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(54) Electronic laser warp stop motion device.

(57) Electronic warp stop motion device, of the type wherein the breaking of a warp yarn, causing the dropping of a corresponding lamina, interrupts a luminous beam between the sending part and the receiving part of one of a plurality of photoelectric cells, provided to each control a corresponding row of warp yarns, to have said breakages signalled and to stop the loom.

The photoelectric cells of said device use beams of coherent light produced by a laser source.

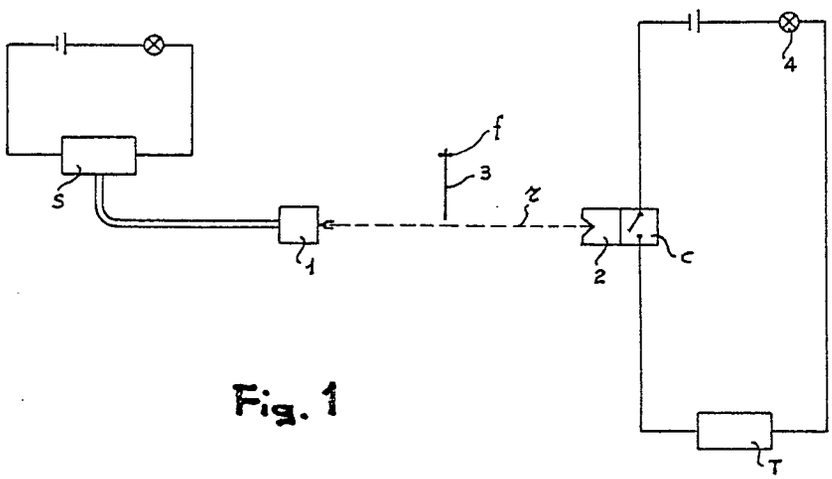

Fig. 1

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ELECTRONIC LASER WARP STOP MOTION DEVICE

The present invention concerns an electronic warp stop motion device employing sensors with beams of coherent light produced by a laser source, for use in weaving looms.

It is already widely known in the textile industry to use warp stop motion devices of the mechanical, electrical or electronic type, apt to signal the breakage of the warp yarns in a weaving loom and to accordingly stop the loom.

These devices usually comprise rows onto which the laminae supported by the warp yarns drops in case of yarn breakage, thereby signalling -each device according to its own working and signalling means - that a yarn has broken and, in the most improved devices, also the position (approximate or exact) of the broken yarn, so as to allow repairing the yarn itself.

Each of the known warp stop motion devices has considerable drawbacks: with the simpler and more economic devices it is usually difficult and it takes longer to detect the broken yarn; the more improved devices may require, according to the type of row used, the use of sophisticated materials and devices, and may involve constructive difficulties which are often too expensive. Furthermore, each of said devices almost always requires the use of laminae differing from those of the other devices, according to its working characteristics, with obvious negative consequences on the weaving. Finally, in the case of electrical devices, the detection of the breakage point and the actual working of the warp stop motion device can often be conditioned by the additional resistance determined by the dirt of the environment.

This last inconvenience is particularly serious when using - to signal the breakage and stop the loom electrooptical devices, wherein the dropping of the lamina on the row interrupts a beam of light in a photoelectric cell. Such devices - which are simple, practical and of reasonable cost - have in fact not been as widely applied as one might have expected and hoped, just on account of the faulty working which would have been determined by the dirt and dust, always present in weaving. Using devices of this type, it is in fact quite likely that the loom stops, not on account of the breakage of a warp yarn, but simply because dust or dirt have interrupted or reduced too much the beam of light, whose penetration power is notoriously limited in the case of ordinary light, by interposing between the sending part and the receiving part of the photoelectric cell, which operation is thus prevented,while all the warp yarns are perfectly intact.

