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(54) **Packaging sealing mechanism and method.**

(57) A jam prevention device comprises a light beam source (63) that emits a light beam and is located on a main frame structure of a packaging machine in the machine's sealing section. During operation, the light beam is reflected off two reflective surfaces located on a moveable support operably connected to a prime mover (14). The reflected beam is received by a receiver (64) located opposite the source. A clamping sub-assembly (13) includes a seal bar and a reciprocable seal pad housing (35). The housing is spring-mounted on the clamping sub-assembly and substantially surrounds the seal bar. The reflective devices (31,33) are mounted on the housing. The prime mover moves the clamping sub-assembly (13) towards a heater bar sub-assembly (15). The housing defines two cavities for receiving the reflective devices. The movement of the clamping sub-assembly brings a loaded bag into contact with the heater bar sub-assembly for the purpose of effectuating a seal of the bag. The pressure applied by the clamping sub-assembly (13) during the meeting of the clamping sub-assembly and the heater bar sub-assembly causes the housing to move during the sealing process thereby moving the reflective devices into the cavities and disrupting the light beam. A photo-sensor (64) is provided for detecting the reflection of the light beam (B) during the sealing process as just described. Control structure either allows or disallows the sealing process to continue based upon detection of the light beam.

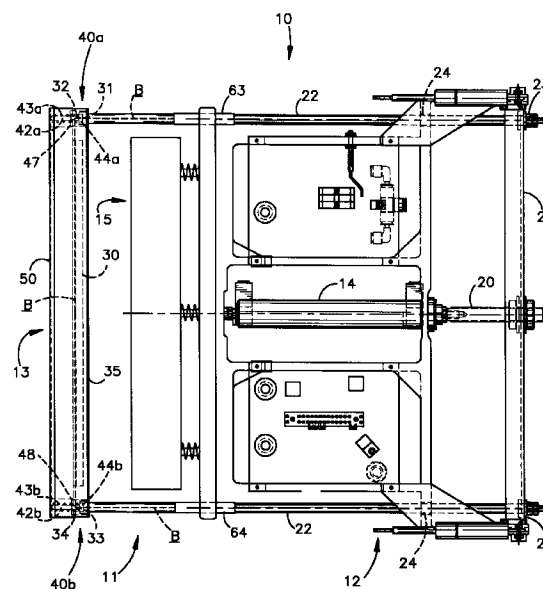


FIG.1

This invention relates to packaging sealing mechanisms, and more specifically, but not exclusively, to a packaging machine having an improved sealing section equipped with a jam prevention mechanism.

The use of chains of pre-opened plastic bags to form packages is now well known. Such chains of bags are disclosed in U.S. Patent Nos. 3,254,828 and 3,965,653. Bags of an interconnected chain are sequentially fed one at a time to a load station. Once a bag is positioned in the load station, a product is inserted and bag separation and sealing of the loaded bag is performed to provide a completed package.

A machine described in U.S. patent 4,899,520 functions in a similar manner but has additional capabilities including the ability concurrently to utilise two chains of bags for "double up" packaging.

With the above machines loaded, bags are sealed at sealing stations each through contact with a heater bar which melts a portion of plastic. During the sealing operation, the weight of a bag's contents and bag separation forces are isolated from the seal by spring-biased grippers which are moved into bag engagement by a clamping sub-assembly that concurrently brings the loaded bag into contact with the heater bar. All of these moving parts can be interfered with by a product that is only partially loaded or a foreign object thereby causing jams which can damage the machine and/or the product can cause an improper seal which creates an unacceptable package.

It is an object of this invention to obviate and/or mitigate this disadvantage.

According to one aspect of the invention, there is provided a package sealing mechanism comprising:

- (a) housing and frame structure (12)
- (b) relatively moveable heater bar (15) and seal pad sub-assemblies (13) connected to the structure;
- (c) a prime mover (14) operably connected to the sub-assemblies selectively to cause relative sub-assembly motion from a spaced package receiving and discharge position to a package sealing position and return, characterised by:
- (d) a light source (63) and a spaced light receiver (64) forming a part of the mechanism and positioned such that a beam emitted by the source along a beam path is received by the receiver under at least certain conditions;
- (e) a beam disrupter (35) movably mounted on one of the sub-assemblies and shiftable between a beam disruption position blocking the path and a beam passage position spaced from the path; and
- (f) control means (m) operably connected to the receiver and the primer mover and adapted to abort a sealing operation in response to signals from the receiver indicating an undesired light beam condition.

According to another aspect of the invention,

there is provided a method of interrupting operation of a packaging machine during a sealing operation characterised by:

- (a) directing a light beam from a source connected to a first component of the sealing mechanism against a reflective surface on a second component of the sealing mechanism;
- (b) actuating a prime mover to move the components relatively toward one another into engagement with portions of a package being formed and thereby compress the portions between a hot element and a seal pad respectively forming portions of the components;
- (c) detecting reflections of such beam with a light beam receiver as the prime mover is actuated; and
- (d) interrupting the prime mover actuation causing relative component movement toward one another if the light beam receiver ceases to receive beam reflections during a predetermined portion of the component relative movement.

The present invention may provide a packaging machine having an improved sealing section. This sealing section has a simple yet effective jam prevention device that is useful in different situations for detecting jams or potential jams.

In the preferred embodiment, a packaging machine for loading bags includes a bag sealing section wherein the sealing section includes a frame structure and a light beam source mounted on the frame structure and adapted to emit an intermittent light beam. A heater bar is connected to the frame structure and may be located in close proximity to the light beam source. In this embodiment, a reciprocable support assembly is movably connected to the frame structure and includes a prime mover for causing reciprocation of the support assembly.

