United States Patent

[11] 3,579,952

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[45] Patented **May 25, 1971**

[73] Assignee **Molins Machines Company Limited London, England**

[32] Priority **Nov. 1, 1965**
[33] **Great Britain**
[31] **46143/65**

[54] **PACKING MACHINES**
63 Claims, 50 Drawing Figs.

[52] **U.S. Cl.** **53/37,** 53/124, 53/151, 53/170, 53/183, 53/252, 93/44.1, 198/167, 221/175

[51] **Int. Cl.** **B65b 19/04,** B65b 19/12, B65b 43/10

[50] **Field of Search** ..... 53/124 (DE), 148—151, 183, 191, 192, 236, 252, 169, 37, 170

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ABSTRACT: A rotary cigarette packing machine having three layers, namely: a top layer in the form of a hopper which receives a continuous stream of cigarettes and divides them up into bundles; a bottom layer which forms open-ended packets from webs of packet material; and a middle layer which pushes the bundles into the packets, closes them and delivers them in one continuous stream. The machine rotates continuously about a vertical axis past a continuous supply of cigarettes and a continuous supply of each of the packet materials and comprises a number of sets of mechanisms, considered vertically, each of which will perform the complete packing operation so that that operation is being performed a number of times simultaneously.

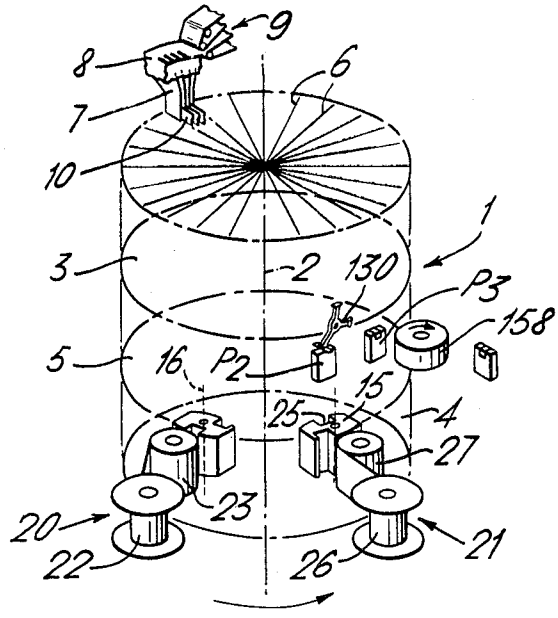

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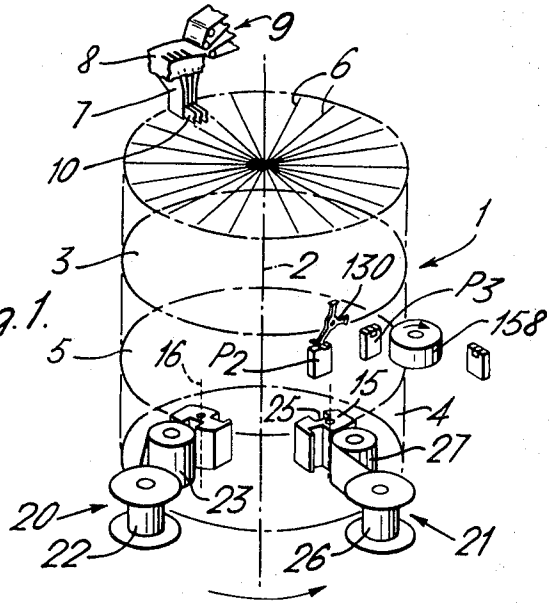
Fig. 1.



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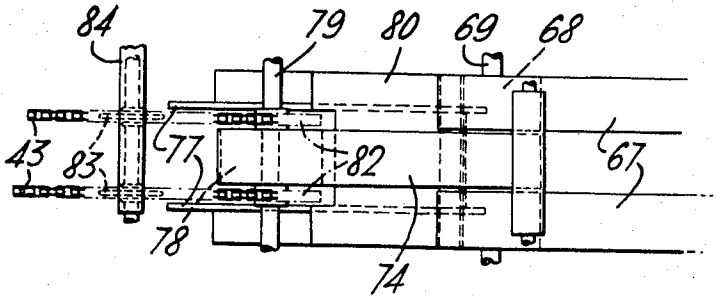

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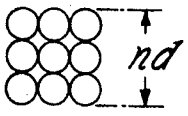

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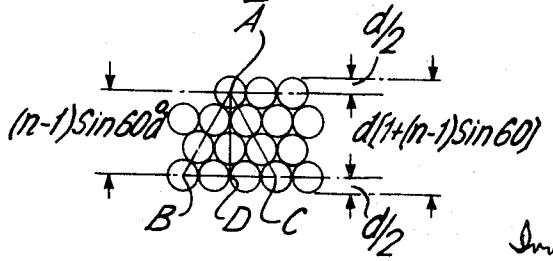

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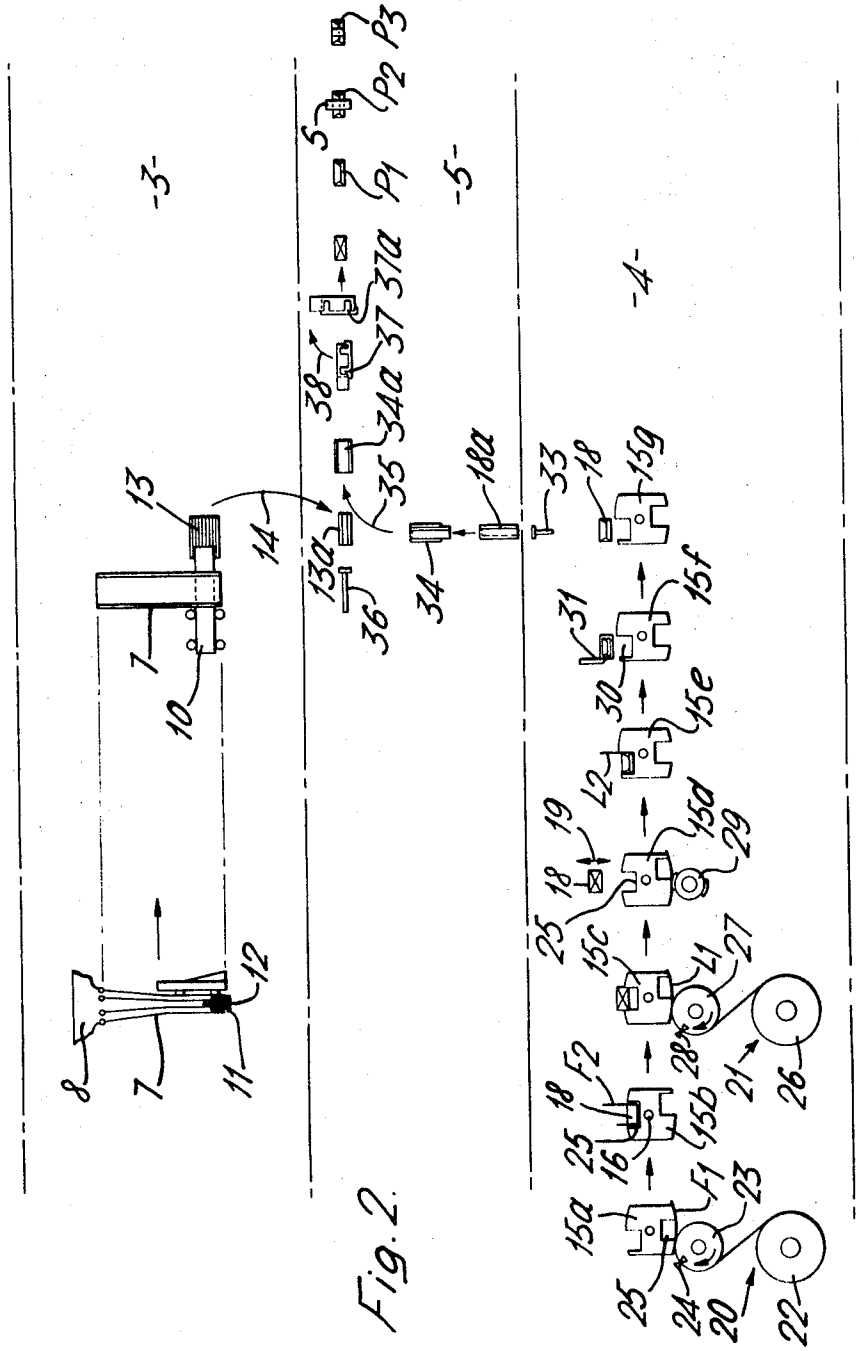

Fig. 2.

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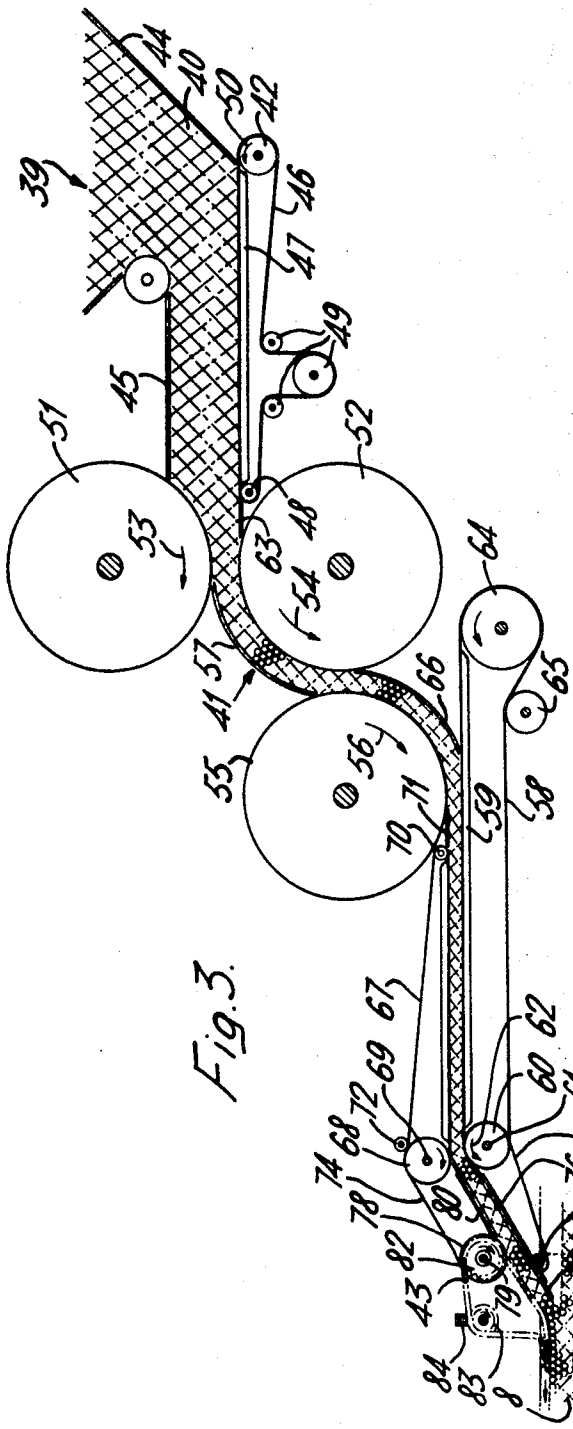

Fig. 3.

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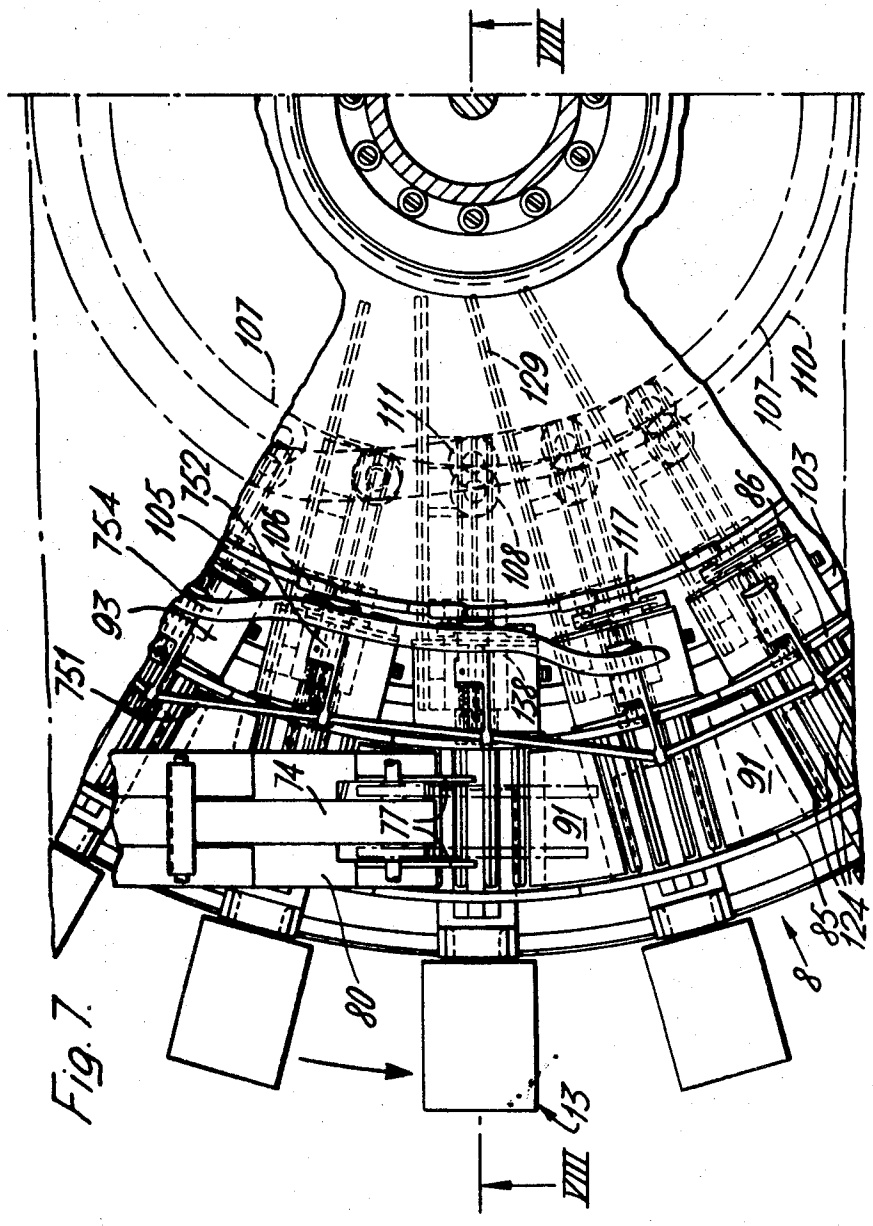

Fig. 7.

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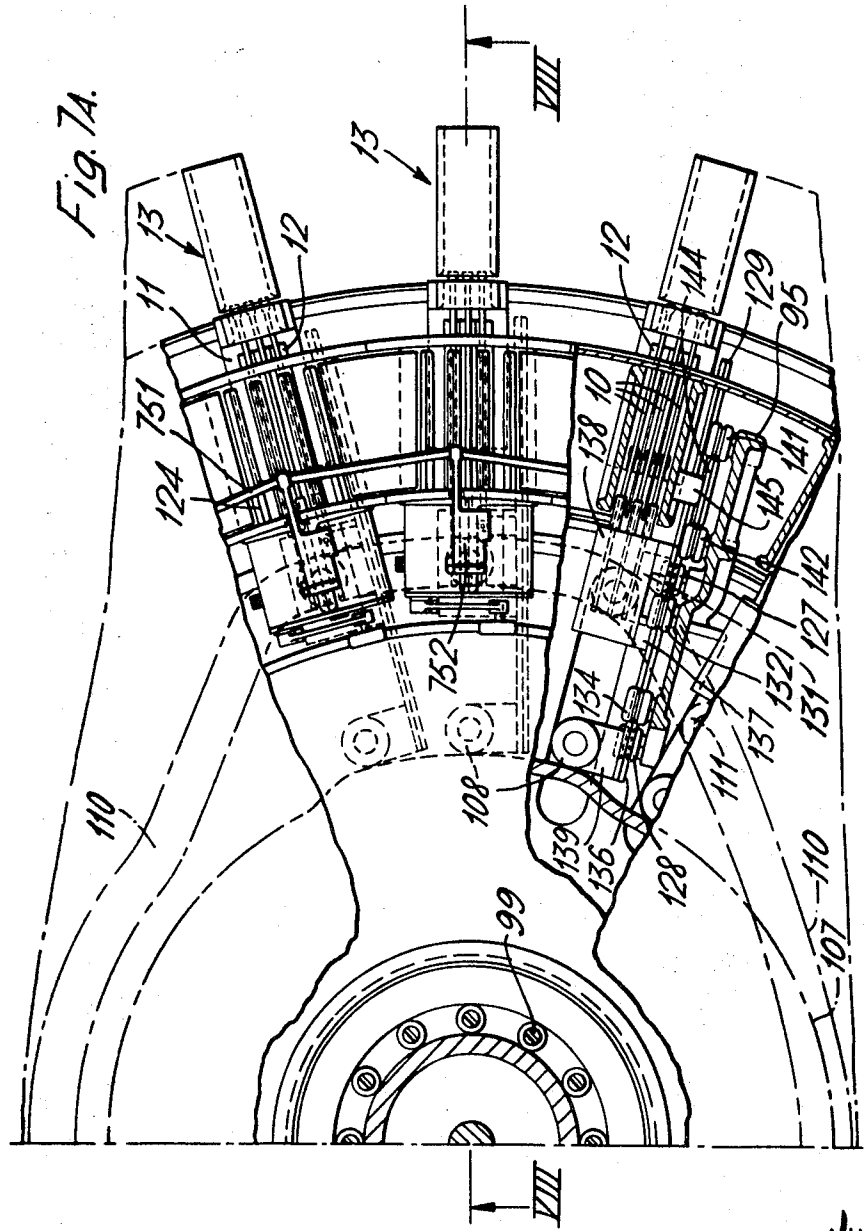
Fig. 7A.



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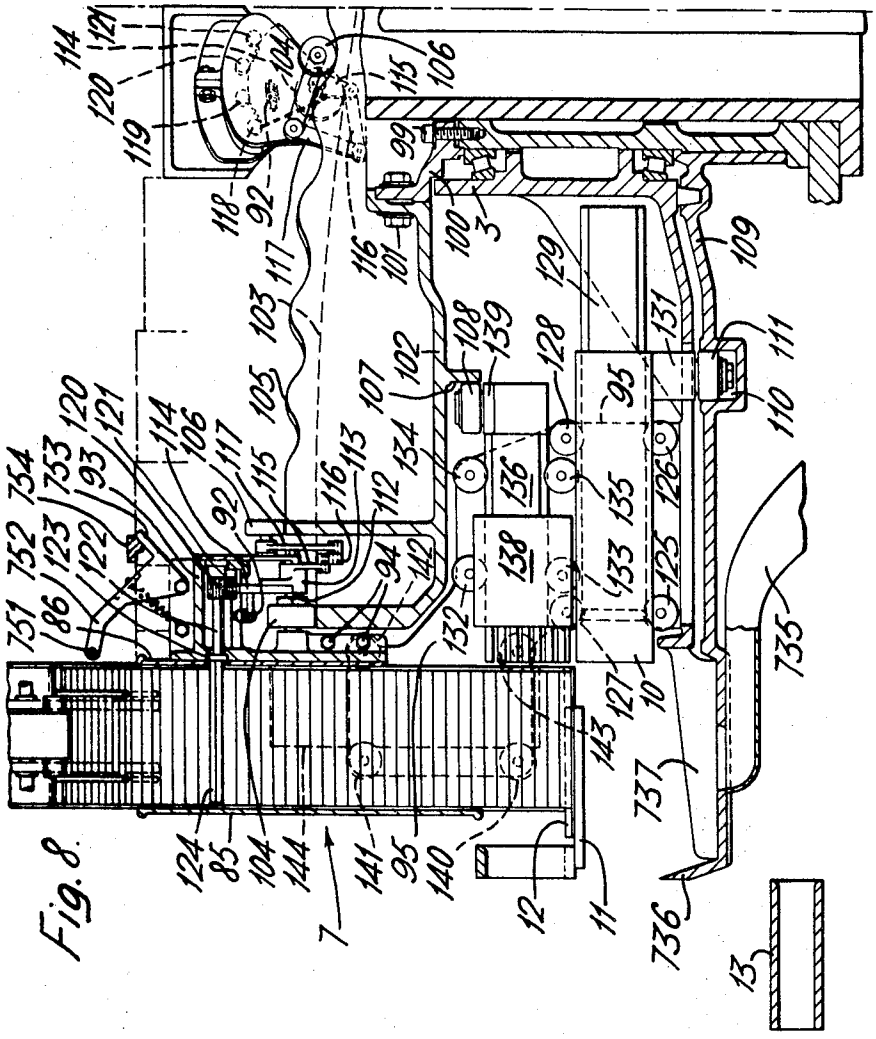

Fig. 8.

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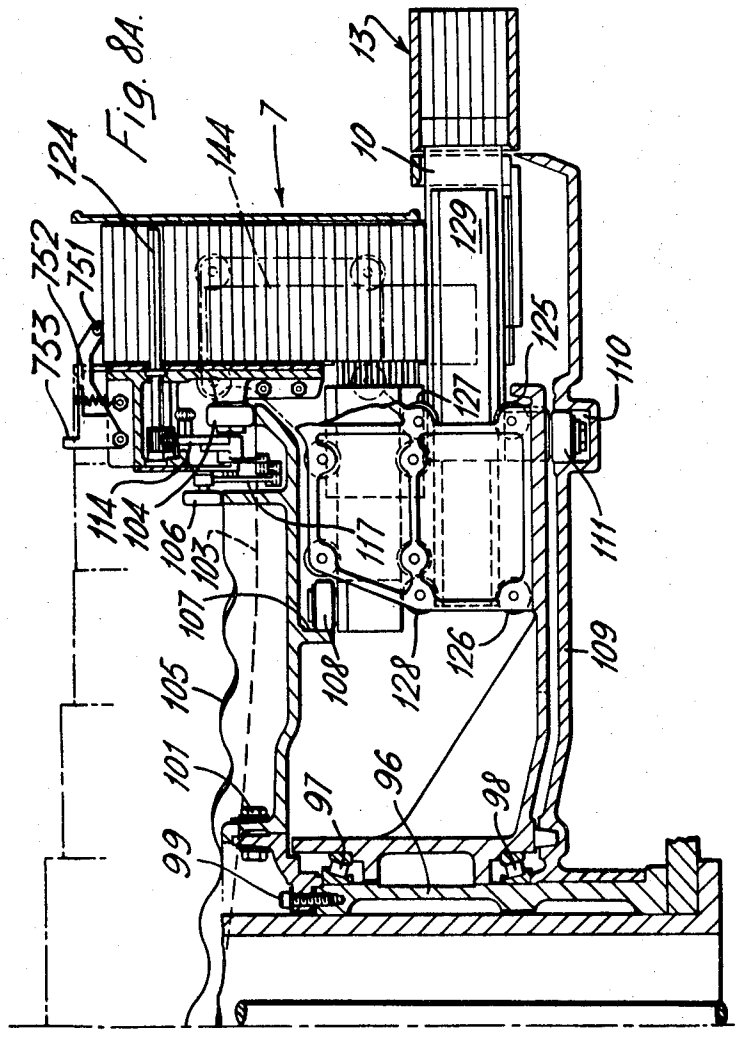

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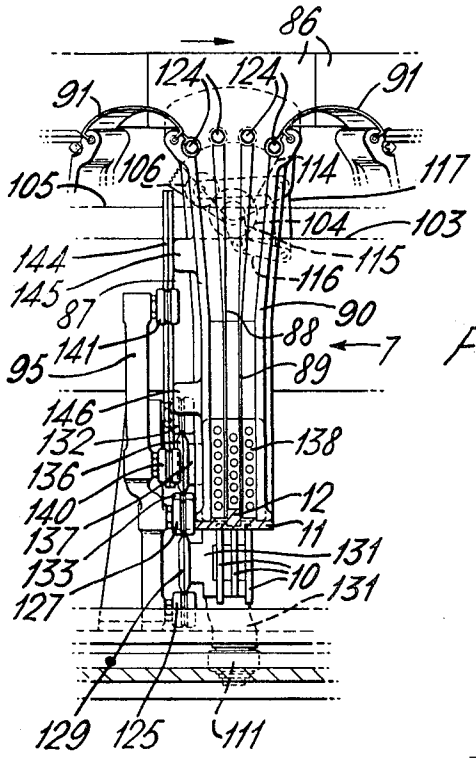

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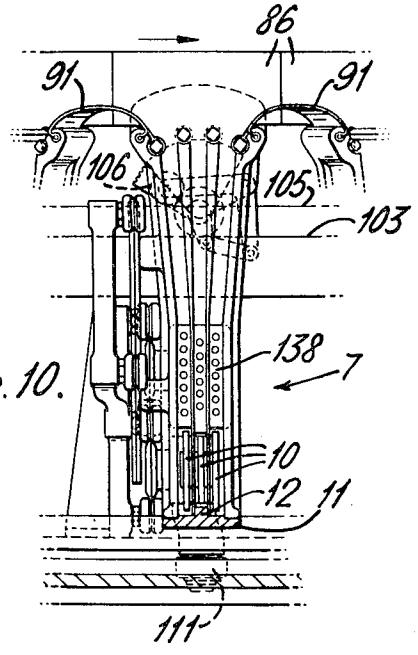

Fig. 10.

