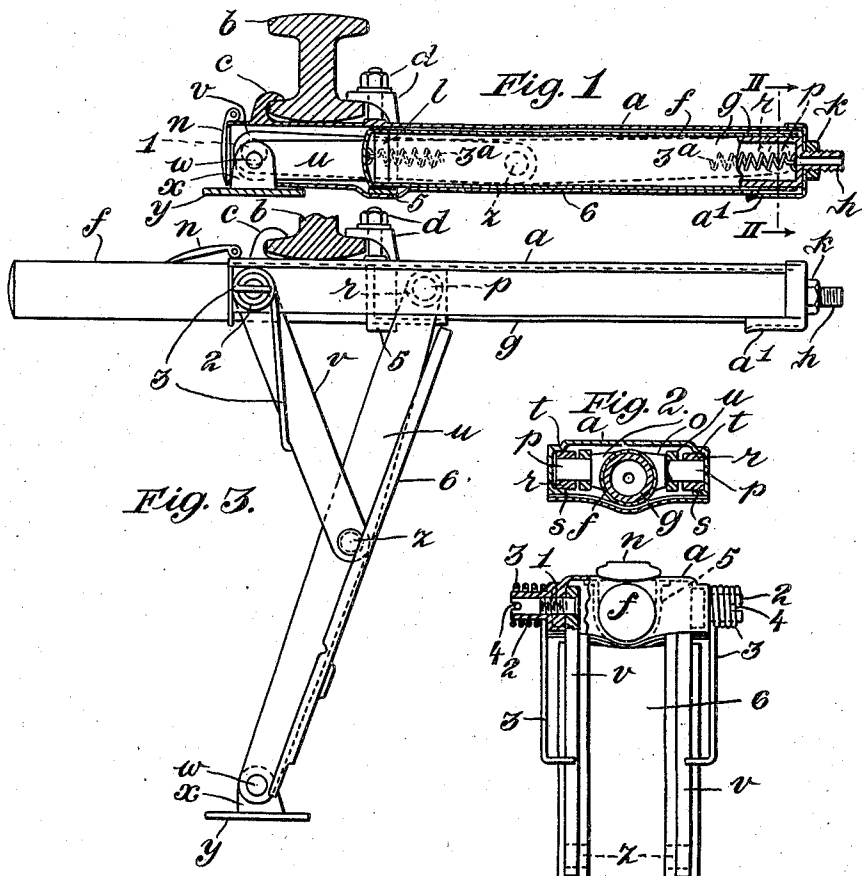
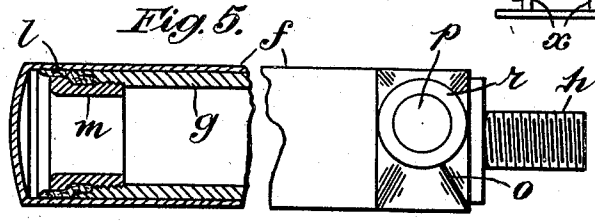
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LIFTING JACK