A clamping sub-assembly may be connected to the support assembly. In use, the sub-assembly may bring loaded bags into contact with the heater bar and may clamp the loaded bag against the heater bar. The clamping sub-assembly may include a seal bar and a reciprocable housing for the seal bar. The housing may be spring biased to normally position the housing such that it substantially surrounds the seal bar.

Two reflective devices are preferably located in the path of the light beam source for reflecting the light beam when emitted by the source. The reflective devices may be located at opposite ends of the seal pad housing. A receiver may be connected to the frame structure opposite the light beam source and receives the beam after reflection by the reflective devices.

An electronic control may be provided for sensing reception of the reflected beam by the receiver and for controlling operation of the sealing section based upon such reception.

In the preferred embodiment, two cavities that

serve as interrupters are defined within the clamping sub-assembly, one for each reflective device. Each reflective device may enter its respective cavity upon reciprocation of the seal pad housing. The reciprocation of the seal pad housing may occur during contact between the heater bar and the clamping sub-assembly. When the reflective devices enter the cavities, the reflection of the light beam may be disrupted by the cavities.

One desirable feature of the jam prevention mechanism of this invention is that it is functional both to sense the present of a foreign object that may cause a jam and also to sense certain machine component failures. To accomplish this feature, light beam interruption during an initial portion of a sealing cycle indicating the presence of a foreign object will result in aborting the seal cycle. Failure of the beam to be interrupted during a later portion of the cycle is an indication of a machine component failure and will also result in aborting of the cycle.

Thus, in the preferred embodiment, the jam prevention device operated to disrupt the operation of the sealing section whenever the light beam or its reflection is disrupted during an initial portion of support assembly motion during a sealing cycle. Undesired disruption of the light beam or its reflection can be caused by either a foreign object in its path or can occur by premature seal pad housing movement, causing the reflective devices to enter the cavities.

Once the clamping sub-assembly engages the heater bar, the housing may shift to cause the reflective devices to enter the cavities, and disrupt the light beam. This disruption is desirable because it is indicative of proper machine functioning, and the required meeting of the clamping sub-assembly and the heater bar has occurred. To this end, an electronic control may include a sensing device for sending the meeting of the clamping sub-assembly and the heater bar. Once the meeting of the clamping sub-assembly and the heater bar sub-assembly is sensed, if the control structure does not sense the disruption of the light beam, the sealing process is interrupted. This feature of the jam prevention device also allows the electronic control to be monitored in that if the control "short circuits" and reception of the light beam is indicated when such reception is undesirable, the sealing process will be interrupted.

A microprocessor may be utilized to determine if the two sub-assemblies have met in a predetermined amount of time. If they have not met within the predetermined amount of time, such as because an obstruction that is not disrupting the light beam is preventing meeting of the two sub-assemblies, the sealing process is interrupted.

Accordingly, an advantage of the preferred embodiment of this invention is to provide a improved packaging machine having an improved jam prevention device and a method of detecting obstructions

and malfunctions in a packaging machine's sealing section.

An embodiment of the invention will now be described by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a plan view of a packaging machine sealing section embodying the invention;

Figure 2 is a side elevational view of the sealing section on an enlarged scale with respect to Figure 1;

Figure 3 is a still further enlarged fragmentary plan view of the sealing section;

Figure 4 is a still further enlarged fragmentary side view of the sealing section;

Figure 5 is a fragmentary side view on the scale of Figure 4 of the sealing section illustrating a clamping sub-assembly engaging a heater bar;

Figure 6 is a fragmentary plan view of an alternative embodiment of the sealing section; and

Figure 7 is a flow chart illustrating a control system of a jam prevention system for a packaging machine sealing section embodying the invention.

Turning now to the drawings, portions of a packaging machine bagger 10 having a sealing section 11 and a frame structure 12 are illustrated. The sealing section 11 includes a clamping sub-assembly 13 connected to a prime mover, preferably in the form of an air cylinder 14. A heater bar sub-assembly 15 is connected to and mounted on the frame structure 12.

The packaging machine 10 is generally of the type described in a co-pending patent application owned by the present applicant, entitled "Packaging Machine" filed concurrently herewith. The co-pending patent application is incorporated herein in its entirety by reference. For purposes of this patent, only a lower sub-assembly of the packaging machine bagger 10 is illustrated.

The air cylinder 14 is mounted centrally on the frame 12. The cylinder includes an actuating rod 20. A channel-like cross member 21 is connected to the actuating rod 20. Guide rods 22 are secured near distal ends 23 of the cross member 21 and extend towards the front of the machine. The guide rods are slidably received (and supported) by bores 24 formed in the frame 12. Other bores (not shown) slidably receive the guide rods 22 and support the rods 22 near the front end of the machine 10. The clamping sub-assembly 13 extends between the front ends of the guide rods 22 so that when the prime mover 14 is energized to extend the actuating rod 20, the clamping sub-assembly 13 is pulled inwardly towards the heater bar sub-assembly 15.

The clamping sub-assembly 13 includes a sealing pad 30 connected to a support 25 which in turn is connected to the guide rods 22. A reflective device 31 is located at a corner end portion 32 of the support 25 and a second reflective device 33 is located at an

opposite corner end portion 34.

