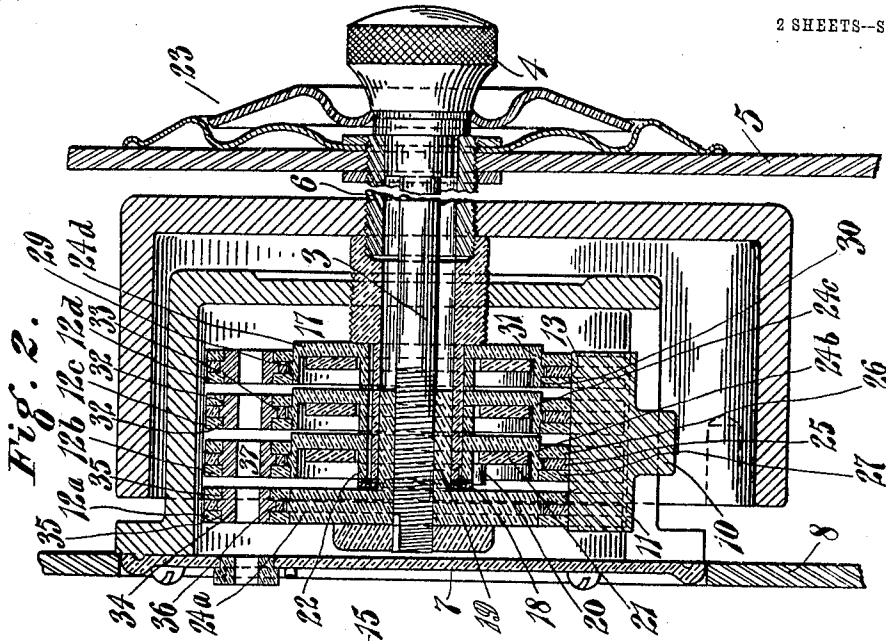
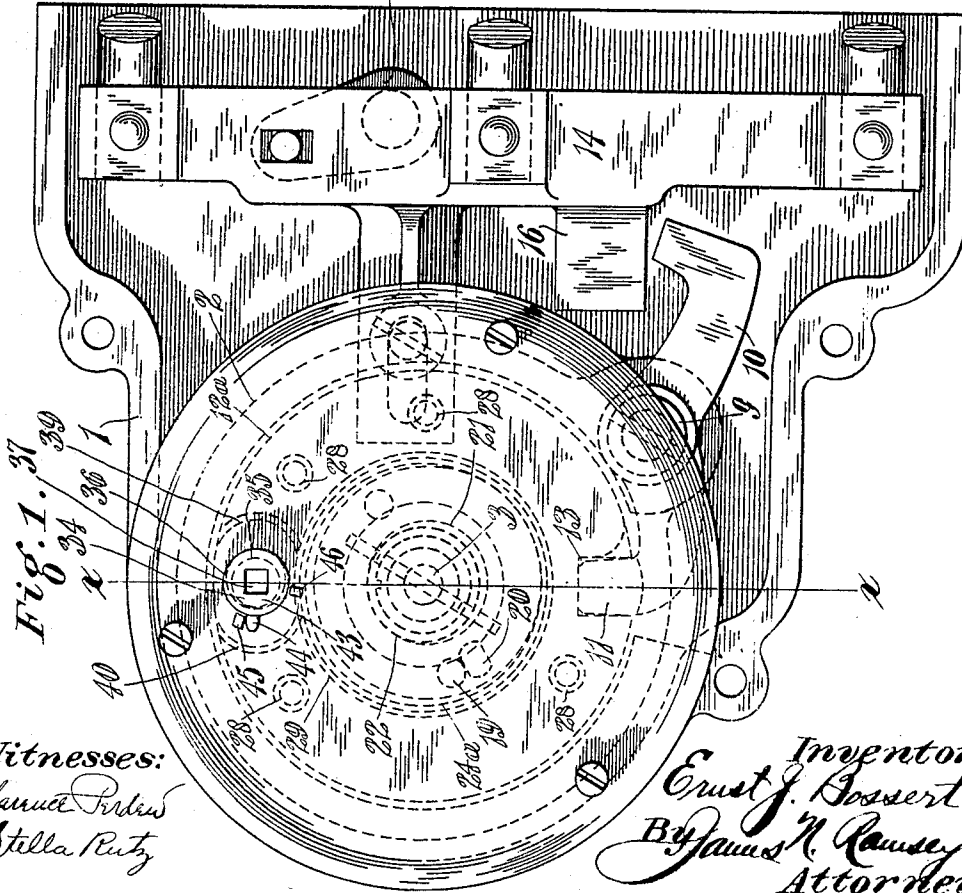


E. J. BOSSERT.
 PERMUTATION LOCK.
 APPLICATION FILED APR. 13, 1908.

904,302.

