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(54) Packing machine particularly for cigarettes, or similar

(57) Packaging machine, especially for cigarettes, comprising a station (SA) for bringing together a pre-ordered group of cigarettes and a wrapper sheet in which said group is later wrapped and from which station (SA) the sheet is transferred together with the cigarettes to a subsequent unit (4) which folds the sheet around the group of cigarettes; means (5, 7) for feeding the group of cigarettes along a defined path (1B) to the bringing-together/transfer station (SA); and means (11, 11') for feeding a sheet, along a defined path different from that of the cigarettes, to the bringing-together/transfer station (SA). According to the invention, the sheet feed means (11, 11') and the means (15, 16, 18, 18', 19) for actuating these and the cigarette feed means (5, 7) are situated and are constructed in such a way that at least the cigarette feed path (1B) is at least partially free, on one or more of its sides, at least in the part associated with the bringing-together/transfer station (SA).

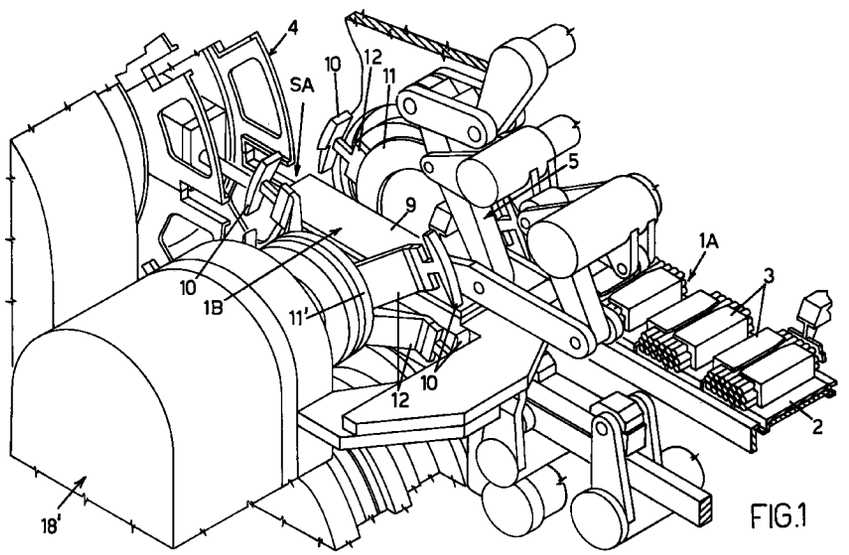

FIG.1

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Description

The invention relates to a packaging machine, especially for cigarettes or the like, comprising:

a station for bringing together a pre-ordered group of cigarettes and a wrapper sheet in which said group is later wrapped and from which station the sheet is transferred together with its group of cigarettes to a subsequent unit which folds the sheet around the group of cigarettes;
means for feeding the group of cigarettes along a defined path to the bringing-together/transfer station;
means for feeding a sheet, along a defined path different from that of the cigarettes, to the bringing-together/transfer station.

It is the object of the invention to provide a device of the type described in the introduction, such that, by the use of simple and comparatively inexpensive means, inspection operations and interventions carried out directly on the cigarettes in the event of malfunctions are greatly facilitated, without restricting the device's performance, especially as regards the cigarette feed rate and the adaptability of the device to different sizes of cigarettes.

The invention achieves the above objects with a device of the type described in the introduction, in which the sheet feed means and the means for actuating these and also the cigarette feed means are situated and are constructed in such a way that at least the cigarette feed path is partially free, on one or more of its sides, especially at the end part towards the bringing-together/transfer station.

Another feature of the invention is that the sheet feed means consist of gripper means each acting on a respective lateral portion of the sheet that extends in a plane parallel to the direction in which the groups of cigarettes are fed, at least in the end section towards the bringing-together/transfer station, which gripper components consist of two separate elements arranged side by side and a distance apart from each other, so that the path of the cigarettes passes between them, both elements of the gripper components being capable of being coupled dynamically to and/or actuated separately from each other in a synchronized manner.

The means of dynamic coupling to the actuating movement of at least one of the two elements that form the gripper components that each act on a respective portion of the sheet's two lateral portions external to the path along which the cigarettes are fed, are situated under the path of these cigarettes and the two gripper elements are mounted or connected to rotary actuator and/or support means that are separate from each other, sideways on to the intermediate path of the cigarettes.

