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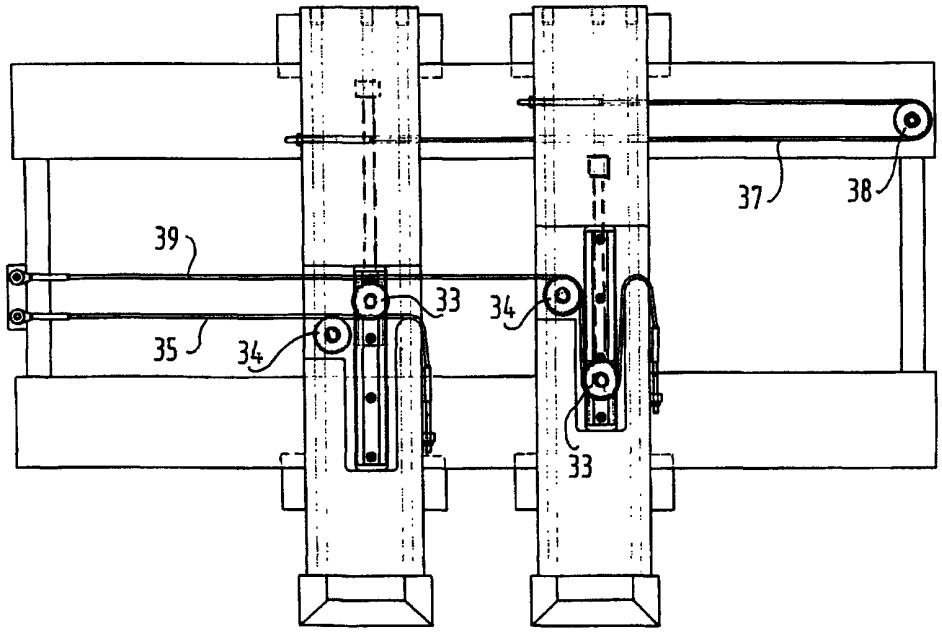
(54) Title: FORK-LIFT TRUCK WITH FORK POSITION ADJUSTMENT DEVICE



(57) Abstract: The invention relates to a fork-lift truck (1) comprising a mobile frame (2), a fork carrier (5) arranged on the frame for at least up and downward movement, two L-shaped forks (6) which are slidable with a standing part (30) along the fork carrier, and adjusting means engaging on one side on at least one of the forks and on the other side on the fork carrier for adjusting the mutual distance between the forks, wherein the adjusting means comprise a jack (31, 32, 29) which is connected to the standing part (30) of at least one fork and which comprises an extending element (33), which is connected by a flexible member (35, 37, 39) to the fork carrier.

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FORK-LIFT TRUCK WITH FORK POSITION ADJUSTMENT DEVICE

The invention relates to a fork-lift truck, the forks of which are adjustable in distance relative to one another by means of a so-called fork adjustment.

This fork adjustment is used to enable placing of the forks at a mutual distance during the use of the fork-lift truck such that a load, particularly on a pallet, can be picked up while being supported in the correct manner.

In a known fork-lift truck with fork adjustment the forks are connected to hydraulic cylinders integrated into the fork carrier. The forks can be moved by feeding the hydraulic cylinders in usual manner with hydraulic oil under pressure.

This known fork-lift truck is complicated. The hydraulic cylinders integrated into the fork carrier result in quite a high cost price.

The invention now has for its object to provide a fork-lift truck of the type specified in the preamble which can be manufactured economically.

This objective is achieved with the fork-lift truck according to the invention as characterized in claim 1. By connecting a jack to the standing part of at least one fork and connecting the extending element thereof to the fork carrier by a flexible member, such as for instance a cable, a construction is obtained which is simple to realize and which can be manufactured economically.

The measure of claim 3 is applied in suitable manner. A complex control of the adjusting means is hereby prevented while there is still the certainty that no eccentric load of the forks can occur.

By arranging or receiving the jack for the fork adjustment in the standing part of the fork, the jack is well protected against damage. Furthermore, the view of the fork-lift truck driver is hardly obstructed.

When the fork adjustment according to the invention is applied in a fork-lift truck with extending forks, the operation of the fork adjustment can be combined in simple manner with that of the extending mechanism. It is only necessary to mount on the fork an electrically operated two-way valve which in the one position enables operation of the extending mechanism and in the other position operation of the fork adjustment.

In the figures:

Figure 1 shows a perspective view of a fork-lift truck according to the invention.

Figure 2 is a partly broken-away view according to arrow II of figure 1.

Figure 3 shows the fork adjustment mechanism of figure 2 in another position.

