(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : **0 555 194 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number : **93850021.2**

(22) Date of filing : **04.02.93**

(51) Int. Cl.[5] : **B66F 9/07**

(30) Priority : **07.02.92 SE 9200354**

(43) Date of publication of application :
11.08.93 Bulletin 93/32

(84) Designated Contracting States :
AT BE CH DE FR GB IT LI NL SE

(71) Applicant : **BT SYSTEMS AB**
Argongatan 30
S-431 53 Mölndal (SE)

(72) Inventor : **Johansson, Lennart**
Kaprifolgränd 12
S-595 00 Mjölby (SE)

(74) Representative : **Norin, Klas**
Kooperativa förbundet Patent Department
P.O. Box 15200
S-104 65 Stockholm (SE)

(54) A crane for indoor handling of materials.

(57) A crane for the indoor handling of materials includes a wheeled chassis (11), a chassis-mounted vertical mast (12) and a lifting carriage (24) which can be moved along the mast and which has a load-handling load-carrier. The lifting carriage is guided along two guide fins (23) which extend longitudinally along the mast and which extend laterally from the crane. The guide fins function to guide the lifting carriage through the agency of runners (38, 39, 40) mounted on a vertical frame part (28) thereof. The runners are fitted to four runner units (37), which are mounted in pairs on the upper end (33) and the lower end (34) of the vertical frame part.

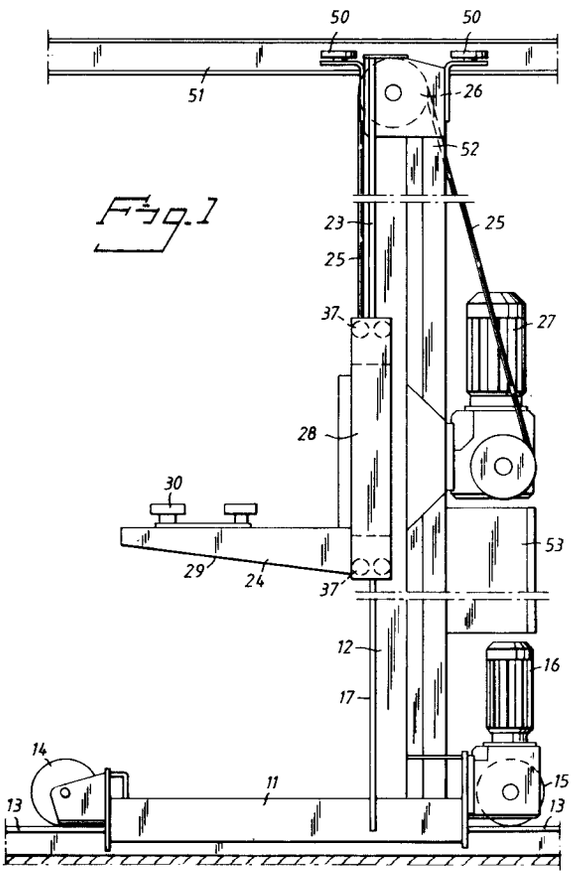


Fig.1

EP 0 555 194 A1

The present invention relates to a crane for the indoor handling of materials, comprising a wheeled chassis, a vertically extending, chassis-mounted mast, and a lifting carriage and load carrier which is movable along the mast for the handling of load units, said lifting carriage being guided along two guide fins that extend longitudinally along the mast.

Cranes of the aforedescribed kind are used to handle materials in storage localities in which the cranes normally run on rails in narrow corridors between the storage shelves. Since the chassis is often supported by only one front and one back wheel, it is also necessary to guide the crane on an overhead rail located at the top of the mast. Hitherto, such cranes have been used mostly in large and high storage localities which experience a high and frequent flow of materials, whereas other solutions are often more competitive in smaller storage locations. This is mainly because the cranes have been constructed with regard to the requirements that prevail in high storage localities and only to a lesser extent with regard to other conditions that may prevail. The simplicity in construction and installation is thus much more significant in the case of a smaller crane which is perhaps to be installed in an existing locality than a large crane which is to be installed in a newly built special storage plant. Furthermore, it must be possible for the smaller crane to utilize the space available to a better effect than a larger crane, since the idle areas adjacent walls, ceiling and floor are of much greater significance in small storage localities.

