Dec. 8, 1931. S. T. SMITH 1,835,349

AUTOMATIC LOCKING DEVICE

Filed Aug. 4, 1930 4 Sheets-Sheet 1

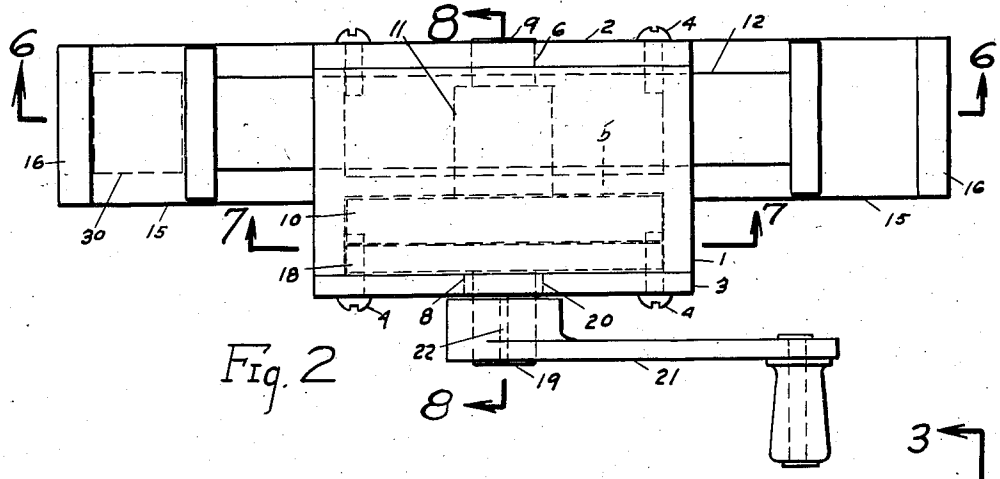

Fig. 2

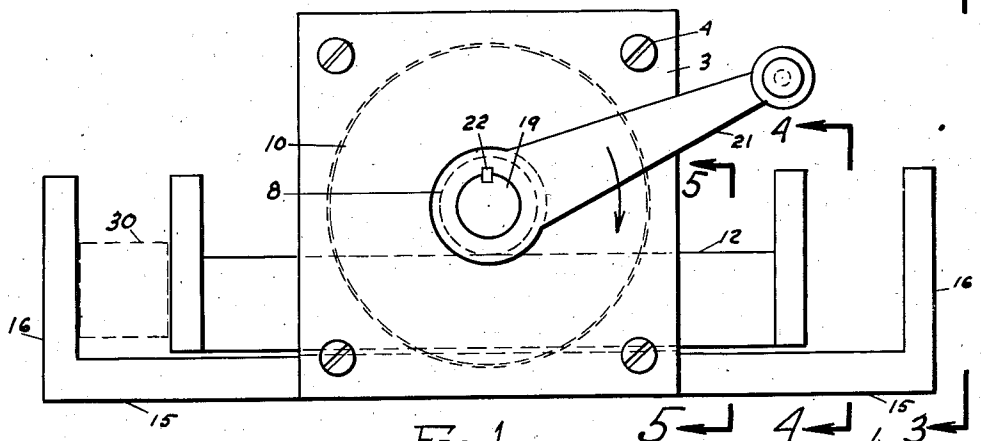

Fig. 1

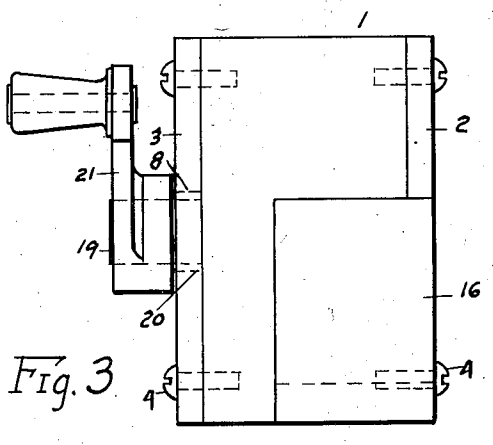

Fig. 3

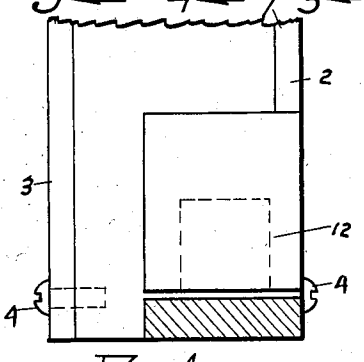

Fig. 4

INVENTOR.