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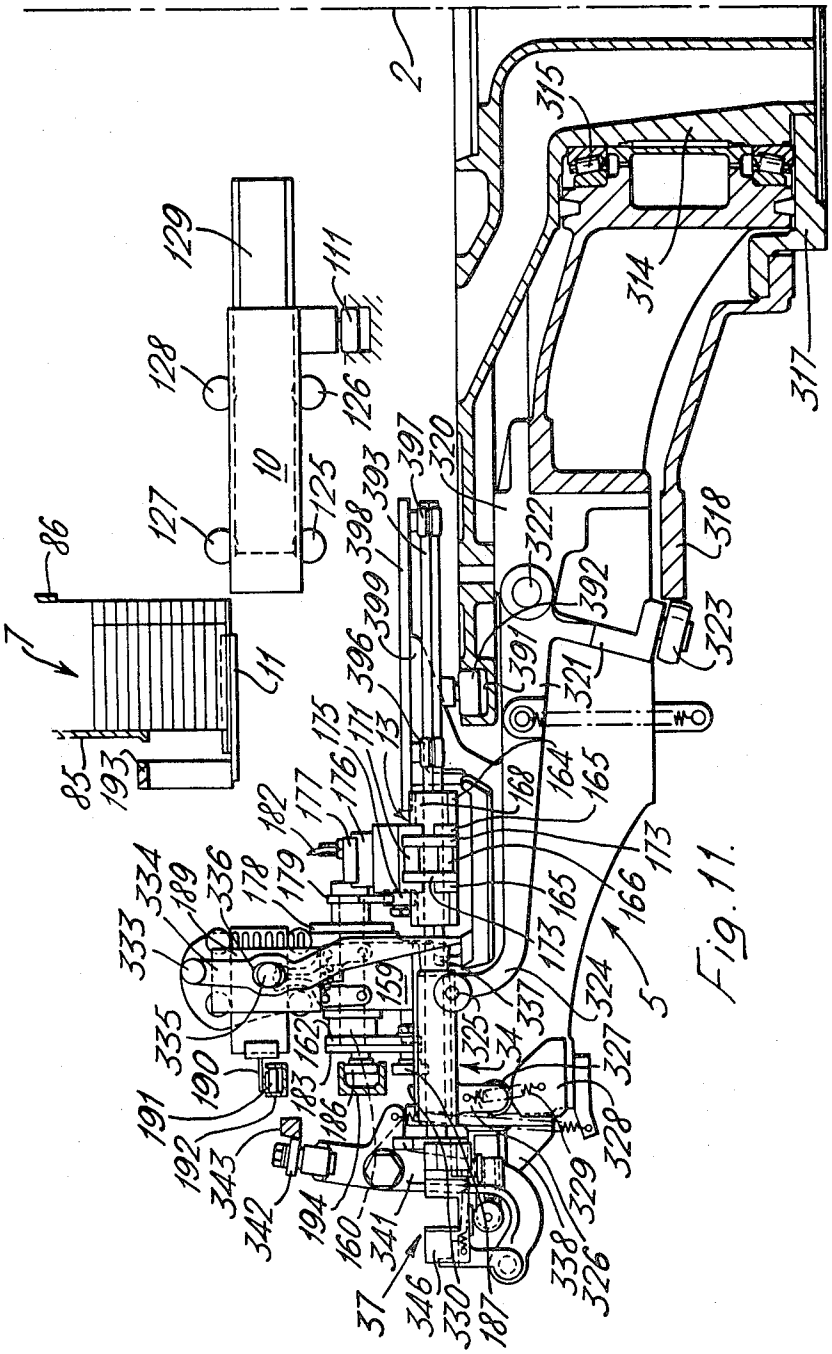

Fig. 11.

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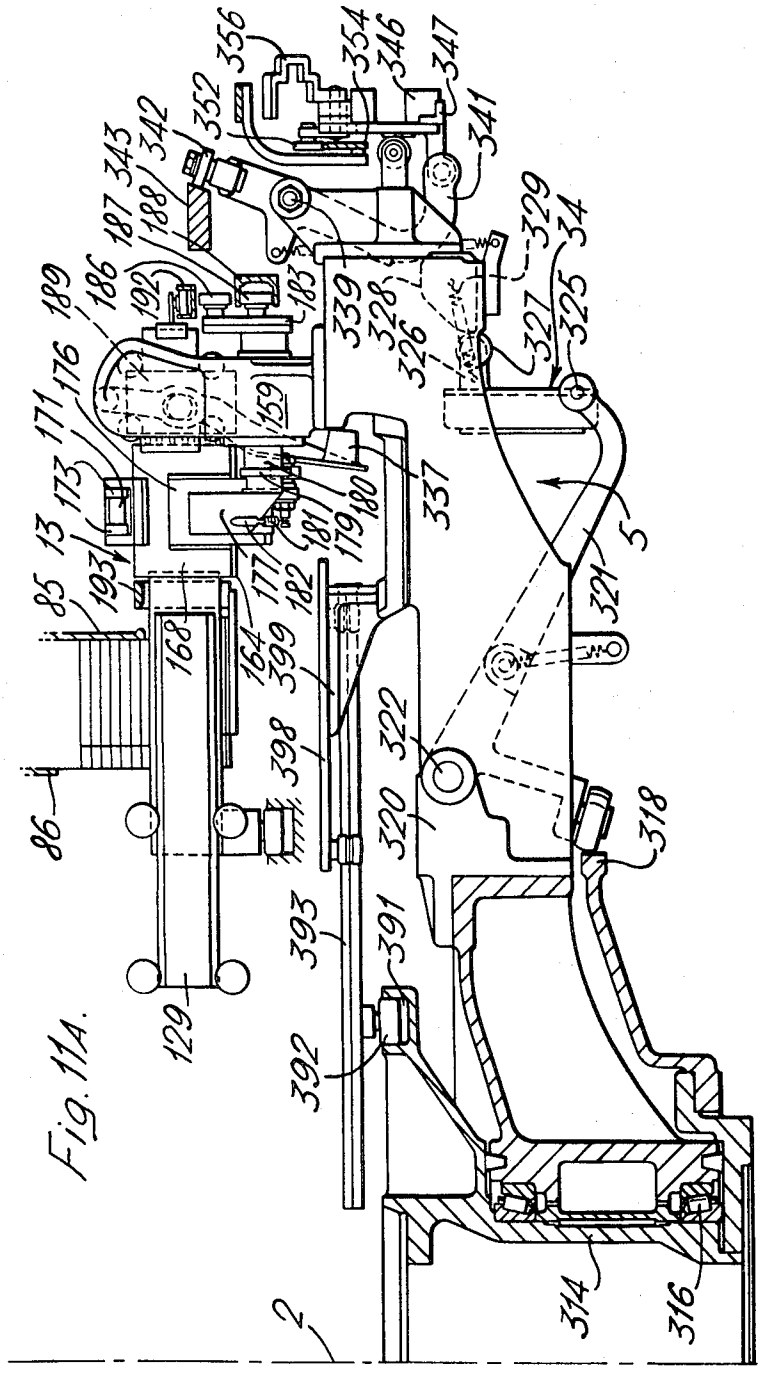

Fig. 11A.

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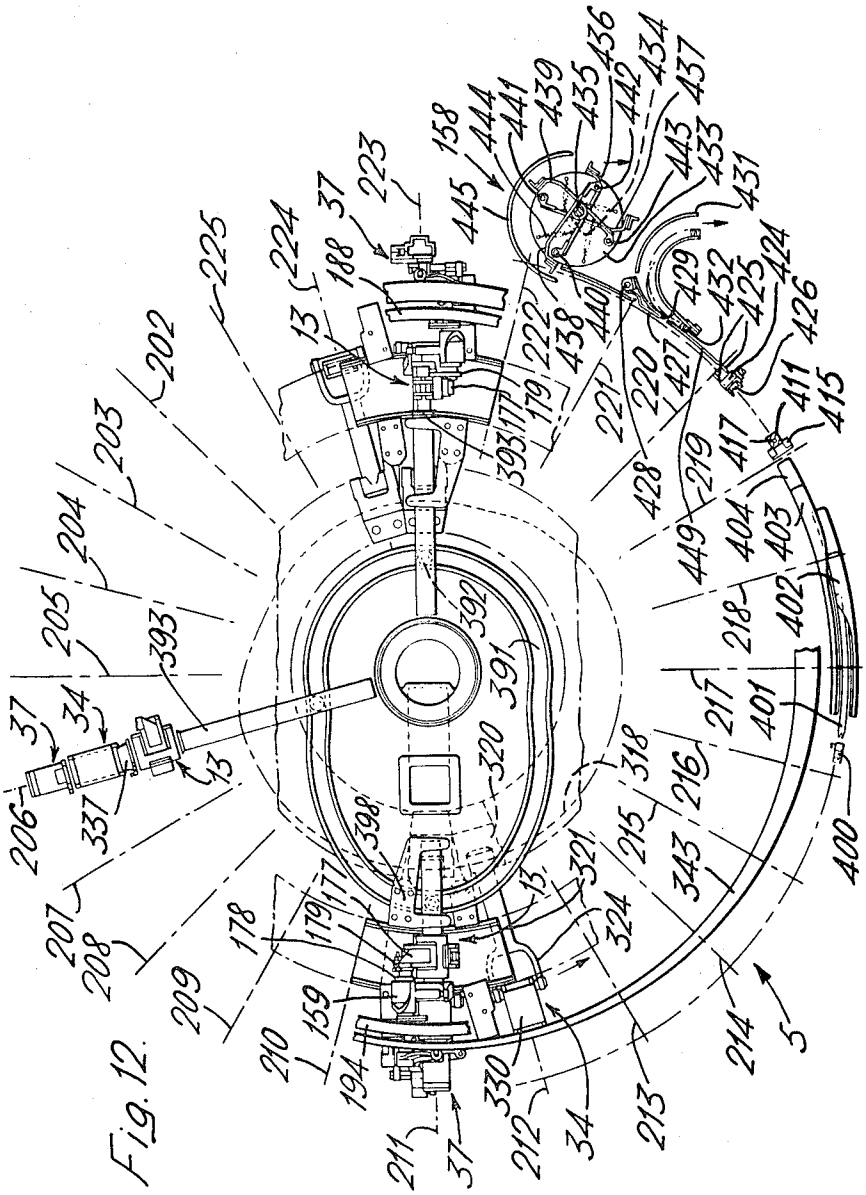

Fig. 12.

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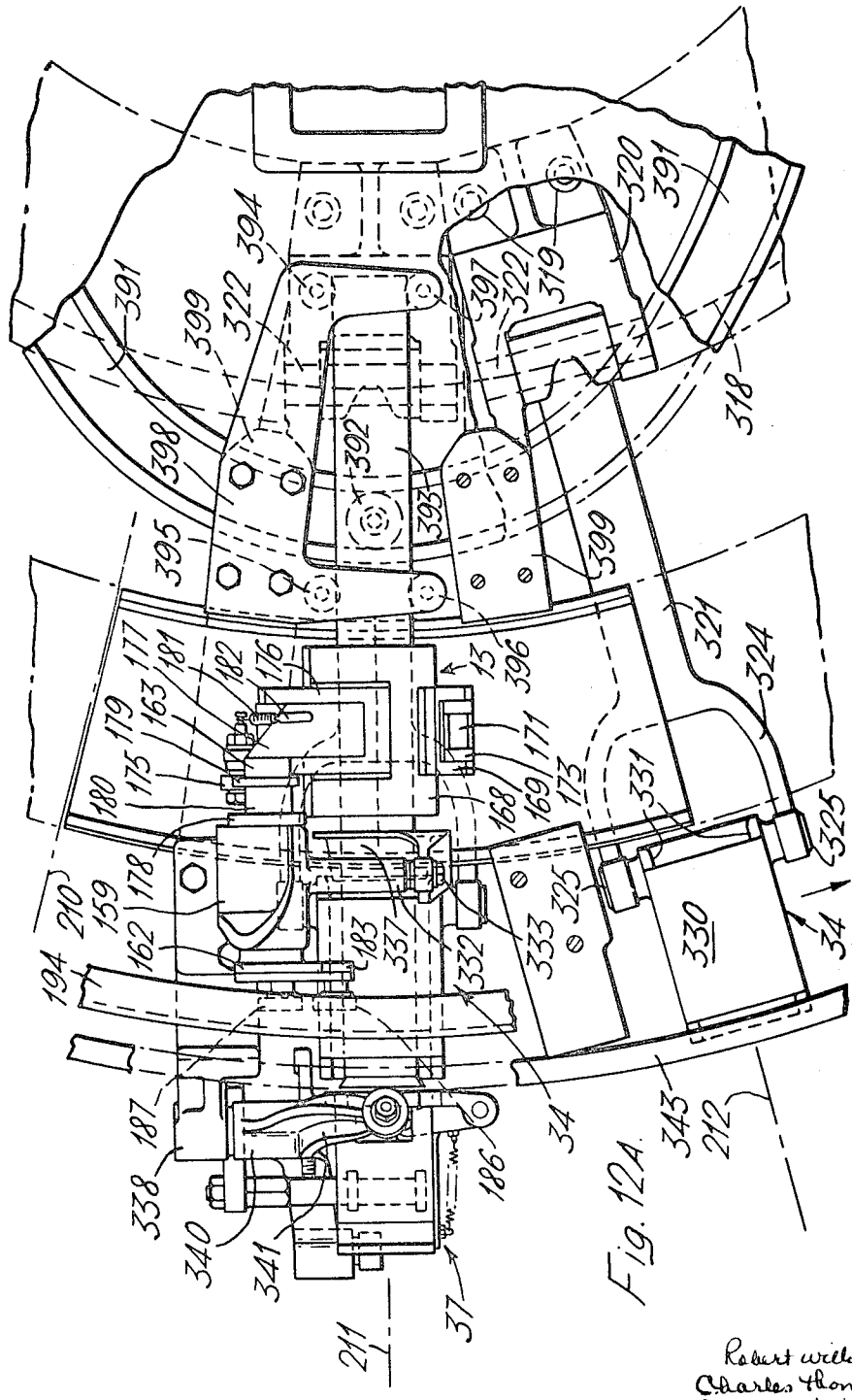

Fig. 12A.

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Fig. 12B.

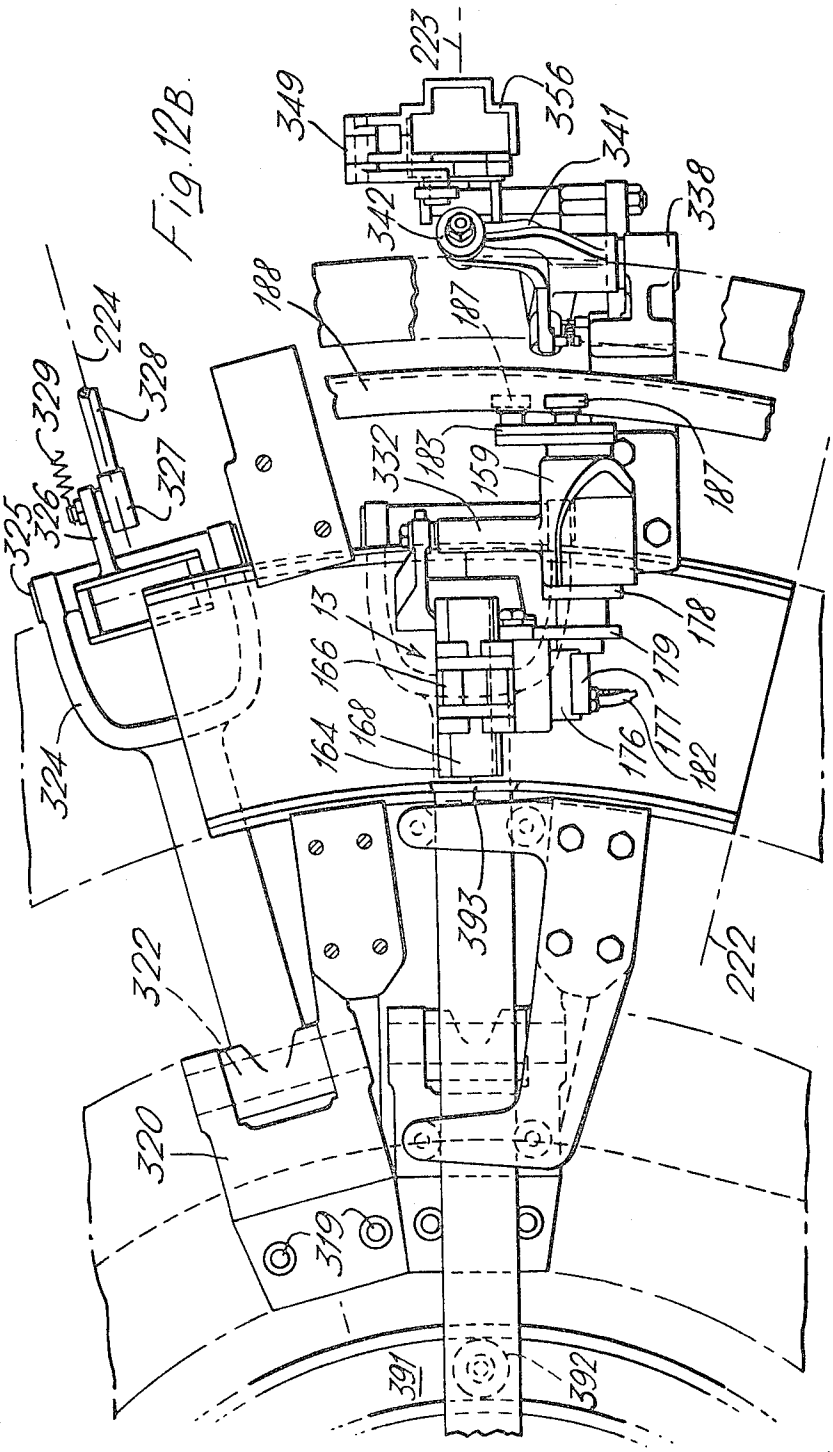

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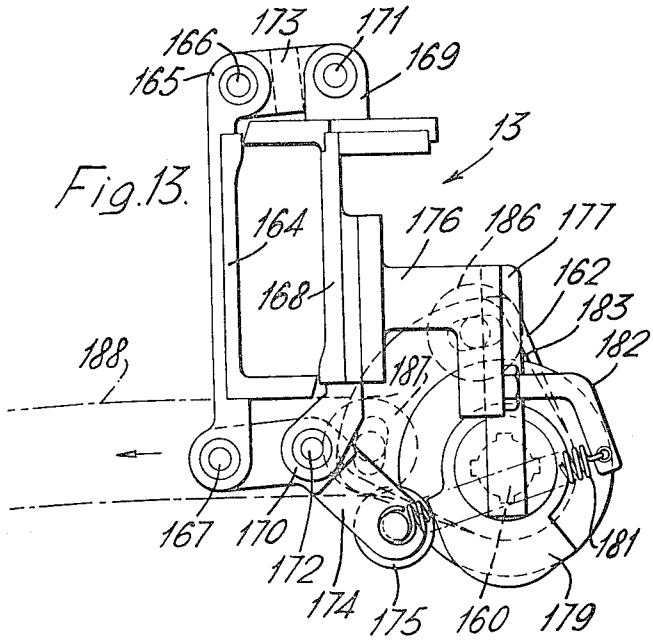
Fig. 13.



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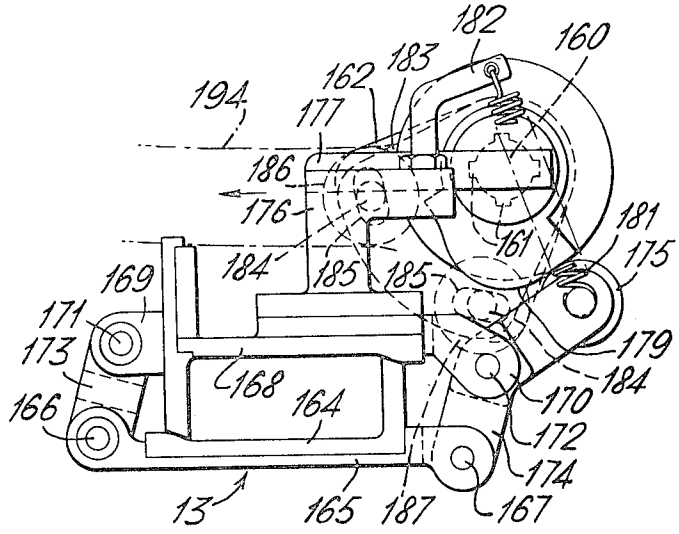

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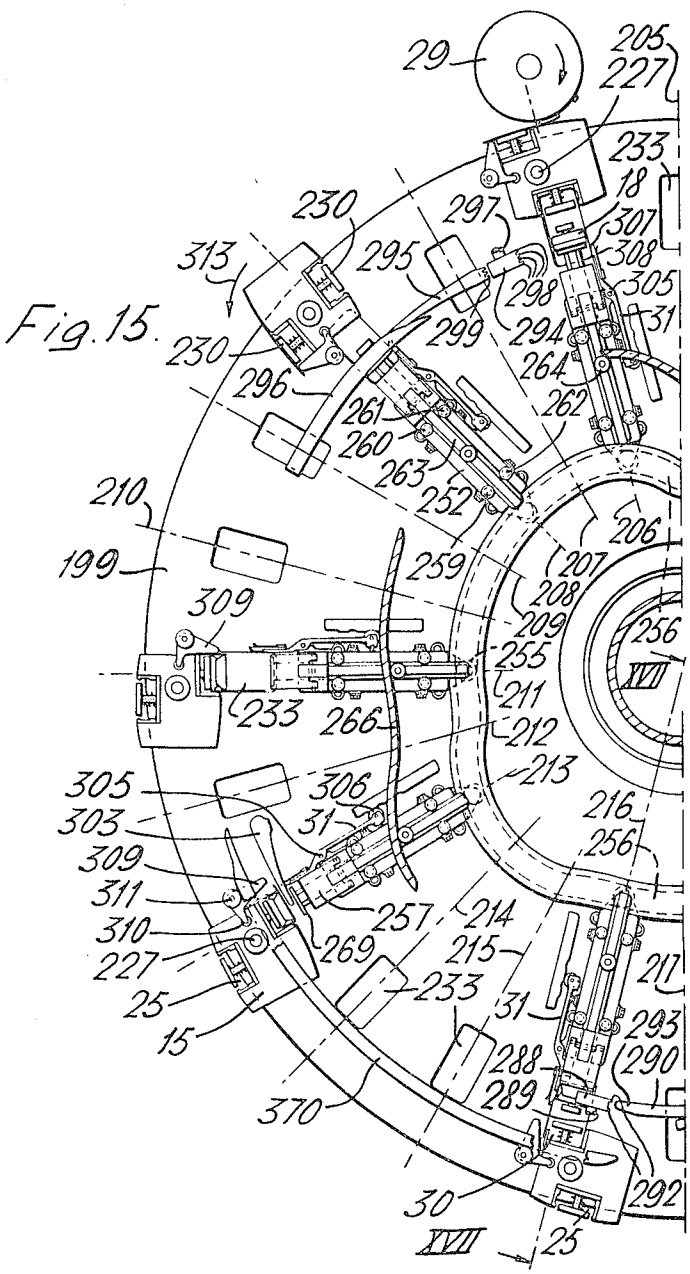
Fig. 15.