Accordingly, one object of the present invention is to provide a crane for the indoor handling of materials which is better adapted to small and medium-sized storage locations than the earlier known cranes. Another object is to provide a compact crane which will enable areas or spaces in the materials handling storage locality to be used more effectively than was previously possible. A third object is to enable the mast and lifting carriage to be manufactured, assembled and installed on site in a simple and efficient fashion. A fourth object is to provide good power transmission with only slight play between the lifting carriage and mast.

Other objects of the invention and advantages afforded thereby will be evident from the following description. These objects are achieved with a crane having the characteristic features set forth in the following Claims.

The present invention is based on the realization that the properties of existing cranes can be greatly improved, particularly with regard to their effective use in small storage plants, with a more integrated view of the manner in which the lifting carriage, mast and mast top are constructed. Thus, a mast construction which includes guide fins that project outwardly from the sides of the mast and the crane not only enable the lifting carriage to be raised to higher levels and lowered to lower levels than those afforded with other solutions, but also enables the whole of the mast construction to be simplified. Furthermore, the inventive solution enables the use of separate runner units which can be pre-manufactured with great precision. This enables the distance between and the angular position of the runners to be accurately determined, so as to avoid all undesirable play. The inventive mast construction also enables the line pulleys at the top of the mast to be placed inwardly of the guide fins and at a height at which they will overlap the guide wheels by means of which the crane is guided on the ceiling mounted rail. In this regard, the pulley wheel is conveniently given a diameter of such size as to require only one pulley with each line, as compared with earlier known solutions which require the use of at least two pulleys.

The invention will now be described in more detail with reference to the accompanying drawings, in which

Figure 1 is a side view of an inventive crane construction;
Figure 2 is a perspective view of a lifting carriage forming part of the crane illustrated in Figure 1;
Figure 3 is a perspective view of a runner unit forming part of the carriage illustrated in Figure 2;
Figure 4 illustrates part of the lifting carriage with the runner unit fitted thereto;
Figure 5 is a cross-sectional view of a runner unit when fitted to the lifting carriage illustrated in Figure 4, said view being taken on the line 5-5 in Figure 4; and
Figure 6 is a schematic view from above of the mast top of the crane illustrated in Figure 1.

The illustrated exemplifying embodiment of the inventive crane includes a chassis or base frame 11 and a mast construction 12 which is mounted vertically on the chassis. The crane is supported on a floor rail 13 through the medium of a front, freely rolling front wheel 14 and a rear drive wheel 15 which is connected to a drive motor unit 16. The mast construction 12 has essentially the form of a beam profile which is mounted on the chassis 11 in some convenient manner. It will be seen from Figure 6 that the front side 17 of the mast construction is comprised of a flat plate 18 whereas the remaining sides of the mast are forced from profiled sheet metal 19. The profile is such that the mast obtains a broader front part 20 and a narrowing or tapering back part 21 and a flat rear side 22. Welded firmly between the plate 18 and the front part 20 of the profile are two longitudinally extending guide fins 23 which form an integral and load-carrying part of the mast construction. The guide fins 23 thus connect directly with the flat plate 18 and can be said to form an extension of said plate laterally from the long sides of the mast.

The crane includes conventionally a lifting carriage 24 which can be moved along the guide fins 23 on the

mast with the aid of a line-pulley arrangement 25. This arrangement is comprised of two mutually parallel lines which extend from the lifting carriage 24 over two guide pulleys 26 at the mast top and to a lifting motor unit 27 mounted on the rear side 22 of the mast. The carriage 24 includes a vertical frame part 28 which moves along the front side 17 of the mast and a horizontal frame part 29 which is rigidly connected to the first mentioned frame part. The horizontal frame part 29 carries a suitable load carrier, for instance a telescopic fork assembly 30 for transporting pallet-carried load units between the lifting carriage and storage shelves (not shown) on the sides of the corridor travelled by the crane. The vertical frame part includes two frame beams 32 manufactured from square profiled sections, for instance RHS. The ends 33, 34 of the beams are provided with grooves 35 and holes 36 for the attachment of separate runner units 37 at the beam ends 33, 34.

