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(71) Applicant: **O R M I G S.p.A., Piazzale Ormig, I-15076 Ovada Alessandria (IT)**

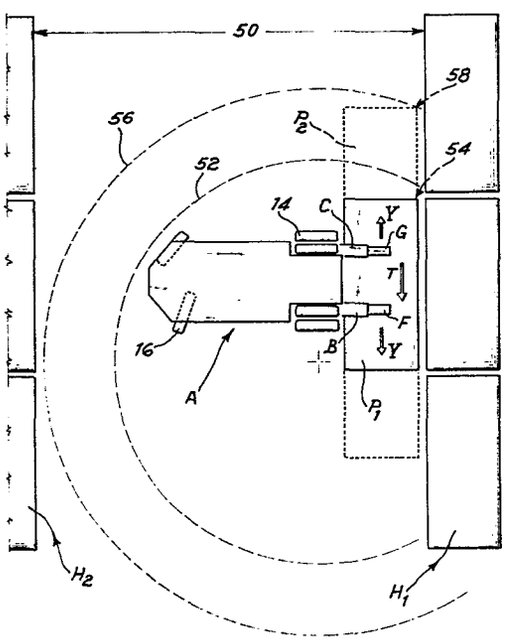
(72) Inventor: **Testore, Guido, Via XXV Aprile 18, I-15076 Ovada (Alessandria) (IT)**

(74) Representative: **Calvani, Domenico, UFFICIO BREVETTI ING. CALVANI, SALVI & VERONELLI 4, Piazza Duca d'Aosta, I-20124 Milan (IT)**

(54) Mobile yard crane for the handling of containers, and container engaging apparatus for use in conjunction with said crane.

(57) A mobile, yard crane for handling containers or the like, characterized in that it comprises at least two lifting jibs (B, C) which act along vertical planes fixedly parallel to one another. The crane jibs are mechanically independent but are connected to one another by way of a suitable hydraulic circuit which is able of ensuring congruency and synchronism in the motions of same.

The heads (F, G) of the crane jibs are fitted with attaching devices (M, N) which are designed to firmly retain a container engaging apparatus (spreader) (P) at least at two locations thereof, the retaining action being preferably of a rigid type.



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This invention relates to a yard crane for handling of containers, as well as to a container engaging apparatus for use in conjunction with said crane.

It is known that handling of containers on loading and unloading yards involves a number of problems, among which are to be cited those relating to the control of the equipments for attaching, transporting and detaching the containers, which control has to be performed under the best possible conditions,as well as those relating to the safety in attaching the containers to the handling machines. As to this latter problem, no satisfactory solutions have been proposed, since during handling the individual container by the handling machine, said container can undergo to shiftings or oscillating movements which, if and when critical values are reached, may become hazardous to the stability of both the load and crane.

The more these conditions, due to uncontrolled movements of the container during manipulation thereof, are becoming dangerous, the more is the load inside the container likely to become unbalanced, i.e. it can assume a

position such that the container effective center of gravity is considerably displaced as compared with the theoretic one.

The attempts made until now for solving this important problem do not appear successful.

This invention aims to overcome the above and further drawbacks; it consists in a mobile, or selfpropelled, yard crane for handling of containers or the like, wherein said crane includes at least two lifting jibs which act along vertical planes fixedly parallel to one another, said jibs being mechanically independent but connected to one another by way of a suitable hydraulic circuit which is able of ensuring a congruence and synchronism in the jib movements, the heads of these jibs cooperating with associated attaching devices which retain the container engaging apparatus (spreader) at two locations thereof at least, said retaining action being preferably of the rigid type.

The above and further features of the invention will be now described with reference to the accompanying drawings, both the description and drawings being given only by way of illustration and not to limit the scope

of the invention.

In the drawings:

Figure 1 is a diagrammatical, side view of a two arm crane truck with the crane jibs in the lowered position;

Figure 2 is a diagrammatical front view of the crane, as seen in the direction of the arrow X in figure 1;

Figure 3 is a diagrammatical, side view of the same crane, with two jibs in their highest position;

Figure 4 is a diagrammatical view, from the above, of the mobile crane, when on a container loading-unloading yard;

Figure 5 is a diagrammatical detail view showing the head of one jib of the mobile crane when fitted with means for preventing the associated spreader, and thus the engaged container, from making any uncontrolled movement;

Figures 6 and 7 are diagrammatical views of attaching arrangements for sec uring the spreader to the jib head by means of associated attaching devices;

Figure 8 is a diagrammatical view of a compensation hydraulic circuit.