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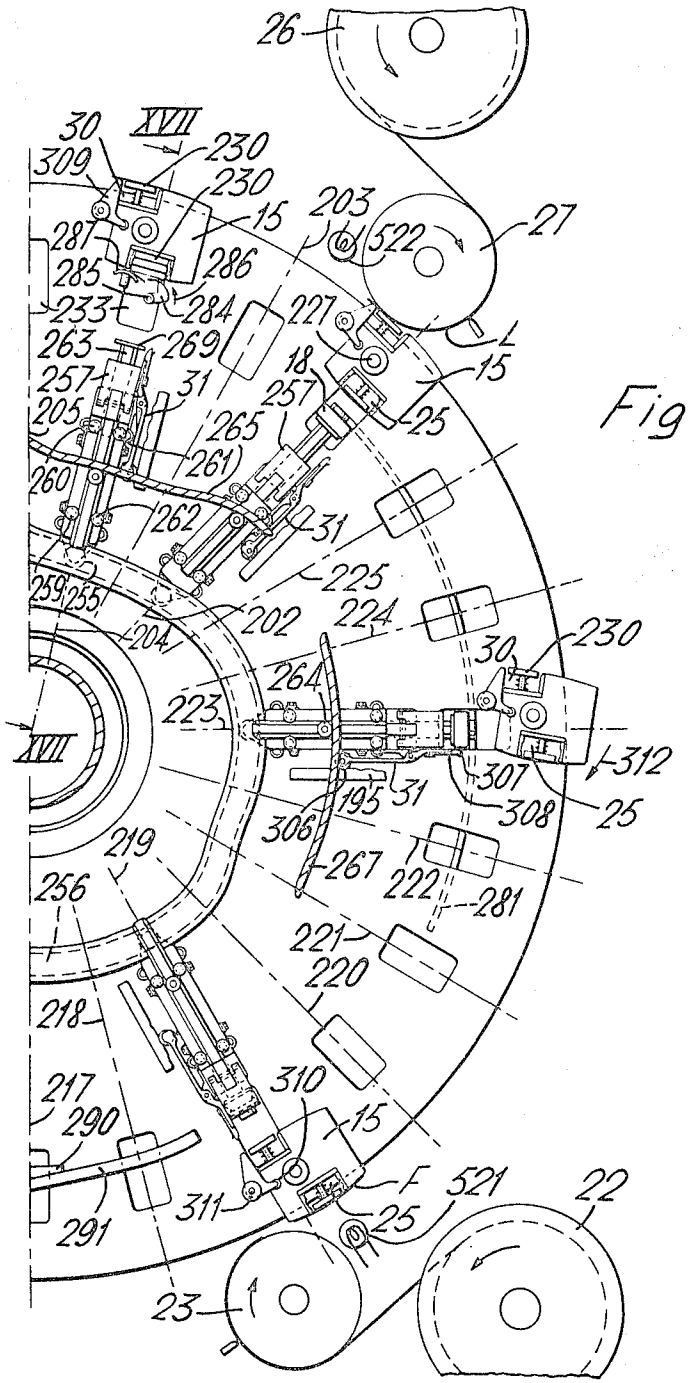

Fig. 15A.

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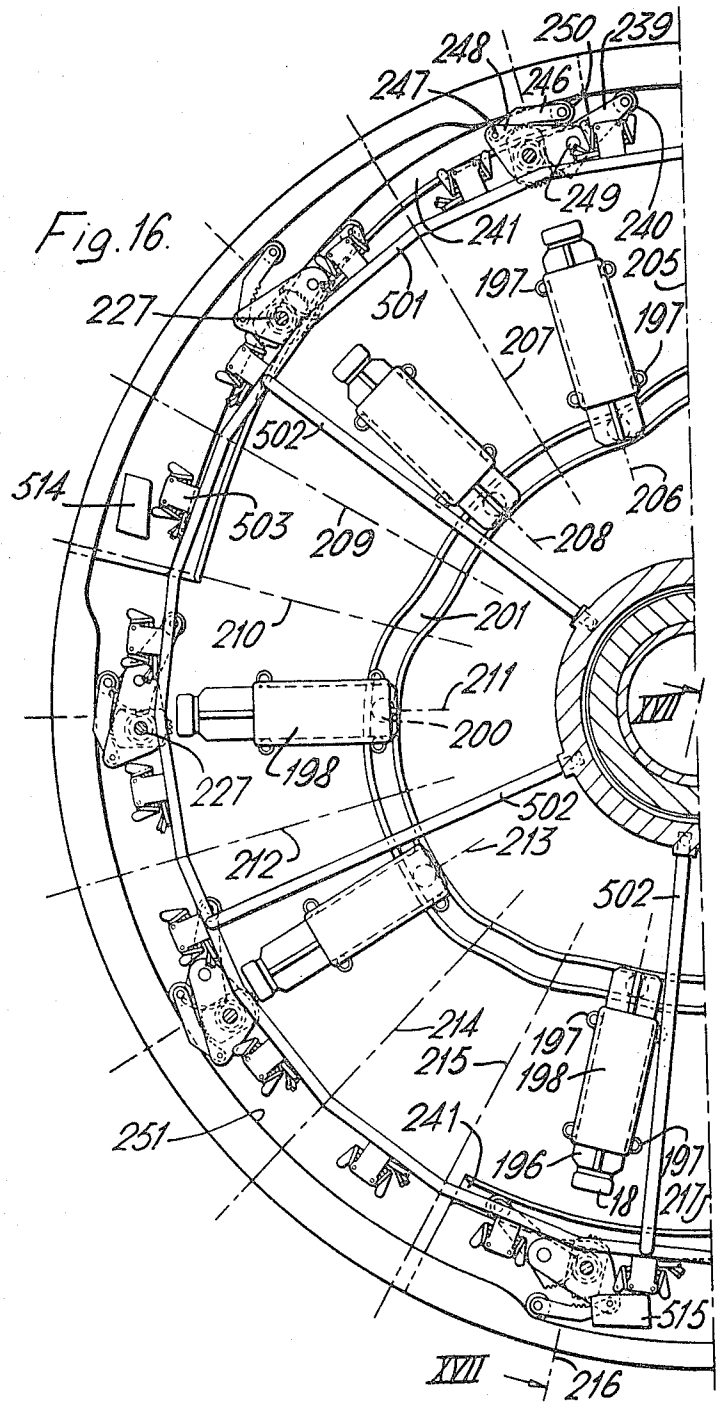
Fig. 16.



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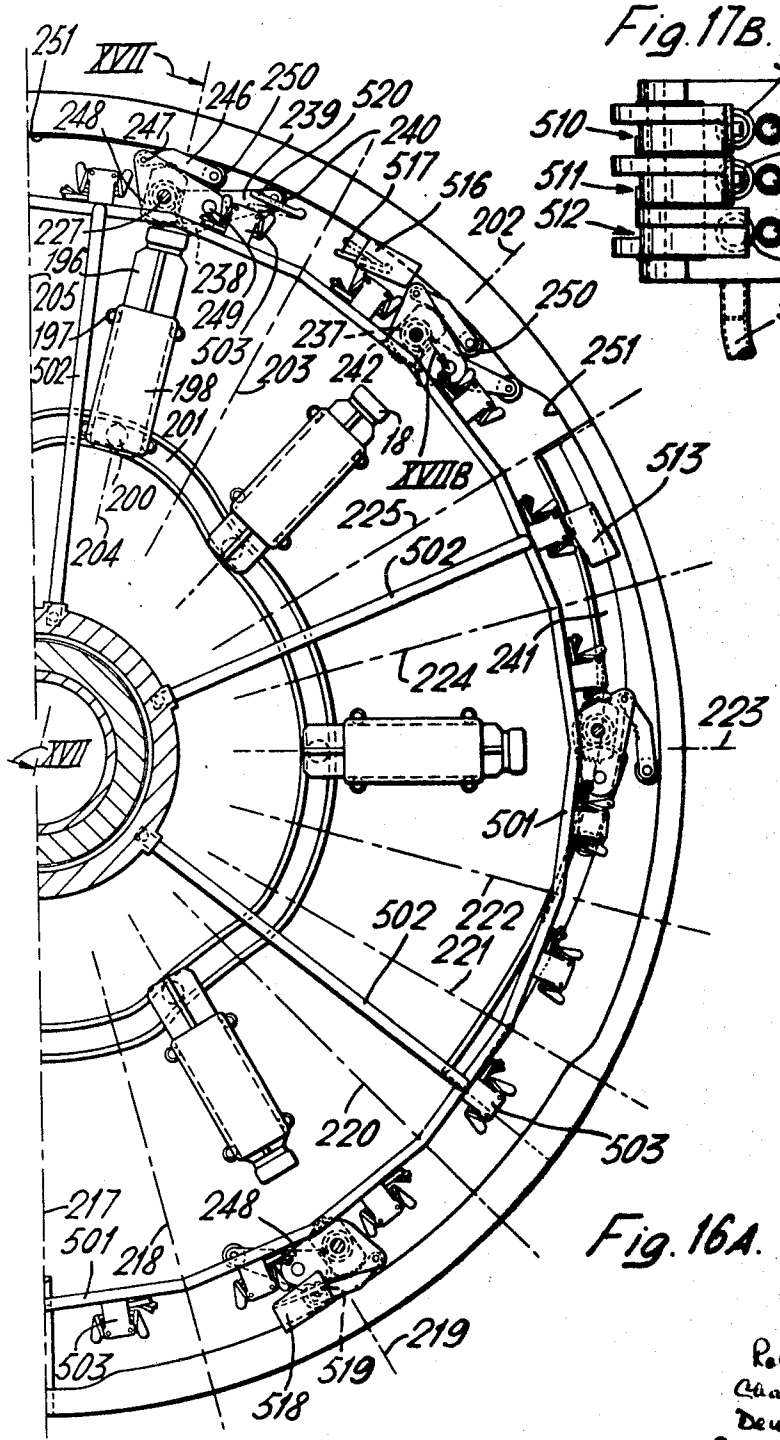

Fig. 17B.

Fig. 16A.

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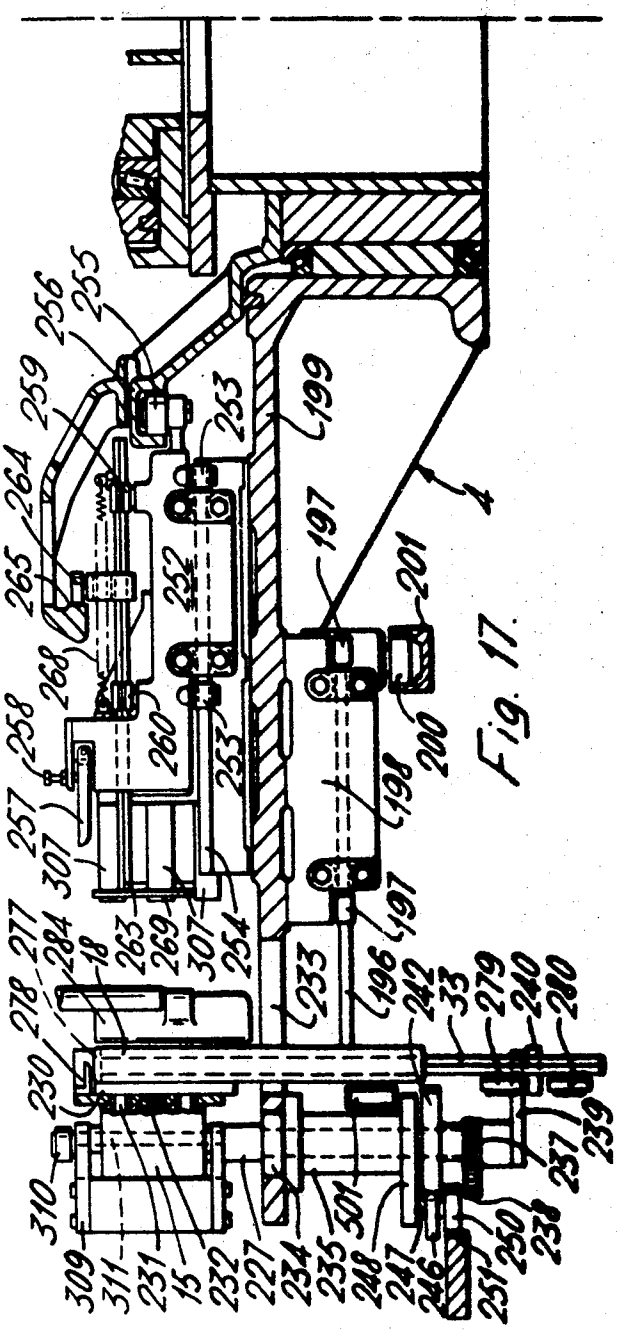

Fig. 17.

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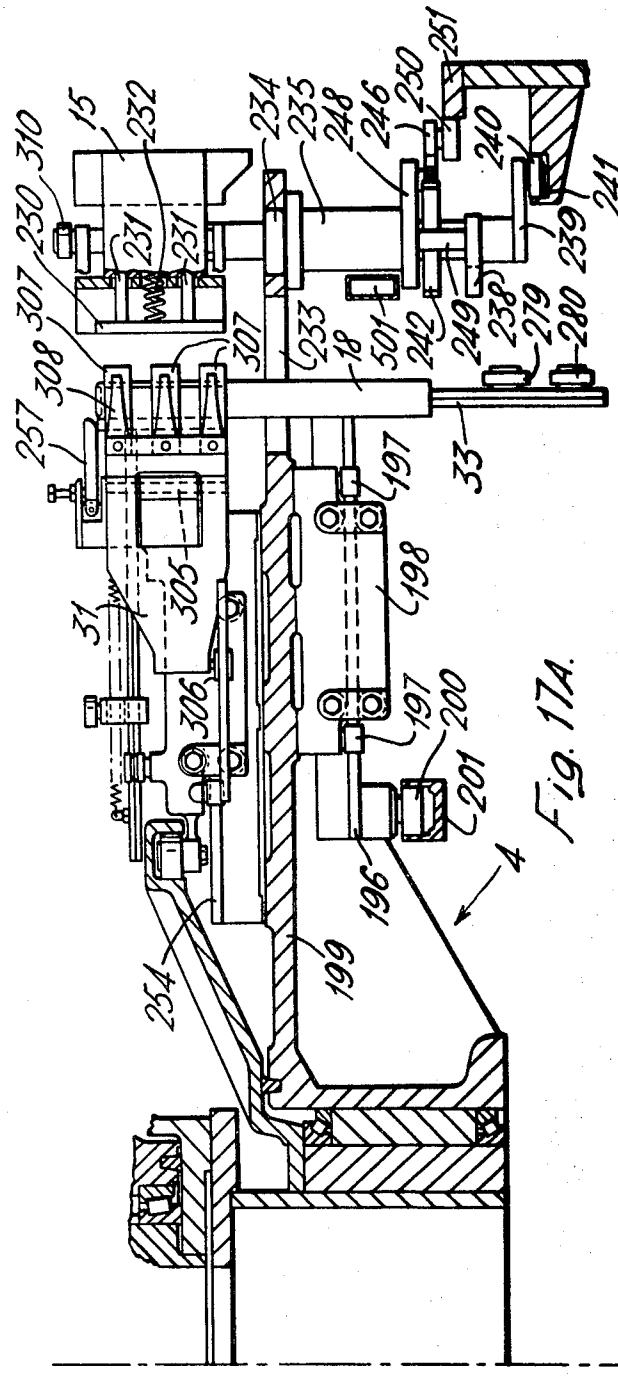

Fig. 17A.

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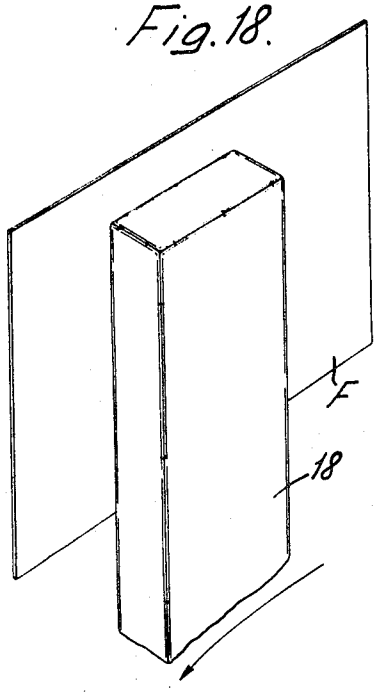
Fig. 18.



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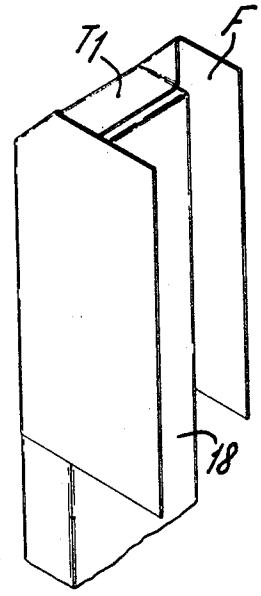

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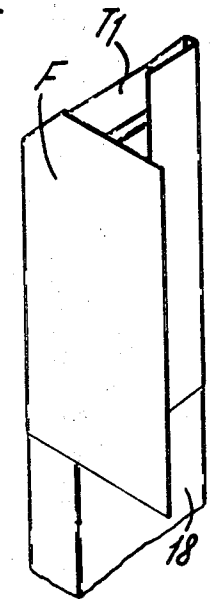

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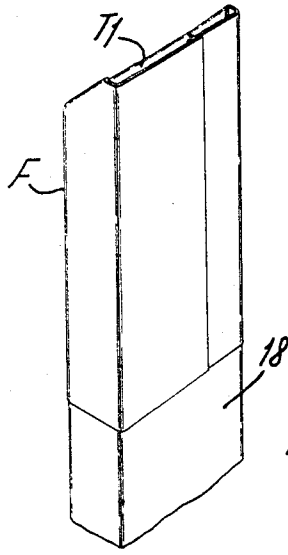

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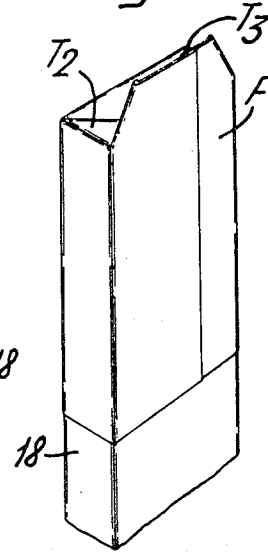

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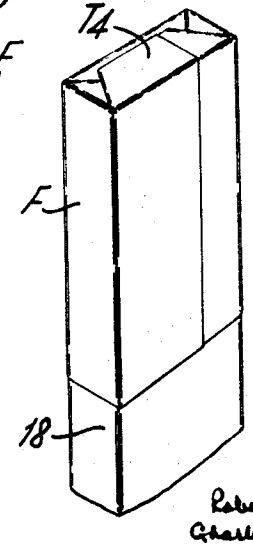

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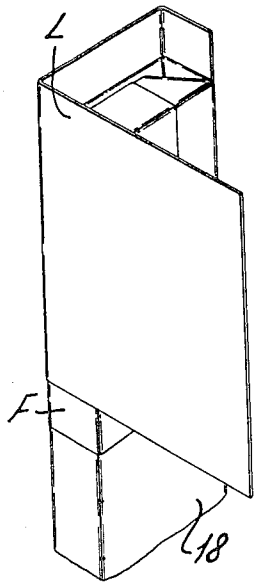
Fig. 24.



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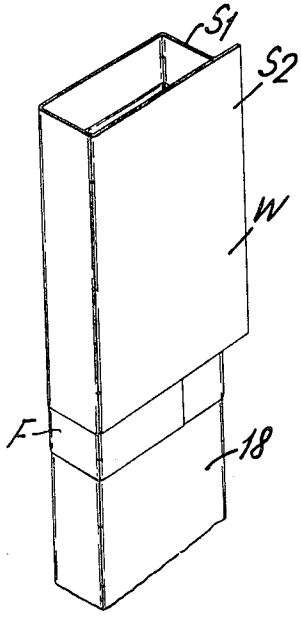

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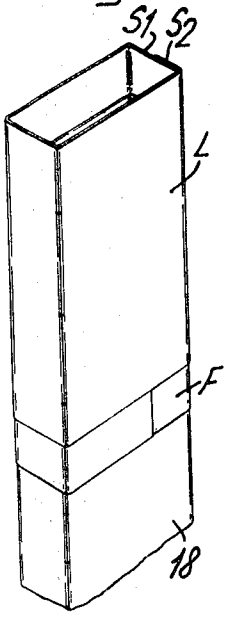

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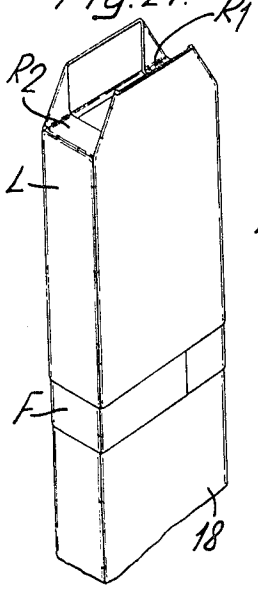

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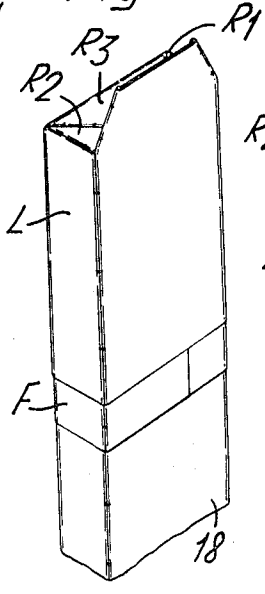

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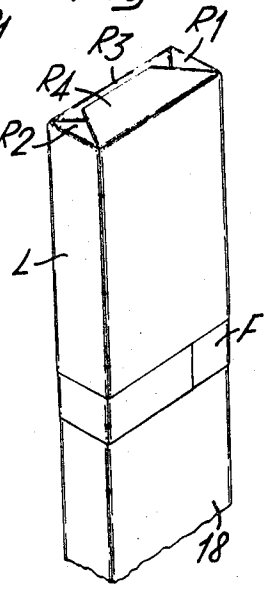

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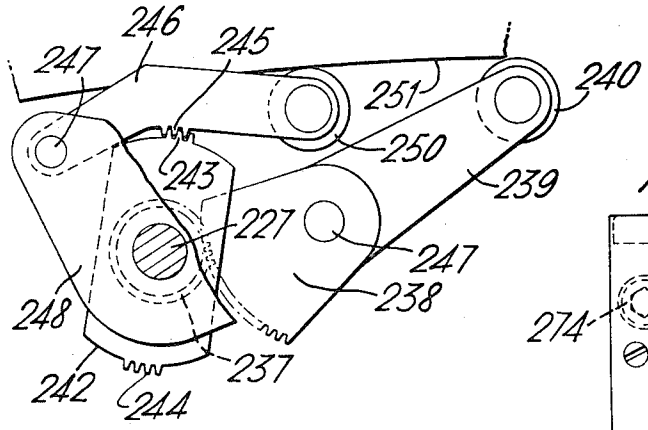
Fig. 30.



