July 27, 1965 W. WINNALL 3,196,981

ADJUSTABLE LADDER

Filed March 8, 1963 3 Sheets-Sheet 1

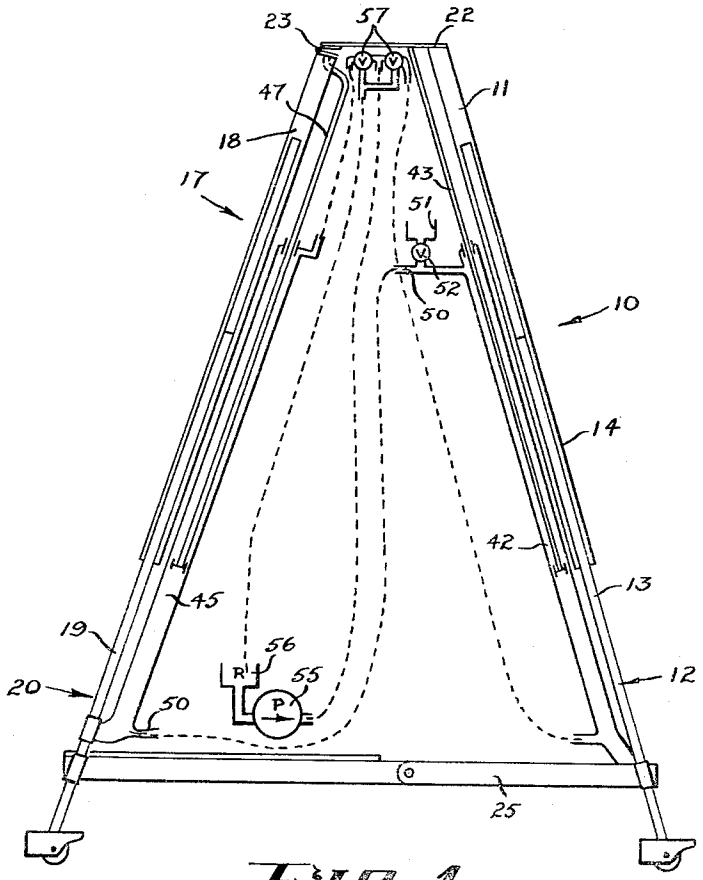


FIG 1

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ADJUSTABLE LADDER

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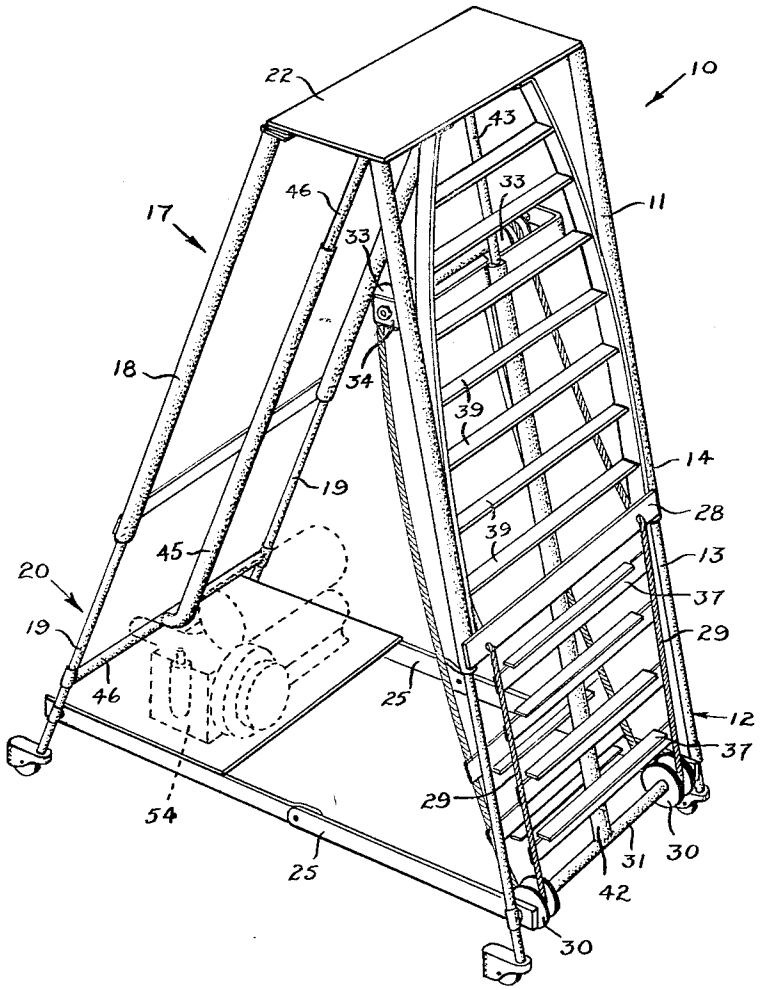


