This invention relates to an apparatus for distributing and metering a granular and tacky paste, more particularly a paste for moulding biscuits.

In the manufacture of biscuits consisting, for example, of agglomerated granules of cooked, expanded cereals coated with a binder based on sugar syrup, considerable difficulties are involved in the handling of the mass of granules mixed with the binder. This is because a mass such as this on the one hand tends to solidify and, on the other hand, has a steep flow slope, in other words it does not flow. These handling problems make the biscuits particularly difficult to mould.

FR-A-2 124 735, for example, describes an apparatus for moulding a similar mass comprising a conveyor belt in the form of juxtaposed plates each drilled with a row of holes into which the mass is introduced by a bottomless distributing box in direct contact with the belt. The mass is held in the holes by a fixed support plate over which the belt passes. The mass is then compressed in the holes or cells by a row of pistons. The moulded biscuits are then ejected by the same pistons downstream of the fixed support. An apparatus such as this is suitable if the mass is sufficiently flowable. If the mass does not flow, all the pressures exerted thereon are transmitted along the axis of the force applied. Accordingly, the holes or cells cannot be uniformly filled during their passage beneath the bottomless box and the pistons are unable subsequently to level the surface. The biscuits thus produced with a mass which does not flow are therefore in danger of varying excessively in their unit weight and of showing irregularities in shape.

The problem addressed by the present invention was to provide an apparatus for distributing and metering a granular and tacky mass which would provide both for precise metering and for regular distribution of the mass in the

moulding cells for example.

Accordingly, the invention relates to an apparatus corresponding to claim 1 of the present application.

The apparatus according to the invention provides for the simultaneous distribution of several portions of the same shape and volume of a non-compacted tacky and granular mass along one and the same production line and enables the operation to be repeated at a suitable frequency without any variation in the state of the distributed mass. In other words, this apparatus guarantees regularity in both the volume and shape of the portions, homogeneity of the mass and the reproducibility of these qualities which is essential for continuous production.

More particularly, the main transport unit enables a granular and tacky mass to be moved in the form of a laminar flow combining a wide front with minimal thickness in which the mass does not undergo any compaction. This flow is unable to drift transversely by virtue of the alternating threads and directions of rotation of the screws. The intermittent stopping of the partial flow corresponding to one or other of the said groups of screws has only a slight effect on the movement of the adjacent partial streams. The all-or-nothing control of these partial flows by clutches and devices for measuring the filling levels of the columns has the remarkable effect that the mass always flows into the columns under the same conditions and at the same rate and that each of the portions of mass delimited by the volume of the air locks is always in the same satisfactory non-compacted state.

In one preferred embodiment, the apparatus according to the invention additionally comprises an auxiliary transport unit comprising juxtaposed parallel screws with alternating threads and directions of rotation, an auxiliary motor and auxiliary transmission means. This auxiliary transport unit may be useful for converting the granular

and tacky mass into a laminar flow combining a wide front with minimal thickness even before it is discharged onto the main transport unit.

The transport units are preferably made in the form of rectangular frames open on top and closed underneath over the greater part of their length by a flat or grooved plate, the downstream end remaining open. The screws are disposed longitudinally above the base and their ends project into bearings provided in transverse mountings downstream and upstream of the frame. The screws may be void or solid. In a preferred embodiment, the screws of the main transport unit are void, in other words they are made in the form of spirals in the manner of a helical spring, and are coated with polytetrafluoroethylene. By contrast, the screws of the auxiliary transport unit are preferably solid and are made of solid polytetrafluoroethylene.

The transport units may be surmounted by mixing units comprising at least one transverse rotary scraper, for example in the form of a shaft bearing radial teeth at regular intervals. A mixing unit such as this can be useful for effectively distributing the granular and tacky mass, particularly in the vicinity of the place where it is discharged onto the main transport unit. In another preferred embodiment of the apparatus according to the invention, it is the auxiliary transport unit which is surmounted by a mixing unit over the greater part of its length.

The main or auxiliary transmission means may assume the form of clutches and/or chains. Thus, the groups of screws of the main transport unit may each be driven via a shaft connected via said clutch, for example an electromagnetic clutch, to a gearwheel driven by a chain which itself is driven by a gearwheel fixed to the shaft of the main motor. The various screws of a group are thus intercon-

nected by a gear system made up of gearwheels fixed to the ends of the screws which can project beyond the outside of one of the said downstream or upstream transverse mountings. By contrast, the auxiliary transmission means may be formed by a single gear system.