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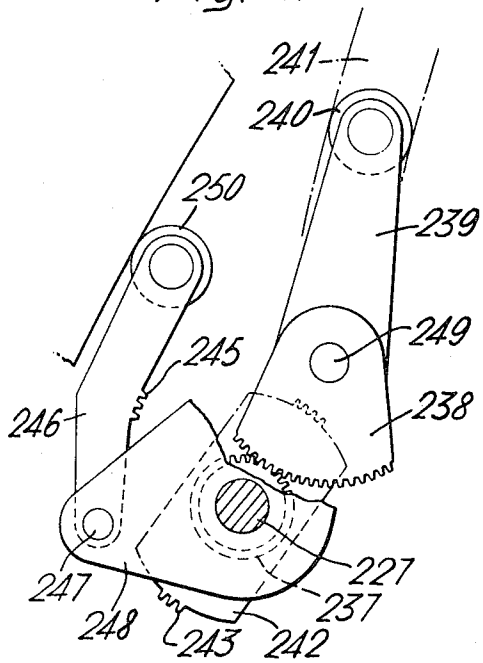

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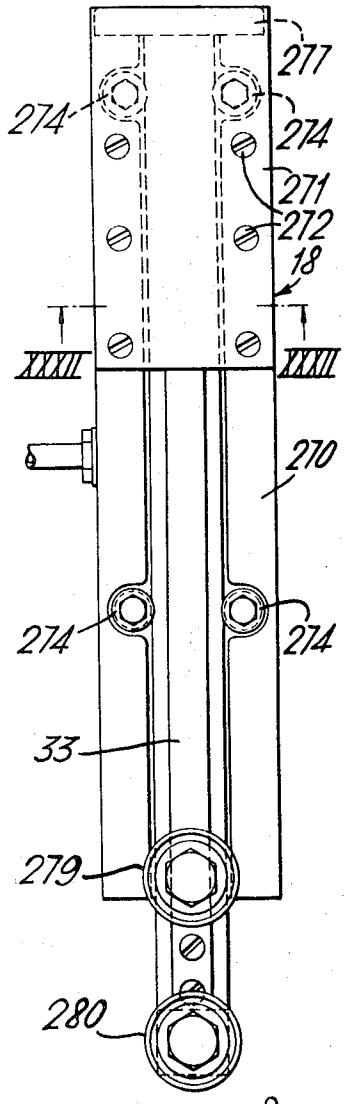

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Fig. 32.

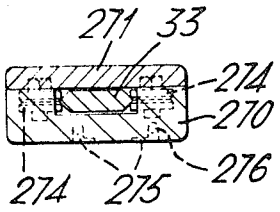
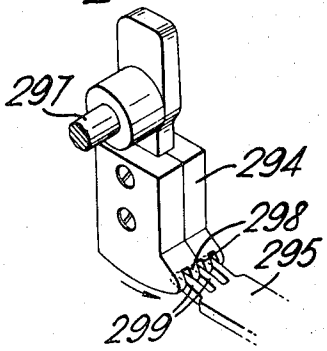


Fig. 34.



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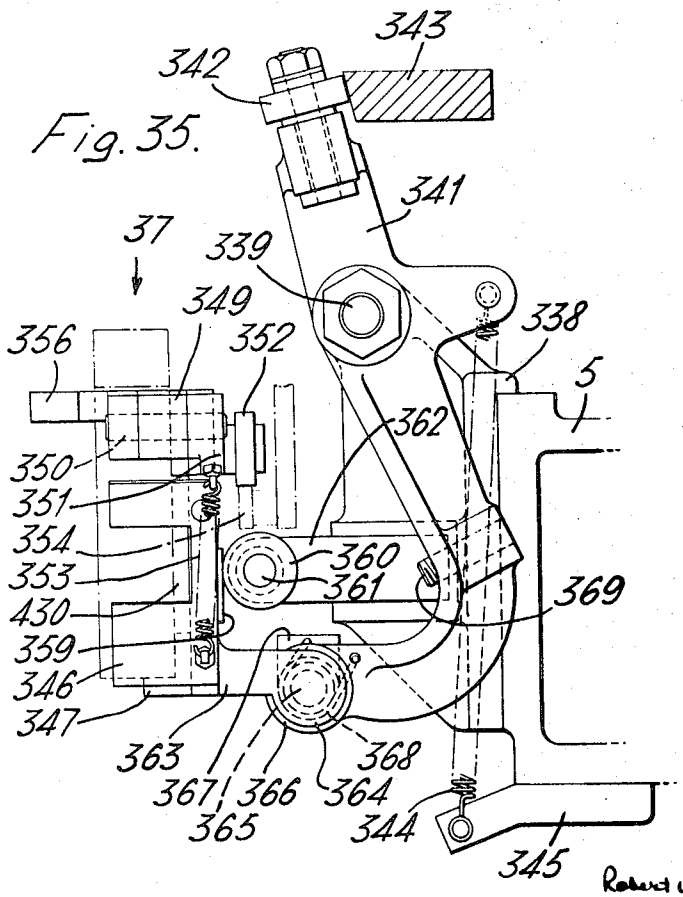

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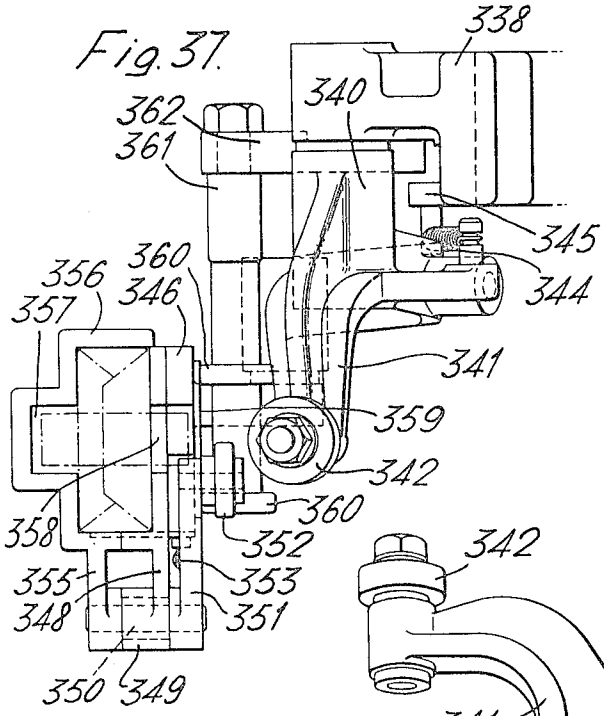
Fig. 37.



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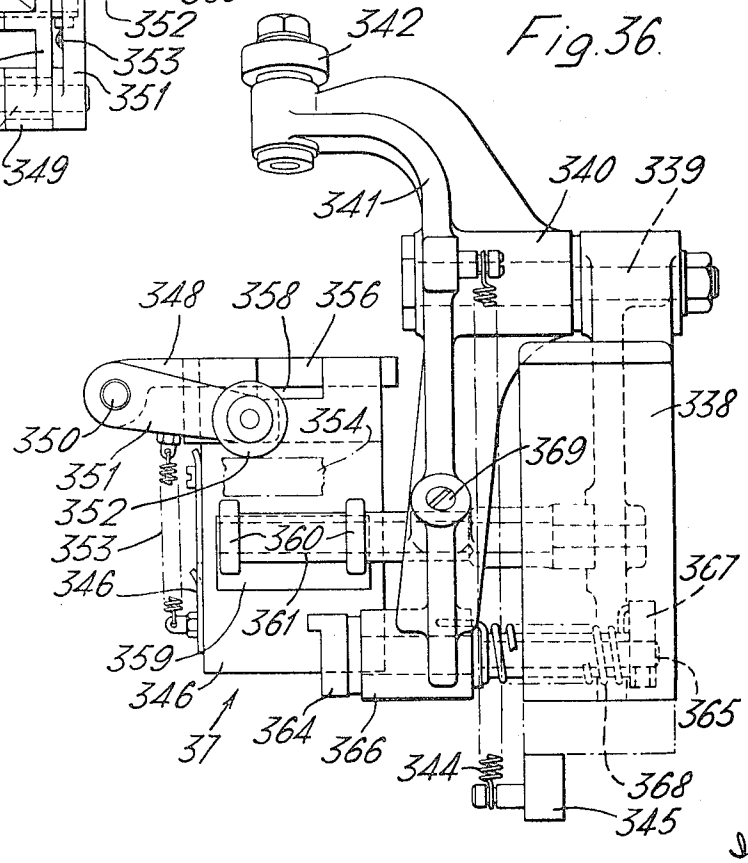

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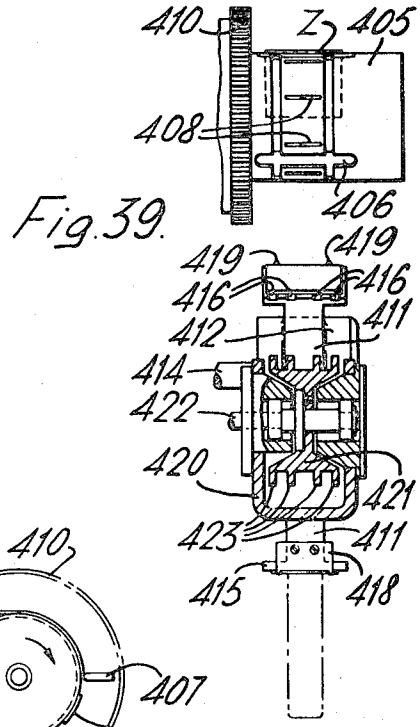

Fig. 39.

Fig. 38.

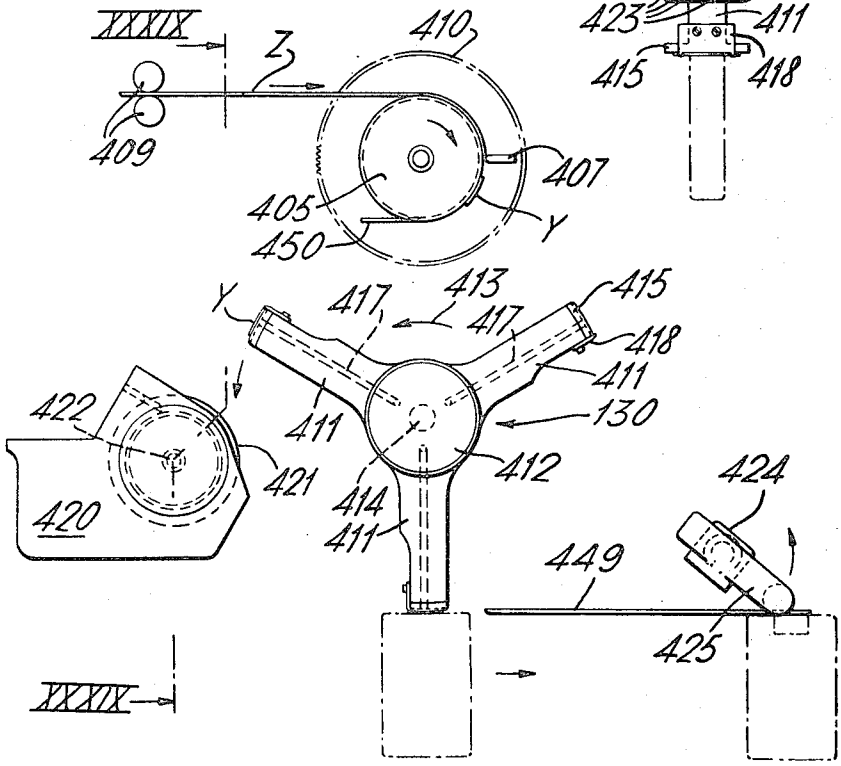

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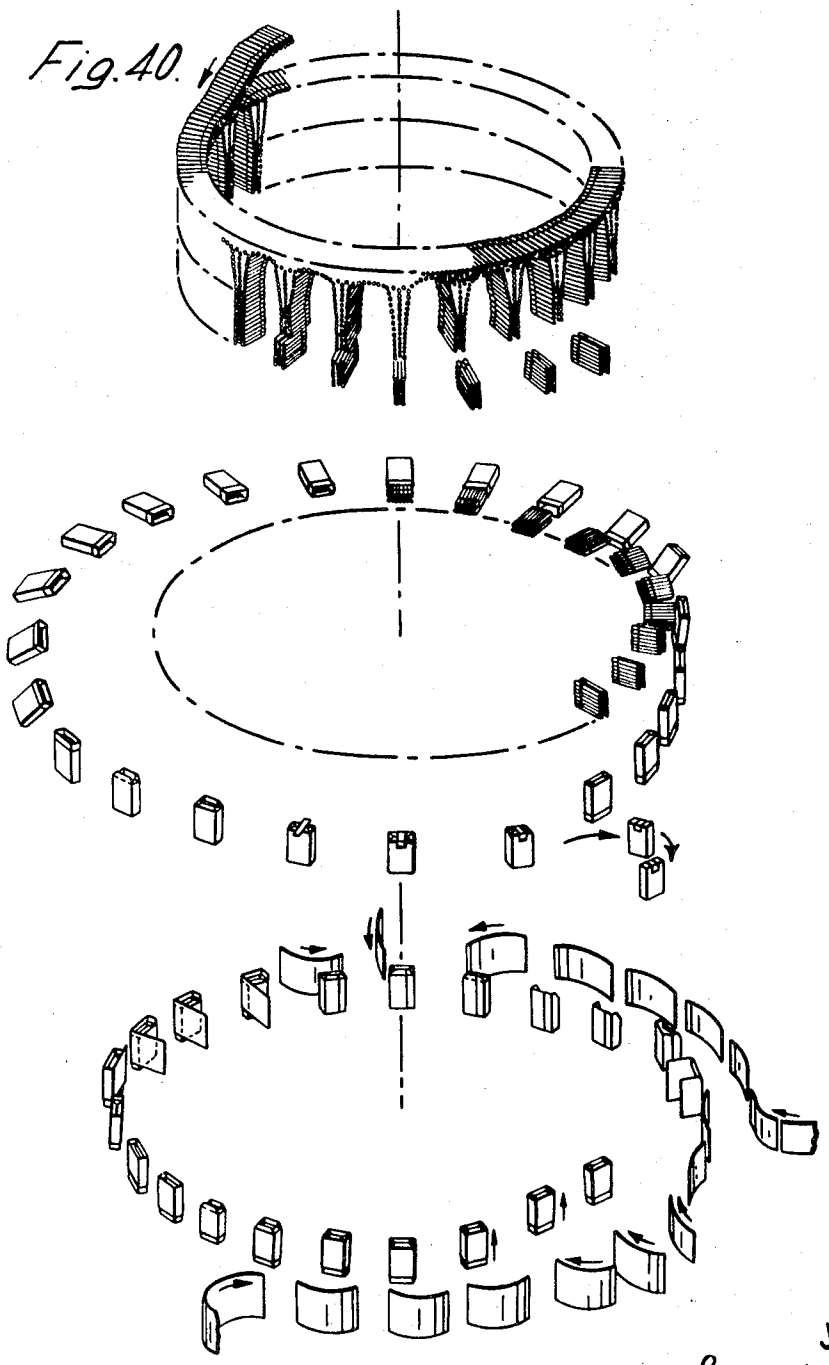
Fig. 40.



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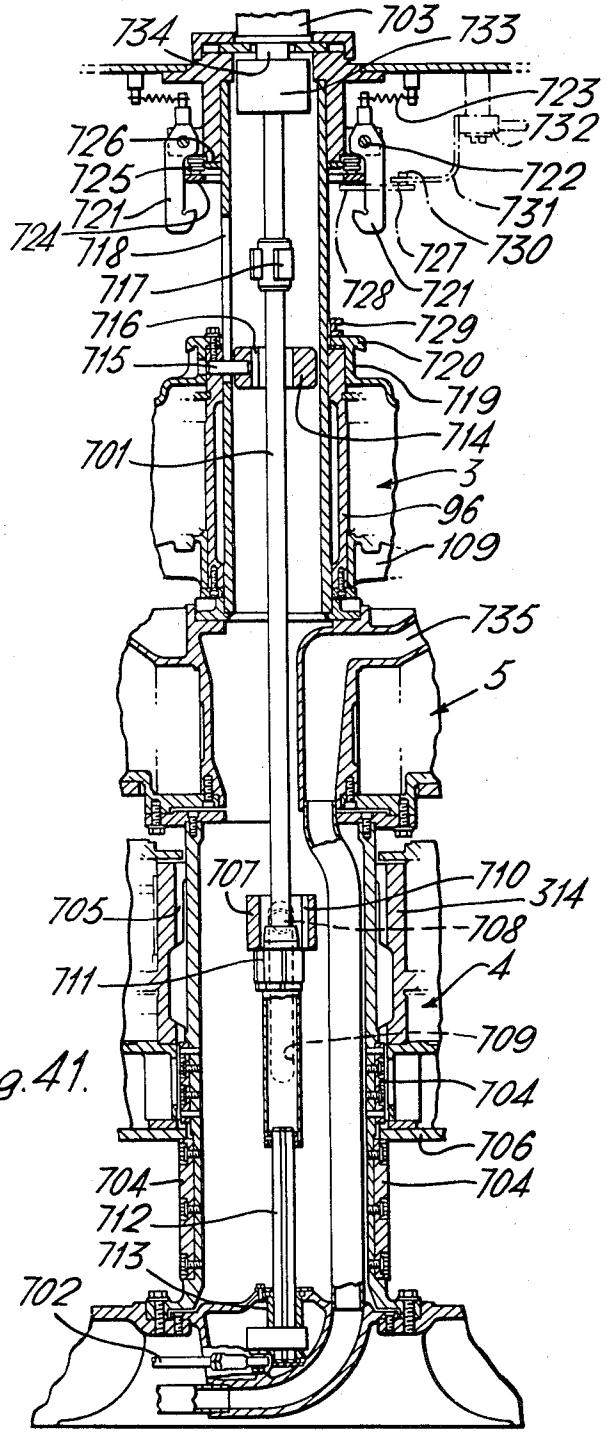

Fig. 41.

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PACKING MACHINES

This invention concerns improvements in or relating to packing machines for packing articles into containers.

Packing machines for packing various kinds of commodities into various kinds of containers have been developed to high degrees of sophistication, but they suffer in general from restrictions on the speed at which they can operate and hence on their output. One cause of restriction on output in many machines, for example, is the need to perform certain operations at rest, notably the operation of inserting goods into a container. There are, of course, many other causes, and many attempts have been made to overcome them, but in general, where the theoretical output has been increased, this increase has frequently been accompanied by a decrease in efficiency.

An object of the present invention is to provide a packing machine capable of producing a higher actual output than is obtainable by machines produced heretofore.

To this end, the invention provides machinery of a character whose principles of construction and operation can readily be adapted for dealing with articles or materials of widely diverse character, and which operates in continuous fashion to insert goods into containers while the containers and the goods are moving in concert with each other. The nature of the machinery makes it possible for a number of containers to be filled, in sequence, during each operating cycle of the machine. To this end the machinery comprises a number of continuously moving, cyclically operating sets of mechanism. These sets, which may all be identical in construction, operate in sequence. The necessary materials on which the mechanism operate to produce the desired end product may be fed into the machinery from definite stations past which all the sets of mechanisms pass in succession, and which are common to all the sets. Preferably, these materials are set in motion before being actually transferred to the machinery, so that at the moment of transfer they are moving with those parts of the machinery which are adapted to receive them.

More specifically, the machinery may be embodied in a rotary machine in which all the sets of mechanisms are arranged as a ring of sets extending about a common axis around which they continuously revolve, so that they follow each other in a circular path. In that case, the supply stations may be located at convenient positions about this circular path, and the materials which are supplied to the machine may be caused to move in directions tangential to the said circular path.

It will be seen that this enables a continuous supply of materials to be fed to the machine with the minimum of disturbance and without interruption of the operation of the machine, so that all the functions of the machine may be performed in a truly continuous manner. This continuity of operation has important advantages in securing an increased output while maintaining a high degree of efficiency.

Each set of mechanisms functions individually, and includes means to handle the goods to be packed, means to handle a container, and means to insert the goods into the container. All the mechanisms contained in a set perform all their cooperating functions once during each complete operating cycle—in the case where the machine is a rotary one, each mechanism functions once during a complete revolution of the machine. Thus during one revolution of the machine, as many containers are filled as there are sets of mechanisms. In the specific machine to be described hereinafter by way of example, there are 24 sets of mechanisms. This number could, of course, be varied according to the particular requirements, such as the nature of the goods to be packed and the size of the containers, and also, of course, the size of the machine, and the rate of output required.

The machine may also include various actuating means, including cams and the like which are common to all the sets of mechanisms and coact with the various mechanisms of each set, in succession, so that all the sets perform their functions in sequence.

A machine of the general nature contemplated in accordance with the invention can be arranged to insert goods

into readymade containers of almost any kind, but one feature of the embodiment hereinafter described is that the containers are made on the machine itself. In this case, one of the materials fed to the machine as mentioned above is material from which the containers are to be made. Thus in this case the machine receives a continuous supply of the goods to be packed and also a continuous supply of the blanks from which the containers are to be made, and in each set of mechanisms the manufacture of a container is effected during an early part of each cycle of operations, the container so formed then being filled during the same cycle.

The machine preferably also includes means for finally closing and sealing the containers when they have been filled, and means for removing the sealed containers from the machine. These operations may be performed at stations through which all the filled containers pass in succession, and thus the filled and sealed containers are produced in continuous succession.

It will be seen that the invention includes a machine which receives a continuous succession of goods to be packed and a continuous succession of blanks from which the containers are made; inserts goods into containers; and ejects filled and sealed containers in continuous succession, all these operations being performed in a continuous manner and in unbroken succession.

In one suitable arrangement, which will be fully described hereinafter, the machine is arranged for rotation about a vertical axis and may be considered as divided into three levels; namely a top level where the goods are received and suitably handled, for example individual articles are formed into hatches; a bottom level where containers are handled, for example blanks are received and formed into containers; and a middle level at which the goods and the containers are brought together and where good are inserted into containers. MOre specifically, each set of mechanisms includes mechanism at each of these three levels.

While it is contemplated that almost any kind of goods, e.g. individual articles, batches of articles, or granular or powdered materials, may be packed on a machine coming within the scope of the invention and working on the principles of the invention, one aspect of the invention concerns specifically the packing of cigarettes in batches.

Assuming that the cigarettes are to be packed in batches of twenty, it will be seen that it is necessary to feed twenty cigarettes, multiplied by the number of sets of mechanisms, during each revolution of the machine. Further, the cigarettes must be fed and handled in an orderly way to permit their assembly into batches, and they must at all times be kept properly oriented, not only in order to make it possible to arrange them in batches in parallel cigarettes but also to avoid damage, since cigarettes are somewhat delicate articles to handle.

One feature of the invention, which may be utilized in a machine of the character discussed above, is a hopper formed as a annulus and arranged to rotate.

According to one aspect of the invention, therefore, cigarettes are fed continuously as a stream, in a direction transverse to their longitudinal axes, into a hopper which is formed as an annulus around the rotary packing machine (which in this case rotates about a vertical axis) and while being so fed, move at substantially the linear speed of the annular hopper, and in the same general direction, for example tangentially.

The hopper, which conveniently may be located at a high level in the machine, communicates at spaced intervals around its circular extent with a number of chutes, one to each of the sets of mechanisms referred to above, and cigarettes can pass down the chutes to be removed in batches as required. Continuity of supply to each set of mechanisms can thus be ensured by continuous replenishment of the annular hopper. The chutes preferably include vanes between which cigarettes move downwardly in columns in the known way. In each set, successive batches are removed from the bottom of the chute, one batch being so removed on each revolution of

the machine. Thus in the machine hereinafter specifically described, which comprises 24 sets of mechanisms, 24 batches of 20 cigarettes each are formed during each revolution of the machine.

The chutes may be arranged to be moved upwardly and downwardly in succession, and may be joined to each other at the top by flexible elements which together with the openings to the chutes form the base of the hopper.

It will be seen that a machine having as many as 24 sets of mechanisms and arranged to pack cigarettes in batches of 20, as described above, makes great demands on the cigarette supply system since 480 cigarettes are required for each revolution of the machine. A feature of the invention, therefore, consists in a novel means for feeding cigarettes in bulk at a high rate of feed and accelerating them to the required speed for transfer to the moving hopper.

