Dec. 2, 1958 P. W. DALRYMPLE ET AL 2,862,689

PAPER LIFT

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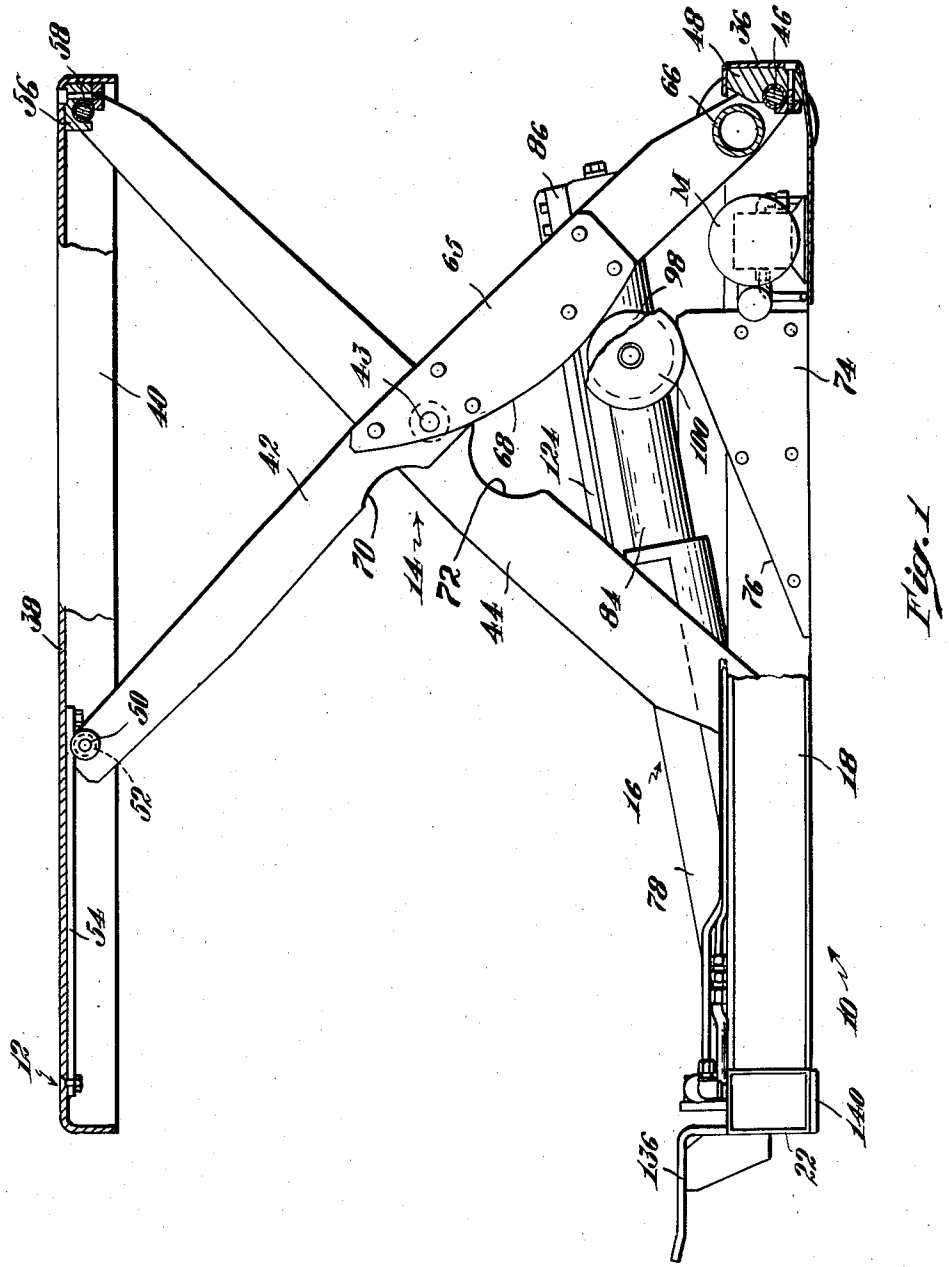