With reference to the above figures, there is shown a self-propelled yard crane A, in particular a crane truck which includes a frame 10 equipped,at the front thereof, with a driver's cab 12 which is able to be moved upwardly to the position 12', said frame 10 resting on the axles of front wheels 14 and of rear wheels 16, these latter wheels being the steering wheels. A number of lifting jiibs, in the example shown two crane jibs B-C, are mounted on the frame 10 by means of associated structures which secure in a rotatively free way the crane jibs to said frame 10. Each of these jibs B-C is mechanically independent from the other one but both jibs are connected to one another by way of suitable hydraulic circuit, not shown, which is able to ensure congruency and synchronism in the rotational, lifting, and lowering motions as performed by said jibs, which motions only take place along vertical planes that are fixedly parallel to one another.

According to the shown embodiment, each of the two jibs B-C is connected to the associated part of the frame 10 by means of a connecting rod 18 that is pivoted

at 20 and 22 to the frame and to the jib, respectively. The connecting rod and the jib are individually operated by two cylinders 24 and 24' which allow the load to be moved along any required path.

As shown, each lifting arm or crane jib is of a telescopic construction and is thus formed by a number of sections which are able to nest into one another. The outermost section of the crane jib provides the head F and respetively G of the jib, which head is designed to manipulate a semitrailer or container H. Each head F-G of the crane truck jibs is associated with a corresponding attaching device M-N, in such a manner that the two attaching devices, and thereby the two jib heads, will firmly retain an engaging apparatus or spreader 9 for a container H, said retaining action being preferably of a rigid type. Actually, each attaching device M-N consists of a rod which is hinged to the related jib head F-G and is rigidly connected with the spreader P, each jib head comprising an associated attaching device for the spreader. In a corresponding manner, the spreader will have, at the top thereof, two respective

attachment points for connection to the devices M-N, and at the bottom, as it is usually known, four points of attachment for the container H. The spreader P is formed, in a known manner, of two parts, namely a lower part which is controllably movable, and an upper part that is fastened to the attaching devices M-N. Actually, the connection of the attaching devices M-N to the jib heads F-G is obtained by means of pivot pins 30 which are inserted and secured in place, in a direction perpendicular to the respective longitudinal center-lines X-X of the jibs B-C, within holes formed in the jib heads F-G, after passage of said pivot pins through associated holes in the rods of the attaching devices M-N. In all possible positions of jibs B-C, the pivot pins 30 always remain in an aligned relationship with one another. Thus, the crane truck A will have its own jib heads fitted with said attaching devices M-N, the gripping regions of which, when duly actuated, will be caused to get engaged with corresponding zones of spreader P. In the shown example, these zones are obviously in number of two and are in an aligned relationship with one another along the longitudinal axis of symmetry Y-Y

of spreader P. Due to the shown securing conditions, the spreader P will only be free to perform, with respect to the jib heads F-G, a pivotal or oscillating motion in the direction of arrow Z and in the opposite direction about the pivot pins 30, because the same attaching device M-N have this movement freedom. No other movement freedom in no other direction is possible for the spreader, due to the fastening constrain with the jib heads. As a result, the load H, when attached to the spreader P, will in turn have the same freedom of movement as the spreader has, so that said load, during manipulation, cannot take any hazardous position due to critical displacements, so that a good safety in handling operation is obtained. Obviusly, the lower part of the spreader, that is actuated by the operator, may perform in a known manner displacements in both the direction of the arrow T and the opposite one, as well as in a direction perpendicular to that of arrow T, differential displacements in this latter direction allowing for the container to perform a controlled rotation of about 12° in either direction.

It has to be noted, furthermore, that the provision of the two crane jibsB-C allows the user to "feel" a load unbalanced condition inside a handled container, because the load weight, in case of nothomogeneously stowed load, will unbalancedly discharge on to the two crane jibs, and this feature is advantageous in handling unbalanced loads.