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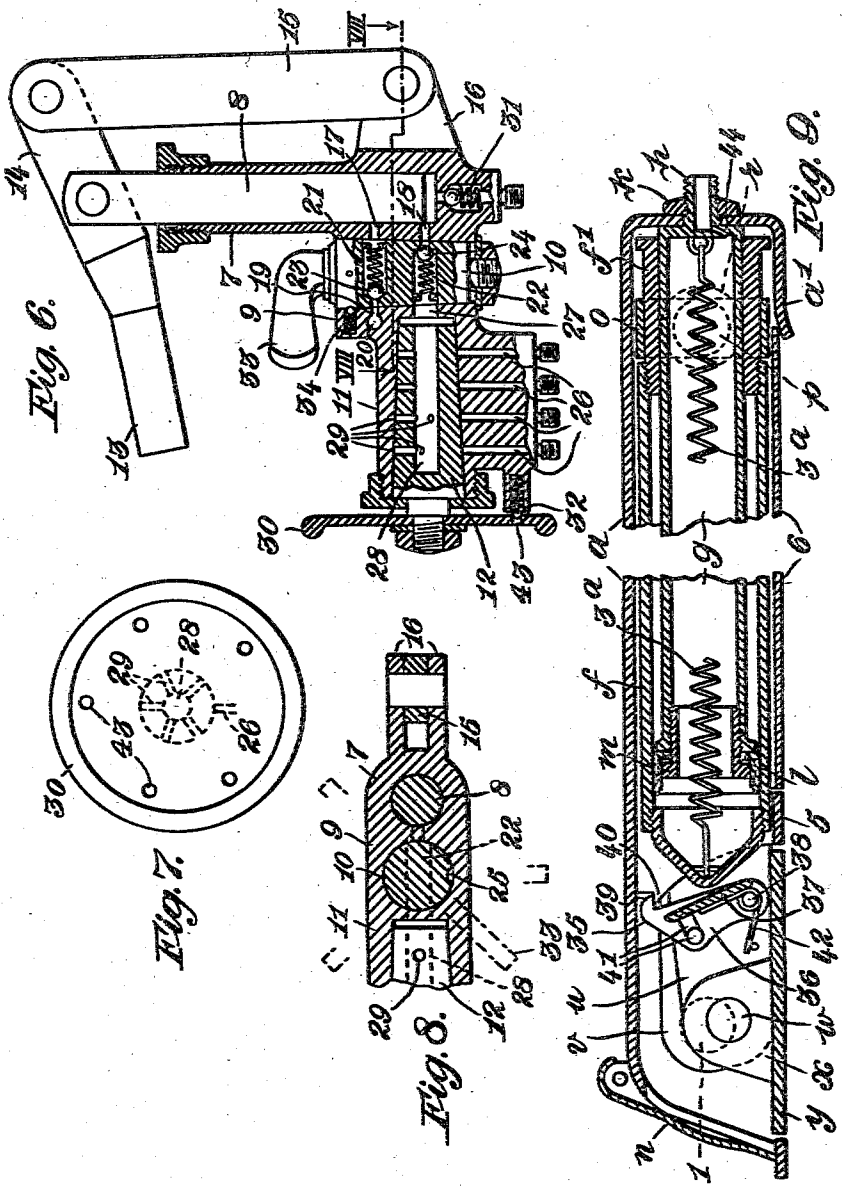


Fig. 6.

Fig. 7.

Fig. 8.

Fig. 9.

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LIFTING JACK

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7 Claims. (Cl. 254—124)

This invention relates to improvements in and connected with collapsible lifting jacks adapted principally to be applied to motor vehicles and other vehicles but which may also be employed for other purposes.

By collapsible lifting jacks is meant jacks which comprise lifting mechanism in the form of an extensible and collapsible linkage, and operating means suitable for effecting the extending and collapsing movements of such mechanism.

The principal object of this invention is to provide an improved collapsible lifting jack of very simple compact and light construction, operable by fluid pressure such as hydraulic pressure or that of compressed air or gas and adapted to be kept as free as possible from damage and from admission of dirt, dust, moisture and other foreign bodies to the working parts when out of use and in the collapsed condition. A further object is to facilitate the jacking-up of vehicles by means of jacks of this nature.

According to this invention, a collapsible lifting jack is provided which comprises lifting mechanism in the form of an extensible or collapsible linkage, operating means including fluid-pressure mechanism in the form of a cylinder and piston or the like, and a casing for the mounting of these parts and adapted to constitute a substantially closed housing therefor when the jack is collapsed.

For the lifting of vehicles, a plurality of these improved lifting jacks is employed together with master control means having fluid-pressure connection with the operating means of the several jacks.

The lifting mechanism is suitably constructed to collapse into a position laterally alongside and substantially co-planar with the cylinder and piston or the like, and the casing suitably is of shallow box-like form.

The improved construction provides a fluid-pressure jack of which the cylinder and piston or the like and the lifting mechanism can be effectively protected by the casing from damage and access of dirt and moisture while, in addition, the jack is capable of ready operation and suitable for easy control. Moreover, the jack need take up little vertical room in the collapsed condition which is an advantage on motor vehicles where space, vertically, is limited. The construction also allows slidable or movable pivotal connections between the lifting mechanism and the fluid-pressure mechanism to be at the sides of the cylinder and piston, so that favourably smooth operation of the parts is attained in a manner hereinafter described.