Patented Nov. 17, 1908.

2 SHEETS—SHEET 1.



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2 SHEETS—SHEET 2.

Fig. 3.

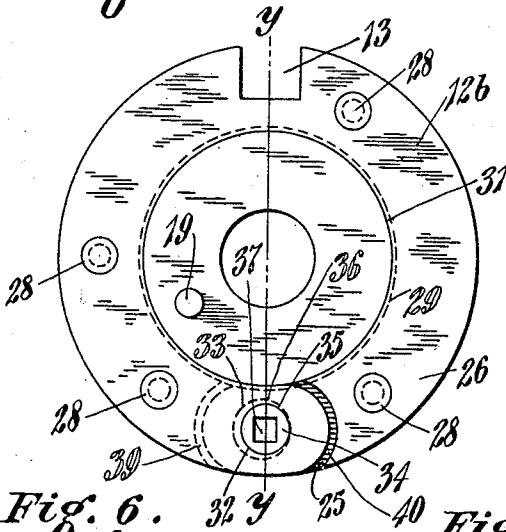


Fig. 4.

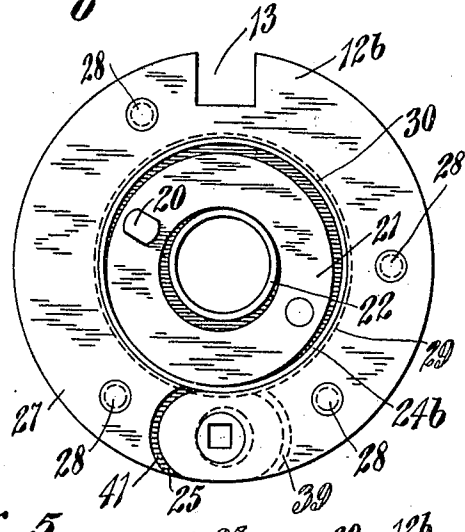


Fig. 6.

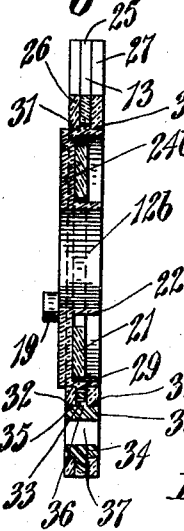


Fig. 7.

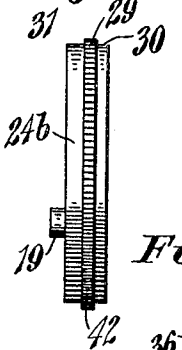


Fig. 5.

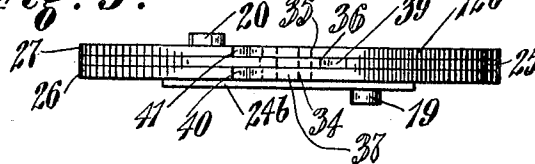


Fig. 8.

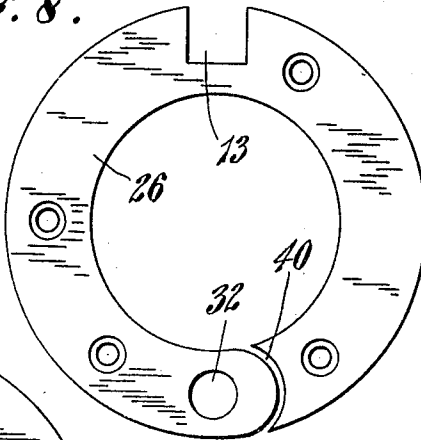


Fig. 11.

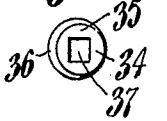


Fig. 9.