This drawback and the others mentioned further above are now brilliantly overcome by the device according to the present invention, which is of the type wherein the breakage of a warp yarn, causing the dropping of a corresponding lamina, interrupts a luminous beam between the sending part and the receiving part of one of a plurality of photoelectric cells, provided to each control a corresponding row of warp yarns and to signal said breakage and stop the loom, and which is characterized in that said photoelectric cells use beams of coherent light produced by a laser source.

The use of these beams, which are very penetrating and which are therefore not influenced by the presence of obstacles - fatal for the normal luminous beams - produced by dust and by dirt, prevents false stoppings of the loom and makes the warp stop motion device safe and reliable.

According to a first, very simple and economic, embodiment of the device according to the invention, when the photoelectric cell no longer receives the laser beam of coherent light, interrupted by the dropped lamina, the circuit feeding the loom motor is disconnected, stopping the loom, and the breakage is generically signalled.

It is necessary, in this case, to search the dropped lamina in order to find the broken warp yarn, so that the advantages of the solution provided by the invention are here limited to the possibility of realizing the warp stop motion device with the photoelectric system and consist thus, in the simplicity, safety, reliability and low cost of the device itself.

A second, more complete and advantageous, embodiment of the warp stop motion device according to the invention provides for a laser source at two energy levels, so as to obtain beams of coherent light of different colourings, and for means to commute said source from the first level (to which there corresponds a colourless or soft coloured luminous beam) to the second level (to which there corresponds a deep coloured luminous beam which is particularly evident) when said first beam is interrupted - between the sending part and the receiving part of the corresponding photoelectric cell - by the dropped lamina. In this case, the deep coloured beam, which settles between the sending part of the photoelectric cell and the dropped lamina, allows the inspection personnel - warned by the usual generic signaling of the loom stopping -to easily and immediately detect said dropped lamina and thus the broken warp yarn.

According to a third, more sophisticated, embodiment of the invention, the position of the dropped lamina (and thus of the broken warp yarn) is furthermore electronically detected, by providing the device according to the invention also with

means to compare and process the times taken by the luminous coherent laser beam sent by the sending part of the photoelectric cell to reach the dropped lamina and, respectively, the receiving part of the photoelectric cell, and with means apt to indicate in digits the corresponding distance between the lamina interrupting the beam and the sending part of the photoelectric cell, the second of said comparison times being calculated thanks to the connection by means of optic fibres of the sending and receiving parts of the photoelectric cells.

The second and third embodiment of the warp stop motion device according to the invention add to the advantage of safety and reliability - provided by using the relatively simple and economic means of the first embodiment of the invention - also that, which is very important for productivity purposes, of being able to detect with extreme precision and rapidity the position of the dropped lamina, and thus of the broken warp yarn, for a prompt restart of the loom, thereby reducing both the dead stopping times of the machine and the personnel required to control a certain number of machines.

The device according to the invention also introduces the importtant simplification of eliminating from the loom the conventional rows -special bars, of different type according to the laminae being used, which require a delicate and costly machining - replacing them by simple nickel-plated spacing bars, of a single type, already used for other operations in the field of textile workings (for example, in order to draw the groups of laminae or drop wires of the rows for selvedge thread drafting). Furthermore, since the working of the device according to the invention is based on the interruption of luminous beams, it is possible to use for all the looms any type of drop wires, among the many kinds existing on the market.

It is evident that both simplifications are highly appreciable, both from the point of view of industrial organization and as far as costs are concerned.

The warp stop motion device can be advantageously used both in cotton mills and in silk weaving, thereby unifying the whole warp stop motion devices for the various types of looms, with the only precaution of using low power laser sources for security purposes in respect of the personnel concerned (in practice, powers not exceeding about 0.5 mW are adopted in order to avoid resorting to the specific protections which would otherwise be required).

The invention will now be described in further detail, by mere way of example, with reference to the accompanying drawings, which illustrate a preferred embodiment thereof and in which:

Fig. 1 is a diagram of a first simplified embodiment of the warp stop motion device according to the present invention;

Figs. 2 and 3 are diagrams of two more complete embodiments of the invention; and

Fig. 4 is a perspective comprehensive view of the embodiment of fig. 3 of the warp stop motion device according to the invention.

