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(54) Control system for a weaving frame

(57) The invention relates to a control system for a weaving frame from out of which pile warp threads are distributed to a weaving machine, with provisions for detecting thread breakage and/or thread over-tension of the pile warp threads whereby the detection provisions are so connected in matrix structure with the control system that the number of the signal points to be detected by the control system is reduced to a fraction of the number originating from the detection provisions. These signals are preferably detected by means of micro-controllers which are connected via a fieldbus provision to a microprocessor operated creel controller processing unit of the weaving machine. Furthermore the control system preferably comprises thread tensioning and thread drawing-back provisions which in case of an extreme condition thereof make contact with detection electrodes.

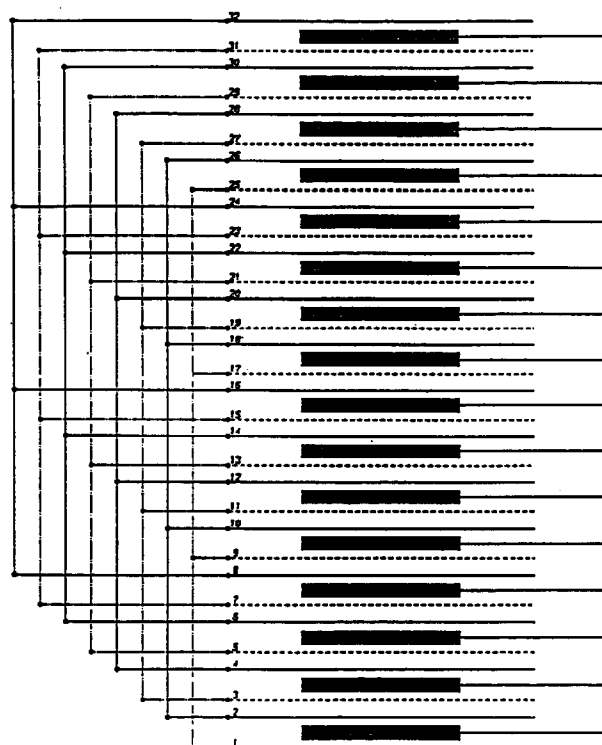


Fig.1

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Description

The invention relates to a control system for monitoring the pile warp yarns of a weaving frame, more especially for detecting thread breakage and/or thread over-tension of the pile warp thread.

The term "system", as used in this text, encompasses both the aspect of a method which is applied for monitoring the pile warp threads and the aspect of a device and/or of device parts which serve for that purpose.

The monitoring of thread breakage and thread over-tension in weaving machines forms a known problem in modern weaving technology. Hence from the BE patent application 9500426 a thread tensioning and drawing-back device is known whereby pile warp thread keepers can be placed in front of the entry grating for monitoring the pile warp threads. These pile warp thread keepers can only detect a broken pile warp thread. Moreover a division into left and right part in relation to the middle of the weaving machine can be provided.

BE patent application 9600219 describes a module for tensioning and drawing back pile warp threads of a weaving machine. This module is placed in front of the weaving frame. In this module a thread breakage and thread over-tension detection is built in whereby with an electrode contact is made when a drawing-back leaf spring comes into its extreme position.

The above mentioned devices are also described in EP 0742297 A2.

With these known devices the processing of the detection signals however meets with an as yet unsolved problem.

A weaving frame for modern jacquard weaving machines, such as namely carpet weaving machines, indeed consists of a number of doors which are disposed in the lateral direction. Each door is divided in height direction into a number of rows. Those rows comprise a number of bobbins in depth direction. For large cross-wound spools the height direction is even divided into a ground floor and a first floor. In the front in each door a module with tensioning and drawing-back device is placed. These modules are provided with breakage and over-tension detections. An example of a typical configuration is a frame with 8 doors disposed next to each other in width direction. Each door has 8 rows in height on the ground floor and 7 rows on the 1st floor, each row has e.g. 48 bobbins in depth. Such a row is on either side of a door: Side A and B. For such a weaving frame 16 modules with detection elements are therefore disposed. Other configurations are however possible.