A sealing bar housing 35 is connected to the support 25 via lost motion connections 40a, 40b and substantially surrounds the sealing pad 30. The lost motion connections 40a, 40b respectively comprise pins 42a, 42b and springs 43a, 43b. Each of the pins 42a, 42b has a corresponding head 44a, 44b. The springs 43a, 43b are mounted around the corresponding pins 42a, 42b between a back portion 50 of the housing 35 and the corresponding heads 44a, 44b. Each head 44a, 44b is located within an associated one of recesses 45a, 45b defined by the housing 35. The springs bias the housing 35 such that respective back portions 46a, 46b of the recess 45a, 45b normally engage a corresponding head 44a, 44b.

The support 25 defines two cavities 47, 48, respectively positioned to receive the reflective devices 31, 33. Figure 4 illustrates the clamping sub-assembly prior to engaging the heater bar sub-assembly. Figure 5 illustrates the clamping sub-assembly meeting the heater bar sub-assembly.

The heater bar sub-assembly 15 includes a heater bar 58 surrounded by a Teflon® cover 59 and upper and lower gripper plates 60, 61, which flank the heater bar. Each of the gripper plates 60, 61 has a flat surface 62 facing the clamping sub-assembly 13.

An infrared emitter 63 is connected to the frame 12. Preferably, the emitter emits a pulsed or intermittent signal with 15 microsecond pulses at 10 KHz. The emitter 63 serves as a light source which emits a light beam B direct toward the reflective device 31 along a beam path. The light beam B is reflected off of the reflective device 31, which is at a 45° angle relative to an incident portion from the emitter. The beam path is reflected 90° from the incident portion to a second path portion directed at the reflective device 33. The light beam is then reflected off of the reflective device 33, which is at a 45° angle relative to the second path portion of the beam path. An infrared receiver 64 is positioned to receive the beam after a second 90° reflection by the reflective device 33. The receiver is preferably in the form of a photo-sensor. The intermittent or pulsed form of the light beam allows the light beam to be distinguished from ambient light by the receiver 64.

Operation

As described in the co-pending application, in operation a chain of inter connected and pre-opened bags (not shown) is fed through the machine 10 to be loaded and sealed by the sealing section 11. Once a positioned bag is loaded, the prime mover 14 moves the clamping sub-assembly 13 towards the heater bar subassembly 15 in order to effect a seal of a loaded bag (not shown) by bringing the loaded bag into contact with the heater bar sub-assembly 15. The bag is clamped and held in place against the gripper

plates 60, 61 by the sealing pad 30. The pressure of the clamping sub-assembly 13 shifts the plates 60, 61 against the action of springs 60a, 61a until the pad 30 forces the bag against the bar. In addition, the pressure exerted by the clamping sub-assembly 13 when it meets the heater bar sub-assembly 15 causes the sealing bar housing 35 to move along the lost motion connections 40, 41 as seen in Figure 5. This moves the reflective devices 31, 33 into the cavities 47, 48 and disrupts the light beam.

During operation, the photo-sensor 64 receives the reflected light beam B and generates an output signal corresponding to reception or non-reception of the light beam. The photo-sensor's signal activates a transistor T. Output of the transistor is coupled to a comparator C that stretches the 15-microsecond light beam pulse to approximately 150 microseconds. If the reception of the light beam B is disrupted for any reason during an initial portion of a sealing cycle, such as obstruction of the light beam B by a foreign object or premature movement of the housing 35 via the lost motion connections, the photo-sensor signal causes the prime mover 14 to reverse its movement.

Upon the meeting of the clamping sub-assembly 13 and the heater bar subassembly 15, and thereby the movement of the housing 35 via the lost motion connections 40, 41, a microprocessor M operates to sense the proper movement of the housing 35. The microprocessor "knows" when the clamping sub-assembly 13 should have met the heater bar sub-assembly 15. The meeting is determined by a proximity sensor PS that senses movement of two relatively movable members. When the proximity sensor senses the clamping sub-assembly meeting the heater bar sub-assembly, output from a proximity switch PSW coupled to the microprocessor changes state. If the light beam is not disrupted at this point, thereby signalling a machine malfunction such as the failure of the housing 35 to move via the lost motion connections, the sealing operation is interrupted.

Once the loaded bag is sealed, the prime mover 14 moves the clamping sub-assembly 13 away from the heater bar assembly 15.

Additionally, if there is a machine malfunction such as if the transistor coupled to the output from the photo-sensor short-circuits causing the output to indicate that the light beam is present when it is not, the sealing cycle will be aborted. Thus, a failure not due to a problem with the sealing section 11, disables the sealing section because of the requirement for disruption of the light beam.

The microprocessor also monitors the output of the comparator. If the time period for pulsing drops below 150 microseconds, it is an indication a lens of the emitter 63 and/or a lens of the receiver 64 is dirty. A signal is then given to an operator to check and clean the lens.

Figure 6 discloses an alternative embodiment in

which only one reflective device 131 is utilized. An infrared emitter 163 is mounted to the clamping subassembly. The emitter 163 is in alignment with the reflective device 131. The reflective device is at a 45° angle relative to the beam path from the emitter and reflects the light beam emitted by the emitter 163 towards an infrared receiver 164. Operation of the sealing section proceeds in the same manner as previously described for the preferred embodiment.

Although the preferred embodiments of this invention have been shown and described, it should be understood that various modifications and rearrangements of the parts may be resorted to without departing from the scope of the invention as disclosed and claimed herein.

