Jan. 21, 1936. S. T. SMITH 2,028,629

AUTOMATIC LOCKING DEVICE

Filed Sept. 5, 1933 3 Sheets-Sheet 1

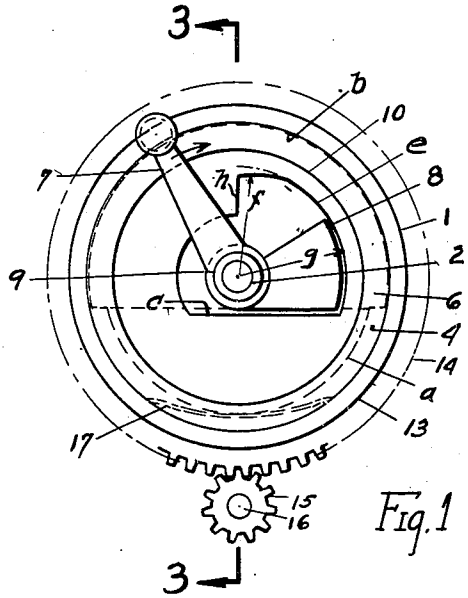


Fig. 1

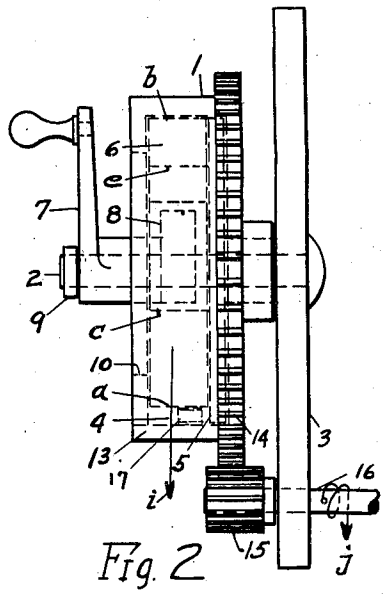


Fig. 2

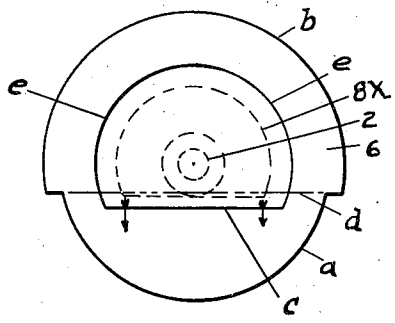


Fig. 4

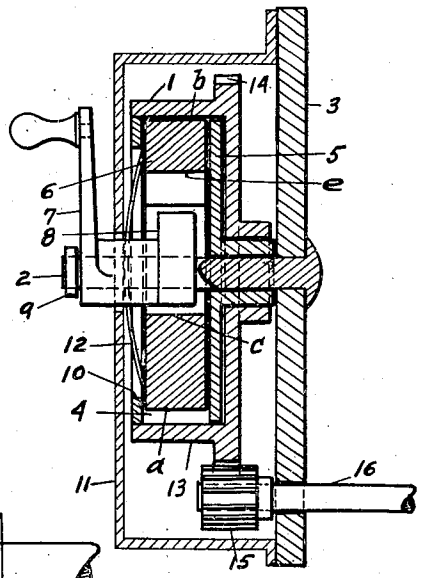


Fig. 3

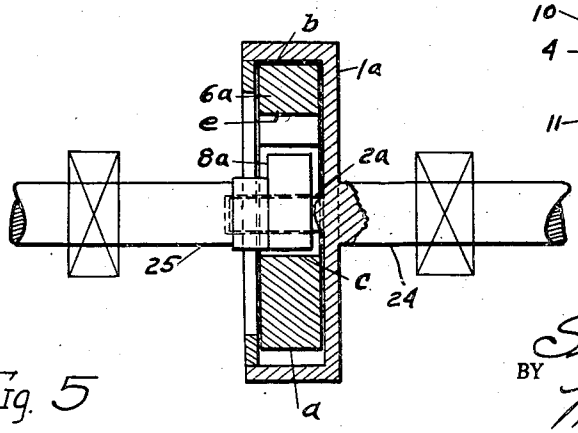


Fig. 5

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Jan. 21, 1936. S. T. SMITH 2,028,629

