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MEANS FOR INDICATING THE POSITION OF AN AUTOMATIC LOCKING DEVICE FOR PISTONS OR OTHER MOVABLE PARTS

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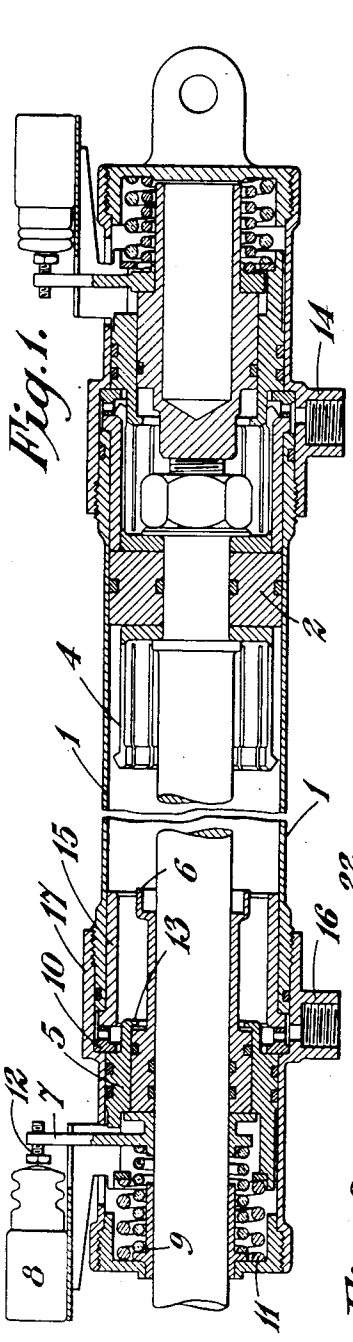

Fig. 1.

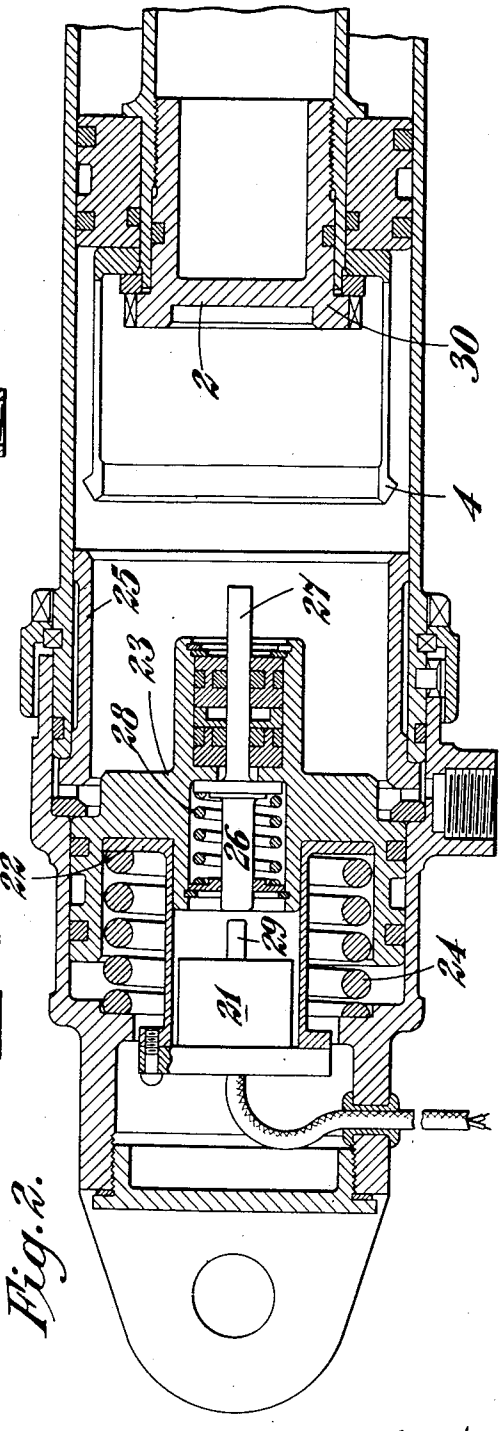

Fig. 2.

