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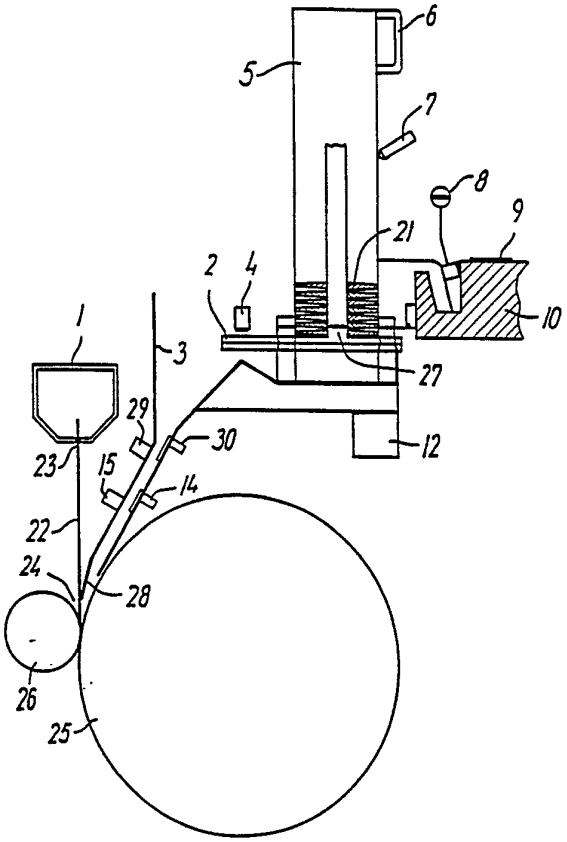
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(54) Title: AN APPARATUS FOR SECURING FITTINGS IN A THERMOPLASTIC FOIL WEB

(57) Abstract

An apparatus for manufacturing a foil web of a thermoplastic with locally secured fittings (21), for use as tarpoulins or similar articles, comprises an extruder head (1) with an entirely or mainly downwards directed ejection orifice and two counterrotating rollers (25, 26) with a nip for calibrating the extruded foil (22). In a feeding device with a vertical supply magazine (10) a stack of fittings (5) is accommodated which by means of a guiding duct (2) may be guided into a discharge duct (3) extending towards the roller nip. The guiding device is electrically operated and an electrically controlled stop member (15) with an associated fitting sensing element (12) are arranged at the lowermost end of the discharge duct (11-15) towards the roller nip (24) for accurate control of the supply of fittings to the roller nip and monitoring the presence of fittings in the discharge duct. The discharge duct is arranged in such a relationship to said counter rotating collers (25, 26) that each fitting is supplied from the mouth of the discharge duct (25) to the roller nip (24) by a substantially free fall.



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An apparatus for securing fittings in a thermoplastic foil,web.

The invention relates to an apparatus for manufacturing a foil web of a thermoplastic with locally secured fittings for use as tarpaulins or similar articles, comprising an extruder head with an entirely or mainly downwards directed ejection orifice and two counterrotating rollers or similar members arranged below the ejection orifice, at least one of said rollers or members being cooled, said rollers or members forming between them a nip for calibrating the extruded foil, and a feeding device with an entirely or mainly vertical supply magazine for accomodating a stack of fittings, a discharge duct extending from the bottom of the supply magazine in a direction towards the roller nip and a guiding device for guiding the lowermost fitting in the magazine into the discharge duct.

An apparatus of this kind, which is used for example for the fastening of eyelets in a plastic foil web, which is subsequently to be cut in suitable lengths for production e.g. of tarpaulins for covering purposes in construction works is known from DK-published patent application No. 130 239.

In this prior art apparatus the guiding device formed as a reciprocating slide is driven by a hydraulic or pneumatical working cylinder and the discharged duct of the feeding device is arranged and designed in such a way that the supplied fittings are guided from the mouth of the duct towards the roller nip by the cooled roller.

Thereby, it is only possible to obtain a relatively inaccurate positioning of the fitting in the foil web, since the velocity with which the fittings are supplied from the mouth of the discharged duct is mainly determined by the stroke velocity of the slide.

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The ejection of fittings may thereby in an unpredictable way take place at such a velocity, that the fittings strike holes in the soft foil web.

When a number of feeding devices arranged on a line in the axial direction of the rollers are used for fastening fittings along a corresponding line in the foil web in one operation, local differences in the surface character of the cooled roller has moreover led to a releatively inaccurate supply of the fittings of the roller nip.

