Dec. 9, 1947. T. A. HAMMOND 2,432,096

AUTOMATIC LOCK FOR JACKS

Filed June 26, 1942

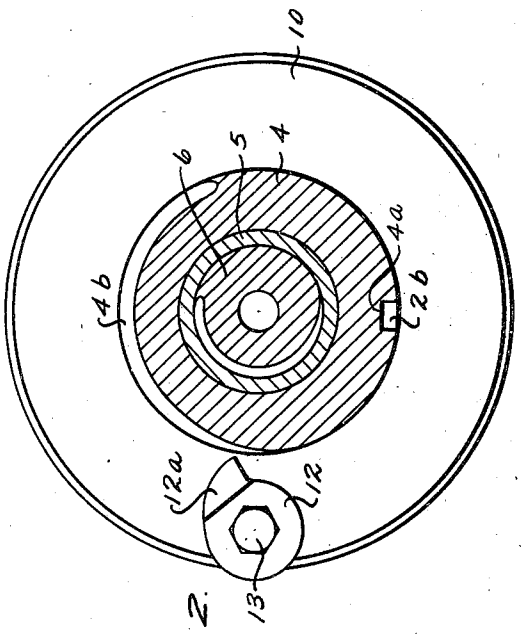


FIG. 2.

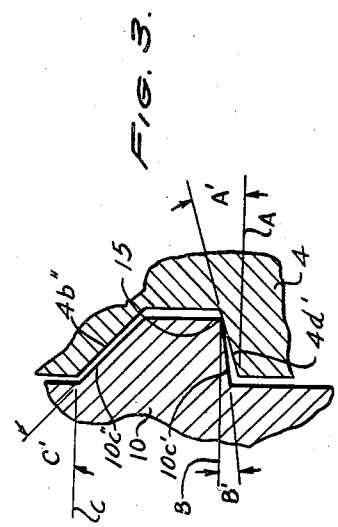


FIG. 3.

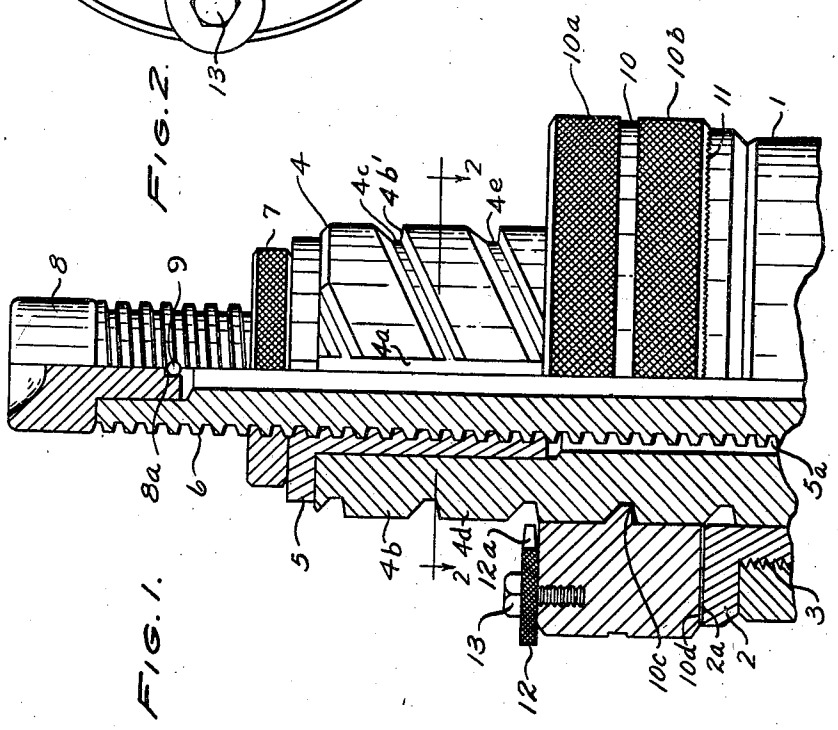


FIG. 1.

INVENTOR
THOMAS A. HAMMOND
By Edgar H. Snodgrass and Chase Kenney
ATTORNEYS

Patented Dec. 9, 1947 2,432,096

UNITED STATES PATENT OFFICE

2,432,096

AUTOMATIC LOCK FOR JACKS

Thomas A. Hammond, Fairfield, Ohio

Application June 26, 1942, Serial No. 448,565

4 Claims. (Cl. 188—67)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

1

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to jack devices such as those employed to lift automobiles, aircraft, and the like for purposes of inspection, lubrication, or repair. This type of jack includes an extensible member longitudinally movable with respect to a main supporting member. More particularly the invention relates to the provision of safety means for positively maintaining the extensible member in a desired extended position relative to its main supporting member.