Whilst endeavouring in the foregoing specification to draw attention to those features of the invention believed to be of particular importance it should be understood that the Applicant claims protection in respect of any patentable feature or combination of features hereinbefore referred to and/or shown in the drawings whether or not particular emphasis has been placed thereon.

Claims

1. A package sealing mechanism comprising:

- (a) housing and frame structure (12)
- (b) relatively moveable heater bar (15) and seal pad sub-assemblies (13) connected to the structure;
- (c) a prime mover (14) operably connected to the sub-assemblies selectively to cause relative sub-assembly motion from a spaced package receiving and discharge position to a package sealing position and return, characterised by:
- (d) a light source (63) and a spaced light receiver (64) forming a part of the mechanism and positioned such that a beam emitted by the source along a beam path is received by the receiver under at least certain conditions;
- (e) a beam disrupter (35) movably mounted on one of the sub-assemblies and shiftable between a beam disruption position blocking the path and a beam passage position spaced from the path; and
- (f) control means (m) operably connected to the receiver and the prime mover and adapted to abort a sealing operation in response to signals from the receiver indicating an undesired light beam condition.

2. A mechanism according to Claim 1 characterised in that the undesired condition during an initial portion of the motion from the receiving to the sealing position is beam interruption and during

a later portion of such motion the lack of beam interruption.

3. A mechanism according to Claim 1 or Claim 2, characterised in that two reflective surfaces (31,33) are positioned along the path and carried by a first of the sub-assemblies and wherein the light source is positioned to impinge a light beam on a first of the reflective surfaces which reflects the light beam onto a second of the reflective surfaces when the sub-assemblies are in the receiving position and during an initial portion of the relative motions of the sub-assemblies from the receiving to the sealing position; the light beam receiver being positioned to receive reflected light from the second surface when the sub-assemblies are in the receiving position, the receiver being adapted to emit a signal when detecting such reflected light; and the control means being adapted to stop relative motion from the receiving to the sealing position during such initial portion if the receiver ceases to emit a signal in response to detected light.

4. A mechanism according to any preceding claim characterised in that the beam disrupter is a reciprocal housing.

5. A mechanism according to Claim 4 further characterised by cavities (47,48) defined within a selected sub-assembly for each reflective device, each reflective device entering its respective cavity upon reciprocation of the housing during contact between the sub-assemblies, thereby disrupting reflection of the light beam.

6. A method of interrupting operation of a packaging machine during a sealing operation characterised by:

- (a) directing a light beam from a source connected to a first component of the sealing mechanism against a reflective surface on a second component of the sealing mechanism;
- (b) actuating a prime mover to move the components relatively toward one another into engagement with portions of a package being formed and thereby compress the portions between a hot element and a seal pad respectively forming portions of the components;
- (c) detecting reflections of such beam with a light beam receiver as the prime mover is actuated; and
- (d) interrupting the prime mover actuation causing relative component movement toward one another if the light beam receiver ceases to receive beam reflections during a predetermined portion of the component relative movement.

7. A method according to Claim 6 characterised in that said second component includes a lost motion connected part and the reflection detection step determines when the lost motion connection part has moved via the lost motion connection. 5

8. A method according to Claim 5 or 6 characterised by the step of interrupting the operation of the primer mover to cause relative component movement toward one another if the receiver continues to receive beam reflections during a second predetermined portion of the component relative movement. 10