BY Skardon J. Smith

Myron J. Dikeman

ATTORNEY.

Dec. 8, 1931. S. T. SMITH 1,835,349

AUTOMATIC LOCKING DEVICE

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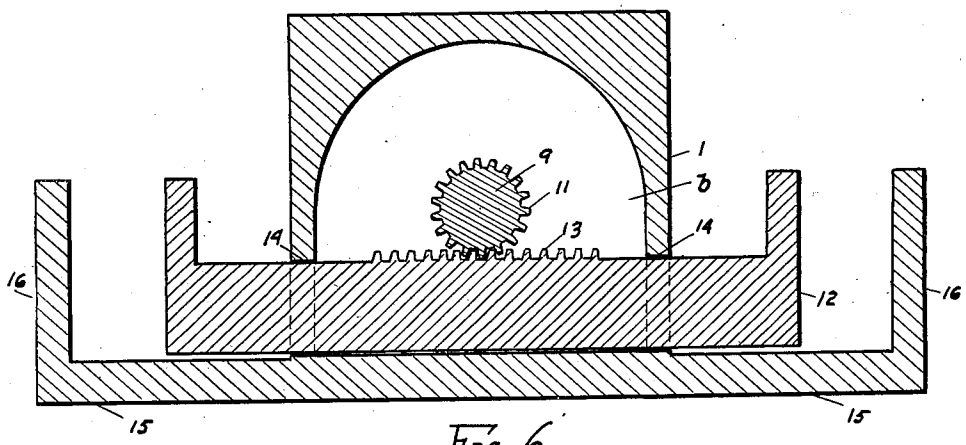

