

**METHOD FOR AUTOMATICALLY INSERTING ITEMS INTO ENVELOPES,
PARTICULARLY DOCUMENTS, AND DEVICE IMPLEMENTING THIS
METHOD**

5 **Technical Field**

The present invention concerns a method for automatically inserting small objects into envelopes, particularly documents or objects to be transmitted in envelopes using a mailing service,

10 It also concerns the device implementing this method.

Background Art

Devices of this type for inserting letters, publicity material, or the like into envelopes for large scale distribution are already known in the art. These
15 devices are generally complicated in design and comprise a large number of moving mechanical parts to guide and feed the envelopes on the one hand and the documents on the other hand towards the zone where the two delivery components meet, called the packaging zone. Since the paths taken
20 by the envelopes and by the documents are separate, whereas the packaging area is a common one, in currently used devices the envelopes are usually first moved along a trajectory in the direction opposite to that of the documents and then along a trajectory identical to that of the documents after the documents have been introduced inside the envelopes. This reversal of
25 direction generally requires the use of a switching mechanism to separate the arrival and departure paths of the envelopes.

Such a design is complicated and it operates slowly, considerably reducing the speed of the packaging operation. In practice, with this system each cycle must be completely finished before the next cycle can start up, that is, one
30 envelope must be filled with the documents intended for it and evacuated from the packaging zone before the next envelope can be delivered to this same zone to receive its documents. The resulting reduced speed, in addition to the

complicated equipment design, makes the equipment difficult to maintain and subject to frequent breakdowns.

DE 10 00 260 concerns a packaging machine that presents some likeness
5 with the device according to the present invention. However this machine does not comprises a rotary drum equipped with a suction device designed to place against the peripheral surface of this drum, first of all, the flap of the envelopes and, after, the body of these envelopes in order to move them towards a filling zone for the introduction of the documents.

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U.S. Patent No. 2, 643,119 A describes a packaging device comprising several units with a storage unit for obliquely arranged envelopes which are removed one at a time using a rotary drum. An air blower is located behind the zone where the envelopes stop in order to open them and allow them to
15 receive the letters or documents to be placed inside. However, this device has several drawbacks. The envelopes are removed while they are closed and through gravitational force pass in groups from a first platform to a second platform where they are taken up by the drum. There is a considerable risk that several envelopes will be selected simultaneously, causing a jam.
20 Furthermore, the envelopes, which are transferred while closed, are not opened by the blower until the moment they arrive at the stop. This sequence reduces speed and creates a high risk that the envelopes will fail to open.

The objective of U.S. Patent No. 3,423,900 A is to achieve a machine that can
25 insert into an envelope several documents, cards, or letters that are separately stored. The envelopes are transported by a rotary drum equipped with a mechanical gripping means and which comprises grooves for the envelope flaps. The documents and the envelopes are driven towards a zone for filling the envelopes with said documents. This machine is completely
30 mechanical and all the operations of the maintenance or gripping fingers are controlled by cams. This procedure, however, does not allow work to progress at a very high speed.

U.S. Patent No. 4,649,691 A concerns an automatic envelope filling machine in which the envelopes are removed mechanically using claws attached to a rotary drum. The envelope is opened by blowers that raise the flap when it arrives in the position for receiving documents. It does not provide any mechanical control to guaranty that the envelope is correctly opened.

U.S. Patent No. 3,962,848 A describes a device wherein envelopes stacked in a column are removed using friction from a rotary drum, opened by a blower, and transported on a conveyor. This system is based only on friction and cannot work reliably at high speed.

The automatic envelope filling machine which is the subject of U.S. Patent No. 3,381,447 A comprises a first drum for removing an item from stored instruction inserts or the like, and a second drum for removing envelopes. The instruction inserts are fed towards a wheel with radial cavities through which the envelopes have been introduced previously, said cavities comprising opening means. Such a device is relatively slow because the envelopes and the documents introduced inside them must be inserted into and then withdrawn from the cavities in the rotating wheel, which cannot be done continuously and thus requires time to stop the wheel.

Disclosure of Invention

The objective of the present invention is to eliminate the disadvantages of these known devices by providing a simple, effective device that is easy to maintain and is capable of automatically filling envelopes at a very high speed.