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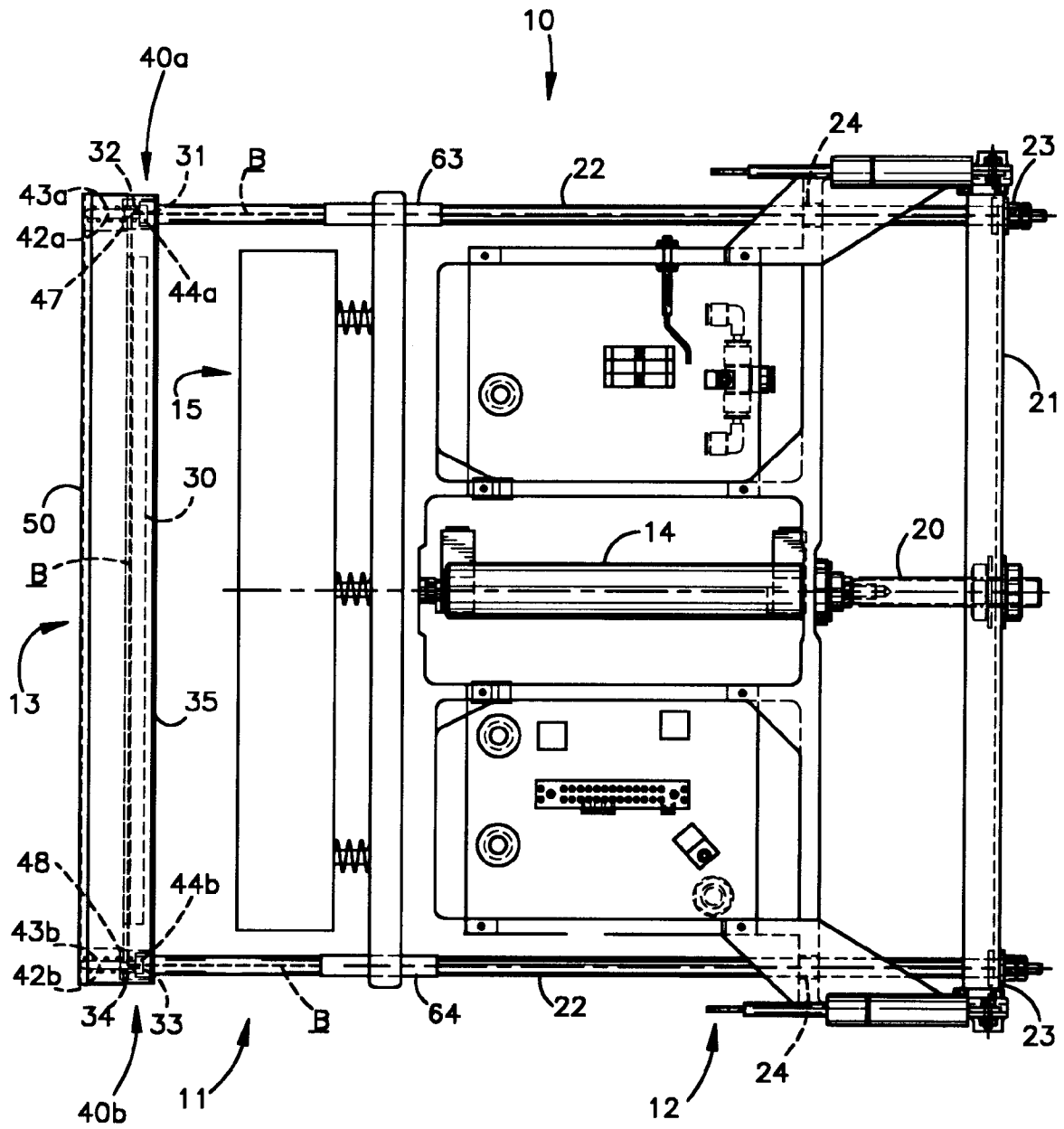
