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(54) An apparatus for handling loads

(57) The invention relates to an apparatus (1) for handling a load, of the type comprising a support structure (2), means (3) for gripping or handling a load, a device (15) for counterbalancing the weight of the load, means (21) for pre-setting or detecting said weight and operating on said conterbalancing device (15) and a first arm (17) hinged to said support structure (2) and supporting said load gripping or handling means (3). In order to avoid design problems of the apparatus structure or the counterbalancing device (15), said counterbalancing device (15) is a commercial zero-gravity balancer acting on at least a rope (16), said balancer and the free end of said rope (16) are attached to the support structure (2) and to a point (19) of said arm (17), or viceversa, and the attaching point (19) on said structure or said arm (7) is chosen according to the working features of said commercial balancer (1) and the required performances of the apparatus.

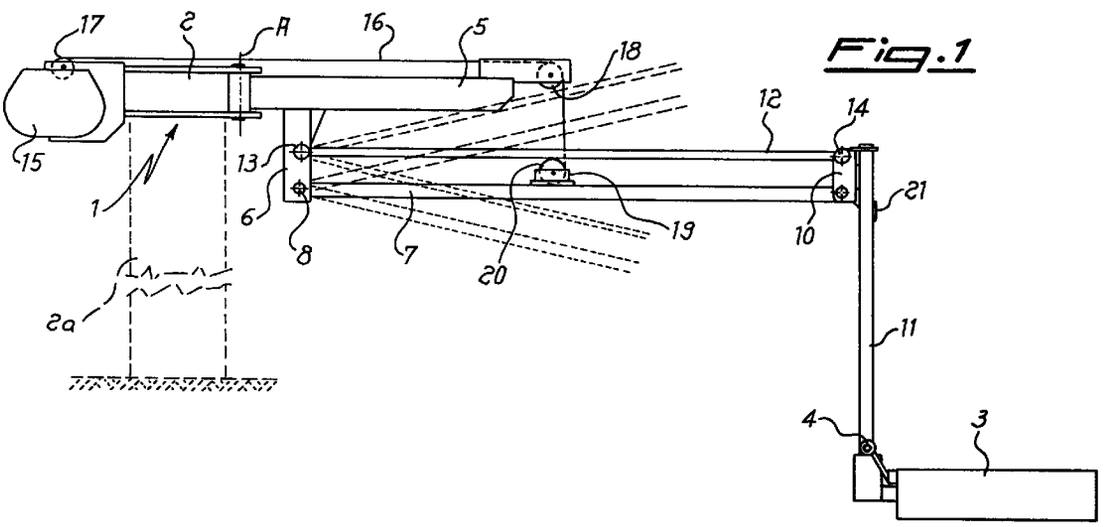

Fig.1

EP 0 930 263 A1

Description

[0001] The present invention relates to an apparatus for the handling of loads.

[0002] This type of apparatus is generally used to lift and move loads within the limits of a predetermined space e.g. at a mechanical component assembly station on a production line, or at a distribution point for products or for semi-finished products which must be sent to other work-stations for further operations to be carried out on them. Devices known to the prior art comprise substantially a means for gripping or holding the load, at least one load counter-balancing device and means of measuring the weight of the load.

[0003] An example of a prior art device is reported in the Italian Patent Application No. IT 26387-A/79 which describes a device for the handling of loads and in particular a means of counter-balancing the load, comprising an electrically driven winch, whose operation is controlled by two potentiometers which regulate the torque of the motor in the loaded and unloaded states.

[0004] Another example of the prior device is reported in the French Patent Application No. FR 2386473 which describes an apparatus for the handling of loads comprising a device for the measurement of the load in addition to those elements already present in the aforementioned Italian patent application.

[0005] In this way, once the electric motor torque values have been set for the loaded and unloaded state, the torque delivered by the electric motor is automatically adapted to the different conditions.

[0006] These devices have been found suitable for light loads. Increasing the load requires more robust structures with greater inertia in the moving parts and more friction in the joints and parts moving across each other.

[0007] For this reason, although the weight of the load can be adequately counter-balanced, the handling of the load requires considerable effort because of the increased frictional forces between the various moving surfaces in contact.