Fig. 1

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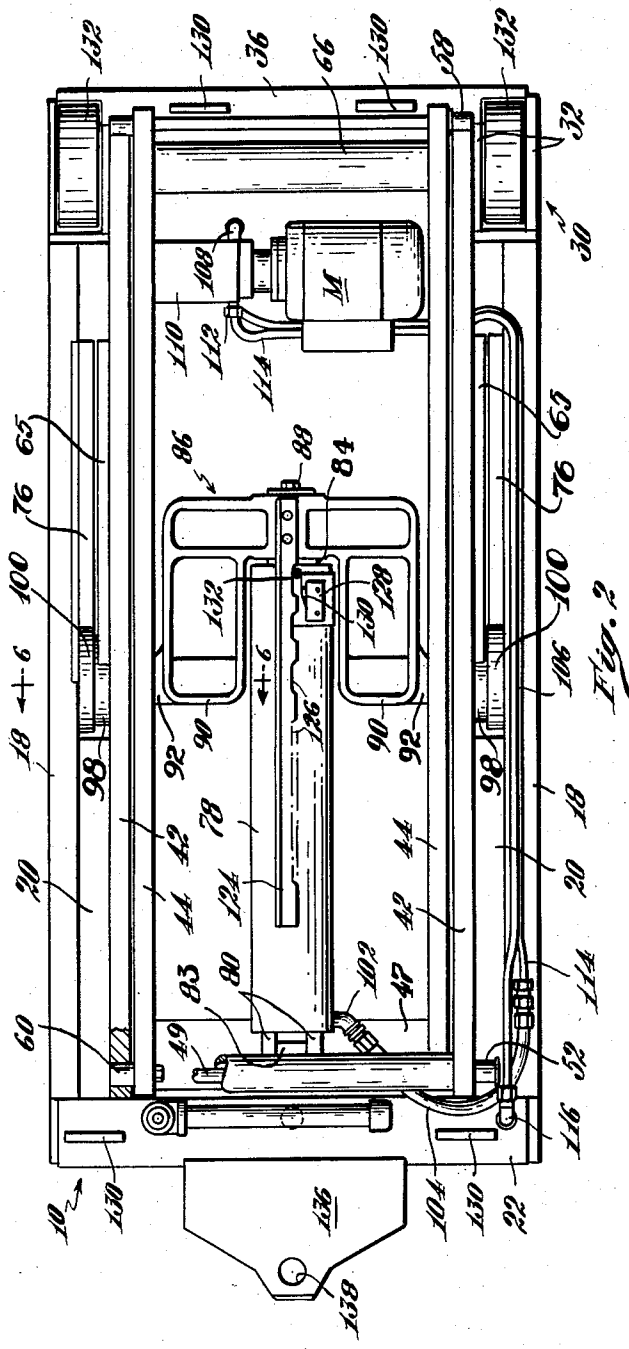