The distribution columns therefore each comprise an entrance, an air lock and an exit. Each entrance is equipped with a device for measuring the filling level which is connected to a device for controlling the clutch of the corresponding group of screws. These devices are intended to bring the said group of screws to a stop or into operation, depending on whether the air lock is completely filled with granular and tacky mass or whether it has just been emptied. The device for measuring the filling level may comprise a sensor, for example an optical, pneumatic or capacitive sensor. It has been found that particularly satisfactory results can be obtained with a capacitive cell which provides an accurate quantitative measurement of the mass which has accumulated in front of it. In this case, the device for controlling the clutch may advantageously be made in the form of an electronic circuit which compares the signal delivered by the capacitive cell with a set value corresponding to a limiting filling level in the entrance.

A central part of each column is made in the form of an air lock communicating with the entrance and the exit by way of an upper shutter and a lower shutter which delimit or meter the volume of the portions of mass to be distributed. The wall of the column between the shutters is preferably made in the form of two telescopic cylinders which enable the height of the air lock and hence the volume of the portions to be adjusted to a desired value. The shutters are connected to a drive and control unit intended to initiate and synchronize their closure and their opening, for example as a function of the movement of

the moulds or cells which come into position beneath the distribution columns.

Each of the said column exits may consist of a simple extension of the air lock, for example in the form of a cylinder of appropriate diameter corresponding, for example, to the diameter of the moulds or cells to be filled. In one variant, the column exits each incorporate an axially arranged distribution cone which widens downwards. These distribution cones are intended even further to improve the regularity of the shape of the distributed portions of mass and, in particular, the smoothness of their surface. In another variant, each of the said column exits has a first inclined part opening onto a second vertical part on the axis of which is arranged a rotary bar which comprises a set of inclined radial vanes at its lower end and which is connected to a piston and to drive means at its upper end. These sets of rotary vanes are intended even further to improve the surface smoothness of the portions of mass, for example after they have been distributed in moulds or cells. In this embodiment, the movements of the said pistons are synchronized with the movements of the said lower shutters.

The apparatus according to the invention is described in detail in the following with reference to the accompanying drawings, wherein:

Figure 1 is a diagrammatic side elevation, partly in section, of one embodiment of the apparatus according to the invention.

Figure 2 is a diagrammatic front elevation, partly in section, of the same embodiment of the apparatus according to the invention.

Figure 3 is a partial diagrammatic plan view of the main transport unit shown in Figs. 1 and 2.

Figure 4 is a partial diagrammatic plan view of the auxiliary transport unit shown in Figs. 1 and 2.

Figure 5 is a diagrammatic side elevation in section of a modified embodiment of the exit of the distribution columns.

In the embodiment shown in Figs. 1 and 2, the apparatus comprises a main transport unit 1 comprising twenty juxtaposed parallel screws 2 having alternating threads and directions of rotation and divided into groups of two pairs of screws, a main motor 3 and main transmission means comprising a chain 4 and one electromagnetic clutch 5 and one gear system 5 per group of screws.

The apparatus additionally comprises upstream of the main transport unit 1 an auxiliary transport unit 7 comprising ten juxtaposed parallel screws 8 having alternating threads and directions of rotation, an auxiliary motor 9 and auxiliary transmission means consisting of a gear system 10. Arranged above the auxiliary transport unit 8 is a mixing unit 11 comprising three transverse rotary scrapers 120 each formed by a shaft bearing rings of four radial teeth at regular intervals. The scrapers 120 are driven by a motor 121 via a gear system 122. A hopper 13 for supplying the apparatus with tacky and granular mass is arranged above the mixing unit 11.

Hoppers 14 are juxtaposed beneath the downstream end of the main transport unit, one hopper being provided for each group of screws. Arranged beneath each hopper 14 is a distribution column comprising an entrance 15, an air lock 16 and an exit 17. Each entrance 15 of the distribution columns is provided with a device for measuring the filling level comprising a capacitive cell 18 connected to a device 19 for controlling the electromagnetic clutch 5. The control device 19 is in the form of an electronic comparison circuit which compares the signal delivered by the capacitive cell with a set value corresponding to a limiting filling level in the entrance. When the signal of the capacitive cell reaches the set value, the comparison

circuit delivers a control signal to disengage the electromagnetic clutch. When the signal of the capacitive cell falls back below the set value, the comparison circuit delivers a control signal to engage the electromagnetic clutch.

Each air lock 16 comprises an upper shutter 20 and a lower shutter 21 in the form of slides. The shutters are connected to a drive and control mechanism comprising a shaft 22 which actuates a rocker arm 23 and which is connected to drive means (not shown) controlled by control and synchronizing means (not shown). This mechanism is intended to open and close the shutters in dependence upon the movement of the moulds or cells 28 which come into position beneath the exit 17 of the distribution columns. The wall of the column between the two shutters is formed by two telescopic cylinders 24,25.