In an advantageous embodiment, at least the end section of the path of the cigarettes towards the bringing-together/transfer station is parallel or approximately parallel to the front side of the machine, one sheet gripper element being externally sideways on to the inner longitudinal side of said end section of the cigarette feed path, while the other gripper element is situated coinciding with the first, but externally sideways on to the opposite longitudinal side, that is, to the front side of the cigarette feed path.

The sheet gripper components comprise pairs of suction segments for each element, which suction segments are axially aligned with each other and are moved together in circular paths. In particular, the gripper elements consist of two discs or of two spoke wheels which are mechanically separate from each other, are supported coaxially with each other and are externally sideways on to the corresponding sides of the end section of the cigarette path, the spokes of the two wheels being aligned axially with each other and forming the means of support of individual circumferentially oriented suction segments, as well as forming, by virtue of their tubular construction, the connecting passages between the suction segments and the suction and/or vacuum source and/or atmospheric pressure or a pressure source.

The axis of the two spoke wheels is positioned approximately level with the cigarette feed path and in particular is oriented transversely to said path, each of the two wheels being supported on the end towards the corresponding longitudinal side of the cigarette path, of a corresponding hub or shaft portion, these being coaxial with each other.

A further characteristic is that the shaft portion driving the spoke wheel situated on the front side of the cigarette feed path stops short of the facing side of said feed path, and a plurality of wheels with radial spokes inclined axially towards the opposite spoke wheel are provided to correspond to a predetermined dimension of the sheet in the transverse direction to the path of said cigarettes.

At the end section of the cigarette feed path, between the sheet gripper components, said cigarettes are moved transversely to their axis. The path is advantageously straight and in particular preferably horizontal.

The two spoke wheels can receive their stepwise drive motion from a single main driven shaft of the machine, or from a plurality of driven shafts of the machine, each spoke wheel having a transmission which converts the motion of the drive shaft into a perfectly synchronized rotary stepwise movement of both wheels with angular steps of identical amplitude.

The drive means of the spoke wheel situated on the front side of the cigarette path comprise motion transmission means that pass underneath the cigarette path, from the inward side of the machine towards its front side, and a kinematic chain for converting the motion into the predetermined angular stepwise motion of the wheel which extend upwards to terminate in a position coaxial with the inner wheel and in front of the corre-

sponding front side of the cigarette path, with the supporting shaft of the outer wheel.

The straight path of the cigarettes is advantageously bounded, at least in said end section between the wrapper sheet feed wheels, by a straight channel formed by a lover travelling surface or guide and by an upper wall that extends between the two wheels and that can in some suitable way be removed, being directly accessible, by hand.

For feeding the cigarettes, the invention employs, in combination with the channel that bounds the end section of the cigarette feed path, components for moving a group of cigarettes, with a gripper head which is caused to travel back and forth along the straight path by an articulated parallelogram, in particular by a five-bar chain, which can be freely introduced into and withdrawn from the channel that bounds the cigarette path and can travel freely in and along this channel.

Said gripper head and the upper wall of the channel that bounds the end section of the cigarette path are so constructed that during the forward stroke, that is, when the cigarettes are being fed to the bringing-together/transfer station, the gripper head comprises parts, at least at the rear, that act on the cigarettes, passing into the interior of the channel, and the return stroke takes place along a higher-level path along `which the gripper elements are external to said channel.

This is easily done by constructing the upper wall with its transverse dimensions shorter than the length of the cigarettes, oriented transversely to the direction of advance, and the gripper parts are constructed in the form of a fork that is generally perpendicular to the travelling surface and lies across the direction of advance, the free arms of which, projecting towards the travelling surface, are the parts that act on the cigarettes and are separated from each other by a slightly greater distance than the transverse dimension of the upper wall.

The gripper head can be provided with two forks separated from each other in the direction in which the group of cigarettes is fed by a distance such that they overlap, one behind and the other in front, at the rear end and at the forward end, respectively, of the group of cigarettes, with reference to its feed direction.