Fig. 2

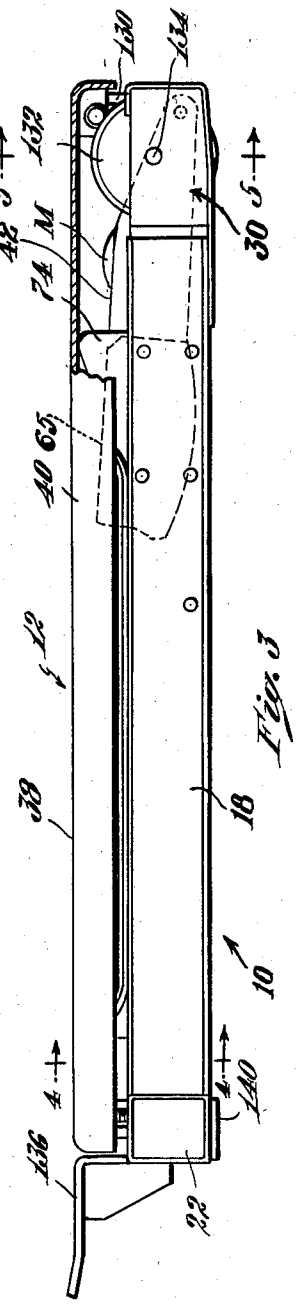


Fig. 3

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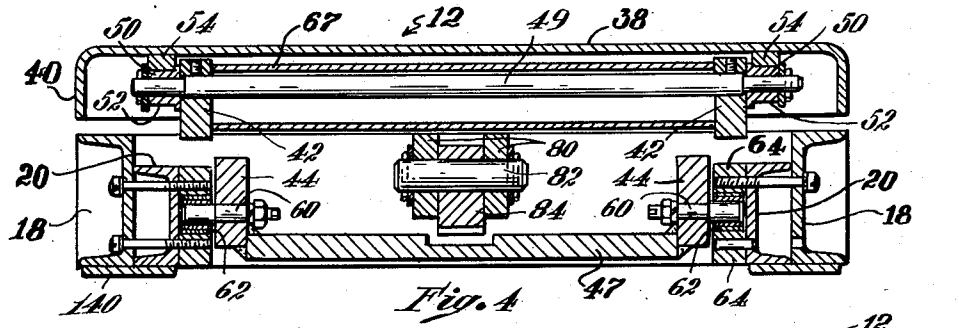