AUTOMATIC LOCKING DEVICE

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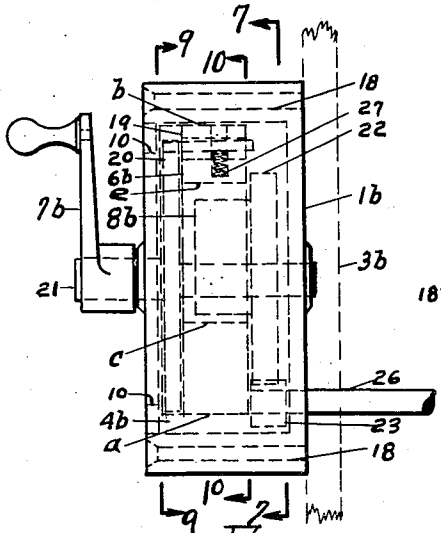


Fig. 6

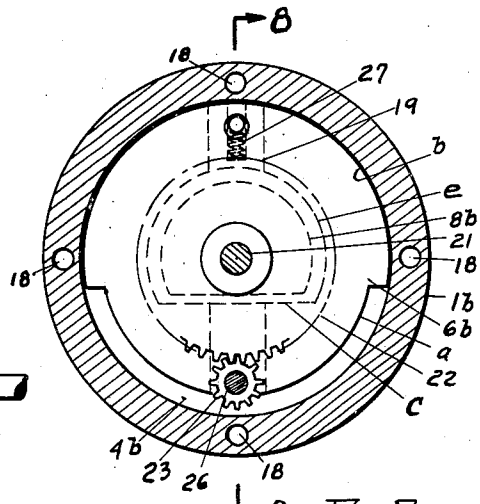


Fig. 7

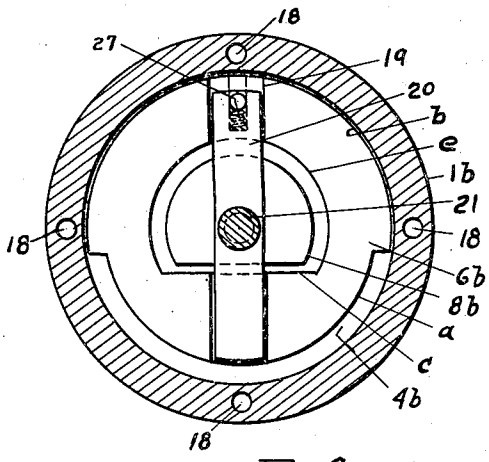


Fig 9

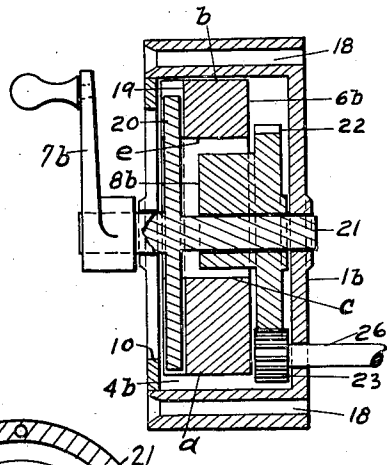


Fig. 8

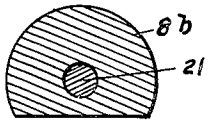


Fig. 10

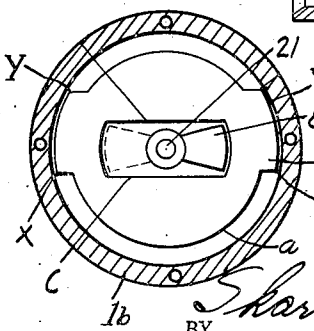


Fig. 17.

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AUTOMATIC LOCKING DEVICE

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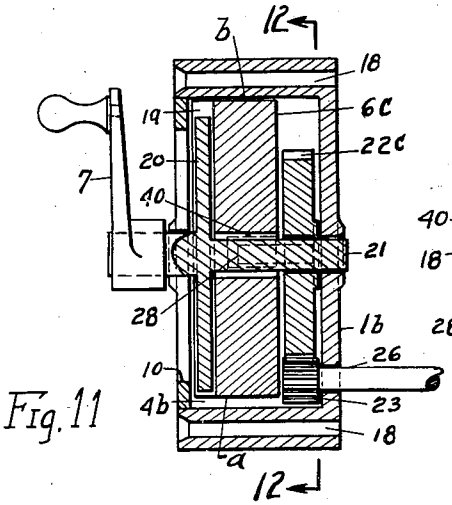