The runners 37 are intended to guide the carriage 24 along the guide fins 23 and each include three rollers 38, 39, 40 which are mounted on a common body 41. The first and the second rollers 38, 39 are mounted in line with one another on the body 41, whereas the third roller 40 is mounted at right angles to the other two rollers. When fitted to the beam ends 33, 34, the third roller 40 will be located in the groove 35 and abut the upper part or outward edge 42 of the guide fin 23. At the same time, the remaining two rollers 38, 39 will each be located on a respective side 43 or 44 of the guide fin. The runner units 37 are secured by means of bolts 45 inserted through holes 36 in the frame beams and through screw-threaded holes 46 in the body 41. The runner units can be fitted from the outsides 47 of the frame beams 32, which are provided with holes 48 which enable bolts and tools to be inserted in the beam. Subsequent to fitting the roller units 37, the holes are preferably plugged with plugs 49, as shown in Figure 5. To facilitate guiding and power transmission, the body 41 of the roller unit is provided with a shoulder 55 whose width corresponds to the width of the groove 35 in the beam ends 33, 34. One of the rollers 38 of each runner unit will take-up the major part of the vertically acting load, while the remaining roller 39 need only function as a guide roller. The third roller 40 functions essentially as a side guide roller, these third rollers being loaded diagonally in pairs when a load is transported laterally along the load carrier. All four runner units 37 have mutually the same design and may be mounted selectively on the different beam ends 33, 34. However, the runner units must be turned so that the larger roller will always take-up the torque generated by the vertically acting load. The runner units can be fitted very simply, by inserting said units into position from above and from beneath respective beam ends 33, 34 with the lifting carriage held in its working position forwardly of the mast. Also fitted to the beam ends 33, 34 is a protective plate 31 which partially surrounds the guide fins 23 so as to protect said fins against dirt and damage, and also functions as an additional safety means in holding the lifting carriage against the fins.

The crane is also guided conventionally at the mast top by means of guide rollers 50 which are intended to run on respective sides of a top guide beam 51. Also mounted on the mast top are two guide pulleys 26 which are placed inwardly of respective guide rails 23 so as not to obstruct passage of the lifting carriage towards the mast top, as evident from Figure 6. The diameter of the guide pulleys 26 is so large that the pulleys extend from the front side 17 of the mast to free spaces 52 at the narrowing rear part 21 of the mast profile. The construction thus enables the guide fins 23, and therewith also the lifting carriage 24, to be moved right to the top of the mast and to pass beyond the mast top guide 50. The inventive construction is thus cheaper and much more favourable to the pulley lines than known constructions which include twice the number of line pulleys.

The crane is constructed to handle the load units fully automatically. An electric box 53 houses a control system for effecting all movements of the crane, and a comprehensive control system is also provided externally of the crane. As before mentioned, the crane is primarily intended for installation in buildings having a relatively low ceiling height, from 6 to 8 m, and must therefore be utilized in the space available as effectively as possible. The described mast construction 12 contributes substantially to this end, partly because the frame beam profile is such as to provide a compact and stable construction, and partly as a result of the illustrated attachment of the guide fins 23 and the line pulley 26 at the mast top. The position of the guide fins on the front side 17 of the mast also enables the construction and guidance of the lifting carriage 24 to be simplified. For instance, the two frame beams 32 can be formed from simple standard profiled sections and can be readily joined together with the aid of straight transverse struts or stays 54 fitted to the front surfaces 17. Positioning of the runner units 37 on the beam ends 33, 34 means that the distance between respective pairs of runners will be as large as is possible, thereby resulting in a smaller torque on the guide fins at an unchanged total building height. The solution afforded by the use of four runner units 37 also greatly reduces the problems earlier associated with the positioning of separate guide wheels in four groups. For instance, the runner units 37 can be produced as identical units irrespective of where they are later to be fitted. Fitting of the runner units is also greatly facilitated by the fact that they can be fitted from above and from beneath each respective beam end, and because fitting of said units can be effected from the sides of the crane with the aid of the holes 48 provided on the outside of the frame beams 32. Instead of the relatively complicated task of positioning twelve individual runners, four readily fitted units can be used instead, which greatly facilitates initial fitting of the units

and also any subsequent exchange of a faulty runner and any other service that needs to be carried out on the lifting carriage.

Another advantage afforded by the inventive mast construction is that the lifting motor unit 27 can be carried on the rear side 22 of the mast and placed above the travelling motor unit 16 and the electrical box 53, thereby reducing the longitudinal extension of the crane as far as possible, which in turn increases the access to walls and other vertical elements delimiting the storage space. The dimensions and general construction of the crane also enables it to be finally assembled in the factory and transported by standard vehicles to its place of use.