This aim is achieved by the method defined in the preamble and wherein

- the envelopes comprising a folded closing flap are stored in such a way that the flap of each envelope is located on the bottom of the envelope and towards the front in the direction of removal,

- said flap is unfolded downwards in the direction of said envelope opening by means of at least one rotary cam combined with at least one stream of air,
- said envelope flap is moved into contact with the surface of a control drum,
- 5 - each envelope is individually and successively displaced towards a zone for introduction of one of said documents or one of said objects by pulling its flap placed against the exterior surface of said control drum by means of a radial suction produced inside said drum,
- said documents or objects to be transmitted are moved towards said
- 10 individual envelopes,
- each envelope is opened, and
- said document or said object is introduced into said previously opened envelope.
- 15 Advantageously, the envelopes are detached from the control drum by means of at least one scraper that is tangential in relation to the surface of said drum

Preferably, each envelope is laterally compressed by means of lateral
20 deflectors in order to initiate its opening.

It is possible to open each envelope using opening guides.

The invention also concerns the device for implementing this method of
25 automatically inserting small objects into envelopes, particularly documents or objects to be sent by a mailing service, this device comprising a storage means for individual envelopes which comprise a folded closing flap, a means designed for unfolding the flap of each individual envelope, this means comprising at least one rotary cam combined with at least one stream of air,
30 and designed to engage below the flap of each individual envelope for its unfolding, a moving means designed to move each envelope by pulling its unfolded flap, individually and successively from said storage means towards

a zone for introducing one of said documents or one of said objects into this individual envelope, said moving means comprising a control drum provided with at least one peripheral zone perforated with openings, said openings being connected to a suction device in an intermediate zone between said storage means and the zone for introduction of one of said documents into one of said individual envelopes, a means for feeding the documents or objects to be transmitted towards said individual envelopes, a means designed to open the pocket of each individual envelope and a means designed to introduce one of these documents or one of these objects into said opened individual envelope.

According to a preferred embodiment, said openings of the drum are connected to a pressurised air generating device in said zone for introduction of one of said documents into one of said individual envelopes.

Preferably, said control drum comprises on at least a portion of its periphery a covering with a high coefficient of friction.

According to one advantageous embodiment, the peripheral covering on said control drum extends over an angular section comprising from 25% to 75% of the periphery.

According to a particular embodiment, said peripheral coating on said control drum comprises several parallel bands extending over an angular section comprising from 25% to 75% of the periphery.

In order for one envelope to be taken up during each cycle that corresponds to one rotation by the control drum, said rotary cam is driven synchronously with said drum.

According to a particularly advantageous design, said rotary cam is equipped with at least one organ that generates at least one stream of air to assist in unfolding the flap of each individual envelope in order to open it.

- 5 Said rotary cam is preferably equipped with at least one projection to initiate the unfolding of the flap of the individual envelope.

Preferably, the control drum and the rotary cam have the same diameter and are driven synchronously at the same speed and, on one portion of their
10 circular trajectory, said rotary cam contacts the peripheral surface of said control drum to drive one envelope from said storage means towards the introduction zone.

To detach the envelopes from the control drum, the device advantageously
15 comprises at least one scraper which detaches said individual envelope from said control drum in said introduction zone.

Advantageously, the device comprises several scrapers parallel to each other, said scrapers being located between the parallel bands of the covering on
20 said control drum.

To facilitate opening the envelope, the device may comprise lateral deflectors for pushing together the lateral edges of the individual envelopes to assist in opening them and opening guides designed to open said individual envelopes.
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According to a first embodiment, said lateral deflectors comprise guide rollers.

According to a second embodiment, said lateral deflectors comprise guide profiles.
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According to a particular embodiment, said control drum comprises at least two cylindrical sections that are separated by at least one unattached ring that can be formed of a roller.