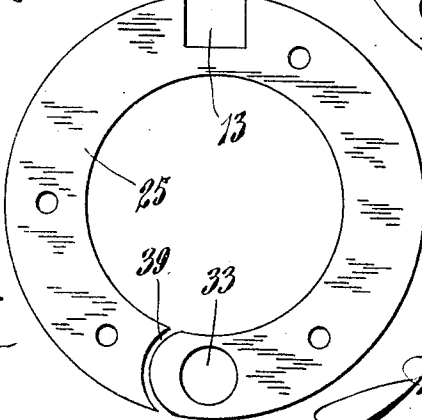
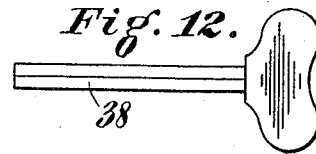


Fig. 10.



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Fig. 12.



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UNITED STATES PATENT OFFICE.

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PERMUTATION-LOCK.

No. 904,302.

Specification of Letters Patent.

Patented Nov. 17, 1908.

Application filed April 13, 1908. Serial No. 426,649.

To all whom it may concern:

Be it known that I, ERNST J. BOSSERT, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Permutation-Locks, of which the following is a specification.

My invention relates to locks having revolving tumbler wheels, the object being to provide a simple, compact and reliable construction, convenient to adjust and to operate.

My invention consists in the combination with the operative mechanism of a lock, of a series of tumbler wheels, each comprising an inner disk by means of which rotary motion is transmitted to the tumbler wheel in the process of unlocking, and a rim surrounding the disks, composed of divided or discontinuous annular plates rigidly and concentrically secured together, whereby the outer edges of these plates form the periphery of the tumbler wheel, and their inner edges are adjacent to the inner disk thereof, having overlapping guiding parts provided with a cam to produce relative movement between the guiding parts, and to flex all of the plates of each tumbler wheel collectively, whereby the inner edges of the plates may be made to engage and clamp the inner disk to cause its rotation to be transmitted to the rim, or to disengage from the inner disk, to allow the inner disk to be rotated while the rim remains stationary, for changing the combination of the lock.

My invention also consists in the parts and in the details of construction and arrangement of parts as will hereinafter be more fully described and claimed.

In the drawings: Figure 1 is an elevation of the inner face of a lock embodying my invention. Fig. 2 is a vertical section on a line corresponding to the line $x-x$ of Fig. 1, parts of the front and rear plates of the door being represented as in position. Fig. 3 is a front elevation, and Fig. 4 is a rear elevation of one of the tumbler wheels constructed according to my invention. Fig. 5 is an edge view of one of the tumbler wheels. Fig. 6 is a vertical section through one of the tumbler wheels, on a line corresponding to the line $y-y$ of Fig. 3. Fig. 7 is an edge view of one of the inner disks. Fig. 8 is a rear elevation of one of the plates comprising the rim of the tumbler wheel. Fig. 9 is

a rear elevation of another one of the plates comprising the rim of the tumbler wheel. Fig. 10 is an edge view, and Fig. 11 is a rear elevation of the cam. Fig. 12 is a side elevation of the key used for rotating the cams.

As illustrated, the various parts constituting my invention are mounted in a lock case 1, provided with an interior tumbler case 2 which has walls preferably concentric to the tumbler spindle 3, by means of which spindle rotary motion is adapted to be transmitted to the tumblers inside the case by means of the knob 4 extending outside the front plate 5 of the door in the usual manner, the tumbler spindle 3 being suitably journaled in a hollow stud 6 secured to the plate 5 and forming a support thereon for the lock case 1 and its tumbler case 2. Rearwardly the tumbler case 2 is closed by a plate 7 which lies in an opening in the rear plate 8 of the door. This tumbler case 2 also supports a stud 9 which forms a pivot for the dog 10, which presents an arm 11 extending parallel with the tumbler spindle 3, and adapted to engage with the peripheries of the tumbler wheels 12^a, 12^b, 12^c and 12^d, each provided with a slot 13, adapted to admit the arm 11. As illustrated, a bolt 14 is slidably mounted in the lock case 1 and adapted to be reciprocated by means of a crank 15 and provided with a projection 16, which will be engaged by a part of the dog 10 unless the arm 11 enters all the recesses 13 in the tumbler wheels.