Claims

1. A crane for the indoor handling of materials, comprising a wheeled chassis (11), a chassis-mounted vertical mast (12) and a lifting carriage (24) which can be moved up and down the mast and which is fitted with a load-unit handling load-carrier (30), said carriage being guided along two guide fins (23) extending longitudinally along the mast, **characterized** in that the guide fins project laterally outwards from the crane and are intended to guide the lifting carriage through the agency of runners (38, 39, 40) mounted on a vertical frame part (28) thereof; and in that the runners are fitted on four runner units (37) which are mounted in pairs on the upper end (33) and the lower end (34) of the vertical frame part.

2. A crane according to Claim 1, **characterized** in that the load-carrying part of the mast is comprised of a beam profile having a front side (17) which faces towards the lifting carriage; and in that the longitudinally extending guide fins (23) have the form of outwardly projecting extensions which extend laterally from said front side (18) or from a location adjacent thereto.

3. A crane according to Claim 1 or 2, **characterized** in that the vertical frame part (28) of the lifting carriage includes two mutually parallel frame beams (32) which are arranged along and outwardly of respective guide fins (23); and in that a runner unit (37) is fitted to each of the ends (33, 34) of said frame beams.

4. A crane according to Claim 3, **characterized** in that the runner units (37) are detachably fitted in grooves (35) on the inside of the frame beams (32) facing the guide fins (23).

5. A crane according to any one of Claims 2-4, **characterized** in that vertical movement of the lifting carriage (24) is effected with the aid of lines (25) which extend over two parallel line pulleys (26) at the top of the crane, said line pulleys being mounted inwardly of the mast beam profile and respective guide fins (23); and in that the line pulleys (26) have a diameter which is so large as to enable the lines (25) to run on respective line pulleys from the front side (17) of the beam profile to the rear side thereof and from there to a lifting motor unit (27).

6. A crane according to Claim 5, **characterized** in that the mast beam profile is a symmetrical box beam profile having a front part (20) of the same width as the mast front side (17) and a narrowing rear part (21); and in that the line pulley has a diameter which is greater than the depth of said front part in the longitudinal direction of the crane, so that the line pulley will project out from the front side (17) of the mast and also laterally from the mast and beyond said rear part (21) of the box beam profile.

7. A crane according to any one of the preceding Claims, **characterized** in that each of the runner units (37) includes three rollers (38, 39, 40) which are mounted on a common body (41), of which rollers a first and a second roller (38, 39) are placed in line with each other so as to roll along a respective side (43, 44) of the guide fin (23), and of which a third roller (40) is placed perpendicular to the remaining rollers and is intended to run along the outer edge (42) of the guide fin.

8. A crane according to any one of the preceding Claims, **characterized** in that the runner units (37) are of mutually identical construction and can be mutually exchanged on the frame beams (32).

9. A crane according to any one of Claims 4-8, **characterized** in that the grooves (35) in the frame beams (32) extend from the end-parts (33, 34) of said beams and slightly along respective beams, so as to enable the runner units (37) to be fitted from above and from beneath respective beam ends with the lifting carriage (24) in its working position.

10. A crane according to Claim 9, **characterized** in that the bodies (41) of the runner units are detachably fitted to the beam ends by means of screw devices (45) which are fitted from the outsides (47) of the vertical frame part (28) facing the sides of the crane.