Fig. 6

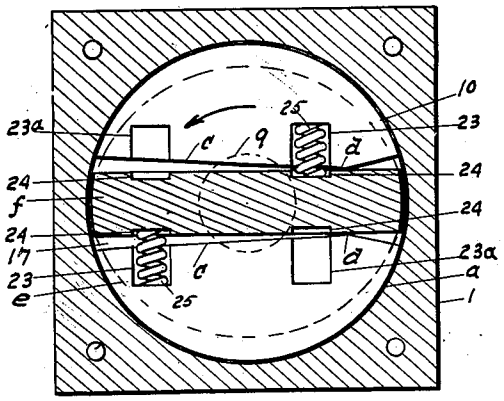

Fig. 7

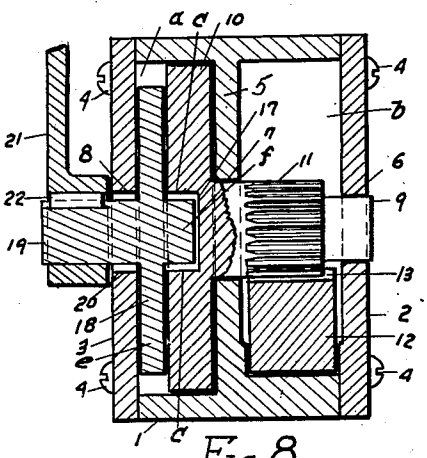

Fig. 8

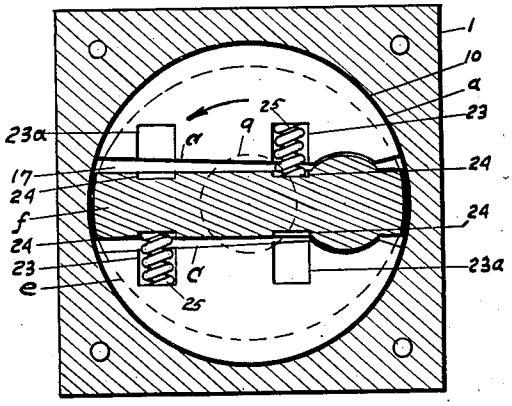

Fig. 9

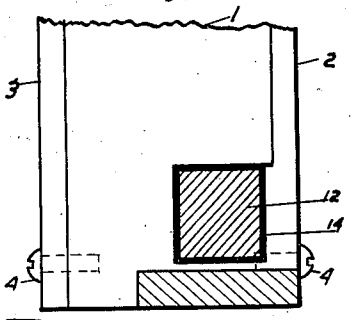

Fig. 5

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Dec. 8, 1931. S. T. SMITH 1,835,349

AUTOMATIC LOCKING DEVICE

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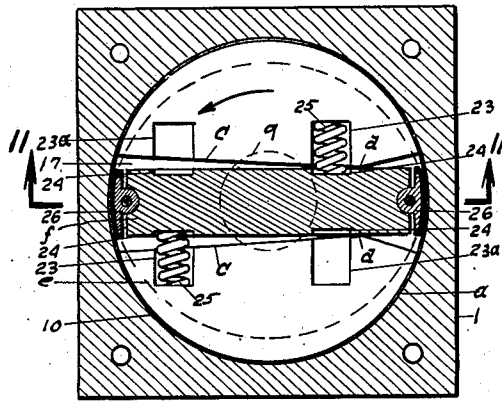