In the case of fig. 1, the warp stop motion device comprises a laser source S, suitably fed, which energizes a plurality of photoelectric cells (only one of them being illustrated) positioned sideby-side on a horizontal plane parallel to the warp yarns. The beam r of coherent light sent by the sending part 1 of each photoelectric cell - perpendicular to said yarns - normally reaches the receiving part 2 of the same cell, which is associated to a commutator C of the circuit feeding the loom T. Between the two parts 1 and 2 of the photoelectric cell, the warp yarns of the loom - of which only the yarn f is shown - each support in known manner a lamina or drop wire 3, above the beams r, on vertical planes which substantially contain said yarns f and which are parallel one to the other and perpendicular to said beams.

During working of the device, the laser source S produces, through the sending part 1 of the photoelectric cells, beams of coherent light which, in normal conditions, reach the receiving part 2 of said photoelectric cells and thus keep the commutator C in a closing position, with the motor of the loom T duly fed and in running conditions. As long as all the drop wires 3 are hanging from their yarns f, the loom runs regularly, even in the presence of dirt and considerable dust, thanks to the high capacity of penetration of the coherent beams r.

When instead one of the warp yarns f breaks, the corresponding drop wire 3, no longer supported, drops and bears onto a spacing bar (not shown in fig. 1, but similar to the bar 11 shown in fig. 4), thereby interfering with the beam r and interrupting it. The receiving part 2 of the corresponding photoelectric cell, no longer energized by the beam, causes the commutator C to move into its opening position, so as to stop the working of the loom T whose motor is no longer fed by current. Simultaneously, a warning signal 4, is emitted from the circuit controlled by the commutator C, in order to call the attention of the inspecting personnel.

As already pointed out, the advantage provided by this first simple embodiment of the invention lies in the possibility to be able to conveniently produce a warp stop motion device with photoelectric sensors apt to guarantee, with a very simple construction and low costs, a safety and a reliability which could not be previously obtained. Nevertheless, in the device heretofore described, in order to

find the broken warp yarn it is necessary to search in the most conventional manner for the dropped wire which has interrupted the beam 2 between the sending and receiving parts of the photoelectric cell of its row.

In the case of the embodiment of fig. 2 of the warp stop motion device, the laser source is a source Ss at two energy levels, which can be commuted from one level to the other by means of an associated switch D controlled by the commutator C, while the remaining part of the device is substantially unchanged in respect of the previous embodiment of fig. 1.

During working of this device, when the beam r (which will normally send a white or soft coloured light) is cut off by the dropped wire 3, not only does it cause - as in the previous case - the stopping of the loom and the signalling of the breakage, but the opening of the commutator C causes furthermore the operation of the switch D. The laser source Ss then changes from the operation at a normal steady energy level to the operation at a different energy level, to which there corresponds a deep coloured beam r - which can be noticed at once by the inspection personnel - between the sending part 1 of the photoelectric cell controlling the row to which the broken warp yarn belongs, and the respective lamina 3 which has dropped onto the spacing bar. This clearly visible coloured beam allows to quickly and exactly detect the broken yarn.

In the case of the more sophisticated embodiment illustrated in fig. 3, the warp stop motion device of fig. 2 is completed with the addition of electronic means to compare and process the times taken for the beam r to move from part 1 of the photoelectric cell to the dropped wire 3 and, respectively, to the part 2 of the same cell. The first of these times is measured by means of receivers 5 of the beam reflected by the lamina or dropped wire 3, while the second time is measured thanks to a connection by means of optic fibres 6 between part 1 and part 2 of the photoelectric cell. The processing of the above times involves the calculation and display, in a suitable warning panel 7, of the distance in mm between the dropped wire 3 and part 1 of the photoelectric cells, for the immediate and precise detection of the broken warp yarn, the row pertaining to which is besides clearly evidenced by the fully perceptible changed colouring of the beam r which has been interrupted.