FIG 2

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ADJUSTABLE LADDER

Filed March 8, 1963 3 Sheets-Sheet 3

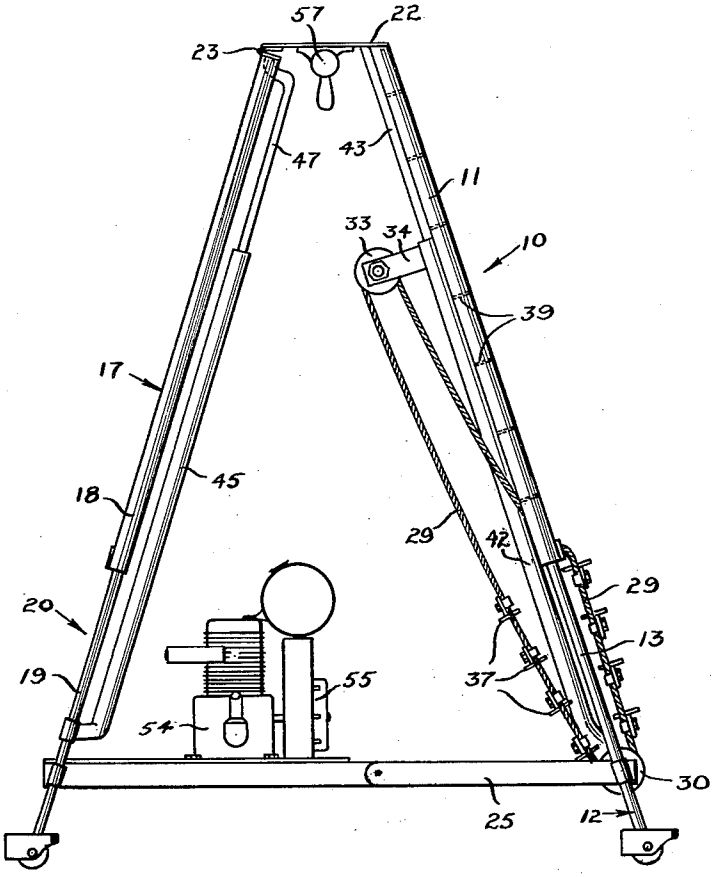


FIG 3

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3,196,981

ADJUSTABLE LADDER

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3 Claims. (Cl. 182—116)

This invention relates to an improved adjustable ladder and in particular it relates to a ladder of the type which can be extended or contracted to allow the user to reach different heights.

Extension ladders are of course already well known, but it is customary in these to set the ladder to the required height before the operator uses same and this means that each time the ladder is to be set to a different height it is necessary for the user to come down from the ladder, to then adjust it to the new height, and to then go back up the ladder.

For painters and others who are working on large surfaces where the ladder has to be constantly adjusted, this is a considerable problem and time waster.

It is the object of this invention to provide a ladder in which the advantages of an extension ladder are retained but wherein adjustment of the ladder can be effected with the operator on the ladder itself.

