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DEVICE FOR SEPARATING AND TRANSPORTING MOULDING MATERIAL
PARTS AND DEVICE AND METHOD FOR GROUPING, POSITIONING AND
TRANSPORTING MOULDING MATERIAL PARTS

5 The invention relates to a device for
separating and transporting moulding material parts from
a feed path to a discharge position. The invention also
relates to a device and method for grouping, positioning
and transporting singly supplied moulding material parts,
such as discharged for instance by the above mentioned
device, from a loading position to an offloading
position.

10 During encapsulation of electronic components
such as for instance lead frames, moulding material parts
have to be carried into a mould. The moulding material is
carried into the mould cavity by heating and exerting
pressure. An important aspect in the feeding of the
moulding material to the mould half is that the latter
15 must be filled in a short time; this in order to prevent
a long cycle time of the moulding device. Another aspect
is that during feed of moulding material parts, which are
often embodied in cylindrical shape, as little dust as
possible must be disseminated. Much use is therefore made
20 in practice of feed devices for moulding material parts
in which the moulding material is transported using
underpressure.

The present invention has for its object to
provide two devices for respectively separating and
25 transporting and grouping, positioning and transporting
of moulding material parts. In combination with an
already existing buffer supply such as for instance a
vibration feed system, it must be possible using the
devices according to the invention to feed moulding
30 material parts at great speed to a mould half. The feed
of moulding material parts must take place in precise
manner with very little risk of malfunction. The devices



must also be inexpensive in production and servicing and easily adjustable.

The invention provides for this purpose a device for separating and transporting moulding material parts from a feed path to a discharge position comprising at least one holder for a moulding material part movable rotatably between a position close to the feed path and the discharge position, and an ejector for discharging a moulding material part arranged in the holder from the movable holder close to the discharge position. The moulding material parts will make forced movements by means of this device, which limits the danger of malfunctions. It is also possible to control in very precise manner the speed at which moulding material parts are separated and transported.

The drive of the rotatable holder is preferably coupled to the drive of the ejector. This makes an additional drive for the ejector unnecessary, which saves cost, and a separate synchronization of the movement of the rotatable holder relative to the ejector is hereby also made unnecessary. This also has a cost-saving effect and limits the danger of malfunctions. In a preferred embodiment the rotation shaft of the rotatable holder is connected to a maltese cross for moving the holder intermittently such that it stands still for a time close to the feed path and close to the discharge position. The intermittent movement of the rotatable holder hereby enables placing of a moulding material part into the rotatable holder respectively removal thereof from the rotatable holder in a manner wherein the danger of damage is minimized. The choice of a maltese cross to generate this intermittent movement has the advantage that a maltese cross is a structurally inexpensive solution which is little susceptible to wear and can operate at great speed.

The device comprises a sensor for monitoring the quality of the moulding material parts received in the holder. In a preferred embodiment this sensor is



connected to a control element for the ejector for either ejecting the moulding material part or not subject to the detected quality. Because the moulding material parts are received in separated manner in the rotatable holder it is possible to carry out in simple manner a quality control of the shape of the moulding material parts. With for instance an optical sensor it is possible to monitor whether the moulding material part for checking does have the correct length. It is also possible for instance using blow air and a pressure-sensitive sensor to check the side of the moulding material part facing toward the sensor for the correct shape.

The device preferably also comprises a discharge guide for removing from the rotatable holder moulding material parts not ejected by the ejector at the discharge position. In order to prevent a moulding material part remaining behind in the rotatable holder, which can result in problems when the unemptied holder once again approaches the feed path so as to be filled with a new moulding material part. In order to prevent this an ejector is provided in the preferred embodiment with which the rotatable holder is always emptied before it again approaches the feed path.

In yet another preferred embodiment the device comprises a gripper for gripping a moulding material part located in the feed path and for moving the moulding material part to the holder located close to the feed path. The drive of the rotatable holder is preferably coupled to the drive of this gripper. The supply of the moulding material part to the rotatable holder also becomes a forced movement by means of this gripper. It is also the case here that a forced movement limits the chance of malfunction and it is also possible to operate at very great speeds.