[0008] Moreover, these prior devices provide a load directly sustained by a cable or rope, and this renders very difficult to handle loads with considerable weight when they must be accurately and precisely handled, for instance in an assembly station for cars or the like.

[0009] In order to solve these problems, devices were proposed in which the load is sustained by an arm, in particular an arm forming an articulated parallelogram to maintain the means for gripping and holding the load always parallel to itself. One of the elements of the articulated parallelogram shows an integral portion extending in a direction opposite to that of the parallelogram and the load gripping means, to be operated by suitable means to counterbalance the load attached to the end of said portion. An example of these devices is given by EP-A-733579, wherein an electric motor operates on a chain fixed to said arm portion end.

[0010] However, such devices suffer the drawback that the structure and the motor must every time be specially designed on the basis of a very narrow range of weights to be handled, so that actually for each weight to handle it is necessary to design at least part of the mechanical structure and/or the balancing electric motor or equivalent device.

[0011] Accordingly, it would be desirable to provide an apparatus for handling a load of the type referred to, which can be operated for a large range of load weights without necessity of changing the counterbalancing motor or structural parts.

[0012] It would also be desirable to provide an apparatus as above described in which a commercial load counterbalancing device can be used irrespective of the actual weight range.

[0013] The above and further advantages can be achieved in one aspect of the invention by an apparatus according to claim 1.

[0014] Accordingly, a commercial balancer can be used with its cable or rope (or cables or ropes) acting on said first arm at a point between the hinging point of the arm to the support structure and the means for gripping or handling the load, or in a point placed on an arm portion extending from the hinge point in a direction opposite to that of the load.

[0015] By suitably choosing the cable or rope attaching point on said arm or on the support structure, for example through a well known stroke reducer, it is possible for the first time to conform the operating features of the commercial balancer - in particular the load capacity, lifting speed and stroke - each time to the desired load weight and handling modes.

[0016] Of course, the device can operate taking into account not only the actual weight of the load but also the frictional forces between the various moving surfaces in mutual contact, and the apparatus may further comprise means of controlling the weight balancer automatically as a function of the weight of the load and the forces applied to it. In this way the power delivered by the balancer is controlled in real-time as a means of assisting the movement imparted by the operative.

[0017] Other aspects of the invention are defined in the claims.

[0018] An embodiment of the invention will now be described in detail with reference to the attached drawings which are given by way of illustration and not with limiting purposes, and in which:

Fig. 1 is a schematic side view of an embodiment of the apparatus according to the present invention;
Fig. 2 is a schematic plan-view of the apparatus according to Fig. 1; and
Fig. 3 is a schematic side view of another embodiment of the invention.

[0019] With reference to the figures, there is shown an apparatus 1 comprising a support structure 2, which

can be mounted on a fixed vertical support 2a or on a support longitudinally movable along a rail (not shown), and means 3 of gripping a load by an operative. The means 3 are represented by a platform with handles *4*, but it is to be understood that said means may include any form which is found suitable to sustain the load, e.g. another frame to maintain a component in a particular position, or a hook.

[0020] The structure 2 carries a second arm 5 which is rotatable in a horizontal plane about the axis A and carries a depending plate 6 to which a first arm 7 is hinged at 8 to be able to swing in a vertical plane.

[0021] The other end of said first arm 7 is hinged, at 9, to a plate 10 carrying a load gripping and holding means, in the form of a rotatable supporting element 11 and said platform 3.

[0022] The arm 7 is twinned by another reinforcing arm 12 to set up a parallel structure in which the arm 12 is hinged at 13 to the plate 6 and at 14 to said plate 10, in order to control the movements of the load gripping or handling means 3, 11 in a vertical plane so that said means 3, 11 always remains parallel to itself.

[0023] In Fig. 1 the positions of arm 7, 12 are also represented by dotted lines in the minimum and maximum elevations of the load.

[0024] In order to counter-balance the weight of the load carrier by the platform 3, a zero-gravity balancer 15 (in this embodiment a commercial zero-gravity balancer) is mounted on the support structure 12, for instance on the side thereof opposite to that of the arms 7, 12.