The above parts are enumerated and the details of their construction and operation set forth, merely in order to facilitate the following description of the construction of my invention and the manner of its operation in conjunction with the mechanism of a lock, and it will be understood that my improved device is not limited in its adaptation to locks of the herein described construction, but may be used with any lock constructed to be operated and controlled by means of a plurality of revolving tumblers, and of which it is desired to change the combination of movements required to bring the tumblers into position for unlocking, without removing any part of the lock or the door on which it is mounted, and where it is permissible to insert the key, for changing the combination, into the face of the lock from the inside of the door.

The tumbler wheel 12^a constitutes the driving tumbler wheel and is suitably rig-

idly secured on the tumbler spindle 3, and journaled, by means of a hub, in the interior of the tube 17, which is rigidly mounted in the tumbler case 2 and also forms the means
 5 of attaching the tumbler case 2 to the hollow stud 6 which supports it. This tube 17 has a shoulder between which and the driving tumbler wheel 12^a are mounted the driven
 10 tumbler wheels 12^b, 12^c and 12^d held on the tube 17 by a ring 18. These driven tumbler wheels are free to rotate on the tube 17 and have washers interposed between them and held stationary by means of lugs taking into
 15 a slot in the tube 17, so that the motion of one tumbler wheel is not transmitted to the other, except by stationary lugs 19 mounted on the front sides of the tumbler wheels, and movable lugs 20 mounted on rings 21 on the
 20 rear sides of the tumbler wheels, which rings are adapted to engage with the hubs 22 of their respective tumbler wheels. The lugs 20 are thus movable, as is common in the construction of permutation locks, for the purpose of increasing the intricacy of the process
 25 of operation of the lock in the transmission of the motion successively from the driving tumbler wheel to the driven tumbler wheels, under the guidance of the dial 23 on the outside of the lock, and according to a
 30 certain formula which constitutes the combination of the lock, to bring the slots 13 of all the tumbler wheels into alinement for the admission of the arm 11 of the dog 10, and allow the bolt 14 to be reciprocated for un-
 35 locking.

For changing the construction of the lock, the tumbler wheels 12^a, 12^b, 12^c and 12^d are composed of inner disks 24^a, 24^b, 24^c and 24^d, respectively, each surrounded by a rim
 40 adapted to be clamped to the inner disk to rotate with it, or to be released from the inner disk and remain stationary while the inner disk revolves. For holding the rims to rotate with the inner disks or to release
 45 the inner disks and allow them to rotate independently of the rims, as may be desired in changing the combination of the lock, the rims are of laminated construction, each one of them comprising a middle plate
 50 25 and a front and a rear flanking plate 26 and 27, respectively, rigidly secured together by means of rivets 28, having counter-sunk heads so that the front and rear sides of the rim thus formed may be smooth. The inner
 55 disk 24^a, 24^b, 24^c, or 24^d, as the case may be, has its periphery turned down near each of its sides, so that a rib 29 extends completely around its periphery in the middle thereof, with journals 30 and 31 formed by the
 60 turned down parts at either side of the rib 29. The width of the rib 29 is only slightly less than the thickness of the middle plate 25, and the central opening in this middle plate 25 is just sufficiently large to admit
 65 the annular rib 29, while the central open-

ings in the flanking plates 26 and 27 are just sufficiently large to admit the journals 30 and 31 of the inner disk, so that when the plates forming the rim are secured together, the inner disks will be journaled in
 70 the flanking plates 26 and 27 and held from movement laterally of the rim by these flanking plates.

Openings 32, of equal diameter, are provided in the flanking plates of the rims, in
 75 such positions that they will be in alinement with each other when the plates are riveted together, while the middle plate 25 is also provided with an opening 33, which, however, is somewhat larger in diameter than
 80 the openings 32 in the flanking plates, and is eccentric to them when the plates are riveted together. The cam 34 is of length equal to the aggregate thickness of the plates constituting the rim and comprises the jour-
 85 nals 35 in alinement with each other and adapted to form journal bearings in the openings 32 in the flanking plates, and a middle rib 36, eccentric to the journals 35, and adapted to form a journal bearing in
 90 the opening 33 in the middle plate. Extending through the cam 34 from end to end, parallel with the axis, is the angulated opening 37, which permits of the insertion of a correspondingly shaped key 38 for rotating
 95 the cam.