Another aspect of the invention relates to a device for grouping, positioning and transporting singly supplied moulding material parts from a loading position to an offloading position, comprising:



- a buffer frame provided with receiving means for the moulding material parts, which buffer frame is displaceable along a guide between the loading position and the offloading position, and
- 5 - a drive for displacing the buffer frame along the guide.

In a preferred embodiment the receiving means are mounted movably in the buffer frame so that in the loading position of the buffer frame the receiving means can be placed sequentially in a position in the buffer frame such that moulding material parts supplied at a fixed position are placeable in separate receiving means, and so that in the offloading position of the buffer frame the receiving means can be placed in positions such that the positions thereof correspond with the receiving positions for moulding material parts in a mould half of an encapsulating device. This device has the advantage that to load a mould half the buffer frame has only to be moved once from the loading position to the offloading position and vice versa. The buffer frame can in any case be loaded while it is situated close to the fixed position at which the moulding material parts are supplied and is then transported to the offloading position as soon as sufficient moulding material parts to fill a mould half are received in the buffer frame. During the movement of the buffer frame from the loading position to the offloading position the receiving means can be positioned in the buffer frame such that the individual moulding material parts are situated at positions corresponding with the positions at which the moulding material parts have to be placed in a mould half.

The buffer frame preferably comprises a drive for displacing the receiving means in a buffer frame. The receiving means are preferably connected to the buffer frame with interposing of a linear guide which lies perpendicularly of the direction of movement of the buffer frame. Driving and linear guiding make it possible



to displace the receiving means in simple manner in the buffer frame, while the construction is relatively inexpensive to manufacture and little susceptible to wear.

5 The receiving means are preferably mounted on releasable elements which can be fixed in the buffer frame depending on the placing of the moulding material parts in the mould half for loading. In the case of a changing arrangement of the moulding material parts to be
10 placed in a mould half, a change-over of the device can be realized within a short time using the releasable elements.

 In a preferred embodiment the receiving means are provided with movable stops for urging moulding
15 material parts out of the receiving means. Using the movable stops the moulding material parts can be removed comparatively simply from the receiving means at the offloading position, i.e. the position where they have to be placed in a mould half. This also limits the danger of
20 malfunctions or of a mould half not being completely filled with moulding material parts. The buffer frame preferably comprises for this purpose a drive for causing the receiving means to move as described above.

 The invention also relates to a method for
25 encapsulating electronic components by loading a mould half at a fixed position with singly supplied moulding material parts, comprising the steps of:
- placing a plurality of moulding material parts in a buffer frame close to the fixed feed position of the
30 moulding material parts,
- transporting the buffer frame from close to the fixed feed position of moulding material parts to a position close to the mould half for loading, and
- offloading the buffer frame into the mould half for
35 loading.

 This method preferably also comprises a step with which: the moulding material parts loaded in the buffer frame are converted from a configuration which is



desired for loading the buffer frame into a configuration which corresponds with the configuration in which the moulding material parts must be received in the mould half. The advantages of using a buffer frame which is transported between the feed position for moulding material parts and the mould half for loading lie in the fact that the number of displacements of the buffer frame is limited. Much transport time is therefore not needlessly lost, the wear of the device is relatively limited and little energy is required to load the mould half.

The present invention will be further elucidated with reference to the non-limitative embodiments shown in the following figures. Herein:

Fig. 1 shows a perspective view of a device for separating and transporting the moulding material parts,

Fig. 2 shows a perspective view of a device for grouping, positioning and transporting the singly supplied moulding material parts,

Fig. 3 is a perspective view of an assembly of the devices shown in fig. 1 and 2, and

Fig. 4 is a perspective view of an alternative of the device shown in fig. 2 for grouping, positioning and transporting the singly supplied moulding material parts.