Figure 4 is a partly perspective view of a preferred embodiment.

Figure 5 shows the fork adjustment mechanism of figure 4 in partly broken-away view.

Figure 6 shows the fork adjustment mechanism of figures 4 and 5 with partly exploded parts.

The fork-lift truck 1 shown in figure 1 comprises a mobile frame or vehicle 2 on which is arranged a mast 3. A fork carrier 5 is mounted height-adjustably on this mast 3. Fork carrier 5 can be moved up and downward by means of a hydraulic cylinder 4.

Two forks 6 are suspended from fork carrier 5 by means of hooks 7. These forks 6 are slidable in sideways direction by means of a fork adjustment shown further in the following figure. By adjusting forks 6 at a suitable mutual distance, loads, such as a pallet 9, of different widths can be picked up in appropriate manner.

Forks 6 are of the hydraulically extendable type, with extendable parts 8.

Figure 2 shows an embodiment of the invention, wherein the jacks are formed by single-action hydraulic cylinders received in forks 30.

These cylinders are formed by bores 31 in the standing part of fork 30. Received in this bore 31 is a piston 32 which is connected to a piston rod 29, which forms the extendable element and on the opposite end of which is mounted a cable 33.

A fixed cable wheel 34 is mounted on the standing part of fork 30 and a cable 35 is arranged round guide wheel 34 and guide wheel 33 in the manner shown in figure 2. One end of cable 35 is fixedly connected to the standing part of fork 30 by means of an adjusting end 36.

A cable 39 is connected in similar manner to right-hand fork 30.

A third cable 37 is connected in the shown manner to both the left-hand fork 30 and right-hand fork 30 and runs round a guide wheel 38 on the right-hand end of fork carrier 5.

It will be apparent that, when in the position shown in figure 2 hydraulic oil is fed to the cylinder in right-hand fork 30, the piston thereof is urged downward and cable 39 is thus tensioned by cable wheel 33 and the right-hand fork 30 herein moves to the left. Owing to the coupling of the two forks 30 by means of cable 37 the left-hand fork 30 moves simultaneously to the right such that forks 30 move mirror-symmetrically relative to one another.

During the movement of the left-hand fork to the right the piston 32 is urged upward. From the position shown in figure 3 it is thus possible to move back to the position shown in figure 2 by feeding oil under pressure to the cylinder of left-hand fork 30.

The embodiment of figures 2 and 3 has the advantage that cables 35, 37 and 39 can be mounted in very simple manner. In the moved upward position of cable wheels 33 which are connected to respective piston rods 29, the cable in question can be guided in simple manner over cable wheel 34 and under cable wheel 33 and secured using adjusting end 36. Cable 37 can also be mounted in simple manner.

Guide wheels 33 can move up and downward in suitable manner in a cold-rolled box profile which is mounted integrally in fork 30. The freely moving wheel is pressed downward by piston rod 29. In the case of wear the wheel and the cold-rolled box profile can simply be replaced by a new set.

Maximizing of the occurring force is achieved in simple manner with a suitable small diameter of the cylinder bores. The bore can be chosen such that no additional safety device is required.

In the embodiment of figures 4-6 the adjusting means are arranged between the standing part of fork 60 and fork carrier 61. Forks 60 are hereby displaced slightly in forward direction however, whereby the centre of gravity of the load to be picked up is also displaced slightly in forward direction. This can however be very limited, for instance in the order of magnitude of 25 mm.

In this embodiment the adjusting means 62 comprise a hydraulic cylinder 63 for each fork 60, which is mounted on the clamp 64 with which the relevant fork is suspended from fork carrier 61.

Piston rod 65 of cylinder 63 protrudes through clamp 64 and on its reciprocally moving bottom end bears a guide wheel 66 over which runs a flexible member 67 in the form of a cable.

As shown particularly in figure 5, the right-hand end of cable 67 in all the figures is fastened to fork carrier 61, and this cable 67 runs over a guide wheel 68 connected to fork 60. The cable then runs round guide wheel 66 on piston rod 55 and the other end 69 of the cable is fixedly connected to fork 60, particularly in that a threaded end is arranged on this end which passes through a bore formed in a protruding portion 79 of block 70 forming the frame of the adjusting means.

As is apparent from the figures, adjusting means 62 are embodied identically for both forks 60. The figures show the situation in which forks 60 are furthest removed from each other. In this situation the piston rod of

right-hand cylinder 63 is extended and piston rod 65 of left-hand cylinder 63 is retracted. By feeding hydraulic oil to the left-hand cylinder 63 the associated fork 60 will move to the centre of fork carrier 61.

