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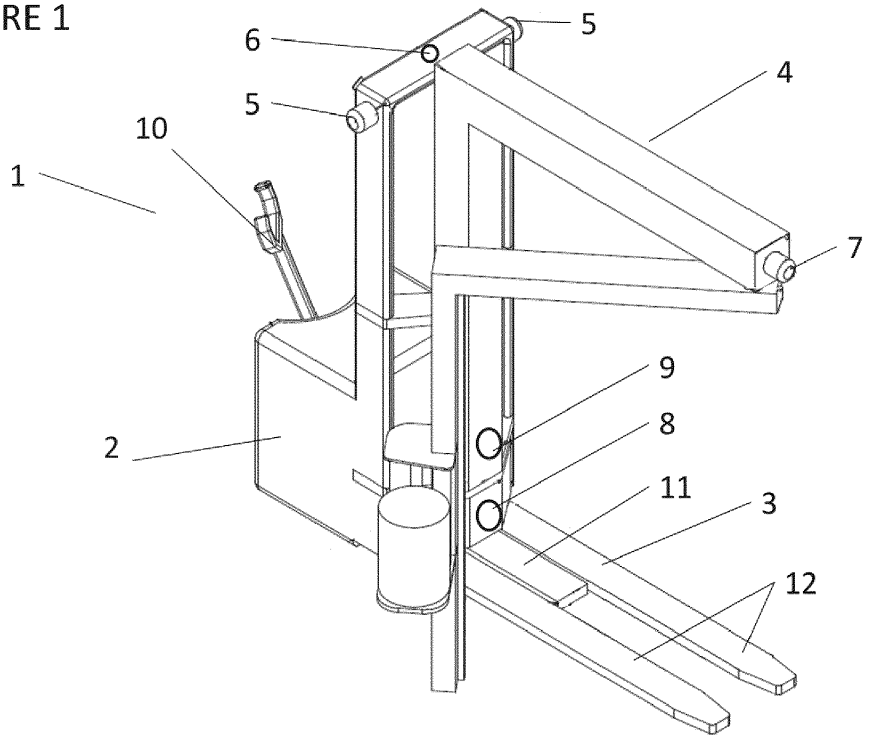
(54) AUTONOMOUS WRAPPING MACHINE

(57) The invention consists of a wrapping machine with autonomy to both carry out its wrapping tasks and with autonomy of movement and navigation, comprising a loading element (3) which positions and supports a pallet, a wrapping element (4) which identifies the load and the wrapping, consisting of a film carriage, a programme selector and a cutting and welding device, an impeller (2) which guides the assembly formed by the impeller, the loading element and the wrapping element, as well as a navigation device.

FIGURE 1



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Description

AUTONOMOUS WRAPPING MACHINE

[0001] This invention, as its name suggests, refers to a wrapping machine that autonomously both to carry out the tasks of wrapping and autonomy of movement and navigation.

[0002] Both capacities combined enable the machine to acquire high levels of autonomy when carrying out its tasks.

[0003] The technical sector in which it is situated is in that of wrapping machines.

BACKGROUND OF THE INVENTION

[0004] The current management and logistics requires the handling of numerous packages that, in order to be processed more efficiently, are wrapped together so that they can be handled in larger units, given that the use of pallets that are used as a base for stacking the packages on top of is very widespread.

[0005] The problem to be solved is normally focused on the way in which the packages can be kept on top of the pallet for their transportation and handling.

[0006] Depending on the type of load, different types of retention are used. Therefore, it is common to use strips, usually to retain large and resistant pieces, such as construction items. However, these strips do not protect against rain, for instance.

[0007] Another type of retention wrap is the use of shrink bags which, after being placed over the load, are subjected to heat to force it to contract. However, this type of wrap is not useful for uneven loads and does obviously not apply to loads that can be damaged by the application of heat.

[0008] In order to overcome these disadvantages, other wrapping systems have been developed, an example of which is United States patent US 3,867,806, in which a stack of packages is placed on a turntable. These packages are generally mounted onto a pallet in such a way that, when rotating the turntable, the palletised load of packages is wrapped with a layer of elastic material, such as film. During the wrapping of the load, the layer of material is subject to tension for adjustment and the load is wrapped with as many layers as necessary to achieve the desired strength.

[0009] Another United States patent, US 4,067,174, also uses the film of plastic material, surpassing the previous patent by incorporating a motor unit that carries the film reel and the stretching unit guided around the material to be wrapped, which is, on this occasion, stopped.

[0010] This system has been improved by other subsequent patents, such as, for example, patent US 4,095,395, which incorporates a self-guiding system for the film carriage.