The advantages of the present invention will be clear from the above account. The construction of the cigarette feed components and of the sheet feed components requires no major modifications that would make it difficult or more expensive to carry out. The transmission of the motion to the outer spoke wheel with means that run under the path of the cigarettes and the supporting of said wheel at the end of a vertical drive line means that the path of the cigarettes, or more specifically the removable upper wall that bounds it, can be left completely free both to the eye and to manual access. Hence, especially in the event of jamming or mispositioning of the cigarettes, it is possible to intervene directly without having to dismantle a large number of parts. Moreover, the special form of construction reduces to a minimum the steps required to adjust the distance between the suction segments of the two wheels when switching to cigarettes of a different length, limiting these steps to the replacement of the spoke wheel on the front side of the path of the cigarettes. The adjustment process is thus made very simple and, more importantly, fast.

Other improvements of the invention are the subject of the subsidiary claims.

The features of the invention and the advantages which arise from these will be made clear in the following description of an illustrative and non-limiting embodiment illustrated in the attached drawings, in which:

Fig. 1 is a perspective view of the part of a cigarette packaging machine around the station which brings together the sheet and a group of cigarettes.
Fig. 2 is a cross-section of the sheet feed means at right angles to the path of the cigarettes.

With reference to the figures, a cigarette packaging machine includes means for moving a series of groups of cigarettes, already arranged in the final arrangement which they are to have in the finished pack. The cigarettes are fed along a generally coplanar and horizontal path 1A, 1B. The initial section 1A generally consists of a so-called cassette belt. This comprises an endless conveyor belt 2 moving stepwise and fitted with a plurality of housings 3 arranged side by side for the individual groups of cigarettes. The cigarettes are arranged so that their longitudinal axis is perpendicular to the direction of advance.

At the termination of the path 1A, the cigarettes are transferred in an axial direction by reciprocating pusher means marked 6 in Fig. 2 to a parallel feed path 1B coplanar with the path 1A. The path 1B is a continuation of the latter and its end section and leads to a station SA which brings together the group of cigarettes and a wrapper sheet (not illustrated).

The reciprocating pusher means 6 move essentially around a rectangular loop in which the forward stroke is level with the group of cigarettes, while the return stroke occurs at a higher level so as not to interfere with that group. The actuation of the axial pusher means 6 may be provided by a simple articulated parallelogram or the like.

The bringing-together station SA is situated in front of the entrance to a folding unit which folds the wrapper sheet around its cigarettes. This unit consists of a forming wheel bearing the general reference 4.

The wrapper sheet and its group of cigarettes are transferred together from the station SA into the forming wheel 4 by transfer means: these are not illustrated in detail and may consist of a combination of two mutually opposing pusher means.

In the straight end section 1B of the cigarette path, the group of cigarettes is conveyed towards the bringing-together station by straight movement means comprising a gripper head that can be moved along the path

1B by an articulated parallelogram, in particular a five-bar chain bearing the general reference 5.

At the end section 1B of the cigarette path is a straight horizontal surface or guide 8 along which the group of cigarettes travels, and an upper wall 9 that bounds the cigarette path 1B and extends parallel to the lover travelling guide 8; it is also removable, in particular by means of a rear transverse extension that projects out on the front side of the machine and that is fixed removably to part of the frame thereof.

The movement means advantageously comprise a gripper head 7 for gripping the group of cigarettes. This head 7 is provided with vertical extensions, i.e. extensions that are perpendicular to the travelling surface 8 of the cigarettes, in the form of a transverse fork 107. The two free arms of the fork 107 are situated at either end of the transverse sides of the gripper head 7 and are separated from each other in such a way that the upper side 9 lies between them. The transverse distance between the arms of the fork 107 of the gripper head 7 is therefore greater than the transverse dimensions of the upper wall 9, while the distance between the respective outer lateral edges of the arms of the fork is equal to or less than the axial length of the cigarettes. It is possible for the gripper head 7 to have a fork 107 both at the rear end of the head, where it lies over the rear end of the group of cigarettes, and also at a forward end, the two forks being separated from each other by a distance such that the forward fork comes over the front side of the group of cigarettes, with reference to the cigarette feed direction. The distance between the travelling surface 8 and the upper wall 9 is approximately equal to the vertical dimensions of the group of cigarettes. As a result, the combination of the travelling surface 8 and the upper wall 9 with the gripper head 7 forms a movement element whereby the group of cigarettes is maintained in its correct ordered arrangement.