Thus one aspect of the invention consists in a method of feeding cigarettes in a direction transverse to their longitudinal axes, which consists in feeding the cigarettes in a stack (i.e. in a number of rows) and reducing the depth of the stack (i.e. reducing the number of rows) while simultaneously applying a force to change their velocity. More specifically, there is provided a cigarette-feeding system having means to feed a stack of cigarettes between opposed surfaces which confine the stack and define its depth and which include moving surfaces to provide an accelerating force. Thus the stack of cigarettes can initially be quiet deep and move relatively slowly, and the depth of the stack can be progressively reduced in stages while the speed of movement of the cigarettes is proportionally increased to the desired delivery speed. To enable this operation to be performed accurately, it is desirable that at each stage of the cigarette conveyance, the cigarettes should be arranged as far as practicable in a definite number of rows, and the opposed confining surfaces are therefore spaced apart suitably to ensure that at any stage in their travel, the cigarettes are stacked in no more than the number of rows required at that stage. Conveniently the distance by which the surfaces are spaced apart may be (at any stage) between a maximum value of nd and a minimum value of $d[1+(n-1)\sin 60]$ (where "n" is the number of rows, and "d" is the diameter of a cigarette) being the values for square and hexagonal close-packing respectively.

Another feature of the invention concerns the supply to the machine of successive blanks from which the containers can be formed in the machine, as mentioned above. This may conveniently be accomplished by causing a suitable length of material to be cut from a web and fed into contact with a blank-receiving part of the packet-forming mechanism of a set, the blank being caused to move, while being so fed, at substantially the same linear speed and in the same general direction as the said blank-receiving part. This operation, of course, is repeated for each set of mechanisms in succession as they pass the source of the blanks, which may be drawn from a reel of material stationed alongside the machine. Where two blanks are required to make a packet, two reels, suitably spaced around the machine, are provided. The invention also includes novel mechanism for receiving the blanks and forming them into open-ended packets.

More specifically, the invention includes container forming apparatus comprising a block having a recess into which a former is moved so that an intervening piece of sheet material is wrapped around three sides of the former, there being provided means to wrap the ends of the piece over the fourth side of the former, and means to fold the top of the resulting tube over the end of the former. Where an inner and outer piece of material are used, e.g. an inner liner and outer wrapper, the block may have one recess on one side and another recess on the other side, and may be rotatable so as to present each recess in succession to the former. To control the material, the block may have suction openings adjacent the recesses, and the former may likewise have suction openings to hold the ends of the piece of material.

Where such apparatus is used in a rotary packing machine as discussed above, the block s can be disposed and rotated so that first one side and then the other is positioned to receive a blank and thus constitutes a blank-receiving part of the machine as mentioned above. Each side which receives a blank is, of course, a side having a recess into which the blank is plunged by the former.

Apparatus in accordance with the invention will now be described by way of example with reference to the accompanying drawings.

In the drawings, because of the complexity of the machine, it has been necessary to split up certain views. The separate parts of such split views have been labeled by numbers and by letters, e.g. FIG. **12**, FIG. **12A** and FIG. **12B** are all parts of the same view, but for convenience such views are referred to, throughout the specification, solely by number. Thus, for example, mention of FIG. **12** includes mention of FIGS. **12A** and **12B** as well. In the drawings:

FIG. **1** represents in diagrammatic form a rotary packing machine,

FIG. **2** is a diagrammatic development of certain parts of the machine of FIG. **1**,

FIG. **3** is a side view of cigarette feeding apparatus,

FIG. **4** is a plan of part of FIG. **3**,

FIG. **5** shows in end view one possible arrangement of stacking four rows of cigarettes,

FIG. **6** shows an alternative arrangement to that of FIG. **5**,

FIGS. **7** and **7A** together are a partial plan view of the top of the rotary cigarette packing machine, partly cut away,

FIGS. **8** and **8A** together are a section along the line VIII–VIII of FIG. **7**,

FIG. **9** is an end view of part of FIG. **8**,

FIG. **10** is the same mechanism as FIG. **9** but in a different operating position,

FIGS. **11** and **11A** together are a section through the center drum of the cigarette packing machine,

FIG. **12** is a plan view of the center drum, FIGS. **12A** and **12B** being enlargements of parts thereof,

FIG. **13** is an end view of part of the mechanism shown in FIGS. **11** and **12** but drawn to a different scale,

FIG. **14** is the same mechanism as that shown in FIG. **13** but in a different operating position,

FIGS. **15** and **15A** together are a plan view of the bottom drum of the cigarette packing machine,

FIGS. **16** and **16A** together are a plan view at a lower level of the same drum as that of FIG. **15**,

FIGS. **17**, **17A** and **17B** together are a section along the lines XVII–XVII of FIGS. **15** and **16**, FIG. **17B** being an enlarged view of a suction valve in the direction of arrow XVIIB,

FIGS. **18**—**23** show perspective views of a piece of foil being formed around a plain former,

FIGS. **24**—**29** show perspective views of a label being formed over the same piece of foil and former as in FIGS. **18**—**23**,

FIG. **30** is a detail drawn to a larger scale of part of the mechanism shown in FIG. **16**,

FIG. **31** shows the same parts as those of FIG. **30** but in a different operating position,

FIG. **32** is a section through the package former shown in FIG. **17** but drawn to a different scale,

FIG. **33** is an end view of the former of FIG. **32** as seen when facing the center of the machine,

FIG. **34** is a perspective view of the folders positioned between the lines **213** and **214** of FIG. **15**,

FIG. **35** is a detail drawn to a larger scale of part of FIG. **11**,

FIG. **36** is an end view of FIG. **35**,

FIG. **37** is a plan view of FIG. **35**,

FIG. **38** is an end view of the stamper mechanism,

FIG. **39** is a section along the line XXXIX–XXXIX of FIG. **38**,

FIG. **40** is a schematic view in perspective showing the disposition of unpackaged cigarettes, packaged cigarettes and the package-forming material in the packing machine,

FIG. 41 is a sectional view through the center of the packing machine.

Reference will firstly be made to FIG. 40 which clearly shows the method according to which the packing machine operates to produce a continuous supply of packaged cigarettes. At any one instant during its operation the machine is processing 24 packages, each of which is in a different stage of manufacture between a first stage of receiving cigarettes and the packaging material and a final stage of ejecting the sealed package of cigarettes from the packing machine. Thus FIG. 40 shows all the stages in the production of a package of cigarettes from a stream of cigarettes and the package-forming materials.

The production of packages of cigarettes is carried out in three stages or layers: an upper layer in which cigarettes are received from a continuous stream supply and divided into batches of 20; a lower layer in which paper and foil are formed into open-ended packets; and a middle layer in which the batches of cigarettes from the upper layer are inserted into the packets from the lower layer which packets are then closed and sealed. In each layer of the machine there are 24 identical mechanisms which are rotated in unison with the other layers about a single common axis. As each mechanism rotates so that production step of the layer in which it is situated progresses through a complete cycle during the course of which the mechanism is presented to stations positioned externally of the rotary part of the machine where materials are supplied and other functions such as stamping performed.

The construction and operation of a packing machine will now be described with reference to FIGS. 1 to 39.

FIG. 1 shows schematically in perspective certain fundamental elements of a packing machine adapted to pack 20 cigarettes into a container consisting of an inner lining of foil and an outer paper shell, the top of the container being secured by a small adhesive strip known as a stamp. The machine comprises a cylinder shown generally as 1 which is rotatable at 25 revolutions per minute about a vertical axis 2. The cylinder 1 is divided into three drums: a top drum 3, a bottom drum 4 and a center drum 5. Each of the three drums 3, 4 and 5 is divided into 24 radial segments, the center lines of which are radii here given the reference 6 but in subsequent more detailed drawings referenced individually as 202 to 225, each segment being of 15°.

The top drum 3 has 24 chute members of which one is shown at 7 provided with vanes and arranged peripherally therearound with one such member to every segment. Arranged above the chute members 7 in the form of an annular ring and part of the drum 3 is a hopper 8 which is fed from stationary feeding means shown generally as 9, only part of which can be seen in FIG. 1. The arrangement is such that cigarettes are fed from the feeding means 9 into the hopper 8 as it rotates beneath it. Each chute member 7 is provided with plungers 10 for removing batches of cigarettes from the chute.

FIG. 2 is a schematic development of certain elements of the machine which are shown sometimes in plan and sometimes in elevation. The confines of the three drums 3, 4 and 5 are outlined in chain lines. A chute member 7 is shown in end view and from this it can be seen that three columns of cigarettes are fed in a downward direction by gravity. At the bottom of the chute member 7 is a plate 11 on which the cigarettes come to rest and which has a projection 12 extending upwardly between the two inner vanes. By means of the projection 12 the center column of cigarettes is offset in an upward direction from the two outside columns. The plunger 10 which, in effect, is a three-pronged fork pushes out a batch of 20 cigarettes in three columns, with seven in the two outer columns and six in the inner column, into a cigarette compression box 13. The compression box 13 can be seen in FIG. 2 aligned with drum 3 where the chute member 7 and plunger 10 are shown diagrammatically in side elevation. After each compression box 13, of which there are 24, is filled it is rotated in a downward direction through 90° as will be explained hereinafter and as indicated by arrow 14 in FIG. 2 to bring it into alignment with cooperating insertion mechanism on drum 5.

Referring again to FIG. 1 the bottom drum 4 is divided, as already explained, into 24 similar segments. Around the periphery of the drum 4 are 24 container-forming blocks 15, one to each segment, each being rotatable about a vertical axis 16 (see FIG. 2 where some of the blocks 15 are diagrammatically shown in plan view as 15*a*, 15*b*, 15*c*, 15*d*, 15*e*, 15*f* and 15*g*). Located radially inward of each block 15, within each segment, is a former 18, which is movable in a radial direction as indicated by double-headed arrow 19. Outside and adjacent to the drum 4 there are located foil- and label-supply apparatus indicated generally by numerals 20 and 21 respectively (see FIG. 1).

The foil-supply apparatus 20 comprises a foil reel 22, a suction roll 23 and knives 24. As a block, i.e. block 15*a* (FIG. 2), which has peripheral ports connected to a suction source (ports and source not being shown), is carried by a drum 4 past the roll 23 it picks up suctionally a piece of foil F_1 which is cut to the correct length by the knives 24. At the same time the block 15*a* starts to rotate about its own axis 16 until it has rotated through approximately 180° when it reaches the position occupied by block 15*b*, being carried there by rotation of the drum 4. Some time previously the former 18 starts to move radially outwards (i.e. towards the block). Suction is released when the former touches the foil and the former comes to rest in the foil recess 25 of the block 15*b* in which it fits snugly. The piece of foil assumes the outline F2. As the block continues to be carried around the periphery of drum 4 the piece of foil is first formed into a tube around the former 18 to which it is suctionally held and then has one end, namely the end which will ultimately be the bottom of the package, folded and tucked, the operation being carried out by stationary ploughs and rotary tuckers which are not shown but which will be described hereinafter.

By the time the block reaches the position indicated at 15*c* former 18 with the foil wrapped therearound has started to move radially inwards (i.e. towards the top of FIG. 2). At the same time the other side of the block 15*c* has suctionally picked up a label L_1 from the label-supply apparatus 21. This comprises a preprinted label reel 26, suction roll 27 and knives 28 (see FIGS. 1 and 2). The block 15*c* does not yet start to rotate about its own axis 16. At the position indicated by 15*d* the former 18 has moved clear of the block while gum application 29 (FIG. 2 only) applies hot melt pressure-sensitive adhesive to appropriate places on the label. The block 15*d* now rotates through approximately 180° until it reaches position 15*e* when the former 18 moves into label recess 30 so that the label assumes the outline L_2. At position 15*f* the former 18 has moved radially inwards and is clear of the block. A folder 31 is shown completing the longitudinal seam of the label. One end of the resultant paper tube is then folded over as described hereinafter to form an open-ended package or cup. At the position of the block indicated by 15*g* the former 18 is at the end of its radially inward movement and a plunger 33 (shown in elevation in FIG. 2) slidable within the former 18 pushes the cup (i.e. foil and label) into an arbor 34 (also shown in elevation) which is located in the drum 5. In FIG. 2 for the sake of clarity, the former 18 in the block position 15*g* is also shown as 18*a*, in which position it can be seen in side elevation as distinct from the plan view of 18.

At the same time, as previously explained, the compression box 13 is rotated through 90° into position 13*a* where it is in line with the arbor 34 which has also been rotated through 90° as indicated by arrow 35 and which is given the reference 34*a* in its new position. As the compression box 13*a* rotates, its sides move in and compress the cigarettes as desired. A plunger 36 pushes the batch of 20 compressed cigarettes into the open-ended package continues pushing package and cigarettes out of the arbor 34*a* and into a packet holder 37. Rotation of the drum 5 causes the packet holder 37 to be rotated upwards as indicated by arrow 38 into position 37*a*. By means of stationary ploughs and rotating folders, the top of

the package, i.e. the foil, is folded as the drum **5** continues its rotation. A completed packet P_1 is shown in plan in FIG. **2**. In the following position P_2 a stamp S is applied to the top of the packet while as shown in FIG. **1** a spider stamper indicated generally as **130** can be seen applying this stamp. In position P_3 the ends of the stamp have been folded down and the completed package is ready to be moved off the drum **5** by a diverter shown in FIG. **1** as a roller **158**. Thus the cycle of making the container or packet, forming the cigarettes into groups of **20**, inserting one group in each packet, and sealing the package is completed.

The packing machine and its operation will now be described in greater detail.

In FIG. **3** the feeding means **9** of FIG. **1** is shown in detail. A stack of cigarettes **39** is fed by means which are not shown from cigarette-making machines. At the base of the stack **39** is a passage **40** leading to a continuous channel **41** which extends from conveyor pulley **42** to double chain **43**. The passage **40** lies between the lower edge of a back plate **44** and the right-hand edge of a stationary surface **45** which is part of the channel **41**.

Opposite the stationary surface **45** is moving surface, being the upper run of a conveyor band **46**, driven by the pulley **42**. The upper run of this band **46** is supported by a table **47**. The band **46**, which is made of a plastic-coated canvas material known under the registered trademark "Mulcott", passes around a head pulley **48** and tensioning rollers **49** and moves in the direction indicated by arrow **50** and 178 mm. per second.

At the left-hand end (as seen when looking at FIG. **3**) of the stationary surface **45**, and almost abutting it, is a cylindrical roll **51**. Below the roll **51** is a further roll **52**, separated by means of bridge piece **63** from the head pulley **48**. The bridge piece **63** continues the straight line of the upper run of the band **46** but this straight line, if extended intersects the roll **52**, forming a chord on its cross section. The distance between the chord and the top of the roll **52** is 5 mm. while the distance between the cylindrical surfaces of the two rolls **51** and **52** is 30 mm. The top roll **51** rotates in the direction of arrow **53** at 70 r.p.m. with a peripheral speed of 915 mm. per second. The bottom roll **52** rotates in the opposite direction, i.e. as indicated by arrow **54**, at 89 r.p.m. with a peripheral speed of 1143 mm. per second.

A third roll **55** rotates in the direction of arrow **56** at 60 r.p.m. with a peripheral speed of 787 mm. per second. Bridging the cylindrical surfaces of the rolls **51** and **55** is an arcuate top plate **57** concentric with the center of the roll **52**, while below the roll **55** are double supporting conveyor bands **58**, the upper runs of which pass over a table **59**. The bands which are made from a material known by the registered trade mark "Terylene" are driven by a roller **60** keyed to a shaft **61** rotating in the direction of arrow **62** and return about tail pulley **64**. **65** is a tensioning roller. Between the upper run of the bands **58** and the cylindrical surface of the roll **52** is a concave plate **66** which is concentric with the center of the roll **55**.

Above the double supporting conveyor bands **58** are pressure bands **67** (see FIGS. **3** and **4**) driven by a drive pulley **68** keyed to shaft **69**. Tail pulley **70** is located as closely as is practicable to the roll **55** and the intervening space is filled by a top plate **71**. **72** is a tensioning roller. Also driven by roller **60** and drive pulley **68** are short conveyor bands **73** and **74** respectively. The band **73** returns about a tail pulley **75** and has its upper run somewhat proud of a flat plate **76** having projecting wings **77** extending into the hopper **8**. The top band **74** returns around a tail pulley **78** keyed to a shaft **79** and has its bottom run extending just below a plate **80**. Keyed to the shaft **79** are two sprockets **82** driving the double chain **43** which is partially supported by idlers **83**. **84** is a pressure pad to hold the chains **43** to the idlers **83**. Thus the chains **43** pass over the idlers **83** and round the sprockets **82**, with the remainder of their length in the form of a bight.

The surfaces of the rolls **52** and **55**, the top plate **57**, the concave plate **66**, the top plate **71**, the surfaces of the bands **58**, **67**, **73** and **74**, as well as the plates **76** and **80** are all covered with "Terylene" or made of material with a similar low coefficient of friction, but not the surface of the roll **51**. The latter has a higher coefficient of friction.

The operation of the cigarette-feeding means as shown in FIGS. **3** and **4** will now be described. Cigarettes are fed to the stack **39** in quantities in the order of 12,000 per minute, control of the feeding rate being exercised by known mean which are not shown. As cigarettes are removed from the bottom of the stack those above move downwards. At the bottom of the passage **40** and band **46** acts as an accelerating force and imparts to the cigarettes in contact with it, and to lessening degree to those above, a horizontal velocity in the direction indicated by the arrow **50**. The distance between the stationary surface **45** and the band **46** is sufficient to allow **10** rows of cigarettes to pass.

The roll **51** which has a relatively high-friction surface acts as a further accelerating force at the left-hand end of the stationary surface **45**. The cylindrical surface of this roll, as can be seen in FIG. **3**, projects deeply into the channel **41** and, due to its surface finish, bites into and accelerates the cigarettes through an angle subtended from its center between approximately 4 o'clock where it intersects the surface **45** and 6 o'clock where it ceases to influence the cigarettes. From the 6 o'clock position of roll **51** which is the same as the 12 o'clock position of the roll **52** to the 9 o'clock position on the latter roll the cross section of the channel **41** is constant and measures 30 mm. The rapidly rotating roll **52** the top of which is 5 mm. higher than the level of the band **46** also bites into the slowly moving stream of cigarettes 10 deep and helps to realign the bottom row of this stream so that the faster moving stream four cigarettes deep can be achieved without crushing.

This distance of 30 mm. is critical and allows four rows of cigarettes to pass between the opposed surfaces (i.e. the top plate **57** and the cylindrical surface of the roll **52**) of the channel **41**. It has been found that this distance must be accurately maintained since otherwise the cigarettes will not travel along the channel **41** without becoming misaligned or causing jams in other ways. In general there are two ways in which cigarettes or other cylindrical objects will stack without gaps occurring. In FIG. **5** one such way is shown. Here each cigarette is supported on one cigarette of the row below. Quite obviously if there are n rows of cigarettes and if the diameter of each is d then the total height is nd. This represents a maximum dimension that the cigarettes can occupy provided they are in rows and without gaps. In FIG. **6** there is shown the alternative method of stacking in rows. This is a stable configuration whereas that of FIG. **5** is not. FIG. **6**, also obviously, gives the minimum dimension cigarettes can occupy under the same conditions, i.e., in rows and without gaps. As can be seen from FIG. **6** this minimum dimension is equal to the height AD of equilateral triangle ABC which is $(n-1)$ sin 60 d. plus 2 times half d (the cigarette diameter). Thus minimum dimension

$$= d + (n-1) \sin 60\, d$$
$$= d[1 + (n-1) \sin 60]$$

The distance between opposed surfaces must lie between the maximum and minimum figure. Assuming the cigarette diameter is 8 mm., which is a commonly adopted dimension, then:

Number of Rows	Distance between Surfaces		
	Maximum	Minimum	Actual
2	16 mm.	14.9 mm.	15.25 mm.
3	24 mm.	21.8 mm.	23.5 mm.
4	32 mm.	28.8 mm.	30 mm.

The above table actually sets out the conditions operating in the apparatus. The channel **41** between the opposed surfaces **57** and **52** (top plate and roll respectively) is 30 mm. wide and permits four rows of cigarettes to pass. The following portion of the channel **41** between opposed surfaces **55** and **66** (roll and concave plate respectively) is 23.5 mm. wide and allows three rows of cigarettes to pass. The final portion of the channel **41**, i.e. between the opposed surfaces of the bands **58** and **67** is 15,25 mm. wide, allowing two rows to pass.

At the start of each portion of the channel, with each portion having a constant cross section, there is an accelerating

force provided by an accelerating means. In the first portion, i.e. up to the end of the stationary surface **45**, as explained hereinbefore, the accelerating means is the conveyor band **46**. In the second portion, i.e. from the end of the surface **45** to the end of the plate **57** the accelerating means is provided by the drums **51** and **52**. From the end of the plate **57** the accelerating force is provided mainly by the drum **55**. In the final section i.e. from the end of the concave plate **66**, the accelerating force is provided by the conveyor bands **67**, **58** and the drum **55**.

Within the arcuate portion of the channel **41**, i.e. from 12 o'clock on the roll **52** to 6 o'clock on the roll **55**, there is a varying amount of slip of the cigarettes in relation to the moving surface. The need to accelerate the cigarettes smoothly from section to section without damage precludes the use of positive drive means such as toothed belts and rollers. The frictional surfaces used permit some slipping to occur and the coefficient of friction of the material used depends upon the traction required for acceleration and upon the pressures between the cigarettes and the driving surfaces. The actual values quoted for roller speeds can be varied if surfacing materials of differing coefficients of friction are used.

In the final portion of the channel where the cigarettes are two rows high, they are positively driven forwards by both opposed surfaces as distinct from the other portions where only one surface is driven. It is important however to avoid matching the surface speeds of the drum **55** and the conveyor band **58**. If a speed difference is not provided there will be no couple acting on the cigarettes and the cigarette stream will not change from three deep to two deep in an orderly way and jamming will occur. At the end of the downwardly inclined part of the final portion the cigarettes are projected on to the rotating hopper **8** at approximately the same speed as the latter is moving. It is important that the cigarettes do not fall freely and bounce but are controlled, without retardation, until they are resting quiescently on the rotating hopper. The cigarettes in the hopper, moreover, are liable to be stacked unevenly in height and this poses a problem for the feeding in of fresh cigarettes. Both difficulties are taken care of by the double chain **43** (see also FIG. **4**) wherein the free bight of the chains sits on top of the cigarettes already in the hopper and those being fed in by the feeding means shown in FIGS. **3** and **4** and just described.

In FIG. **7** the double chain **43** has been omitted for the sake of clarity. The plate **80** and the wings **77**, however, can be seen. The hopper **8** (see also FIG. **8**) comprises 24 arcuate front walls **85** and 24 arcuate back walls **86**, both being arranged in abutting order so as to form an annulus. Each opposed front and back wall pair forms part of a chute member **7** of which there are also 24 equally spaced below the hopper **8**.

In FIG. **9** a chute member **7** can be seen in detail and comprises a quadruplet of vanes **87**, **88**, **89** and **90** of which **87** and **90** are outside vanes. The outside vanes of each chute member are joined by means of flexible arched resilient plates **91** between the outside vanes of adjacent chute members. Thus the base of the hopper **8** comprises alternating arched plates and openings to chute members **7**.

The drum **3** rotates about a sleeve **96** from which it is separated by two roller thrust bearings **97** and **98**. Fixed to the sleeve **96** by means of screws **99**, a ring member **100** and nuts and bolts **101**, is a stationary compound cam member **102** having a cam face **103** (see FIGS. **7**, **8**, **9** and **10**) over which 24 cam rollers **104** pass. Each cam roller **104** is attached to a casting **93** which is fixed to one of the chute members **7**. A second cam face **105** is also provided on the compound cam member **102** and similarly there are 24 cam rollers **106** passing over it. The member **102** is provided with a third cam face **107** having a further 24 cam rollers **108** held to its face by means of springs which are not shown. Also fixed to the sleeve **96** is a second cam member **109** provided with a box cam **110** in which 24 cam rollers **111** are tracked.

Each casting **93** and thus each chute member **7** has attached to it one cam roller **106**. Fixed to each casting **93** is a rotatable shaft **112** keyed to which is a bush **113** having integral therewith a geared quadrant **114** and an arm **115**. Attached to the arm **115** through an intermediary link **116** is a bell crank **117** at the other end of which the cam roller **106** is free to rotate. Four small gears **118**, **119**, **120** and **121** mesh with the teeth of the quadrant **114**. Each of the gears **118**—**121** is carried on a spindle **122** which is journaled at **123** and which extends into its chute member **7** in the form of a shaft **124** having a square cross section.