Fig. 4

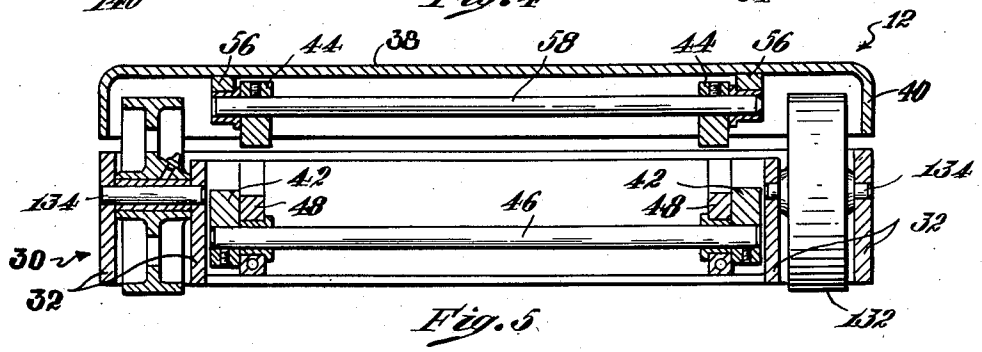


Fig. 5

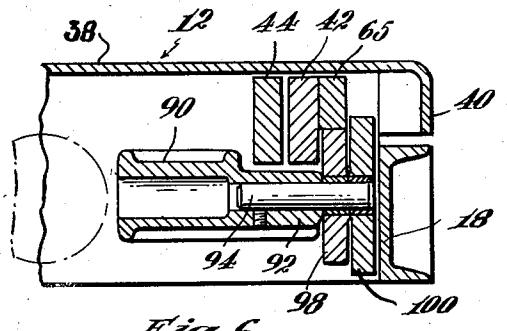


Fig. 6

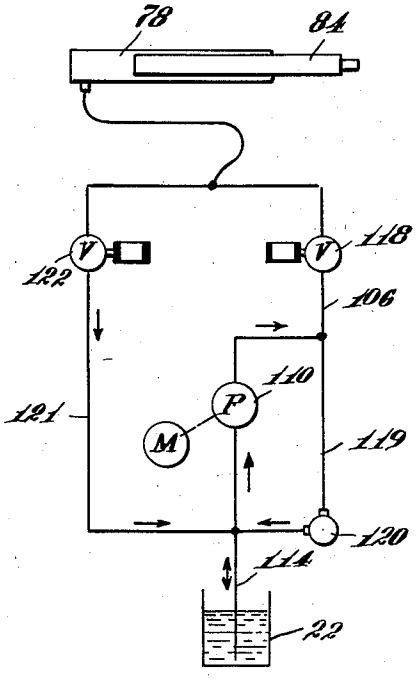


Fig. 7

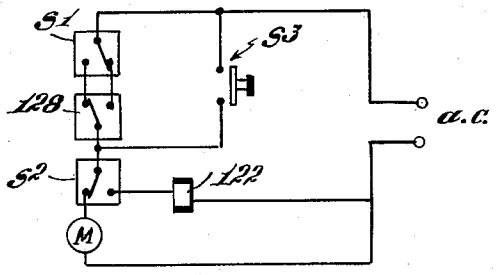


Fig. 8

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PAPER LIFT

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Application November 3, 1955, Serial No. 544,745

4 Claims. (Cl. 254—8)

This invention relates to platform lifts for sheet material such as paper, and has for its principal objects to provide a lift with a minimum vertical depth, without sacrificing the height to which the platform may be elevated and/or the mechanical advantage attainable to raise it to its maximum height. Other objects are to provide a lift in which the operating parts are designed so that a maximum lifting effort may be attained in a space limited both as to length and height, and in which a lifting effort may be attained which is substantially uniform throughout elevation of the platform. Another object is to provide a lift which is resistant to torsion caused by unbalanced loading and hence to provide stability in elevation. Another object is to provide a lift which is motivated by power and can be closely controlled during elevation and lowering and stopped at any given vertical height between its highest and lowest positions. Still other objects are to provide a lift which may be moved about when desired, which may be stabilized when located in a position for use so that there is no danger of accidental or unintended movement, which is compact and space saving when collapsed and is attractive in appearance.

As herein illustrated the lift has a base and platform, the latter being connected to the base by arms, of which there are two pair. One arm of each pair has a cam track along its underside with which is engaged a cam follower adapted to move along the base to elevate the arms and hence the platform. Motivation of the cams is effected by a cylinder mounted on the base which contains a ram and means mounting the cam followers on the ram so that they have a stroke corresponding in length to that of the ram but which commences and terminates intermediate the butt end of the cylinder and forward extremity of the ram when the ram is fully extended. The upper end of one arm and the lower end of the other arm of each pair are pivotally connected to the platform and base respectively. The lower end of the one arm and the upper end of the other arm of each pair are slidable on tracks fast to the base and platform for movement from a point intermediate the ends of the base toward the end of the base opposite the pivoted ends of the lazy-tong arms. There are additional cam tracks on the base beneath the cam tracks on the arms, which are located between the pivoted ends of the arms and the innermost ends of the tracks for supporting the slidable ends of the arms. The cam followers are rollers mounted on the ram for movement between the cam tracks and they are fastened to the ram rearwardly of its leading end and at opposite sides thereof, so that the stroke of which they partake is coextensive with the cam tracks on the base, the latter being limited in its height to the maximum depth of the lift when the platform is in its lowermost position.

The invention will now be described in greater detail with reference to the accompanying drawings wherein:

Fig. 1 is a side elevation of the lift with the platform elevated and with parts shown in section;

Fig. 2 is a plan view of the lift with the platform

omitted, showing the elevating arms in their prone positions;

Fig. 3 is a side elevation of the lift with the platform at its lowermost position;

Fig. 4 is a vertical transverse section taken on the line 4—4 of Fig. 3;

Fig. 5 is a vertical transverse section taken on the line 5—5 of Fig. 3;

Fig. 6 is a fragmentary vertical section taken transversely of Fig. 2 on the line 6—6;

Fig. 7 is a schematic diagram of the hydraulic system; and

Fig. 8 is a schematic diagram of the electrical system.

Referring to the drawings (Figs. 1 to 3), the lift has a substantially rectangular base **10**, a correspondingly shaped platform **12**, two pair of arms **14**, connecting the platform to the base, and power operated means **16** for effecting elevation of the mechanism and hence elevation of the platform relative to the base.