The principal object of the invention is to provide a safety means which is automatically operative upon movement of the extensible member relative to its main supporting member, to positively maintain the extended relation of said members.

A further object of the invention is to make provision for rendering the safety means inoperative when retraction of the extensible member is desired.

In carrying my invention into practice I provide a jack device having a threaded extensible and retractable member, or ram, and I provide automatic safety lock means comprising a threaded member or nut whose threads cooperate with the threads on the ram, the cooperating threads having a sufficient spiral inclination, or helix angle, such as to cause rotational movement of the safety lock nut downwards by gravity relative to the ram until said nut engages the supporting member, whereby to prevent automatically any unauthorized retraction of the ram with respect to its main supporting member when the ram is desired to be maintained in extended position.

The cooperating threads on the ram and the safety lock nut are so formed that they have a minimum area of contact when the safety lock nut is not under load and a maximum area of contact when the safety lock nut is sustaining a load supported by the jack.

Additionally there is provided means on the safety lock nut which is movable into and out of engagement with the threads on the ram to prevent downward movement of the nut with respect to the ram when it is desired to retract the

2

ram relative to its main supporting member. This latter means, in the embodiment of the invention herein shown and described, takes the form of an eccentric lock device mounted on the nut.

In the use of my invention in connection with jacks employing pressure operated rams, particularly, the safety means serve to prevent collapse of the jack in the event of pressure failure.

The invention will now be more fully described in connection with the accompanying drawing, in which:

Fig. 1 is a side elevation of a portion of a jack device embodying my invention, shown partly in section.

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1 looking in the direction of the arrows.

Fig. 3 is an enlarged, fragmentary, sectional view showing the inter-relation of the threads on the ram and the safety lock nut.

The jack device shown in the drawing comprises a main supporting member 1 comprising a fluid cylinder and provided with a ram guide bushing 2 at its upper end, having threaded cooperation at 3 with the interior of the cylinder 1. The extensible and retractable member comprises a ram 4 fitting within the bushing 2 and longitudinally movable into and out of the cylinder 1. The ram 4 is hollow and is provided at its upper end with a threaded bushing 5 cooperative with a screw extension 6 which has a lock nut 7 threaded thereon. The upper end of the screw extension 6 is provided with a removable jack pad socket 8 having a milled slot 8a for engagement with a pin 9 extending into the screw extension 6. The latter may be rotated relative to the ram 4 for extending or retracting the screw extension 6 which is locked in position by engagement of the lock nut 7 with the threaded bushing 5.

The ram 4 is provided with a key-way 4a for cooperation with a key 2b on the ram guide bushing 2, to prevent the ram 4 from turning relative to the main support 1.

A threaded member or safety lock nut 10 having knurled peripheral portions 10a and 10b, has threaded cooperation with the ram 4.

The angle of spiral inclination, or helix angle, of the cooperating threads on members 4 and 10 is relatively steep, so that for each degree of rela-

tive rotation of said members the relative axial movement of said members is comparatively large. The angle of spiral inclination, or helix angle, of the cooperating threads on the members 4 and 10 is such that when the ram 4 is extended so as to raise the member 10 away from the ram guide bushing 2 the member 10 will tend to rotate by gravity downwardly relative to the ram 4 until it is again engaged with the abutting face of the bushing 2.

Because of the steep angle of spiral inclination, or helix angle, of the cooperating threads on members 4 and 10, these members are preferably each provided with triple threads. The provision of triple threads serves to support member 10 on ram 4 more evenly and prevent binding.

As shown, the ram 4 is provided with exterior threads 4c and 4e, defining spiral teeth 4b and 4d, and the member 10 is provided with interior threads corresponding and cooperating respectively with the ram threads 4c and 4e. Figure 1 shows the spiral tooth 10c, defining the threads on member 10, which cooperates with the thread 4e of the ram 4 and it will be understood that member 10 has another spiral tooth cooperating with the thread 4c of ram 4. The cooperating triple threads on the members 4 and 10 have the steep angle of spiral inclination, or helix angle, above specified, which is such as to cause axial movement of member 10 downward by gravity relative to ram 4 until member 10 engages the main ram support 1—2.

In order to reduce the friction between the sides of the threads on member 10 and ram 4, which are in contact when there is no load on the member 10, these contacting sides of the threads are preferably inclined away from one another as best shown in Figure 3. As there shown, the upper side 4d' of the ram tooth 4d (lower side of ram thread 4e) is inclined at a greater angle A' than the angle of inclination B' of the under side 10c' of the nut tooth 10c (upper side of the nut thread), the angles A' and B' being measured with reference to lines A and B, respectively, which are normal to the axis of ram 4. Likewise, the upper side 4b' of the ram tooth 4b (lower side of ram thread 4e) and the under side of the corresponding nut tooth (upper side of the nut thread) are inclined away from each other. Suitable clearance is, of course, provided between the teeth on ram 4 and member 10. Thus the sides of the threads of the members 4 and 10 which are in engagement when there is no load on the member 10 (as when the member 10 is out of contact with bushing 2a and rotating downward toward the latter) have a minimum of surface contact (as indicated at 15). This provision serves to make the member 10 rotate downwardly more easily when it is not under load.