Fig. 11

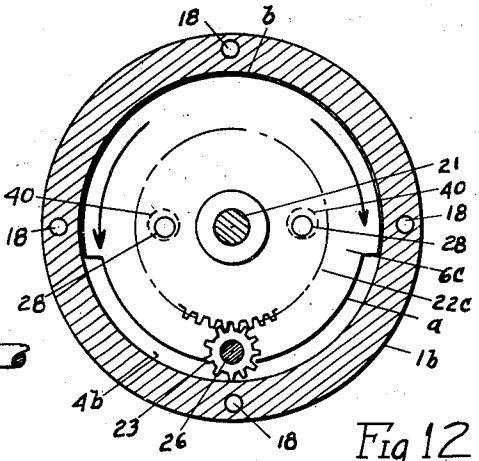


Fig 12

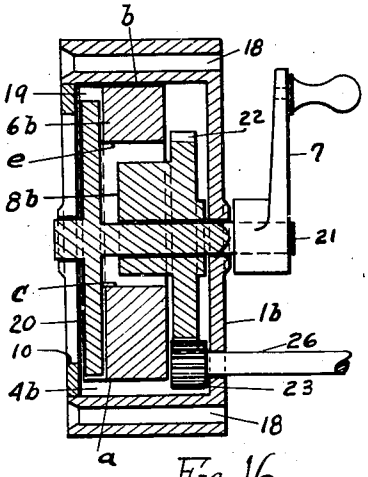


Fig. 16

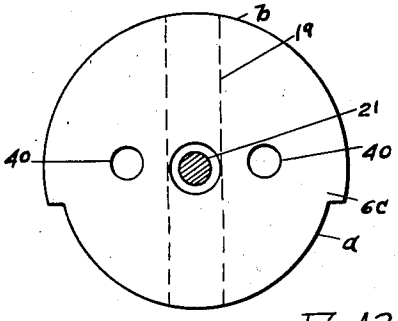


Fig. 13

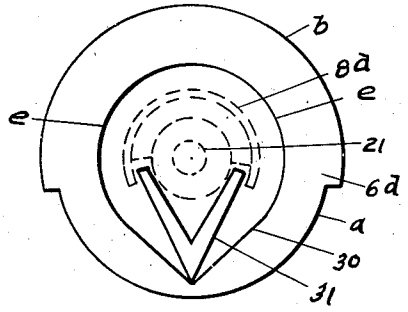


Fig. 14

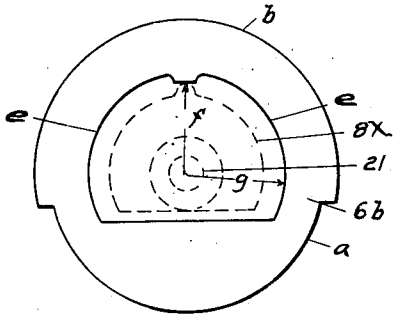


Fig 15

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Patented Jan. 21, 1936 2,028,629

UNITED STATES PATENT OFFICE

2,028,629

AUTOMATIC LOCKING DEVICE

Skardon T. Smith, Detroit, Mich.

Application September 5, 1933, Serial No. 688,140

8 Claims. (Cl. 192—8)

This invention is an improvement of my former device described in Patent No. 1,835,349, issued Dec. 8, 1931, and while this invention involves a similar principle as used in the former patented device, its combination and mechanical structure and operation is entirely different.

The object of my invention is to produce a locking unit that is adapted to either rotatable or stationary members, and that can be easily and readily functioned even while the retaining member is in motion.

Another object is to provide an automatic locking device that is especially adapted for installation within either large or small gears or wheels which control connected rotating shaft members, that will allow free rotation thereof in either direction, or will automatically lock the rotating members in either direction at the will of the operator.

A further object is to produce an automatic locking device that may be operative by either manually applied means during the rotation of an inclosing member, or by a reverse force applied on the rotatable inclosing member shaft.

A still further object is to produce an automatic lock that is simple in construction, easily and efficiently operated and that can be manufactured at a very low cost.

My improved form of lock is especially adapted to fishing reels, anchor lines, etc., and for mechanical machine construction, either stationary or rotatable members, where locking of some rotatable part is required in one or both directions of rotation, at some desired interval, or where a reverse application of a drive takes place.

