first embodiment (Figs. 1 to 7) the lower member B is clamped between a base plate 1, which may be round or otherwise shaped, and another plate 2 of the same shape, the plates being fixed together by four rivets of which two, 3 and 4, are shown in Fig. 1. The base plate 1 is provided with a central circular opening 5 in which is engaged the base 6 of the guiding core 7 which is in the form of a hollow cone. The fastening of the core to the plate 1 is effected by caulking its lower edge 6 in the opening 5. The guiding core 7 is formed with a rectangular axial slot 8 made so as to cover a fraction of the length of the external and internal generatrices of the cone (Fig. 6). The fixing of the said core to the base plate 1 is facilitated by the shoulder 9 at the bottom of the core.

A latch 10, mounted in the slot 8, is allowed to slide therein in a direction perpendicular to the axis of the core 7 (Fig. 1). It is provided with a stopping catch 11 which prevents it from leaving the slot. A plate-spring 12, the extremities of which are supported against the inside wall 13 of the core, bears, with its convex part 14, against the back side of the latch. The latch is provided with equidistant saw-type teeth 15, 16 and 17.

The upper member A which is to be fastened to the lower member B by means of the lock, is clamped to a frame 18 and a bottom plate 19, both of which are oval in outline, by means of rivets 20, 21, 22 and 23 (Figs. 1 and 2). The upper wall 24 of the frame is provided with an annular recess of cavity 25, the bottom wall 26 of this recess being provided with an aperture with a circular outline 27, to enable the guiding core 7 to pass through. In the circular edge 28 of the cavity 25 a narrow groove 29 is provided. On its upper surface round the cavity 25 the frame 18 is provided with signs 30, for instance the letters of the alphabet, or numerals, for the combinations which enable the lock to be opened.

A first annular disc 31 is accommodated in the cavity 25 in such a way as to be capable of turning, in this cavity, about the vertical axis of symmetry of the frame 18. This disc 31 is provided with a central circular aperture 32 in its wall 33 which is deep with respect to the upper surface 34 in such a way as to form an annular cavity 35 in which is accommodated a second disc 36

which can be turned about the axis of the frame 18. As in the case of the frame, the cylindrical edge of the cavity 35 of the first disc is formed with a narrow groove 37.

In addition, a complementary deep groove 38 is formed in the peripheral wall of the disc 31. The second disc 36, co-axially arranged on the first disc 31, in its turn comprises a recess or cavity 40 serving to accommodate a third disc 46 the shape of which is similar to that of a cap. The second disc 36 is illustrated in detail in Figs. 4 and 5. This disc is provided with a narrow groove 42 in the inner cylindrical edge of its cavity 40 and with a narrow deep groove 43 in its periphery.

The inner wall 44 of this disc 36 is sunk in relation to its upper and lower surfaces and is provided with a circular aperture 45 with a conical edge, the generatrices of which are practically parallel to those of the guiding core 7 when the lock is in the closed position. In its cavity 40 the second disc 36 carries the cap 46 comprising a flat intermediate wall 47 provided with a circular aperture 48 with a conical edge, this aperture being coaxial to the axis of symmetry of the frame 18. The outer cylindrical edge of the cap 46 is formed with a narrow deep slot 49. The inner extremity 50 of this cap is shaped so as to fit the top of the guiding core 7 exactly. Between the extremity 50 and the intermediate wall a circular groove 51 is cut, the depth of which is equal to the height of the tooth 17 of the latch 10. A second circular groove 52 is provided between the intermediate wall 47 of the cap and the intermediate wall 44 of the second disc 36; the depth of the groove 52 is scarcely greater than the height of the tooth 16 of the latch. Lastly, a third circular groove 53 is provided between the intermediate wall 44 of the second disc and the wall 33 of the first disc 31. In the separation walls 33, 44 and 47 of the grooves 51, 52 and 53, notches 54, 55 and 56 are respectively cut, which are slightly wider than the teeth of the latch 10 and having a depth substantially equal to the height of the upright side of the saw teeth 15, 16 and 17. The bottom wall 26 of the frame 18 is likewise provided with a notch 64 in its circular aperture 27.