Whereas these disadvantages have to a certain extent been acceptable in case of foil tarpaulins for singular use, they are not acceptable, when a greater number of tarpaulins are used for covering in construction works and arranged with overlapping edges since the said inaccuracies entail that the eyelets along the overlapping edges cannot be positioned opposite each other.

It is the object of the invention to provide an apparatus of the kind referred to, by which the said disadvantages are avoided so that the fittings are positioned with a great accuracy in the foil web and at a substantially higher working speed than has been possible in the above mentioned prior art apparatus, while at the same time a very high safety against malfunction, e.g. failing supply of fittings from one or more of a number of feeding devices, is obtained and thereby a considerable reduction of the rejection percentage.

To achieve this an apparatus according to the invention as characterized in that the guiding device is electrically operated and an electrically controlled stop member with an associated fitting sensing element are arranged in the vicinity of the lowermost end of the discharge duct towards the roller nip for accurate control of the supply of fittings to the roller nip and

minitoring the presence of fittings in the discharge duct, the discharge duct being arranged in such a relationship to said counter rotating collers that each fitting is supplied from the mouth of the discharge duct to the roller nip by a substantially free fall.

Thereby, in addition to a more accurate control of the movement per se of the guiding device the advancement of fittings from the mouth of the discharge duct to the roller nip will be independent of the movement of the guiding device as well as the surface character of the roller and may thereby be controlled with a uniform and constant speed in such a way that damage to the foil web is avoided also in cases, where a great number of feeding devices are arranged on a line in the axial direction of the rollers.

Moreover, by means of the fitting sensing member it is to a large extend made sure that a fitting will always be present in the discharge duct prior to operation of the controlled stop member.

This safety may be further improved in that a further controlled stop member with an associated fitting sensing element is arranged as a buffer device a distance above said stop member, said sensing element being connected via a control circuit to an operating device for said guiding device.

In the following the invention will be further explaned with reference to the schematical drawing in which,

Fig. 1 shows an example of a tarpaulin with locally fastened eyelets cut out from a reinforced thermoplastic foil web,

Fig. 2 and 3 shows an example of an eyelet fitting,

Fig. 4 a preferred embodiment of an apparatus according to the invention, and

Fig. 5 a simplified control diagram.

Fig. 1 shows an example of a tarpaulin 20 cut out from a net reinforced web of thermoplastic foil such as polyethylene foil having a rectangular shape and being provided with eyelet fittings 21 fastened at separated positions along all edges of the tarpaulin.

In Fig. 2 and 3 an example is shown of an eyelet fitting 21 in the form of a flat circular disc with a central eyehole extending through approximately one third of the diameter of the disc. As shown in Fig. 3 the thickness of the disc decreases towards a rather thin edge at the circumference of the disc such as known per se from the above-mentioned Danish published patent application No. 130239.

The eyelet fitting 21, which is preferably manufactured from a cast moulded plastics constitutes, howeever, only an example of such fittings, which may be fastened to a foil web by means of an apparatus according to the invention. As further possible forms of such fittings, which may also be manufacatured from metal or other materials, shackles, buckles or hooks may be mentioned.

In the embodiment of the apparatus shown in Fig. 4 the foil web 22 consisting of a thermoplastic is extruded from an extruder head 1 formed as a wide slit ejector and having a downwards directed ejection orifice 23 towards the roller nip 24 between two counterrotating rollers 25 and 26 arranged below the ejection orifice, at least one roller 25 being a cooled roller.

The apparatus comprises a tubular and substantially vertical supply magazine file arranged above the cooled roller 25 for accomodating a stack of eyelet fittings 21 having a form as shown in Figs. 2 and 3.

By means of a reciprocating slide 2 operated by an electric motor 12 with an associated gearbox through a connecting rod mechanism not shown and having

an upwards directed projection 27 matching the central hole in the eyelet fittings 21, the lowermost fitting in the stack in the magazine 5 may be guided outside the magazine to a position, in which it is detached from the slide 2 by means of a detaching device 4 and at the return movement of the slide 2 falls down in the upper end of a slidlike discharge duct 3.

The discharge duct 3 extends mainly linearly through an inclination of substantially 70° with the horizontal downwards towards the roller nip 124 with its mouth positioned immediately above the roller nip.

At its mouth the duct 3 has a guiding plate 28 for accurate guiding the direction of an eyelet supplied from the duct towards the roller nip 24.

In the vicinity of the lowermost end of the discharge duct 3 an electrically controlled stop member 15 is arranged and immediately above this a sensing element 14 for sensing the presence of a fitting 21 at the position in the duct 3 determined by the stop member 15.