These several objects are attained in the preferred form by the construction and arrangement of parts more fully hereinafter set forth.

Similar parts on all drawings are marked by similar numerals or letters.

Fig. 1 is a plan view of the preferred construction of the assembly adapted for mounting within rotatable inclosing members showing the general arrangement of the exterior operating parts.

Fig. 2 is a side view of the assembled device shown in Fig. 1 showing the locking unit mounted within a rotatably mounted gear and its connection to a driven shaft.

Fig. 3 is a vertical cross sectional view through the gear and locking mechanism showing the relative position of the operating locking members mounted therein.

Fig. 4 is a plan view of a modified locking cam operative for locking the inclosing casing therewith when displaced by rotations in either direction.

Fig. 5 is a partial sectional view diametrically across a locking unit, similar to Fig. 3, when the locking unit is applied between two rotatably mounted shafts.

Fig. 6 is a side view of a modified form of the locking device as applied to a stationary inclosing member showing its means for mounting, and the connecting operating members.

Fig. 7 is a sectional view taken on the line 7—7 of Fig. 6 showing the position of the drive gear member relative to the inclosed lock cam.

Fig. 8 is a cross sectional view taken on the line 8—8 of the Fig. 7 showing the general arrangement of the operating parts.

Fig. 9 is also a cross sectional view taken on the line 9—9 of Fig. 6 showing the connecting drive bar between the hand crank and the lock disc.

Fig. 10 is a cross sectional view of the gear hub taken on line 10—10 of Fig. 6 showing the operating means for displacing the lock disc member when any reverse rotating force is applied thereto.

Fig. 11 is a cross sectional view as taken on the line 8—8 of Fig. 7 showing a modified or alternate means for connecting the drive gear to the lock disc.

Fig. 12 is a cross sectional view taken on the line 12—12 of the Fig. 11 showing the drive pin connection between the gear and lock disc illustrated in Fig. 11.

Fig. 13 is a plan view showing the detail of the disc used in Fig. 12, showing the drive pin recesses therein.

Fig. 14 is a plan view of an alternate form of lock disc showing means of applying both directional locking forces to the lock cam at the same point.

Fig. 15 is a plan view of a further modified form of lock cam, operative in both directions, and provided with a neutral free section therein.

Fig. 16 is a modified cross section as taken on the line 8—8 of Fig. 7 showing a modified form of hand driving member as may be mounted on the opposite side of the inclosing casing member, adjacent the gear.

Fig. 17 shows a double edge disc for lock or brake combined.

In general my locking device comprises a semi-circular shaped locking disc formed with one receded edge, rotatably mounted within a cylindrical chamber provided within an inclosing member, concentric with an axis of rotation

therethrough, said locking disc being of a slightly smaller diameter than the inclosing chamber to allow a slight displacement of the disc in the direction of its receded edge. The displacement of the locking disc is effected by either mechanical means through a connected hand crank, or by an excentric hub projection of an adjacent rotatable member with which the lock disc operates. When the disc is so displaced by an excentric force applied thereto, the two members rigidly lock together and may serve as a coupling between the members, or as a rigid locking means therefor, but when the excentric force is released, the lock cam member may rotate freely within the chamber.

My locking device may be applied within a rotatably mounted member, such as inside a gear or wheel, or it may be applied within a stationary casing member rigidly mounted on some suitable support. I will herein describe the preferred form of construction as applied to a rotatably mounted member, with further modifications thereof as applied to stationary casing members.

I will now describe more fully the detailed construction of my device, referring to the drawings and the marks thereon.