Through each module therefore run a number of rows of warp threads situated one above the other which come from the row of bobbins lying behind, e.g. 48 bobbins in depth according to the previous example. In order to make possible the installation of the warp thread tensioning and drawing-back device in the available width, each row is split into 2 sub-rows or layers situated one above the other. A module provided for controlling 8 rows of bobbins therefore has 16 rows for the detection elements. Two detections are provided per warp thread: one for warp thread breakage and one for over-tension. This situation is applicable for both sides of a door.

A row of 48 bobbins in depth is therefore split up into two layers or sub-rows of 24 warp threads. There are therefore 2 x 24 or 48 detections to be processed per layer in the module if each warp thread or bobbin is to be individually allocated. In order to locate a breakage or over-tension for each thread individually, use will preferably be made of electrodes. Therefore per module 48 warp threads x 2 detections x 8 rows x 2 sides = 1536 contact points are necessary. This poses a problem for the cabling in order to connect these contact points individually to a supply of electricity. Furthermore this large number of signals also has to be processed.

The number of connection points can be reduced by using non-segmented electrodes. Then there still remain 8 rows x 2 layers x 2 detections x 2 sides = 64 connections and detections to be processed per module. If it is further desired not to distinguish between side of door there still remain 32 connections per module. This makes the cabling and processing of detections ever less extensive.

For the above mentioned typical example according to the desired degree of allocation the following number of connections are therefore to be made and possible signals processed.

Individual allocation:

below: 8 modules x 8 rows x 48 bobbins x 2 sides x 2 detections = 12288
above: 8 modules x 7 rows x 48 bobbins x 2 sides x 2 detections = 10752
total: 23040

Allocation per side and per layer:

below: 8 modules x 8 rows x 2 layers x 2 sides x 2 detections = 512
above: 8 modules x 7 rows x 2 layers x 2 sides x 2 detections = 448
total: 960

Allocation per layer:

below: 8 modules x 8 rows x 2 layers x 2 detections = 256
above: 8 modules x 7 rows x 2 layers x 2 detections = 224
total: 480

A system must be sought in order to reduce the cabling to a minimum.

The detection of the signals must be able to be

effected very fast, but may not be burdensome for the control unit of the weaving machine. Parameters such as filter times, number of contact signals that are permitted before a weaving machine stop signal is generated, etc., must on the other hand be accessible on the control unit of the weaving machine.

The system must be flexibly adaptable to other configurations of weaving frame arrangements.

It must be possible to define per bobbin and or per layer to which pile warp thread the bobbins belong and which colour these should have (frame arrangement - lattice colours per pile warp thread) so that the monitoring system can keep track of how many stops occurred from thread breakage and over-tension per colour and where in the weaving frame and in which weaving frame. This information must be simultaneously available for all weaving machines which are provided with the same frame arrangement at that time.

It is the object of this invention to provide a solution to the problems which arise with the processing of the detection signals with the known devices and which achieve the above mentioned goals.

For that purpose the invention provides a control system for a weaving frame from out of which pile warp threads are distributed to a weaving machine, which system comprises provisions for detecting thread breakage and/or thread over-tension of the pile warp threads, whereby the detection provisions are so connected in matrix structure with the control system that the number of the signal points to be detected by the control system is reduced to a fraction of the number originating from the detection provisions, and whereby the detection of the signals originating from the detection provisions is effected by means of one or more micro-controllers.

According to a further characteristic of the invention the aforementioned provisions for detecting thread breakage and/or thread over-tension per weaving frame part can very suitably be provided in a separate module, whereby the detection of the signals originating from the detection provisions is effected by means of one micro-controller per module.

According to a preferred embodiment of the invention the micro-controllers are connected via a fieldbus provision to a creel controller provision of the weaving machine. Moreover the creel controller provision can very suitably consist of a microprocessor operated processing unit which processes and translates the data originating from the micro-controllers into signals for a control unit (machine controller) of the weaving machine.