The drum **3** is provided with webs **95**, of which there are 24, each having fixed to its rollers **125**, **126**, **127** and **128**, provided with V-shaped grooves. Fitting within the grooves is a slide **129** having attached thereto the three pronged plunger **10** by means of an extension **131**. The cam roller **111** is also fixed to the plunger **10** by means of the extension **131**. Four further V-grooved rollers **132**, **133**, **134** and **135** are also fixed to each web **95** and have running between them a slide **136**. Fixed to the slide **136** by means of an extension **137** (see FIG. **7**) is an ends detector of known design, **138**, while fixed to the slide **136** by an extension **139** is the cam roller **108**. Still further V-grooved rollers **140**, **141**, **142** and **143** are fixed to each web **95** and have a slide **144** which can move in a vertical direction therebetween. The slide **144** is attached by means of lugs **145** and **146** to the outside vane **87** of each chute member **7**.

The cigarettes in the top of the hopper are resiliently constrained against slipping and skewing by means of a flexible snake chain **751** lying over them and extending all around the hopper. This snake chain is held in position by means of 24 spring-loaded arms **752** pivoted one to each hopper section. In order to lift the chain as it rotates past the accelerator so that it does not interfere with the flow of cigarettes into the hopper each spring arm **752** is formed with a cam lever **753** and a cam track **754** is positioned in the region where the hopper is filled to engage each cam lever **752**, pivot the cam arm **751** and lift the chain **752** off the cigarettes.

In FIGS. **7** and **8** there is shown located outside, but in line with, each chute member **7** a compression box **13**. This box is shown diagrammatically and will be described in detail hereinafter.

The operation of that part of the apparatus illustrated in FIGS. **7** to **10** will now be described. The function of the hopper and the top section of the packing machine is to accept the fed cigarettes and to segregate them into successive batches each containing twenty cigarettes. The hopper **8** is an annulus rotating at 25 r.p.m. into which are fed the cigarettes moving over the plate **80**. This rotation enables the cigarettes to be removed continuously from the feeding apparatus. Depending below the annulus are the 24 chute members **7** each connected to its neighbor by a flexible plate **91**. These plates cover the mechanism below and help to direct the cigarettes into their required positions between the shafts **124** of the chute members **7** whilst at the same time allowing limited relative movement between the chute members **7**.

During rotation of the drum **3** each chute member **7** moves from a top position which is that shown on the left-hand side of FIG. **8** to a bottom position which is that shown on the right-hand side of the same figure. Its vertical position is determined by the movement of cam roller **104** over cam face **103**. The movement of chute member **7** is restricted to a vertical path by means of the appended slide **144** which is restrained to move between the rollers **140**, **141**, **142** and **143**. In the top position of the chute member **7** (also to be seen in FIG. **9**), the vanes **124** are filled with cigarettes. In its bottom position (FIG. **10**), a batch of 20 cigarettes is removed by plunging, as will be described, into one of the compression boxes **13** associated with each chute member **7**. As adjacent chute members assume different relative vertical positions, any such difference in levels is taken up by the flexible plates **91**.

Fresh cigarettes entering a chute member **7** move downwards until the bottommost one in each column comes to rest on the plate **11** with the middle column displaced by half a cigarette due to the projection **12**. In looking at FIG. **7**

and treating the plan view as a clock face it can be seen that the box cam **110** starts causing the appropriate cam roller **111** to move radially out when the hypothetical hour hand is at approximately 6 o'clock. By the time that particular cam roller **111** has moved in a counterclockwise direction to 3 o'clock the movement is completed and the bottom twenty cigarettes have been ejected by the three pronged plunger **10** into the accompanying compression box **13**. These twenty cigarettes comprise two columns of seven each from between the outer pairs of vanes **87**, **88** and **89**, **90** and one column of six cigarettes from between the center vanes **88**, **89**. The projection **12** and the shape of the plunger **10** which can be clearly seen in end view in FIG. **10** account for the center column containing one less cigarette than the two outer columns. The plunger **10** is held steady during its stroke by the attached slide **129** which is only free to move radially being restrained by the rollers **125**, **126**, **127** and **128**.

It will be seen in FIG. **10**, in which a chute member **7** is shown in the 3 o'clock position of FIG. **7**, that the plunger **10** passes below the ends detector **138**. Reference to FIG. **7** shows that the cam **107** causes each cam roller **108** to start moving at about 4 o'clock with its maximum achieved by 3 o'clock, reading in an anticlockwise direction. Thus each ends detector which is attached to one of the cam rollers **108**, is moved radially outwards prior to plunging so that its prongs test the ends of the 20 cigarettes situated immediately over the plunger **10**. Any faulty end leads to rejection of the particular group of twenty as will be described hereinafter. A missing cigarette will also be detected in the same way, the test results being stored on a memory drum (not shown) and used to actuate a rejector gate at the output stage of the machine, to be described hereinafter. The batch of 20 cigarettes being tested rests on top of the three-pronged plunger **10** as can be clearly seen at the right-hand side of FIG. **8**.

The shape of the cam **110** is such that the cigarettes continue to be supported by the plunger **10** until approximately the position indicated by 10 o'clock. During this time, i.e. from the 3 o'clock position in an anticlockwise direction up to the 10 o'clock position, the chute member **7** is rising due to the shape of the cam face **103**. The bottom plate **11** is provided with three slots so that, as the chute member **7** is rising, it can pass through the plungers **10**. Finally, because the bottom plate **11** of the chute member rises above the top surface of the plunger and so fully supports the cigarettes, the plunger **10** can be completely withdrawn behind the chute member which is then lowered between 9 o'clock and 6 o'clock ready for the next plunge.

In FIGS. **11** and **12** there can be seen the center drum shown generally as **5**. Fixed to this by means of 24 castings **159** are the compression boxes indicated by the general references **13**. These compression boxes can be seen in greater detail in FIGS. **13** and **14**. The latter, FIG. **14**, is an end view from the vertical axis of the center drum **5** towards the compression box shown on the left of FIG. **11**, and indicates the lowered position of the compression box after it has been rotated through 90° away from its associated chute member **7**. FIG. **13** is an end view of another compression box seen from the same vertical axis of the center drum **5** but directed towards the compression box **13** shown on the right of FIG. **11**.

Running through each casting **159** is a shaft **160** provided with internal bearings which are not shown. At one end, a plate **162** is fixed to the shaft **160** by means of the splines **161** while at the other end there is a plate **177** integral with the shaft **160**. It is to this plate that the compression box **13** is fixed.

The compression box **13** comprises an L-shaped plate **164** having the longer arm of the L fixed to two members **165** (see FIG. **11**) provided with pins **166** and **167** at their ends. Opposed to the L-plate **164** is an inverted L-plate **168** having a composite format, as can be seen in FIGS. **13** and **14**. At either end of the longer arm of the L are extension pieces **169** and **170** provided with pins **171** and **172** respectively. The pins **166** and **171** are joined by two links **173** (see FIG. **11**) while the pins **167** and **172** are joined by one arm of a bell crank lever **174**. The other arm of the bell crank lever **174** has fixed to it in a rotatable manner a cam roller **175**.

Fixed to the inverted L-plate **168** is a bracket **176** which is joined to the plate **177**. The casting **159** has bolted to it a flange **178** integral with a cam **179**. The cam roller **175** is held in contact with the face of the cam **179** by means of a spring **181** held to an anchor **182** fixed to the plate **177**.

An adjustable plate **183** is attached by means of two screws **184** and two slotted holes **185** to the plate **162**. Attached to the screws are two cam rollers **186** and **187** which operate within cam tracks **188** and **194**.

Also fixed to the casting **159** is an ends detector **189** having an extension **190** to which is attached a cam roller **191** running in a box cam **192**. The ends detector **189** which is similar to the ends detector **138** is slidably mounted in the casting **159**. **193** is a mouthpiece on the exit of the chute **7**.

The remaining mechanism shown in FIGS. **11** and **12** will be described hereinafter when the mechanism for forming the package has first been detailed.

The operation of the mechanism shown and described in FIGS. **11**, **12**, **13** and **14** will now be explained. In FIG. **12** the radial lines given the general reference **6** in FIG. **1** are shown, being here referenced consecutively from **202** to **205**. As the three-pronged plunger **10** moves radially outward to push 20 cigarettes from its associated chute member **7** into the associated compression box **13**, the box cam **192** forces the cam roller **191** into place so that the ends detector **189** is in its operative position. This position is that sown on the right-hand side of FIG. **11** and is such that twenty cigarettes have been pushed through the mouthpiece **193** and home into the compression box **13** where they abut against the prongs of the ends detector **189**.

This position is also that shown in FIG. **13** in which the cam roller **187** can be seen entering the cam track **188**. This track is shaped to cause the roller **187** to move downwards so that the compression box **13** starts rotating in a counterclockwise direction (as seen when looking at FIG. **13**) about the shaft **160**. After the box **13** has turned through 45°, which takes place while the drum **5** rotates through approximately 30°, the cam roller **187** leaves the cam track **188** and the cam roller **186** enters the track **194** which is shaped to complete the 90° counterclockwise rotation of the compression box. This occupies a further 30° of rotation of the center drum **5**. As soon as the compression box **13** is in its lowered position i.e. as shown in the left-hand side of FIG. **11** and in FIG. **14**, it is locked in place by means which for the sake of clarity are not shown.

In FIG. **14** the compression box **13** is shown as it is when it starts to lift i.e. to rotate in a clockwise direction through 90° about the axis of the shaft **160**. The cam roller **186** is entering the track **194** which act together to lift the box **13** through 45°. At this point the roller **186** leaves the track **194** and the cam roller **187** enters the track **188** to complete the last 45° of the lift. The total lift occupies approximately 60° of the rotation of the center drum **5**.

When the compression box **13** is in its upper position, as shown in FIG. **13**, the cam roller **175** which rotates with the box has not started to lift on the cam **179** which does not so rotate. As the roller **175** lifts, the bell crank lever **174** pivots about the pin **172** thereby causing the short face of the L-plate **164** to move towards the short face of the inverted L-plate **168**. At the same time the long face of the plates **164** and **168** also move towards each other, though to a lesser degree. In FIG. **14** the movements described are completed so that the volume enclosed by the plates **164** and **168** is considerably less than that enclosed when the parts are in the positions shown in FIG. **13**. In both cases the length is the same, this corresponding with the length of the cigarettes, but the cross-sectional area is diminished, the dimunution corresponding to the desired degree of compression of the cigarettes' cross section. The shape of the cam **179** gives a maximum compression to the cigarettes at approximately 50° rotation of the box with a gradual release by the time the box reaches 90° so that the

cigarettes are not held so tightly as to hinder their subsequent removal from the box.

The compressed cigarettes within the compression box **13** in its lowered position, are now ready for inserting into a package. The apparatus and operation of this insertion of cigarettes into the package will be described hereinafter but, firstly, it will be necessary to relate how the package is formed and moved into the insertion position.

The function of the bottom drum **4**, shown in section in FIG. **17** and in plan in FIGS. **15** and **16**, is to make up an open-ended pack and to transfer it to the center drum **5**. Both foil and label pieces are made up on a former **18** which is one of 24 such arranged at 15° intervals around the drum **4**. Each former **18** is movable in a radial direction being fixed to a slide **196** shown in FIGS. **16** and **17**. The slide **196** is constrained to move within four rectangularly positioned rollers **197** which are fixed by means of brackets **198** to a flange **199** of the drum **4**. Fixed to the bottom of the slide **196** is a cam roller **200** which is movable within a box cam **201**.

In FIG. **15** the radial lines chain the center of each former **18** are shown as chain lines and are referenced as already explained as **202** to **225** in a counterclockwise direction which is the direction of rotation of the drum **4**. Associated with each former **18** is rotatable block **15** having suction holes on both its operating faces. These are not shown but are of known construction and are in communication with a suction source via cam-operated vacuum switches which are described hereinafter.

Each block **15** is carried on a vertical shaft **227** rotating about the vertical axis **6**. The block **15** is provided on its operating faces with two recesses, on one a foil-receiving recess **25** and on the other a label-receiving recess **30**. Each shaft **227** is offset from its own radial line, **202—225**. The centers of the recesses **25** to **30** are offset by an equal amount from the shaft **227**. Thus as can be seen in FIG. **15** when a foil recess **25** is directly facing its former **18**, as on the radial lines **206**, both are in line. Similarly when a label recess **30** is directly facing its former **18**, as on radial line **211**, both are also in line.

Each recess **25** and **30** is provided with a backing plate **230**. The backing plate **230** (see FIG. **17**) has two steadying pins **231** which can slide into the body of the block **15** and a spring **232** which holds it normally away from the back of its recess.

The flange **199** is provided with 24 openings **233** through which the formers **18** extend. Adjacent to each opening the shafts **227** pass through the flange **199** at bearings **234**. Each shaft **227** also passes through an extension piece **235**. As can best be seen in FIGS. **30** and **31** the end of the shaft **227** has a gear **237** which meshes with a geared quadrant **238** carried on an arm **239** to which is fixed a cam roller **240**. The cam roller **240** runs within the track of an interrupted box cam **241**.

Also fixed to the shaft **227** is a sector **242** having three gear teeth **243** at one end and four similar teeth **244** at the opposite end. The teeth **243** and **244** are capable of meshing with teeth **245** on an arm **246** which is joined by means of a pivot pin **247** to a plate **248**. When they so mesh, the block **15** is locked in position. The shaft **227** passes through the plate **248** which is also attached to the quadrant **238** by means of pin **249** about which the quadrant **238** pivots. The free end of the arm **246** has a cam roller **150** fixed thereto, this cam roller **250** running over a cam track **251**.

In FIG. **15** and **17** there can be seen further packet-forming mechanism. A slide member **252** (see FIG. **17**) is constrained to move in a radial direction by four rollers **253** fixed thereto and a rail **254** over which they roll. Radial movement is effected by a cam roller **255** fixed to the slide member **252** and running within a box cam **256**. On top of the slide member **252** is a folder **257**, the position of which can be adjusted by screw **258**.

Fixed to the slide member **252** are four further rollers **259**, **260**, **261** and **262** (see FIG. **15**). A double V-rail **263** is capable of radial movement, running within the confines of these four rollers. Fixed to the rail **263** is a cam roller **264** which is held in contact with three cam surfaces **265**, **266** and **267** by means of a spring **268**. At the radially outer end of the rail **263** is a plate **269**.

The former **18** (see FIGS. **32** and **33**) is made up of a body **270** to which is fixed a back plate **271** by means of screws **272**. The body **270** is shaped like a shallow U and within the hollow U the plunger **33** runs between V-notched rollers **274**. The face of the body **270** is provided with suction openings **275** which communicate with distribution holes **276**. These holes **276** in their turn communicate by flexible piping with a suction source via switches which are described hereinafter. The top of the plunger **33** terminates in a plunger face **277** (see FIG. **17**). **278** is a tucker positioned on each block **15** above its foil recess **25**. Two cam rollers **279** and **280** are fixed to the lower end of the plunger **33** and ride on either side of a switchback cam **281** extending between segments **221** and **203**.

Suction is supplied to the blocks **15** and the formers **18** by means of a suction ring main **501** which extends around the packet-forming drum **5** near its periphery and which is secured thereto to rotate therewith. The ring main **501** is fed by six symmetrically disposed radial feed pipes **502** and supplies the 24 packet-forming mechanisms through 24 switch-operated valves **503** each positioned 7½° behind its associated packet-forming mechanism.

Referring to FIG. **17B** each valve **503** comprises a valve block having a suction inlet port **504** connected to the ring main **501** and three suction outlet ports **505**, **506** and **507** connected respectively to the label and foil faces of block **15** and to former **18**. Each outlet port communicates with inlet port **504** through a respective one of valve chambers **508** which extend longitudinally through the valve block and in each of which there is disposed a sliding valve member the position of which controlled by one of the three pairs of wing switches **510**, **511** and **512** respectively which are pivotally mounted one at either end of the valve block. The switches of each pair comprise an upper "off" switch disposed at the near end of the block and a lower "on" switch disposed at the far end, the pair being interconnected by a linkage extending through the block so that depressing one resets the other.

The suction valves are switched on and off by fixed cams which engage and depress the wing switches as the machine rotates. The arrangement of these cams is shown in FIG. **16**. Suction is switched on to the label faces of blocks **15** by cam **513** (**224**) and off by cam **514** (**209**) which engage switch pair **510**; on to the foil faces by cam **515** (**216**) and off by cam **516** (**202**) which engage switch pair **511**; on to the former **18** by adjustable cam **517** (**202**) which is in the form of a movable plough and off by cam **518** (**218**) which engage switch pair **512**. The wind switches are each at a different height on the valve block and the cams are in the form of plates thin enough to pass through the gap between alternate wings so that any one cam only strikes one wing. In addition, there are two further adjustable cams **519** (**218**) and **520** (**203**) both of which comprise a plough pivoted to be movable into and out of a wing-engaging operative position in which they turn off suction to the foil and label faces respectively of the blocks **15** in response to signals received from detectors **521** and **522** positioned at the foil and label-applying stations (FIG. **15**) respectively. Each of these detectors operates to examine the blocks **15** at a position where they should be charged with material and if no material is present the detector operates to move the appropriate cam **519** or **520** to its operative position to turn off the suction to the appropriate block face and thus remove the suction leak which should otherwise occur and might deleteriously reduce the suction strength in other parts of the machine. Adjustable cam **517** which operates to turn suction on to the former is normally in its operative position but is pivoted in response to a signal from the foil detector **521**, received when no foil was present on the corresponding block, to an inoperative position. The signals from the detectors **521** and **522** are also used in rejecting faulty packets.

Referring once again to FIG. 15, the foil reel 22 feeds a continuous web to the drum 23 on which it is cut into pieces, this apparatus being preferably of the type disclosed in copending British Patent application No. 8971/62 Ser. No. 1,037,261. F is a piece of foil cut to length on the drum 23, suctionally transferred and held to the block 15. 284 is a folder adapted for the single longitudinal fold in the foil piece F which is rotatable about a spindle 285 in the direction of arrow 286. 287 is a convex shaped folder. Both folders 284 and 287 are stationary in the sense that they do not rotate with the drum 4 but have fixed positions independent of it, i.e. the folder 284 rotates about a fixed axis.

294 is a tucker rotatable about a spindle 297 and 295 is a fixed tucker while 296 is a plough. The rotating tucker 294, the fixed tucker 295 and the plough 296 are all mounted on the stationary mechanism of the machine and thus do not rotate with the drum 4. The operating tip of the tucker 294 is provided with four times 298 which mesh with three tines 299 on the leading edge of the tucker 295. The construction can be clearly seen in FIG. 34.

The label reel 26 feeds a label web to a label cutting drum 27 of similar construction to the foil cutting drum 26. The drum 27 delivers labels, L, cut to size, to each block 15 to which they are suctionally held though on the opposite face to that to which the foil was held. Each label L receives adhesive streams from a gum applicator 29. 303 is a stationary label folder.

288 is a tucker rotatable about a spindle 289, adapted for making an end fold in the label. It is analogous to the foil tucker 294. 290 is a fixed tucker while 291 is a plough. In the same way as with the foil tucker 295 and the plough 296 these do not rotate with the drum 4. The operating end of the tucker 288 has two projections 292, similar to the four foil tines 298, which mesh with leading edge 293 of the tucker 290.

Fixed to each slide member 252 is a folder 31 which is pivotable about a pin 305, being operated by a cam roller 306 passing over a cam 195 which is fixed to each segment and rotates about the drum 4 with the slide. Fixed to the front of the folder 31 are three fingers 307 biased inwards by springs 308 (see FIG. 17).

Each block 15 has the radially outer side of its label recess 30 formed by the face of a bracket 309. This bracket 309 pivots about a pin 311 and is actuated by a cam roller 310 running over a stationary cam track 370.

The operation of forming the packet on the bottom drum 4 will now be described. Foil from the foil reel 22 is fed by metering rollers, which are not shown, to the foil cutting suction drum 23 which rotates in a known manner at a faster speed than the foil speed. A rotatable internal knife and fixed external knife cut the foil into pieces F of predetermined size, each piece being accelerated away from the reel by the faster speed of the drum 23 to which it adheres suctionally. The drum 23 is so positioned in relation to the drum 4 that each block 15 brushes past the drum 23. Suction is cut off in the drum 23 and at the same time is put into communication with the suction holes on the face of the block 15 so that the foil piece F is transferred from the one to the other.

As described hereinabove the radial lines 202—225 represent center lines through each former 18. These lines can also be considered as consecutive portions, with 15° spacings, of one rotation of one particular former 18 and of all the mechanism that accompanies it. In what follows the lines 202—225, which are shown on both FIGS. 15 and 16, will be used in this sense.

Thus the block 15 on the line 219 has just picked up its piece of foil F. Before this was achieved, at a position between the lines 217 and 218 the cam roller 250 (FIG. 16) moved up the lift of the cam track 251 and caused the teeth 245 to mesh with the four teeth 244 (see FIGS. 30 and 31), thus locking the block 15.

Between the lines 220 and 221 (see FIG. 16) the cam roller 240 enters the box cam 241. This cam 241 starts to lift after the line 221, i.e. when the roller 250 falls, thus unlocking the block 15. As the surface of the cam 241 moves radially outward, the roller 240 moves with it causing the quadrant 238 to rotate about pin 249. This in its turn rotates, via gear 237 and the shaft 227, the block 15 until, when the cam 241 stops on the line 225, it has rotated in a clockwise direction as indicated by arrow 312 in FIG. 15, through 183½°. Between the lines 225 and 202 the cam track 251 again lifts thereby causing the teeth 245 to mesh with the three teeth 243 to lock the block 15 in position with the foil piece F directed radially inwards.

On the line 202 the box cam 201 starts to lift, thus moving the cam roller 200 radially outwards and with it the slide 196 and the former 18. This lift is completed between the lines 203 and 204. At approximately the line 203 (see FIG. 15) the former 18 comes into contact with the foil piece F, this being also shown in FIG. 18. Between the lines 203 and 204 the former 18 is pushed fully home into the foil recess 25 against the backing plate 230. This plate 230 and its spring 232 serve to keep the foil F flat against the former 18.

With the former 18 fully home the position is as shown in FIG. 19. The foil piece F is now wrapped around three sides of the former 18 while the tucker 278 fixed to the top of recess 25 of the block 15 has made one top fold F1. FIG. 20 shows the state of folding after the rotary folder 284 has wiped in the trailing end of the foil piece F. In FIG. 21 the convex folder 287 has completed the folding of the foil into a tube. At this stage the holes 276 in the former body 270 are put into communication with the suction source so that the tube formed from the foil piece F is firmly held to the former 18.

Between the lines 204 and 205 the cam track 201 (see FIG. 16) starts to move the cam roller 200 radially inwards and thus to withdraw the former 18 with the foil tube wrapped therearound from the foil recess 25. At approximately the line 205 the box cam 256 (see FIG. 15) starts to lift and to move the cam roller 255 radially outwards. This movement causes the slide 252 to move radially outward towards the former 18 which is at the same time moving radially inward. This convergent movement, approximately on the line 206 leads to the plate 269 abutting against the former 18 and remaining in contact with it, being urged radially outward by the spring 268. Previously to the line 206 the plate 269 was held away from the former 18 by the cam 265 restraining the roller 264.

Between the lines 206 and 207 the cam roller 200, and thus the former 18, reach the limit of their inward radial movement. The former 18 then follows a circumferential path that will lead it below the foil tucker 294, the fixed tucker 295, and the plough 296. The shape of the tucker 294 and the leading end of tucker 295, is shown in FIG. 34, and the timing of tucker 294 is such that the leading upstanding end of the foil, T2 in FIGS. 21 and 22, is missed by it. At approximately the same time as the trailing end T3 starts to be folded down the leading end, T2, is ploughed downwards by the tucker 295. The trailing end, T3, is, however, wiped downwards in the same direction as the former 18 is moving by the rotating tucker 294 and is held down by the tines 298 until it enters under the fixed tucker 295. Thus on the line 207 the foil piece F is as shown in FIG. 22. The intermeshing tines 298 and 299 are necessary to prevent any possibility of the folded trailing end, T3, springing up again. Multiple tines moreover provide more effective coverage of the asymmetrical triangulated shape of the foil flap to be folded.