In the shown embodiment the on center distance 40 between the two jibs B-C is of 2.10 meters, the on center 42 is of 2.59 meters and the on center 44 is of 3.53 meters, while the lenght 46 of the machine frame is 6.55 meters and the lenght 48 of each crane jib, with throughly nested-in head, is of 8.03 meters. The spreader is of a hydraulically adjustable type for hoisting from 20 to 40 ft containers with possibility of adding attachments for 35 ft containers.

With reference now to figure 4, the plan view thereof diagrammatically shows a yard and a number of containers arranged in two rows H1 and H2 that are spaced apart by a distance 50, which is to be in proportion to the overall dimension of the mobile crane and its motion possibilities. Reference 52 designates the path

as described by the apex 54 of a 20 ft container P1 and reference 56 designates the path as described by the apex 58 of a 40 ft container P2, these paths being given by way of examples only as results of rotational motions of crane A.

Referring now to figure 5, the jib head F has a related attaching device M which retains, together with an identical device (not shown) carried by the other jib head, the spreader P to which the container H is fastened. In this case the reference 100 designates suitable means that are effective for providing a complete stiffening of the attaching device M and, therefore, of both the spreader P and container H, in relation to the jib head F, thereby depriving said spreader of even any residual freedom of oscillation about the pivot pins 30 it might have in either the direction of the arrow Z or in the opposite direction. Said means 100 could take the form of a hydraulic jack, the piston rod of which is pivotally secured at 102 to the related jib head, while the jack cylinder is seeured, at 104, to the related spreader. In this way, due to the fact that the rotations of the jib B

cause the distance between points 102-104 to change in extent(said distance increasing for the lower position of the jib and decreasing for the raised position thereof), the hydraulic jack consequently increases and reduces the extension, but always maintains a rigid connection between the jib head and the spreader.

With reference to figure 7, an alternative arrangement for fastening a spreader P is shown, said spreader being designed for engaging the load H, to three jib heads 200-202-204 which are fitted at the ends of related crane jibs, said jib heads including corresponding attaching devices 206-208-210 which are the same as the previously described device M-N. In this case, if the attachment of devices 206-208-210 is linear that is such that the three attachment points are arranged on a same line Y-Y, then it could be advantageous for at least one jib head to be equipped with the above described means 100. On the other hand, should the three attaching points not be aligned along a line Y-Y, then due to obviuos geometrical conditions, the freedom of oscillation about the pivot pins 30 would be prevented and, thereby no stiffening would need to be added.

In figure 8, a hydraulic system for operating two corresponding cylinders 300-302 of said two crane jibs comprises a pump 304, a distributor 306 for delivering oil, for example, to the cylinder 302, the outlet 308 of which is connected with the inlet of cylinder 300, the free surface areas of the cylinders being equal. An electric valve 310 allow the two cylinders 300, 302 to be operated independently from one another when particular motions are required.

Thus, it becomes possible with the invention to handle a container while maintaining the container parallel to itself, no matter what the real position of its center of gravity may be with respect to the theoretical one, obviously subject to loading regulations.

C L A I M S

1. A mobile yard crane for handling containers and the like, characterized in that it comprises at least two lifting jibs which are arranged to act along vertical planes ~~fixedly~~ parallel to one another, said crane jibs being mechanically independent but connected to one another by way of a suitable hydraulic circuit which is able of ensuring congruency and synchronism in the motions of same, the heads of said crane jibs being fitted with attaching devices that are designed to firmly retain a container engaging apparatus (spreader) at least at two locations thereof, said retaining action being preferably of a rigid type.

2. A mobile crane according to claim 1, characterized in that it allows a container to be handled by fastening at least at two locations thereof by crane jib heads, via attaching devices, the attachment points on the container being aligned or staggered, so to prevent the attached container from having freedoms of movement which create a dangerous handling and maintain the container parallel to itself independently from the actual position of its center of gravity with respect to

the theoretical one, obviously within the loading regulation.

3. A mobile crane according to claim 1, characterized in that each crane jib is telescopic.

4. A mobile crane according to claim 1, characterized in that each telescopic crane jib is connected to the machine by means of a connecting rod, and in that the connecting rod and the jib are independently operated by separate hydraulic cylinders.

