(12) UK Patent Application (19) GB (11) 2 102 760 A

(21) Application No **8213629**
(22) Date of filing **11 May 1982**
(30) Priority data
(31) **8114350**
(32) **11 May 1981**
(33) **United Kingdom (GB)**
(43) Application published **9 Feb 1983**
(51) INT CL[3] **B65G 57/30**
(52) Domestic classification **B8C** 40B1D1 40B1D3 40B1F1 40C4 SF3
(56) Documents cited
GB 1253846
GB 1149693
GB 0832551
GB 2087827A
(58) Field of search **B8C**
(71) Applicants
Auto Wrappers (Norwich) Limited,
(Great Britain),
Whiffler Road,
Norwich NR3 2AU
(72) Inventor
Paul Albert Leak
(74) Agents
William Jones,
Old Bank of England Court,
Queen Street,
Norwich NR2 4SX

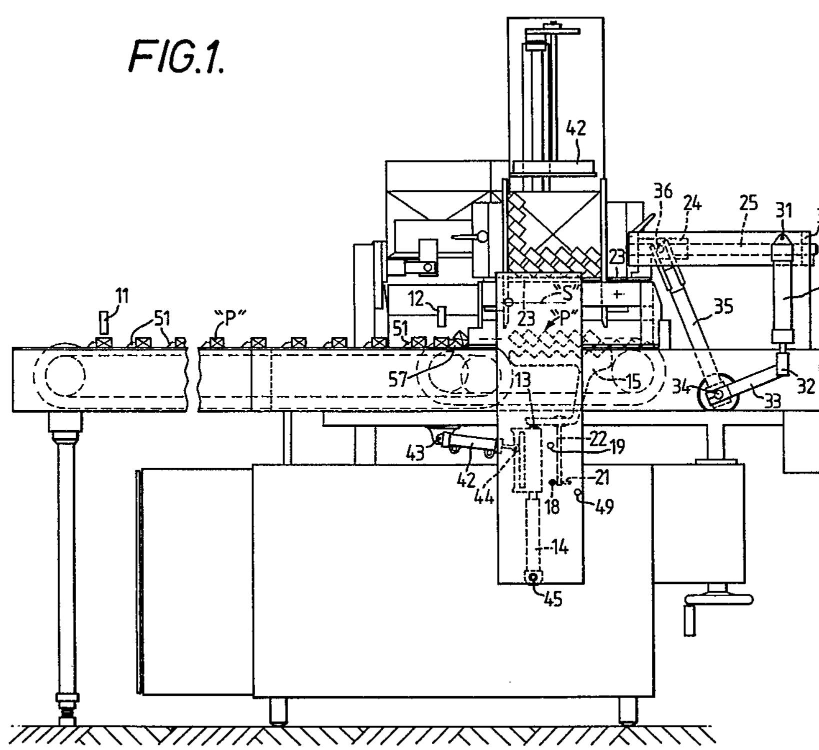
(54) Stacking and boxing elongate packages

(57) A flow of non-cylindrical elongate packages P is built up into a stack from beneath by counting off a number from the incoming flow, aligning that number of packages into a row having the sides of each package inclined to the plane of the row, and lifting each such lined-up row past a pair of spaced latching supports to build up a stack, of desired height and having successive rows inter-engaged, which is then transferred onto dump flaps and dumped into a waiting box.

The same lifting means, e.g. a two-stage pneumatic ram (13, 14), can be used both to lift each row into the stack and to lift the whole stack a further distance for transfer onto the dump flaps.

Alternatively elevating bars can perform a repetitive and standardised row-elevating and latching movement whilst a pair of secondary latches, normally level with primary row-latching means, periodically lifts the whole stack for transfer.

FIG.1.



GB 2 102 760 A

2102760

1/10

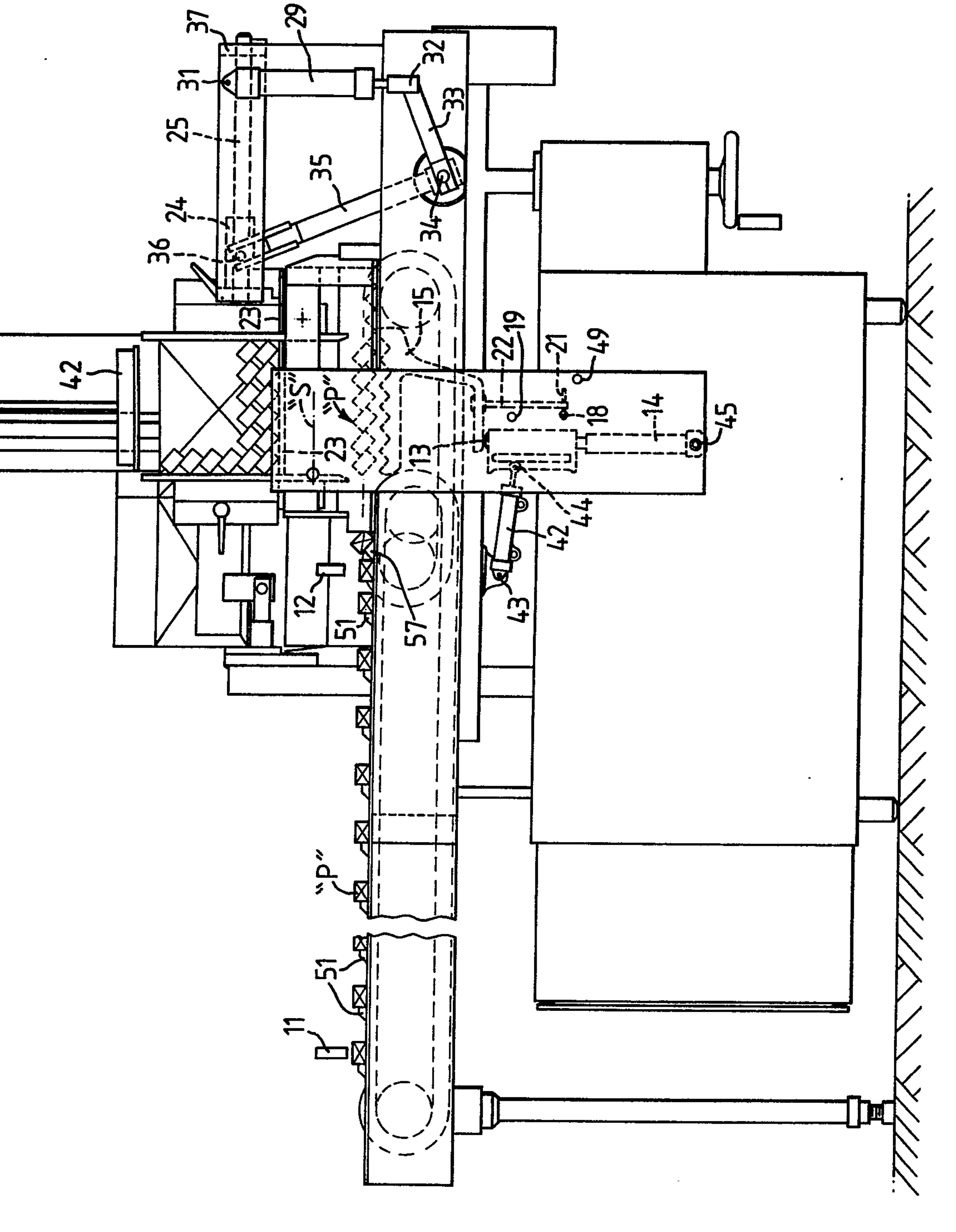


FIG.1.