Coupling means which correspond in principle to those described with reference to figures 2 and 3, herein ensure that the other fork is likewise moved to the centre of fork carrier 61, wherein piston rod 65 is urged into cylinder 63.

These coupling means comprise a flexible member in the form of a cable 71 which is fixedly connected with its end to the blocks 70 of the adjusting means and is trained round a guide wheel 72 which is mounted rotatably on fork carrier 61.

Cable 71 runs along guides 73 of adjusting means 62, which are formed for instance by a sleeve arranged on the shaft of guide wheels 73. Cable 71 does not move at this position, so that it is possible to suffice with a fixed guide.

Adjusting means 62, at least the guide elements thereof, are combined into an assembly which is formed by the above mentioned block 70 and two plates 75, 76 mounted on either side thereof. This assembly is mounted, in particular with bolts, against the rear side of the upward protruding part of forks 60.

Adjustment bolts 77, 78 are arranged to bound the sideways stroke of forks 60. The adjustment bolts 77, which are arranged in the upper end of hydraulic cylinders 63, limit the upward stroke of cylinder rods 65, and the adjustment bolts 78, which are received in the bottom of block 70, limit the stroke of piston rod 65 in downward direction. Limiting the stroke of piston rods 65 will of course limit the reciprocating stroke of rods 60 in corresponding manner.

Existing fork-lift trucks can readily be provided with the fork adjustment according to the embodiment of figures 4-6. Only the clamps 64 with cylinders 63 arranged in the upper of these require replacement, and the

assembly consisting of block 70, plates 75 and 76 and guide wheel 73 has to be mounted against fork 60. Cables 67, 71 can readily be arranged and replaced in the case of wear. When piston rod 65 is moved fully upward, cable 67 can be trained in simple manner along the top of wheel 73 and along the bottom of wheel 66 and then mounted on block 70. Cable 71 can be arranged in front of piston rods 65 as shown in the figures, or to the rear thereof. This cable 71 is also simple to arrange and, in the case of wear, to replace.

For the hydraulic cylinders for extending purposes and the hydraulic cylinder for the fork adjustment it is possible to suffice with a single set of hydraulic hoses. A hydraulic two-way valve which is electrically operated can be used to select the fork adjustment respectively the extending.

The invention is not limited to the embodiments shown in the figures. The jacks used for the fork adjustment can thus be separate jacks mounted on the forks. However, integration of the jacks in the forks achieves the advantage of a simpler and less vulnerable construction. Instead of a cable a random other flexible member can be applied such as a chain, belt or the like. All such variants fall within the scope of a skilled person in the field.

CLAIMS

1. Fork-lift truck comprising a mobile frame, a fork carrier arranged on the frame for at least up and downward movement, two L-shaped forks which are slidable with a standing part along the fork carrier, and adjusting means engaging on one side on at least one of the forks and on the other side on the fork carrier for adjusting the mutual distance between the forks, wherein the adjusting means comprise a jack which is connected to the standing part of at least one fork and which comprises an extending element which is connected by a flexible member to the fork carrier.

2. Fork-lift truck as claimed in claim 1, wherein the jack is arranged in the longitudinal direction of the standing part of the fork and guide means for the flexible member are arranged on the standing part, and the flexible member extends substantially vertically from the extending element to the guide means and substantially horizontally therefrom to the fork carrier.

3. Fork-lift truck as claimed in claim 1 or 2, comprising coupling means for coupling the forks to each other and the fork carrier that they slide symmetrically relative to the fork carrier.

4. Fork-lift truck as claimed in claim 3, wherein the coupling means comprise a flexible member connected to both forks and the fork carrier.

5. Fork-lift truck as claimed in any of the foregoing claims, wherein each fork comprises a single-action jack which co-acts with a first respectively second flexible member and coupling means such that when the extending element of the one jack is extended the forks move toward each other and the extending element of the other jack is retracted, and vice versa.

6. Fork-lift truck as claimed in any of the foregoing claims, wherein the jack is a hydraulic jack and the forks are of the hydraulically extending type, and in

the hydraulic circuit therefor a switch-over valve is arranged having a first position for operating the extending action and a second position for operating the fork adjustment.

7. Fork-lift truck as claimed in any of the foregoing claims, wherein the adjusting means are arranged between the fork carrier and the forks.

8. Fork-lift truck as claimed in any of the foregoing claims, wherein the jack is a hydraulic jack and the cylinder thereof is formed by a bore in the standing part of the fork.