The base (Fig. 2) consists of spaced parallel, outwardly facing channel beams **18**, which have secured to their webbed inner sides along part of their lengths, the left ends herein shown, smaller outwardly facing channel beams **20**. At the left ends of the channels **18** and **20**, which terminate together, there is fastened a transversely extending box girder **22**, the ends of which are closed and which girder provides a reservoir for oil, for purposes which will appear hereinafter. At the right-hand ends of the channels **18** there are fastened a pair of box-like frames **30** having spaced parallel, vertically disposed walls **32** and the outer ends of these frames are connected by a transverse, inwardly facing channel beam **36**. The foregoing parts are preferably welded together to afford an extremely rigid frame for the lift.

The platform **12**, which corresponds in length and breadth to the base, has a flat work-receiving surface **38** and a peripheral skirt **40**, the lower edge of which is adapted to substantially meet the top of the base and hence to conceal the subjacent operating mechanism when the platform is lowered thereby to provide an attractive apparatus and to protect the mechanism from dirt and the like.

The arms **14**, of which there are two pair, one pair at each side of the base and platform, each comprise an arm **42** and an arm **44**. The lower ends of the arms **42** are pivotally connected to a transversely extending shaft **46** (Figs. 1 and 5), the opposite ends of which are journaled in bearing blocks **48** fastened to the end channel **36** so that these arms may swing from a prone position within the base, upwardly in a clockwise direction, as viewed in Fig. 1. The upper ends of the arms **42** are joined by a transversely extending shaft **49** (Fig. 4), on the opposite ends of which are mounted rollers **50** having peripheral grooves **52**, engaged with tracks **54** fastened to the underside of the platform. The upper ends of the arms **44** are pivotally connected to a shaft **58** (Fig. 5), which extends transversely and is journaled at its ends in bearings **56** fastened to the underside of the platform. The lower end of each of these arms **44** (Fig. 4) has fastened to it a stub shaft **60** on which is mounted a roller **62**, the latter engaging a track on the base formed by vertically spaced bars **64** bolted to the web of the channel **20**. The arms of each pair are also pivotally connected to each other at their midlengths by pins **43**. As thus constructed the arms **42** and **44** are pivoted to the base and platform at one end and are slidable linearly along the base and platform at their opposite ends. Since the pivot points for the ends of the arms are arranged vertically, operation of the arms effects vertical movement of the platform relative to the base.

To make the lazy-tong arms rigid and thus to eliminate torque due to unbalanced loading the lower ends of the

arms 42 are joined just above their pivot points by a transversely extending torque resisting tube 66, welded at its ends to the inner sides of the arms. The ends of the arms 44 are also reinforced to make them rigid by a transversely extending flat bar 47, welded at its ends to the inner side of the arms. Use of a bar rather than a tube was required because of the lack of space to accommodate a tube.

A cam plate 65 (Fig. 1) is attached to each of the arms 42. Each cam plate has a downwardly facing edge 68 which is substantially an arc of a circle and is designed to insure that elevation of the platform from its lowermost position to its uppermost position may be attained by uniform pressure.

On the base at each longitudinal side there is fastened to the web of the channel 18 a triangular cam 74 having an inclined cam track 76. These cams are located between the pivoted lower ends of the arms 42 and the innermost ends of the tracks 64 supporting the slidable lower ends of the arms 44, in cooperative relation to the cams 68 on the legs 42.