Fig. 10

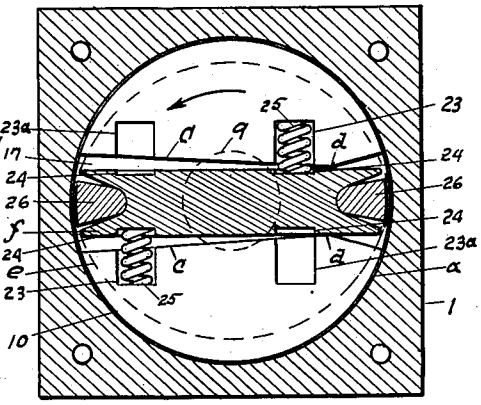

Fig. 12

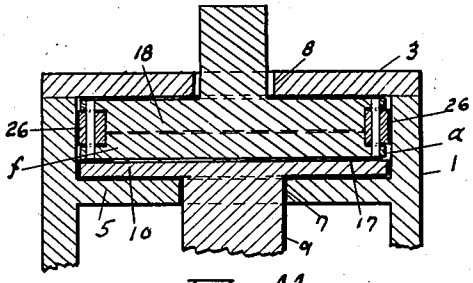

Fig. 11

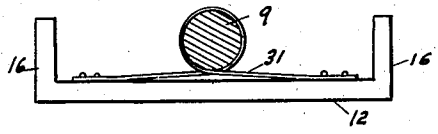

Fig. 19

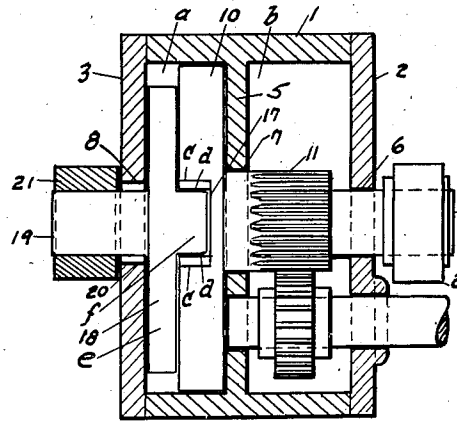

Fig. 20

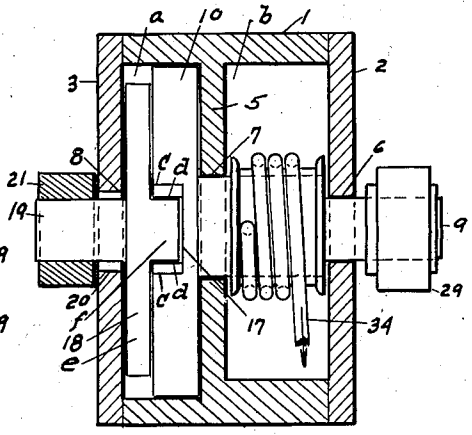

Fig. 21

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AUTOMATIC LOCKING DEVICE

Filed Aug. 4, 1930 4 Sheets-Sheet 4

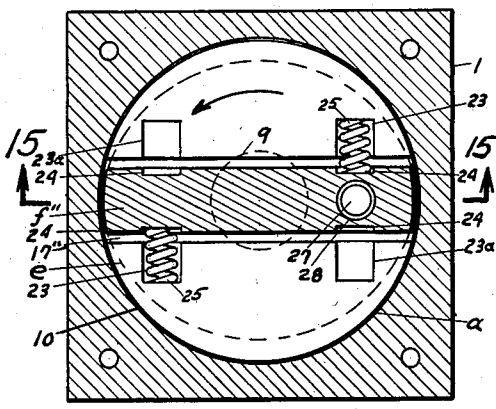

Fig. 14

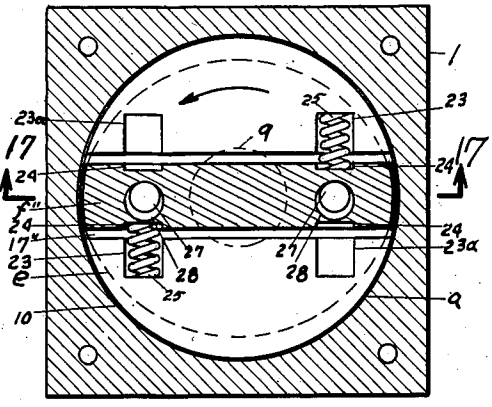

Fig. 16

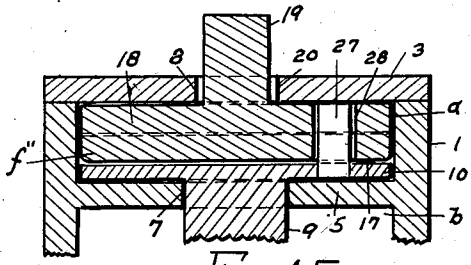

Fig. 15

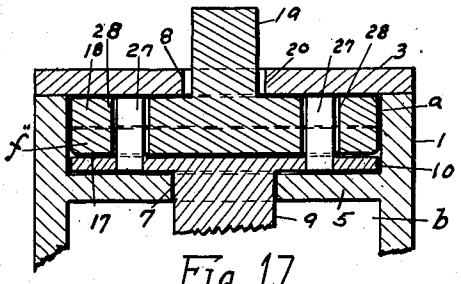

Fig. 17

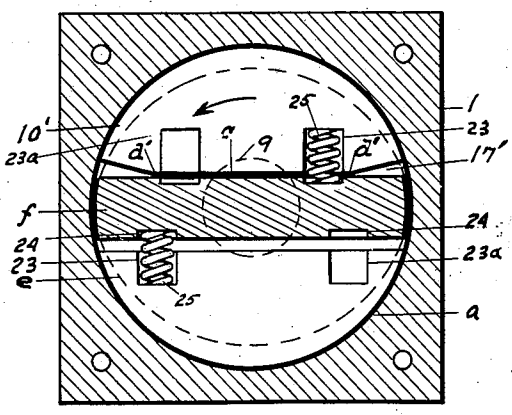

Fig. 13

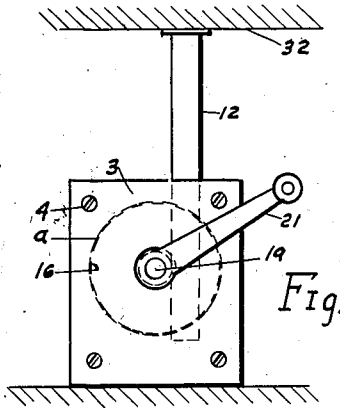

Fig. 18

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BY

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Patented Dec. 8, 1931 1,835,349

