Sept. 15, 1964 M. L. E. P. A. GOURJON 3,148,789

MECHANICAL SHOVEL CAPABLE OF WORKING AS A LIFTING DEVICE OR LOADER

Filed Aug. 7, 1961

3 Sheets-Sheet 1

Fig. 1

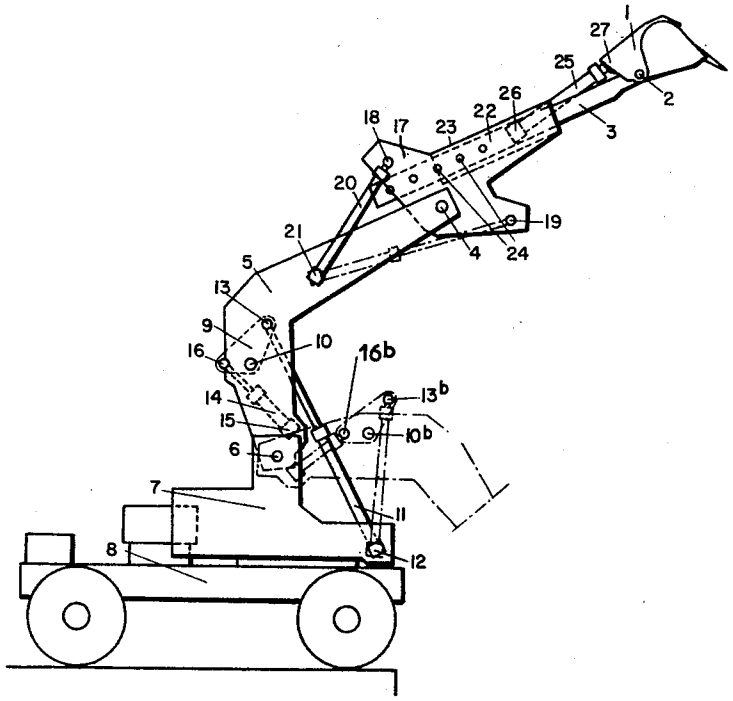
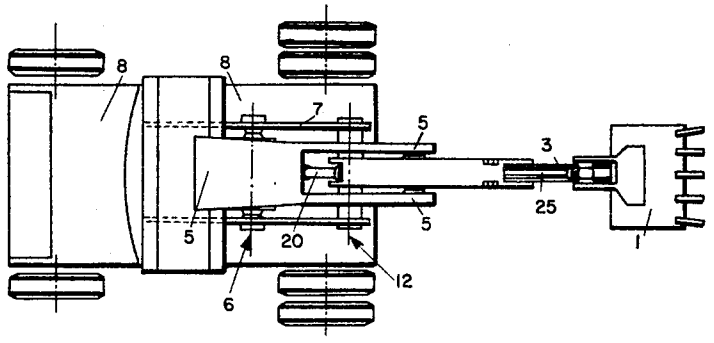


Fig. 2



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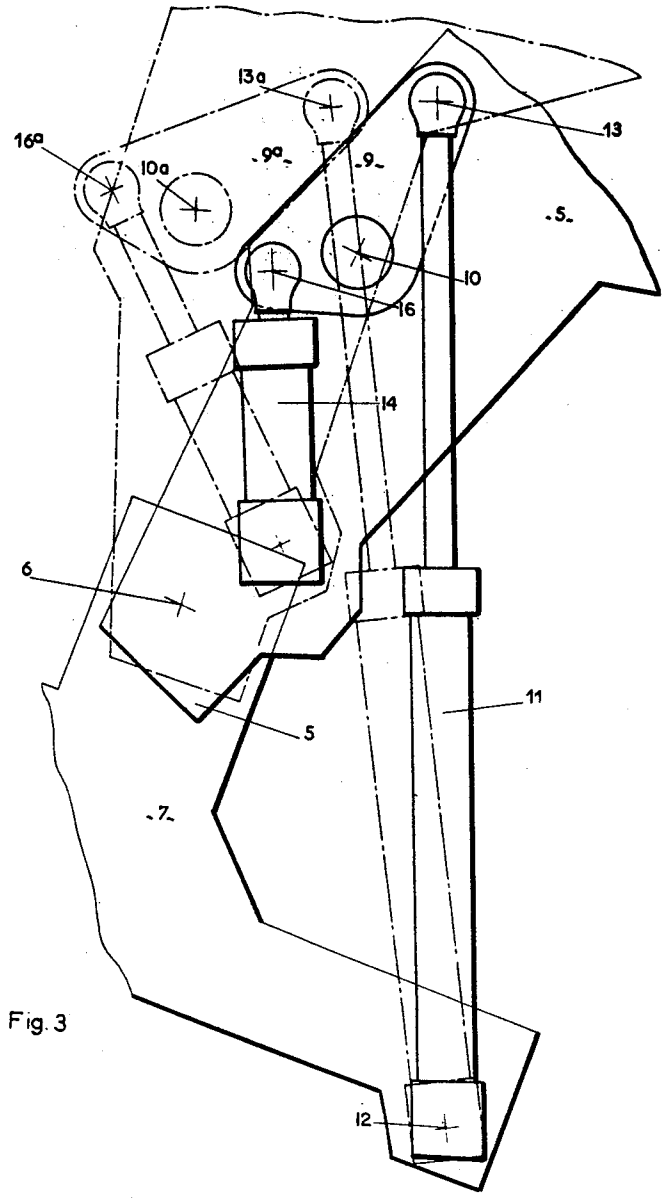