Furthermore, the particular construction of the gripper head 7 enables it to describe a rectilinear forward movement in which the forks pass into the interior of the channel which forms the cigarette path 1B, and an approximately parallel return stroke in which the forks move on a higher level than the upper wall 9 and do not interfere with the cigarette path 1B.

The cigarette path 1B ends at the bringing-together/transfer station SA at approximately the same point as, and in particular very slightly set back from, the circular feed path of the sheet. The latter is fed by rotating feed means with suction segments 10. The suction segments 10 are arranged in coinciding but axially separate pairs, enabling them to act on the end portions of the circumferentially oriented bands of the sheet that project beyond the axial length of the cigarettes. For each sheet there are two pairs of suction segments 10 in axial alignment, with one pair acting on the front sections and the other on the end sections of said projecting lateral bands of the sheet, with reference to the sheet feed direction.

The suction segments corresponding to each of the two opposite lateral bands of the sheet are mounted on a separate wheel or disc 11, 11'. In particular, the example illustrated shows wheels 11, 11' in which the circumferential suction segments 10 are each supported by a radial spoke 12. The two wheels 11, 11' are mechanically completely separate from each other and are mounted coaxial with each other on rotary supports.

One wheel 11 is positioned externally alongside that side of the cigarette path which is opposite the front side of the machine. It is attached to a ring gear 13 which revolves on a stationary axis or stationary hub 14. The ring gear 13 meshes with the output gear 21 of a drive line connected to a main driven shaft of the machine. The drive provides, in particular, means 18 for converting the rotary motion of the main shaft into reciprocating motion, e.g. an intermittent movement mechanism, such as an oscillator with parallel axes, or the like. The opposite wheel 11' is attached to and rotates with the end of a shaft portion 15. The shaft portion 15 and hence also the wheel 11' are situated alongside the front side of the cigarette path 1B. The common axis of rotation of the two independent wheels 11, 11' is transverse to the cigarette feed direction and lies approximately level with said path, in particular with the upper wall 9 thereof.

In the same way as described for the wheel 11, the wheel 11' receives its actuating movement from a main shaft of the machine which may be the same as that connected to the wheel 11 or a different shaft. A drive shaft 16 parallel to the common axis of rotation of the two wheels 11, 11' lies underneath the cigarette path 1B and its end projecting on the front side of the machine is connected to a transmission capable of converting its rotary motion into reciprocating motion, for example an intermittent movement mechanism, that is an oscillator with parallel axes 18'. When, as in the case illustrated, the drive shaft itself executes an oscillatory or stepwise movement different from that required for turning the wheel 11' in synchronism with the wheel 11, it is possible to interpose an additional drive that converts the motion in a suitable way such as that bearing the general reference 19 in Fig. 2.

The output shaft 118' of the parallel-axis oscillator 18' is connected to the shaft portion 15 supporting the wheel 11' by means of a coupling of a gearwheel and a ring gear bearing the general reference 20.

The drive or drives 18, 18', 19 extend vertically upwards in such a way that the axis of rotation of the wheel 11' is coaxial with that of the opposite wheel 11.

The ways in which the motion is converted by the two parallel-axis oscillators 18, 18' are identical or different depending on how the motion is passed to their input shafts and are such that the two wheels 11, 11' are always precisely synchronized with each other, their steps being of identical angular amplitude and the wrapper sheet being held perfectly taut on the suction segments 10.

The connection of the suction segments 10 to the vacuum or to the suction and, in alternation, their con-

nection to atmospheric pressure or to a pressure source is brought about by means of a revolving valve which comprises a stationary bottom 22 provided with chambers 122 in the form of circular sectors of defined amplitude that are connected to the vacuum sources or to atmospheric pressure, or to the pressure sources, and over whose end surface there move, leaktightly, the passage holes communicating with the channels formed by the tubular spokes 12.