The lifting mechanism suitably, but not necessarily, comprises a strut device pivotally connected at one end to the cylinder or the piston, and a link device pivoted at one end to the strut and at the other end to a suitable support in the casing. The lifting mechanism or strut is preferably provided with a foot, which may be pivoted to the strut or the like, as is frequently the case with motor-jacks, so as to allow the foot to conform to the contour of the ground where the jacking-up is to take place.

The opening in the casing through which the lifting mechanism or strut is extended and collapsed may be closed by a shield or cover-plate fixed to said lifting mechanism or strut. If desired, the pivoted foot may be adapted to serve as an auxiliary shield or cover-plate to close the slight opening which may appear at the bottom of the casing beyond the free end of the collapsed strut.

In order to avoid lateral stresses on the moving parts, such as the cylinder or the piston, as the case may be, a guide may be provided in the casing and this guide may be annular or part-annular or of other appropriate construction.

In order to enable the invention to be readily understood, reference is directed to the accompanying drawings in which:—

Figure 1 is a part-sectional elevation of one form of jack in accordance with these improvements, the parts being in the collapsed or folded condition and the jack applied to a vehicle axle.

Figure 2 is a transverse section taken on the line II—II of Figure 1.

Figure 3 is an elevation showing the jack in an extended condition.

Figure 4 is a view looking from the left-hand side of Figure 3, but with parts broken away.

Figure 5 is a fragmentary part-sectional view of the cylinder and piston or plunger shown on a larger scale than Figures 1 to 4 to illustrate details.

Figure 6 is a sectional elevation of a suitable form of master control means.

Figure 7 is an end elevation of the operating hand-wheel of the distributing valve of the master control means.

Figure 8 is a section on the line VIII—VIII of Figure 6 to illustrate particularly the pump control valve construction, and

Figure 9 is a sectional elevation in collapsed condition of a modified construction of jack.

According to Figures 1 to 4, the jack comprises a shallow, more or less rectangular, and inverted box-like casing *a* which is mounted in horizontal position on the vehicle axle *b* by claw and stud and clip devices *c*, *d* respectively. The casing is open at the bottom, except for a short wall portion a^1 at one end and the flanges or guides *s* hereinafter referred to, and it has mounted in it the fluid pressure means which will now be described. This comprises a cylinder *f* and a piston or plunger *g*. The latter is a hollow structure which is open at its outer end (Figure 5), and has the inner end closed except for a fluid-pressure supply connection or nipple *h* by means of which, and a nut *k*, it is mounted in a stationary condition in the casing *a*. The cylinder *f* is movable on the piston under the action of the fluid pressure and comprises a hollow body closed at the outer end and open at the inner end. It is packed against the piston in any suitable manner for example by a packing ring *l* which is held in position by a screw-threaded ring *m* as seen in Figure 5. The outer end of the casing *a* has an aperture for passage of the cylinder in its movement on the piston and this aperture, in the collapsed condition of the jack, is closed by a hinged flap *n* provided with a spring (not shown). The inner or open end of the cylinder carries a cross-head *o* having a gudgeon *p* on each side furnished with a roller *r*, and each roller rests on a narrow inwardly and laterally projecting bearing flange or guide *s*, extending practically the whole length of the casing *a* at the bottom, so that the cylinder *f* is supported at the inner end independently of the support afforded by the fixed piston *g*. The casing also has bearing or guide surfaces *t* at the top on which the rollers *r* may run and bear when the jack is in lifting condition. The lifting mechanism comprises a strut device formed by a pair of bars *u* and a link device formed by a pair of bars *v*. The bars *u* are perforated at one end to engage pivotally with the gudgeons *p* aforesaid and they are also perforated at the other end to engage pivotally with rivets or the like *w* on lugs *x* projecting upwards from a plate *y* forming a foot. The bars *v* are similarly perforated at each end to engage pivotally with rivets or the like *z* on the strut bars and with studs or gudgeons 1 screwed into bosses 2 near the outer end of the casing *a*. Both the strut bars *u* and the link bars *v* are at such a distance apart transversely as to enter freely between the narrow flanges *s* at the bottom of the casing when folded up to the collapsed condition of the strut. In the folded condition of the parts the pivots *z* are slightly below the level of the gudgeons *p* and 1. In order to ensure the folding of the parts after jacking-up is finished, coiled springs 3 may be provided on the bosses 2 and engaged at one end in slots 4 of the bosses and at the other end with the link bars *v*. A tension spring 3^a is also connected between the closed ends of the cylinder and piston, on the interior, to assist the collapsing movement.