UNITED STATES PATENT OFFICE

SKARDON T. SMITH, OF DETROIT, MICHIGAN

AUTOMATIC LOCKING DEVICE

Application filed August 4, 1930. Serial No. 473,108.

The object of my invention is to produce a locking unit combined with operating mechanism so as to automatically lock in any position if released under a resisting load.

Another object is to produce a locking unit that may be used as an operating means for rotating a shaft in one direction, yet will automatically lock said shaft if the direction of rotation is reversed by any resisting force applied thereto through said shaft.

A further object is to provide a mechanical unit for exerting great pressure in one direction, and that will automatically lock in any position when under load when the handle pressure is released.

A still further object is to produce a combination operating and locking unit that may be readily applied to lifting jacks, vises, cable tighteners etc., where a resisting load is to be displaced by mechanical means and locked in various positions.

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

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

Fig. 1 is a front view of the device as applied to a double vise showing the general arrangement of the exterior operating members.

Fig. 2 is a top view of the assembled device showing the relative position of the operating members.

Fig. 3 is an end view taken on the line 3—3 of the Fig. 1 showing the relative position of the clamps.

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 1 showing the inner clamp formed on the end of the ram bar.

Fig. 5 is also a sectional view taken on the line 5—5 of Fig. 1 showing the casing end bearing for slidably mounting the ram bar therein.

Fig. 6 is a vertical sectional view lengthwise of the assembled device taken on the line 6—6 of Fig. 2 showing the relative position of the ram bar and casing clamps and the geared operating means connected thereto.

Fig. 7 is a sectional view taken on the line 7—7 of the Fig. 2 showing the cylindrical casing chamber and the bar locking mechanism mounted therein.

Fig. 8 is a vertical sectional view crosswise of the casing taken on line 8—8 of Fig. 2 showing the general arrangement of the operating mechanism.

Fig. 9 is a sectional view showing a modified form of lock bar mounting, utilizing bearing surfaces instead of points for holding the bar in position.

Fig. 10 is also a sectional view showing a modification of the lock bar ends designed for resisting heavy loads.

Fig. 11 is a sectional view taken on the line 11—11 of Fig. 10 showing the general arrangement of the lock cam end blocks and means for retaining them therein.

Fig. 12 is also a sectional view showing a further modification of the end blocks as mounted in the lock bar.

Fig. 13 is a further modification of the lock bar and driving slot showing a double bar pivot as arranged in one slot wall only.

Fig. 14 is a sectional view showing a modified form of bearing for controlling the lock bar.

Fig. 15 is a sectional view taken on line 15—15 of Fig. 14 showing the bearing pin as mounted therein.

Fig. 16 is a sectional view also showing a further modification of double bearing pins for controlling the movements of the lock bar.

Fig. 17 is a sectional view taken on the line 17—17 of Fig. 16 showing the double bearings as mounted in the shaft head.

Fig. 18 illustrates my device applied as a lifting jack, supporting a load.

Fig. 19 illustrates the application of belt means as applied to the movable ram bar in place of geared means as shown in the Figs. 6 and 8.

Fig. 20, illustrates my device as applied to geared mechanism.

Fig. 21 illustrates the device applied to a cable tightener.

In general my device comprises a stub drive shaft rotatably mounted within a suitable frame support, and so connected with a combination driving and locking unit as to cause rotation of the shaft in one direction for ex-

erting a force against any connected mechanism, but which will automatically lock said drive shaft if the resisting force of the connected mechanism tends to cause a backward rotation of the shaft. The driven mechanism may be connected to the stub drive shaft by either rack, gear or belt means, and the resisting force applied in either direction thereon.