[0025] The balancer 15 usually operates by means of a cable or rope or a plurality of cables or ropes 16 to the end of which the load to be balanced is attached.

[0026] In the embodiment shown in Figs. 1 and 2, the cable or rope 16 passes over two freely rotatable pulleys 17 and 18, and is attached to a chosen point 19 along the extension of arm 7. More detailedly, the second arm 5 carries a support for the pulley 18 so that said pulley 18 and the point 19 are substantially aligned.

[0027] As the zero-gravity balancer 15 can be of a commercial type, with given ranges of load capacity, lifting speed and stroke, it is possible to conform the balancer 15 with the required load weight and operating features of the apparatus by simply choosing the point 19 of attachment for the end of cable(s) or rope(s) 16 along the arm 7. Between the rope end and the arm attaching point 19, a conventional stroke reducer 20 can be placed. In this way, by simply varying the attaching point 19 (and if appropriate the horizontal position of pulley 18) it is possible to cover with a single balancer 15 very wide ranges of load weights and working requirements of the apparatus.

[0028] The balancer may be of the known type in which the (load) weight is pre-set, or of the self-balancing type, for instance by means of a load cell 21.

[0029] Figure 3 shows another embodiment of the present invention, wherein the same references indicate similar components to those of Figures 1 and 2.

[0030] According to this embodiment, the arms 7 and 12 are directly hinged to the support structure 2 which is rotatably mounted on its base 2a. Arm 7 has an extension 7a in a direction opposite to that of the load and the attaching point 19 for the rope 16 of balancer 15 is provided at a suitably chosen point along this arm extension 7a.

[0031] The balancer 15 is fixedly mounted on the structure 2 and the rope 16 may reach the attaching point 19 directly or after passing on a free pulley 22 mounted on an arm 23.

[0032] It is to be pointed-out that it is possible to invert the position of the balancer 15 (which could be mounted on the arm extension 7a) and of the cable or rope attaching point, which can be placed on the support structure 2. In the same way, instead of choosing the rope attaching point, it is possible to foresee an apparatus in which said rope attachment point 19 is fixed and the balancer position on the structure 2 or the arm extension 7a can be modified at will.

[0033] The present invention encompasses apparatus and designs thereof in which the position of the rope or cable attachment point and the positions of the balancer are defined during design of the apparatus to meet particular operating requirements. This permits a basic design to be used for a variety of applications simply by varying one or both of the positions defined above. The apparatus is then constructed according to the design with the above positions predetermined. The invention also encompasses apparatus and designs in which a plurality of attachment positions of the rope/cable and/or of the balancer may be pre-defined, and an individual apparatus can be configured or re-configured to suit immediate operating requirements.

[0034] Features believed to be of particular importance are defined in the claims. However, the applicant claims protection for any novel feature or aspect described herein and/or illustrated in the drawings, irrespective of whether emphasis has been placed thereon.

Claims

1. An apparatus for handling a load, of the type comprising a support structure, means for gripping or handling a load, a device for counterbalancing the weight of the load, means for presetting or detecting said weight and operating on said counterbalancing device, and a first arm hinged to said support structure and supporting said load gripping or handling means, characterised in that said counterbalancing device is a commercial zero-gravity balancer acting on at least one cable or rope, in that said balancer and the free end of said rope or cable are attached to the support structure and to a point of said first arm, or viceversa, and in that the attaching point on said structure or said arm is chosen according to the working features of said commer-

cial balancer and the required performances of the apparatus.

2. An apparatus according to claim 1, characterised in that said rope or cable of said zero-gravity balancer passes over at least one free pulley carried at the free end of a second arm fixed to said support structure above said first arm and its free end is attached to a chosen rope or cable attaching point on said first arm, and in that the position of said pulley can be modified along said second arm accordingly to said chosen point on said first arm.

3. An apparatus according to claim 2, in which said first arm is formed by two articulated elements, hinged at fixed points to said support structure and to said load gripping or handling means, said two elements being superimposed in a vertical plane, characterised in that said second arm lies in said vertical plane, above the upper one of said two elements, and said attaching point is chosen along said first arm upper element.