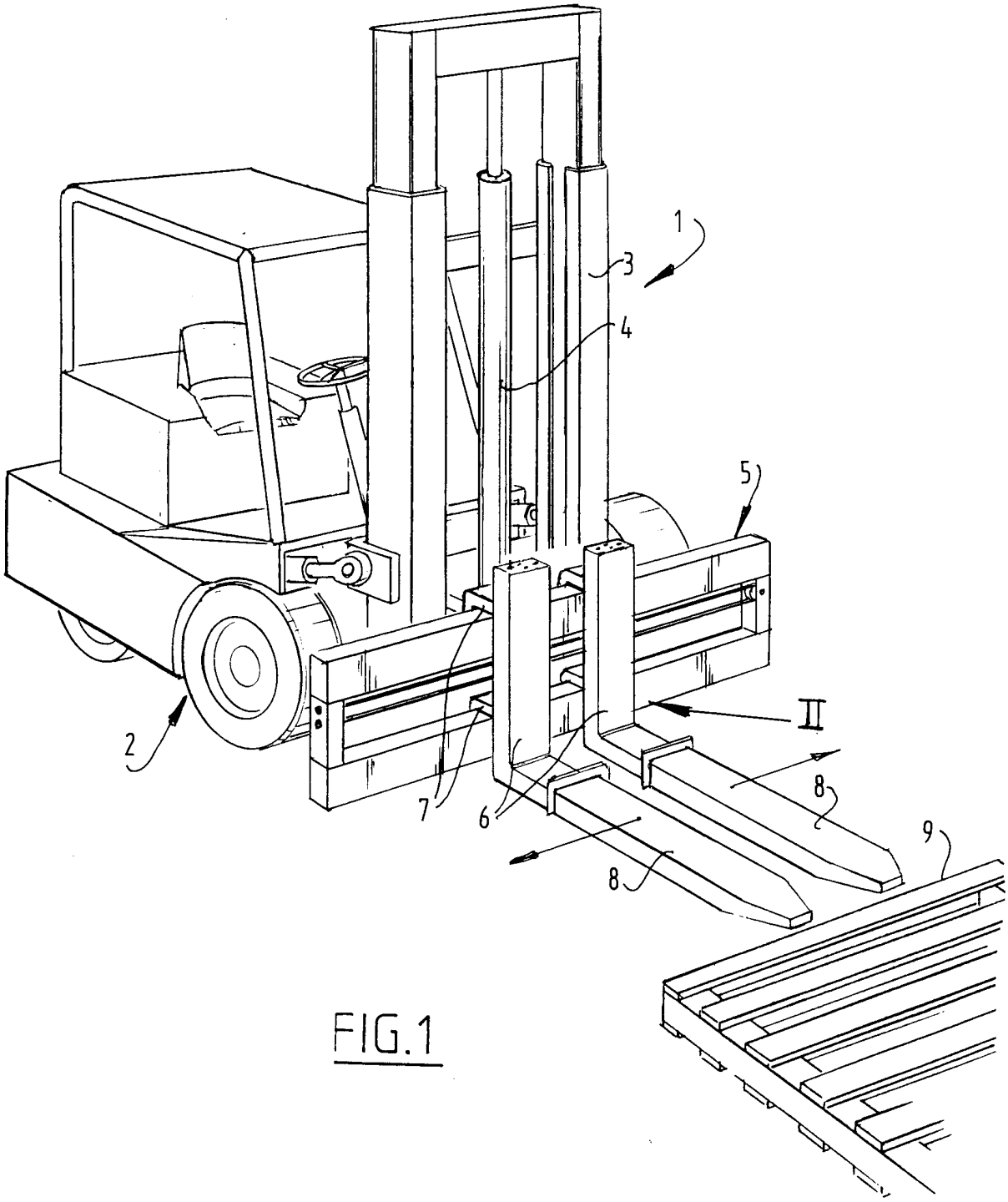

FIG.1

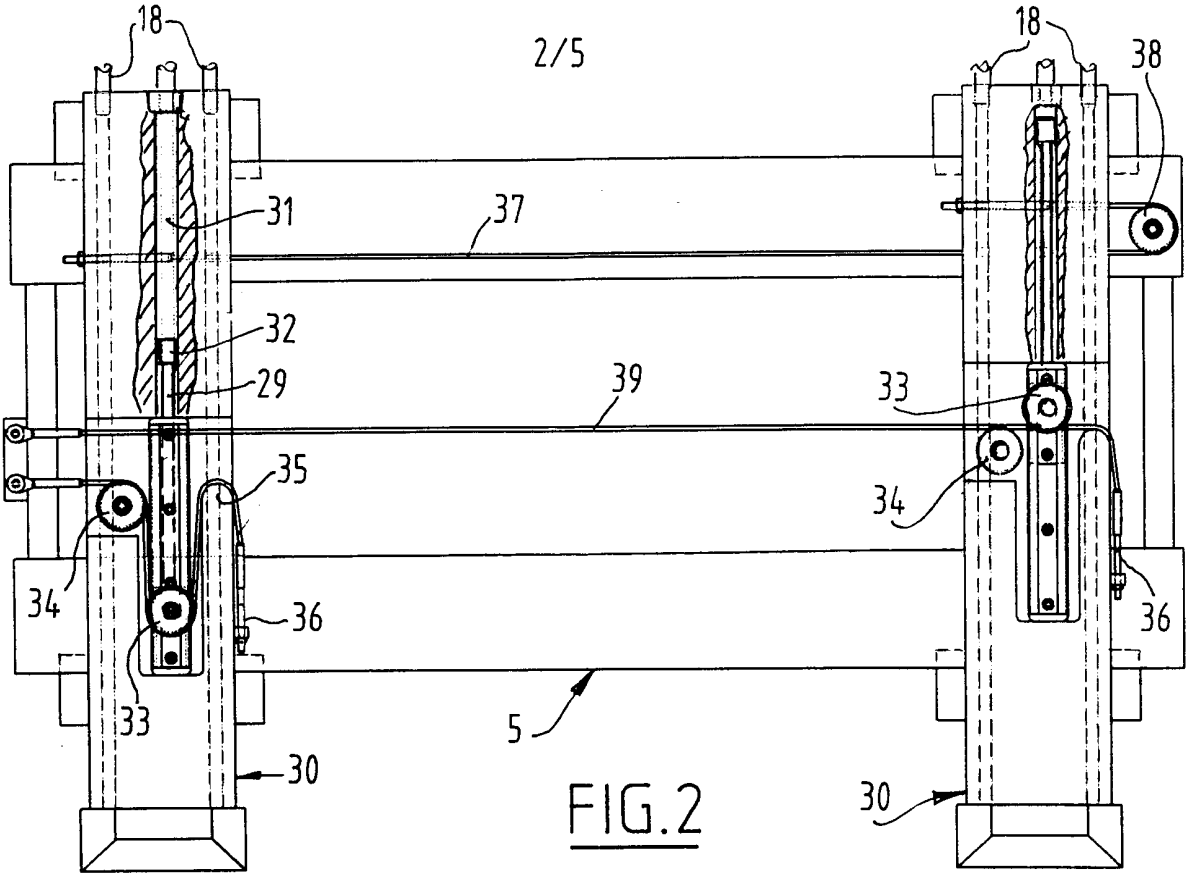
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