Each of the column exits consists of an extension of the air lock in the form of a cylinder 26 corresponding in diameter to the diameter of the moulds or cells 28 to be filled. Each exit incorporates an axially arranged distribution cone 27 which widens downwards.

As shown in Figs. 1, 2 and 3, the screws 2 of the main transport unit 1 are void, in other words they are in the form of helical spirals. They are coated with polytetrafluoroethylene. The main transport unit 1 is in the form of a rectangular frame open on top and closed underneath over the greater part of its length by a flat base 29, the downstream end 30 remaining open. The screws 2 are arranged longitudinally above the base 29 and their ends 31,21 project into bearings provided in transverse downstream and upstream mountings 33 and 34 of the frame. The main motor 3 drives the chain 4 by a gearwheel fixed to its shaft 35. The chain drives gearwheels fixed to the upstream shafts 36 of the clutches 5. The downstream shaft 37 of each clutch drives the gear system 6 in the form of

gearwheels fixed to the ends 32 of the screws which project beyond the outside of the upstream transverse mounting 34.

As shown in Figs. 1, 2 and 4, the screws 8 of the auxiliary transport unit 7 are solid. They are made entirely of polytetrafluoroethylene. The auxiliary transport unit 7 is also in the form of a rectangular frame open on top and closed underneath over the greater part of its length by a grooved base 38, the downstream end 39 remaining open. The screws 8 are arranged longitudinally above the bases 38 and their ends 40,41 project into bearings provided in the downstream and upstream transverse mountings 42 and 43 of the frame. The screws 8 are driven by the auxiliary motor 9 by way of a single gear system 10 in the form of a gearwheel fixed to the shaft 44 of the motor and gearwheels fixed to the ends 41 of the screws which project beyond the outside of the upstream transverse mounting 43.

The modified embodiment of the exit of the distribution columns shown in Fig. 5 has a first inclined part 45 which is positioned beneath the lower shutter 21 of the air lock (see Figs. 1 and 2) and which opens onto a second vertical part 46. Arranged on the axis of the vertical part 46 is a rotary rod 47 which comprises a set of inclined radial vanes 48 at its lower end and which is connected at its upper end to a piston 49 combined with pneumatic drive means. The set of rotary vanes 48 is designed to descend under the effect of the movement of the piston to level the surface of the portion of granular and tacky material which has entered into the mould or cell 28. The movements of the piston 49 are synchronized with the movements of the lower shutter 21 of the air lock.

CLAIMS

1. An apparatus for distributing and metering a granular and tacky paste, more particularly a paste for moulding biscuits, characterized in that it comprises a main transport unit (1) comprising juxtaposed parallel screws (2) with alternating threads which are divided into groups of at least one pair of screws, a main motor (3) and main transmission means (4-6) - adapted to drive the screws in alternating directions of rotation - comprising one clutch (5) per group of screws, juxtaposed hoppers (14) beneath the downstream end of the main transport unit, there being one hopper per group of screws, and beneath each hopper a distribution column comprising an inlet (15), an air lock (16) and an outlet (17), said inlet (15) being provided with a device (18) for measuring the filling level which is electronically connected to a control mechanism (19) for the clutch (5) of said group of screws.

2. An apparatus as claimed in claim 1, characterized in that it additionally comprises an auxiliary transport unit (7) comprising juxtaposed parallel screws (8) with alternating threads and directions of rotation, an auxiliary motor (9) and auxiliary transmission means (10).

3. An apparatus as claimed in claim 1, characterized in that the screws (2) of the main transport unit (1) are in the form of helical spirals and are coated with polytetrafluoroethylene.

4. An apparatus as claimed in claim 2, characterized in that the screws (8) of the auxiliary transport unit (7) are solid and are made of polytetrafluoroethylene.

5. An apparatus as claimed in claim 2, characterized in that the auxiliary transport unit (7) is surmounted by a mixing unit comprising at least one transverse rotary scraper (12).

6. An apparatus as claimed in claim 1, characterized in that each of the devices (18) for measuring the filling

level comprises a capacitive cell.

7. An apparatus as claimed in claim 1, characterized in that each of the column outlets (17) comprises a downwardly widening, axially arranged distribution cone (27).

8. An apparatus as claimed in claim 1, characterized in that each of said column outlets (17) comprises a first inclined part (45) opening onto a second vertical part (46) in the axis of which is arranged a rotary rod (47) which comprises a set of radial, inclined fins (48) at its lower end and which is connected to a piston (49) and to a drive means at its upper end.