Fig. 1 shows a separating and transporting device 1 for pellets, 2,3,4,5 of moulding material. A pellet 2 supplied over a linear feed path not shown in this figure is gripped by means of a gripper 6 and pushed into a holder 7, which holder 7 is formed by rod-like elements 8. Holder 7 forms part of a mill 9 on which a plurality of holders 10 are mounted as holder 7. Mill 9 with holders 7,10 is connected to a maltese cross 11 whereby a rotating movement of a drive disc 12, which drive disc 12 is provided with a cam 13 co-acting with maltese cross 11, is converted into an intermittent movement of mill 9. The intermittent movement of mill 9 enables sliding of pellet 2 into holder 7 using the



gripper 6. The driving of gripper 6 will be elucidated hereinbelow. After pellet 2 has been pushed into holder 7 the mill 9 will progress further in stepwise manner. In the position of pellet 4 a sensor 14 is placed close to holder 10 with which for instance the length of pellet 4 can be checked. In the position of pellet 5 which has progressed still further the pellet 5 can be pressed out of holder 10 using an ejector 15. Pellet 5 is situated for this purpose close to a discharge position 16 where the discharged pellets can be further processed, and further attention will be given hereto below. Ejector 15 is coupled by means of a rod 17 to the reciprocating movement of gripper 6. The reciprocating movement of coupling rod 17 is indicated by means of arrow P1. With the feed of a new pellet 2 a pellet 5 will therefore also be discharged from the mill 9. If however it is determined by sensor 14 that a particular pellet, for instance pellet 5, is not of the correct quality, an actuator 18 is operated as soon as this rejected pellet 5 is located close to discharge position 16, which actuator 18 engages on a protrusion 19 fixed to coupling rod 17. By actuator 18 exerting pressure on protrusion 19 the coupling rod 17 will rotate as according to arrow P2. After turning of coupling rod 17 the reciprocating movement of coupling rod 17 as according to arrow P1 results in the ejector 15 no longer engaging on pellet 5. The latter will consequently not be discharged at discharge position 16 but is carried through to a subsequent position where a fixed discharge guide 20 will discharge through a reject guide 21 the pellets not discharged at the discharge position 16 by ejector 15. After passing the fixed discharge guide 20 the holder 10 is in any case empty again to receive a freshly supplied pellet 2. It will be apparent that in the described method the sensor 14 is linked to actuator 18 with interposing of a control mechanism incorporating a delay for the progression of mill 9.

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The movement of gripper 6 and the ejector 15 connected thereto by means of coupling rod 17 is carried out, as is the driving of mill 9, by drive disc 12. Connected rotatably to drive disc 12 for this purpose is
5 a rod 22 which on its side remote from drive disc 12 is mounted pivotally on a plate 23. This plate 23 is connected on the side remote from gripper 6 by a U-shaped profile 24 to a linear guide 25 forming part of the fixed components. By rotating drive disc 12 the plate 23 will
10 make a linear reciprocating movement as according to arrow P1. Coupling rod 17 is connected in axial direction to plate 23 whereby coupling rod 17 also makes the reciprocating movement as according to arrow P1. In addition to a movement component parallel to the linear
15 guide 25, the outer end of rod 22 connected to drive disc 12 also comprises a movement component perpendicular to the linear guide 25. Since rod 22 is pivotally connected to plate 23 on the side remote from drive disc 12, the rod 22 does not have at the position where it is coupled
20 to plate 23 this freedom of movement in perpendicular direction of linear guide 25. Mounted rigidly on rod 22 between the two outer ends of rod 22 is a block 26 which in addition to a reciprocating movement as according to arrow P1 will also undergo a reciprocating movement in a
25 direction perpendicularly thereof as according to arrow P2.

The gripper 16 comprises two gripper arms 27,28 which are pivotable round a shaft 29 fixedly connected to plate 23. Block 26 is connected by means of two parallel
30 drive rods 30,31 to the respective gripper arms 27,28. The rotating movement of drive disc 12 is converted by means of the described mechanism into a reciprocating movement of gripper 6 as according to arrow P1, wherein gripper arms 27,28 are moved toward each other during a
35 feed movement of gripper 6 and moved away from each other in the return stroke. In order to obtain the correct bias of gripper 6 on the pellet 2 to be supplied, it is



advisable to manufacture at least a part of the gripper arms 27,28 from spring steel.

Fig. 2 shows a buffer frame 32 provided with receiving means 33 into which moulding material parts can be placed. The transport of buffer frame 32 between a loading position and an offloading position will be described with reference to fig. 3.