At a position upstream in the duct 3 a further electrically controlled stop member 29 with an associated sensing element 30 is arranged as a buffer device.

In order to sense the height of the stack of fittings in the magazine 5 a sensing element 7 is provided in connection therewith.

For the purpose of manually moving the entire feeding device the magazine 5 is further provided with a handle 6.

By means of a locking device 8 the feeding device may be locked in any desired position along a mounting bar 10 extending parallel to the axial direction of the rollers 25 and 26, on the other side of which a yardstick may be provided for accurate po-

sitioning of a number of feeding devices side by side on a line parallel to said axial direction.

The feeding devices may be positioned as closely on the mounting bar 10 as the width of the individual feeding device allows e.g. with a mutual separation down to 14 cms.

As shown in the diagram in Fig. 5 several feeding devices may be controlled by means of a common electronic control device 32 such as a PLC/PPC-control circuit receiving signals from sensing elements 7, 14 and 30 in each feeding device and generating energizing signals for the motor 12, the detaching device 4 and for release of the stop members 15 and 29 in response to such signals.

An alarm device 33 may be connected to the control device 32 for generating a visual and/or acustical alarm signal, when the height of the stack of fittings in the supply magazine 5 of a feeding device falls below a level corresponding to the position of the sensing element 7. Correspondingly, the control device may be programmed to generate an alarm signal if no fitting reaches the stop member 29 in spite of repeated operation of the motor 12 and the detaching device 4.

The control device 32 may be programmed for accurate positioning of fittings in the foil web 22 in any desired configuration, e.g. also along diagonal lines as shown at 34 and 35 in Fig. 1.

In itself, generation of the reciprocating movement of the slide 2 by means of a connecting rod mechanism operated by an electric motor provides high safety for the slide to gripping the lowermost eyelet in the stack of fittings in the magazine 5 during each stroke and for detaching this eyelet from the slide by means of the detaching device 4 since the relevant extreme positions of the slide correspond to the dead points in the connecting rod movement.

A further improved safety may be provided by a arranging the control device to operate the electric motor 12 so as to be briefly stopped in diametrically opposite rotor positions corresponding to said extreme positions.

The electric motor 12 may be a controlled DC-motor or a step motor, in which latter case a high accuracy may be obtained by adjustment of the pulse shape and frequency for the control pulses.

PATENT CLAIMS

1. An apparatus for manufacturing a foil web of a thermoplastic with locally secured fittings (21), for use as tarpoulins or similar articles, comprising an extruder head (1) with an entirely or mainly downwards directed ejection orifice and two counterrotating rollers (25, 26) or similar members arranged below the ejection orifice, at least one of said rollers or members (25) being cooled, said rollers or members forming between them a nip for calibrating the extruded foil (22), and a feeding device with an entirely or mainly vertical supply magazine for accomodating a stack of fittings (5), a discharge duct (3) extending from the bottom of the supply magazine in a direction towards the roller nip and a guiding device (2) for guiding thelowermost fitting in the magazine into the discharge duct, c h a r a c t e r i z e d in that the guiding device is electrically operated and an electrically controlled stop member (15) with an associated fitting sensing element (12) are arranged in the vicinity of the lowermost end of the discharge duct (11-15) towards the roller nip for accurate control of the supply of fittings to the roller nip and monitoring the presence of fittings in the discharge duct, the discharge duct being arranged in such a relationship to said counter rotating collers (25, 26) that each fitting is supplied from the mouth of the discharge duct (25) to the roller nip (24) by a substantially free fall.

2. An apparatus as claimed in claim 1, c h a r a c t e r i z e d in that a further controlled stop member (29) with an associated fitting sensing element (30) is arranged as a buffer device a distance above said stop member (15), said sensing element (30) being connected via a control circuit to an operating device for said guiding device.

3. An apparatus as claimed in claim 2, c h a r a c t e r i z e d in that an alarm device (33) is connected to said control circuit for actuating an alarm when no fitting has been guided on to said fitting sensing element (30) after several repeated operations of the guiding device.

4. An apparatus as claimed in any of the preceeding claims c h a r a c t e r i z e d in that said discharge duct (3) extends substantially linearly from said feeding device to a mouth at a short distance from the roller nip, a guide plate (28) being arranged at the mouth for accurately guiding the direction of the fittings.

5. An apparatus as claimed in claim 4 c h a r a c t e r i z e d in, that the discharge duct (3) has an inclination of substantially 70° with respect to the horizontal.