5. A mobile crane according to claim 1, characterized in that at least one of the jib heads cooperates with means for completely stiffening the related spreader, said stiffening means comprising a hydraulic jack of the like, which is hinged on one side to the jib head and,on the other side, to the spreader.

6. A mobile crane according to claim 1, characterized in that, due to its structure, said mobile crane offers the opportunity of 'feeling' a load unbalanced condition within a handled container, as the load weight, in case of not omogeneously stowed load, differently operates on to the crane jibs and then allows for suitably regulate the handling of unbalanced loads.

7. A mobile crane according to claim 1, characterized in that said hydraulic circuit connecting the crane jibs includes two coupled cylinders, the outlet of one cylinder feeding the inlet of the other one, and the outlet free cross section of said one cylinder and the inlet free section of said other cylinder being equal in surface [illegible] area.

8. A mobile crane according to claim 7, characterized in that said hydraulic circuit includes means for controllably disconnecting the connection between said two crane jibs.

9. A mobile crane according to any preceding claim, characterized in that the crane driver's cab is controllably movable in a vertical direction.

10. An apparatus for fixedly engaging containers, or spreader, characterized in that it is connectable to the heads of the lifting jibs of a mobile crane, as claimed, said spreader being arranged to receive, at one or more aligned or not aligned locations thereof, parts of attaching devices carried by said crane jib heads, as well as to receive, at least at one location thereof, means for completely stiffening thereof in relation to the jib heads.

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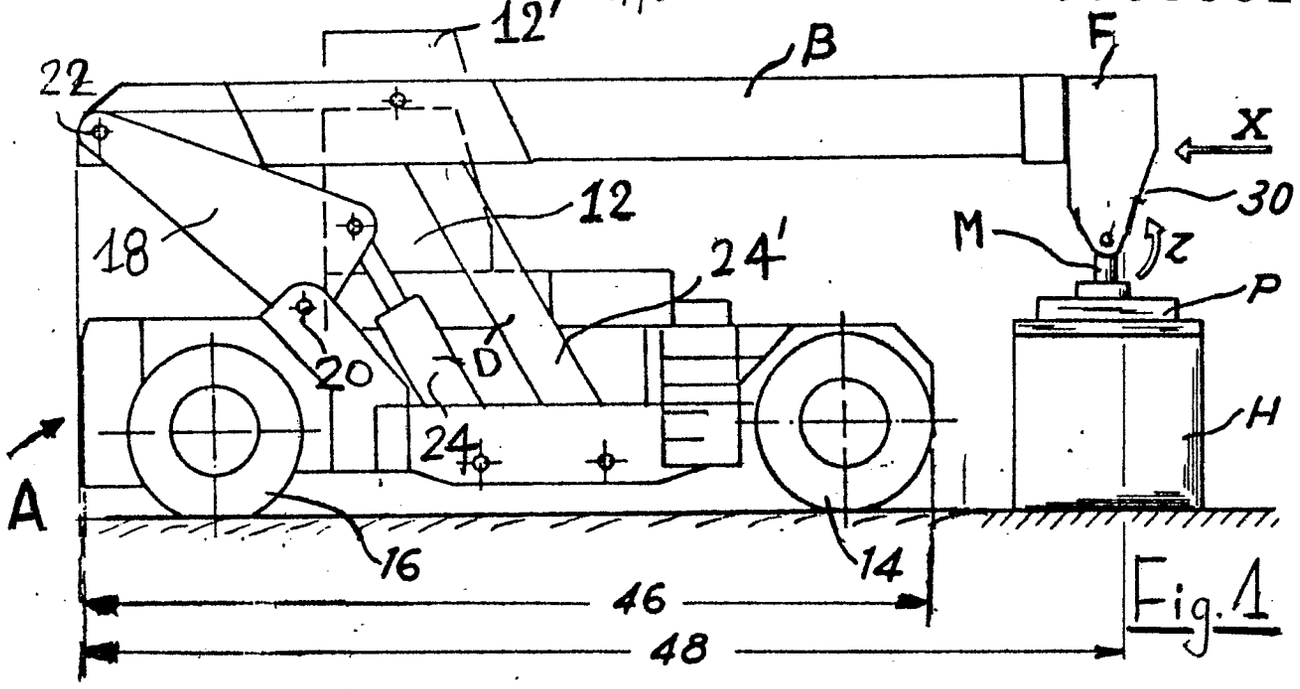