The casing member 1 is made of metal, and is herein illustrated in the Figs. 1 to 3 as a combination pulley and gear member rotatably mounted on a fixed pivot shaft 2. The pivot shaft 2 may be supported by any rigidly positioned member, such as a bar 3 illustrated in Figs. 2 and 3, or in the end of a shaft member 24 as is illustrated in Fig. 5 of the drawings. The casing 1 is provided with a cylindrical chamber 4 formed in one side thereof positioned concentric with the axis of the pivot shaft 2, and shaft 2 preferably carries a circular, thimbled hub bearing disc 5 fitted within the chamber bottom and with the thimbled hub projected through the casing hub bearing, extending slightly outside the said casing hub end, said bearing disc being free to rotate within the inclosing recess 4. Within the outer end of the chamber 4, adjacent the bearing disc 5, is rotatably mounted, a semi-circular lock disc 6. Said lock disc is formed of a circular section having one receded edge *a*, providing a semi-circular bearing section *b* somewhat greater than a half circle, the diameter of which is slightly less than the diameter of the inclosing chamber 4 to allow for a slight displacement of the lock disc 6 edgewise within the chamber in the direction of the receded disc edge *a*, sufficient to form a contact angle between the ends of the disc circumference *b* and the cylindrical walls of the chamber 4 slightly less than the angle of friction for the two metals, forming a locking angle therebetween when excentric pressure is applied to the said lock disc member or slightly greater angle if it is to be used as a brake. The center section of the lock disc 6 is open and formed with one bearing edge *c*, preferably a straight flat wall, positioned parallel to a line *d* as may be extended between the ends of the disc exterior bearing circumference *b*, as illustrated in Fig. 4, and at one side of the disc center. The opposite internal disc wall *e* is curved but with the top distance *f* slightly less than the side radius *g*, and when the lock disc is operative in one directional rotation only, a stop shoulder *h* is provided at the top portion of the curve. The lock disc 6 is free to rotate within the chamber 4 when unstrained. Rotatably mounted on the pivot shaft 2 is a small hand crank 7 formed with an excentric hub projection 8, and is free to turn on the shaft 2, being positioned thereon with the hub projection 8 inside the open center of the lock disc 6, capable of contacting both walls *c* and *e* thereof as it is turned in opposite direction therein, engaging the straight wall *c* for displacing and locking the said disc within the chamber. Said hub projection also engages the shortened curved wall *e* at the top, at the radius *f* when rotated in the opposite direction on the pivot shaft, slightly lifting the disc until it retains a perfect concentric position with the inclosing chamber 4, thus releasing the locking edges of the disc from the recess walls, and allowing free rotation, or free wheeling, of the gear casing 1 thereon. The hand crank is retained in position on the pivot shaft 2 by an end collar 9, or by any other desired means suitable. If desired, a small retaining ring 10 may be mounted within the outer end of the chamber opening 4 for retaining the lock disc 6 in position. Should the casing gear 1 be inclosed with an outer casing 11 as indicated in the Fig. 3, a light tension spring 12 may be inserted between the disc face and the casing wall, causing a slight pressure of the disc 6 on the bearing disc 5 and likewise against the face of the support 3, producing a frictional resistance for said discs 5 and 6, preventing their free rotation when unstrained, although allowing the casing gear 1 to rotate freely thereon.

When desired, the bearing disc 5 may be omitted, and the lock disc 6 rest directly on the casing chamber bottom, as illustrated in Fig. 5 of the drawings.

When a torsion load is applied externally to the casing 1, either through a belt force *i* applied on the pulley face 13, or a torsion force *j* applied to a gear section 14 through a connecting pinion gear 15 and shaft 16, and the lock 6 is unrestrained, the casing gear 1 may rotate freely thereon in either direction, and allow a spinning of the connected pinion and shaft 15 and 16. However, if pressure is applied to the crank handle in a direction as indicated by the arrow in Fig. 1, causing contact of the hub projection 8 with the interior cam wall *c*, displacing the disc 6 in the chamber 4, said disc and casing will lock together and both then be rotated by the crank action as a solid rotatable member, but which are released and separated if the crank 7 is rotated in the opposite direction, and which causes the hub projection 8 to engage the inner cam top curved wall, lifting and freeing the cam lock contact surfaces. This structure is especially adapted to the free wheeling type of fishing reel, for winding up the line in one directional rotation of the crank, and allowing it to spin out when the line is cast. However, if it may be desirable to make the crank function the lock disc 6 by turning in both directions, the inner cam opening is made symmetrical and open on both sides as illustrated in Fig. 4 also Fig. 15, and used with a corresponding double hub projection 8*x*, operative both ways, as illustrated therewith, the pressure being applied to the disc interior wall, either one side or the other as indicated by the arrows in Fig. 4. When the excentric pressure is released, the lock disc will instantly free itself from the lock contact, if the angle formed between the connecting surfaces is properly selected. Where necessary, to secure a more efficient release of the disc from its locking position, a weak release spring 17 may be inserted in any suitable manner as illustrated in Figs. 1 and 2 as an alternate arrangement to cause a slight pressure on the disc edge to aid in return-

ing it to its concentric position within the inclosing chamber 4 when not engaged by the hub projection 8.