In the operation of the device, assuming the same to be collapsed, pressure fluid supplied to the interior of the cylinder and piston *f*, *g* through the nipple *h* acts on the cylinder to move it outwardly and in this operation the cross-head *o* is moved with the cylinder to cause the gudgeons *p* to approach the fixed gudgeons 1. As a result, the strut and link devices *u*, *v* are extended through the bottom opening of the casing *a* as shown for instance in Figures 3 and 4 to bring the foot *y* into contact with the ground or floor and then, on continued admission of pressure fluid into the cylinder, the axle *b* is raised from the ground. When the jack is to be collapsed, pressure is released or withdrawn from the cylinder and piston *f*, *g* and the springs 3 and 3^a cause folding of the strut and link bars into the casing laterally alongside and substantially co-planar with the cylinder and piston as shown in Figures 1 and 2.

In order that the foot *y* may always be approximately in the same vertical plane as that in which the pivots 1 of the link device *v* lie, the effective length of the link device is made about equal to half the effective length of the strut device, that is half the distance between the pivots *p* and *w*, and the pivots *z* are arranged approximately at the middle of the length of the strut. This prevents lateral movement of vehicles in jacking-up.

During the movement of the cylinder *f*, the roller *r* on the cross-head gudgeons *p* move along between the parts *s* and *t* of the casing and thus the inner end of the cylinder *f* is guided in a straight path. An annular or part-annular guide may also be provided for the outer end of the cylinder, as at 5 for instance, this also acting as a stop for the cylinder.

As the movable pivotal connections between the strut device and the cylinder are at the sides of the cylinder (at the gudgeons *p*), there is little or no tendency for the crosshead *o* to cant in the vertical plane of the jack and cause the cylinder to bind on the piston, so that the moving parts operate in favourably smooth manner as will be understood.

In the jacked-up condition of the axle, the rollers *r* on the strut gudgeons *p* bear against the casing parts *s* or *t* and as the jack is mounted on the axle by the casing *a*, it follows that the cylinder and piston are relieved to a favourable extent by the casing of stresses which would tend to disalign or distort them.

The flap *n* aforesaid yields on outward movement of the cylinder *f* and closes on its return. The strut bars *u* carry a cover plate 6 which principally closes the bottom opening of the casing *a* when the jack is collapsed as seen in Figure 1, the foot *y* practically closing the small opening which may be left. Thus in the collapsed condition of the jack, the cylinder and piston and the strut and link devices are practically entirely enclosed against damage and against access to them of dust, dirt and moisture. In moving into the position shown in Figure 1, the cover plate 6 is projected at one end into the recess formed by the downturned end of the short casing-bottom part a^1 and this serves to prevent rattling of the mechanism, and to retain the strut device in the collapsed condition of the jack.

It is preferred to operate the jacks by hydraulic power and when they are employed in jacking vehicles, master control means is provided so that the several jacks can be controlled from a common point such as the dash-board of a motor vehicle. Such master control means conveniently comprises pump and valve apparatus as shown in Figures 6 to 8. This pump and valve apparatus may be in the form of a casting comprising a cylinder 7 for a pump piston or plunger 8, a casing part 9 for a pump control valve member 10 and a casing part 11 for a distributing valve member 12. The piston or plunger may be operated by a hand lever