According to its simplest form, the invention consists of an adjustable ladder comprising an upper section and a lower section, the front stiles on the upper section slidably engaging the front stiles on the lower section, the rear stiles of the upper section slidably engaging the rear stiles of the lower section, a first hydraulic ram between the upper and lower front sections, a second hydraulic ram between the upper and lower rear sections, hydraulic pump means on the ladder, valve means between the pump means and the rams, and valve control means at the upper end of the front ladder section, and has a flexible ladder of novel construction depending from the upper section.

An embodiment of the invention is described hereunder in some detail with reference to and is illustrated in the accompanying drawings in which

FIG. 1 is a schematic layout showing the relatively slidable member and lower sections, and the hydraulic means for effecting the height adjustment,

FIG. 2 is a perspective view of the ladder, and

FIG. 3 is a side elevation thereof.

The ladder 10 comprises an upper front section 11 and a lower front section 12, the lower front section 12 having its stiles 13 telescopically engaged within the tubular stiles 14 of the front section 11 so that the upper front section 11 is movable for height relative to the lower front section 12.

In a similar manner the upper rear section 17 has its tubular stiles 18 telescopically engaging over the stiles 19 of the lower rear section 20.

The upper end of the upper front section 11 is fixed to the front lower edge of the platform 22, while the top of the rear upper section 17 is secured to a hinge 23 which is on the rear lower edge of the platform 22 so that the upper rear section 17 is hingeable in relation thereto.

The stiles 13 of the lower front section 12 are linked to the stiles 19 on the lower rear section 20 by means of a pair of articulated braces 25, one on each side of the ladder 10. Thus when the braces 25 are in their extended position as shown in the drawings the ladder 10 resolves into a triangular structure and is stable.

The lower ends of the stiles 14 of the upper front section 11 have extending between them a transverse member 28, and a pair of flexible side members 29 are secured at their upper ends to the transverse member 28, and extend over lower pulleys 30 on a transverse shaft 31 positioned between the stiles 13 near their lower ends. The flexible side members 29 extend upwardly over an upper set of pulleys 33 on brackets 34 extending rearwardly of (but not secured to) the stiles 14 of the upper front section, and the flexible side members 29 then extend downwardly, each being secured at its upper end to the transverse member 28.

The flexible side members 29 have a series of rigid rungs 37 between them, the flexible side members 29 and rungs 37 thereby constituting a flexible ladder. In this embodiment the flexible side members 28 are ropes, but they can of course be chains in which case the pulleys 30 and 33 can conveniently be sprockets. The rigid rungs 37 are spaced beneath rungs 39 disposed between the stiles 14 of the upper front section 11, and co-operate with the rungs 37 to always form the step portion on the front side of the ladder 10.

A front hydraulic ram 42 is fixed at its lower end to the transverse shaft 31 and its piston rod 43 is fixed at its upper end to the end surface of the platform 22. The brackets 34 are secured to the upper end of the ram 42, and are thereby retained in a fixed relative relationship with the lower front section 12.

A rear hydraulic ram 45 is fixed at its lower end to a transverse member 46 which extends between the lower ends of the stiles 19 of the lower rear section 20, and its piston rod 47 is fixed to the upper end of the upper rear section 17. The rams 42 and 45 are of such dimension that the annular area within the ram 42 but surrounding the piston rod 43 is equal to the circular cross sectional area of the lower end of the rear hydraulic ram 45 whereby magnitude of volume of liquid displacement above the piston of ram 42 equals the magnitude of volume of lower displacement below the piston of ram 45 for equal piston movement. An oil conduit 50 extends from the lower end of the rear hydraulic ram 45 to the upper end of the front hydraulic ram 42, the conduit 50 having secured to it a priming reservoir 51, and a shut off valve 52, so that the system between the front hydaulic ram 42 and the rear hydraulic ram 45 can be filled with oil at any time to thereby constitute a closed hydraulic system.