A modified form of my device is illustrated in Fig. 5, applying my locking unit between two rotatably mounted shaft members 24 and 25, both being concentric about the same axis. The casing 1a and pivot shaft 2a are made integral with the shaft 24, concentric with the axis thereof, while the hub projection 8a is integral with the oppositely positioned shaft 25, but rotatably on the pivot pin 2a. The lock disc 6a is the same as in the former case, but with the bearing disc 5 omitted. The operation is the same as heretofore described, and the locking unit functions as an automatic shaft coupling, uniting the shafts as a solid unit when torsion is applied so as to displace the lock cam, or each running independent of each other when the cam is released and in its concentric position. The operation is exactly the same as heretofore described.

Figs. 6, 7, 8, and 9 illustrate a modified form of my device applied to rigidly positioned casing members. The casing 1b is herein illustrated as cylindrical in form and provided with screw holes 18 therethrough for rigidly attaching same to any suitable wall support 3b, said casing being formed with a cylindrical chamber 4b as in the former case. The lock disc 6b is of the same interior and exterior structure, fitted to the said chamber and operated exactly as heretofore described, except it is provided with a driving recess 19 along the back side thereof, herein shown as a rectangular shaped recess positioned diametrically across the disc face, intersecting, symmetrically the disc circumference b. A drive bar 20 is fixedly mounted on a drive shaft 21, at right angles thereto, shaft 21 being rotatably mounted concentrically with the chamber 4b, and with the driving bar positioned to fit and engage the driving recess 19 of the lock cam and rotate the same therewith but with the cam free to slide thereon. A hand crank 7b is fixedly mounted on the outer end of the drive shaft 21, operative by manual power applied thereto in either direction. At all times when rotation of the shaft and lock disc is effected by the crank 7b, because of frictional resistance between the surfaces of the bar 20 and disc slot 19 said lock disc will remain concentric to and rotate freely with the shaft and without forming a locking contact with the casing. Also within the casing chamber 4b is mounted a drive gear 22, positioned adjacent the inner face of the lock disc 6b, said gear being loosely mounted on the drive shaft 21. The gear 22 is provided with a hub projection member 8b on the inside face thereof, of the same construction and position for engaging the lock disc 6b as heretofore described for the crank 7 of Figs. 1, 2, and 3, said hub projection engaging and operating the lock disc 6b exactly as heretofore described in the former case. The gear 22 merely replacing the crank 7 previously illustrated, said gear 22 rotatable with both lock cam and shaft when the power is applied through the crank member or by other mechanical means applied therethrough, and will readily transmit power to a connected gear 23 mounted on shaft 26 without locking the disc 6b within the casing chamber 4b. However, if an excessive torsion load is applied on the shaft 26, in excess of the crank power, and tending to cause a reverse rotation of the gear 22, the gear hub projection 8b will operate to lock the disc 6b with the chamber walls as heretofore described and prevent any backward rotation of the shaft. The lock structure and its operation is exactly the same as in the former case except the gear 22 is substituted for the crank 7. This construction is especially adapted to window lift mechanism, or any similar device, where a constant load, such as the weight of a window sash may cause a backward turning force on the connected shaft 26. If the device should be installed where it may be subject to heavy vibrations or shocks, such as in an operating automobile window, a tension spring 27 may be mounted in the disc 6b as illustrated in Figs. 6 and 7 as an alternate arrangement for more firmly retaining the locking contact between the disc and casing wall, although not sufficiently strong as to prevent turning of the disc by the crank member. Likewise to insure free rotation of the disc 6b in very light instruments the same tension spring 27 as shown may be installed exactly the same as shown but on the opposite end of the drive bar 20, engaging the disc to retain it in its free concentric position about the shaft 21 when the disc is unrestrained.

Figs. 11, 12, and 13 show the same mechanism as illustrated in the Figs. 6, 7, and 8 but with a slightly modified connection between the lock disc 6c and the gear 22c, the connection and displacement means being provided by means of contact pins 28 fixedly mounted in the inner gear face and engaging enlarged recess holes 40 formed in the adjacent lock disc. When both pins 28 are in place the gear is operative for locking the disc for either directional rotation, however, either pin may be removed making the device operative in one direction only. The excentric position of the pins 28 function exactly the same as the hub projections 8b.