Inventors;
Jack Perdue & Stanley Hackney
By their attorneys,
Baldwin, Wight, & Prevost

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MEANS FOR INDICATING THE POSITION OF AN AUTOMATIC LOCKING DEVICE FOR PISTONS OR OTHER MOVABLE PARTS

Jack Perdue, Great Sankey, near Warrington, and Stanley Hackney, Warrington, England, assignors to Electro-Hydraulics Limited, Warrington, England, a company of Great Britain

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5 Claims. (Cl. 200—52)

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This invention relates to means for indicating the position of an automatic locking device for pistons or other movable parts. Such an automatic locking device is described in the British specification No. 527,225, and it is to this kind of locking device to which this invention is more particularly but not exclusively applicable. The locking device is applicable in particular to jacks and other telescopic systems of retractable undercarriages for aircraft, and the known kind of locking device comprises a resilient sleeve provided with claws or tongues which sleeve is secured to the member to be locked, a guide surface secured to the fixed member and adapted to cause contraction of said sleeve before locking, a slide subjected to the action of a resilient force and adapted to be encountered and pushed backwards by said sleeve in the contracted state until the edges of the tongues have reached a fixed releasing slope which allows the sleeve to expand again, so that responsive to the resilient force that urges it, the slide moves forward inside the sleeve and presses the tongues against the releasing slope, thereby preventing the member to be locked from moving backwards; unlocking of the device is effected by pressure applied between the member to be locked and the slide.

It is often found desirable to have some means of knowing when the automatic lock has engaged; for example, if an aeroplane undercarriage is raised and lowered by hydraulic jacks fitted with such automatic locking devices, it may be necessary to inform the pilot when the automatic lock has engaged so that he may be aware that the undercarriage is in a safe landing or retracted position.

The object of this invention is to provide one method of obtaining this indication which is effected electrically by means of a switch which operates to join two or more contacts only when the internal parts of the mechanical lock are such that the jack is positively locked. This object is achieved by requiring two conditions to be fulfilled before the switch can operate: one is that the piston shall be in the position relative to the cylinder at which jack locking is desired, and the other is that the slide shall be displaced a distance towards the piston such that the lock is positively engaged.

Means for indicating the position of an automatic locking device of the kind described comprises a lock bolt and sleeve concentrically arranged with respect to one another, a switch member carried by said bolt and a contact member or striker normally biassed away from the switch member, which together with the striker is capable of axial movement whilst permitting relative axial movement therebetween, the arrangement being such that as the movable parts (the piston and tongues) are approaching the locked position they move the bolt and sleeve, together with the switch member and striker, the last part of movement of said parts to the locked position causing the bolt and switch member to move axially relatively to the striker to effect the locking and close an electric circuit to indicate that the moving parts are in the locked position.

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Two forms of construction according to this invention are illustrated diagrammatically in the accompanying drawing in which Figure 1 is a longitudinal section of a jack fitted with internal locks so that the jack can be locked either in the fully extended or closed position, whilst Figure 2 is a similar section of a modified form wherein the jack is locked in the closed position.

Referring now to Figure 1 this construction is shown as applied to means for indicating that the hydraulic jacks having the locking device of the kind described are in the locked position; in this construction the jack comprises a cylinder 1 in which a piston 2 and piston rod 3 are free to slide, the piston carrying locking tongues 4, the functioning of the mechanical lock being fully described in the said British specification No. 564,590. At the piston rod end of the jack there is provided a lock bolt 5 in which is concentrically arranged a sleeve 6, one end of which is adapted to abut against the moving assembly when the jack is in the locked position as will be described below, the piston rod being free to slide through said sleeve. The piston rod is also arranged to slide through a contact member 7 of an electric switch 8, said member being in the form of a striker which is mounted adjacent the bolt and sleeve, part of said striker passing through a slot in the cylinder casing and through a slot in an extension of the switch 8, which extension is fast with the bolt 5. The striker 7 is urged against the sleeve 6 and bolt 5 by means of a spring 9 thus keeping them normally in contact with an internal shoulder 10 in the cylinder, which shoulder acts as a stop. The bolt itself is also spring loaded onto the shoulder 10 by means of a second spring 11. It will thus be appreciated that it is possible for the sleeve 6 to slide within the bolt 5 whilst the latter remains at rest compressing the striker

spring 9, although normally the bolt and sleeve are positioned relative to each other by a face on the switch arm through which the load from the said spring is transmitted to the bolt and sleeve.