The two discs 31 and 36 and the cap 46 are kept in a convenient position on top of one another on the frame 18 in all positions of the supporting member A. For this purpose radially deformable retaining, cut rings 57, 58 and 59 are each engaged in two corresponding grooves at the same time. The first ring 57 is confined within the groove 29 of the frame and the external groove 38 of the first disc 31; the second, 58, within the grooves 37 and 43 of the first disc and of the second disc 36 respectively; the third ring 59 is confined within the internal groove 42 of the second disc and the deep groove 49 is provided in the cylindrical external edge of the cap.

The two discs 31 and 36 and the cap 46 are each marked on the upper surface with a radial adjustment line 60, 61, and 62 respectively; each of these lines has to be made to coincide with the radius passing through the corresponding letter 30 of the chosen combination, on the frame 18.

Assuming that the lock is closed, it can be opened only by bringing the notches 54, 55 and 56 of the two discs and the cap into alignment with the fixed notch 64; this alignment is effected by turning the discs and the cap, independently of one another, so that the adjustment lines 60, 61 and 62 are pointed towards the letters of the secret combination. The discs and the cap then occupy the positions illustrated in Fig. 1, in relation to the latch 10. It is seen that the sawteeth 15, 16 and 17 can pass freely through the corresponding notches 54, 55 and 56 when the operator lifts the supporting member A with the frame 18 and the members which it carries: the discs slide axially along the guiding core 7.

In order to close and lock the lock immediately, even if in the meantime the discs have been brought into any other relative position, one needs only to bring the member A up to the member B so that the series of coaxial circular apertures 25, 32, 45 and 48 is automatically centred on the guiding core 7. The edges of the said apertures then act on the inclined sides of the teeth 15, 16 and 17 and drive the latch 10 into the interior of the cone 13 as far as the position drawn in dot-dash lines in Fig. 1 whereby the discs and the cap are enabled to slide over the core 7 until the top of the cone 7 touches the extremity 50 of the cap. The teeth are then opposite the grooves corresponding to them and are introduced into these grooves by the action of the spring 14 which slides the latch 10 from right to left (Fig. 1) so as to lock the combination lock.

In the second embodiment, shown in Figs. 8 to 13, the lower flat part B is at all times clamped between a base plate 130 and an external anchor plate 131, the plates being held together by rivets 3 and 4. The base plate 130 is fixed by screws 67 to a flange of a guiding core 68 and to a ring 69. The conical guiding core 68 is provided, over the whole of its height, with an axial slot limited by parallel sides 70, in which is guided the operative part 71 of a sliding latch (Fig. 9). This operative part 71, one edge of which is cut out so as to be provided with two or more locking teeth 72 and 73, is supported by a small base plate 74 which can slide in the interior of the ring 69, between the base 120 of the core 68 and the anchor plate 131. A rounded triangular wire spring 75 is supported in a circular recess limited by the ring 69. This spring having its extremities engaged in holes 76 in the small base plate 74, urges the latch 71—74 as shown by the arrow F^1 (Figs. 8 and 10).

The upper part A which the lock is to fasten to the lower one B is clamped, by means of rivets 20 and 22, between a frame 118 and a lower circular plate 77 provided with an aperture. This frame 118 is provided with a central partition 78 separating two circular cavities 79 and 80 in one of which (79) is placed a triangular stopping spring 81, the corners of the triangle being let into notches 135 of the lower rim 82 (Fig. 11). When the lock is closed the spring 81 resiliently engages in a groove 83 of the core 68 to effect the stopping of the frame 118 and the discs on the said core. It is thus possible to keep the lock closed without having to operate the discs of the secret combination.