The means for raising the mechanism consists of a power operated cylinder 78 pivotally mounted on the base and to this end it has at its butt end a pair of spaced ears 80 (Figs. 2 and 4) which embrace a stud 83 welded to the box girder 22, midway between its ends. The ears and stud have registering holes through which there is placed a pin 82 which supports the cylinder for pivotal movement in a vertical plane. The cylinder has in it a ram 84, the latter being adapted to be reciprocated in the cylinder, as will appear hereinafter, and being so designed that the overall length of the cylinder and ram when the latter is fully extended does not exceed the overall distance between the pivoted butt end of the cylinder and the pivoted lower ends of the arms 42. A U-shaped casting 86 (Fig. 2) is fastened to the outer end of the ram 84 by a bolt 88 and has rearwardly extending, laterally spaced arms 90 which lie at opposite sides of the center line of the ram. The ends of the arms 90 terminate in laterally, outwardly extending bearing sleeves 92 (Fig. 6) in which are secured shafts 94. Each shaft 94 has mounted on it a cam follower 98 and 100, adapted to engage the cams 65 and the cams 74 at all times, and has cam follower surfaces of different diameter, the former being located so as to engage the edge 68 of the cam 65 and the latter to engage the edge 76 of the cam 74. Movement of the cams along the base as the ram is extended from the cylinder causes the cam followers 100 to roll upwardly along the inclines 76. At the same time the cam followers 98 are caused to rise and to raise the arms 42 by rolling contact with the cam surfaces 68. The arms have at their undersides semicircular notches 70 and 72 to permit the arms to be lowered to prone position, these notches being designed to register with and give clearance for the subjacent sleeves 92 when the ram is fully withdrawn.

Power is supplied to the cylinder 78 to drive the ram outwardly through a nipple 102 (Fig. 2) fastened to its butt end, which has connected to it a conduit 104 and a line 106 which runs to a nipple 108 at one side of a pump 110. The other side of the pump draws oil through a nipple 112 and line 114 from the oil sump 22 through a nipple connection 116. The pump 110 is driven by a motor M and the flow of the hydraulic fluid for controlling the cylinder or ram is diagrammatically shown in Fig. 7. As there shown, oil drawn from the sump 22 through the line 114 by the pump 110 passes through the line 106 to the cylinder 78. A check valve 118 is interposed in this line 106 to prevent return of the fluid through the pump. A by-pass 119 is provided, connecting the line 106 to the line 114, in which there is a relief valve 120 so that if the pressure exceeds a predetermined amount the fluid may return to the sump without causing damage. The platform is therefore elevated by supplying oil to the pump which in turn supplies oil under pressure to the butt end of the cylinder 78. The platform is lowered by operation of a solenoid valve 122 in a return line 121 leading from the line 106 to the line 114 and hence to the sump. Opening this valve permits oil to flow from the cylinder back to the sump and the weight of the platform and load serves to cause the parts to collapse.

The lift is designed with electric controls for the hydraulic mechanism which permits the platform to be inched up or down or to be raised all the way up or lowered all of the way down as the need may require. To effect this there is fastened to the casting 86 (Fig. 2) a bar 124 which extends rearwardly, parallel to the cylinder wall and substantially along a vertical projection of its center line. The bar has along one edge a succession of regularly spaced notches 126. Since the bar 124 is fastened to the casting it moves with the ram relative to the cylinder and has a stroke corresponding in length to that of the ram. A switch 128 is fastened to the cylinder wall near its forward end and has an arm 130 carrying a roller 132 adapted to yieldingly engage the notched edge of the bar 124. Thus as the ram moves the notched edge of the bar is drawn along relative to the roller 132, which alternatively deflects and releases the switch arm 130. The switch 128 forms part of a circuit in which are also the motor M and the solenoid valve 122, the circuit being shown diagrammatically in Fig. 8. In this circuit there is a switch S1 which is adapted to be manually operated by a push button to close the circuit in either one of two positions to cause the motor M to deliver fluid to the cylinder and hence to advance the ram or to cause operation of the solenoid 122 to release oil from the cylinder and hence to permit the ram to retract depending upon the position of a switch S2, also in the circuit. Movement of the ram brings a land between notches on the bar, opposite the roller 132, thereby throwing the switch 128 to an open position, thus cutting off the current and stopping the motor or operating the valve. By punching the switch S1 a second time the circut may be re-established to cause the ram to move another step, up or down, as the case may be. The switch S2 selectively controls whether operation of the switch S1 effects an elevation or lowering of the platform. Preferably the steps are arranged to be about an inch long. A third switch S3 is provided in the circuit and closing of this switch by-passes the switch S1 and the switch 128 so that depending upon the position of the switch S2 a full rise or a full fall may be secured.