In order to load the buffer frame 32 with moulding material parts the buffer frame 32 is placed as a whole for instance close to a single feed position where separated moulding material parts are supplied. Receiving means 33 are arranged in receiving beams 34 which are displaceable along linear receiving means guides 35 by rotating a rotor arm 37 using a drive 36. The outer ends of rotor arm 37 are connected to receiving beams 34 by means of coupling rods 38. In order to load buffer frame 32 the receiving beams 34 are carried as close as possible to each other by rotation of rotor arm 37. In the situation shown here the receiving beams 34 each contain a single row of receiving means 33. It is however also possible to embody the receiving beams 34 differently, for instance by means of a double row of receiving means 33. Moving the receiving beams 34 toward each other to load the buffer frame 32 has the advantage that loading takes less time than if the receiving beams 34 are located at a greater mutual distance. For loading of the individual receiving means each receiving means 33 must be placed separately at the correct loading position. Arranged for this purpose in buffer frame 32 is a cylinder 39 with which the entirety of drive 36, rotor arm 37 and receiving beams connected thereto can be moved along the receiving means guides 35. Cylinder 39 thus provides receiving beams 34 with a lateral freedom of movement in order to carry them in lateral direction relative to the loading position. For positioning in perpendicular direction of the receiving means guides, in this figure the vertical direction, use is made of the



freedom of movement of buffer frame 32 as a whole. This is further elucidated with reference to fig. 3.

Buffer frame 32 further comprises stops 40 which are movable in the receiving means 33. During
5 offloading of receiving means 33, by causing the stop beams 41 bearing the stops 40 to move the stops will be moved such that moulding material parts situated in receiving means 33 are forced at least partially out of receiving means 33. In order to cause the stops 40 to
10 move, the stop beams 41 are arranged in a framework 42. Framework 42 is connected with knee joints 43 to buffer frame 32. By extending a stop cylinder 44 which is connected on one side to buffer frame 32 and on the other side to framework 42, the latter can be moved relative to
15 buffer frame 32 such that the stops 40 move in the receiving means 33.

During offloading of buffer frame 32 the receiving beams 34 will first be moved apart by rotating the rotor arm 37 using the drive 36 such that their
20 mutual position corresponds with the configuration in which the moulding material parts have to be received in a mould half. Depending on the configuration in which the moulding material parts have to be placed in a mould half, receiving beams 34 associated with a mould half and
25 stop beams corresponding thereto can be mounted in buffer frame 32. Adjustment of receiving beams 34 and stop beams 41 is relatively simple to carry out.

Fig. 3 shows an assembly of the separating and transporting device 1 as shown in fig. 1 and the buffer
30 frame 32 as shown in fig. 2. The discharge position of the separating and transporting device 1 herein forms the fixed loading position of buffer frame 32. In order to place the receiving means 33 in a correct position relative to the loading position defined by separating
35 and transporting device 1, the buffer frame 32 comprises a cylinder 39 with which, as described with reference to fig. 2, the receiving beams 34 are displaceable along receiving means guides 35. The freedom of movement of



buffer frame 32 perpendicularly of receiving means guides 35 is realized by displacing buffer frame 32 along guide rods 45 and vertical guides 46 running parallel to a part of guide rods 45. Buffer frame 32 is provided for this purpose with guide wheels 47 which co-act with guide rods 45 and with guide blocks 48 pivotally connected to buffer frame 32 which co-act with the vertical guides 46. Since close to the feed position for moulding material parts defined by the separating and transporting device 1 the guide rods 45 and vertical guides 46 run mutually parallel in the direction perpendicularly of receiving means guides 45, the buffer frame 32 is also vertically transportable along the guide rods 45 and 46. At a greater distance from the separating and transporting device 1 the guide rods 45 are bent such that as the buffer frame 32 progresses further upward the spatial orientation of buffer frame 32 will change and it will be able to assume a horizontal position as indicated by means of broken lines 49. This position indicated by means of broken lines 49 corresponds with the offloading position of buffer frame 32. In the position as indicated by means of lines 49 the stops 40 will be employed to urge the upward transported moulding material parts out of the receiving means 33 where these parts will be transferred to a mould half.

The figure further shows a vibration feeder 50 with which moulding material parts 51 are supplied to separating and transporting device 1.