5 **Brief Description of Drawings.**

The present invention and its features will be better understood from the description of its preferred embodiments, furnished by way of non-limiting examples, with reference to the attached drawings, wherein:

- 10 - Figure 1A is a partial perspective representing the principal elements constituting a first embodiment of the device according to the invention;
- Figure 1B is an elevation of the device of Figure 1A shown in a particular phase of operation;
- 15 - Figure 1C is an elevation of the device of Figure 1A shown in another particular phase of operation;
- Figures 1D, 1E and 1F are enlarged partial views of certain portions of the device of Figure 1A in particular positions corresponding to operational
20 phases of the device;
- Figure 1G is a detailed view showing one element of the device of Figure 1A;
- 25 - Figure 1H shows one portion of the device of Figure 1A during operation;
- Figure 1I is a plane view from the top of the device of Figure 1A;
- 30 - Figure 1J is a perspective view from below showing the device of Figure 1A during operation;

- Figure 2A is a partial perspective showing the principal elements constituting a second embodiment of the device according to the invention; and
- 5 - Figures 2B, 2C and 2D are enlarged partial views of certain portions of the device of Figure 2A in particular positions corresponding to operational phases of the device.

Mode for Carrying Out the Invention

10 With reference to Figures 1A through 1J, device 10 consists principally of a frame 11, shown schematically by a lateral support element, but which may comprise as shown in Figure 1I two lateral support elements that are parallel and essentially identical, to which a storage bin 12 for envelopes or packets is attached, said bin constituting said storage and delivery means, a control
15 drum 13, and at least one rotary cam 14. Storage bin 12 may contain a stack of superimposed envelopes 15 arranged so they may be removed one at a time from the base of the bin. The storage bin is open at the base, allowing rotary cam 14 to access envelope 15 located at the lower part of the stack. Each envelope is arranged so its closing flap is folded down against the
20 envelope surface.

Cylindrical control drum 13 is attached to a rotary shaft 16 supported by frame 11. It may be made of metal or synthetic material, for example, a carbon fiber based- material or the like. It comprises an exterior covering 17 consisting of a
25 material with a high coefficient of friction, such as, for example, foam rubber or the like. This exterior covering 17 preferably extends along only one portion of the drum periphery, for example, along an angular section ranging from 25% to 75% and preferably of the order of 50%. Said covering advantageously takes the form of several parallel bands 18 which may be three in number,
30 separated by annular spaces 19. Drum 13 is perforated and in the area with the covering, it comprises a plurality of openings 20 penetrating exterior covering 17. These openings communicate with the hollow interior of control

drum 13 and because of this they are connected through a turning connection to a suction device (not shown) when said control drum is in an intermediate zone between said storage means and the zone for introduction of one of said documents into one of said individual envelopes 15.

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When said control drum 13 is located in the zone for introduction of one of said documents into one of said individual envelopes, said openings 20 are connected through a turning connection to a pressurized air delivery device which detaches the envelope from the control drum.

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Rotary cams 14, which number three in the embodiment shown, are attached to a shaft 21 supported by said frame 11 and are driven in synchronous rotation with said control drum 13.

15 The mechanism which drives and connects the two shafts 16 and 21 is shown schematically by a circle A. Said rotary cams 14 comprise a projection 22 which initiates the unfolding of the flap of each individual envelope during each operational cycle by the device. This projection 22 is equipped with at least one nozzle 23 producing a stream of air 24 (see Figure 1D) designed to
20 contribute to the unfolding of each individual envelope flap in order to open the envelope. This nozzle 23 is supplied with compressed air through a turning connection (not shown) attached to shaft 21.

Device 10 further comprises at least one scraper 25 designed to detach said
25 individual envelope from said control drum 13 in the introduction zone. In the exemplary embodiment described, it comprises two parallel scrapers 25 attached to an axle 26 supported by frame 11. These scrapers consist of a thin plate slightly curved at its free end that contacts the peripheral surface of control drum 13.

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In the example shown, control drum 13 comprises, on one portion of annular spaces 19, bearing supports 27 or roller supports 28 that rotate freely, which

are level with the peripheral drum surface and over which scrapers 25 can slide without engaging. The function of these unattached bearings or rollers 28 is to facilitate detachment of the individual envelopes from the drum in the zone for introduction of documents or objects into the envelopes.