4. An apparatus according to claim 1, characterised in that said first arm has an arm portion protruding from the arm hinging point to the structure in a direction opposite to that of said load gripping or handling means, and in that said balancer or the free end of its rope or cable is attached to said arm portion.

5. An apparatus according to claim 4, characterised in that the attachment point of said balancer, or rope or cable free end, to said arm portion is chosen along said arm portion and the attachment point of said balancer, or rope or cable free end, to said support structure is fixed.

6. An apparatus according to claim 4, characterised in that the attachment point of said balancer, or rope or cable free end, to said support structure is chosen along said structure and the attachment point of said balancer, or rope or cable free end, to said arm portion is fixed.

7. An apparatus according to one of the preceding claims, characterised in that a stroke reducer is placed between the balancer rope or cable and its attaching point.

8. An apparatus according to one or more of the preceding claims, characterised in that said zero-gravity balancer is of the type in which the load weight is pre-set.

9. An apparatus according to one or more of claims 1 to 8, characterised in that said zero-gravity balancer is of the self-balancing type.

10. An apparatus according to claim 9, characterised in that it further comprises a load cell on said load gripping or handling means, said load cell acting on said balancer.

11. Apparatus for handling a load, comprising a support structure, least one arm movably mounted with respect to the support structure, and means coupled to the support structure and to the arm for counter balancing the weight of a load supported by the arm, the position of attachment to the support structure and/or to the arm being determined to suit the characteristics of the balancer and/or the desired characteristics of the apparatus.

12. A method of providing a load handling apparatus, the method comprising:

providing a support structure;
providing an arm moveably mounted with respect to the support structure;
providing means for counterbalancing the weight of a load to be supported by the arm, and
determining a point for attachment of the counterbalancing means to the support structure and/or to the arm in accordance with the characteristics of the balancer and/or the desired characteristics of the apparatus; and
coupling the counterbalancing means to the support structure and to the arm.

13. Apparatus according to claim 11, or a method according to claim 12, wherein the counterbalancing means comprises a zero-gravity balancer, and at least one tension cable on which the balancer acts.

14. Apparatus according to claim 11 or 13, or a method according to claim 12 or 13, wherein the position of attachment to the support structure and/or position of attachment to the art is or are selected from a range or ranges of predetermined possible positions.

Fig.1

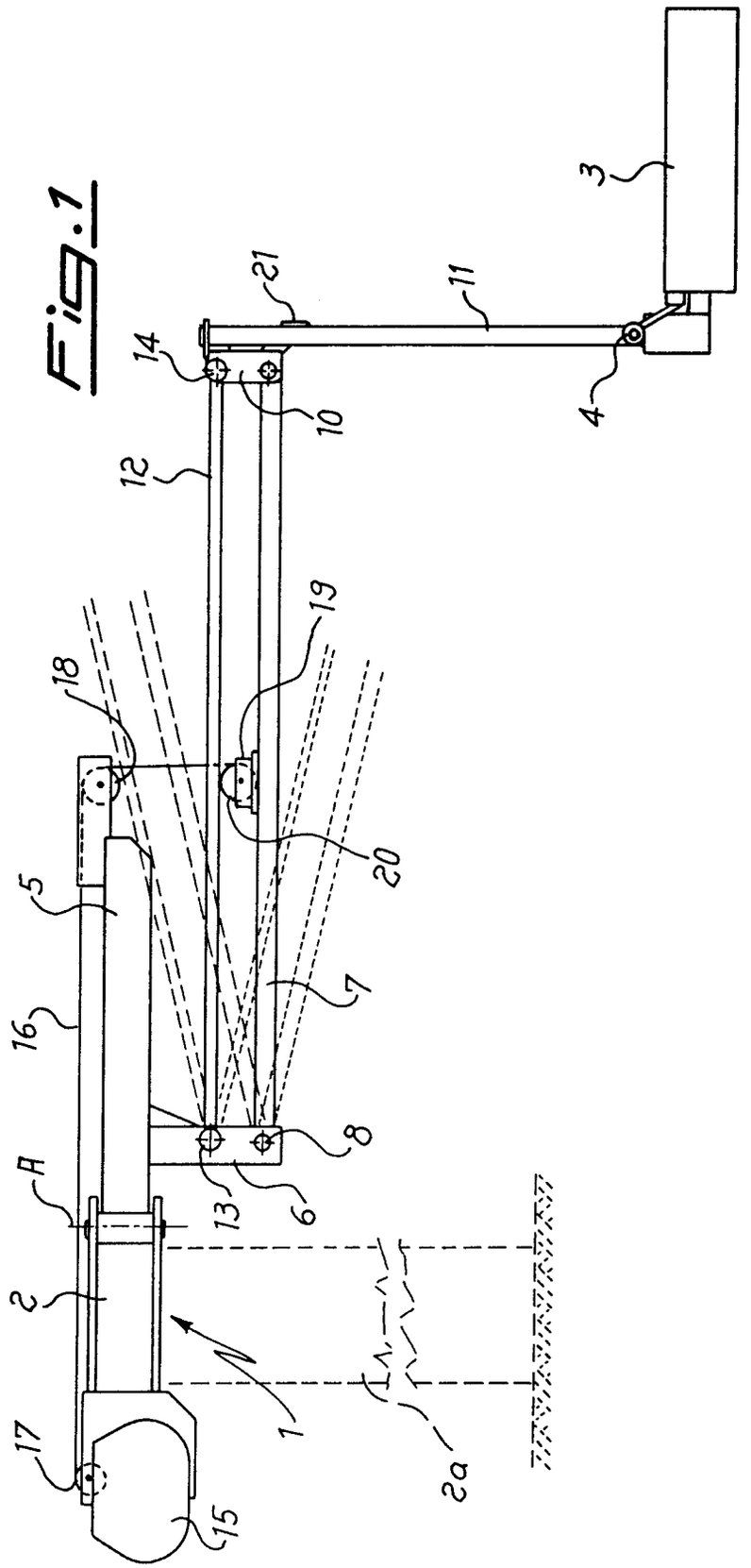
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Fig.2