Fig. 1

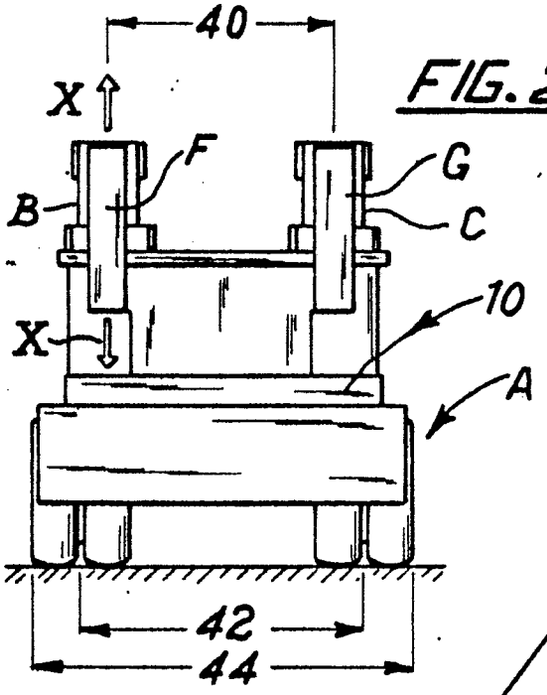

FIG. 2

FIG. 3

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FIG. 4

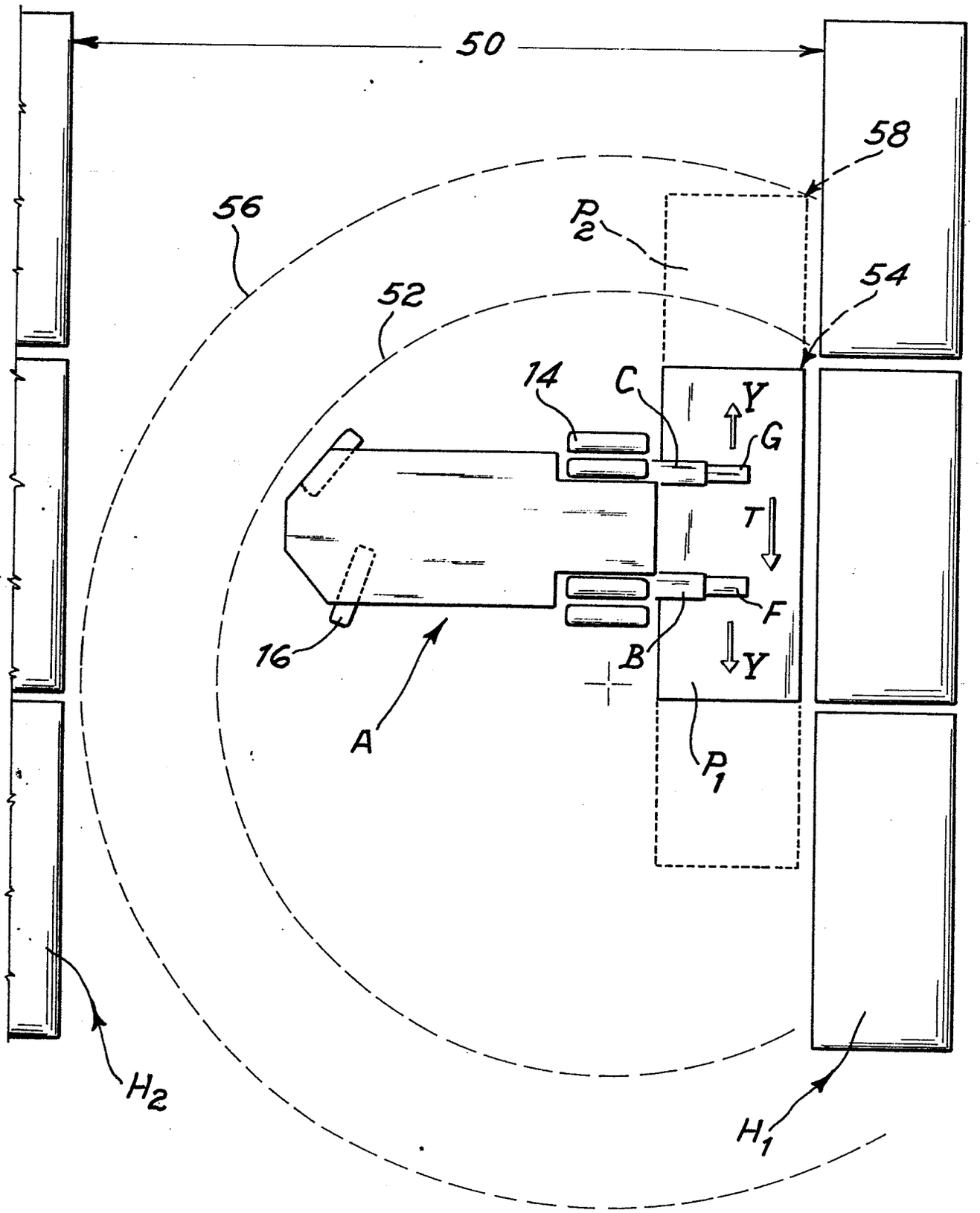

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FIG. 5

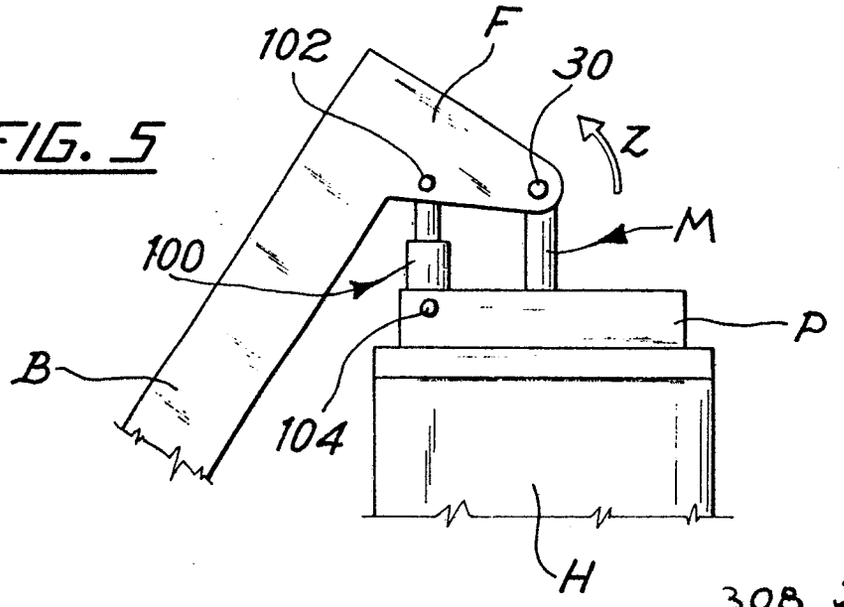


FIG. 6

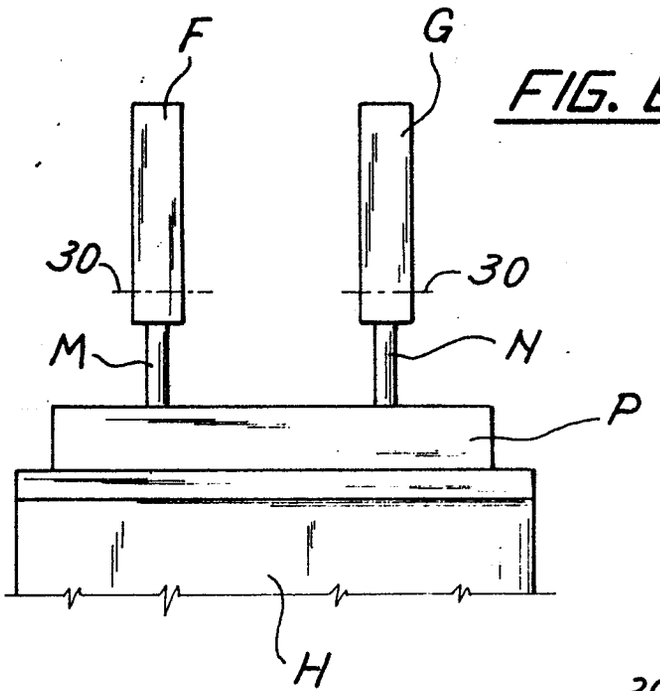


Fig. 8

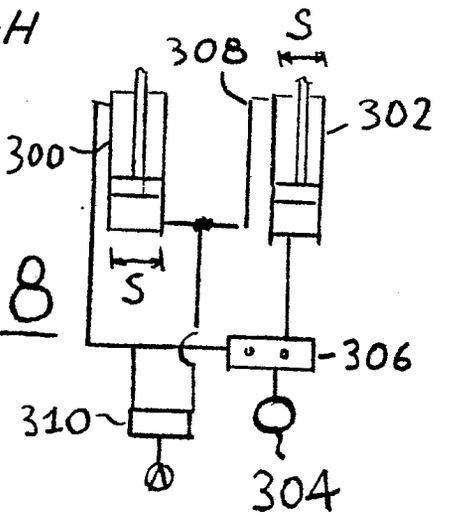
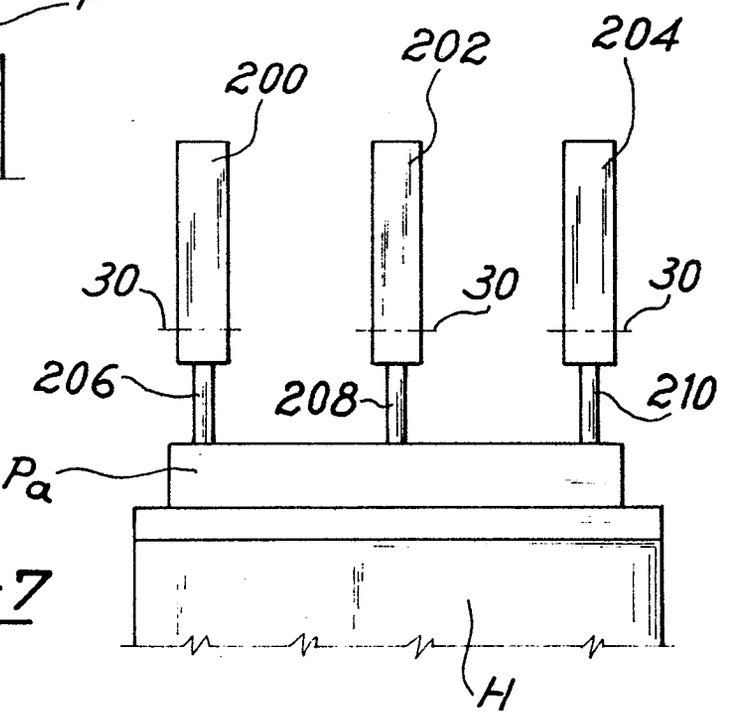


FIG. 7



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EUROPEAN SEARCH REPORT

Application number
0080002
EP 81 83 0235

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Y	US-A-3 958 702 (HAND) * Column 2, lines 52-68; column 3, lines 1-55; column 4, lines 39-52 *	1-4	B 66 C 23/42
Y	GB-A-2 013 616 (CORMACH DI COMENSOLI) * Whole document *	1,3	
A	FR-A-2 181 565 (HAULOTTE) * Page 3, lines 26-30 *	9	
A	US-A-3 780 877 (LEVITT)		
A	FR-A-2 092 315 (CRUTCHER RESOURCES CORP.) & GB - A - 1 288 327 & US - A - 3 685 673		TECHNICAL FIELDS SEARCHED (Int. Cl. ³) B 66 C B 60 P B 65 J
A	GB-A- 547 537 (DEMPSTER BROTHERS)		
A	FR-A-1 356 379 (BENNES MARREL)		
A	FR-A-2 393 757 (P.P.M.) & GB - A - 1 600 938 & US - A - 4 201 511		

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	13-08-1982	VAN DEN BERGHE E.J.J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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EUROPEAN SEARCH REPORT

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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
A	GB-A-1 522 666 (KASPAR KLAUS)		

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

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THE HAGUE	13-08-1982	VAN DEN BERGHE E.J.J

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