The position of the switch 8 and the striker set schew 12 is adjusted so that in the normal position the switch is not compressed.

A shoulder 13 is provided on the bolt at the end remote from its spring so that the sleeve 6 cannot pass completely through the bolt 5, as might tend to occur when the jack is placed in a near vertical position due to gravity or when the pressure in the jack should drop below atmospheric pressure.

Suppose now that the piston 2 is half way along the cylinder, and fluid under pressure applied through a connection 14 to extend the jack. The piston moves toward the lock, the tongues 4 being deformed radially under the guide surface 15 until they strike the bolt 5. Further movement of the piston carries the bolt with the switch 8 and the striker 7 with it, but does not alter the relative position of the striker and switch. It is arranged that simultaneously with the contact of the tongues and the bolt, or slightly afterwards, the piston meets the extremity of the sleeve 6 and thereafter the sleeve 6 moves with the piston 2. After the lock tongues 4 have passed through the guide surface 15 and regained their undeformed position, the bolt 5 slides toward the piston 2 entering the space formed by the tongues and preventing the latter from closing. During this time the sleeve 6 is unable to move as it is in contact with the piston 2 and hence the switch 8 moves toward the striker 7 making the necessary contacts and providing the required indication that the jack is safely locked.

The jack is unlocked by applying fluid under pressure through a connection 16 to cause movement of the bolt 5 away from the piston 2 and allowing the tongues 4 to be deformed and pass inside the guide surface 15. As the bolt moves the switch 8 away from the striker 7, the contacts are broken. The bolt 5 and sleeve 6 remain in their respective positions and thus the contact remains broken whatever the pressure in the cylinder may be. Should the pressure applied to unlock the jack be sufficient to overcome the load produced by the striker and bolt springs 9 and 11 the bolt and sleeve will be moved away from the piston until their movement is arrested by a conveniently arranged stop (not shown) but which may be located between the switch 8 and the bolt 5 or securing nut 17. Should the said pressure, however, be smaller than the load of the springs, the bolt and sleeve will move simultaneously until their movement is arrested by the internal shoulder 10 in the cylinder. In this case the switch is not actuated as there is no relative movement between the bolt and sleeve and, therefore, no relative movement between the striker and switch.

It is preferable to arrange that the pressure required to move the sleeve against the striker spring and the friction of the necessary sealing rings between the sleeve and piston rod is greater than that required to move the bolt against the corresponding load of its sealing rings and its spring but only by a small amount so that a sudden pressure drop in the cylinder will not allow the bolt to return to the internal shoulder smartly and leave the sleeve behind thus allowing the striker to make contact with the switch.

The method of indication at the other end of the jack is similar except that the construction is simplified owing to the absence of the piston rod.

In the alternative form shown in Figure 2 which is applicable to jacks with locks of any known construction, the switch and contact member are positioned within the jack cylinder and in this arrangement the switch member 21 is carried on a tubular sleeve 22 which is held against the sliding lock bolt 23 by a spring 24 biassing the bolt against its locking sleeve 25. It will, of course, be appreciated that the tubular sleeve 22 can be made in one with the lock bolt. The striker 26 in this case passes through the bolt 23 so that a projecting end 27 of the striker is adapted to be contacted directly by the piston 2 when the lock bolt 23 slides. The striker 26 is moved against the action of a spring 28 onto the pin 29 of the switch member 21 when it is desired to actuate the switch.