A narrow groove 84 provided in the cylindrical edge of the cavity 80 partly accommodates an assembling flat circlip 85. The upper annular surface 86 of the frame 118 is provided with letters of the alphabet which are not shown in the drawing but are arranged in the same way as the letters 30 in the first embodiment (Fig. 2), for the combinations which enable the lock to be opened.

A first annular disc 87 is accommodated in the cavity 80 in such a way as to be able to turn, in the cavity, about an axis R—R which is common to the two discs 87 and 88. The disc 87 is

provided with a central circular aperture 89 in its wall 90 which being set back in relation to the upper surface of this disc, forms the bottom of a cavity in which the second disc 88 can turn, this second disc serving also as a cap. The cylindrical edge of the cavity containing the second disc is in its turn formed with a narrow groove 92 which partly accommodates an assembling circlip 93. The second disc 88 is provided with a central wall 94 with a central aperture 95 to enable the core 68 to pass through.

When the lock is in the closed position the locking tooth 72 of the latch is engaged freely between the wall 90 of the disc 87 and the central wall 94 of the second disc, and the second tooth 73 is engaged freely between this central wall 94 and the extremity of the disc 88 which is cap-shaped.

A groove 96, provided on the periphery of the first disc, cooperates in a registering position with the complementary groove 84 of the frame to support the assembling circlip 85. The second circlip 93 is accommodated in the groove 92 of the first disc and at the same time in a corresponding groove 97 provided on the periphery of the second disc 88. The grooves 84, 96 and 92, 97 have a rectangular cross section and are parallel to the wall 90 of the first disc 87. The lower face of this wall 90 is applied by the edge of its circular aperture 89, on the annular seating 140 of the core 68, so that the discs 87 and 88 are held in parallel relationship to the base-plate 74 of the latch. The circular apertures 89 and 95 in the rotary discs are provided with radial notches 89' and 95' respectively which are a little wider than the teeth 72 and 73 of the latch.

The discs 87 and 88 are each marked on their outer surfaces, towards the periphery, at 87' and 88' with a radial adjustment line which is not shown but which is equivalent to the lines 60 and 61 of Fig. 2. Each of these lines in succession has to be made to coincide with the radius passing through the corresponding letter of the secret combination. In order to open the lock the notches 89' and 95' are brought into alignment with the slot 70 containing the latch, by pressing with the fingers on the milled parts 87' and 88' so as to point the adjustment lines towards the letters of the secret combination. With the exception of the number of letters, the operation of this lock is the same as that of the first embodiment described.

The central partition 78 is provided with an arch-shaped window 98 for lateral access to the circlip 85 and the wall 90 is provided with an arch-shaped window 99 for access to the second circlip 93. In a certain position the window 98 communicates with a notch 100 in the lower edge of the disc 87, and the window 99 communicates with a notch 101 in the second disc when this latter is in a certain position. The extremities of the circlip 85 are bent back inwardly as at 85' (Figs. 12 and 13) and those of the circlip 93 are likewise bent at 93'.

The circlips 85 and 93 when free have maximum diameters slightly greater than those of the respective grooves 84 and 92 of the frame and of the first disc, and as a result the said circlips bear resiliently against the bottoms of these grooves.

To disassemble the unit consisting of the discs 87 and 88, from the frame 118 after the lower plate 77 has been removed, the disc 87 is turned until the window 98 and the notch 100 are facing one to the other. When the lock was being assembled the circlip 85 was inserted in the external groove 84 in a position such that its extremities 85' appeared in the notch 100, as seen in Fig. 12. It is then only necessary to bring these extremities 85' together by means by tweezers and to place them in contact (position shown in Fig. 13) to enable the circlip 85, by being compressed, to escape from the groove 84 under the action of an axial pressure. The unit consisting of the discs 87 and 88 is then removed from the frame 118.

In the second stage, the window 99 and the notch 101 will be made to coincide, then the extremities 93' of the circlip 93 will be made to touch (position shown in Fig. 13), whereby the circlip 93 will be enabled to escape from the outer groove 92 under the action of an axial pressure. The discs 87 and 88 are separated.