Fig. 3

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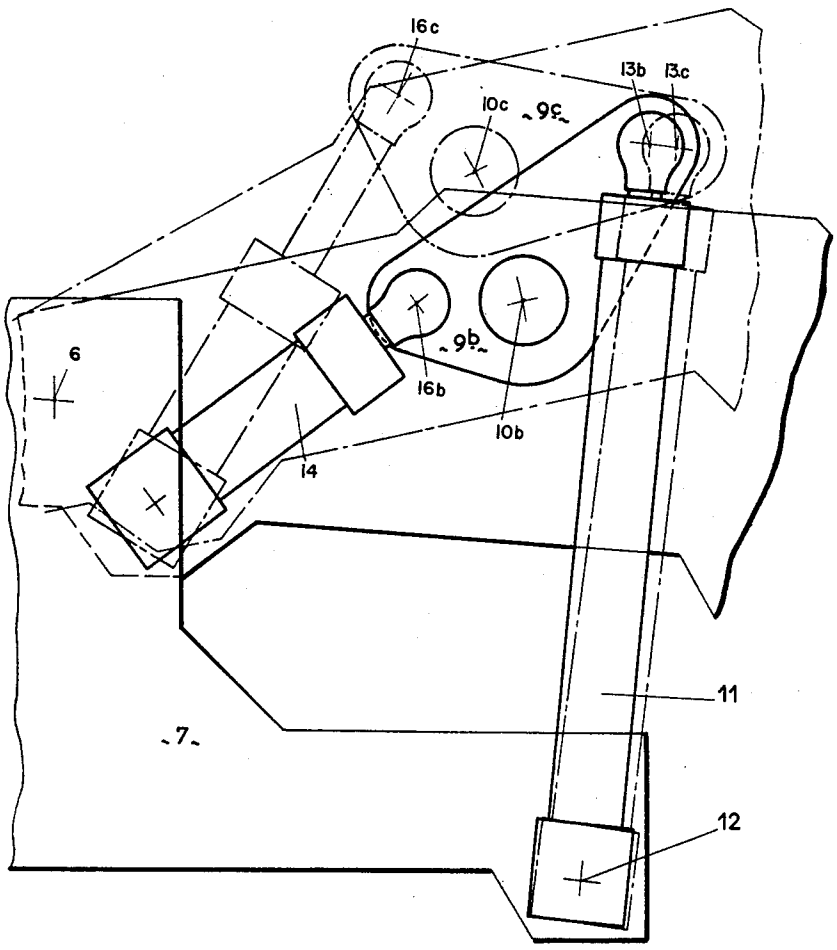
Fig. 4



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MECHANICAL SHOVEL CAPABLE OF WORKING AS A LIFTING DEVICE OR LOADER

Marie Louis Emile Pierre Amédée Gourjon, Lyon, Rhone, France, assignor to Compagnie des Engins Hydromecaniques de Chantiers (C.H.O.C.), Pont-d'Ain, Ain, France, a company of France

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7 Claims. (Cl. 214—140)

The present invention has for its object a mechanical srovel which can be used for excavation and loading work, but which is easily adaptable for use as a crane.

These devices generally comprise a jib pivoted about a horizontal axis on a turret rotating about a vertical axis and mounted on a platform or a driving chassis. On this jib is pivoted, about a horizontal axis, an arm which carries a tool at its extremity, for example an excavating bucket or a lifting hook. In the greater part of present day machines, the movements of the various parts are controlled by hydraulic or other jacks of the double-acting type, suitably arranged.

In particular, it has already been proposed to control the inclination of the jib by means of a jack (known as the jib-jack) articulated on the one hand to an intermediate point of the jib and on the other hand to a point of the turret located in the pivotal plane of the jib, while the tool-carrier arm is operated by a second jack (known as the arm-jack) interposed between suitable points of the jib and the arm. A device of this kind has especially been described in Swedish Patent No. 129,142, published on August 15, 1950.