It is desirable to limit the lowermost position of the platform; accordingly there are fastened to the end members of the base pairs of transversely spaced, upright blocks or posts 130 which engage the underside of the platform as it reaches its lowermost position and prevents further movement and at the same time stabilizes the platform in its lowermost position by four point contact. If desired the platform may be provided with leveling screws at its corners in place of the aforesaid stops or in addition thereto.

At the right-hand end of the lift, as shown in Figs. 2 and 3, the base is provided with wheels 132 mounted on shafts 134 journaled in the vertical walls 32 of the box members 30. The lower parts of these wheels extend but a very little distance from the bottom of the base and provide for rolling the lift about when required. To assist in movement of the lift a lifting flange 136 is welded to the box girder 22, through which there is an aperture 138 for receiving the upright pin on a dolly and by lifting on the flange the whole base may be tilted just enough to roll freely on the wheels 132. To prevent drag the extreme right-hand end of the base, from about the shaft 134 of the wheels 132, is inclined upwardly to afford clearance for tilting. The left-hand end of the base is provided with a pair of blocks 140 on which this end may rest and which levels this end with the opposite end supported by the wheels.

From the foregoing it is apparent that a very simple, effective, compact and rugged apparatus is obtained.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

We claim:

1. A lift comprising a base, a platform over the base, a pair of arms on each side of the base and platform interconnecting the base and platform to permit the platform to rise and fall relatively to the base, cam means for lifting the platform including cams on said arms and followers engaging the cams, a piston and cylinder for actuating said followers, one end of the cylinder being mounted at one end of the base and the piston extending from the other end of the cylinder beyond said followers, and means interconnecting the outer end of the piston with the followers, said means having arms extending lengthwise of the piston toward said end of the base and being spaced from the piston so that they overlap the cylinder when the piston is retracted into the cylinder, and said arms also extending lengthwise of the piston when the piston is advanced.

2. A lift comprising a base, a platform over the base, a pair of arms on each side of the base and platform interconnecting the base and platform to permit the platform to rise and fall relatively to the base, cam means for lifting the platform including base and arm cams on said base and arms respectively, the base cams being offset relatively to the arm cams so that they overlap when the platform is lowered, and coaxial followers engaging said base and arm cams respectively, a piston and cylinder for actuating said followers, one end of the cylinder being mounted at one end of the base and the piston extending from the other end of the cylinder beyond said followers, and means interconnecting the outer end of the piston with the followers, said means having arms extending along the piston toward said end of the base and being spaced from the piston so that they overlap the cylinder when the piston is retracted into the cylinder.

3. A lift comprising a base, a platform over the base, a pair of arms on each side of the base and platform

interconnecting the base and platform to permit the platform to rise and fall relatively to the base, cam means for lifting the platform including cams on said arms and followers engaging the cams, a piston and cylinder for actuating said followers, one end of the cylinder being mounted at one end of the base and the piston extending from the other end of the cylinder beyond said followers, and a U-shaped head interconnecting the outer end of the piston with the followers, the arms of the U-shaped head extending lengthwise of the piston toward said end of the base on opposite sides of the piston and being spaced from the piston so that they overlap the cylinder when the piston is retracted into the cylinder, and said arms also extending lengthwise of the piston when the piston is advanced.

4. A lift comprising a base, a platform over the base, a pair of arms on each side of the base and platform interconnecting the base and platform to permit the platform to rise and fall relatively to the base, cam means for lifting the platform including base and arm cams on said base and arms respectively, the base cams being offset relatively to the arm cams so that they overlap when the platform is lowered, and coaxial followers engaging said base and arm cams respectively, a piston and cylinder for actuating said followers, one end of the cylinder being mounted at one end of the base and the piston extending from the other end of the cylinder beyond said followers, and a U-shaped head interconnecting the outer end of the piston with the followers, the arms of the U-shaped head extending along the piston toward said end of the base on opposite sides of the piston and being spaced from the piston so that they overlap the cylinder when the piston is retracted into the cylinder.

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