detachably applied to the squared end 13 of a short lever 14 which is pivotally connected to the piston or plunger and fulcrummed on a link 15 pivotally mounted on a lug or lugs 16 at the lower end of the cylinder. If the pump were driven by a motor, obviously the parts 14, 15 and 16 could be dispensed with and the piston be reciprocated by a crank or eccentric and connecting rod or the like. The control valve casing 9 has two ports 17, 18, one above the other, communicating with the pump cylinder and a port 19, diametrically opposite the port 17, communicating by a lateral passage or port 20 with a reservoir (not shown) for liquid such as oil. The control valve member 10 has two transverse passages 21, 22 at the levels of the ports 17, 18 and these passages are fitted with spring-pressed ball valves 23, 24 respectively, engageable with oppositely disposed seats as shown. The valve member 10 also has a longitudinal by-pass passage 25. The casing 11 of the distributing valve has one or more radial ports, such as 26, for connection with the nipple *h* of the jack or with the nipples of several jacks of a set, say four, one for each wheel of a vehicle. The casing 11 also has a central longitudinal port 27 at the level of the lower passage 22 of the control valve member 10. The distributing valve member 12 has an axial passage 28 aligned with the port 27, and one or more radial passages 29 for cooperation with the port or ports 26 of the casing. If several ports 26 are used as illustrated they may be formed in one plane, while the passages 29 would then be angularly spaced apart as shown by the dotted lines in Figure 7. By having four individual passages in four of the angular positions and four passages in line in the remaining angular position, it is possible, on operation of the distributing valve member 12 by hand-wheel 30 or the like, to cause each of the wheels of a vehicle to be raised separately or all wheels simultaneously. Both the pump control valve and the distributing valve would be suitably packed to prevent leakage and a safety valve with very strong spring may be disposed at the bottom of the pump cylinder as at 31 and communicate by pipe or port with the reservoir, to prevent accidental overcharge of the cylinders and pistons of the jacks.

In operation, the pump control valve member 10 is turned by its handle such as 33, to a position in which the valve passages 21, 22 are aligned with the respective pairs of ports 17, 19 and 18, 27 with the valve 23 adjacent to the port 19 and the valve 24 adjacent to the port 18, see Figure 6. In this position of the valve member, the valve 23 is ready to act as a suction valve and the valve 24 as a delivery valve. The distributing valve member 12 is now operated by its hand wheel 30, and if any individual wheel of the vehicle is to be raised, the appropriate passage 29 of the valve member is brought into register with the corresponding port 26 of the casing. Thereupon, the pump lever 14 is set in operation so that the piston or plunger 8 draws in liquid from the reservoir past the valve 23 to the cylinder and then forces it past the valve 24 and through the said passage 29 and port 26 to the jack cylinder at the vehicle wheel. If all four wheels of the vehicle are to be raised simultaneously, the four aligned passages 29 are brought into register with the several ports 26. The several positions of the distributing valve member 12 may be determined by a ball-click device 32 the ball engaging in recesses or holes 43 in the hand wheel, and if desired appropriate markings may be placed on the hand-wheel adjacent to the holes to give indications of the positions. Similar provision may also be made for the control valve member 10, for example as shown at 34.

When the vehicle wheels have been raised sufficiently and pumping is discontinued, the jacks are kept in raised condition because the valves 23, 24 are non-return valves and wheel-changing, for instance, may be effected. If, however, the raised condition is required for a more lengthy period than is required merely for changing a wheel or wheels, the control valve member 10 may be given a partial turn to a position in which all communication between the jacks and the operating pump is shut off independently of the valves 23, 24.

When the jacks are to be collapsed, the control valve member 10 is turned to a third position in which the by-pass pasage 25 is in line with the ports 19, 17. The liquid then discharges from the jack cylinders and flows back to the reservoir, urged by the weight of the vehicle, but the cross-section of the passage 25 is made sufficiently small to prevent unduly quick lowering of the vehicle. As an alternative, and particularly when the pump, 7, 8 is engine operated, the control valve member 10 may be moved to a position diametrically opposite to that shown in Figure 6 and the pump be used for discharging the jack cylinders. In this case, the functions of the valves 23, 24 are reversed, that is to say, the valve 23 which first acted as a suction valve, now acts as a delivery valve and the valve 24 which acted as a delivery valve is now in a position to act as a suction valve. After the jacks are collapsed, the pump control and distributing valve members are moved to a closed position as will be understood.

A further important use of the pump control valve member 10 in the reversed position of the valves 23, 24 above stated, is that it enables the pump 7, 8 to be employed for withdrawing the liquid partly or wholly from the jack cylinders, after collapse of the jacks, thereby creating a vacuum condition in the cylinders which is advantageous as a means for retaining or assisting in retaining the strut and link devices in the collapsed condition and preventing or decreasing rattling of the parts.

In order to prevent accidental displacement of the pump control and delivery valve members 10 and 12, suitable retaining means such as spring-pressed bolts or other locking means may be provided. For example if the springs of the ball-click devices 32 and 34 were made strong enough these devices could be made appropriate for the purpose.