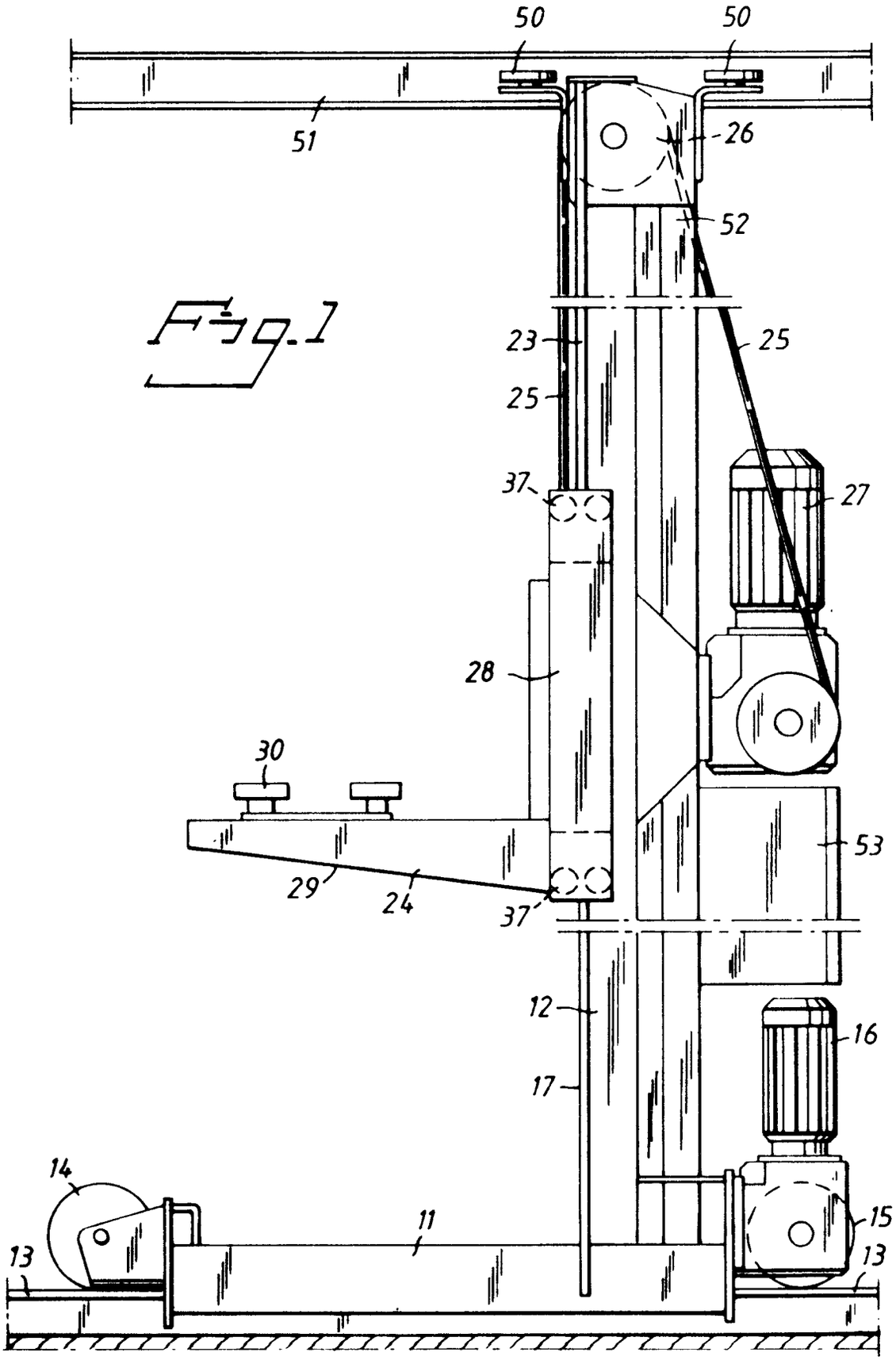


Fig.1

Fig.2

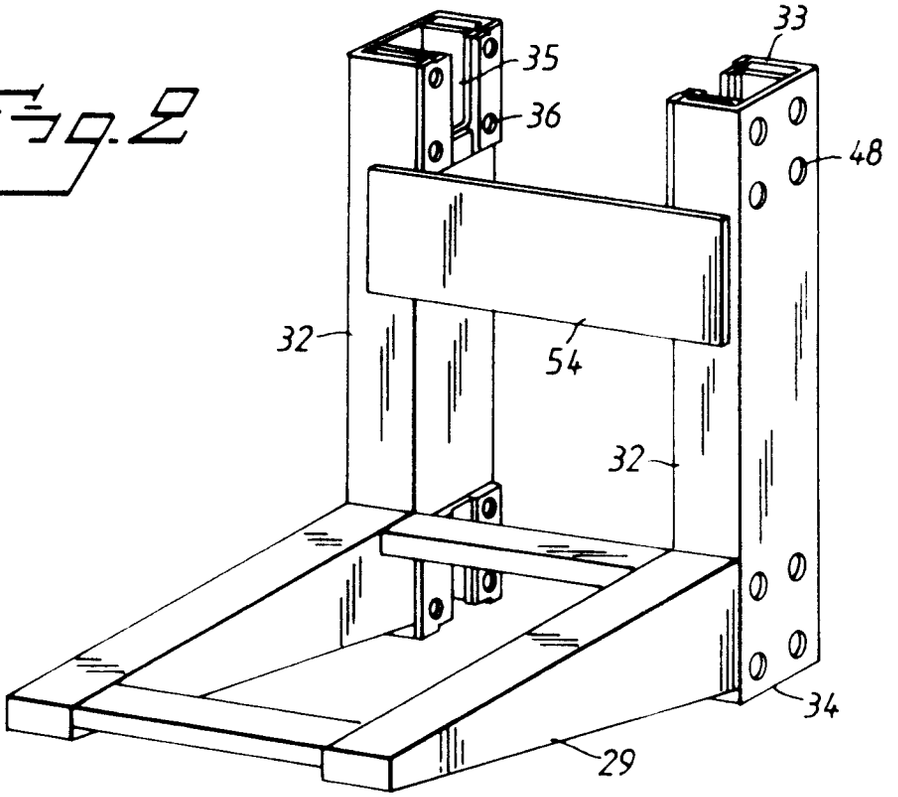


Fig.3

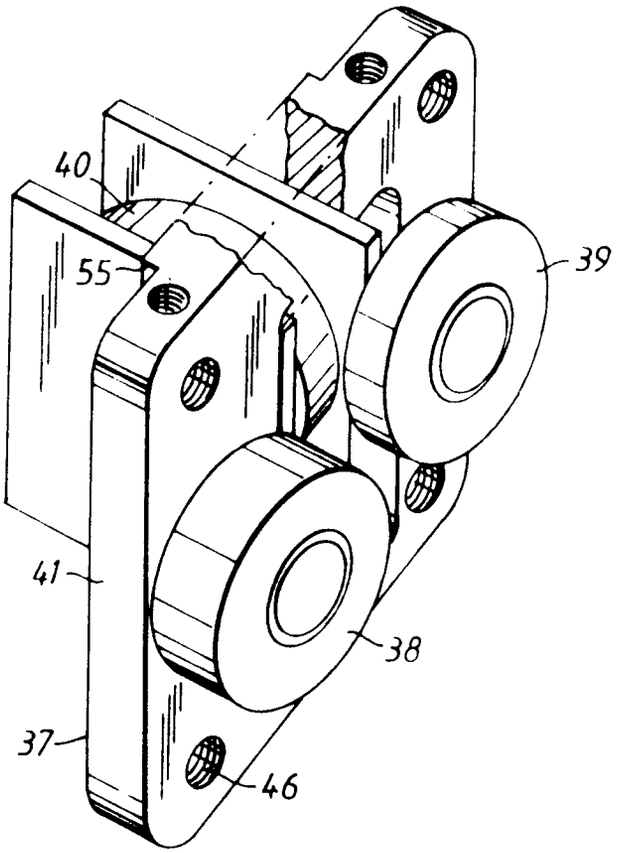


Fig. 4

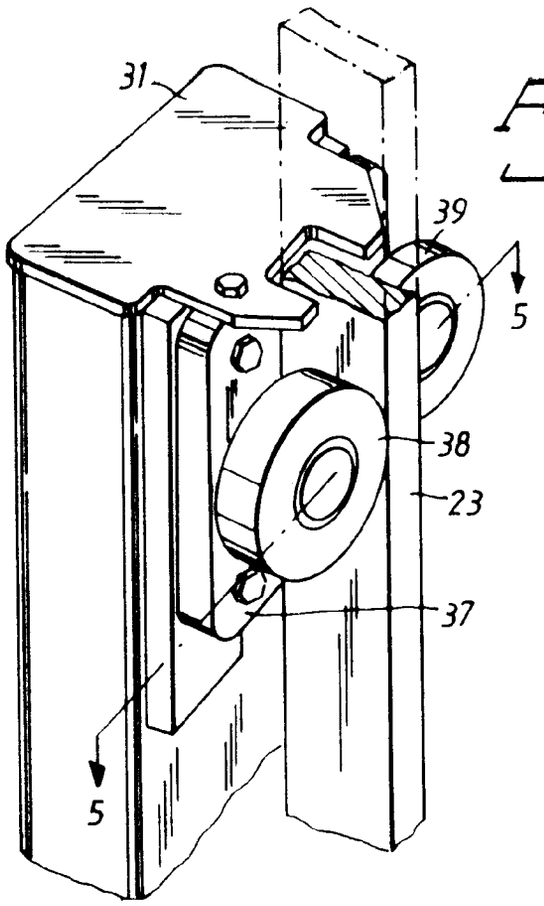


Fig. 6

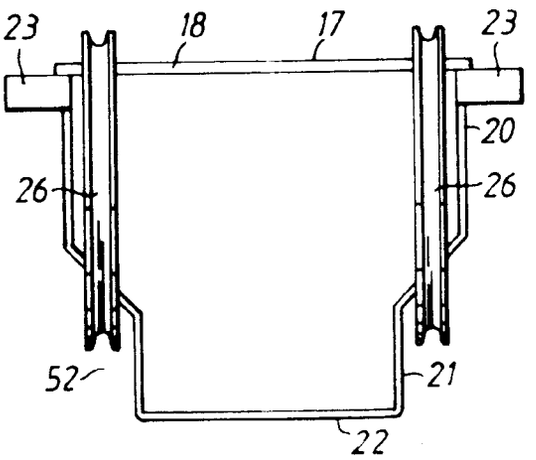
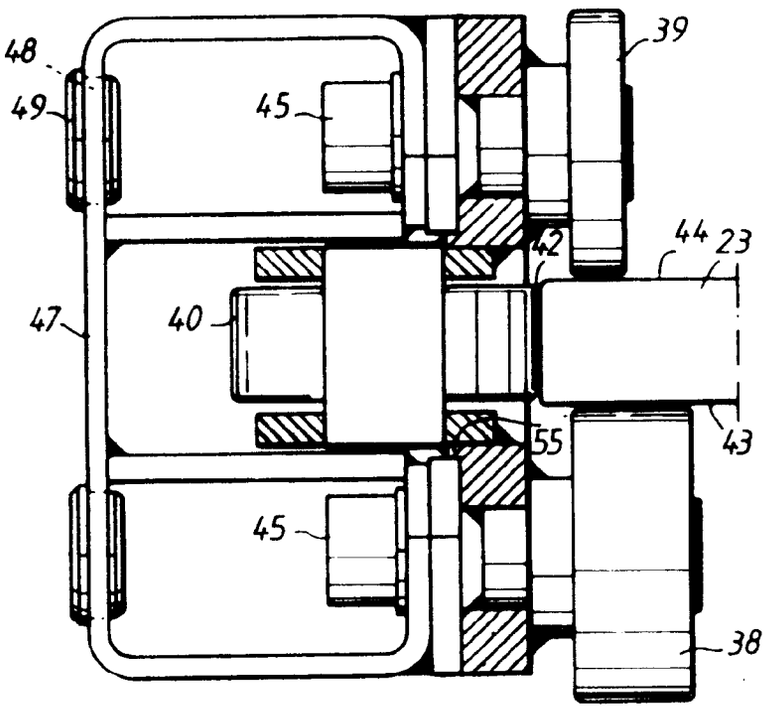


Fig. 5



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 93 85 0021

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.5)
Y A	US-A-5 048 642 (LLOYD) * figures 1-3,6-8 * * column 2, line 44 - line 57 * * column 3, line 1 - line 8 * * column 3, line 47 - line 61 * * column 4, line 5 - line 11 * * column 4, line 55 - line 60 * * column 5, line 3 - line 20 *	1,3,7 2,5,6	B66F9/07
Y A	US-A-4 538 954 (LUEBKE) * figures 3-5 * * column 5, line 36 - line 51 *	1,3,7 2,8	
A	US-A-4 354 579 (LOW) * figures 2,4,6-9 *	1,8	
A	US-A-4 529 066 (WIESCHEL) * figures 1-4 * * column 4, line 64 - line 67 * * column 5, line 13 - line 36 *	1,3,5,7	
A	US-A-4 358 239 (DECHANTSREITER)		TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A	US-A-4 331 418 (KLEBE)		B66F
A	DE-A-1 481 149 (DEMAG - ZUG G.M.B.H.)		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	04 MAY 1993	GUTHMULLER J.A.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P0401)