Fig 1

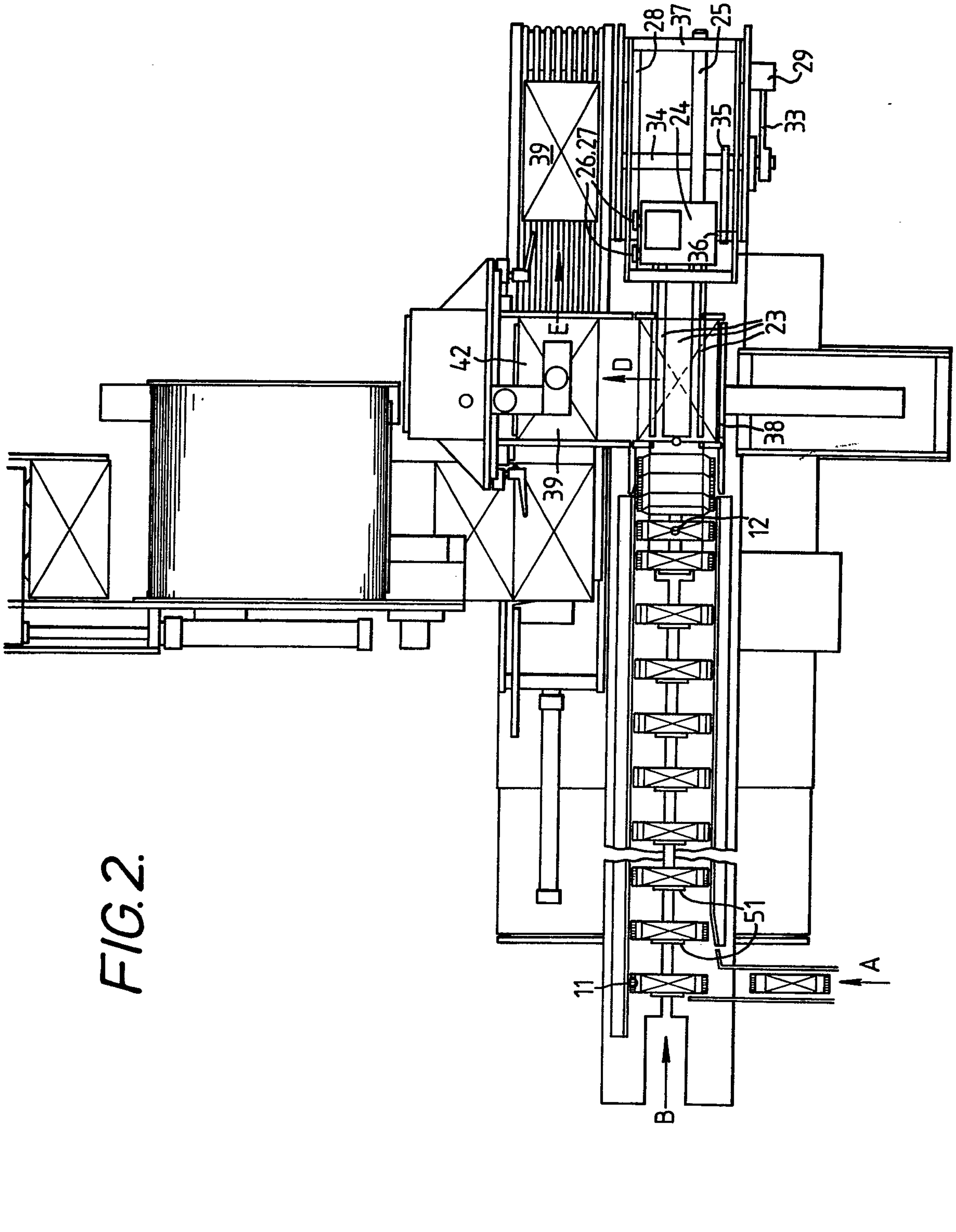
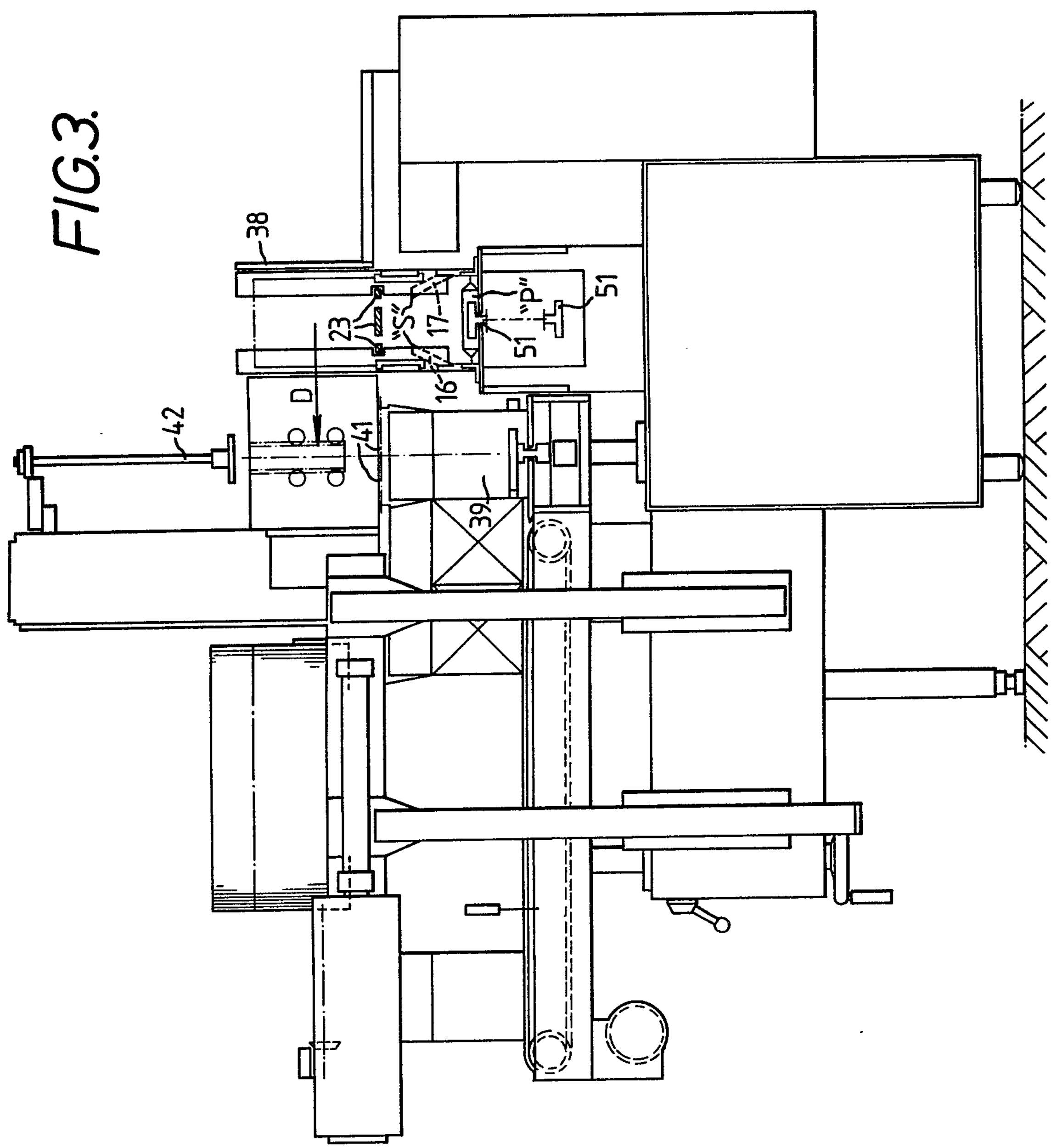


FIG. 2.

FIG.3.