The middle plate 25 is completely divided and terminates at 39 on one side of the cam 34, while the flanking plates 26 and 27 are completely divided and terminate at 40 and
 100 41, respectively, on the other side of the cam 34, one of the rivets 28 being preferably placed adjacent to the division at 39 of the middle plate, and another adjacent to the divisions at 40 and 41 of the flanking plates,
 105 on the sides away from the cam 34, to reinforce the rim at these points. However, no rivets are placed between the cam and the places where the plates are divided, and a sufficient amount of material composing the
 110 rings is removed at each of the places where they are divided, to form a considerable interstice and allow of relative edgewise movement of the parts of the several plates adjacent to the cam 34. Thus, the part of the
 115 middle plate lying around the cam 34 is adapted to slide between the adjacent parts of the flanking plates, and when the cam 34 is rotated, its rib 36 being eccentric to its journals 35, the part of the middle plate
 120 adjacent to the cam will be moved with respect to the parts of the flanking plates adjacent thereto, with the effect that the plates comprising the rims will be flexed in an edgewise direction and the central openings
 125 in the plates will be increased or decreased in size, when the cam 34 is rotated. The plates comprising the rims being so formed that their central openings accommodate the
 130 inner disks to form journal bearings for

them, and to admit their middle annular ribs 29 for allowing them to turn in the rims when the cam 34 is in position for holding the parts of the plates apart where the plates are divided, the rotation of the cam to draw these parts of the plates together will also decrease the size of the central openings in the plates to such an extent that the inner edges of the plates around these central openings will engage with the peripheries of the inner disks and compel the rims to rotate with the inner disks.

It is preferable that the central openings in the middle plates should be so proportioned with respect to the central openings in the flanking plates that the inner edges of the middle plates, around the central openings, will not engage with the ribs 29 of the inner disks when in released position, and this allows the annular ribs 29 to be provided with teeth 42, as illustrated in Fig. 7 of the drawings, for increasing the effectiveness of the frictional contact between the inner edges of the middle plates and the inner disks, when the rims are in clamped position.

A key guide 43 is rotatably mounted in the plate 7 in such position that it will be in alinement with the cams 34 in the rims of the tumbler wheels when these tumbler wheels have been rotated, so that their slots 13 are all in alinement and so that they admit the arm 11 of the dog 10. Preferably the cams are placed diametrically opposite from the slots 13 in the rims, and when the cams of all the tumbler wheels thus come into alinement, a key 38 may be inserted through the key guide 43 and through all of the cams 34 to rotate all of them simultaneously. In order to limit the rotation of the cams by the key, the key guide 43 is provided with a radially extending lug 44 adapted to engage with stops 45 and 46 when the cam is rotated to clamping position and releasing position, respectively. The key thus inserted into openings in the cams after rotating them to releasing position, also serves to maintain the rims of all of the tumbler wheels in the position in which they were released from the inner disks.

In order to change the combination of the lock it is only necessary to bring all of the tumbler wheels into position with their slots 13 in alinement so that the arm 11 of the dog 10 enters the slots, bringing the lock into unlocking position and bringing all of the cams into alinement, as above described, insert the key and release the rims from the inner disks, then destroy the existing combination of positions of the inner disks by rotating the tumbler spindle in alternate directions, after which the new combination may be formed by manipulating the tumbler spindle according to the new formula that it is desired shall govern the new combination of the lock, guided by the dial in the usual

manner. When this manipulation of the tumbler spindle according to the new formula has been completed by bringing the tumbler spindle into the last position of the combination, it is allowed to remain in this position, the key 38 is turned to rotate the cams of all of the tumbler wheels back to clamping position, securely clamping the rims on the inner disks, and then withdrawing the key, allowing the various tumbler wheels to be rotated according to the engagement of the stationary lugs with the movable lugs on the inner disks, and making it necessary, in order to again bring the slots 13 into alinement for allowing the unlocking of the lock, to manipulate the tumbler spindle according to the formula by which it was manipulated while the rims were released from the inner disks and held stationary by the key 38.