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Parallel bands 18 of exterior coating 17 on control drum 13 form an extra layer and define two hollow annular spaces 19. The unattached ends of the plates constituting scrapers 25 contact the peripheral drum surface in the two hollow annular spaces 19. The number of these hollow annular spaces depends upon the number of parallel bands 18 of exterior covering. This number is not critical and there should be a minimum of two.

In the zone for introduction of one of said documents into one of said individual envelopes 15, the device is equipped with two opening guides 29 each comprising two branches 29a and 29b, converging at one extremity to define a projection for opening the envelopes. Documents 30 to be introduced in the individual envelopes are delivered in known manner along rails or some type of support and guide surface 31, for example, a conveyor belt, and are driven by cogs 32 integral with this endless conveyor belt. The filled envelopes are then taken up by a recovery cam 33 rotating on shaft 34, which rotates synchronously with control drum 13. The synchronous driving of shaft 16 for drum 13 and shaft 34 for recovery cam 33 is shown schematically by circle 35.

As shown more particularly by Figure 11, device 10 is further equipped with two lateral deflectors 36 which push the lateral edges of the envelopes together to help open them. These deflectors consist of guide profiles, but they may also be equipped with rollers to reduce the friction of contact with the envelope.

During one operating cycle said device operates according to the principle of the invention wherein the envelopes are stored in such a way that the flap of each individual envelope is on the bottom of the envelope and towards the

- front in the direction of removal, said flap is unfolded downwards in the direction in which the envelope opens, said envelope flap is moved into contact with the surface of the control drum, the envelopes are individually and successively displaced by pulling the flaps placed against the exterior
- 5 surface of the control drum towards the zone for introduction of one of said documents or said envelopes, the envelopes are then opened and said documents or said objects are introduced inside said previously opened envelopes.
- 10 Consequently, to effect this series of operations, the elements comprising device 10 operate as follows:
- rotary cams 14 turn counterclockwise so that projections 22 move closer to the flap of the lower envelope in stack of envelopes 15,
 - nozzles 23 begin to act and emit a stream of air 24 (see Figure 1D) that
 - 15 initiates unfolding of the envelope flap,
 - projection 22 on rotary cam 14 comes into contact with the flap and completes the unfolding,
 - the unfolded flap comes into contact with control drum 13 in the zone which has exterior covering 17,
 - 20 • suction passing through holes 20 of the drum then flattens the unfolded flap against control drum 13 and the entire envelope is then sandwiched between said drum and rotary cams 14,
 - the envelope arrives at the document introduction zone and lateral deflectors 36 press in opposing directions against the lateral envelope
 - 25 edges to initiate opening,
 - scrapers 25 detach the flap and then the entire envelope from control drum 13. The scrapers are assisted in this function by compressed air blown through openings 20 formed in the peripheral wall of the drum and exterior covering 17,
 - 30 • the envelope is speared by opening guides 29 which complete the envelope opening by engaging their two branches 29a and 29b in the

envelope opening and positioning it at the stop so it will be ready to receive documents 30,

- said documents 30 arrive and engage with the open envelope,
- the envelope is then driven by cogs 32 of conveyor belt 31 which has fed
5 the documents, and
- the envelope containing documents 30 is evacuated through the action of uptake cam 33 which contacts unattached bearings or rollers 28 on control drum 13. Said bearings or rollers 28 rotate freely so as not to impede the envelope evacuation process activated by uptake cam 33.

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During these later phases when the envelope is detached from control drum 13, the first phases of the next cycle may be already underway, allowing work to take place in condensed time and reducing the effective duration of a cycle, thereby increasing the speed of the device.

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In the example shown in Figures 2A through 2D all the components of device 50 are identical to those of device 10 described above, except control drum 53 differs in design and function from control drum 13.

- 20 With reference to the drawings, said device 50 principally comprises a frame 51 shown schematically by a lateral support element to which there are attached a bin 52 for storing envelopes or packets, said bin constituting said storage and conveyance means, a control drum 53 and at least one rotary cam 54. Storage bin 52 may contain for example a stack of superimposed
25 envelopes 55 arranged so they may be removed one by one from the base of the bin. The base of the storage bin is open, allowing rotary cam 54 to access envelope 55 located at the lower portion of the stack. Each envelope is positioned so that its closing flap is folded against the body of the envelope.