According to a further embodiment of the invention the data originating from the micro-controllers is preferably transmitted by the creel controller provision via a fieldbus provision for parameters to the machine controller, while control parameters can be transmitted via the machine controller to the creel controller provision via the fieldbus provision for parameters.

According to yet another embodiment of the inven-

tion the provisions for detecting thread breakage and/or thread over-tension more especially comprise thread tensioning and thread drawing-back provisions for the pile warp threads which in case of an extreme condition of those tensioning and drawing-back provisions make contact with detection electrodes.

Moreover the detection electrodes can very suitably consist of segmented electrodes in the form of a printed circuit provided with current paths, or of a common detection conductor destined to make contact with at least a part of the tensioning or drawing-back provisions in case of an extreme condition thereof.

The characteristics and distinctive features of the invention and the operation thereof are hereafter further explained with reference to the attached drawings, in which:

Figure 1: is a schematic representation of the control system according to the invention with signal points connected in matrix structure;

Figure 2: is a schematic representation of the global division of the control system according to the invention in an operating system of a weaving mill;

Figure 3: is a view in perspective of a part of a weaving frame with thread tensioning and thread drawing-back provisions and detection electrodes according to the invention;

Figures 4 and 5: are respectively a front view and a view from above of segmented electrodes such as applied according to the invention;

Figure 6: is a cross-section according to line I-I from figure 5.

As explained above with the control system according to the invention the weaving frame is preferably split up into a number of modules. By way of example the control system is explained on the basis of figure 1 for the most simplified module where 32 signals are still to be controlled. The cabling per module is implemented in a matrix structure so that the number of points to be controlled is limited to 12. Through the appropriate combinations when sensing those 12 points 32 signals can nevertheless be controlled. The layers through which the pile threads run are grouped in blocks of 4. For each row of thread tensioning and drawing-back provisions an electrode is required for the over-tension control: this is represented in continuous line in the drawing and is indicated by even numbers 2 up to and including 32. The electrodes for thread breakage control are drawn in dashed line and are indicated by uneven numbers 1 up to and including 31. In the drawing 8 lines will be seen on the left for the cabling and on the right another 4 lines with common connection point for 4 blocks.

In figure 2 the global division of the control system

according to the invention in an operating system of a weaving mill is explained by way of example. For the sake of clarity the description is limited to the most simple embodiment according to figure 1. The sensing of the 12 signals is effected by means of a micro-controller C1 up to and including Cn per module.

In order to minimise the cabling between the various modules use is made of a fieldbus ("fieldbus for weaving frame" or Creel Fieldbus). This fieldbus on the one hand runs to the various modules and on the other hand to the creel controller. In that manner modules can easily be added depending on the weaving frame.

The creel controller is a microprocessor based processing unit which handles the processing of the data supplied by the micro-controllers C1..Cn. This information has to be translated into breakage or over-tension, and this per colour. At the same time a stop signal must be provided to the operating unit of the weaving machine (machine controller).

On the weaving machine itself 2 different fieldbuses are provided. On the one hand there is the fieldbus for transmitting parameters (fieldbus for parameters) and on the other hand the fieldbus for transmitting large data blocks (fieldbus for data).

The fieldbus for parameters connects the various microprocessor based operating units on the weaving machine (creel controller, machine controller, jacquard controller, ...). The fieldbus for data is a connection between the jacquard controller and the jacquard machines.

Via the fieldbus for parameters the creel controller can transmit the data in relation to thread breakage and over-tension to the machine controller. There these can then be shown on a monitor. On the other hand on the monitor of the machine controller the parameters for the creel controller can be input and be transmitted via the fieldbus for parameters.

In the weaving mill a central network is provided which makes a connection between on the one hand the network server and on the other hand the weaving machines. In this network a CAD/CAM drawing system and an administrative computer can also be included.