On the other hand, the formation of the cooperating threads on members 4 and 10 is such that the area of surface contact is increased when the member 10 is under load, as when the member 10 is in engagement with the ram guide bushing 2a and member 10 is then supporting the weight of whatever load is resting on the jack. Under such condition the opposite sides of the threads on members 4 and 10 will be in closer contact; that is, the lower side 4b'' of ram tooth 4b (upper side of ram thread) will be in close contact with the upper side 10c'' of nut tooth 10c (lower side of nut thread) and likewise at such time the corresponding sides of the other teeth on members 4 and 10 will be in close contact. Since the lower sides of the ram teeth and the upper sides of the nut teeth, as indicated by 4b'' and 10c'' in Figure 3, are parallel and are inclined at a large angle C', with reference to line C which is normal to the ram axis, the members 4 and 10 will have a maximum area of frictional contact which is greater when the member 10 is under load than when it is not under load. This increased area of frictional engagement of the cooperating threads on members 4 and 10 assists in preventing the load on ram 4 from causing rotation of the nut 10 upwardly relative to the ram when the nut is in engagement with guide bushing 2a.

For the purpose of illustration, it may be stated that devices of the construction shown have been operated satisfactorily when the cooperating threads on the members 4 and 10 had a helix angle of about thirteen degrees, an angle A' of about twelve degrees, and an angle B' of about four degrees. These angles may be varied to the extent that the ability of the member 10 to rotate downwardly by gravitational force alone, until it engages bushing 2, is not interfered with. The specific angles A' and B' are not in themselves so important as the fact that the sides of the threads to which these angles relate are inclined away from each other. As an example, angle C' may be forty-five degrees but the specific angle C' is not so important as the fact that the sides of the threads to which this angle relates are parallel and angling these sides of the threads increases the area of frictional engagement with the result above mentioned in reference thereto.

The angle of spiral inclination, or helix angle, of the cooperating threads on members 4 and 10 and the extent of desired surface contact of these threads will be determined, to some extent, at least, by the coefficients of friction of the materials composing these members and by the smoothness of the contacting surfaces of said members.

The surface 10d of the member 10 and the upper surface 2a of the ram guide bushing 2 are roughened or serrated, as indicated at 11 to prevent relative turning movement of the member 10 and bushing 2 when their serrated surfaces are in abutting engagement.

An eccentric lock device is provided on the member 10 for holding the member 10 in fixed position relative to the ram 4 when it is desired to lower or retract the latter relative to the main supporting member or cylinder 1. The eccentric locking device comprises a knurled eccentric member 12 pivotally secured to the member 10 upon a screw 13 threaded into member 10. When it is desired to maintain the member 10 in a fixed position relative to the ram 4, the member 12 is rotated about the screw 13 so that the portion 12a engages the thread 4b or 4c of the ram 4.

From the foregoing it will be clear that the screw extension 6 may be rotated relative to the ram 4 for preliminary adjustment by turning the removable jack pad socket 8, the extension 6 being maintained in such adjusted position by engagement of the lock nut 7 with the threaded bushing 5. The ram 4 may be operated by any suitable means, such as fluid pressure, to move the same relative to the main support or cylinder 1, the ram being guided in such movement by the ram guide bushing 2. If the eccentric member 12 is in the position shown, out of engagement with the threads of the ram 4, the member 10 will tend to be carried with the ram 4 away from the ram guide bushing 2 when the ram is extended or moved upwardly relative to the main

supporting member 1. However, the helix angle of the cooperating threads on members 4 and 10 will cause rotation of the member 10 downward by gravity relative to ram 4 until said member 10 is in abutting engagement with the upper surface of the ram guide bushing 2, turning movement of the member 10 when engaged with bushing 2 being prevented due to the roughened or serrated abutting surfaces 10*d* and 2*a* of the member 10 and the ram guide bushing 2 respectively. Thus the ram 4 will automatically be prevented from retracting into the main cylinder 1 in the event of failure of pressure supporting the ram 4 in extended position relative to the cylinder 1.