The cigarette path 1B lies between the two wheels 11, 11', and the shaft 15 supporting the wheel 11' on the front side of the machine is separated by a large distance from the nearest side of the cigarette path 1B. This makes it possible to use different sizes of sheet, with reference to their dimension across the cigarette path 1B, simply by providing wheels 11', in which the spokes 12 carrying the suction segments 10 are more or less inclined towards the axis of rotation of the wheel 11', to correspond to the transverse dimension of the sheet. This situation is illustrated in Fig. 2. The spokes 12 in solid lines are of the type that incline towards the axis of the wheel in the direction of the cigarette path 1B, in order to grasp a sheet with shorter transverse dimensions, whereas the chain lines show the spoke 12' of a wheel 11' designed to grasp a sheet whose transverse dimensions relative to the cigarette path 1B are the maximum length.

Consequently the distance between the end of the shaft 15 supporting the wheel 11' on the front side of the machine is approximately equal to, or slightly greater than, the maximum projection of the sheet having the greatest possible transverse dimensions, from the corresponding front side of the cigarette path 1B.

The invention is not of course limited to the embodiments described and illustrated but can be altered and modified, especially constructionally. Thus, the invention should not be regarded as limited to a situation in which the end section of the cigarette path has the orientation described, but extends to all orientations as well as to the possible constructions of the cigarette and sheet feed means; all of which being done without departing from the underlying principle set forth above and claimed below.

Claims

1. Packaging machine, especially for cigarettes or the like, comprising:

   a station (SA) for bringing together a preordered group of cigarettes and a wrapper sheet in `which said group is later wrapped and from which station (SA) the sheet is transferred together with its group of cigarettes to a subsequent unit (4) which folds the sheet around the group of cigarettes;
   means (5, 7) for feeding the group of cigarettes along a defined path (1B) to the bringing-together/transfer station (SA);
   means (11, 11') for feeding a sheet, along a defined path different from that of the cigarettes, to the bringing-together/transfer station (SA), which machine is characterized in that the sheet feed means (11, 11') and the means (15, 16, 18, 18', 19, 20) for actuating these and also the cigarette feed means (5, 7) are situated and are constructed in such a way that at least the cigarette feed path (1B) is partially free, on one or more of its sides, especially at the end part towards the bringing-together/transfer station (SA).

2. Machine according to Claim 1, characterized in that the sheet feed means consist of gripper means each acting on a respective lateral portion of the sheet that extends in a plane parallel to the direction in which the groups of cigarettes are fed, at least in the end section towards the bringing-together/transfer station (SA), which gripper components consist of two separate elements (11, 11') arranged side by side and a distance apart from each other, so that the path (1B) of the cigarettes passes between them, both elements (11, 11') of the gripper components being capable of being coupled dynamically to and/or actuated separately from each other in a synchronized manner.

3. Machine according to Claim 1 or 2, characterized in that the means (16) of dynamic coupling to the actuating movement of at least one of the two elements (11, 11') that form the gripper components that each act on a respective portion of the sheet's two lateral portions external to the path (1B) along which the cigarettes are fed, are situated under the path (1B) of these cigarettes and the two gripper elements (11, 11') are mounted or connected to rotary actuator and/or support means that are separate from each other, sideways on to the intermediate path (1B) of the cigarettes.

4. Machine according to one or more of the previous claims, characterized in that at least the end section of the path (1B) of the cigarettes towards the bringing-together/transfer station (SA) is parallel or approximately parallel to the front side of the machine, one sheet gripper element (11) being externally sideways on to the inner longitudinal side of said end section of the cigarette feed path, while the other gripper element is situated coinciding with the first, but externally sideways on to the opposite longitudinal side, that is, to the front side of the cigarette feed path.

5. Machine according to one or more of the previous claims, characterized in that the sheet gripper components comprise pairs of suction segments (10) for each element (11, 11'), which suction segments are axially aligned with each other and are moved

together in circular paths.

6. Machine according to Claim 5, characterized in that the gripper elements consist of two discs or of two spoke wheels (11, 11') which are mechanically separate from each other, are supported coaxially with each other and are externally sideways on to the corresponding sides of the end section (1B) of the cigarette feed path, the spokes (12) of the two wheels (11, 11') being aligned axially with each other and forming the means of support of individual circumferentially oriented suction segments (10), as well as forming, by virtue of their tubular construction, the connecting passages between the suction segments and the suction and/or vacuum source and/or atmospheric pressure or a pressure source.