The connection to the weaving machine runs via the jacquard controller. This handles the processing of the various orders to be woven and the dispatching of the data to the jacquard machines (via the fieldbus for data).

One of the product parameters which is of importance for being able to process a certain weaving order on the weaving machine or not is the frame arrangement. For that reason it is provided that on the network server, which supports the production preparation, the frame arrangement can be identified. Once this is available this data can then be transmitted via the network to the jacquard controller. By means of the fieldbus for data this can then transmit the frame arrangement to the creel controller in order to translate the transmitted data into the correct colour by the microprocessors

C1..Cn. This information can then in its turn be returned to the network server via the fieldbus for data and the network in order to process stop data and make global surveys for each machine and the entire weaving mill.

In figure 3 a part of a weaving frame is represented with which the operation of the control system according to the invention is illustrated; in that figure it can be seen how the pile warp thread (40) runs via a guiding reed or grating (50) to the weaving machine; the thread (40) is held tight via guiding means (41) on the free extremity of a thread tensioning and thread drawing-back provision (42) - in the example shown more especially a spring strip. The strips are mounted per row between common clamping rods (43), (44); the provisions for yarn breakage and yarn over-tension detection comprise connections (45) from the clamping rods (43), (44) to a power source (not shown), and connections (46), (47), to the other pole of the aforementioned voltage supply, from non-segmented detection electrodes (48) for detecting yarn over-tension and (49) for detecting yarn breakage.

With non-segmented electrodes the electrode consists of an electric conductive bar which is disposed insulated in relation to the frame. The drop lever or the drawing-back leaf spring makes an electric contact with the bar. Only one electric connection is provided on this bar. Should it be desired to make the division in side A and side B of the door then this bar must be divided into two insulated parts each with its own connecting point.

For the control system according to the invention in place of non-segmented detection electrodes as illustrated on the basis of figure 3, segmented electrodes can also be used. As illustrated in figures 4 - 6, a segmented electrode (60) preferably consists of a synthetic material printed circuit (61) provided with current paths (62). On one side the current paths end in contact segments (63) separated from each other and on the other sides in a connector. A contact segment can consist of a clip which is clipped on to the current path or a soldered-on contact pin (64) as shown in figures 5 and 6. The thread tensioning and thread drawing-back provision - such as for example the spring strip (42) shown in figure 3 - will make an electric contact with the clips or the contact pin. With the connector the electrode can be linked to a flat cable. This flat cable is then linked over a matrix connecting structure to a processing unit.

It is to be noted that the specific aspects of the embodiments of the invention described above in greater detail are only intended as preferred examples within the scope of the general description of the invention given for that purpose, and must in no way be interpreted as a restriction on the scope of the invention as such or as expressed in the following claims.

Claims

1. Control system for a weaving frame from out of which pile warp threads are distributed to a weaving machine, which system comprises provisions for

detecting thread breakage and/or thread over-tension of the pile warp threads, characterized in that the detection provisions are so connected in matrix structure with the control system that the number of the signal points to be detected by the control system is reduced to a fraction of the number originating from the detection provisions, and that the detection of the signals originating from the detection provisions is effected by means of one or more micro-controllers.

to make contact with at least a part of the tensioning or drawing-back provisions in case of an extreme condition thereof.

2. Control system according to claim 1 for a weaving frame in which the aforementioned provisions for detecting thread breakage and/or thread over-tension per weaving frame part are provided in a separate module, characterized in that the detection of the signals originating from the detection provisions is effected by means of one micro-controller per module.
3. Control system according to claim 1 and 2, characterized in that the aforementioned micro-controllers are connected via a fieldbus provision to a creel controller provision of the weaving machine.
4. Control system according to claim 3, characterized in that the creel controller provision consists of a microprocessor operated processing unit which processes and translates the data originating from the micro-controllers into signals for a control unit (machine controller) of the weaving machine.
5. Control system according to claim 4, characterized in that the data originating from the micro-controllers is transmitted by the creel controller provision via a fieldbus provision for parameters to the machine controller, while control parameters can be transmitted via the machine controller to the creel controller provision via the fieldbus provision for parameters.
6. Control system according to one of the preceding claims, characterized in that the provisions for detecting thread breakage and/or thread over-tension comprise thread tensioning and thread drawing-back provisions for the pile warp threads which in case of an extreme condition of those tensioning and drawing-back provisions make contact with detection electrodes.
7. Control system according to claim 6, characterized in that at least a part of the detection electrodes consists of segmented electrodes in the form of a printed circuit provided with current paths.
8. Control system according to claim 7, characterized in that at least a part of the detection electrodes consists of a common detection conductor destined