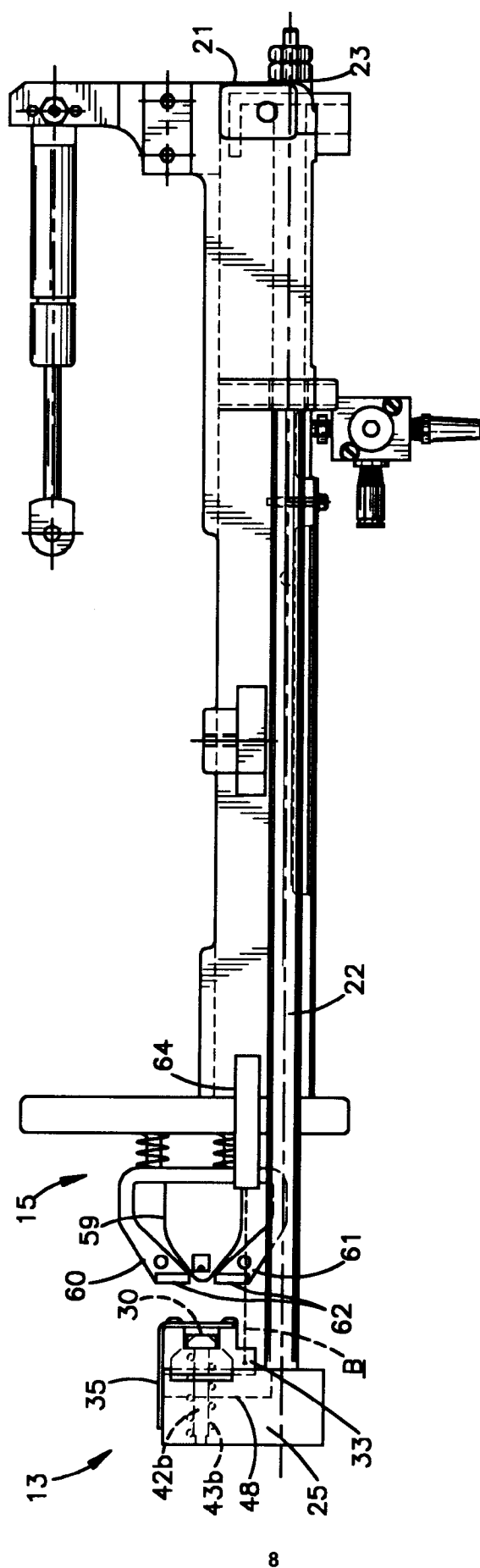
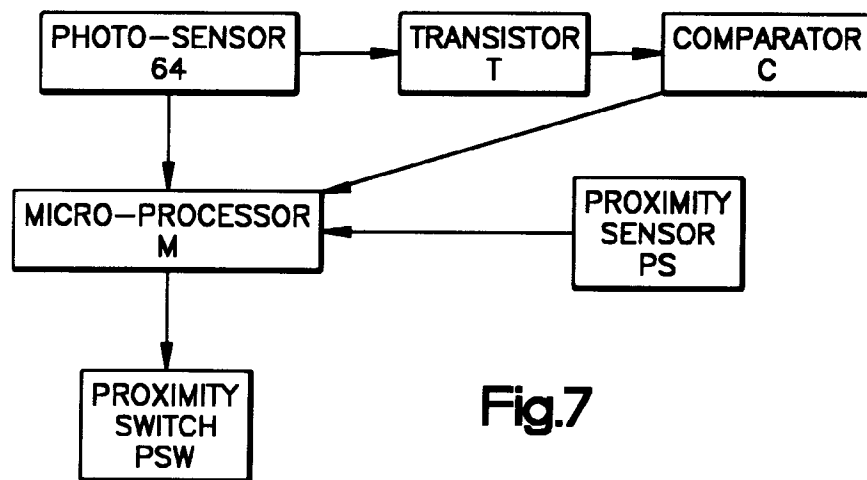
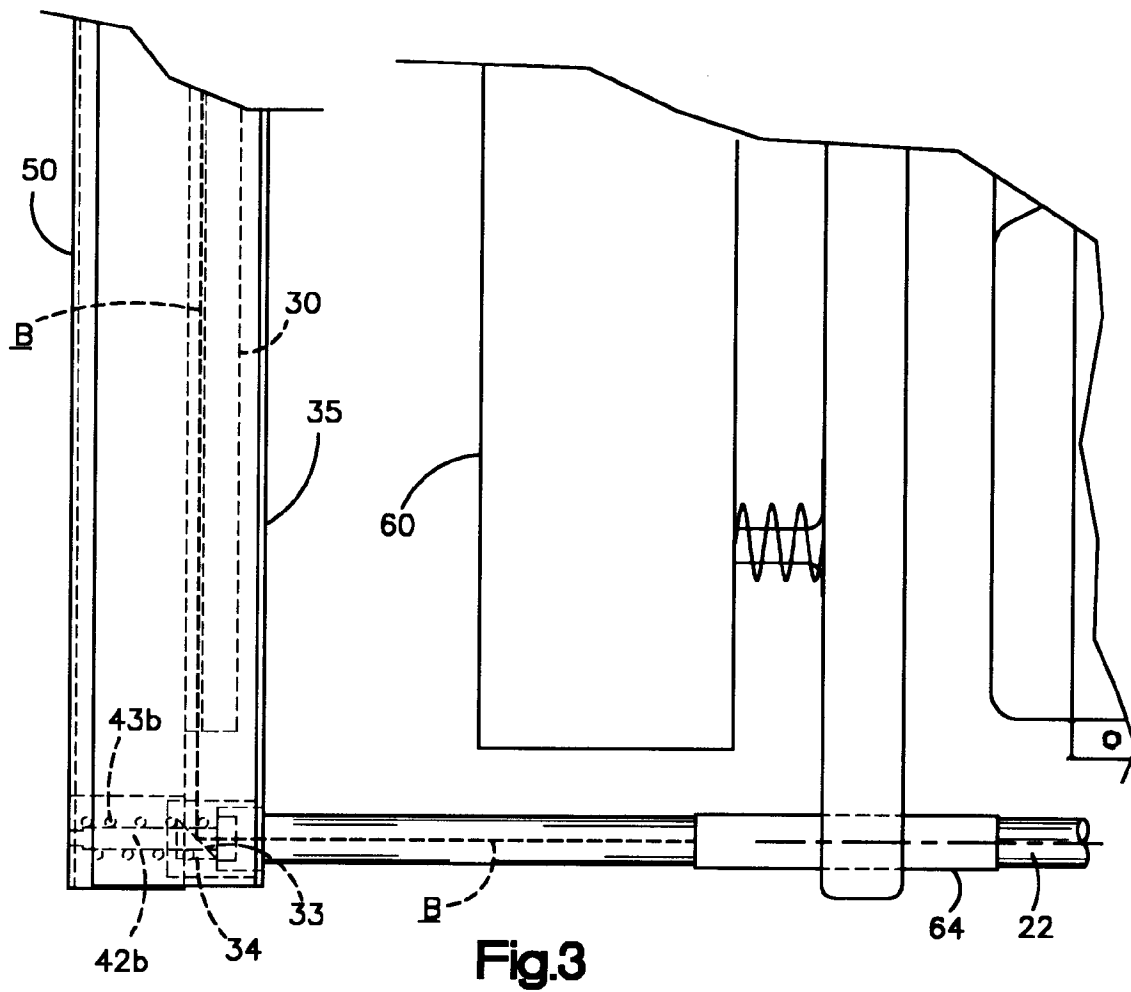