FIG.2

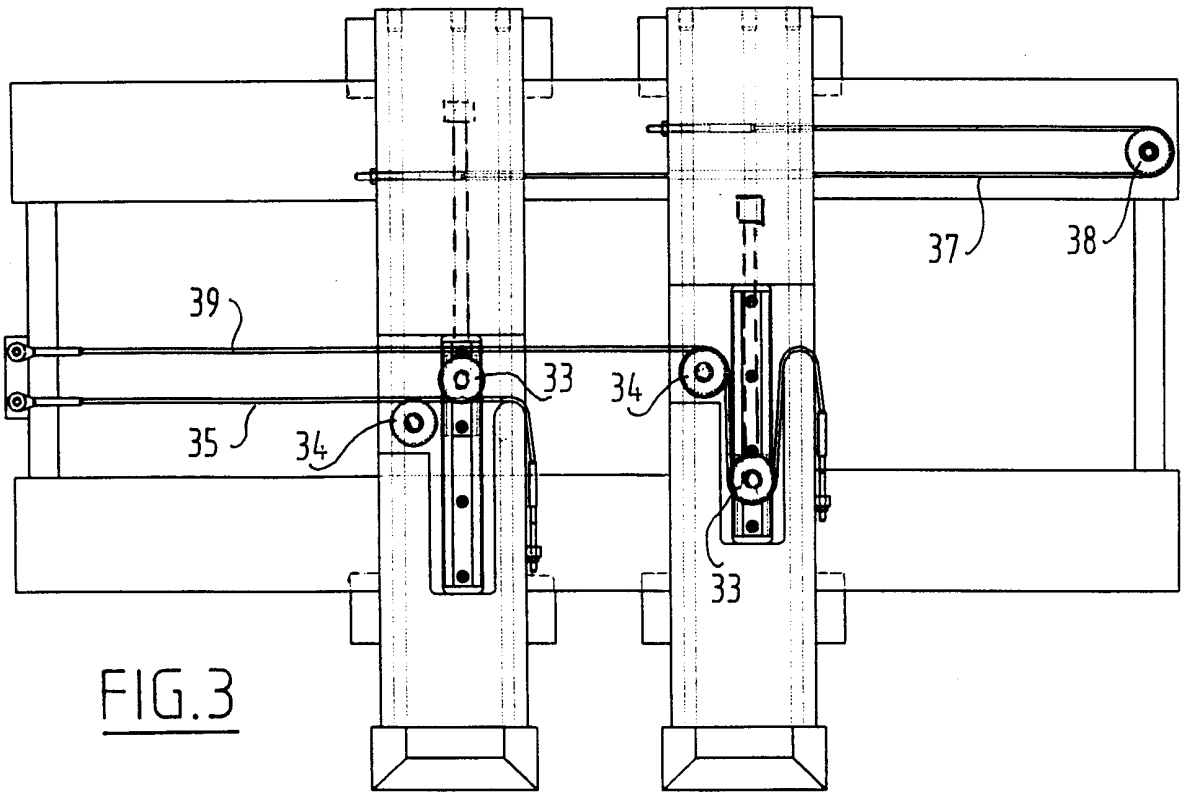
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FIG.3