2102760

4/10

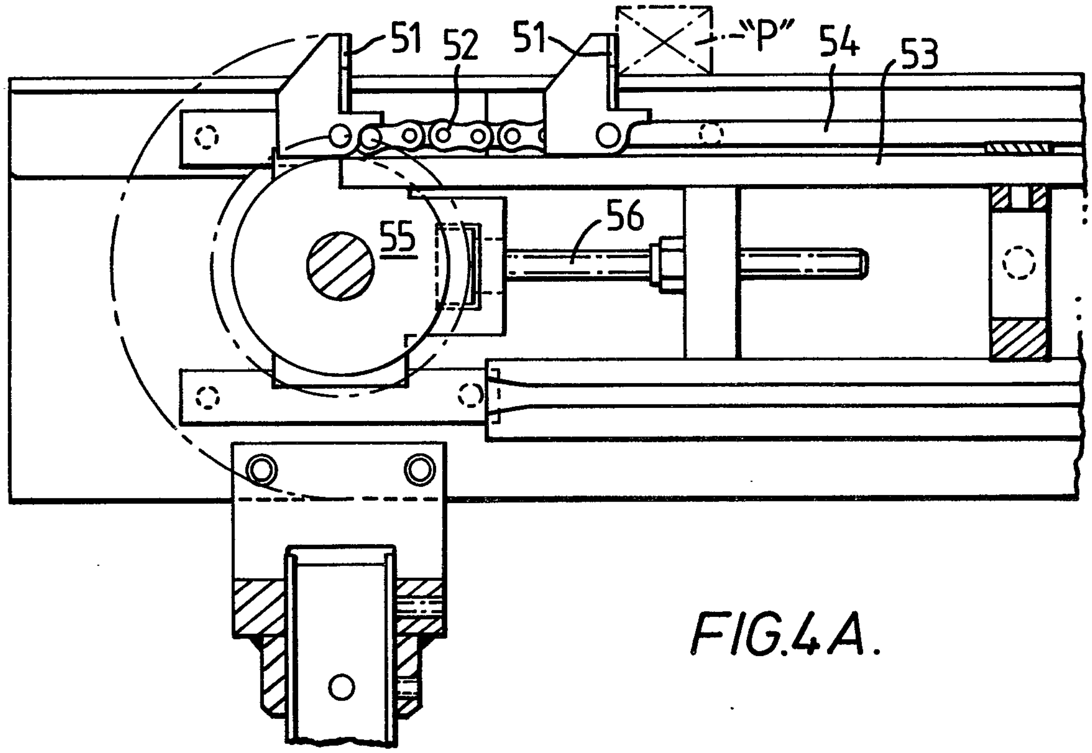


FIG.4A.

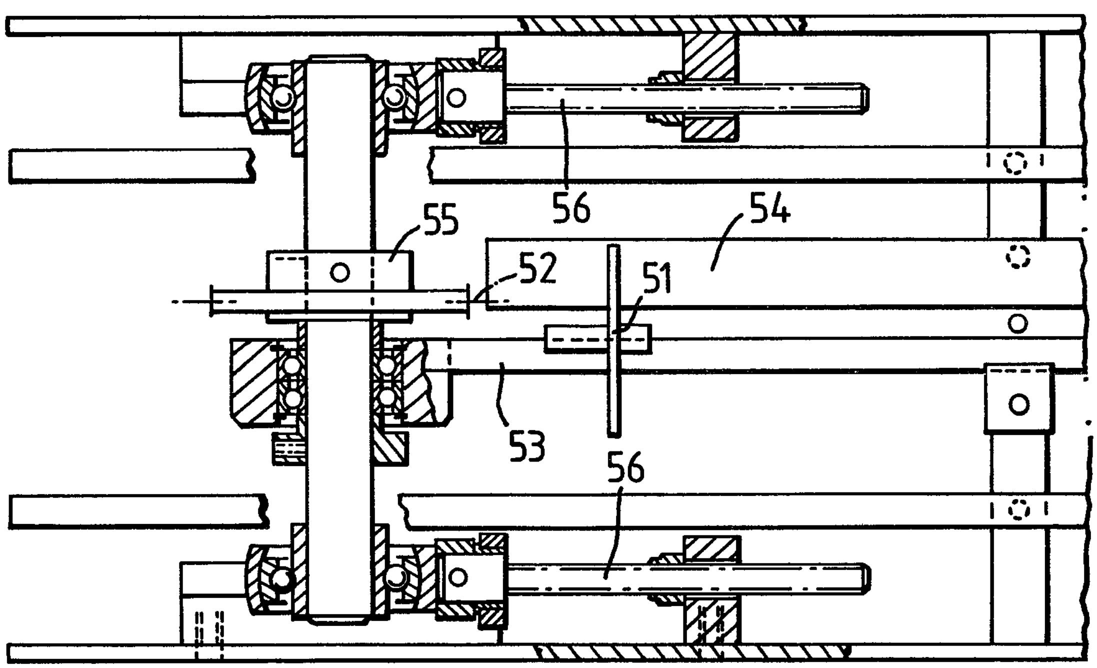


FIG.4B.

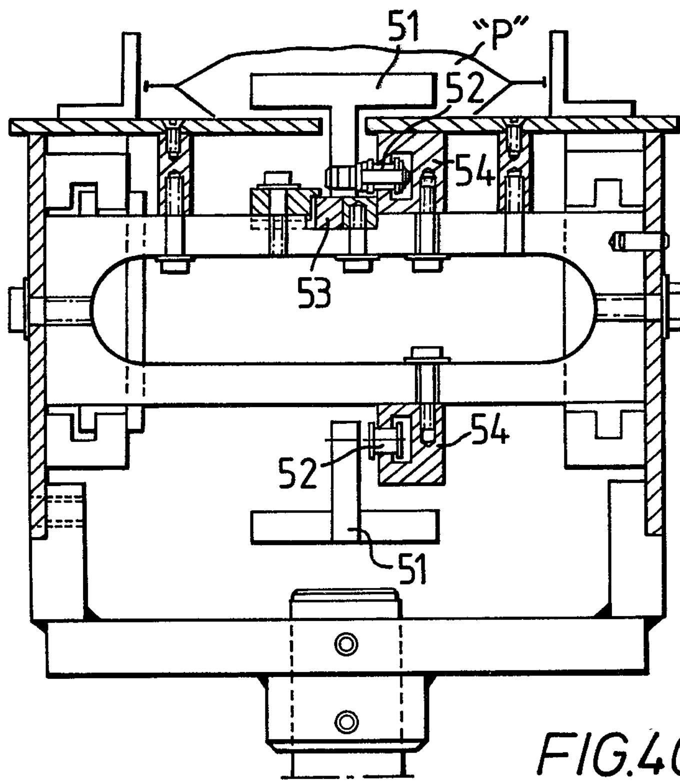


FIG.4C.

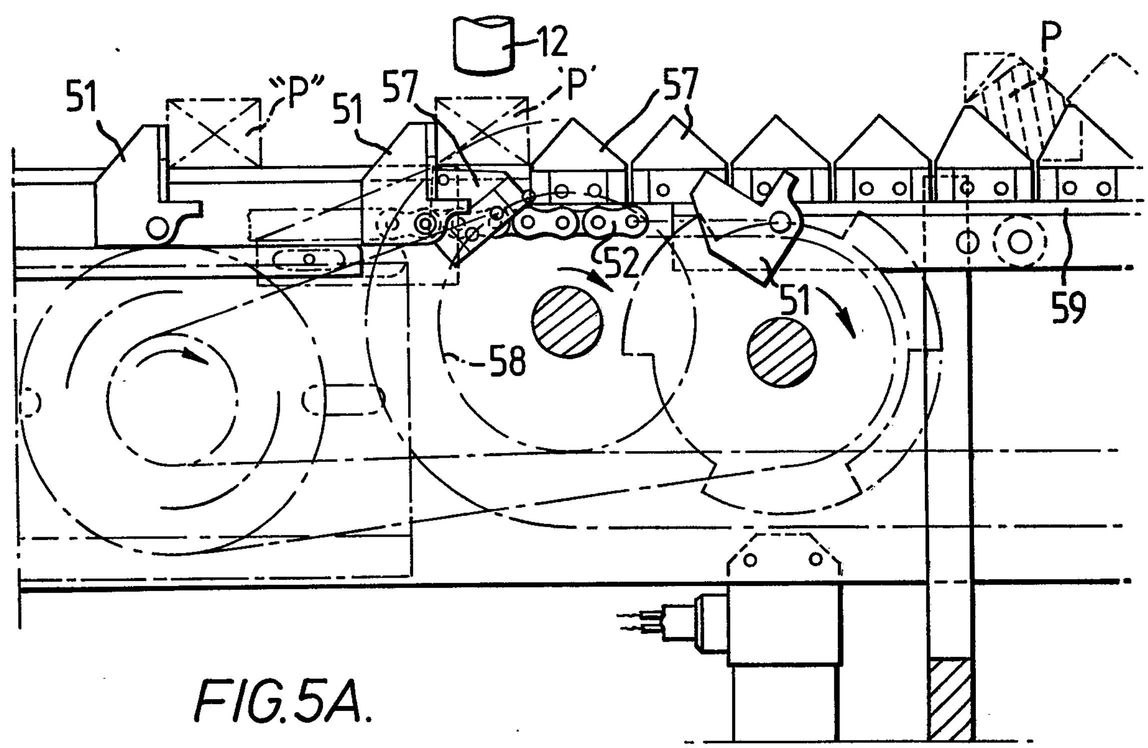


FIG.5A.