Fig. 4 shows the buffer frame 32 of fig. 2 provided with receiving means 33 in which moulding material parts can be placed. The device shown in fig. 4 corresponds very largely with the device shown in fig. 2, wherein however for the displacing of receiving beams 34 along linear receiving means guides 35 a cylinder 55 is arranged which is mounted fixedly on the buffer frame 32 on one side and mounted rotatably on a cam 56 on the other side. Cam 56 is fixedly connected to a shaft 57. By now extending or retracting cylinder 55 the shaft 57 will



rotate. Both ends of shaft 57 are provided with rotor arms 58. The outer ends of rotor arms 58 are pivotally connected to receiving beams 34 by means of coupling rods 59. In order to load or offload receiving beams 34 a mutual distance can be altered by the cylinder 55 with interposing of the mechanism formed by cam 56, shaft 57, rotor arms 58 and coupling rods 59.

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CLAIMS

1. Device for separating and transporting moulding material parts from a feed path to a discharge position comprising at least one holder for a moulding material part movable rotatably between a position close to the feed path and the discharge position, and an ejector for discharging a moulding material part arranged in the holder from the movable holder close to the discharge position.
2. Device as claimed in claim 1, wherein the drive of the rotatable holder is coupled to the drive of the ejector.
3. Device as claimed in claim 1 or 2, wherein the rotation shaft of the rotatable holder is connected to a maltese cross for moving the holder intermittently such that it stands still for a time close to the feed path and close to the discharge position.
4. Device as claimed in any of the foregoing claims, wherein the device comprises a sensor for monitoring the quality of a moulding material part received in the holder.
5. Device as claimed in any of the foregoing claims, wherein the sensor is connected to a control element for the ejector for either ejecting the moulding material part or not subject to the detected quality.
6. Device as claimed in any of the foregoing claims, wherein the device comprises a discharge guide for removing from the rotatable holder moulding material parts not ejected by the ejector at the discharge position.
7. Device as claimed in any of the foregoing claims, wherein the device comprises a gripper for gripping a moulding material part located in the feed path and for moving the moulding material part to the holder located close to the feed path.





8. Device as claimed in claim 7, wherein the drive of the rotatable holder is coupled to the drive of the gripper.

9. Device for grouping, positioning and
5 transporting singly supplied moulding material parts from a loading position to an offloading position, comprising:
- a buffer frame provided with receiving means for the moulding material parts, which buffer frame is
displaceable along a guide between the loading position
10 and the offloading position, and
- a drive for displacing the buffer frame along the guide.

10. Device as claimed in claim 9, wherein the receiving means are mounted movably in the buffer frame
15 so that in the loading position of the buffer frame the receiving means can be placed sequentially in a position in the buffer frame such that moulding material parts supplied at a fixed position are placeable in separate receiving means, and so that in the offloading position
20 of the buffer frame the receiving means can be placed in positions such that the positions thereof correspond with the receiving positions for moulding material parts in a mould half of an encapsulating device.

11. Device as claimed in claim 10, wherein the
25 buffer frame comprises a drive for displacing the receiving means in the buffer frame.

12. Device as claimed in claim 10 or 11, wherein the receiving means are connected to the buffer frame with interposing of a linear guide which lies
30 perpendicularly of the direction of movement of the buffer frame.

13. Device as claimed in any of the claims 9-12, wherein the receiving means are mounted on releasable elements which can be fixed in the buffer frame depending
35 on the placing of the moulding material parts in the mould half for loading.

14. Device as claimed in any of the claims 9-13, wherein the receiving means are provided with movable





stops for urging moulding material parts out of the receiving means.

15. Device as claimed in claim 14, wherein the buffer frame comprises a drive for causing the receiving means to move.

16. Method for encapsulating electronic components by loading a mould half at a fixed position with singly supplied moulding material parts, comprising the steps of:

- 10 - placing a plurality of moulding material parts in a buffer frame close to the fixed feed position of the moulding material parts,
- transporting the buffer frame from close to the fixed feed position of the moulding material parts to close to
- 15 the mould half for loading, and
- offloading the buffer frame into the mould half for loading.

17. Method as claimed in claim 16, wherein the method also comprises a step with which:

- 20 - the moulding material parts loaded into the buffer frame are converted from a configuration which is desired for loading the buffer frame into a configuration which corresponds with the configuration in which the moulding material parts must be received in the mould half.

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