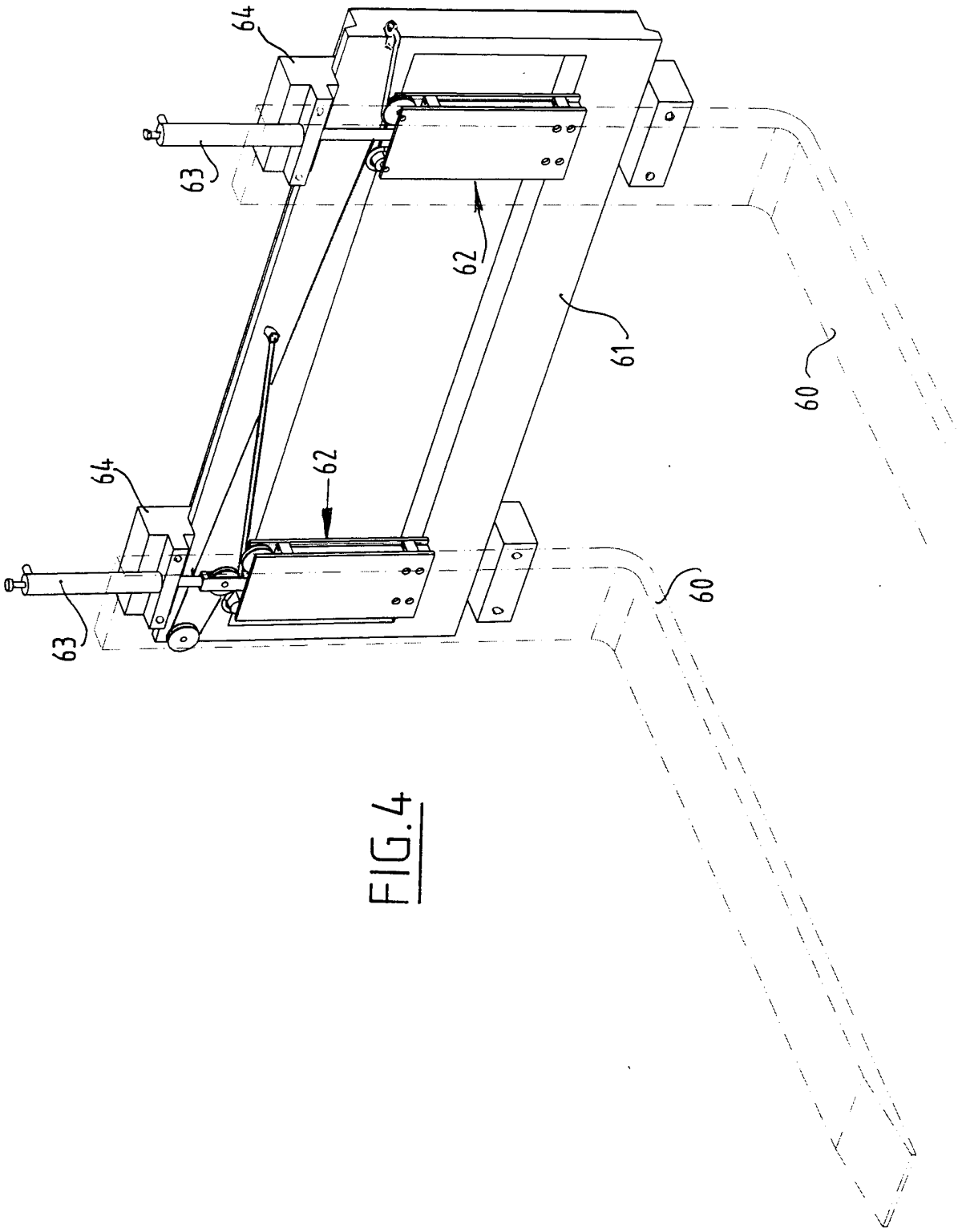

FIG.4

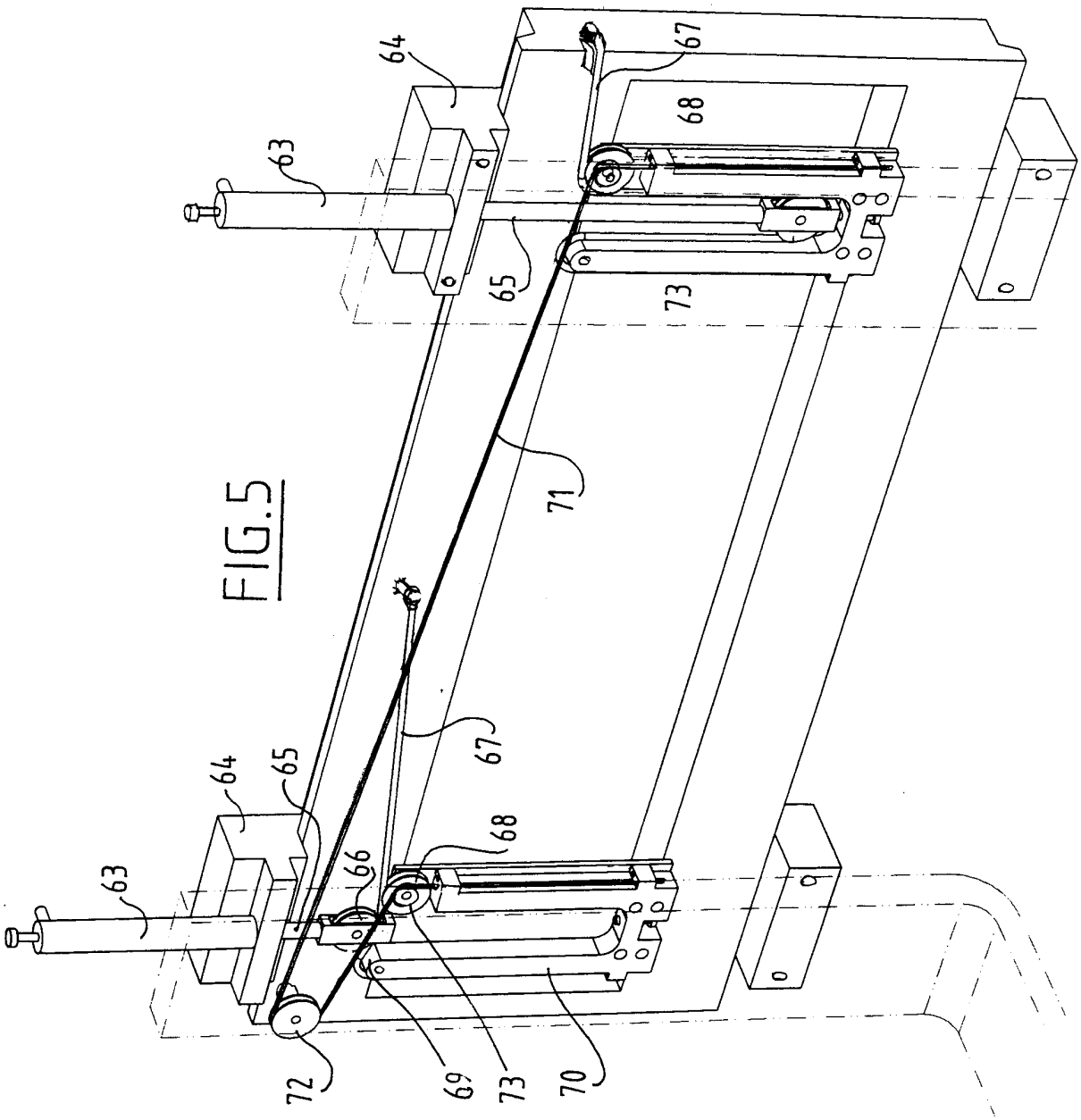

FIG.5

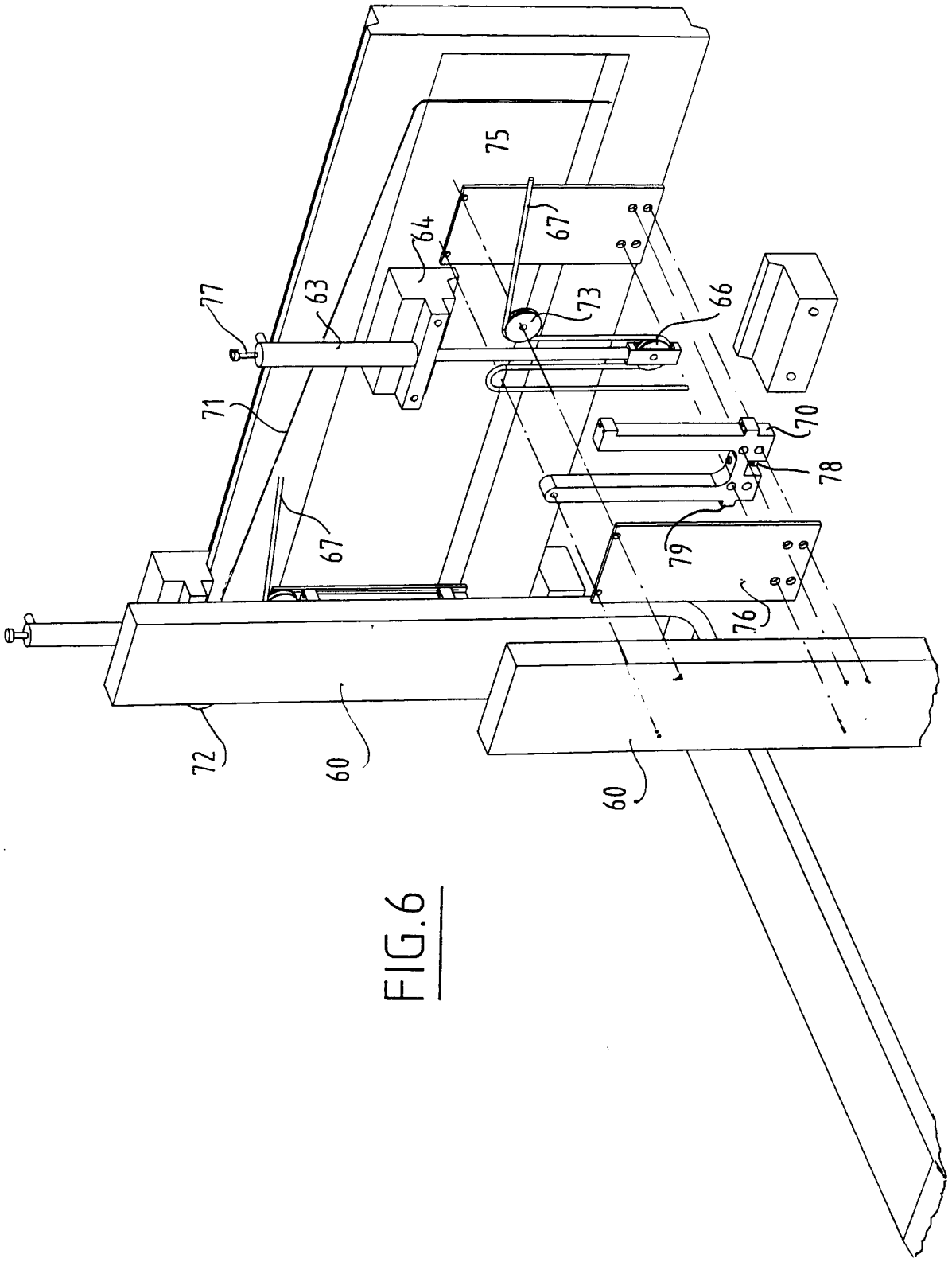

FIG.6

INTERNATIONAL SEARCH REPORT

Int tional Application No
PCT/EP 00/10914

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B66F9/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B66F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	page 4, line 13 - line 32 figures 1,2	3,4,7,8

X	DE 198 05 790 A (BOLZONI SPA) 20 August 1998 (1998-08-20)	1
A	figures 1,2,4,6 column 2, line 26 - line 37 column 2, line 42 - line 51 column 2, line 63 -column 3, line 7 column 3, line 28 - line 53	3,4,7

X	DE 195 28 885 C (KAUP GMBH & CO KG) 17 October 1996 (1996-10-17)	1
A	figures 1-4,6	3,4,7

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
5 March 2001	15/03/2001

Name and mailing address of the ISA	Authorized officer
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
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A	figure 1	3,4
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A	figures 3-6 column 5, line 22 - line 63	3,4
A	US 3 424 328 A (GIDEONSEN ARTHUR J ET AL) 28 January 1969 (1969-01-28) figure 1	3,4
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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PCT/EP 00/10914

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