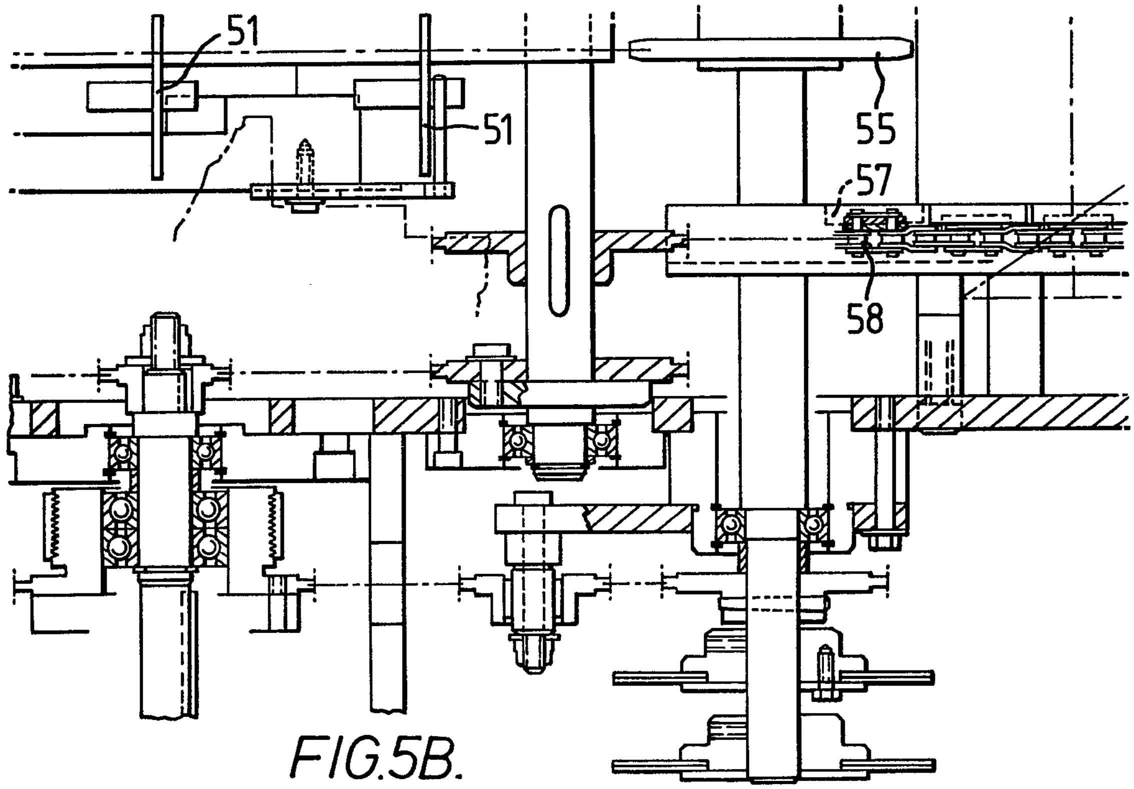


FIG.5B.

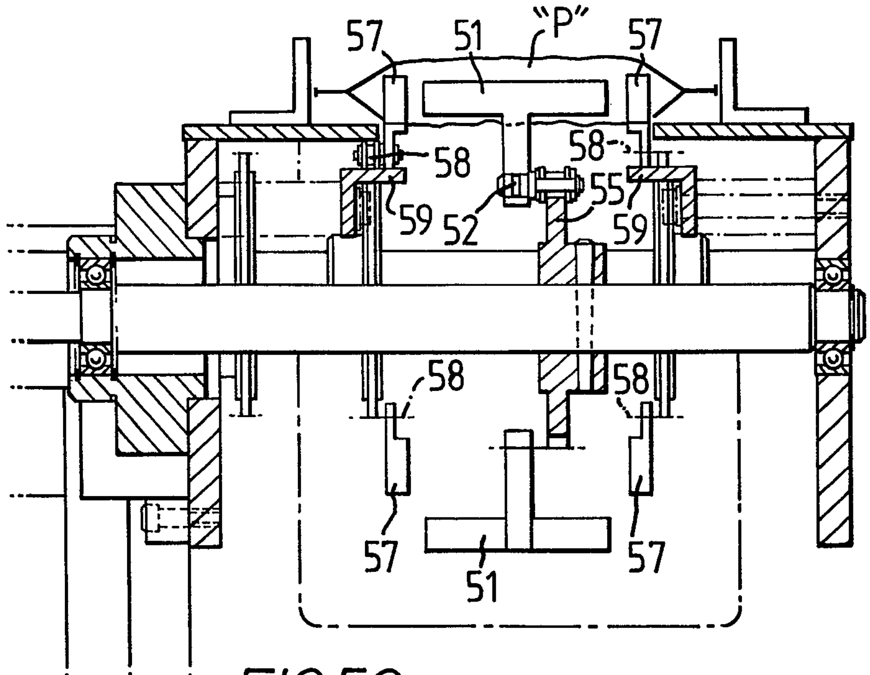


FIG.5C.

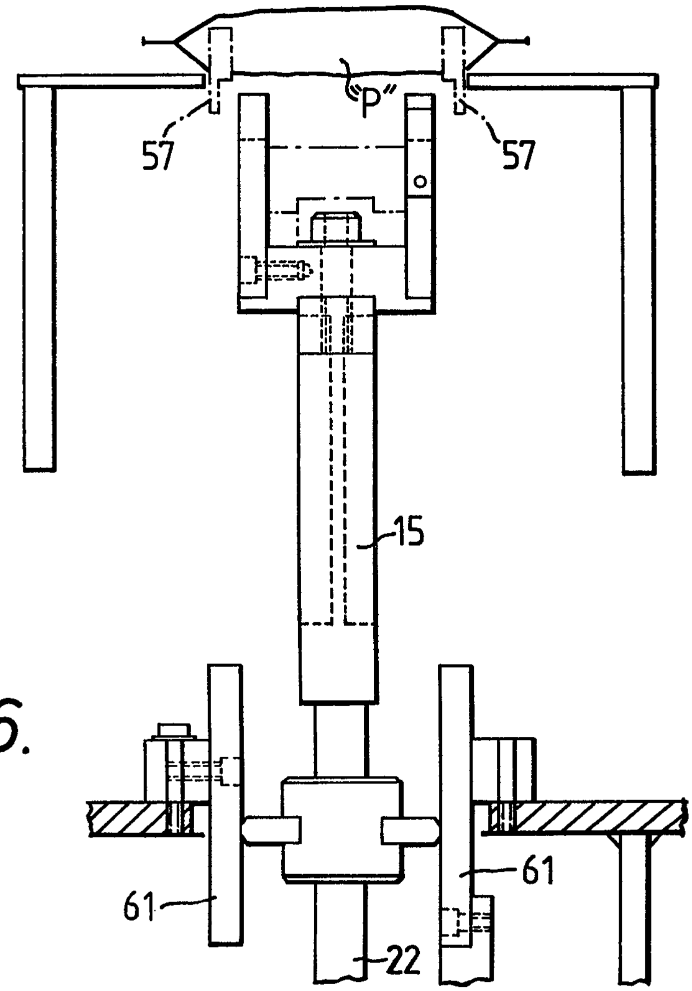


FIG.6.