While I have illustrated my device as applied to a vise, using rack and gear means for connecting the stub drive shaft thereto, it is to be understood this is only illustrative of one application of my locking unit, and that this locking unit may be applied to any other type of mechanism equally as well.

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

The casing —1— is preferably made of cast metal, rectangular in form, and provided with detachable end plates —2— and —3—, fixedly attached thereto by the screws —4—. The rectangular casing —1— is divided into two chamber sections —*a*— and —*b*— by a vertical partition wall —5—. Through the center of the casing —1— are formed shaft bearings —6—, —7— and —8—, all concentric with an axis at right angles to the casing walls and passing therethrough. Within the bearings —6— and —7— is rotatably mounted a stub drive shaft —9—, preferably formed with an enlarged bearing head collar —10— on the inner end thereof, and with a pinion gear section —11— near the center of the shaft, said head collar —10— being projected within the casing chamber —*a*— and the gear section —11— positioned centrally within the chamber —*b*—, the shaft —9— being free to rotate within the bearings. Directly beneath the gear section —11— and at right angles thereto is mounted a ram bar —12—, formed with rack teeth —13— along the top side and positioned to mesh with the teeth of gear —11—. The ram bar —12— is slidably mounted along the bottom of the casing —1— and is projected outside the casing walls at both ends through the casing end wall openings —14—, and is capable of sliding therein in either direction. The casing block —1— is formed with extended base arms —15—, positioned parallel to the ram bar —12—, and are bent at right angles at the outer ends forming a clamp member —16— positioned opposite the ram bar ends. The vise herein shown is illustrated as a double vise, as the ram bar is operative in either direction.

The chamber —*a*— is formed with true cylindrical walls positioned concentric with the axis of the drive shaft —9—, said cylindrical walls preferably being ground and hardened. The circumference of the head collar —10— is preferably fitted to the cylindrical wall chamber —*a*—, forming a bearing therein, said head collar —10— also being formed with a deep drive groove —17— positioned diametrically across the outer face thereof. The drive groove—17— is formed with V-shaped side walls —*c*— positioned symetrically about the collar diameter, with the wall apex —*d*— positioned at one side of the cylinder chamber axis. Within the chamber —*a*—, adjacent to the collar —10— is mounted a driving and locking unit —18—, formed of an elliptical shaped flange —*e*—, having a straight rectangular lock bar —*f*— positioned diametrically across the collar face along the long collar axis, said lock bar —*f*— being of sufficient width to practically fill the drive groove —17— between the apex points —*d*—, yet capable of slight side movement at the groove ends as the lock bar is tilted over the apex points, for displacing the lock bar diameter off the cylinder casing center. The ends of the lock bar —*f*— are preferably to a circumference having a diameter slightly less than the diameter of the cylinder chamber —*a*—, also preferably hardened and ground to form a perfect contact wall surface, the difference between the two diameters being just sufficient to allow for the desired side displacement of said lock bar before forming contact with the chamber walls sufficiently for seizing and locking therein if a reverse motion of the drive shaft —9— takes place. The elliptical collar —*e*— having its short diameter positioned at right angles to the lock bar —*f*— allows the side movement of the entire unit within the chamber —*a*—, while the flange collar —*e*— is fitted between the collar —10— and end plate —3—, but free to rotate therein, provides a stable mounting for the unit —18—. A turning hub —19—is mounted on the opposite side of the collar —*e*—, positioned concentric with the drive shaft axis, said turning hub being projected through an enlarged wall opening —20—, and extended outside the casing wall and carries a turning crank —21— fixedly mounted thereon by the shaft key —22—, providing means for applying turning force to the driving and locking unit.