Between the lines 207 and 208 the former 18 passes below the plough 296 which completes the top folding of the foil by ploughing down the remaining flap, T4. The former and foil emerge from beneath the plough 296 between the lines 209 and 210 with the foil completely folded and as shown in FIG. 23.

On the line 202 (FIG. 15) the block 15 is shown picking up, again suctionally through suction mechanism which is not shown, the label L from the label-cutting drum 27 which is positioned and operates in a similar manner to the foil-cutting drum 23. On the line 206 the gum applicator 29 can be seen applying strips of hot melt adhesive in the required positions

to the inside of the label L. Between the lines 205 and 206 the cam roller 240 (FIG. 16) again enters the box cam 241. Between the lines 206 and 207 the cam track 251 allows the cam roller 250 to move radially outward thereby disengaging the teeth 245 from the three teeth 243. This unlocks the block 15 which soon after starts to rotate in an anticlockwise direction as indicated by arrow 313, in FIG. 15 (line 208), due to the fall of the cam 241. This rotation is completed between the lines 209 and 210 after the block 15 has moved through 176 ° Between the lines 210 and 211 the cam 251 again rises and causes the teeth 245 to mesh with the four teeth 244, thus once again locking the block 15 in its required label-forming position.

Between the lines 209 and 210 the box cam 201 (FIG. 16) again starts to lift, thereby moving the cam roller 200, the slide 196 and the former 18 radially outwards. At the same time the cam track 266 (FIG. 15) restricts outward movement of the cam roller 264 so that the plate 269 does not move outwardly with the former 18 around which is wrapped the foil piece F. Between the lines 211 and 212 the former 18 reaches the position of its maximum outward travel and in this position is pushed fully home in the label recess 30 of the block 15. The relative positions of the former 18 and the label L at this stage can be clearly seen in FIG. 24. In approximately the same position, i.e. between the lines 211 and 212 the box cam 256 and the cam track 266 both start to lift thereby moving the slide 252 and the plate 269 radially outward. This movement is completed between the lines 213 and 214. Prior to this however, the former 18 and the block 15 move past the label folder 303 which wipes the outstanding wing W of the label L flat against the former 18, as can be seen in FIG. 25.

At approximately the position indicated by the line 213 the bracket 309 pivots about its pin 311 so as to move away from the side S1 (FIG. 25) of the label L, the pivoting being achieved by the engagement of cam roller 310 with cam track 370. Before the label folder 303 releases the wing W of the label L the plate 269 moves still further outwards due to the shape of the cam track 266 (FIG. 15) until it clamps the label L tightly against former 18. At the same time the slide 252 under the control of the cam 256 moves radially outwards and the fingers 307, attached thereto via the folder 31, tuck the label side into the gap between the side S1 and the operating face of the bracket 309.

Between the lines 213 and 214 the cam track 201 (FIG. 16) starts to fall, thereby causing the cam roller 200 and the former 18 to start moving radially inwards, thus completing the label side fold against the now stationary fingers 307. Between the lines 214 and 215, the box cam 256 starts to fall thus causing the slide 252 (FIG. 15) also to move radially inwards but more slowly than former 18. The movement of the slide 252 causes the folder 31, which is pivotally attached to it and spring driven, to move towards the former 18 since the folder driving roller 306 falls into a recess in the linear cam face 195. This action causes pressure to be exerted on the longitudinal fold of the label thus completing the adhesive joint. Hot melt pressure sensitive adhesive has been chosen for this purpose since the instant application of pressure causes the surfaces to which it has been applied to adhere firmly together. The inward movements of the slide 252 and the former 18 are completed approximately on the line 216. The spring 268, however, causes the plate 269 to remain in contact and exerting pressure upon the label L wrapped in the form of a tube about the former 18.

Between the lines 215 and 216 the cam 251 falls thereby unlocking in the same way as already explained the block 15. The cam roller 240 again enters the box cam 241 which in this portion only has a small fall sufficient to rotate the block 15 in an anticlockwise direction through 7°. Between the lines 217 and 218 the cam track 251 again rises and causes the teeth 245 to mesh with the four teeth 244 so that the block 15 is once again locked in the correct position to receive a fresh piece of foil. The reason for providing four teeth 244 as distinct from the three teeth 243 is to allow for this extra rotation, i.e. 7°, which is the difference between 183½° and 176½° needed to return the block 15 to its original position.

To finish the formation of the package the top of the label L must be folded and the top fold caused to adhere to the one below.

This is done between the lines 216 and 219. Firstly, the rotary folder 288 wipes down R_1 which is the trailing side of the upstanding end of the label L (see FIG. 27). Then the stationary folder 290 turns over the leading end R_2 as the former 18 passes beneath it. Further movement of the former 18 brings it beneath the plough 291 which turns down side R_3 (see FIG. 28). Finally radially inward movement of the former 18 due to the fall of the cam 201 between the lines 218 and 219 whilst the slide 252 remains in its extended position, brings the upstanding end R_4 against the folder 257 which then wipes it down. The label is then completed and is as shown in FIG. 29, being ready for upward plunging as will be described hereinafter.

Returning to FIG. 11 the center drum 5 rotates about an extension 314 to the center column 96, which is shown in FIG. 8, and is separated therefrom by taper roller thrust bearings 315 and 316. Bolted to the extension 314, and therefore stationary, is a flange 317 to which is fixed a cam track 318 (see also FIG. 12).

Fixed to the center drum 5 by means of bolts 319 (shown in FIG. 12) are 24 members 320. An arm 321 in the shape of a bellcrank is attached by means of a pivot pin 322 to each member 320. One end of the arm 321 is provided with a cam roller 323 which is held into contact with the surface of the cam track 318 by gravitational pull and a tension spring acting about the pivot pin 322 as can be seen in FIG. 11. The other end of the arm 321 divides into a yoke 324 (see FIG. 12) at the ends of which are further pivot pins 325 fixed to the arbor 34. Each arbor 34 is provided with a bracket 326 (see FIG. 11) at the end of which is a cam roller 327. Each cam roller 327 is held in contact with its individual cam 328 by means of a spring 329. There are 24 cams 328 fixed to the drum 5. The arbor 34 is three-sided having a top plate 330 fixed thereto so as to form the fourth side. The sides of the arbor 34 are provided with chamfers 331 on the side nearest the center of the drum 5 (see FIG. 12) so as to allow easy ingress of a packet as it is plunged thereinto.

Each casting 159 is provided with an extended boss 332 (see FIG. 12) to which is fixed by means of a stud 333 an arm 334. A pin 335 fixed to the ends detector 189 extends through a slotted hole 336 in the arm 334. Thus as the ends detector 189 moves radially inwards the arm 334 moves with it, pivoting about the stud 333. The free end of the arm 334 has fixed to it a mouthpiece 337.

Fixed to the periphery of the center drum 5 are 24 brackets 338 to each of which is fixed one packet-holder 37 shown diagrammatically in FIG. 2 and in detail in FIGS. 35, 36 and 37. The top of the bracket 338 is drilled to take a pin 339 about which pivots a boss 340 of an arm 341. The top end of the arm 341 is provided with a cam roller 342 which is held in contact with a fixed cam track 343 by a spring 344 having one end fixed at anchor plate 345 to the drum 5.

The packet-holder 37 is attached to the end of the arm 341 opposite that provided with the cam roller 342 and comprises a body 346, to the lower part of which is fixed an angle piece 347 against which the bottom of the packet bears. Extending from one side of the body 346 is an arm 348 terminating in a boss 349 through which a pin 350 is free to rotate. Fixed to the pin 350 and rotatable with it is an arm 351 at the free end of which is a cam roller 352. A spring 353 having one end anchored to the arm 351 and the other to the body 346 holds the cam roller 352 in contact with a cam track 354 (see FIGS. 11 and 37). At the opposite end of the pin 350, fixed thereto and rotatable therewith is a further arm 355 which has an extension in the form of a guard ring 356 having a U-shaped opening 357. In its closed position the guard ring 356 is flush with the top of the body 346 as can be seen in FIG. 37. Opposite the opening 357 in the body 346 is a further opening

358. The guard ring 356 can be seen in its open position on the right-hand side of FIG. 11. Fixed to the back of the body 346 is a plate 359 which is in contact with two rollers 360 rotatable about a shaft 361. The shaft 361 is fixed to an arm 362 which is bolted to the bracket 338. Also fixed to the lower part of the body 346 is a further arm 363 terminating in a boss 364 to which is fixed a pin 365. The arm 341 at its end opposite to the one carrying the cam roller 342 ends in a boss 366 through which the pin 365 passes and about which it is rotatable. At one end of the pin 365 is fixed a block 367 into which is inserted one end of a torsion spring 368, the other end being inserted into the boss 366. The effect of this joint and of the spring 368 is to cause the packet holder 37 to be urged in a clockwise direction (as seen when viewing FIG. 35) whereby the plate 359 is held in contact with the two rollers 360. The arm 341 is provided with adjustable stop 369 which bears against the shaft 361 thereby limiting clockwise rotation of the packet-holder 37 (again as seen when viewing FIG. 35).

Fixed to the extension 314, and therefore stationary, is a box cam 391 within which run 24 cam rollers 392 (see FIGS. 11 and 12). Each cam roller 392 is attached to a plunger 393 which is constrained to move in a radial direction, being confined by four rollers 394, 395, 396 and 397 carried on a bracket 398. The bracket 398 is bolted to a pad 399 on the drum 5. The cross section of the plunger 393 is shaped so as to pass through the compression box 13 when it is in its lowered position, i.e. as shown in FIG. 14.

The operation of marrying together a group of 20 cigarettes and an empty unclosed packet will now be described. The group of 20 cigarettes whose passage through the machine has so far been described was left in the compression box 13 in a position which corresponds to the line 206 of FIG. 12. The empty unclosed packet is on the line 219 of FIG. 15.

As the drum 4 continues to rotate taking the packet from the line 219 to a position between the lines 221 and 222 the cam rollers 279 and 280 (see FIG. 17) engage the switchback cam 281 (see FIG. 15). The lift of this cam 281 causes the rollers 279 and 280 to lift with it. Thus the plunger 33 and its face 277 move upwards taking the formed packet with them. Also on the line 221 the cam track 318 allows the cam roller 323 to assume a path whereby the arm 321 is in its lowest position. In this position the arbor 34 is vertical and is held there by the action of the spring 329 holding the roller 327 against the face of the cam 328. This position is that shown on the right-hand side of FIG. 11. On further rotation of the drums 4 and 5 the packet is pushed into the arbor 34 and due to the chamfers 351 slides in without any jamming or tearing. Between the lines 224 and 225 the switchback cam reaches the peak of its rise and the package is pushed fully h9me. Between the lines 202 and 203 the plunger 33 is back in its lowermost position with its face 277 well clear of the arbor 34.

At a position approximately on the line 202 the cam track 318 starts moving the cam roller 323 radially outwards. This causes the arbor 34 to start pivoting about the pin 325 and about the center of the cam 328. This movement continues until between the lines 205 and 206 the cam 318 reaches the top of its lift and the arbor 34 is in a horizontal position in which it is again held by the action of the spring 329 holding the roller 327 against the face of the cam 328. This position is that shown on the left-hand side of FIG. 11.

The batch of 20 cigarettes whose movement has been so far traced were left in the compression box 13 at the position on line 206 in FIG. 12. Thus on the line 206 the compressed 20 cigarettes are in a horizontal position ready to be plunged into the awaiting open-ended packet in the arbor 34.

Just before line 206 the compression box 13 and the arbor 34 are in line whilst in this position the box cam 391 starts to lift. The cam roller 392 is thus forced radially outward and with it the long plunger 393. Between the lines 208 and 209 the 20 cigarettes are transferred from the compression box 13 into the open end packet in the arbor 34 by the long plunger 393. However the cam 391 continues lifting so that the plunger 393 now pushes the filled packet out of the arbor 34 into the awaiting packet-holder 37, which has previously started to move into position from the line 204, when the cam-track 343 (see FIG. 12) starts to actuate the cam roller 342 so that the packet-holder 37 is caused to move in a clockwise direction (as seen when looking at FIG. 35) about the pin 339 assisted by the action of the spring 344. The packet-holder 37 is controlled by the plate 359, which is fixed to its body 346, rotating about the two rollers 360. The plate 359 is held in constant contact with the rollers 360 by means of the torsion spring 368 which urges the arm 363 and thus the packet-holder 37 itself in a clockwise direction. The clockwise movement of the packet-holder 37 is completed approximately on the line 209 and its horizontal location is fixed by the adjustable stop 369 bearing against the shaft 361 (see FIG. 36). In this location it is held by the spring 344 and is aligned with both the arbor 34 and the compression box 13. Thus, continued radially outward movement of the long plunger 393 beyond the position between the lines 209 and 210 causes the filled packet to be inserted in the packet-holder 37. In FIG. 35 the open-ended but filled packet is so shown in chain lines. By the line 211 this transfer is completed.

Referring once again to FIG. 12, 400 is a rotary tucker, 401 is a stationary tucker while 402 and 403 are stationary ploughs.

The mechanism for applying the stamp to the top of the packet is shown in FIGS. 38 and 39 as well as in FIG. 12. A web Z of stamp material is led around a drum 405 provided with suction channels 406 which are internally connected by known means to a suction source. The suction source is not shown. A knife 407 is actuated by means which are not shown to sever the web Z against hardened anvils 408 inset into the drum 405. The web Z is fed by metering rolls 409 at a slower speed than the peripheral speed of the drum 405 which is driven through a gear 410. Thus as soon as the knife 407 severs the web Z, the cut piece Y is accelerated away from the end of the web. The spider stamper 130 shown in FIG. 1 and again in FIGS. 37 and 38 has three arms 411 attached to a hub 412 rotating in the direction of arrow 413 about a shaft 414. Each arm 411 ends in a shoe 415 provided with suction slots 416 connected by a channel 417 to the hub 412 which is in communication with a suction source. This source is again not shown. A keep plate 418 with two projections 419 is fixed to the trailing end of each arm 411. Stripper plate 450 is arranged so that its prongs mesh with the grooves in the drum 405. 420 is an adhesive container within which a gum wheel 421 rotates driven by a shaft 422. The gum wheel 421 is provided with four circumferential projections 423 so that four gum streams are applied to each stamp Y as it is carried past the gum wheel 421 by an arm 411. The suction source is switched off as each stamp enters into contact with its packet. The adhesive force of the gum between stamp and packet allows the stamp to be transferred from spider to packet. A rotary dabber 424 having two arms 425 which are urged towards each other by a compression spring 426 (see FIG. 12) is used to fold the stamp down the sides of the packet.

Located between the lines 220 and 221 is a reject packet mechanism operated by any of the ends detectors 138 and 189. 427 is a gate which is movable in a clockwise direction (as seen when viewing FIG. 12) about a pivot pin 428. The leading edge 429 when in its actuated position engages in slot 430 of the body 346 (see FIG. 35) of the packet holder 37. 431 is a concave guide and 432 is a convex brush guide.

The packet takeoff shown diagrammatically as 158 in FIG. 1 is located between the lines 221 and 222 (see FIG. 12). A disc 433 rotates about the axis of a driven shaft 434, offset from which is a stationary circular column 435. Four arms 436, 437, 438 and 439 are attached to the disc 433 and pivot respectively about pins 440, 441, 442 and 443. Springs 444 hold each arm against the offset column 435. The pins 440 and 441 are fixed directly to the disc 433 whereas the pins 442 and 443 are attached by cantilevered supports which in the interests of clarity in FIG. 12 have not been shown. 445 is a concave guide engaging in the slot 430 of each packet-holder 37.

The operation of the mechanism for closing the filled packet and for ejecting it from the machine will now be described. On the line **211** the packet-holder **37** is horizontally aligned i.e. in the position shown on the left-hand side of FIG. **11**. When it has moved to a position between the lines **212** and **213** the cam track **343** (see FIG. **12**) causes the cam roller **342** (see FIG. **35**) and the arm **341** to start pivoting in a counter-clockwise direction until between the lines **215** and **216** it is vertically aligned and in the position shown in FIG. **36** which is an end view of the packet-holder **37** looking radially outwards from the center of the machine. Between the lines **216** and **217** the top end folds are made in an exactly similar manner as that used for the bottom end folds. The leading end fold is missed by the rotary tucker **400** but is ploughed down by the stationary tucker **401**. The trailing end fold is wiped down by the rotary tucker **400**. The top side folds are ploughed down by the stationary ploughs **402** and **403**. The whole top fold is held in position by the restraining strip **404** until it comes under the influence of the stamper **130** at a position approximately on the line **219**.

In FIG. **37** a plan view is shown of the top of the packet-holder **37** with a packet and stamp in chain-lines in their correct positions. The stamp Y after being cut from the web Z by the rotating anvils **408** and fixed knife **407** (FIG. **38**) is accelerated by the greater surface speed of the drum **405** to which it is suctionally attached. The stamp arrives at the stripper plate **450** at the same time as the rotating arm **411** whose peripheral speed is matched to the surface speed of the top of the packet.

Suction on drum **405** is cut off and the stamp is momentarily retarded by frictional contact with the stripper plate thus allowing the projections **419** of the keep plate **418** on the arm **411** to make contact with the stamp's trailing edge. Immediately this occurs suction is applied to the stamp via the slots **416** in the arm **411** and the stamp Y is carried around on the arm **411**. As the stamp passes the gum wheel **421** four strips of hot melt adhesive are applied. Further rotation of the arm **411** marries the stamp with the top of the packet to which it adheres, suction being cut off from the slots **416** in the arm **411**.

Just before the line **220** the packet, now having the stamp Y adhering to its top as illustrated in FIG. **37**, passes below the dabber **424** (see FIGS. **12** and **38**). The ends of the two arms **425** rotate through the openings **357** and **358** in the guard ring **356** and the body **346** respectively of the packet-holder **37** (see FIG. **37**) and in so doing bring the ends of the stamp into contact with the sides of the packet. As soon as the arms **425** are clear of the packet-holder **37** the cam **354** (see FIGS. **35** and **36**) causes the cam roller **352** to lift and to raise with it the guard ring **356**. The cam **354** is quick acting since the guard ring **356** must be fully raised and clear of the packet before the packet reaches the gate **427**. The guide rail **449** prevents the packet from falling outwards from the machine.

If any ends detectors **138** or **189** signals either a soft end or a missing cigarette, such a signal is stored and eventually actuates a solenoid which causes the gate **427** to move inwardly thereby ploughing off the offending packet into the channel between the concave guide **431** and the brush guide **432**. Faulty packets are stored in this channel, each fresh addition resulting in a stored packet being pushed out of the end. As soon as a faulty packet has been segregated the solenoid relaxes and the gate **427** returns to its normal position, i.e. that shown in FIG. **12**.

Thus all vendible packets bypass the gate **427** and move on, until between the lines **221** and **222** they are ploughed off the machine by the leading edge of the concave guide **445**. Whereupon they are guided approximately 180° around the guide **445** by the ends of one of the four arms **436**, **437**, **438** or **439**. The ends of these arms travel with variable speed since each one rolls around the offset column **435** against which they are held by the springs **444**. The pivoted end of the arms, i.e. the opposite end to the operating one, is moved at constant speed by the pins **440**, **441**, **442** and **443** which are attached to the disc **433**. Thus the speed of the free end is proportional to the distance from the free end to the point of contact with the offset column **435**. The arrangement is such that each free end moves at the same speed as a packet whilst the latter is being removed from the machine and then slows down to a minimum speed at a position 180° away where the packets are disposed of in any known manner.

Referring now to FIG. **41**, each of the three layers **3**, **4** and **5** of the packing machine is supported upon a central column. The central layer **5** is secured to this column but each of the other layers **3** and **4** is mounted on the column for sliding movement away from the central layer, when the machine is at rest, to provide access between the layers for maintenance and faultfinding. The operation of separating the layers is controlled by a shaft **701** extending through the column and controlled at its lower end, for rotational movement, by means of a hand-operated lever linkage **702**, and at its upper end, for vertical movement, by means of a jack **703** which is mounted to bear against the upper end of the column.

The details of the layer-separating mechanism are not shown in any of the other FIGS. and in addition FIG. **41** contains some minor modifications of details appearing in other FIGS.

The lower packet-forming layer **4** moves along a set of four keys, each of which comprise a radially extending vertical flange. These keys **704** slide in keyways **705** in the sleeve **314** of the lower layer. The keys **704** are formed in two parts spaced apart to define a gap in which a locking ring **706** in the form of an annular disc, is rotatable. This disc **706** is formed with four slots corresponding to the keyways **705** and in the normal operating position of the machine it is positioned so that these slots are out of alignment with the keys **704** thereby preventing the lower layer **4** from moving downwards. The layer **4** is supported for vertical movement by means of a yoke comprising a central ring **707** extending around the shaft **701** and connected to the layer by means of cross pieces **708** sliding in slots **709** formed in the column at positions perpendicular to the plane of this section. Ring **707** is formed around its inner periphery with vertically extending keyways **710** which mate with the keys on a keyed boss **711** carried on the shaft **701**. The lower end of the shaft **701** is hollow and is formed to be a close sliding fit on a locating stub **712** which is of generally square cross section, and relative to which the shaft **701** can move vertically, but cannot rotate. Stub **712** is mounted for rotation by the lever linkage **702** in a sleeve **713** journaled in bearings.

The upper layer **3** is supported for vertical movement by means of a support ring **714** disposed within the column and extending around the shaft **701** and which is secured to the layer **3** by means of three equally spaced connecting pins such as **715**. Support ring **714** is also provided with vertically extending keyways **716** which mate with three keys such as **717** carried on a further boss on the shaft **701**. The arrangement is such that when the keys **717** are in line with keyways **716** then in the lower keyways **710** are out of alignment with the keys **711**. Connecting pins **715** extend through and slide within slots such as **718** formed in the column and cooperate therewith to locate the layer against rotational movement. The upper end of the layer **3** is formed with a peripheral groove **719** defining a locking lip **720** beneath which claws such as **721** disposed at the top of the column can engage to lock the layer in its uppermost position, spaced apart from the middle layer **5**. Claws **721** depend from pivots **722** and are urged by the means of tension springs **723**. A release mechanism is provided to disengage the claws **721** from the groove **719** so that the layer **3** may be lowered from it uppermost, inspection position to the operating position shown in the drawing. This release mechanism comprises an annular disc **724** which is supported for rotation about the column by means of a plurality of grooved rollers **725** running on a circular knife-edged cam **726**, and is formed to have an outer periphery engaging the inner surface of each of the claws **721** and cammed for each claw so as, successively, to force it outwards against the

action of spring **723** to unlock the layer, and then, to allow it to move inwards under the influence of spring **723** to lock the layer. The release mechanism is controlled by means of a manually operated locking mechanism which comprises a lever **727** pivoted to the underside of the disc **724** and formed at one end with a tooth **728** which is engageable with a socket **729** in a member on top of the layer **3**, and formed at the other end with a spigot **730** which engages within a bifurcated arm **731** which is pivotally mounted at **732** for manual operation. The upper end of shaft **701** is journaled in a bearing **733** carried on the piston arm **734** of jack **703**.

Running through the column to the middle layer is a shorts removal suction duct **735** which communicates with a circular trough **736** (see FIG. **8**) disposed directly beneath the chutes **7** to receive the shorts dislodged from cigarettes during the batching operation. A sweeper **737** rotates with the rotary part of the mechanism and acts to push the shorts into the removal duct **735**.

The operation of the layer-separating mechanism is as follows. To lower the bottom layer **4** from the position shown in FIG. **41**, the weight is taken off disc **706** by raising the jack **703**, the load being transmitted through keys **711** which are out of alignment with keyways **710**. Disc **706** is rotated to bring its keyways into alignment with the keys **704** and the layer is now lowered on the jack **703** with the keyways **705** and the discs **706** passing over the keys **704**. The layer is returned to its operating position by reversing this procedure, the final step being to lower the shaft **701**, having rotated disc **706** to be out of alignment with the keys **704**, so that the weight of the layer is taken on that disc.