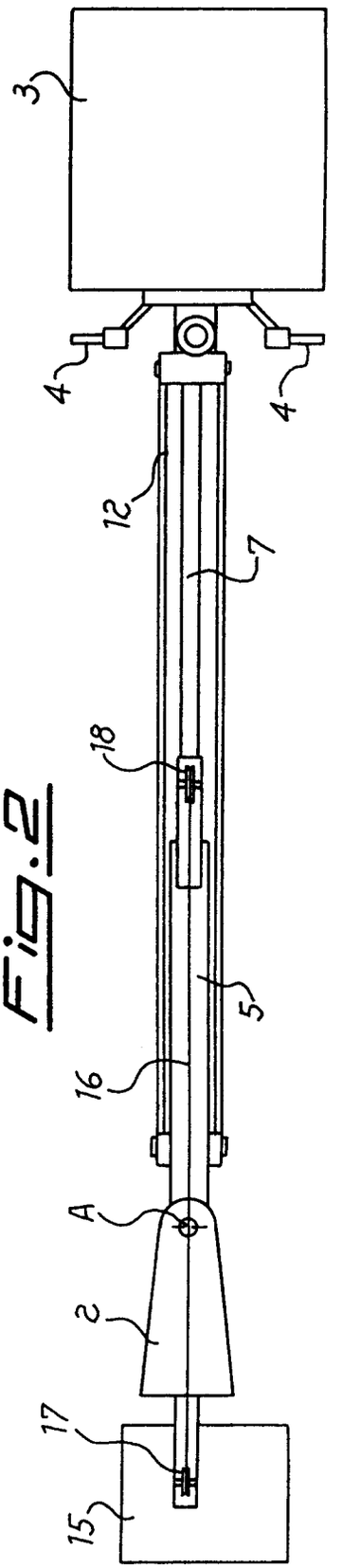
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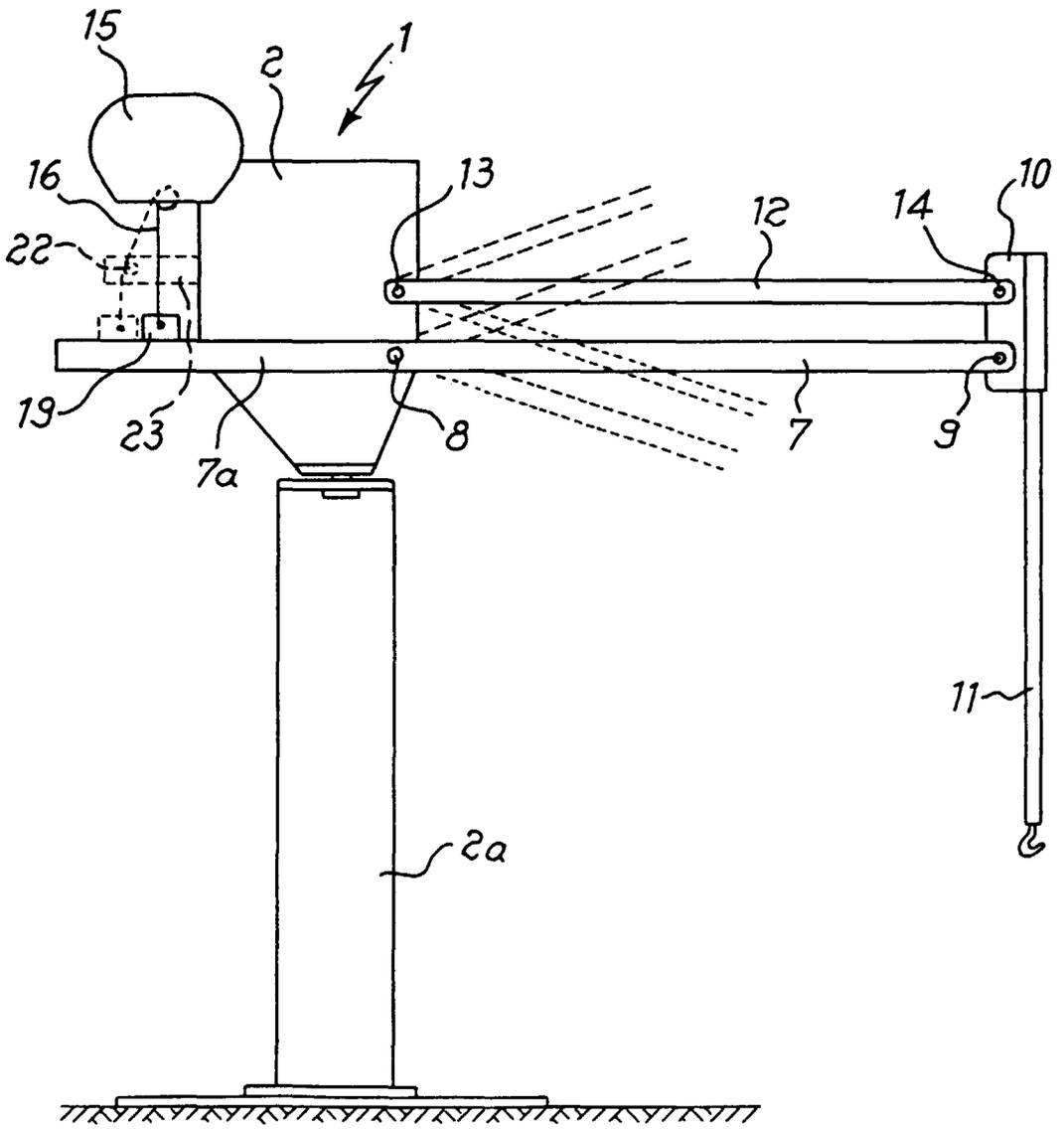
Fig.3



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EUROPEAN SEARCH REPORT

Application Number
EP 98 30 0239

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.6)
X Y	DE 30 20 562 A (FUCHS JOHANNES) * page 4, last paragraph - page 5, paragraph 1; claims 1,4; figure 1 *	11,12 1,8,9	B66C23/00
Y	US 4 529 064 A (D ANDREA JR ROCCO A) * column 2, line 15 - line 23; figures 1,2 *	1,8,9	
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			TECHNICAL FIELDS SEARCHED (Int.Cl.6) B66C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	7 May 1998	Thomas, C

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 98 30 0239

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07-05-1998

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