- 30 Cylindrical control drum 53 is attached to a rotary shaft 56 supported by frame 51. Like drum 13, it has an exterior covering 57 consisting of a material with a

high coefficient of friction which preferably extends along a portion of its periphery.

Said coating 57 advantageously takes the form of several parallel bands 58, which may be three in number, separated by annular spaces. The drum is perforated and in the covered zone it comprises a plurality of openings 60 penetrating said exterior covering. These openings communicate with the hollow interior of control drum 53 and for this reason they are connected by a turning connection to a suction device (not shown) when said control drum is in an intermediate zone between said storage means 52 and the zone for introducing documents into one of said individual envelopes.

Rotary cams 54, which are three in number in the embodiment shown, are attached to a shaft 61 supported by said frame 51 and driven to rotate synchronously with said control drum 53. Said rotary cams 54 comprise a projection 62 to initiate the unfolding of each individual envelope during each cycle of operation by the device. Said projection 62 is equipped with at least one nozzle 63 producing a stream of air 64 (see Figure 2D) which assists in unfolding the flap of each individual envelope in order to open the envelope.

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Device 50 further comprises at least one scraper 65 for detaching said individual envelope from said control drum 53 in the introduction zone.

In the zone for introduction of one of said documents into one of said individual envelopes, the device is equipped with two opening guides 69 each comprising two branches 69a and 69b that reconnect at one of their extremities to define an envelope opening projection. The documents to be introduced into the individual envelopes are moved in known manner along rails or any sort of support and guide surface 71, for example a conveyor belt, and are driven by cogs 72 integral with said endless conveyor belt. The filled envelopes are then taken by an uptake cam 73 rotating on shaft 74 which rotates synchronously with control drum 53.

As Figures 2B and 2C show more specifically, control drum 53 is composed of cylindrical segments 80, which may be three in number, each with a covering 57 along a portion of its periphery and which are separated by unattached rings 81 which are formed in the example shown of a ball bearing with a cage 82 composed of an interior ring 83 and an exterior ring 84 enclosing bearings 85. In this way cylindrical segments 80 and unattached rings 81 can turn independently. The envelopes are in contact with covering 57 along a portion of their trajectory and then, having received the documents, they are in contact with unattached rings 81, or more specifically, they are sandwiched between these rings and uptake cams 73.

CLAIMS

[Claim 1]

An automatic loading method for, by an apparatus including means for accumulating and continuously drawing individual envelops, means for drawing written documents or articles to be fed to the individual envelops including folding-back portions of closing portions folded, and means for inserting one of the written documents or one of the articles into one of the envelops, transferring a written document or an article which is a small-sized paper in the envelop via a mail dispatching service, comprising the steps of:

accumulating the individual envelops such that the folding-back portions of the individual envelops are positioned on a lower sides of the individual envelops and on a front side in a taking-out direction of the individual envelops;

spreading the folding-back portions toward a bottom side in an opening direction of the individual envelops by at least one rotary cam;

bringing the folding-back portions of the individual envelops into contact with a surface of a loading drum;

individually and continuously moving the respective individual envelops toward a region of inserting one of the written documents or one of the articles into each of the individual envelops while pulling each of the individual envelops by the folding-back portion of each of the individual envelops which has been pressed on an outer surface of the loading drum;

moving the written documents or the articles towards the envelops;

performing openings of the envelops; and

inserting the written documents or the articles into the opened envelops, wherein

the rotary cam spreads the folding-back portion of each of the envelops while generating at least one air jet (24, 64), and thereafter radial suction generated inside the drum presses the folding-back portion of each of the envelops on a surface

of the loading drum.

[Claim 2]

The method according to claim 1, wherein each of the envelops are scraped from the loading drum by at least one scraper disposed in a tangential direction regarding the surface of the drum.

[Claim 3]

The method according to claim 1, wherein opening of each of the envelops is performed by an opening guidance apparatus.

[Claim 4]

The method according to claim 5, wherein each of the envelops is shrunk laterally.