An engine 54 drives a pump 55 which draws oil from a reservoir 56 and delivers it to a double acting valve 57 which is disposed on the under face of the platform 22. The double acting valve in one position allows exhaust oil from the upper end of the rear hydraulic ram 45 to flow back into the reservoir 56, and at the same time directs pressure oil from the pump 55 to the lower end of the front hydraulic ram 42. This then drives the piston rod 43 upwardly and in turn drives the piston rod 47 upwardly through the closed hydraulic system including the conduit 50.

When the double acting valve 57 is set in the reverse position, the reverse action takes place therefore allowing exhaust oil through the lower end of the front hydraulic ram 42 to flow into the reservoir 56 and at the same time introduces oil at pressure to the top end of the rear hydraulic ram 45. Thus it will be seen that the platform 22 remans substantially horizontal and the slope of the upper and lower front sections 11 and 12 remain substantially unaltered during raising and lowering of the upper sections relative to the lower sections.

What I claim is:

1. An adjustable ladder comprising an upper section and a lower section, front stiles and rear stiles on each said section, the front stiles on the upper section slidably engaging the front stiles on the lower section, the rear stiles of the upper section slidably engaging the rear stiles of the lower section, a first hydraulic ram between the upper and lower front sections, a second hydraulic

ram between the upper and lower rear sections, hydraulic pump means on the ladder, valve means between the pump means and the rams, valve control means at the upper end of the front ladder section, a series of rungs between said front stiles of said upper section, a pair of lower pulleys one on each of the lower ends of said front stiles on the lower section, a pair of upper pulleys attached to the upper end of said first hydraulic ram and a flexible ladder comprising flexible side members and rigid rungs, each flexible side member being secured at both its ends to the lower end of said upper section but passing over an upper and a lower said pulley.

2. An adjustable ladder comprising an upper section and a lower section front stiles and rear stiles on each said section, the front stiles of said upper section slidably engaging the front stiles of said lower section, the rear stiles of said upper section slidably engaging the rear stiles of said lower section, a platform secured to the upper ends of said front stiles, a pair of hinges one between the upper end of each rear stile and said platform, a front hydraulic ram between the front lower section and the platform, a rear hydraulic ram between the rear lower section and the rear upper section, a hydraulic pump on said ladder, a reservoir connected to the pump inlet, a double acting hydraulic valve connected to the pump outlet, said valve being on said platform, conduits between said valve and said rams, pulleys on the lower end of said front lower section, pulleys on the upper end of the front ram cylinder, a pair of flexible side members each secured at one end to the lower end of said front upper section, each passing over corresponding said pulleys, and each secured at its other end to said lower end of the front upper section, a series of rigid rungs between said flexible side members, and a series of rungs between said front stiles of the upper section.

3. An adjustable ladder comprising an upper section and a lower section, front stiles and rear stiles on each said section, the front stiles of said upper section being tubular and telescopically engaging the front stiles of said lower section. The rear stiles of said upper section similarly telescopically engaging the rear stiles of said lower section, a platform secured to the upper ends of said front stiles, a pair of hinges one between the upper end of each rear stile and said platform, a pair of articulated braces between the lower ends of said lower sections, a front hydraulic ram between the front lower section and the platform, a rear hydraulic ram between the rear lower section and the rear upper section, the annular cross-sectional area between the upper end of one of said rams and its piston rod equalling the circular cross-sectional area of the lower end of the other said ram whereby equal piston movement gives equal fluid displacement of the relevant parts of said rams, a hydraulic conduit interconnecting said relevant parts thereby constituting a closed hydraulic system, an engine on said ladder, a hydraulic pump connected for drive to said engine, a reservoir connected to the pump inlet, a double acting hydraulic valve connected to the pump outlet, said valve being on said platform, conduits between said valve and said rams, pulleys on the lower end of said front lower section, pulleys on the upper end of the front ram cylinder, a pair of flexible side members each secured at one end to the lower end of said front upper section, each passing over corresponding said pulleys, and each secured at its other end to said lower end of the front upper section, a series of rigid rungs between said flexible side members, and a series of rungs between said front stiles of the upper section.

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