FIG.1

**FIG. 2**



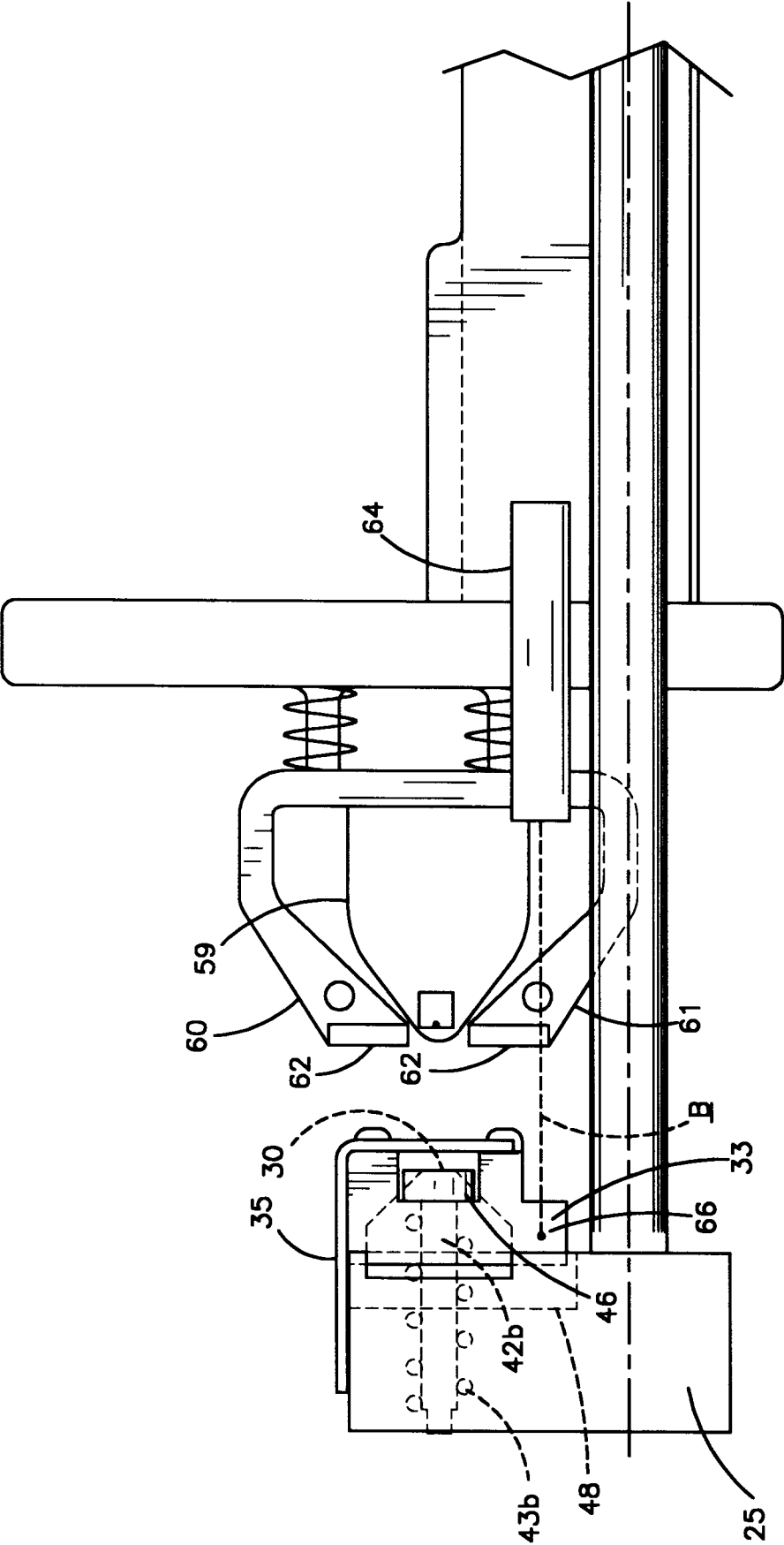


Fig.4

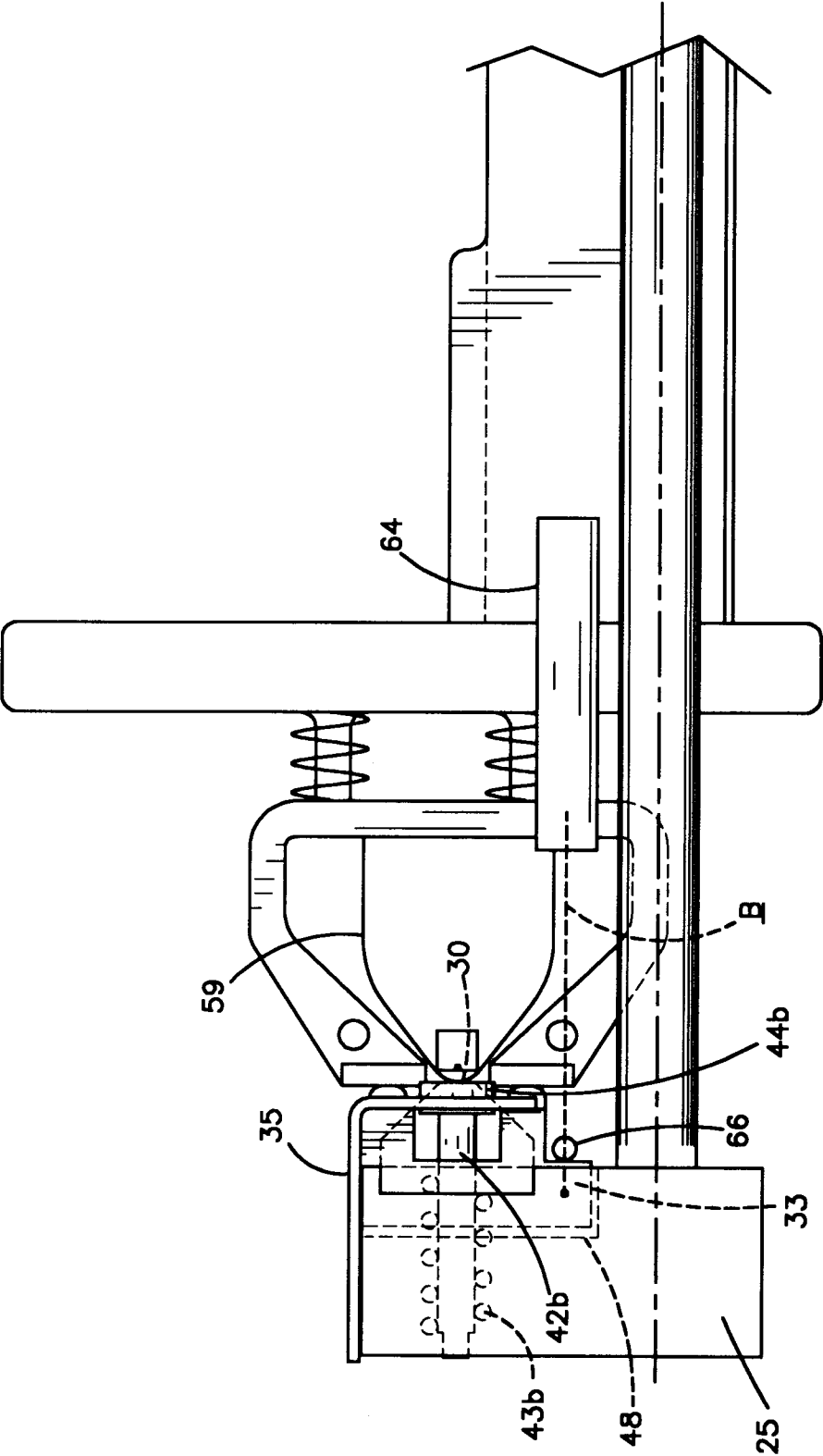


Fig.5

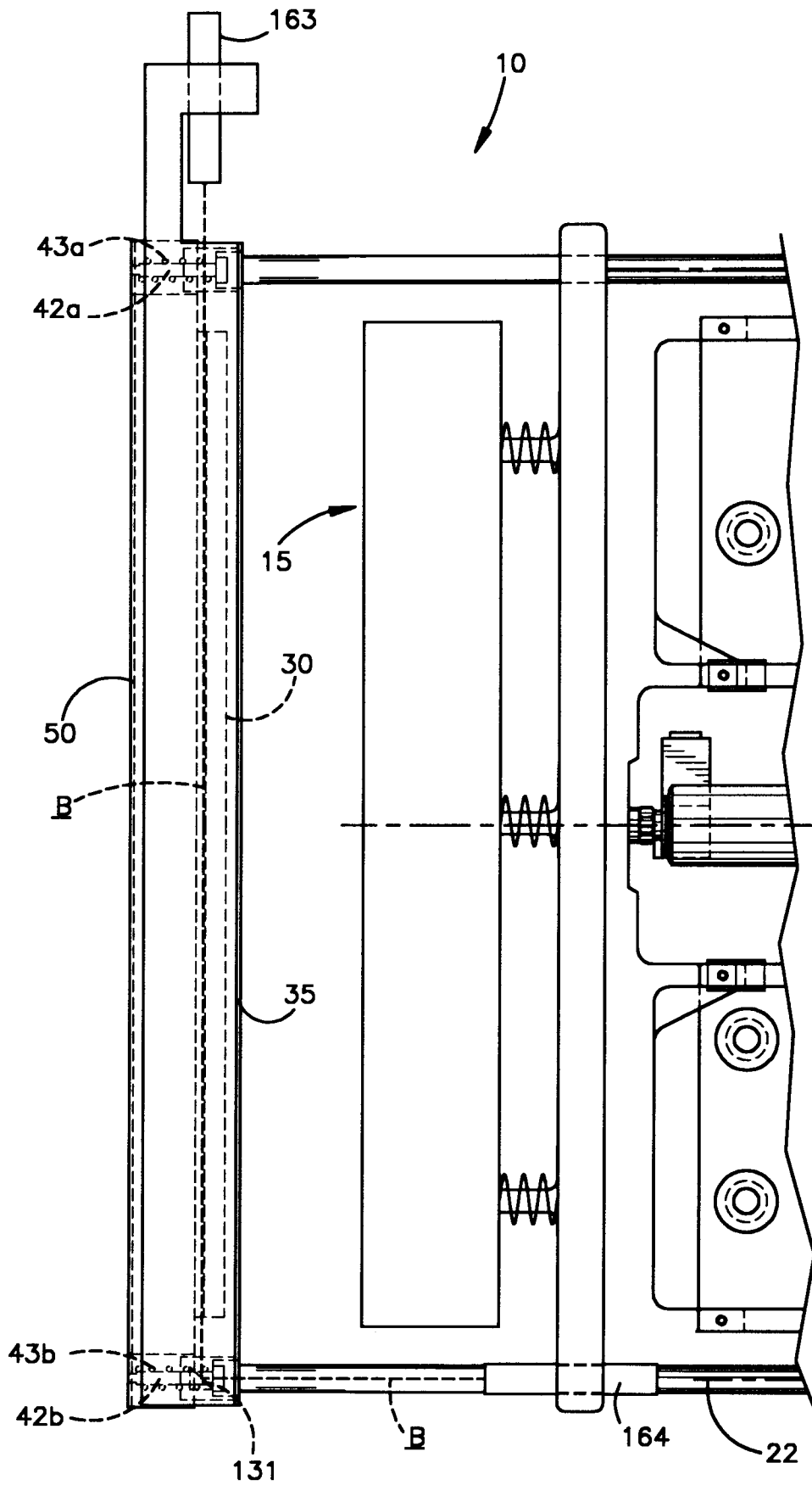


FIG.6



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 93 30 6800

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-2 638 420 (CL. JAQUIER) * page 11, line 23 - page 13, line 24; figures 6-8 *	6	B65B51/30 B65B57/02
A	---	1,3	
D,X	US-A-4 899 520 (B. LERNER) * column 9, line 29 - line 66; figures 1,4,7 *	6	
D,A	---	1,3	
A	EP-A-0 296 387 (PACKAGE MACHINERY COMPANY) * column 6, line 28 - column 10, line 10; figures *	1,6	
A	US-A-4 546 596 (D. CHERNEY) -----		
			TECHNICAL FIELDS SEARCHED (Int.Cl.5)
			B65B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 28 December 1993	Examiner Jagusiak, A
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