6. An apparatus as claimed in any of the preceding claims c h a r a c t e r i z e d in, that the feeding device with associated discharge duct (3) is mounted for lateral displacement in the axial direction of the rollers and for being locked in any desired position.

7. An apparatus as claimed in any of the preceding claims c h a r a c t e r i z e d in that a sensing element (7) is arranged at said suipply magazine (5) for sensing the heigth of the stack of fittings.

8. An apparatus as claimed in claim 2 c h a r a c t e r i z e d in, that the guiding device (2) with associated operating device comprises a reciprocating slide, which via a connecting rod is operated by an electric motor (12) so as to be briefly stopped at its two extreme positions, in which it grips the lowermost fitting (21) from the stack of fittings in the supply magazine and delivers said fitting at the upper end of the discharge duct by means of an electrically controlled detaching member (4).

9. An apparatus as claimed in any of the preceding claims c h a r a c t e r i z e d in that a number of fitting devices with associated discharge ducts arranged in predetermined positions along the axial direction of the rollers are controlled by a common PLC/PPC control unit.

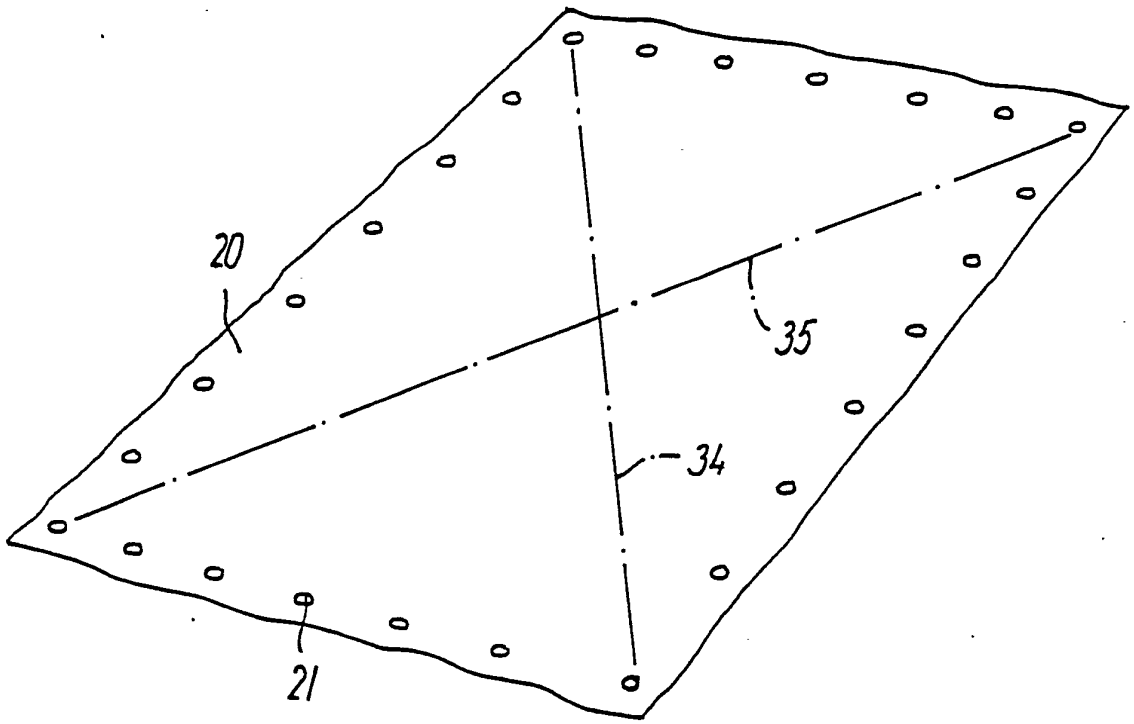


FIG. 1

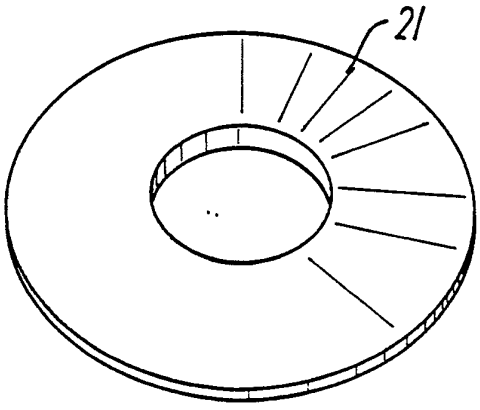


FIG. 2



FIG. 3

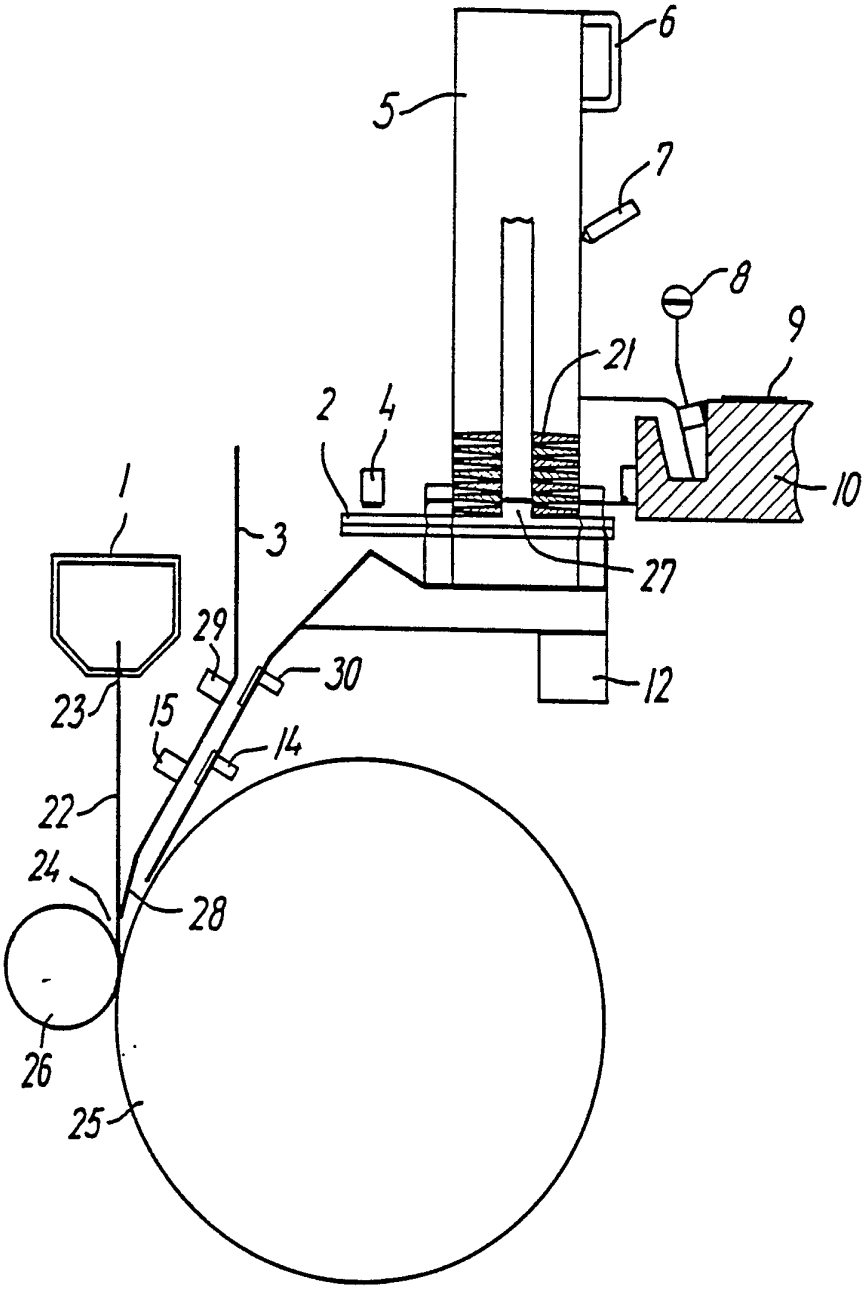


FIG. 4

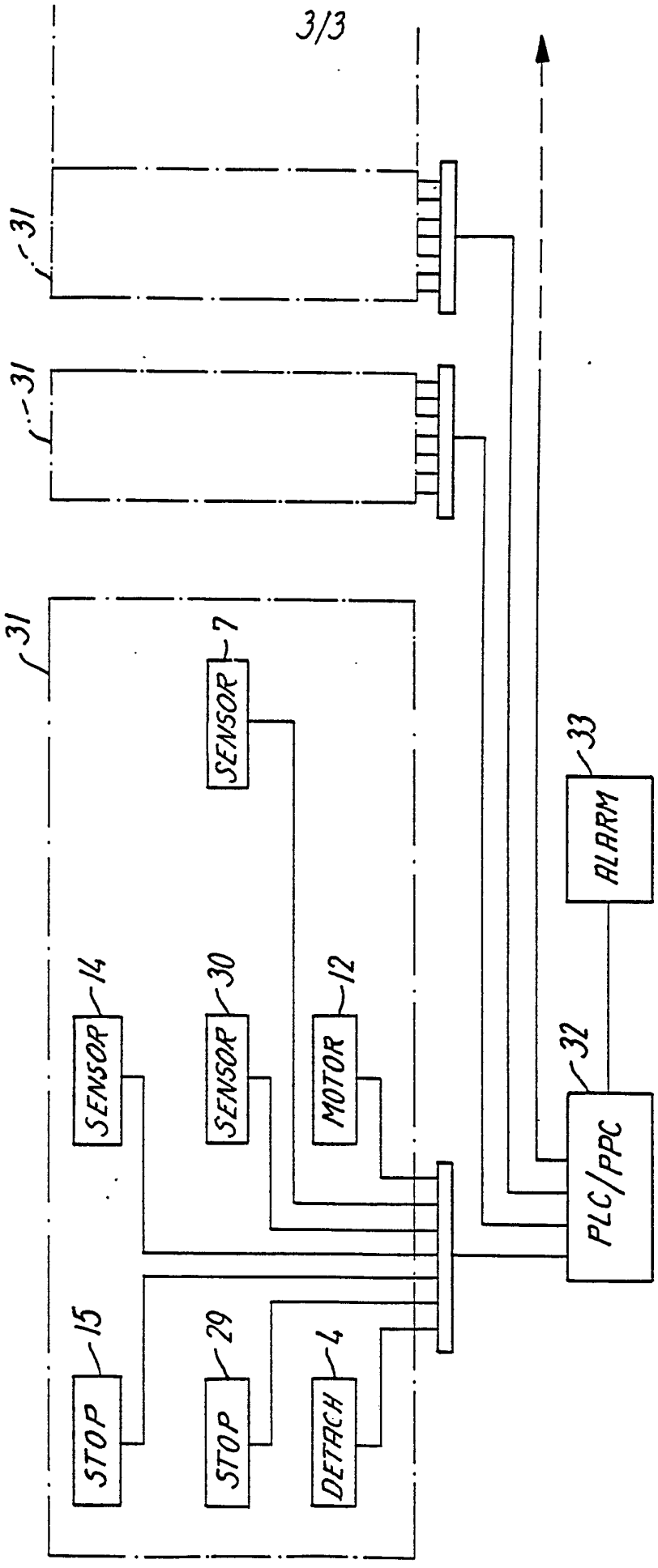

31
31
31
SENSOR
7
SENSOR
14
SENSOR
30
MOTOR
12
STOP
15
STOP
29
DETACH
4
ALARM
33
PLC/PPC
32

FIG. 5

INTERNATIONAL SEARCH REPORT

International Application No PCT/DK 90/00171

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: B 29 C 67/12

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	B 29 C; B 29 D

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
A	US, A, 3909340 (ERIK SØLBECK) 30 September 1975, see the whole document --	1
A	US, A, 3219507 (HURL W. PENMAN) 23 November 1965, see the whole document --	1
A	DK, B, 130239 (ERIK SØLBECK) 27 January 1975, see the whole document --	1

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* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

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"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
18th August 1990	1990 -10- 11
International Searching Authority	**Signature of Authorized Officer**
SWEDISH PATENT OFFICE	Allan Westrin

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

DK,B, 130 239 and US,A, 3 909 340
belong to the same patent family.

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE [1]

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers....., because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim numbers....., because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claim numbers....., because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING [2]

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the the claims. It is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additonal fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional seach fees.

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.PCT/DK 90/00171

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the Swedish Patent Office EDP file on 90-08-28
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US-A- 3909340	75-09-30	AT-B-	347114	78-12-11
		AU-B-	461261	75-05-22
		AU-D-	5437773	74-10-17
		BE-A-	797973	73-07-31
		CA-A-	1014310	77-07-26
		CH-A-	560096	75-03-27
		DE-A-	2317015	73-11-08
		FR-A-B-	2180900	73-11-30
		GB-A-	1416374	75-12-03
		JP-C-	991382	80-03-27
		JP-A-	49021461	74-02-25
		JP-B-	54019907	79-07-18
		NL-A-	7304960	73-10-23
		SE-B-C-	379959	75-10-27
US-A- 3219507	65-11-23	NONE		
DK-B- 130239	75-01-27	NONE		