7. Machine according to one or more of the previous claims, characterized in that the axis of the two spoke wheels (11, 11') is positioned approximately level with the cigarette feed path (1B) and in particular is oriented transversely to said path (1B), each of the two wheels (11, 11') being supported on the end towards the corresponding longitudinal side of the cigarette path (1B), of a corresponding hub or shaft portion (14, 15), these being coaxial with each other.

8. Machine according to one or more of the previous claims, characterized in that the shaft (16) supporting the spoke wheel (11') situated on the front side of the cigarette feed path (1B) stops short of the facing side of said feed path (1B), and a plurality of wheels (11') with radial spokes (12, 12') inclined axially towards the opposite spoke wheel (11) are provided to correspond to a predetermined dimension of the sheet in the transverse direction to the path (1B) of said cigarettes.

9. Machine according to one or more of the previous claims, characterized in that at the end section (1B) of the cigarette feed path, between the sheet gripper components (11, 11'), said cigarettes are moved transversely to their axis.

10. Machine according to one or more of the previous claims, characterized in that the cigarette feed path (1B) is straight and in particular preferably horizontal.

11. Machine according to one or more of the previous claims, characterized in that the two spoke wheels (11, 11') can receive their stepwise drive motion from a single main driven shaft of the machine, or from a plurality of driven shafts of the machine, each spoke wheel having a transmission (18, 18', 19) which converts the motion of the drive shaft into a perfectly synchronized rotary stepwise movement of both wheels (11, 11') with angular steps of identical amplitude.

12. Machine according to Claim 11, characterized in that the drive means of the spoke wheel (11') situated on the front side of the cigarette path (1B) comprise motion transmission means that pass underneath the cigarette path (1B), from the inward side of the machine towards its front side, and a kinematic chain (18', 19) for converting the motion into the predetermined angular stepwise motion of the wheel (11') which extend upwards to terminate in a position coaxial with the inner wheel (11) and in front of the corresponding front side of the cigarette path (1B), with the supporting shaft (15) of the outer wheel (11').

13. Machine according to one or more of the previous claims, characterized in that the straight horizontal path (1B) of the cigarettes is advantageously bounded, at least in said end section between the wrapper sheet feed wheels (11, 11'), by a straight channel formed by a lover traveling surface (8) or guide and by an upper wall (9) that extends between the two wheels (11, 11') and that can in some suitable way be removed, being directly accessible, by hand.

14. Machine according to one or more of the previous claims, characterized in that in combination with the channel (8, 9) that bounds the end section of the cigarette feed path (1B), components (5, 7, 107) are provided for moving a group of cigarettes, with a gripper head (7, 107) which is caused to travel back and forth along the straight path by an articulated parallelogram (5), in particular by a five-bar chain, which can be freely introduced into and withdrawn from the channel (8, 9) that bounds the cigarette path (1B) and can travel freely in and along this channel.

15. Machine according to Claim 14, characterized in that said gripper head (7, 107) and the upper wall (9) of the channel that bounds the end section (1B) of the cigarette path are so constructed that during the forward stroke, that is, when the cigarettes are being fed to the bringing-together/transfer station (SA), the gripper head (7, 107) comprises parts, at least at the rear, that act on the cigarettes, passing into the interior of the channel, and the return stroke takes place along a higher-level path along which the gripper elements (107) are external to the upper wall (9), that is, to said channel.

16. Machine according to Claim 15, characterized in that the upper wall (9) is constructed with its transverse dimensions shorter than the length of the cigarettes, oriented transversely to the direction of advance, and the gripper parts are constructed in

the form of a fork (107) that is generally perpendicular to the travelling surface (8) and to said upper wall (9) and lies across the direction of advance, the free arms of `which, projecting towards the travelling surface (8), are the parts that act on the cigarettes and are separated from each other by a slightly greater distance than the transverse dimension of the upper wall (9).

17. Machine according to Claim 16, characterized in that the gripper head (7) can be provided with two transverse forks (107) separated from each other in the direction in which the group of cigarettes is fed by a distance such that they overlap, one behind and the other in front, at the rear end and at the forward end, respectively, of the group of cigarettes, with reference to its feed direction.