Fig. 4 of the drawings shows an example of practical realization of the warp stop motion device according to the embodiment of fig. 3, with three photoelectric cells representing as many rows, having their sending and receiving parts enclosed in protection cases, 8 and 9 respectively, and the optic fibres 6 protected by a tube 10.

It is evident that the warp stop motion device according to the embodiments of figs. 2, 3 and 4 adds to the advantages of simplicity and reliability provided by the warp stop motion device shown in fig. 1, also that - which is very important for productivity purposes - of being able to detect with extreme precision and rapidity the position of the dropped wire, and thus of the broken warp yarn, for a prompt restart of the loom, thereby reducing both the dead stopping times of the machine and the personnel required to control a certain number of machines. This latter, in fact, as soon as warned by the signal 4 that a warp yarn has broken and the loom has stopped, can immediately locate, by observing the deep coloured beam r sent by the photoelectric cells, the row of the broken yarn and quickly find the lamina or dropped wire of said row and the actual broken yarn. In the embodiment of figs. 3 and 4, the exact position of the dropped wire and of the broken yarn in the row concerned may be detected even more easily by reading the digits of the warning panel 7 expressing the distances in mm between the yarn itself and the sending part 1 of the photoelectric cell of the row concerned.

Other embodiments of the warp stop motion device according to the present invention could of course be realized without thereby departing from the scope of the invention itself.

For example, it could be possible to associate to the laser source of the device outputs with optic fibres in a number exceeding that of the rows of warp yarns, to be used for codings of various types allowing to increase the automation of the loom and/or improve its adjustment, and to obtain statistical and information data of various kinds.

It will also be possible to connect to the described and illustrated devices various types of flash or digital signalings.

Claims

1) Electronic warp stop motion device, of the type wherein the breaking of a warp yarn, causing the dropping of a corresponding lamina, interrupts a luminous beam between the sending part and the receiving part of one of a plurality of photoelectric cells, provided to each control a corresponding row of warp yarns, to have said breakages signalled and to stop the loom, characterized in that said photoelectric cells use beams of coherent light produced by a laser source.

2) Device as in claim 1), wherein said laser source is at two energy levels so as to obtain beams of coherent light of different colourings, and wherein means are provided to commute said source from the first level (to which there cor-

responds a colourless or soft coloured luminous beam) to the second level (to which there corresponds a deep coloured luminous beam which is particularly evident) when said first beam is interrupted - between the sending part and the receiving part of the corresponding photoelectric cell - by the dropped lamina.

3) Device as in claim 2), wherein said commuting means are controlled by the circuit signalling the warp yarn breakage and stopping the loom when said beam is interrupted.

4) Device as in claim 2), comprising also means to compare and process the times taken by the luminous coherent laser beam sent by the sending part of the photoelectric cells to reach said dropped lamina and, respectively, the receiving part of the photoelectric cell, and means apt to indicate in digits the corresponding distance between the lamina interrupting the beam and the sending part of the photoelectric cell, the second of said comparison times being calculated thanks to the connection by means of optic fibres of the sending and receiving parts of the photoelectric cells.