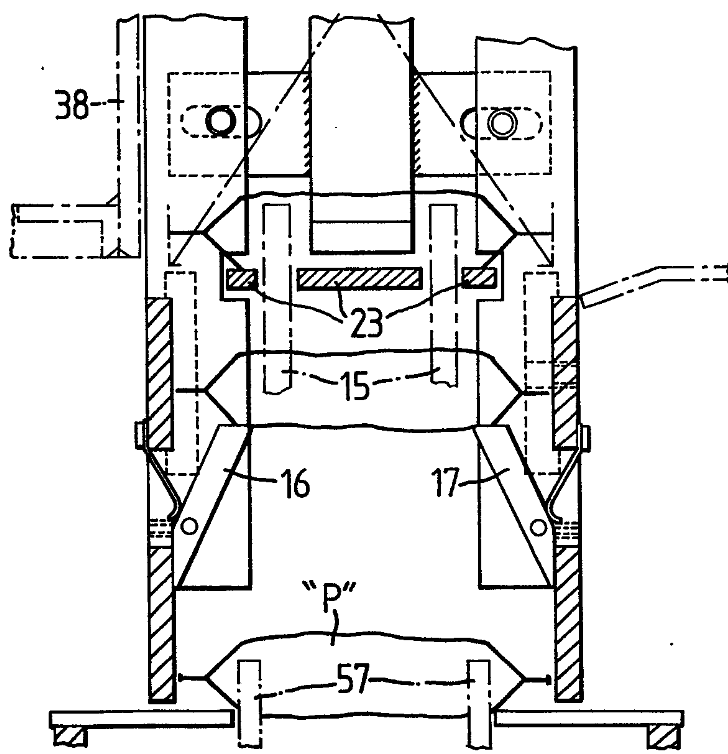
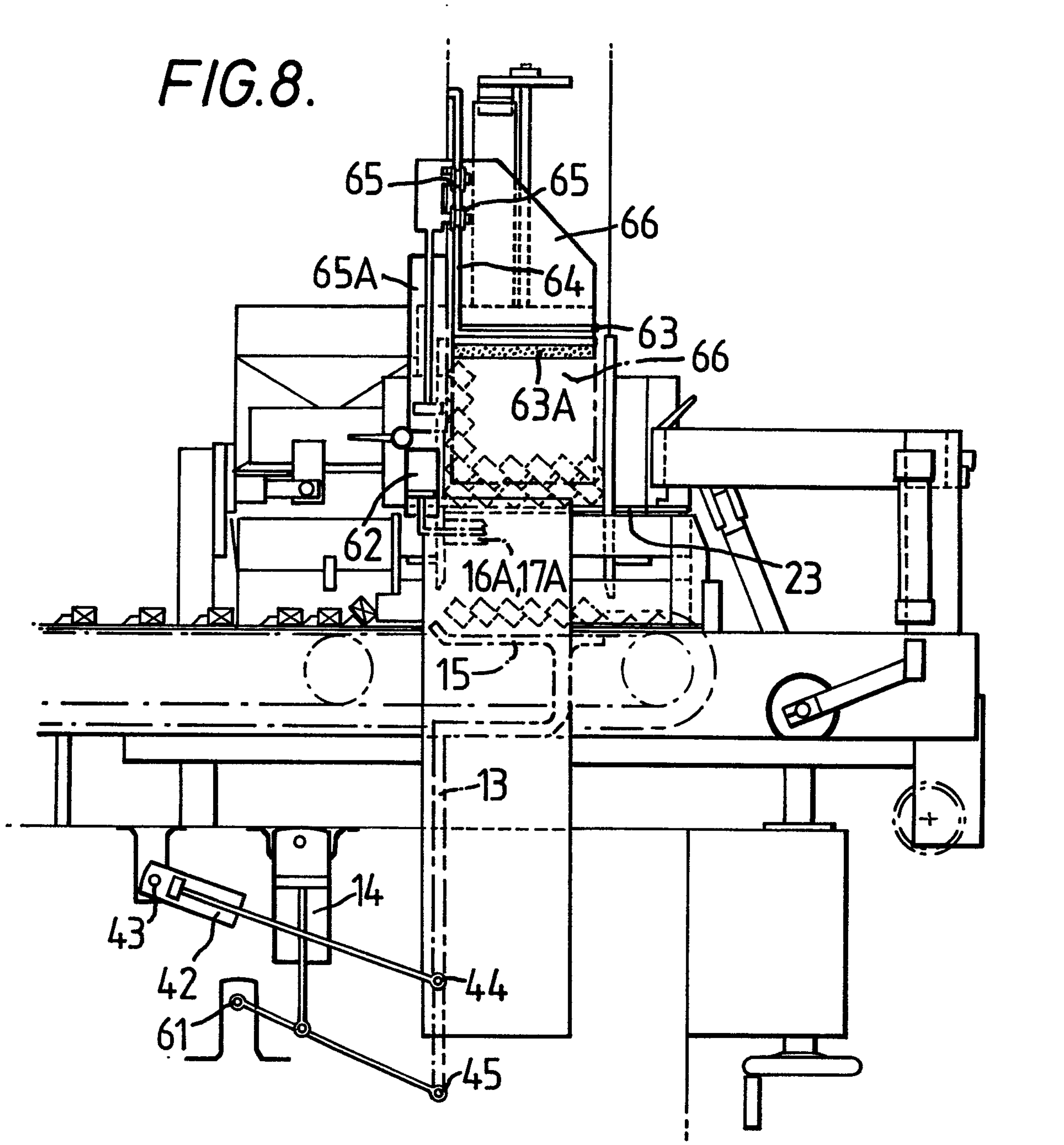


FIG.7.

FIG.8.



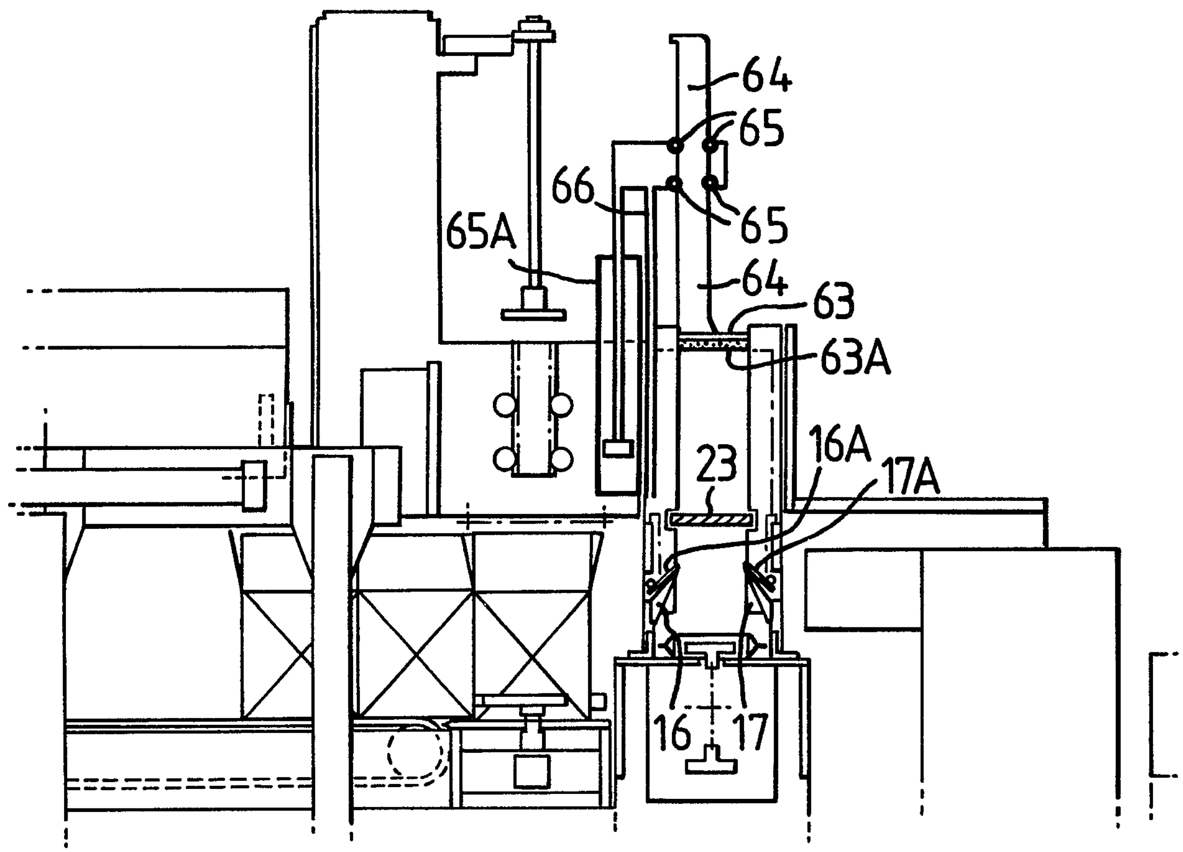


FIG.9.