The present invention relates to improvements made in devices of this type, with a view to improving its reach and to improving its effectiveness.

In accordance with one of these improvements, the jib-jack controlling the inclination of the jib is not directly articulated thereon, but through the intermediary of a lever device or rocking-lever, to which is further coupled an auxiliary jack pivoted at its opposite extremity on the jib, the pivotal or articulation axes of the various members being all horizontal.

By the action of the auxiliary jack, when the jib-jack is in a given position, this arrangement enables the jib to be given a complementary rocking movement and, all other things being equal, its maximum angular displacement to be increased, thus widening its field of action.

In accordance with a further improvement, the tool-carrier arm has two possible points of articulation for the arm-jack, preferably arranged symmetrically with respect to the axis of articulation of the latter on the jib, which is shaped so as to permit free movement of the arm jack in all cases. The latter can thus be coupled to one or the other of these points, depending on the conditions of working.

The advantage of this last improvement arises from the fact that for the same hydraulic supply pressure, of double-acting jacks, the force which they generate is larger in the direction of extension than in that of contraction, in consequence of the cross-sectional area occupied by the jack rod, which correspondingly reduces the free surface of the adjacent face of the piston as compared with the opposite face of the piston.

The coupling point of the arm-jack will thus be chosen so that its extension corresponds to the active stroke of the tool. In particular, when the shovel is working against a face, the active travel, having the effect of filling the bucket with material, is carried out in the direction moving away from the chassis, while on the other hand

in the working known as "reverse" the bucket moves towards the chassis. By virtue of the second improvement above, it is thus possible, without either dismantling or reversing the tool-carrier arm and by choosing the point of attachment of the arm-jack, to work with the maximum power developed by this jack either in "butt" or in "reverse."

The description which follows below with regard to the accompanying drawings, given by way of example and without any implied limitation, will make it quite clear how the invention may be carried into effect, the special features which are brought out either in the drawings or in the text, being understood to form a part of the said invention.

FIG. 1 is a diagrammatic view in elevation of a device according to the present invention, equipped in this example for working in "reverse."

FIG. 2 is a plan view of the device of FIG. 1.

FIG. 3 shows the two positions of the jib corresponding to the extreme positions of the auxiliary jack when the jib-jack is extended.

FIG. 4 is a view similar to that previously referred to, but corresponding to the retracted position of the jib-jack.

The device shown in the drawings is a mechanical shovel comprising an excavating bucket 1. In the case of working in "reverse" which corresponds to the example of the drawing, this bucket pivots at 2 at the extremity of a support 3, 23 which is articulated at 4 on a jib 5 pivoted at 6 on a turret 7 mounted on a driving chassis 8.

In accordance with one of the particular features of the present invention, a rocking lever or lever device 9 is provided on the jib 5 and pivots about a shaft 10 rigidly fixed on the jib. A jack 11 known as the "jib-jack" is pivoted on the one hand at a point 12 on the turret and on the other hand at a point 13 on the rocking lever, while a second jack 14, known as the "auxiliary jack" is articulated on the one hand at 15 on the jib 5 and on the other hand at a point 16 of the rocking-lever 9, situated beyond the pivot 10 with respect to the first articulation point 13.

In accordance with a further particular feature of the present nivention, the support of the tool or bucket is equipped with a tail 17 having two points 18 and 19, symmetrical with respect to the articulation 4, for coupling to the rod of a jack 20 known as the "arm-jack," the other extremity of which is pivoted at 21 on the jib.

At this extremity, the jib is of forked shape as can be seen from FIG. 2, and the jack 20 is arranged between the arms of the fork, which permits it to oscillate freely both upwards and downwards.

For working in "reverse," the tool support is adjustable in length in known manner, by sliding of the portion 3 in the form of a girder in a guide 22 provided in the part 23 rigidly fixed to the tail 17, and by pinning at a point such as 24.

A jack 25 known as the "tool-jack" is interposed between a point 26 which can be taken on the sliding portion 3, and a point 27 on the reverse working bucket 1, the active travel of which corresponds to a movement approaching the chassis of the device. This jack 25 enables the tool to be swung about its pivotal shaft 2.

In the form of embodiment shown, the four jacks 11, 14, 20 and 25 are double-acting hydraulic jacks. All the pivotal and articulation shafts 2, 4, 6, 10, 12, 13, 15, 16, 18, 19, 21, 26 and 27 are horizontal and parallel, only the the axis of rotation of the turret 7 is vertical.