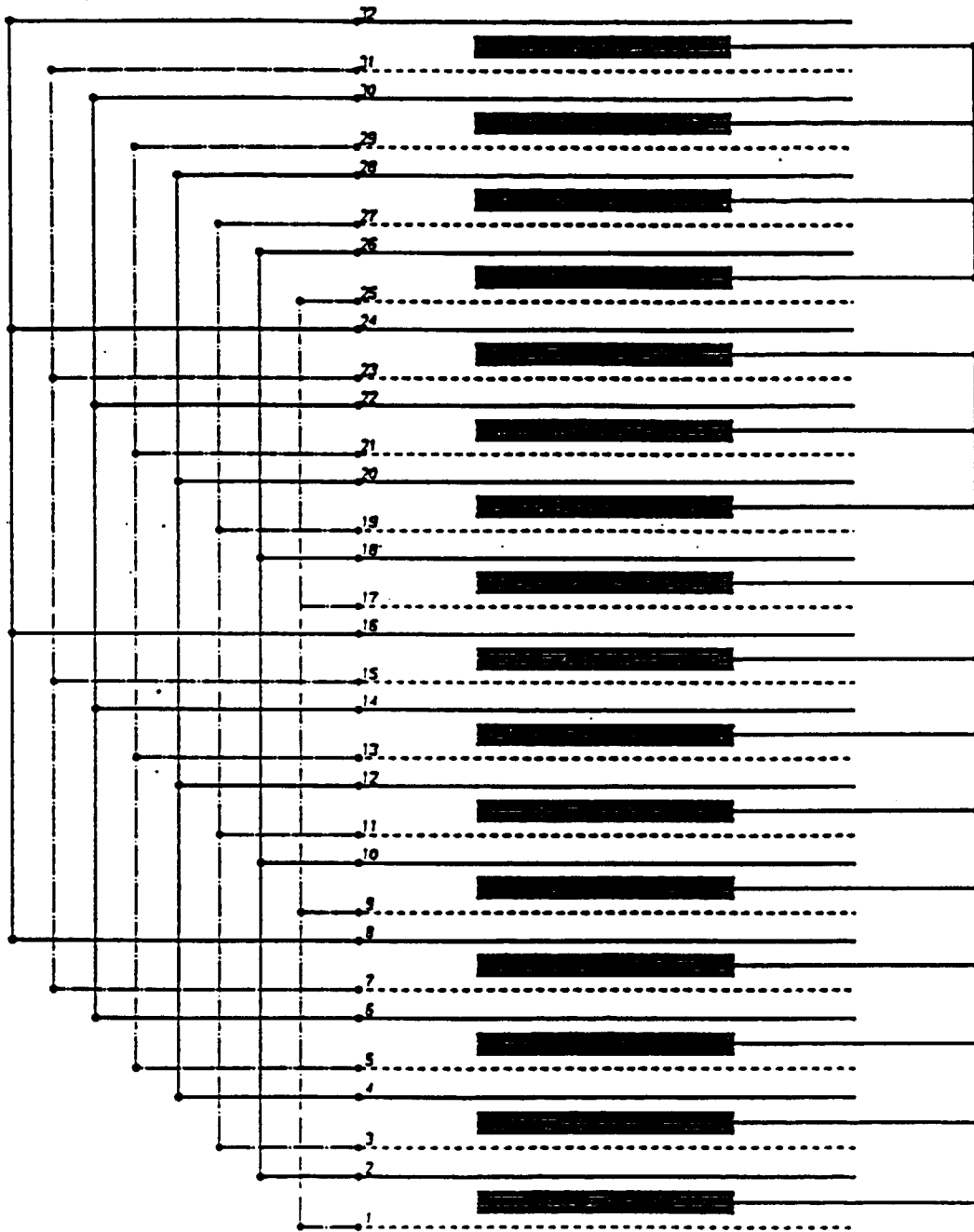


Fig.1

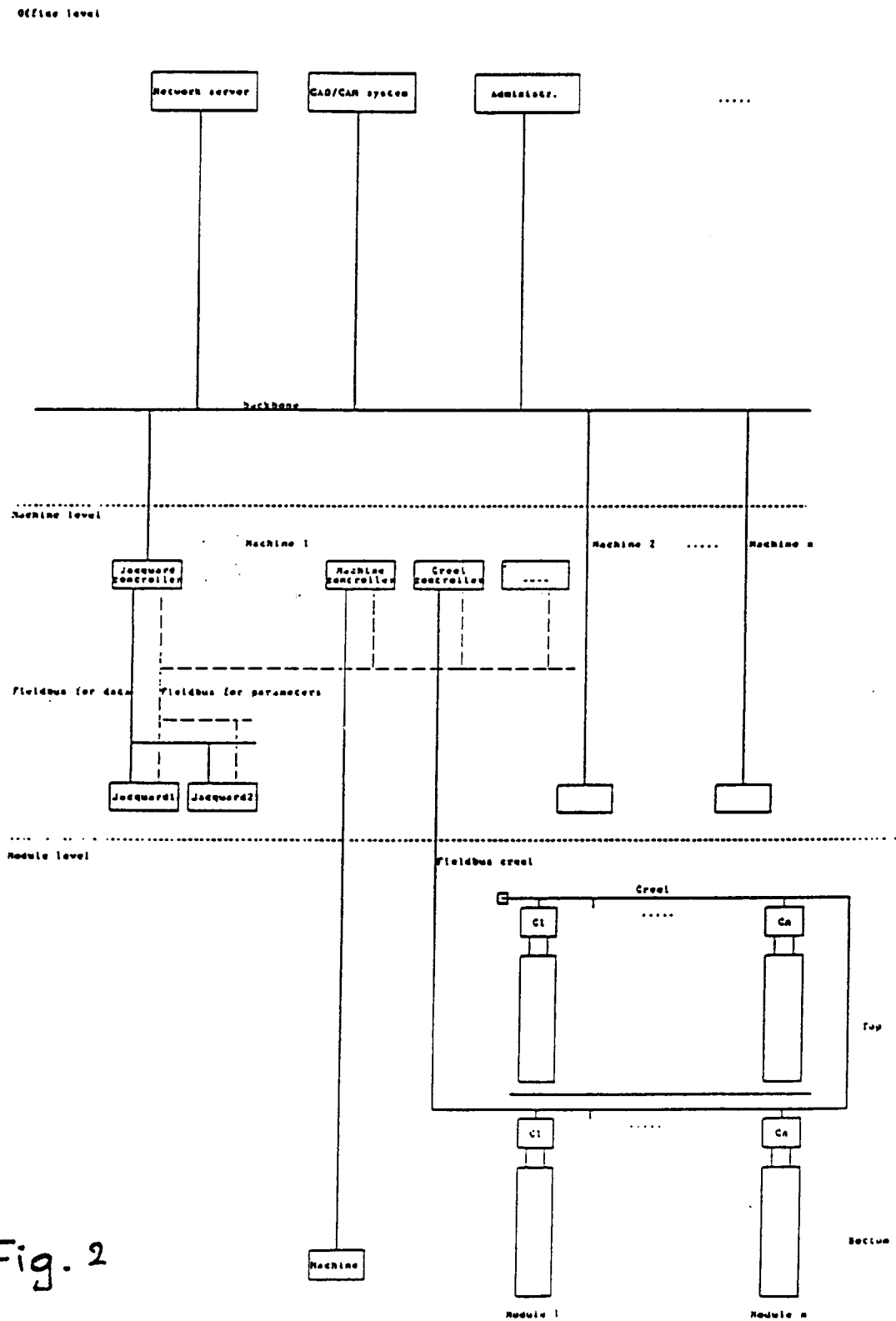


Fig. 2

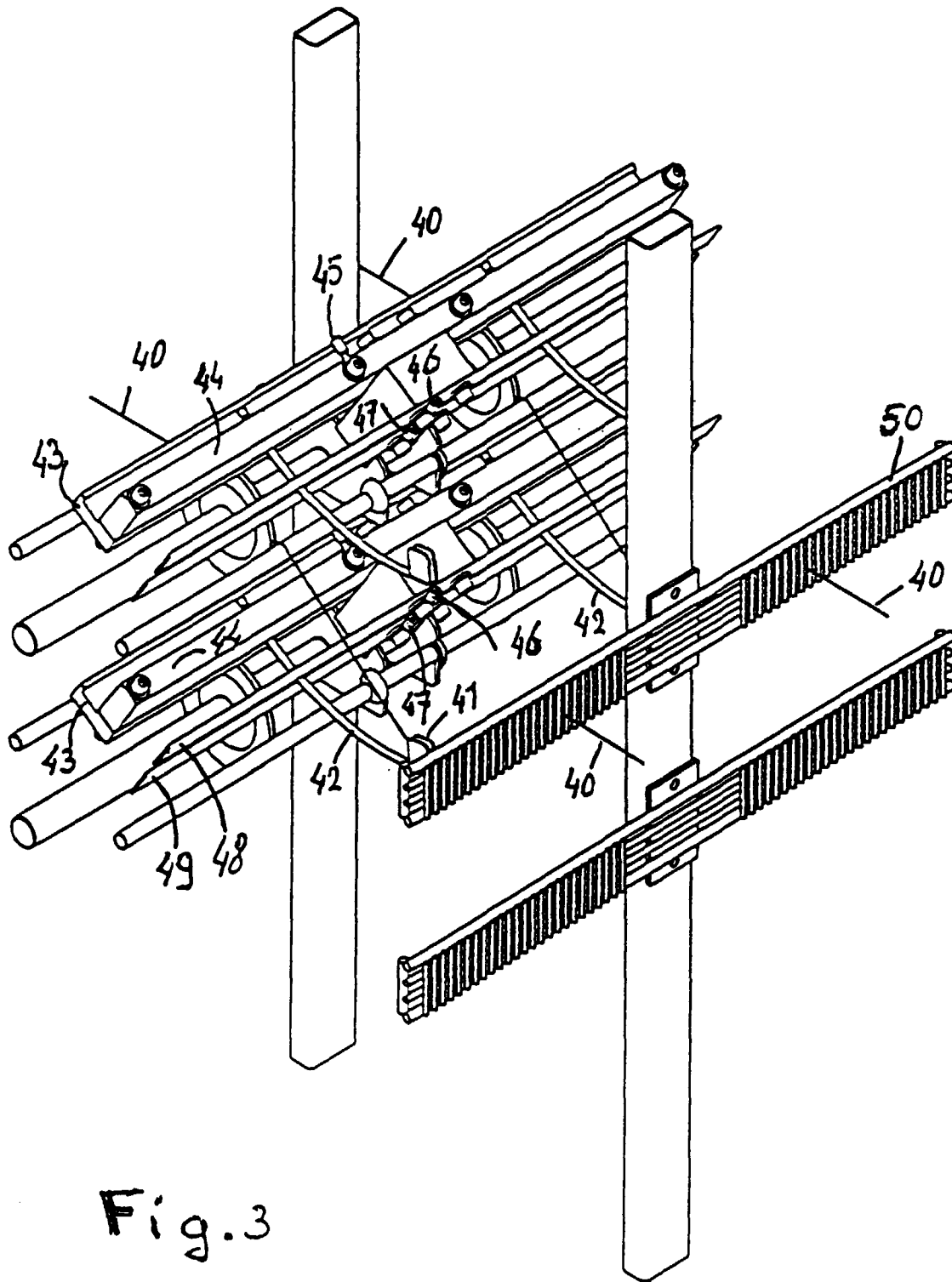


Fig. 3

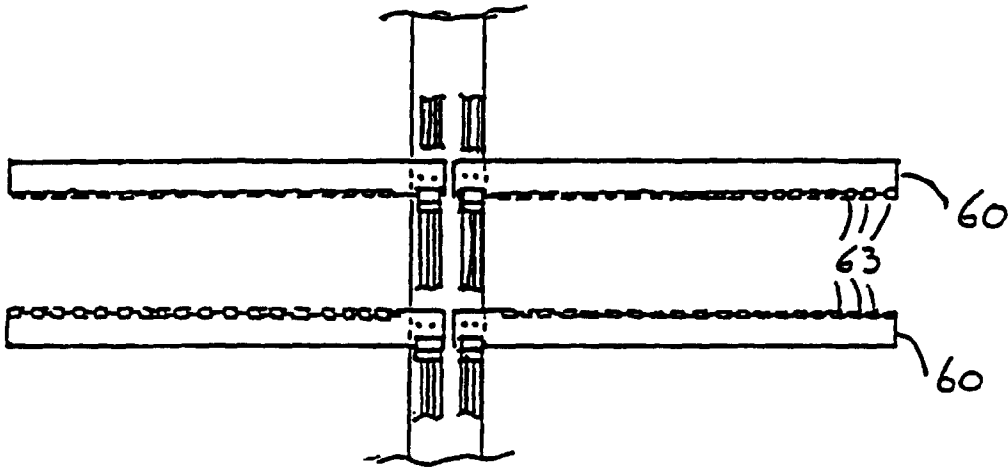


Fig. 4

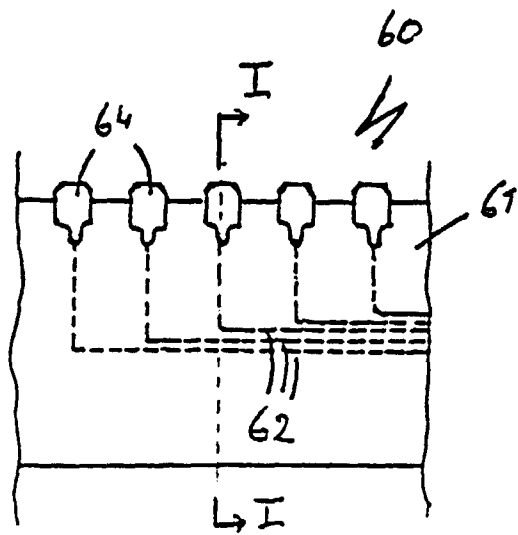


Fig. 5

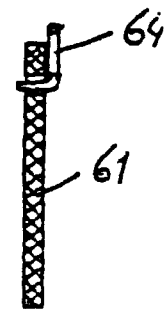


Fig. 6



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EUROPEAN SEARCH REPORT

Application Number
EP 98 20 1380

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)
A	EP 0 728 857 A (SUCKER MUELLER HACOBA GMBH) 28 August 1996 * column 2, line 34 - line 47; figure * ---	1, 3, 4, 6	D02H13/08
A,D	EP 0 742 297 A (WIELE MICHEL VAN DE NV) 13 November 1996 * column 7, line 19 - line 31; figures 5-8 *	1, 6-8	
A	GB 384 660 A (T. CARVER) * the whole document * ---	1, 6, 8	
A	BE 649 291 A (LIBREX) 15 December 1964 * figures * -----	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			D02H D03D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 2 September 1998	Examiner Rebiere, J-L
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