[0011] The applicant himself is the owner of patent EP2147864, which refers to a wrapping machine of the type that has a rotating arm and a film carriage that orbits the load and the stack, the load being stationary.

[0012] The applicant himself is also the holder of patent EP10005504, referring to a structure for joining a functional element, such as a wrapping arm, to a pallet truck, in such a way that it is not necessary to transport the load to the wrapping location, but rather the wrapper can be transported to the loading location or the transits of the load can even be taken advantage of for their wrapping.

[0013] United States patent US4282700 refers to a wrapping device attached to a stacker truck-type vehicle, in which the wrapping element is attached to the chassis of the vehicle and presents an inclination, with respect to the ground, so as not to compromise the centre of gravity of the assembly, especially when the lifting of the load occurs and this is despite the use of a heavy vehicle, such as forklift, which generates complications for its use as a stacker.

[0014] Patent EP2749498, referring to a transportable stacker wrapping machine, is also known.

[0015] None of the aforementioned patents solves the problem of a wrapping machine that can work autonomously by joining with the pallet to be wrapped, selecting the type of wrapping that is adequate for the pallet load and transporting the pallet, if necessary.

DESCRIPTION OF THE INTERVENTION

[0016] To solve the problems mentioned above, this invention refers to a wrapping machine comprising:

1.- A loading element suitable for positioning and supporting the pallet during the wrapping operations and, where appropriate, transportation operations.

2.- A wrapping element suitable for carrying out load identification and wrapping operations of said load, for which it comprises:

- A structure with a film carriage that orbits the load, dispensing film.
- A wrapping programme selector comprising a load identifier, a file with different wrapping programmes and a selection software.
- A device for cutting and welding the film.

3.- An impeller suitable for moving and guiding the assembly, formed by an impeller, loading element and wrapping element, comprising:

4.- A navigation and guidance device that comprises:

- Positioning sensors.
- Proximity sensors.
- Space sensors.
- Motion sensors.
- Navigation and guidance software.

5.- Communications between the various elements and sensors.

[0017] The three elements - the impeller, the load and the wrapping - interact in a coordinated manner by exchanging information due to the fact that there are communications between them.

1.- The wrapping element communicates with at least the following devices which determine the start or stop of the wrapping cycle:

Communication with the impeller so that this impeller distinguishes between start and stop, communicating this to the wrapping element in such a way that the wrapping will not start or stop if the assembly is not stopped.

Communication with the space sensor or sensors arranged at any point of the assembly in such a way that the wrapping cycle will only start if there is enough space around the wrapping element.

Communication with the loading element, such that a sensor detects and reports on the position of the load in such a way that the wrapping cycle will only start if the load is positioned properly.

Communication with load type identifiers, in such a way that the wrapping cycle will only start if the load type has been identified and a wrapping programme has been selected. Communication with the cutting and welding system in order to identify the point within the wrapping cycle at which it needs to operate.

2.- The impeller, in turn, communicates with the following devices and sensors:

Communication with a navigation and guidance device comprising positioning sensors to determine the position of the assembly and proximity sensors to determine the possible existence of obstacles in the foreseeable movements of the assembly, governing the start or stop instructions of the impeller.

Communication with the wrapping element in such a way that the impeller will only proceed to move the assembly if the wrapping element is stopped and positioned properly.

3.- The loading element comprises a load detection and positioning sensor which communicates with the following devices and elements:

Communication with the impeller such that it guides the approach, loading and positioning operations of the load.

Communication with the impeller such that the movement of the assembly is prevented if the load is not well positioned, enabling, in that case, only load positioning operations.

Communication with the wrapping element, preventing the wrapping cycle from starting if the load is not positioned properly.

[0018] In view of the foregoing, the wrapping machine autonomously coordinates the following processes, the order of which may vary:
Locating of the load, approaching it, thanks to a navigation system and positioning it for its subsequent wrapping. Transfer of the load, in the event that, due to lack of space, or for any other reason, it needs to be transferred.

[0019] Identification of the load to determine the wrapping programme.

[0020] Verification of sufficient space and stopping of the impeller in order to start the selected wrapping cycle.

[0021] Comprehensive wrapping cycle involving applying the film to the load, wrapping and cutting and welding of the film.

[0022] Transportation and storage of the already wrapped load.

[0023] For a better understanding of the above, the following figures are provided.

BRIEF DESCRIPTION OF THE FIGURES

[0024] FIGURE 1 shows an exemplary embodiment of an autonomous wrapping machine seen as a whole (1) and comprising an impeller (2) a loading element (3) and a wrapping element (4).