Fig. 14 shows a further modification of the lock disc 6d, the exterior parts being exactly the same as in the former case, but with the interior opening modified by a symmetrical V-shaped bottom recess 30 and provided with a V-shaped saddle member 31 which engage the side projections of the hub 8d as formed on the modified gear 22 heretofore described, and applies the excentric locking force therefrom in either directional rotation, at the same point on the lock disc making the disc operative in both directions. The operation of the disc is the same as heretofore described in the other types of units.

Fig. 17 illustrates a further modification of the lock disc 6c which has a central portion of the circumference b cut away, providing a double set of contact ends x and y. The contact ends x are the same as in the former discs described and will seize and lock with the walls of the chamber 4b when the excentric pressure of the hub projection 8c is applied thereto as shown, or in the reverse position as illustrated by the dotted lines. The contact ends y are somewhat extended so as to form an angle of contact with the chamber walls slightly greater than the angle of friction between the two engaging metals, just sufficient to prevent seizing or locking of the engaging edges, and will serve as a brake in the unit. The combination disc is especially adapted to the coaster brake for the bicycle, the lock side acting as a direct drive for the wheel, while the reverse reacts as a brake unit.

Having fully described my improved automatic locking device, what I claim as my invention and desire to secure by Letters Patent is:

1. An automatic locking device adapted for engaging two mounted members together, comprising a casing formed with a cylindrical chamber therein and provided with a center pivot shaft

therethrough concentric with the casing chamber axis, a circular lock disc having one receded edge loosely fitted within the said casing chamber and concentric therewith, but capable of slight edgewise displacement therein, sufficient to form a locking angle between the disc edge and the chamber wall, said lock disc being formed with an irregular shaped central opening surrounding the pivot shaft, an irregular shaped lock hub having rotatable means provided thereon, loosely but rotatably mounted on said pivot shaft, positioned within the disc central opening, for engaging the disc opening walls excentrically and displacing the said lock disc edgewise within the casing chamber when a force is applied rotatably in one direction to said lock hub, sufficient to cause the two members to engage and lock together.

2. An automatic locking device adapted for engaging two mounted circular members together, comprising a casing member formed with a cylindrical chamber therein and provided with a central pivot shaft therethrough concentric with the chamber axis, means for mounting the said casing in a predetermined location, a circular lock disc having one receded edge loosely fitted within said chamber, concentric therewith, but capable of slight edgewise displacement therein, sufficient to form a locking angle between the disc edge and the chamber wall, said lock disc being formed with an irregular shaped central opening surrounding the pivot shaft, an irregular shaped lock hub having rotatable means provided thereon, loosely but rotatably mounted on said pivot shaft, positioned within the disc central opening, for engaging the disc opening walls excentrically and exerting an excentric force edgewise thereon for slightly displacing said disc edgewise within the casing chamber in the direction of its receded edge, and causing a pressure thereon sufficient to engage and lock the two members together when a force is applied rotatably in one direction to said lock hub.

3. An automatic locking device adapted for locking two rotatable members together, comprising a rotatably mounted casing member formed with a cylindrical chamber in one side thereof, a circular lock disc having one receded edge, loosely fitted within said chamber, concentric therewith, but capable of a slight edgewise displacement therein, sufficient to form a locking angle between the disc edge and the chamber wall, said lock disc being formed with an irregular shaped central opening surrounding the pivot shaft, an irregular shaped lock hub having rotatable means provided thereon, loosely but rotatably mounted on said pivot shaft, positioned within the disc central opening, for engaging the disc opening walls excentrically and causing a slight edgewise disc displacement within the chamber, sufficient to cause a pressure between the two engaging surfaces and lock the two members together when a force is applied rotatably in one direction to said lock hub.

4. An automatic locking unit adapted for engaging and locking two rotatable members together, comprising a rotatably mounted cylindrical casing member formed with a cylindrical chamber therein positioned concentric with the said casing rotation axis and provided with a center pivot shaft extended through the casing chamber also concentric with the axis of rotation, a bearing disc mounted within the chamber positioned against the chamber bottom wall and projected through the casing bearing, a semi-circular lock disc loosely mounted within the casing chamber, concentric with the casing axis and positioned adjacent the bearing disc but capable of a slight edgewise displacement therein, sufficient to form a locking angle between the disc edge and the chamber wall, said lock disc being formed with an irregular shaped central opening surrounding the pivot shaft, an irregular shaped lock hub having rotatable means provided thereon, loosely but rotatably mounted on said pivot shaft, positioned within the disc central opening, for engaging the disc opening walls excentrically and exerting an excentric force thereon for causing a slight edgewise displacement thereof within the casing chamber when pressure is applied thereto, causing said lock disc edge to seize the chamber wall and lock the two members together.