There has been shown in full lines in FIG. 1 the position of the jack 20 corresponding to the working of the bucket 1 in "reverse". On the other hand, for the working in "butt" during which the bucket moves away from

the chassis (the bucket employed in this case having the opposite orientation from that of the bucket **1** shown), the jack **20** will be in the position shown in chain-dotted lines. In the first case, its rod is coupled to the point **18** of the tail **17**, whereas in the second case it is connected to the point **19** of the said tail. It can be seen that in both cases, the active travel of the bucket is effected by extension of the jack **20**, during which it can develop its maximum force.

In the case of working in "butt," the tool or bucket is fixed directly to the part **23**, the extension girder **3** and the "reverse" bucket which it carries being removed, together with the jack **25**.

FIG. 3 shows the jib in the top position corresponding to the extension of the jack **11** of the jib. The arrangement when the auxiliary jack **14** is returned has been shown in full lines.

If the auxiliary jack is put into extension, the arrangement passes into the position shown in chain-dotted lines, the point **13** passing to **13***a* after having travelled over an arc of a circle centered on **12**, the point **10** moving to **10***a* after having travelled over a circular arc centered on **6**, and finally the point **16** moving to **16***a*. The rocking-lever **9** then occupies the position shown at **9***a*.

It can be seen that this operation has enabled the pivotal axis of the jib **5** to be pushed farther away.

In the same way, in the bottom position of the jib corresponding to the retracted position of the jib-jack **11** (see FIG. 4), a certain angular displacement of the jack can be obtained by acting on the auxiliary jack **14**.

In fact, there is shown in full lines the position which corresponds to the auxiliary jack retracted, and in chain-dotted lines that which corresponds to the auxiliary jack extended. As in the previous case, the point of articulation **10***b* passes to **10***c* by describing a circular arc centered on **6**, the point **13***b* passes to **13***c* by describing a circular arc centered on **12**, and the point **16***b* passes to **16***c*, which moves the rocking-lever from the position **9***b* to the position **9***c*.

It is obvious that the forms of embodiment described are only examples, and that they could be modified in particular by the substitution of equivalent technical means, without thereby departing from the scope of the invention. In particular, the hydraulic jacks could be replaced by jacks of any other system.

What I claim is:

1. A lifting device comprising a supporting member, a jib member pivotally mounted on said supporting member for inclination about a first horizontal axis, a rocking lever pivotally mounted on the jib member about a second horizontal axis, a jib-jack for controlling the inclination of the jib member, said jib-jack having one end pivotally mounted on the supporting member and an opposite end pivotally mounted on the rocking lever, and an auxiliary jack for varying the inclination of the jib member, said auxiliary jack having one end pivotally mounted on the jib member and an opposite end pivotally mounted on the rocking lever.

2. A lifting device as defined in claim 1, wherein the jib-jack and auxiliary jack are pivoted on the rocking lever about respective axis that are spaced on either side of said second horizontal axis.

3. A lifting device as defined in claim 1, further comprising a tool-carrier arm mounted on the jib member for vertical rotation about a third horizontal axis, said tool-carrier arm being provided with two connecting means, and an arm-jack for controlling said vertical rotation, said arm-jack having one end pivotally mounted on the jib member and an opposite end pivoted on the tool-carrier arm, said opposite end of the arm-jack being adapted to be mounted on either of the two connecting means provided on the tool-carrier arm.

4. A lifting device as defined in claim 3, wherein the two connecting means are spaced on the tool-carrier arm symmetrically with respect to said third horizontal axis.

5. A lifting device as defined in claim 3, wherein the jib member has a fork-shaped extremity comprising two limbs, and the arm-jack is pivoted between said limbs, whereby the arm-jack is permitted to pivot freely upwards and downwards on the jib member.

6. A lifting device capable of operating as a mechanical shovel, comprising a turret mounted for horizontal rotation on a driving chassis, a jib member pivotally mounted on said turret for vertical inclination, a rocking lever pivotally mounted on the jib member, a jib-jack operating between respective pivotal connections thereof with the turret and rocking lever for controlling the inclination of the jib member, an auxiliary jack operating between respective pivoted connections thereof with the rocking lever and jib member for shifting said inclination, a tool-carrier arm pivotally mounted adjacent the extremity of the jib member and adapted to accommodate a bucket, and means for pivoting the tool-carrier arm relative to the jib member.

7. A lifting device as defined in claim 6, wherein two pivotal connections are provided on each side of the tool-carrier arm, and wherein said means comprise an arm-jack having one end pivotally mounted on the jib member and an opposite end pivoted on either of the two pivotal connections provided respectively on the sides of the tool-carrier arm relative to the pivotal connection thereof on the jib member.

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