18. Machine according to one or more of Claims 14 to 17, characterized in that the gripper head (7) is moved by a five-bar chain (5) on a generally two-dimensional rectangular path lying in the plane perpendicular to the direction in which the cigarettes are advanced and in this direction.

19. Packaging machine, especially for cigarettes, wholly or partly as described and illustrated and for the objects set forth above.

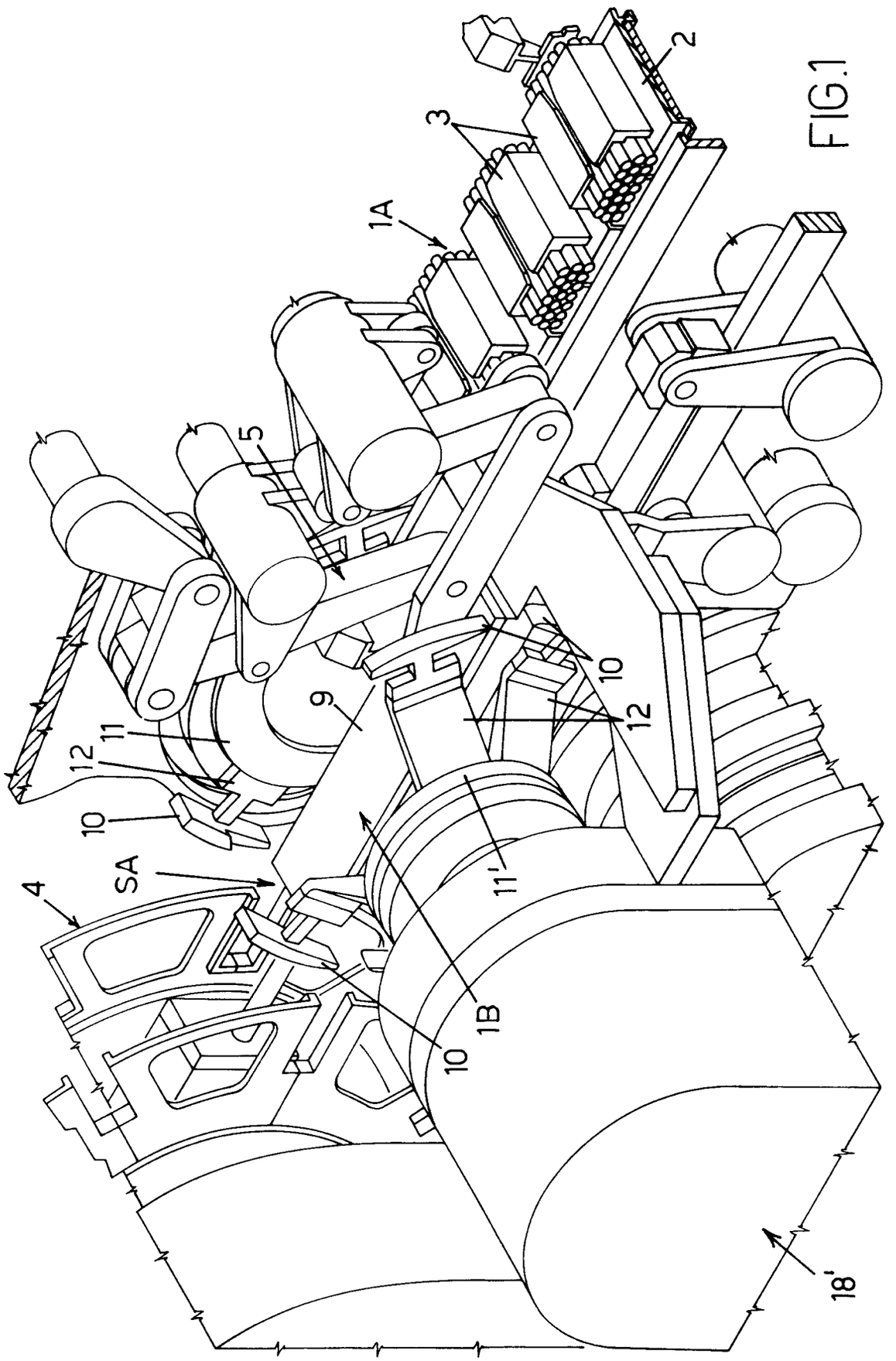

FIG.1

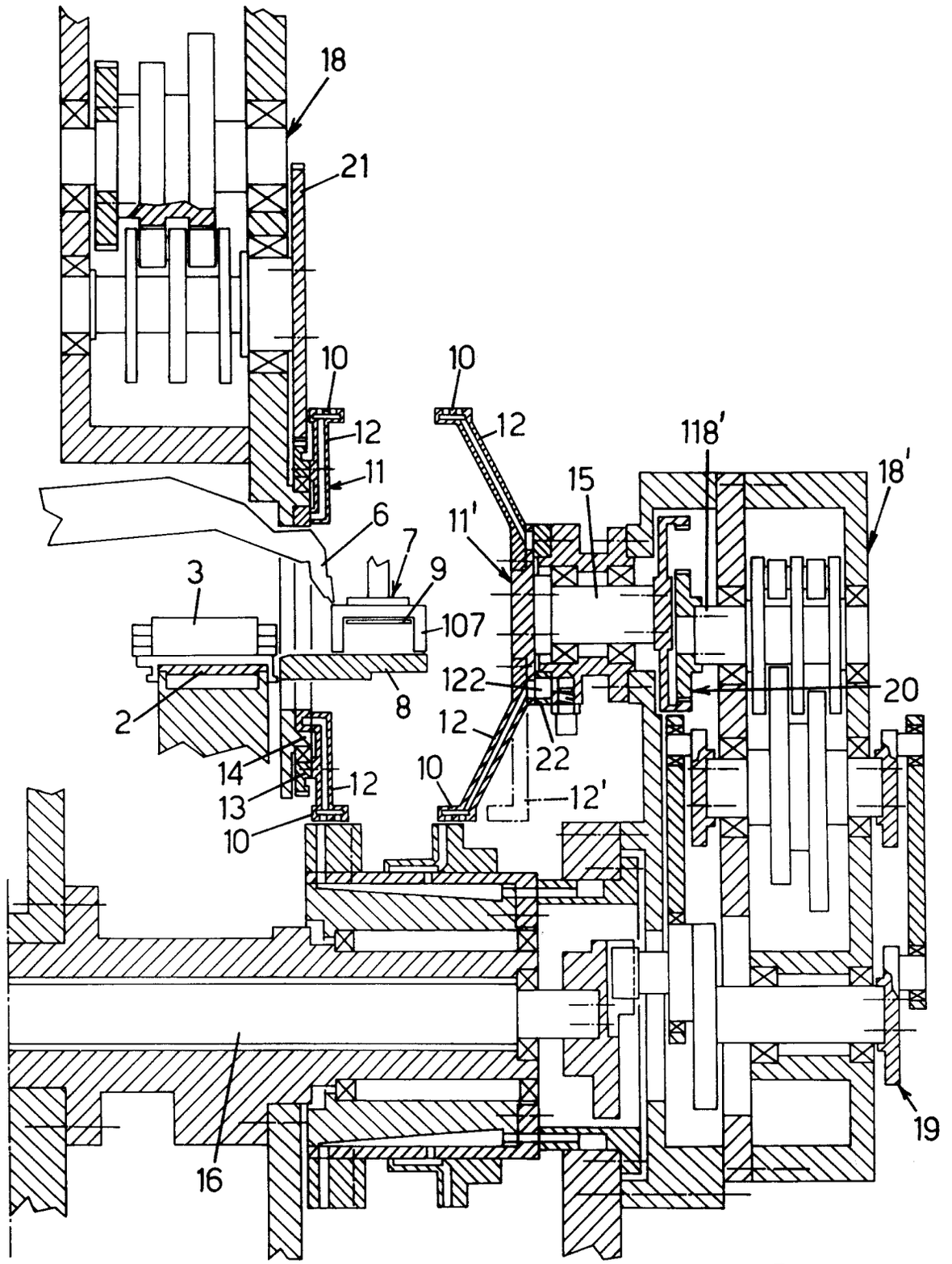
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FIG.2