When the piston assembly is moved against the lock bolt 23 the lock tongue 4 will move the lock bolt with the switch and striker away from the face of the piston 2 or a lock nut 30 thereon; when the lock tongue 4 has passed through the lock sleeve 25, the lock bolt assembly is returned to its former position by its biassing spring 24 and the striker 26 will be forced back by the face of the piston or lock nut thereon to actuate the switch. The striker spring 28 is so selected that it is strong enough to keep the striker in position when fluid pressure is applied to unlock the jack.

What we claim is:

1. Means for indicating the position of an automatic locking device for fluid operated jacks or the like, of the type including a jack cylinder, and a movable assembly therein comprising a piston and piston rod, reciprocable in said cylinder, and a locking device fixed with respect to said piston and movable therewith in said cylinder; said indicating means comprising a sleeve slidably mounted on said piston rod, a lock bolt concentrically arranged on said sleeve and capable of relative axial movement with respect thereto within said cylinder, an electric switch member carried by said lock bolt, a switch closing contact member normally biased away from said switch member, said lock bolt being disposed in line for engagement by said locking device upon the advancing stroke of said piston, as the said locking device approaches locking position, means associated with said contact member and lock bolt, operable upon axial movement of the latter by said advancing stroke, to cause joint axial movement therewith of said sleeve, contact member, and switch member, and means operable upon completion of said stroke to permit relative axial movement of said lock bolt and switch member with respect to said contact member and sleeve, to effect locking of said device and to close said switch to indicate locked position.

2. Means for indicating the position of an automatic locking device for fluid operated jacks or the like, of the type including a jack cylinder, and a movable assembly therein comprising a piston and piston rod, reciprocable in said cylinder, and a locking device fixed with respect to said piston and movable therewith in said cylinder; said indicating means comprising a sleeve slidably mounted on said piston rod and having an extension engageable by said piston upon its advancing stroke, a lock bolt concentrically mounted on said sleeve and slidable both with respect thereto and jointly as an assembly therewith, said lock

bolt being arranged in line for engagement by said locking device on said advancing stroke, an electric switch member carried by said lock bolt and movable therewith, a switch closing contact member interposed between said switch member and said lock bolt and sleeve assembly, means normally biasing said contact member axially away from said switch member into abutment with said lock bolt and sleeve respectively, and separate means normally biasing said lock bolt and switch member in the same direction for relative movement with respect to said contact member, whereby, upon the completion of said advancing stroke of the piston and locking device, said sleeve and contact member remain stationary and relative movement of said lock bolt and switch member is permitted with respect to said contact member to effect the locking of said device and to close said switch for indicating locked position.

3. Indicating means as claimed in claim 1, wherein one end of said sleeve is extended beyond said lock bolt and serves as an abutment for said movable assembly when said locking device is in locked position.

4. Indicating means as claimed in claim 2, wherein said switch member is located externally of the cylinder, said contact member being slidably mounted on said piston rod and comprising a contact arm which extends through a slot in said cylinder and terminates in line for engagement with said switch member.

5. Means for indicating the position of an automatic locking device for fluid operated jacks or the like, of the type including a jack cylinder, and a movable assembly therein comprising a piston and piston rod, reciprocable in said cylinder, and a locking device fixed with respect to said piston and movable therewith in said cylinder; said

indicating means comprising a sleeve slidably mounted on said piston rod and having an extension engageable by said piston upon its advancing stroke, a lock bolt concentrically mounted on said sleeve and slidable both with respect thereto and jointly as an assembly therewith, said lock bolt being arranged in line for engagement by said locking device on said advancing stroke, an external electric switch member carried by said lock bolt by means of an extension projecting through a slot in said cylinder, a switch closing contact member slidably mounted on said piston rod and having a contact arm interposed between said switch member and said lock bolt and sleeve assembly, means normally biasing said contact member away from said switch member into abutment with said lock bolt and sleeve respectively, and saparate means normally biasing said lock bolt and switch member in the same direction for relative movement with respect to said contact member, whereby, upon the completion of said advancing stroke of the piston and locking device, said sleeve and contact member remain stationary and relative movement of said lock bolt and switch member is permitted with respect to said contact member to effect the locking of said device and to close said switch for indicating locked position.

JACK PERDUE.
STANLEY HACKNEY.

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