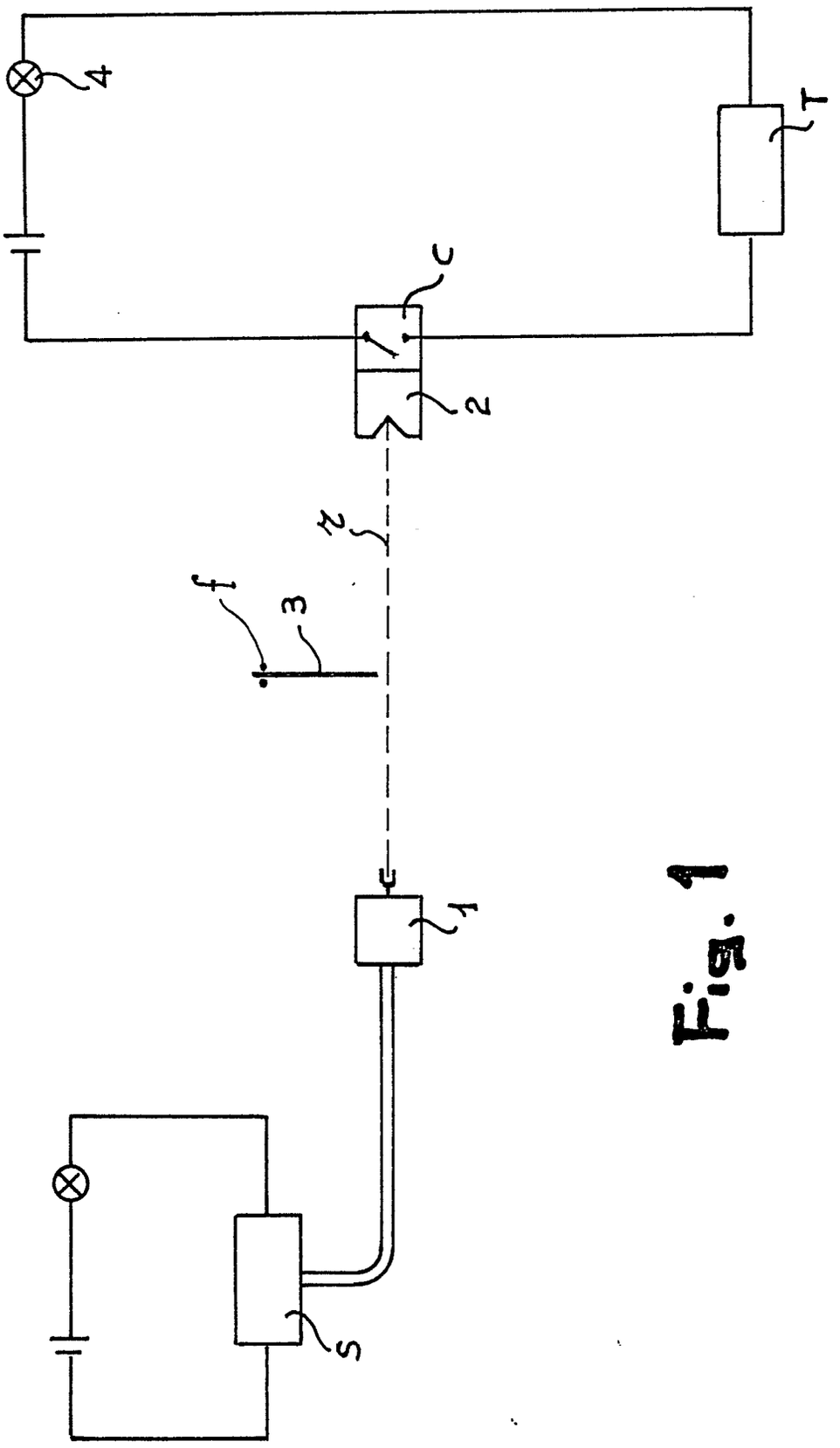

Fig. 1

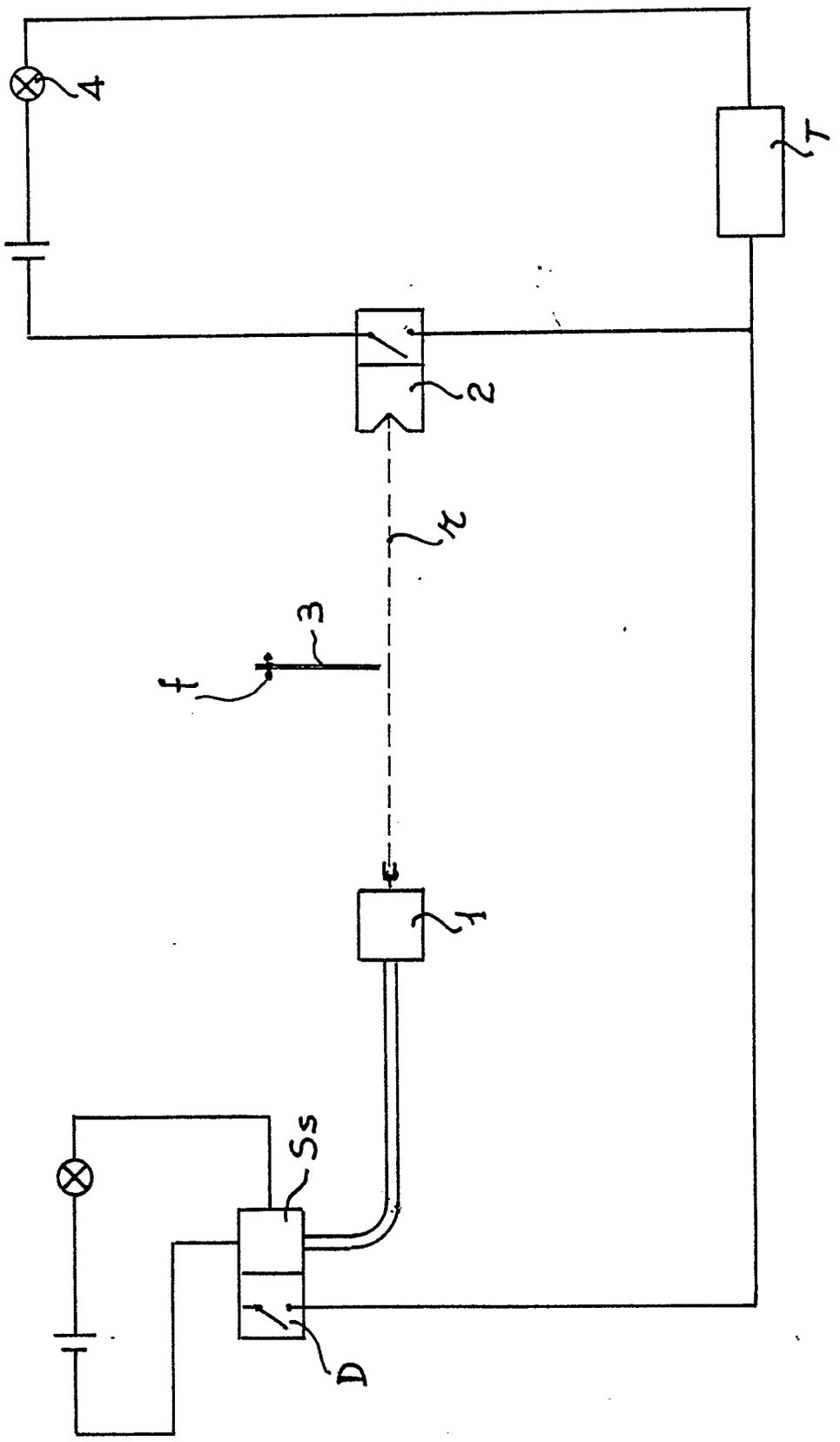

Fig. 2

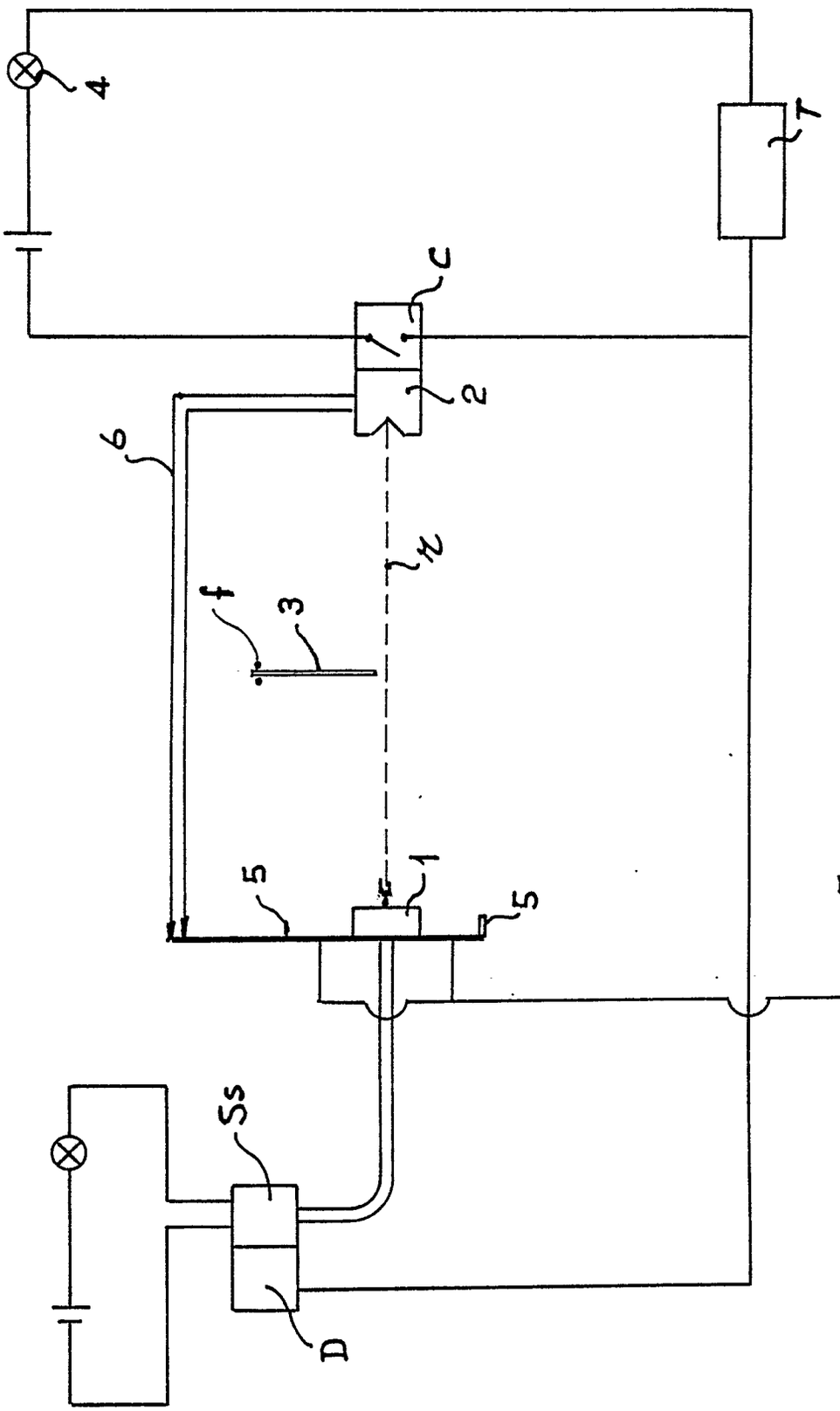

Fig. 3

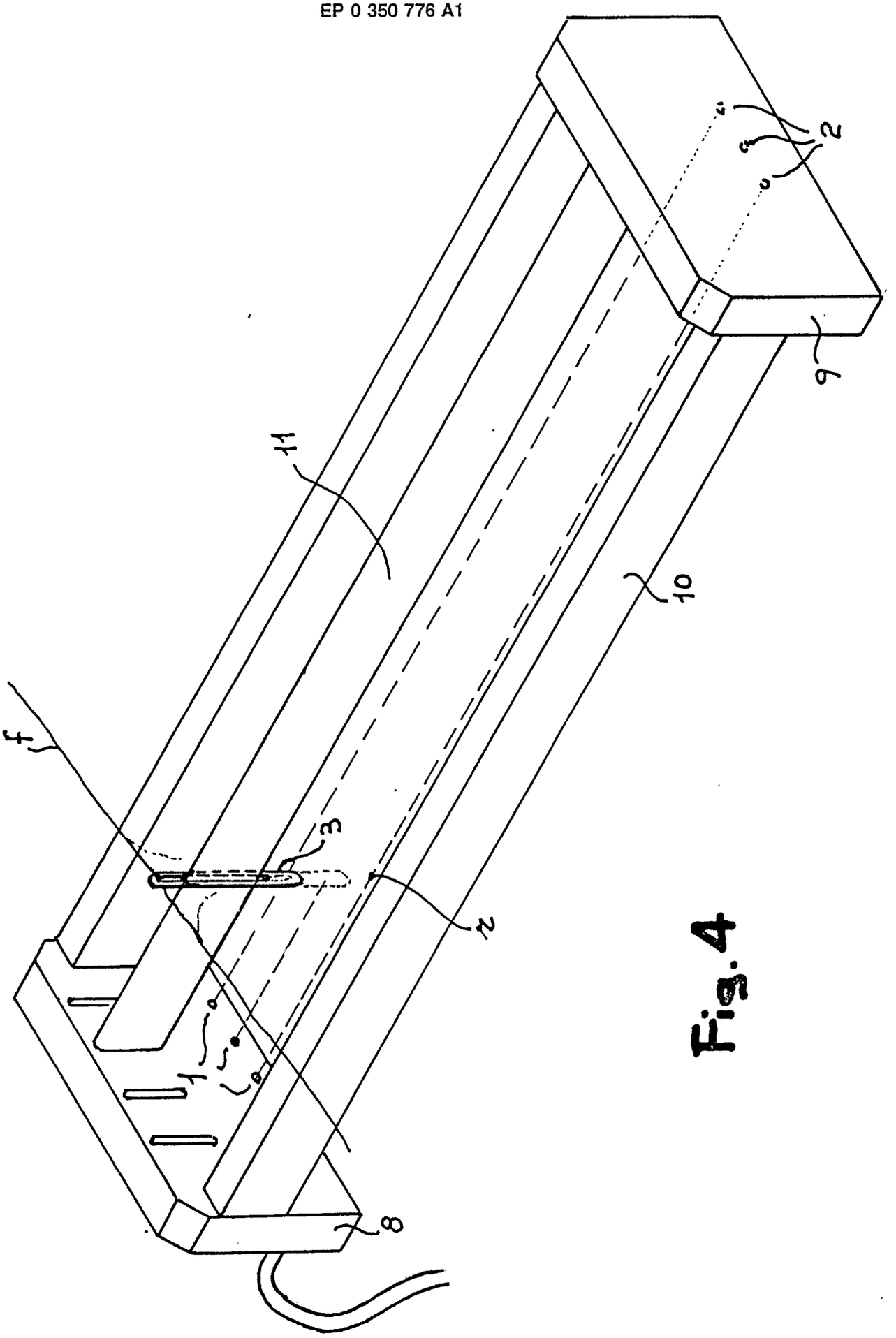

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number

EP 89 11 2266

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)
X	FR-A-2150357 (NORDISKA) * page 7, line 4 - line 6; claim 1 *	1	D03D51/28
X	DE-A-2034485 (SICK) * page 2, line 17 - page 3, line 31; claims 1, 2; figure 1 *	1, 3	
X	DE-A-2628664 (JAGER) * claim 1 *	1	
A	EP-A-0234630 (PICANOL) * abstract *	4	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

D03D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	05 SEPTEMBER 1989	BOUTELEGIER C.H.H.

CATEGORY OF CITED DOCUMENTS

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