Obviously, the distributing valve could be constructed to allow the several jacks on a vehicle to be raised in pairs, as well as individually or collectively as described.

In the modified form of lifting jack shown in Figure 9, a catch device 35 is provided for retaining the strut device in the folded or collapsed condition. The strut and link devices are of similar construction to those shown in Figures 1 to 4 and the catch device is pivotally mounted between the two bars of the strut device. It comprises two end plates, one of which is shown at 36, joined by a cross-piece 37 and its pivotal mounting is by two studs or rivets one of which is seen at 38. The end plates have teeth, as at

39, which engage corresponding formations, as at 40, on the cylinder guide 5, and the movement of the catch is restricted by pin and slot devices as at 41. Springs such as 42 may be provided for projecting the catch to operative position.

In operation when extending the jack, it is necessary to allow a small initial movement of the cylinder *f*, to release the catch device, before movement is imparted to the strut device, and for this purpose it is convenient to mount the cross-head *o* slidably upon an end portion *f'* of the cylinder, thereby allowing a little lost motion before the cylinder becomes effective to move the cross-head on the extending movement of the strut device.

Figure 9 also shows the jack casing *a* with sloping outer end. This allows the foot *y* to be flush with the bottom of the casing in the collapsed condition of the jack. It is also seen that the closed end of the cylinder *f* in Figure 9 has a sloping or conical surface which acts as a cam against the part 37 of the catch and initiates starting of the extending movement of the strut device after the catch is released and just before the lost-motion aforesaid ends. With this construction the pivots at *p*, *z* and *i* may be at the same level in the collapsed condition of the jack. Figure 9 also shows that the passage in the pressure supply nipples *h* may be drilled on the slant at its end, as at 44, so as to open to the interior of the cylinder and piston at as low a point as possible and thereby enable all, or as much as possible, of the pressure fluid to be drawn out, if desired, when the jack is collapsed. If all the liquid is withdrawn there is less weight to cause rattling of the parts.

The constructions of lifting jack and controlling means above particularly described are suitable embodiments of my invention but it will be obvious that they are susceptible of modification to suit different requirements or conditions. For instance, the valve members 10 and 12 could be adapted for distant control from the dash-board of the vehicle, particularly when the pump 7, 8 is motor operated and may thus also be adapted for distant control from the dash-board.

I claim:—

1. A collapsible lifting jack comprising an extensible and collapsible linkage, fluid-pressure mechanism operatively connected with said linkage, a casing for the mounting of said linkage and fluid-pressure mechanism and adapted to constitute a substantially closed housing therefor when the jack is collapsed, a catch device for retaining said linkage in the collapsed condition, and means permitting slight lost-motion to take place between said fluid-pressure mechanism and said linkage on the extending movement of the latter, to enable said fluid-pressure mechanism to release said catch.

2. A collapsible lifting jack including a casing to be removably secured to the part to be lifted, a pressure-responsive element movable longitudinally of the casing, strut bars connected to the element, links pivotally connected to the casing and to the strut bars, the strut bars and links being movable in the pressure-responsive operative movement of the element to a position below the casing to cause the strut bars to provide a lifting element, said strut bars and links being movable in the opposite movement of the element to an inoperative position within the casing, and means fixed with relation to the strut bars to provide a closure for the casing when the strut bars have reached an inoperative position within the casing.

3. A construction as defined in claim 2, wherein the means carried by the strut bars to provide a cover for the casing is in the form of a plate rigid with and additionally functioning to brace the strut bars in use.

4. A construction as defined in claim 2, wherein the free ends of the strut bars are provided with a relatively movable ground-engaging foot, said foot operating in the inoperative position of the strut bars to cooperate with the cover-forming means of the strut bars to complete a closing of the casing.

5. A construction as defined in claim 2, including a spring connected to the casing and to the strut bars and assisting movement of the strut bars and links to inoperative position in the corresponding movement of the element.

6. A construction as defined in claim 2, including means for locking the links in inoperative position within the casing.

7. A construction as defined in claim 2, wherein the links and strut bars each comprise spaced members fitting respectively on opposite sides of the element when the parts are in inoperative positions.

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