To raise the upper layer **3** from the position shown in FIG. **41**, shaft **701** is firstly rotated by means of lever linkage **702** to bring keys **717** into alignment with keys **716**. The shaft is then lowered on the jack **703**, keys **717** passing through the support ring **714**. Once below the support ring the shaft is again rotated by means of lever **702** to bring the keys **717** out of alignment with the keyways **716** so that the weight of the upper layer **3** can be supported on the keys **717**, and to bring keys **711** into alignment with keyways **710** so that the keyed boss may pass through the support ring **707**. The shaft **701** is then raised on jack **703** raising the layer **3** until claws **721** snap into groove **719**. The layer is locked in this position by manual operation of the locking mechanism to bring the tooth **728** into engagement with the socket **729**. Once the layer is locked in this position shaft **701** can be used for lowering the bottom layer **4**.

To lower the upper layer and return it to its operating position the weight is first taken on the jack **703** by way of keys **717**, the locking mechanism is released, and the release mechanism is operated by rotating disc **724** thereby bringing its outer cam surfaces into engagement with claws **721** and moving them outwards to disengage them from the grooves **719**. The layer is then lowered on the jack **703**.

The rotary parts of each of the three layers are driven by means which are not shown, but which comprise a gear wheel secured to the bottom layer and meshing with a geared drive shaft connected with a rotary power source, and comprise mechanical connections in the form of pegs engaging in sockets, between the lower and middle and middle and upper layers. In the case of the latter radially extending arms are provided to transmit the drive over the stationary parts which project almost to the periphery of the machine.

We claim:

1. Carrier apparatus comprising a hollow column, first- and second-carrier members disposed externally thereof for movement along the column towards and away from each other, power means for effecting such movement, an operating member disposed in the column and connected with said power means, first and second releasable connecting means operated by said operating member for the first and second carrier members respectively to connect them with the operating member for the transmission of power from the power means to effect said movement, and control means for the operating member, wherein operation of said control means to actuate one of said connecting means releases the other of said connecting means.

2. A packing machine for continuously packing batches of compressible rodlike articles, comprising a plurality of batch-forming mechanism arranged to move in a continuous sequence past a supply station for the articles and to form the articles into predetermined batches, a plurality of continuously moving supports for carrying containers in alignment with said batch-forming mechanisms over a predetermined path, and means for progressively pushing the batches into the containers while the batch-forming mechanisms and supports move along said predetermined path, and including a compression box operable to compress each batch of articles laterally prior to insertion into a container, a mouthpiece to guide each batch into the respective container, and means for receiving filled containers, each batch and the corresponding container being aligned longitudinally in relation to the articles and being similarly aligned with means for receiving filled containers, each said pushing means being arranged to push the respective batch of articles into the respective container and then to push further so as to push the container and articles onto the filled container receiving means.

3. A packing machine for continuously packing batches of goods in containers, comprising a plurality of continuously circulating batch-forming mechanisms arranged to move in a continuous sequence past a supply station for goods and to form the goods into predetermined batches, a plurality of packet-making mechanisms to make containers in the form of packets from sheet packet material supplied at packet material supply stations past which said packet-making mechanisms are arranged to circulate continuously whereby each packet-making mechanism in turn receives packet material, and a plurality of filling mechanisms to insert into the said packets batches of goods received from said batch-forming mechanisms, each packet-making mechanism comprising a rotatable block having a plurality of shaping portions spaced apart around its axis of rotation, each capable of holding sheet packet material, supply means to supply sheet packet material to each of said shaping portions, and a packet former arranged to mate with said shaping portions in succession, wherein rotation of the block brings each said shaping portion in succession into a position to receive sheet packet material and then into a position at which said former can mate with it to shape the material between the shaping portion and the former, and wherein material can be supplied to one shaping portion while material is being shaped on another shaping portion.

4. A machine according to claim **3**, including a container support and a plunger to remove a packet from the former and to insert it into the container support, the former and the container support being arranged to cooperate with the plunger for said removal and insertion.

5. A packing machine for continuously packing batches of goods in containers, comprising a plurality of sets of mechanisms arranged to move in a continuous sequence past a supply station for the goods, said sets of mechanisms being arranged in three layers one above the other, comprising an upper layer including batch-forming mechanisms to receive goods from the supply station, a lower layer including container-handling means, and an intermediate layer including filling mechanisms to insert into the containers batches of goods received from the batch-forming mechanisms, and including means to support the three layers comprising a column extending through the layers so that the sets of mechanisms are disposed around the column, the upper and lower layers being slidably mounted on the column whereby the three layers can be moved apart from one another to allow access to the interior of the machine.

6. A machine according to claim **5** comprising an operating member disposed in the column for vertical and rotational movement, means to connect each layer with the operating member for movement therewith, said connecting means being selectively operable according to the rotation of the

operating member, power means for raising and lowering the operating member and control means operable to rotate the operating member.

7. A machine according to claim 3 wherein each shaping portion comprises a recess to receive the former.

8. A machine according to claim 7 wherein a sidewall of one of the recesses is formed by a member pivotable about an axis parallel with the axis of rotation of the block.

9. A machine according to claim 7 wherein the packet former comprises a forming piece of substantially rectangular cross section about which an open-ended packet can be formed by folding material.

10. A machine according to claim 9 wherein the packet former comprises a plunger which is extendable through the forming piece to remove an open-ended packet and retractable into the forming piece.

11. A machine according to claim 7 comprising a movable clamping member to clamp material against one side of the packet former and a resilient back plate in the recess to engage the material and clamp it against the other side of the packet former.

12. A machine according to claim 3 wherein the packet former is mounted for reciprocatory movement along a line perpendicular to the axis of rotation of the block.

13. A machine according to claim 3 wherein the rotatable block is provided with means to support packet material by suction.

14. A machine according to claim 3 wherein the packet former is provided with means to support packet material by suction.

15. A machine according to claim 3 further comprising a rotary table on which the packet-forming mechanisms are carried, being disposed at regular intervals around the table.

16. A machine according to claim 15 wherein each packet-forming mechanism includes cam-operated means reciprocably to rotate the blocks to present the shaping portions alternately to the material supply means and to the packet former, and wherein block-rotating cams are provided in juxtaposition with the rotary table to operate the block-rotating means as the table rotates.

17. A machine according to claim 16 wherein the cam-operated block-rotating means includes a pinion rotatable with the block, and a pivoted drive lever, one end of which is provided with a follower to engage the block-rotating cams, and the other end of which has a toothed portion meshing with said pinion to rotate the block as the drive lever pivots, and means to lock the block in position.

18. A machine according to claim 17 wherein the locking means comprises a pivoted locking arm engageable with the block to lock it against rotation and carrying a cam-operated follower, the block-rotating cams including cams to actuate said follower.

19. A machine according to claim 15 wherein said packet material supply means comprises a rotary drum, a reel store of material and means to cut strips of material from the reel and feed the strips on the drum.

20. A machine according to claim 19 wherein the surface of each rotary block in the regions of the shaping portions is cylindrically curved about the axis of rotation and is engageable with a strip of material on the material supply drum surface to remove it therefrom.

21. A machine according to claim 20 wherein the rotatable block is provided with means to support packet material by suction, and the material supply drum is provided with suction ports in its surface for securing the strip by suction, means being provided for disconnecting said ports from suction and for applying suction to the block to transfer a strip of material from the supply drum to the block at the time of engagement of each block with the supply drum, the speeds of rotation of the block and the drum being synchronized.

22. A machine according to claim 15 comprising a plurality of slides movable radially of the table under the control of cam means, each packet former being carried on one of said slides.

23. A machine according to claim 22 wherein each packet former comprises a forming piece of substantially rectangular cross section about which an open-ended packet can be formed by folding material and a plunger which is extendable through the forming piece to remove an open-ended packet and retractable into the forming piece, each plunger being carried on a slide, and cam means for controlling movement of each plunger.

24. A machine according to claim 8 comprising a folder piece for each block mounted for radial and tangential movement, a cam operatively connected to said folding piece to fold material against the packet former when the packet former is engaged in said one recess, and the pivotable member is pivoted away from its normal, recess-defining position.

25. A machine according to claim 3 including an adhesive applicator past which each packet-forming mechanism moves for applying adhesive to packet material carried by the mechanisms.

26. A machine according to claim 3 comprising tucking devices past which each packet-forming mechanism moves and which act to fold the material against the packet former to form a packet end.

27. A machine according to claim 26 wherein the tucking devices comprise a rotatable tucker to fold a flap of material and a plough to hold the so folded flap in position, the tucker and the plough being formed to intermesh so that the flap is continuously constrained in passing from the tucker to the plough.

28. A machine according to claim 15 comprising a ring main extending around the rotary table and communicating with a suction source, wherein each packet-forming mechanism includes means connecting its suction ports with the ring main.

29. A machine according to claim 28 comprising a bearing valve having a first bearing member rotating with the rotary table of the machine about the same axis, and a second bearing member stationary relative to the first, wherein each member is apertured for continuous transmission of suction through the bearing, the rotary bearing member communicating with the suction ring main and the stationary member communicating with the suction source and wherein the bearing members are spaced apart sufficiently to allow convenient relative rotation without undue suction leakage.

30. A machine according to claim 28 wherein the suction-connecting means includes a cam-operated suction control valve.

31. A machine according to claim 30 wherein each suction-control valve comprises a valve passage communicating with the ring main provided with a valve member, movable to close the passage, for and communicating with each set of suction ports which is to be operated independently and a pair of movable cam-engaging wings for and connected one pair to each valve member, and wherein operation of one wing by engagement with a cam opens the valve and resets the other wing and operation of the other wing closes the valve and resets the one wing.

32. A machine according to claim 30 comprising a set of cams for the operation of all the suction valves, disposed for engagement therewith as the table carrying the packet-forming mechanisms rotates, and arranged to time the suction control according to the operation of the packet-forming mechanisms.

33. A machine according to claim 31 including a material detector, and a cam movable to an operative position in response to operation of the detector, wherein the detector operates to sense the absence of material supported over suction ports when, in the normal running of the machine, such material should be present, and the cam acts in its operative position to cause suction to be cut off from the relative suction ports.

34. A packing machine for continuously packing batches of cylindrical rodlike articles in containers, comprising a plurali-

ty of batch-forming mechanisms arranged to move in a continuous sequence past a supply station for the articles and to form predetermined batches from the articles received from the supply station, a plurality of filling mechanisms to insert into the containers batches of articles received from the batch-forming mechanisms, and supply means to feed the articles at the supply station in alignment in rows moving transversely to their lengths and at a speed substantially equal to the speed of movement of the batch-forming mechanisms past the supply station, said machine further comprising means to feed articles along a flow path to the supply station and including at least two regions along said flow path means for accelerating the articles whereby a substantial number of rows of articles in a slow moving stream is reduced and the speed of said stream is increased as it approaches said supply station, said flow path including throughout its length means to align the articles.

35. A packing machine comprising a plurality of mechanisms for inserting batches of rodlike articles into packets each having a closed end and an open end to receive the articles longitudinally, each said mechanism comprising batch support means and packet support means to hold the batch and packet respectively against lateral movement while allowing longitudinal movement, a mouthpiece to guide the batch into the packet, a holder for the filled packet, said batch support means, packet support means and holder being normally disposed in longitudinal alignment, and means to push the batch through the mouthpiece into the packet and thence to push the filled packet into the holder, and means for moving said holder between its aligned position and an out-of-alignment position for handling the filled packet, said machine further comprising means to act on each filled packet in the out-of-alignment position of the holder to close the open end of the packet, said holders being arranged to move successively past said packet closing means.

36. A cigarette packing machine comprising a plurality of continuously circulating batch-forming mechanisms arranged to move in succession past a cigarette supply and to form predetermined batches of cigarettes, a plurality of continuously circulating packet-forming mechanisms arranged to move in succession past at least one packet blank supply and to form packets from the blanks, support means for continuously moving the completed packets and the cigarette batches at the same speed and in end-to-end alignment along a predetermined path, and a plurality of continuously circulating plunger means movable longitudinally under the influence of a stationary cam so as to push the cigarette batches smoothly and progressively all the way into the packets as the batches and packets move along said predetermined path.

37. A packing machine according to claim 36 in which said support means moving the packets and batches along said predetermined path comprises a circular rotary member, said predetermined path being arcuate.

38. A packing machine according to claim 37 further comprising a plurality of filled packet holders and in which each plunger means furthermore pushes the respective packet and cigarette batch smoothly and progressively out of the packet support means and onto said filled packet holder.

39. A packing machine for packing batches of goods in packets, comprising a plurality of similar packing mechanisms arranged along a closed path, means for moving said mechanisms continuously along said closed path, a goods supply station which each mechanism in turn passes while moving along said closed path, and a packet material supply station which each mechanism in turn passes while moving along said closed path, each mechanism including batch-forming means for forming predetermined batches from the goods supplied at the supply station, packet forming means for forming packets from the packet material supplied at the packet material supply station, and means for inserting batches of goods into the packets including plunger means for progressively inserting each batch of goods into a packet formed by the respective packet forming means.

40. A packing machine according to claim 39 further comprising a rotatable drum member, said packing mechanism all being mounted at circumferentially spaced positions around the axis of said rotatable drum member whereby said closed path is circular, and including means for rotating the drum member continuously about its axis.

41. A packing machine according to claim 40 in which the axis of rotation of the drum member is vertical.

42. A packing machine according to claim 41 including an annular gravity feed hopper into which the goods from the goods supply station are delivered, said hopper having a plurality of goods outlets each leading to one of the packing mechanisms.

43. A machine according to claim 42 in which the drum member comprises three layers, the upper layer of which comprises the annular gravity feed hopper, the lowest layer of which comprises the packet-forming means, and the middle layer of which comprises the means for inserting batches of goods into the packets.

44. A cigarette packing machine for packing batches of cigarettes in packets, comprising a plurality of similar packing mechanisms arranged along a closed horizontal path, means for moving said mechanisms continuously along said path, a movable hopper extending all the way along said closed path, means for moving the hopper along said closed path at the same speed as the packing mechanisms, and cigarette supply means for delivering into the hopper cigarettes lying transversely to the direction of movement of the hopper, each mechanism including batch-forming means for forming predetermined batches from cigarettes received from the hopper, packet support means for supporting a packet in alignment with the batch formed by the respective batch-forming means, and plunger means for progressively pushing each batch of cigarettes endwise into the packet as the respective mechanism moves along said closed path.

45. A machine according to claim 44 in which the closed path is circular and in which the hopper is annular, the cigarette supply means being arranged to deliver the cigarettes tangentially into the hopper.

46. A machine according to claim 44 in which the hopper has a plurality of outlets for cigarettes leading to the respective packing mechanisms, each outlet comprising a vertically movable chute having a bottom wall, and operating means comprising means for moving the chute up and down in a repeating cycle, means for moving said plunger means to push a batch of cigarettes horizontally out of the chute while the chute is at its lowest position, said chute being then raised by the operating means while the articles are supported by the plunger means until the chute reaches an upper position in which said bottom wall of the chute supports the remaining cigarettes, and means to withdraw the plunger means to enable the chute to move downwards again to the position in which the next batch of cigarettes can be pushed out by the plunger means.

47. A machine according to claim 46 in which each chute comprises a plurality of vertical vanes defining a plurality of vertical channels for the discharge of separate rows of cigarettes, and in which the plunger means comprises a plurality of prongs which enter the different channels.

48. A machine according to claim 44 in which the cigarette supply means comprises means for feeding the cigarettes as a stream comprising a plurality of rows moving transversely to the lengths of the cigarettes and at a speed substantially equal to the speed of movement of the hopper past the supply means, and including means for accelerating the cigarette stream in at least two regions whereby the number of rows in the stream is reduced before the stream reaches the hopper.

49. A cigarette packing machine for packing batches of cigarettes into packets, comprising a plurality of similar packing mechanisms arranged along a closed path, means for moving said mechanisms continuously along said closed path, a plurality of batch-forming mechanisms, means for moving each batch-forming mechanism in turn past a cigarette supply

station for receiving cigarettes to form a predetermined batch, means for continuously conveying packets for enclosing the batches of cigarettes, a plurality of compression boxes for compressing the batches of cigarettes laterally, and a plurality of plunger means for progressively inserting each batch of cigarettes after compression into one of the packets, each said compression box comprising two L-sectioned parts which cooperate to define a box of rectangular section and which are movably connected together by two parallel link members each of which is pivoted to both of said parts so as to constrain the two parts to move to compress cigarettes lying within the box formed by the two parts.

50. A machine according to claim 49 in which the compression box swings progressively about an axis parallel to the pivots of the link members as the two parts of the compression box move together to compress the cigarettes.

51. A packing machine for packing batches of goods in packets comprising inner and outer wrappers, said machine comprising a plurality of similar packing means, a plurality of packet-forming mechanisms, and a plurality of batch holders for conveying batches of goods for insertion into the packets by the packing means, means for continuously circulating said plurality of packing means, packet-forming mechanisms and batch holders along a closed path whereby each packet-forming mechanism in turn is moved past two supply stations respectively for the sheet materials forming the inner and outer wrappers of the packet, each said packet-forming mechanism comprising a rotatable block having two shaping portions spaced apart around its axis, each capable of holding said sheet material, and a packet former arranged to cooperate with said shaping portions in succession, whereby rotation of the block brings each said shaping portion in succession into a position to receive sheet material from one of the supply stations and then into a position at which said former can cooperate with it to shape the material between the shaping portion and the former, with sheet material being supplied to one shaping portion while material is being shaped on the other shaping portion.

52. A packing machine according to claim 51 further comprising a rotatable drum member, said plurality of packing means, packet-forming mechanisms and batch holders being mounted at circumferentially spaced positions around the axis of said drum member whereby said closed path is circular, the two packet material supply stations being mounted at circumferentially spaced positions alongside the drum member.

53. A cigarette packing machine comprising a plurality of batch-forming mechanisms arranged to circulate continuously past a cigarette supply station, each mechanism being arranged to form a batch from the cigarettes supplied at the supply station; a plurality of packet-forming mechanisms arranged to circulate continuously past at least one supply station for packet sheet material and to form packets from said sheet material, and means moving the batch-forming mechanisms and packet-forming mechanisms in end-to-end alignment around a fixed axis; and plunger means for progressively pushing each batch from the batch-forming mechanism into the packet formed by the respective packet-forming mechanism.

54. A cigarette packing machine according to claim 53 further comprising a plurality of filled-packet holders, each said plunger means being capable of continuing its movement, after pushing the batch of cigarettes into the respective packet, so as to push the packet with the cigarettes onto said filled-packed holder.

55. A method of packing cigarettes comprising continuously transporting batches of cigarettes along a closed path with the axes of the cigarettes lying transversely to the direction of the movement of the batches, continuously transporting packets along a closed path, bringing the batches and packets into end-to-end alignment while being transported, progressively and smoothly pushing each batch along a straight line extending in the direction of the axes of the cigarettes and into the corresponding aligned packet and continuing the pushing of the batch with the packet further along said straight line to a position where said filled packet is transported along a further path extending transversely to said straight line, with the cigarettes in the packet still extending in the same direction, and closing said filled packets while they move along said further path.

56. A packing machine for continuously packing in containers batches of compressible, cylindrical, rodlike articles such as cigarettes, comprising a plurality of sets of mechanisms arranged to move in continuous sequence past a supply station for the articles, each set comprising a batch-forming mechanism to receive articles from the supply station, and a filling mechanism to insert into the containers batches of articles received from the batch-forming mechanism, said sets being arranged to operate cyclically and in succession, each said filling mechanism comprising means to receive and support a bundle of goods from the batch-forming mechanism, means to support a container to receive the bundle in alignment with said bundle-receiving means, a holder for the filled containers, and means to push the bundle into the container and thence to push the filled container into its holder, said bundle support means, container support means and filled-container holder all being alignable longitudinally of the bundle of goods whereby the bundle can be pushed from the bundle-support means along a straight line into the filled-container holder, and wherein each set of mechanisms comprises a mouthpiece to guide the bundle into the container, and the bundle-support means comprises a compression box operable to compress the bundle laterally.

57. A packing machine for continuously packing batches of goods in containers, comprising a plurality of sets of mechanisms arranged to move in continuous sequence past a supply station for the goods, each set comprising a batch-forming mechanism to receive goods from the supply station, and a filling mechanism to insert into the containers batches of goods received from the batch-forming mechanism, said sets being arranged to operate cyclically and in succession, each set of mechanisms comprising a packet-making apparatus to make containers in the form of packets from at least one source of sheet material past which each set of mechanisms in turn moves, and to supply these packets to the filling mechanism of the respective set, each packet-making apparatus comprising a rotatable block having shaping portions spaced apart around its axis of rotation, each capable of holding sheet packet material, supply means to supply sheet material to said shaping portions, and a packet former arranged to mate with said shaping portions in succession, wherein rotation of the block brings each said shaping portion in succession into a position to receive sheet material and then into a position at which said former can mate with it to shape the material between the shaping portion and the former with sheet material being supplied to the one shaping portion at the same time that material is being shaped on the other shaping portion.

58. A packing machine for packing batches of compressible rodlike articles in containers, comprising a hopper mounted for circulation continuously along a closed horizontal path, said hopper being of a troughlike construction extending along said path, a plurality of batch-receiving mechanisms mounted for continuous circulation and arranged to receive batches of articles from said hopper, a plurality of holders for the containers mounted for continuous circulation, means for moving said hopper, said batch-receiving means and said holders at the same speed, and a plurality of packing mechanisms mounted for continuous circulation and arranged to transfer said batches from the batch-receiving means and into the containers, said hopper having means defining a plurality of outlets through which batches of articles are delivered successively to said batch-receiving means, said packing machine including means for delivering said articles continuously into the hopper as a stream moving in the same direction and at substantially the same speed as the hopper with said articles arranged transversly to the direction of movement of the stream.

59. A cigarette packing machine according to claim 58 in which each of said outlets from the hopper is defined by a plurality of vanes for passing the cigarettes out of the hopper in a plurality of separate rows lying between the vanes.

60. A packing machine for packing batches of goods in packets comprising a plurality of wrappers, said machine comprising a plurality of similar packing means mounted for continuous circulation, a plurality of packet-forming mechanisms mounted for continuous circulation, means for moving each packet-forming mechanism in turn successively past at least two supply stations respectively for the sheet material forming each of the wrappers of the packet, and a plurality of batch holders mounted for continuous circulation for conveying batches of goods for insertion into the packets by the packing means, each said packet-forming mechanism comprising a rotatable block having at least two shaping portions spaced apart around its axis, each capable of holding said sheet material and packet-former means, arranged to cooperate with said shaping portions in succession, whereby rotation of the block brings each said shaping portion in succession into a position to receive sheet material from one of the supply stations and then into a position at which said former means can cooperate with it to shape the material between the shaping portion and the former means with sheet material being supplied to one shaping portion while material is being shaped on another shaping portion.

61. A packing machine as claimed in claim 60 for packing batches of goods in packets comprising an inner and an outer wrapper wherein said means for moving each packet-forming mechanism moves each said mechanism in turn successively past two supply stations respectively for the sheet material forming the inner and outer wrappers of the packet, and each of said rotatable blocks has two shaping portions.

62. A cigarette packing machine according to claim 53 in which the plunger means are carried by a rotating drum around which the batch-forming mechanisms and packet-forming mechanisms move in end-to-end alignment while each batch is being progressively pushed into the corresponding aligned packet.

63. A method for packing cigarettes comprising continuously transporting batches of cigarettes along a closed path comprising at least partly a first arcuate section, continuously transporting packets along a closed path comprising at least partly a second arcuate section coaxial with the first arcuate section, said first and second arcuate sections defining an arcuate plane, bringing the batches and packets into end-to-end alignment while being transported, progressively and smoothly pushing each batch along a straight line extending in the direction of the axes of the cigarettes into the corresponding aligned packet while the batch and packet are moving along said arcuate plane and continuing the pushing of the batch with the packet further along said straight line while the batch and packet still move along said arcuate plane to a position where said filled packet is transported along a further path, and closing said filled packets while they move along said further path.