It will be seen that the rims constructed as above described effectually engage with the peripheries of the inner disks throughout their entire extent, constituting a positive and reliable clamping engagement between the rims and the inner disks, which is a most essential requirement in a permutation lock having a combination changing device, since, should one of the inner disks slip in its rim, the combination will be destroyed, rendering it practically impossible to unlock the lock by manipulation of the tumbler spindle, and making it necessary to open the safe, or other receptacle, by other means. While thus forming a thoroughly efficient clamp, the rim is of simple, compact construction, consisting, as it does, of only the three plates rigidly secured together and limited to collective flexure, each having parts lapping over a part of the other adjacent to their terminations, and of the cam journaled in the overlapping parts, being, in effect, only two relatively moving parts. By this simplicity of construction, economy in first cost is not only attained, but the reliability of the operation of the device, aside from the obviation of the danger of the inner disks inopportunely turning in the rims, is insured, due to the fact that the cam, composed of a single piece and simply journaled in the rim, which, in effect, is also a single piece, affords very little possibility of derangement, while the broad overlapping arrangement of the rigidly joined plates, adjacent to the cam, insures an efficient guidance of the moving parts of the plates in clamping and unclamping. The collective flexure of all of the plates in such a laminated construction is especially desirable in that it relieves the rivets or other members used to secure the plates together, of all strain tending to dismember the rim, so that efficient maintenance of the shape of the tumbler wheel, when in position for operation, is insured. The interstices,

where the plates are divided, not being continuous throughout the thickness of the rim, the peripheral surface of the tumbler wheel in the region of these divisions remains continuous, and affords the desired smooth bearing for the arm 11 of the dog 10 which rests against the periphery of the tumbler wheel, while the general construction allows the other surfaces of the tumbler wheel to retain the smoothness essential to its successful operation.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent is:

15 1. In a permutation lock, the combination with the operative mechanism of the lock, of a series of tumbler wheels, each comprising an inner disk by means of which rotary motion is transmitted to the tumbler wheel, 20 and a laminated rim surrounding each of the inner disks, composed of divided annular plates which are rigidly secured together and have overlapping parts, and a cam mounted in the overlapping parts adapted to 25 produce relative movement between them, substantially as and for the purposes specified.

2. In a permutation lock, the combination with the operating mechanism of the lock, 30 of a series of tumbler wheels, each comprising an inner disk by means of which rotary motion is transmitted to the tumbler wheel, and a laminated rim surrounding each of the inner disks, composed of divided annular 35 plates which are rigidly secured together and have overlapping parts, and a cam journaled in one of the overlapping parts and having a projection adapted to engage with one of the other overlapping parts, whereby rela- 40 tive movement may be produced between them, substantially as and for the purposes specified.

3. In a permutation lock, the combination with the operative mechanism of the lock, 45 of a series of tumbler wheels, each comprising an inner disk by means of which rotary

motion is transmitted to the tumbler wheel, a laminated rim surrounding the inner disk, comprising a divided annular middle plate and divided annular flanking plates, rigidly 50 secured to the middle plate, a cam having journals in the flanking plates and having a projection eccentric to the journals, the middle plate having an opening eccentric to the journal bearings of the cam in the flanking 55 plates, and the eccentric projection of the cam being journaled in said eccentric opening in the middle plate, whereby the middle and flanking plates may be collectively flexed, substantially as and for the purposes 60 specified.

4. In a permutation lock, the combination with the operative mechanism of the lock, of a series of tumbler wheels, each comprising an inner disk by means of which rotary 65 motion is transmitted to the tumbler wheel, a rim surrounding the inner disk comprising a divided annular middle plate and divided annular flanking plates, a cam mounted in the plates, adapted to produce collective 70 flexure of the plates, the middle plate having terminations on one side of the cam and the flanking plates having terminations on the other side of the cam, substantially as and for the purposes specified. 75

5. In a permutation lock, the combination with the operative mechanism of the lock, of a series of tumbler wheels, each comprising an inner disk by means of which rotary motion is transmitted to the tumbler wheel, 80 a laminated rim surrounding the inner disk, composed of divided annular plates rigidly secured together, a cam mounted in the rim to produce collective flexure of the plates, and teeth on the periphery of the inner disk, 85 adapted to be engaged by one of the plates when they are collectively flexed, substantially as and for the purposes specified.

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Witnesses:

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