Spring recesses —23— and —24— are formed in the collar —10— and lock bar —*f*—, and carry compression coil springs —25— mounted therein, said springs being placed in the proper recesses for taking all slack motion of the lock bar —*f*— within the drive groove —17—, and retaining said lock bar in a locking position at all times. The springs —25— as shown in the recesses —23— are in position for causing the locking bar to seize the walls of the chamber —*a*— when rotated in the direction as indicated by the arrow in Figs 7, 9, 13, 14 and 16, if said rotation is caused by a resisting force applied through the stub drive shaft —9—, but the coil springs —25— may be transferred to the opposite spring recesses —23*a*— if locking

of the unit is desired in the opposite direction for resisting an opposite force as may be applied thereto through the drive shaft. (The double set of recesses —23— and —23*a*— are shown to complete the design of the device as actually made and used, and to more clearly illustrate the utility of the device and its adaption for operation in either direction, but the invention resides in the device with the springs —25— in either set of recesses, the invention is the same in either case. (The application of the locking unit to a vise jaw, or to vise jaws is purely illustrative of the utility of the invention or locking unit, and which may be adapted to the different types of devices as illustrated in Figs. 18, 19, 20 and 21, equally as well.)

If desired, the rack —13— and pinion —11— may be replaced with a belt member —31— as shown in the Fig. 19, the belt —31— being wound around the body of shaft —9— and having its ends fixedly attached to the ram bar ends. The movement and operation is practically the same as heretofore shown for the connecting gears.

In operating my device, when a resisting load is rotatably connected to the drive shaft —9—, causing a tortional moment therein, as by placing a block —30— between the ram bar end —12— and clamp member —16— and tightly clamping same by applying pressure to the crank —21— in the direction as indicated by the arrow in Fig. 1, or by a supported load —32— as shown in Fig. 18, or by the gear or cable means as illustrated in Figs. —20— and —21—, the turning crank —21— provides means for applying operative power to the stub shaft —9— and its connected mechanism, for rotating same in the direction as may be required for the particular type of mechanism used therewith, and at the same time the crank pressure causes a side displacement of the lock bar —*f*— to one side of the cylindrical chamber center, due to its eccentric contact with the wall of the drive slot —17—, said lock bar will drag along the cylinder wall in the turning as may be caused by the crank —21—, but will instantly seize the chamber walls and lock if the crank pressure is released and the direction of rotation reversed by back pressure from the resisting load applied through the drive shaft —9—, automatically locking said drive shaft and its connected mechanism in that position, and which will remain locked until the lock bar —*f*— is released from the chamber walls by again applying pressure on the crank —21— in the opposite direction.

Figs. 10 and 12 show a modified type of lock bar having adjustable friction blocks —26— pivotally mounted at the ends, and is especially adapted for resisting heavy stresses or loadings as may be applied through the drive shaft —9—.

Fig. 13 shows a modified driving groove —17′—, where the side wall apexes —*d*′— are both on the same side of the driving groove as formed across the head collar —10′—, the springs —25— being placed in either the recess —23′— or —23*a*′—, depending upon the direction of rotation desired for locking. The operation is the same as heretofore described.

Figs. 14, 15, 16, and 17 show alternate forms of the lock bar contact, where float pins —27— are fixedly mounted in the bottom of the drive shaft groove —17″— and engage enlarged recesses —28— formed through the lock bar body —*f*″— at corresponding positions, instead of the side wall contact at the apex —*d*— as previously shown.

The device, by removing the base arms —15— and clamp members —16—, may be applied as a lifting jack, or hoist as illustrated in Fig. 18, the crank —21— providing the lifting power the same as heretofore described, and the locking unit —18— retaining the load —32— in its elevated position when the crank pressure is released, or may be lower when desired by simply turning the crank —21— in the opposite direction.

Fig. 20 shows my device as applied as a driving unit for connected gear mechanism, allowing free rotation thereof in one direction, but instantly locking if the direction of rotation is reversed by the resisting force reacting through the drive shaft, and is especially adapted for elevated conveyor machinery for preventing any backward rotation thereof when the conveyor is loaded and the driving power be disconnected.