[Claim 5]

An implementing apparatus (10, 50) of the automatic loading method for transferring written documents or articles which are small-sized paper into envelops via dispatching operation of mails according to claim 1, comprising:

means (12, 52) for accumulating folded individual envelops (15) including folded folding-back portions for closing;

means for flipping the folding-back portions of the individual envelops (15), which includes at least one rotary cam (14, 54) provided to mesh with back portions of the folding-back portions of the individual envelops for the purpose of flipping the folding-back portions of the individual envelops;

means with a loading drum (13, 53) for individually and continuously moving the envelops (15) whose folding-back portions have been flipped from the accumulating means (12, 52) to a region of inserting one of the written documents or one of the articles into each of the individual envelops;

means for drawing written documents or articles to be fed to the individual envelops (15);

means (29, 36) for opening the individual envelops (15);

and

means for inserting one of the written documents or one

of the articles into each of the opened envelopes (15), wherein the rotary cam spreads the folding-back portion of each of the envelopes while generating at least one air jet (24, 64), and

at least one circumferential region (17, 57) in which an opening portion (20, 60) has been bored is contained in the loading drum (13, 53), and the opening portion is connected to a sucking apparatus within an intermediate region between the accumulating means and the region of inserting one of the written documents into each of the individual envelopes.

[Claim 6]

The apparatus according to claim 5, wherein the opening portion (20, 60) is connected to a generating apparatus of compressed air within the region of inserting one of the written documents into each of the individual envelopes.

[Claim 7]

The apparatus according to claim 5, wherein a covering portion (17, 57) having a high friction coefficient is included on at least one portion of the circumference of the loading drum (13, 53).

[Claim 8]

The apparatus according to claim 7, wherein the circumferential covering portion (17, 57) of the loading drum (13, 53) occupies a region defined by a fan-shaped portion having an angle between 25% and 75% of the circumference.

[Claim 9]

The apparatus according to claim 7, wherein a plurality of band-shaped portions (18, 58) which are parallel to one another and defined by a fan-shaped portion having an angle between 25% and 75% of the circumference is included in the circumferential covering portion (17, 57) of the loading drum.

[Claim 10]

The apparatus according to claim 5, wherein the rotary cam (14, 54) is driven in synchronization with the loading drum together.

[Claim 11]

The apparatus according to claim 5, wherein at least one generating device (23, 63) of at least one air jet (24, 64) is provided in the rotary cam (14, 54) in order to serve to flip the folding-back portion for the purpose of opening each of the individual envelops.

[Claim 12]

The apparatus according to claim 5, wherein at least one lip portion (22, 62) is provided on the rotary cam (14, 54) in order to guide flipping of the folding-back portions of the individual envelops.

[Claim 13]

The apparatus according to claim 5, wherein the loading drum (13, 53) and the rotary cam (14, 54) have the same diameter and are driven in synchronization with each other at the same velocity, and the rotary cam (14, 54) is supported on a circumferential surface of the loading drum (13, 53) in order to drag each of the envelops from the accumulating means (12, 52) into the inserting region.

[Claim 14]

The apparatus according to claim 5, further comprising at least one scraper (25, 65) provided in order to scrap each of the individual envelops from the loading drum (13, 53) in the inserting region.

[Claim 15]

The apparatus according to claim 5, further comprising a plurality of scrapers (25, 65) provided between parallel band-shaped portions (18, 58) of the circumferential covering portion (17, 57) of the loading drum to be arranged in parallel to each other.

[Claim 16]

The apparatus according to claim 5, further comprising a laterally-deflecting device (36) provided so as to serve to bring lateral edges of each of the individual envelops close to each other in order to serve to open each of the individual envelops.

[Claim 17]

The apparatus according to claim 5, further comprising an opening-guidance portion (29) for opening the individual envelopes.

[Claim 18]

The apparatus according to claim 16, wherein a guiding roller is included in the laterally-deflecting device (36).

[Claim 19]

The apparatus according to claim 16, wherein a guiding tool section is included in the laterally-deflecting device (36).

[Claim 20]

The apparatus according to claim 5, wherein at least two cylindrical portions (80) separated by at least one free-axis flange (81) are included in the loading drum (53).

[Claim 21]

The apparatus according to claim 20, wherein the at least one free-axis flange (81) is formed of a bearing.