5. An automatic locking unit adapted for engaging and locking two rotatably mounted members together, comprising a rotatably mounted casing member formed with means for applying external power thereto, said casing being formed with a cylindrical chamber in one side thereof and having a pivot shaft therethrough concentric with the axis of said chamber and axis of rotation, a bearing disc formed with hub bearing mounted within the bottom of said casing chamber and with the hub projected through the casing bearing, a semi-circular lock disc loosely fitted within the chamber adjacent the bearing disc and concentric with the chamber axis, but capable of a slight edgewise displacement within said chamber sufficient to form a locking angle between said disc edge and the chamber wall, said lock disc being formed with a central walled opening therethrough, a crank member formed with an excentric hub projection rotatably mounted on the pivot shaft adjacent the lock disc and with said hub projection within the lock disc central opening, capable of engaging with the inner disc walls excentrically on rotation of said crank, causing an edgewise displacement of the lock disc within the casing chamber and when pressure is applied to said crank to cause the disc and chamber wall to lock together.

6. An automatic locking unit, comprising a rotatably mounted casing member having means formed thereon for connecting same to a power shaft, and having a cylindrical chamber formed in one side thereof concentric with the axis of rotation and provided with a pivot shaft therethrough concentric with the casing chamber axis, a circular lock disc having one receded edge loosely fitted within the chamber, concentric therewith but capable of a slight edgewise displacement therein, sufficient to form a locking angle between the disc edge and the chamber wall, said lock disc being formed with an irregular shaped central opening surrounding the pivot shaft, an irregular shaped lock hub having rotatable means provided thereon, loosely but rotatably mounted on said pivot shaft, positioned within the disc central opening, for engaging the disc opening walls excentrically and slightly displacing said disc excentrically in a locking position when pressure is applied to the lock hub in one direction, but returning the said lock disc to its free concentric position when the crank pressure is reversed.

7. An automatic locking device adapted for locking two mounted members together, comprising a casing member formed with a cylindrical chamber therein and provided with a

pivot shaft rotatably mounted therethrough concentric with the chamber axis, said pivot shaft being provided with a driving member positioned thereon inside the chamber and also provided with power means for causing rotations of said shaft within the casing, a circular lock disc having one receded edge loosely mounted within the said cylindrical casing chamber, concentric therewith but capable of a slight edgewise displacement therein sufficient to form a locking angle between the disc edge and the chamber wall, said disc being formed with an irregular shaped central opening and provided with engaging means for connecting with the pivot shaft driving member, gear means rotatably mounted on said pivot shaft adjacent the lock disc, formed with an irregular shaped lock hub positioned inside the disc central opening capable of engaging said disc excentrically and causing a slight edgewise displacement thereof in the direction of the disc receded edge when turning power is applied to said gear for causing the lock disc and chamber wall to lock together.

8. An automatic locking unit adapted for locking a rotatable member within a cylindrical casing, comprising a casing member formed with a cylindrical chamber in one side thereof, means provided for rigidly mounting said casing to a suitable support member, a pivot shaft rotatably mounted through the casing chamber concentric with the chamber axis, said shaft being formed with a driving bar thereon positioned within the chamber and also provided with means for applying power of rotation to said shaft, a semi-circular lock disc loosely fitted within the said chamber, concentric with the chamber axis but capable of a slight edgewise displacement therein sufficient to form a locking angle between the disc edge and the chamber wall, said lock disc being formed with an irregular shaped central opening and formed with a recess for receiving and engaging the pivot shaft drive bar, a power gear rotatably mounted on said pivot shaft adjacent the lock disc formed with an irregular shaped lock hub positioned inside the disc central opening capable of engaging therewith excentrically and apply a force thereto edgewise of said lock disc for causing a slight displacement thereof and a locking pressure on the disc, and spring means mounted therein for engaging the said lock disc edgewise for retaining same in a pre-determined position within the casing chamber when said disc is unrestrained.

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