[0025] There are also different sensors distributed throughout the assembly, such as space sensors (5) a sensor to determine the position of the assembly (6) a proximity sensor (7) to detect possible obstacles, a load identifier (8) and a load positioning sensor (9).

[0026] The wrapping machine also comprises an arm (10) for manual handling, if necessary.

[0027] One of the elements that enable the full autonomy of the machine is the cutting and welding device (11) which, in this case, is arranged between the loading skids (12)

DESCRIPTION OF A MODE FOR CARRYING OUT THE INVENTION

[0028] A mode for carrying out the invention is described herein, which is not unique, but merely exemplary.

[0029] The wrapping machine comprises:

1. A loading element (3) suitable for positioning and supporting the pallet during the wrapping operations and, where appropriate, transportation operations, comprising a load detection and positioning sensor.
2. A wrapping element (4) suitable for carrying out load identification and wrapping operations of said load, for which it comprises:

- A structure with a film carriage that orbits the load, dispensing film.
- A wrapping programme selector comprising a load identifier, a file with different wrapping programmes and a selection software.
- A device for cutting and welding the film.

3. An impeller (2) suitable for moving and guiding the assembly, formed by an impeller, loading element and wrapping element.
4. A navigation and guidance device that comprises:

- Positioning sensors (6).
- Proximity sensors (7).
- Space sensors (5).
- Navigation and guidance software.

5. Communications between the various elements.

[0030] This wrapping machine has the characteristic of being transportable and, consequently, of being able to pick up the load arranged on the pallet, position it, wrap it and transport it until it is deposited at the place of destination, with all of these operations being automated and therefore preventing human error or risks, which are always inevitable and which can occur when a machine comprises mobile elements or moves, both of which are factors that are at issue here.

[0031] Their operating cycles are as follows.

[0032] The navigation and guidance device receives the location of the load to be wrapped and, by communication with the impeller (2), begins to move to find it.

[0033] The wrapping element distinguishes between a correct or incorrect position of the arm and whether the arm is moving or stopped. The position will be correct when the vertical part of the arm is located at its minimum distance from the impeller. Before starting to move, the wrapping element (4) communicates with the impeller (2) if the position of the arm is correct and if the arm is stopped. If this is not the case, the assembly will not start to move until the arm is stopped and in the starting position.

[0034] Once the machine has started to move, the guidance device, using the information provided by the positioning sensors (6), guides the assembly towards the destination and, using the information provided by the proximity sensors (7), makes the decision to stop in the event that it locates an obstacle on the planned route.

[0035] Once it has reached the load, the navigation and guidance device, using the information provided by the load proximity, detection and positioning sensors, carries out the stowage operations aimed at properly inserting the loading skids (12) into the pallet to be wrapped and leaving the load positioned for wrapping.

[0036] The load positioning sensor (9) determines the optimum position point of the load and ends the stowage manoeuvres.

[0037] The wrapping programme selector, via its load identifier (8) obtains information regarding the type of load and selects between the predetermined wrapping programmes.

[0038] Once the programme has been selected, it proceeds with the wrapping cycle itself.

[0039] The impeller (2) distinguishes between start and stop, communicating the start or stop situation to the wrapping element (4) before the beginning of the wrapping cycle, in such a way that this cycle will only start if the assembly is stopped.

[0040] Likewise, the space sensor (5) distinguishes between sufficient space or insufficient space in order to carry out the wrapping cycle, communicating this to the wrapping element, which will only start the wrapping cycle if there is enough space.

[0041] After ensuring that the assembly has stopped and that there is enough space, the wrapping cycle begins.

[0042] To this end, the cutting and welding device (11) retains the film with a clamp whilst the film carriage starts its orbital and ascending movement around the load until it reaches its maximum height and then descends again.

[0043] After the film has been applied, the cutting and welding element (11) proceeds to weld the end of the film with the layers already applied and to cut it, leaving it fixed to a clamp for the next cycle.

[0044] Once the load is wrapped, it is moved to its final destination, if this has not already been done, again with the intervention of the navigation and guidance devices governing the impeller.

Claims

1. AUTONOMOUS WRAPPING MACHINE **characterised by** the fact that it jointly comprises a loading element (3) suitable for positioning and supporting the pallet during the wrapping operations, a wrapping element (4) suitable for carrying out the load identification and wrapping operations, an impeller (2) suitable for moving and guiding the assembly comprising the impeller, loading element and wrapping element, a navigation and guidance device, as well as communications between the elements.

2. AUTONOMOUS WRAPPING MACHINE according to claim 1, **characterised by** the fact that the loading element comprises a load detection and positioning sensor.

3. AUTONOMOUS WRAPPING MACHINE according to claim 1, **characterised by** the fact that the wrapping element comprises a wrapping programme selector.