Fig. 21 illustrates a further application of my locking device, using rope —34— or belt means for applying a resisting force to the drive shaft —9—, and is especially adapted for winding up stressed flexible cables or for splicing broken cable wires etc.

In all cases, if desired, the actual operating power for driving the connected mechanism through the drive shaft —9—, may be applied through the pulley —29— fixedly mounted on the outer end of the drive shaft —9—, instead of the operating crank —21—, provided the compression springs —25— be sufficiently stressed to properly set the lock bar —*f*— in its locking position for seizing the cylinder walls. However the crank —21— must be used for unlocking the shaft.

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

1. A locking device adapted for automatically locking connected mechanism for preventing a backward movement thereof, comprising a rigid support frame formed with a cylindrical chamber therein, a drive shaft rotatably mounted in one end of said cylindrical chamber, positioned concentric with the chamber axis and projecting outside of

the chamber end, a lock bar movably mounted diametrically across said cylindrical chamber and connected to said drive shaft end, said lock bar being capable of seizing the cylindrical chamber walls if displaced to one side of the chamber center, means connected with said lock bar for causing its sidewise displacement within the cylindrical chamber, and means mounted therein for returning the said lock bar to its central position within the said chamber.

2. A locking device adapted for automatically locking connected mechanism for preventing a backward movement thereof, comprising a rigid support frame formed with a cylindrical chamber therein, a drive shaft rotatably mounted in one end of said chamber and projected outside the chamber end, said drive shaft being positioned concentric with the cylindrical chamber axis, a lock bar movably mounted diametrically across the cylindrical chamber and connected with the inner end of the drive shaft for rotating therewith, said lock bar being capable of seizing the cylindrical chamber walls and locking if displaced from its central position within said chamber, lever means mounted on said lock bar for causing a sidewise displacement thereof within the cylindrical chamber, spring means mounted therein for holding said lock bar in a displaced locking position within said chamber, and means connected to said drive shaft for engaging a resisting movable load.

3. A locking device adapted for automatically locking connected mechanism for preventing a backward movement thereof, comprising a rigid support frame formed with a cylindrical chamber therein, a short drive shaft rotatably mounted within one end of said chamber and projected outside of the chamber end wall, said drive shaft being formed with a slotted recess diametrically across the inner end thereof, the shaft being positioned concentric with the cylindrical chamber axis, a lock bar movably mounted diametrically across the cylindrical chamber and engaging with the slotted end of said drive shaft, said lock bar being capable of seizing the chamber walls if displaced to one side of the chamber center, crank means mounted on said lock bar and projected outside of the chamber end, capable of applying a turning moment to the connected crank shaft and at the same time displace said lock bar from its central position within the chamber, spring means mounted within the said drive shaft slot and engaging the lock bar for retaining same in its displaced locking position within said chamber, and means mounted on said drive shaft for connecting the same to resisting mechanism movable thereby.

4. A locking device adapted for automatically locking connected mechanism for preventing a backward movement thereof, comprising a rigid support frame formed with a cylindrical chamber therein, a drive shaft rotatably mounted in one end of said chamber and projected outside of the chamber end, said drive shaft being positioned concentric with the cylindrical chamber axis, said shaft being formed with a slotted recess diametrically across the inner end thereof, a lock bar movably mounted within said cylindrical chamber placed diametrically thereacross and engaging the said slotted recess in the drive shaft end, said lock bar being capable of seizing the cylindrical chamber walls if displaced from its central position within the chamber, means formed in said drive slot for engaging said lock bar at one side of the cylindrical chamber center axis, crank means mounted on the lock bar and projected outside the chamber end, said crank being capable of imparting a turning moment to the connected drive shaft and also displace said lock bar from its central position within the cylindrical chamber, spring means mounted within the drive shaft slotted recess for engaging the lock bar and retaining same in its displaced locking position within the chamber when the attached crank is released, and means formed on the drive shaft for connecting same rotatably with a resisting load.

In witness whereof I sign this specification.

SKARDON T. SMITH.