2102760

10/10

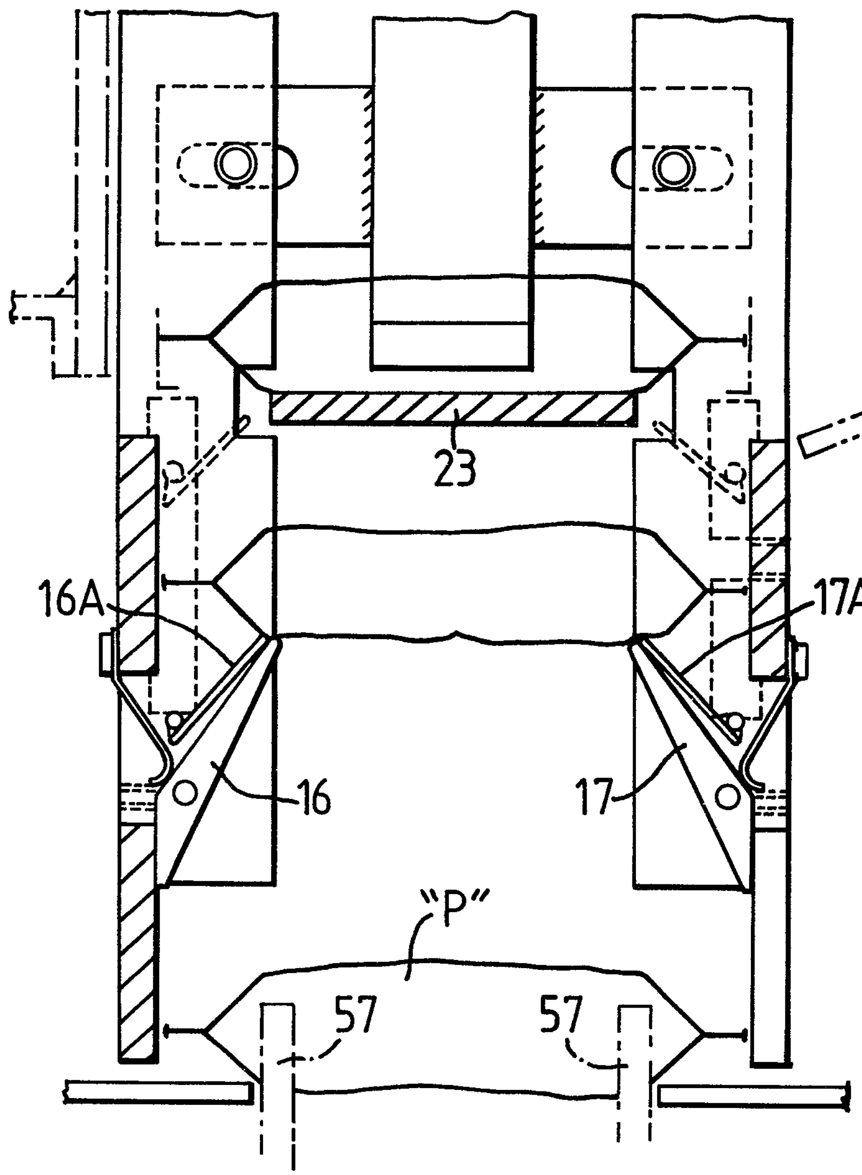


FIG.10.

SPECIFICATION

Stacking and boxing a flow of elongate packages

The invention is concerned with methods and apparatus for stacking and boxing a flow of elongate packages.

The invention is particularly applicable to the stacking and boxing of a flow of generally non-cylindrical elongate packages such as for example the packages produced by a horizontal form-fill-seal crimp-wrapping machine. Chocolate-coated bars are wrapped by such machines. The filled packages produced will generally be of substantially identical dimensions, but with the packaging film wrapped relatively loosely around the bar, and with crimp-sealed ends which project beyond the bar ends and which are relatively easily deformed. In these respects the packages differ from the essentially tightly-wrapped solid cylindrical rolls produced by a form-fill-seal roll-wrapping machine.

The stacking and boxing of the output of a roll-wrapping machine has been successfully automated, but because the surfaces of a crimp-wrapped package cannot be used as a reliable datum it has been conventional to "jumble-fill" such packages by hand into the boxes in which they are eventually despatched for sale. This conventional practice has several drawbacks, not least the high cost of a labour-intensive operation, and the risk of individual packages being damaged as the labourers try to keep pace with the output of the form-fill-seal machine.

The invention is based on the realisation that it is possible to build up, from beneath, a stack of generally non-cylindrical elongate packages such as crimp-wrapped chocolate-coated bars, if the rows of packages counted off the incoming flow are put together in echelon formation. Successive rows so formed will nest into one another as they are stacked row-on-row from beneath, resulting in a tightly-packed stack which will retain its shape when transferred from the stacking station and which will "dump" cleanly into a waiting box.

The stack may be built up from beneath by latching successive rows of packages onto the top surfaces of two spaced-apart flaps which are automatically pushed apart as the row of packages is elevated and which come towards one another again to support the packages as the elevating means withdraw. When the stack has reached its desired height, a supporting plate can be brought into position beneath the bottom row, and the stack can then be transferred from the stacking station to the boxing station of the machine.

Preferably the stack is lifted off the latching flaps before the supporting plate is brought into position beneath the bottom row of the stack. The stack can then be supported and transferred for boxing, without delaying the continuing formation of the next stack. If the stack is not so lifted, the formation of the next stack must be delayed, otherwise the next elevated row of packages will hit the supporting plate.

So, two elevating movements are desirable: a repetitive row-elevating movement, to "latch" each row as the stack builds up; and, periodically, a stack-elevating movement to lift the formed stack to a level at which it can be supported for subsequent transfer whilst the next stack starts to build up underneath it.

The same elevating means may be used both to build up the stack to its desired height and then to elevate the whole stack the required further distance before introducing the supporting plate. In one aspect of the invention, such an elevating means comprises essentially a two-stage ram, one stage of which is used for the repetitive row-elevating operation, with the other stage augmenting that operation periodically whenever a stack-elevating movement is needed.

Alternatively a separate elevating means may be used to lift the formed stack off the top surfaces of the latching flaps. In accordance with the invention, this separate stack-elevating means may comprise a pair of secondary latching flaps whose top surfaces normally lie level with or below the top surfaces of the row-receiving primary latching flaps, and which lift the bottom row of the stack off the primary flaps when the stack formation is complete.

If the row-elevator rises and falls along a vertical line of action, the incoming flow of packages must be temporarily halted for an appreciable period to give the elevating means time to return fully to its bottom position, as otherwise the descending elevating bars would hit the tops of the next incoming row of packages. This can make the overall stacking operation unduly lengthy. If the same elevating means is used both to build up the stack and to elevate it for transfer to the boxing station, the incoming flow of packages must be periodically halted even longer in order to give the elevator time to return from its extreme, whole-stack-elevating, position.

It is clearly desirable not to have to hold up the flow of packages into the stacking station for anything other than a minimum, and preferably standard repetitive, time. It would be better still if the flow could continue uninterrupted during the whole of the time the stack was being formed, elevated, and transferred for boxing.

To that end, and in accordance with the invention, the elevating bars preferably describe a non-linear path as they descend, and swing out in a package-avoiding movement to return beneath the incoming row of packages. The first packages of the next row can then start entering the stacking station as the previous row is latched, and, even if the elevating bars go on to lift the whole stack before descending, they can swing out around the incoming row and be back in position by the time all the packages in the row have been counted into the stacking station.

With such an arrangement, if the flow does have to be halted, the dwell period can be long enough for a combined row-elevator and stack-elevator to return

The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

from its extreme (stack-elevating) position, whilst being short enough for the machine to operate at acceptable output rates.

Conversely, with such an arrangement, the flow into the stacking station may be able to be slowed to a rate at which it remains continuous whilst allowing the elevator to return from its extreme position and whilst retaining an acceptable rate of output of stacks from the stacking station.