I claim:

1. In a combination lock joining two separable, apertured flat parts, a first part carrying a first portion of said combination lock comprising a hollow guiding core provided with a sliding toothed latch, a second part carrying a second portion of said combination lock comprising a supporting frame through which said core extends and on which are stacked coaxial washer like discs having external marks for a secret combination and a radial inner slot, whereby these discs are separately rotatable and cooperate with the teeth of the latch, the following structure comprising supporting members fastened to said first flat part and shaped to form a recess limited by a flat bottom parallel to the first flat part and by peripheral walls; said guiding core being of substantially conical shape and being fastened to said supporting members, said core having a lower face opposite and parallel to the flat bottom of said recess and a radial straight-lined slot, said latch comprising a plate having a plurality of aligned saw-type teeth positioned and guided in said radial slot and a base-plate (74) resting on the flat bottom of said recess, said base-plate being held in said recess by the lower face of said core, spring means yieldingly applied on the peripheral walls of said recess and on said base-plate to urge the teeth of the latch outwardly of said radial slot into locking engagement with said washer like discs.

2. In a combination lock joining two separable, apertured flat parts, a first part carrying a first portion of said combination lock comprising a hollow guiding core provided with a sliding toothed latch, a second part carrying a second portion of said combination lock comprising a centrally apertured supporting frame (118) through which said core extends and on which are stacked coaxial washer like discs having external marks for a secret combination and radial inner slot, whereby these discs are separately rotatable and cooperate with the teeth of the latch, the following structure comprising: supporting members fastened to said first flat part and shaped to form a recess limited by a flat bottom parallel to the first flat part and by peripheral walls; said guiding core being of substantially conical shape and being fastened to said supporting members, said core comprising a lower plane face (120) parallel to said flat bottom, an external shoulder or annular seating (140) in parallelism with said lower plane face and a straight lined radial slot (70), said latch member consisting of a base-plate (74) slidingly arranged in said recess in said supporting

members and of a plate-shaped working part positioned and guided in said radial slot and being provided with two teeth the sides thereof being parallel to said base-plate (74), while the tops of said teeth are inclined; spring means yieldingly applied on the peripheral walls of said recess and on said base-plate to urge the teeth of the latch outwardly of said radial slot into locking engagement with said washer like discs, said centrally apertured frame being provided around its central aperture, with a cylindrical recess (80) having a flat bottom parallel to said base-plate of the core, in the locked position, the lateral wall of said recess being provided with a cylindrical, rectangular sectional groove; said coaxial washer like discs including a first combination disc rotatably fitted in said cylindrical recess and provided at its periphery, with a rectangular sectional groove registering with said groove in said frame, said first combination disc comprising an upper cylindrical recess having a lateral wall provided with a rectangular sectional groove, and a flat apertured bottom the underface of which is applied on said annular seating (140) of said core; said coaxial washer like discs also including a second combination disc rotatably fitted in said cylindrical recess of said first combination disc and being provided with an external groove, rectangular in section and registering with said groove of the cylindrical recess of said first combination disc; a first split washer engaged in said both registering grooves of the frame and of first combination disc; and a second split washer engaged in the said registering grooves provided in the upper recess of said first combination disc and in the periphery of said second combination disc, said first and second split washers having their extremities bent back, said grooves in said first and second combination discs being parallel to said annular seating of said core, said first and second combination discs being laterally notched (100, 101) in such a manner that the notches communicate with the peripheral grooves therein, said bent extremities of the split washers extending into said notches, the sizes of said notches being greater than the spacing of said bent extremities of the split washers in their expanded position in said grooves, whereby the outer diameter of said washer in a compressed state, through contacting their extremities is smaller than the respective outer diameters of first and second combination discs, in order to allow the disassembling of the latter by an axial shifting.

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