When it is desired to lower the ram 4 from extended to retracted position respecting cylinder 1, member 10 may be rotated upward toward the top of the threads on ram 4 and the eccentric member 12 then rotated to engage the portion 12*a* thereof with the thread 4*c* or 4*e* of the ram 4; and upon such engagement the member 10 will be maintained in fixed position relative to the ram so that the latter can be lowered into cylinder 1.

Having now described my invention and the manner in which the same may be used, what I claim as new and desire to secure by Letters Patent is:

1. In a jack device of the class described, in combination, a supporting member, a first threaded member associated therewith for extending and retracting movements relative thereto, and a second threaded member associated with the first threaded member, said threaded members having cooperating threads whose helix angle is such that, upon extending movement of the first threaded member relative to said supporting member, the weight of the second threaded member will cause the same to rotate downward by gravity relative to the first threaded member until the second threaded member engages the supporting member, said second threaded member being cooperable with said first threaded member and said supporting member to prevent retracting movement of the first threaded member relative to the supporting member upon such engagement, the sides of said threads which are in contact when there is no load on the second threaded member being inclined away from one another, so that under such condition said sides have contact only between the outer edge of one of said sides and the side of the cooperating thread, said threaded members being arranged so that under said latter condition there is substantially no frictional contact between the threaded members except in the region defined.

2. In a jack device of the class described, in combination, a supporting member, a first threaded member associated therewith for extending and retracting movements relative thereto, and a second threaded member associated with the first threaded member, said threaded members having cooperating threads whose helix angle is such that, upon extending movement of the first threaded member relative to said supporting member, the weight of the second threaded member will cause the same to rotate downward by gravity relative to the first threaded member until the second threaded member engages the supporting member, said second threaded member being cooperable with said first threaded member and said supporting member to prevent retracting movement of the first threaded member relative to the supporting member upon such engagement, the sides of said threads which are in contact when there is no load on the second threaded member being inclined away from one another, so that under such condition said sides have contact only between the outer edge of one of said sides and the side of the cooperating thread, said threaded members being arranged so that under said latter condition there is substantially no frictional contact between the threaded members except in the region defined and the sides of said threads which are in contact when the second threaded member is under load being parallel and inclined at an angle to a line normal to the axis of said threaded members.

3. In a jack device of the class described, in combination, a supporting member, a ram member associated therewith for lifting and lowering movements relative thereto, a lock member associated with said ram member for rotation relative thereto about a substantially vertical axis, said ram member and said lock member having parts including cooperating helical surfaces whose helix angle is such that, upon lifting movement of said ram member relative to said supporting member, the weight of the lock member will cause rotational movement of said lock member downward by gravity relative to the ram member until the lock member engages the supporting member, said lock member being cooperable with said supporting member and said ram member to prevent unauthorized lowering movement of the ram member relative to the support upon such engagement, said parts being respectively provided with cooperating helical surfaces having the same axial pressure angle, the last-mentioned surfaces being adapted for cooperative engagement throughout substantially their entire area when the lock member is under load, whereby to provide a comparatively large area of frictional contact between said ram member and the lock member when the latter is under load, and said parts being respectively provided with other cooperating helical surfaces having different axial pressure angles, the last-mentioned surfaces being adapted for cooperative engagement when there is no load on the lock member, said parts being arranged so that under the latter condition there is substantially no frictional contact between the lock member and ram member except between comparatively narrow areas of the last-mentioned surfaces.

4. In a jack device of the class described, in combination, a supporting member, a ram member associated therewith for lifting and lowering movements relative thereto, a lock member associated with said ram member for rotation relative thereto about a substantially vertical axis, said ram member and said lock member having parts including cooperating helical surfaces whose helix angle is such that, upon lifting movement of said ram member relative to said supporting member, the weight of the lock member will cause rotational movement of said lock member downward by gravity relative to the ram member until the lock member engages the supporting member, said lock member being cooperable with said supporting member and said ram member to prevent unauthorized lowering movement of the ram member relative to the support upon such engagement, said parts being respectively provided with cooperating helical surfaces having different axial pressure angles, said last-mentioned surfaces being adapted for cooperative engagement when there is no load on the lock member, said parts being arranged so that under the latter

condition there is substantially no frictional contact between the lock member and the ram member except between comparatively narrow areas of the last-mentioned surfaces.

THOMAS A. HAMMOND.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
705,571	Ferguson	July 29, 1902
811,093	Roberts	Jan. 30, 1906
836,303	Christensen	Nov. 20, 1906
1,443,630	Masson	Jan. 30, 1923
1,905,869	Hoke	Apr. 25, 1933
2,054,393	Sharp	Sept. 15, 1936
2,093,026	Bernhard	Sept. 14, 1937
2,408,181	Simonton	Sept. 24, 1946

FOREIGN PATENTS

Number	Country	Date
90,772	Switzerland	Sept. 16, 1921