In the accompanying drawings:

Figures 1, 2 and 3 show the overall layout of one machine embodying the invention, in, respectively, side elevation, plan, and end elevation;

Figures 4A to 4C show in greater detail, and again in side elevation, plan and end elevation, respectively, the conveyor infeed of the machine;

Figures 5A to 5C are views, corresponding respectively to Figures 4A to 4C, of the discharge end of the conveyor and the infeed to the stacking station;

Figure 6 shows in end elevation part of the elevating means;

Figure 7 shows in end elevation and in part-cross-section the collating box of the stacking station;

Figures 8 and 9 are views corresponding respectively with Figures 1 and 2, and show the second machine in side elevation and end elevation; and

Figure 10 is a view of the second machine and corresponds to the Figure 7 view of the first machine.

Figures 1, 2, 3, 8 and 9 are all drawn to the same scale. The remaining Figures are also drawn to the same scale as one another, and this scale is enlarged from that of Figures 1 to 3 and Figures 8 and 9.

The overall operation of both machines can best be understood by referring initially to Figures 1, 2 and 3. A succession of wrapped and sealed packages from a horizontal form-fill-seal machine arrive in a continual high-speed flow indicated in Figure 1 by the arrow A. The form-fill-seal machine forms no part of the present invention, and is not shown in any of the drawings. The packages each contain a chocolate-coated bar, around which they have been fairly loosely formed with crimp-sealed ends. All the packages are of the same general dimensions, but are not guaranteed to be identical with one another. The chocolate-coated bar occupies the greater portion of the length of the package, but the packaging material is not wrapped tightly around it, and the end regions in particular extend well beyond the ends of the bar itself.

The packaging material which surrounds the bars is inherently of a fairly flexible nature. Because of this, and because the packages are considerably longer than the bars they contain, the crimp-sealed end regions of each package are easily deformed.

The incoming flow of packages passes beneath an electronic proximity switch, referenced 11 in Figures 1 and 2. The switch registers the presence or absence of a package on the conveyor which receives the incoming packages. The packages are carried one behind another, in parallel but not co-axial, alignment, in the direction indicated by the arrow B. An air jet, not shown in the drawings, plays across the flow of incoming packages to displace automatically any package which by mischance has inadvertently been formed and sealed without being filled. Such unfilled packages are blown away before they reach the conveyor B.

As the conveyed packages approach the stacking station of the machine, a second proximity switch 12 starts the count. As the packages pass under this switch 12 they are discharged by the conveyor and are picked up by a second conveyor which forms them into a row in echelon. They enter the collating box of the stacking station in this form, as Figure 1 shows clearly.

With a row of packages counted into the collating box as shown in Figure 1, the count for the next row starts. The top stage 13 of a two-stage ram 13, 14 is actuated to cause a spaced-apart pair of elevating bars 15 to lift the row of packages P immediately off the surface of the second conveyor, before the first package of the next row enters the collating box, and lift them between a pair of spaced-apart latching flaps 16, 17 (Figure 3).

The row of packages P is elevated to a position just above the top surfaces S of the latching flaps. The elevating bars 15 are then withdrawn back to their Figure 1 position, and the row of packages rests on and is supported by the top edges S of the flaps 16, 17.

To reach their Figure 1 position after a row-elevating and latching operation, the bars 15 descend below the latching surface S, move out to avoid the incoming packages, move down to a level below the conveyor surface, and move in again below the conveyor. Proximity detectors dictate the path of movement in each case.

When the bars 15 are back in their Figure 1 position, and the second conveyor has moved another row of packages into the collating box position indicated in Figure 1, this second row of packages is elevated by the bars 15 through the latching flaps 16, 17, to displace the first row of packages upwards. The two rows of packages nest tightly against one another. The bars 15 are then withdrawn again, and the second row of packages rests on the top surfaces S of the latching flaps and supports the first row of packages above it.

This procedure is repeated until five rows of packages rest one on top of another on the top edges S of the latching flaps 16, 17. Each time a row of packages is elevated, the second conveyor continues whilst the elevating bars 15 are returned to their non-elevating position. Any break in the flow of packages simply gives the bars 15 a longer "rest" in that position. The extension and retraction of the ram 13, and hence the bars 15, is controlled by proximity switches 18, 19 triggered by a disc 21 carried on a rod 22 which is itself secured to the bars 15.

When a sixth row of packages has been formed in the collating box, the programmable logic circuitry which governs the operation of the whole machine causes the elevating bars 15 to lift this sixth row of packages through the latching flaps 16, 17, as before; but the bottom stage 14 of the two-stage ram 13, 14 is also then actuated to cause the bars 15 to continue lifting the sixth row beyond the surface S of the latching flaps and into an extreme position which is some distance above that surface S. As shown in

Figure 1, the whole stack of six rows of packages is thereby elevated well above the surface S.

A supporting plate 23 is then brought into position beneath the elevated stack. Figure 1 shows the plate 23 in its final stack-supporting position, but it has in fact been kept wholly out of the collating box whilst the stack was being formed and elevated. The blade 23 is secured to a block 24 which slides horizontally back and forth along an elongate linear bearing rod 25 fixed to the main frame of the machine. The rod 25 runs through one side of the block 24. The other side of the block 24 has two rollers 26, 27 projecting from it, and these run along a track 28 as indicated in Figure 2.

Movement of the block 24 along the rod 25 is caused by a ram 29 which is pivoted at one end, referenced 31, to the machine frame and is pivoted at its other end 32, to a crank arm 33.

The arm 33 is fastened to a shaft 34 journalled in the main frame of the machine. Another crank arm 35 is fastened to this shaft 34 and embraces a stub-shaft 36 projecting from one side of the block 24. The end of the shaft 35 is forked around the stub-shaft 36 so as to embrace the shaft 36 without being pivotally fastened to it.

When the ram 29 is extended, it swings the arm 33 clockwise (when viewed as in Figure 1). This in turn swings the arm 35 clockwise and slides the block 24 horizontally to the right (viewed as in Figure 1) until it reaches an extreme position, not illustrated, in which the back end of the block bears against a cross-piece 37. In that position the supporting plate 23 is fully clear of the collating box in which the stack is being built up. When the stack is subsequently elevated to the position indicated in Figure 1, the ram 29 is retracted to swing the arms 33, 35 anti-clockwise (in Figure 1) and move the plate 23 into position beneath the elevated stack as shown in Figure 1.

The pivots 31, 32 enable the ram 29 to swing in a slight arc across its line of stroke and so to accommodate the arcuate movement of the end of the arm 33.

As Figures 2 and 3 show clearly, the plate 23 is forked to allow it to embrace the elevating bars 15 as it comes into position to support the elevated stack of packages. The bars 15 can then be withdrawn, descending vertically initially, and the stack of packages stay supported in the collating box. They are then shifted sideways horizontally in the direction indicated in Figures 2 and 3 by the arrow D. A ram-operated plate 38 moves the entire stack into position above an open-topped flapped carton 39. The "dump flaps" 41 then swing open, pushing into the flaps of the container 39, and a ram-operated plunger 42 assists the force of gravity in pushing the stack into the carton 39.

The then-filled cartons 39 are despatched by conveyor in the direction indicated by arrow E in Figure 2 to be closed and sealed for despatch to retail sales outlets. The carton-erecting and carton-advancing mechanism is illustrated generally in Figures 1 to 3 but forms no part of the present invention. Similarly the means for opening the dump flaps 41, and closing them again, before the filled carton 39 is moved, to receive the next incoming stack from the stacking station, can be selected from known alternatives. So can the method of operation of the plunger mechanism 42.

When the ram-driven plate 38 has moved the stack completely off the supporting plate 23, the plate 23 is automatically withdrawn to its extreme right-hand position (not indicated) in Figure 1. Similarly the plate 38 is withdrawn to its Figure 2 and Figure 3 position as soon as the stack has been dumped into the waiting carton 39.