4. AUTONOMOUS WRAPPING MACHINE according to claim 3, **characterised by** the fact that the wrapping programme selector comprises a load identifier, a file containing the various wrapping programmes and a selection software.

5. AUTONOMOUS WRAPPING MACHINE according to claim 1, **characterised by** the fact that the wrapping element comprises a film cutting and welding device.

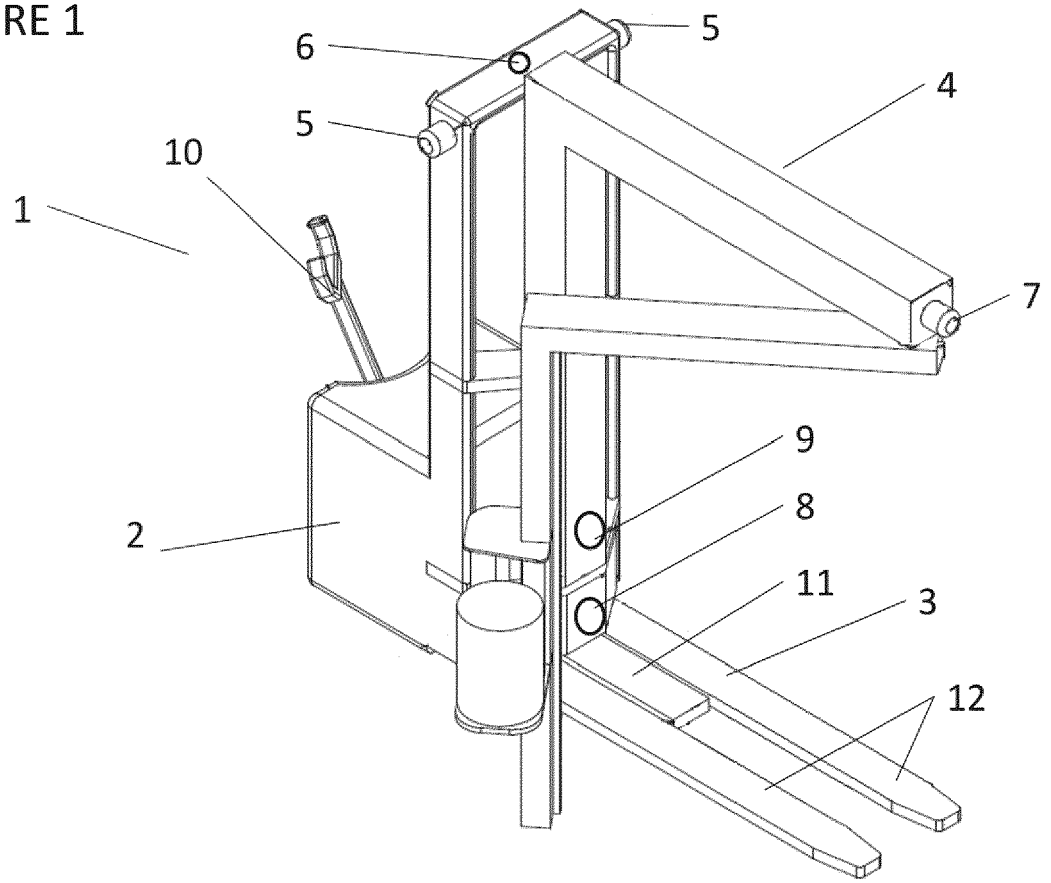
6. AUTONOMOUS WRAPPING MACHINE according to claim 1, **characterised by** the fact that the navigation and guidance device comprises positioning sensors (6), proximity sensors (7), space sensors (5) and a navigation and guidance software.

7. AUTONOMOUS WRAPPING MACHINE according to claim 1, **characterised by** the fact that the wrapping element (4) distinguishes between correct or incorrect position of the arm (10) and between whether the arm is operating or stopped, communicating both results to the impeller (2), which will only start up if the arm is stopped and in the correct position.

8. AUTONOMOUS WRAPPING MACHINE according to claim 1, **characterised by** the fact that the impeller (2) distinguishes between start and stop, communicating the start or stop position to the wrapping element (4) before the beginning of the wrapping cycle, in such a way that said cycle will only start if the assembly is stopped.

9. AUTONOMOUS WRAPPING MACHINE according to claim 1, **characterised by** the fact that the space sensor (5) distinguishes between sufficient space or insufficient space in order to carry out the wrapping cycle, communicating this to the wrapping element, which will only start the wrapping cycle if there is enough space.

FIGURE 1



REFERENCES CITED IN THE DESCRIPTION

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