Once the supporting plate 23 is initially in position beneath the elevated stack, the elevating bars 15 begin to descend vertically as their supporting rams are retracted. They descend vertically to a level at which the elevating "teeth" of the bars 15 are somewhat below the surface S of the latching flaps 16, 17. When the bars 15 have reached the position, just below the surface S, described above, another ram 42 is automatically extended. This ram 42 is pivoted at one end, 43, to the main frame of the whole apparatus, and is pivoted at its other end 44, to a housing which contains the top stage of the two-stage ram 13, 14. When the bars 15 are fully elevated, the top stage 13 of the two-stage ram is pushed up through this housing without the housing itself moving vertically. However, when the ram 42 is extended, this housing is moved to the right (in Figure 1).

The bottom stage 14 of the two-stage ram 13, 14 is pivoted at 45 to the main frame of the machine. When the ram 42 is extended, the two-stage ram swings clockwise (in Figure 1) at the same time as the bars 15 continue to move downwards. The effect of this combined clockwise pivoting and linear retracting movement of the rams 13, 14 is to move the bars 15, from their position just below the surface S, in a clockwise curve (in Figure 1). This curving rightwards and downwards movement continues until the left-hand end (in Figure 1) of the bars 15 is clear of the row of packages P being formed in the collating box.

At that point, the bars 15 will be displaced above and somewhat to the right of the position in which they are shown in Figure 1. The ram 13, 14 will have swung clockwise in Figure 1 through approximately 10 degrees. The swinging movement of the ram 13, 14 is then automatically stopped, by stopping any further extension of the ram 42, and the linear retraction of the rams 13, 14 continues. This causes the bars 15 to move along a straight line towards the pivot 45.

When the bars 15 have reached a position below the row of packages still being formed in the collating box, the rams 13, 14 will be substantially fully retracted. The ram 42 is then retracted to swing the rams 13, 14 back into their substantially vertical position shown in Figure 1, and to bring the bars 15 back underneath the row of packages P now fully formed in the collating box.

The bars are then ready to elevate the row of packages, as previously described. By repeating the described sequence, successive rows of packages can be built up into a stack, the stack can be transferred and boxed, and the elevating bars 15 can be returned to the position shown in Figure 1 whilst the next row of packages for the next stack is being formed in the collating box. In each case the elevating bars 15 reach their Figure 1 position by descending around the curved package-avoiding path dictated by the proximity switches. This path is identical after each row-elevating movement, but incorporates a wider swing after each stack-elevating movement, because the extra time taken to elevate the whole stack will have allowed a relatively greater number of packages to enter the collating box in the formation of the next incoming row.

All the rams on this particular machine are pneumatic rams. Their operation is governed by proximity switches controlled by the programmable logic circuitry with which the machine is equipped. One such switch reference 49 in Figure 1 and not previously referred to, is used to determine when the straight-line movement of the bars 15 should cease, before the rams 13, 14 are swung back into their Figure 1 positions. The disc 21 actuates the switch 49 when it approaches to within a predetermined distance of the switch.

Figures 4A to 4C show in detail the infeed end of the first conveyor. A spaced succession of T-bars 51 are pivoted to the links of an endless chain drive 52. Along the delivery run of the conveyor, the bottom surfaces of the T-bars 51 slide along the top surface of a hard nylon bar 53. The T-bars 51 are automatically kept vertical during the conveying run of the conveyor by this bar 53. When they reach the end of the conveying run, as will be explained with reference to Figures 5A to 5C, they flip backwards (i.e. anti-clockwise when viewed as in Figures 4A and 5A) and they are not supported during the return run of the conveyor.

The conveying chain 52 is supported throughout both its conveying and return runs. The supports are indicated at 54. Threaded means of adjusting the tension in the conveying chain 52, by moving the sprocket 55 which carries the chain, are indicated at 56. They need not be described in detail.

At the discharge end of the first conveyor, shown in Figure 5A, the nylon bar 53 ends before the conveying chain 52 is taken around the sprocket 55 which drives the first conveyor. When the T-bars ride off the end of the bar 53, they pivot backwards as shown in Figure 5A. This enables them to ride underneath the "teeth" 57 of the second conveyor which takes over the conveying of the packages P and automatically lifts them into echelon formation.

The second conveyor comprises two endless drive chains 58 each travelling in unison and each with teeth 57 permanently fixed to its links. As Figure 5C shows, the two chains 58 are spaced apart across the second conveyor, and the single chain 52 of the first conveyor overlaps them at its discharge end and travels in between them. Tracks 59 support the chains 58 on their delivery runs.

There is a clutch and brake mechanism at the infeed end of the first conveyor. There is another such mechanism at the discharge end of the first conveyor, and infeed end of the second conveyor, shown in Figure 5A and 5B. Neither mechanism need be described in detail, and they are not referenced in the drawings. These mechanisms enable the normally continually-driven conveyors to accommodate "no-pack-present" indications from either of the switches 11 and 12, by momentarily stopping and starting again, and to allow pack-rejection at any point up to the entry to the collating box. The first conveyor is driven normally slightly faster than the flow of packages arriving from the form-fill-seal machine.

Figure 6 shows the construction of the elevating bars 15, and also indicates the way in which the rod 22 is constrained between nylon guides 61 which are fixed to the main frame of the machine and which give stability to the two-stage ram 13, 14, and the elevating bars 15, during the extending, retracting, and swinging movements of these parts.

Finally Figure 7 shows the construction of the collating box, including the way the flaps 16, 17 pivot and are spring-loaded towards one another; the way in which the plate 23 is forked to clear the elevating bars 15; the way the end face of the collating box is itself cut out to allow the elevating bars 15 to swing clear of the box as they avoid the new row of packages during their descending movement after elevating a row, or after elevating the entire stack; and the three successive positions of packages P, i.e. formed into a row; elevated and latched, and elevated and supported by the plate 23 before being transferred and dumped.

In the drawings, the surfaces indicated by a quartered roundel symbol are datum surfaces. The dimensions of the collating box can be altered to accommodate rows of packages, and stacks, of different sizes, by moving the box sides and end face towards or away from the datum surface. The means of adjustment need not be described in detail.

Each formed stack is elevated to a level high enough for the first row of the next stack to be elevated and latched into place with the stack-supporting plate 23 still supporting the existing stack in the collating box. By the time the next row of the new stack is elevated, the existing stack will have been fully transferred onto the dump flaps 41, and the stack-supporting plate will have withdrawn from the collating box.

The machine shown in Figures 8, 9 and 10 is generally similar to that of Figures 1 to 7. Corresponding parts have been given the same reference numbers. This second machine is designed especially to cope with high-speed inputs to the collating box. The elevating bars 15 are used solely for row-elevating, and the periodic stack-elevating requirement is catered for by a pair of secondary latching flaps. Thus the cycle of movement of the elevating bars need not vary.

As before, the elevating bars 15 elevate each row of packages vertically under the action of a pneumatic ram 14. This time, however, the ram 14 operates through a swing linkage, one of whose pivots (61) is fixed to the machine frame whilst the pivot 45 can swing about that pivot 61. This enables the elevating ram 14 and the swing-out ram 42 to give the elevating bars 15 a more efficient curved descending path.

As before, latching flaps 16, 17 support the rows of packages as they are elevated to build up the stack.

Additional, secondary, latching flaps 16a, 17a lie outside the primary latching flaps 16, 17 and can be elevated by their own pneumatic ram 62 (Figure 8). Both flaps 16a, 17a are moved simultaneously up and down by the ram 62 in operation.

The top surfaces of the secondary latching flaps 16a, 17a lie normally level with the top surfaces of the primary flaps 16, 17 as Figure 10 shows. Each time a row of packages is elevated, the top surfaces of both sets of flaps support it. To elevate the entire stack to the point at which the supporting plate 23 can be brought underneath it, the ram 62 is actuated and the secondary latching flaps 16a, 17a rise simultaneously to bear the bottom row of the stack off the top surfaces of the primary flaps 16, 17 and raise it to a position, shown in broken line in Figure 10, at which the plate 23 can be brought underneath it.

The slideways along which the secondary latching flaps 16a, 17a move need not be described and are not illustrated in any detail in the drawings. Their design can readily be settled by the skilled reader.

A top control is used in this second machine, to counteract any tendency of packages on the top row of the stack to jack-knife, fall forward, and generally disturb the collation under the forces generated by high-speed elevating. The top control comprises a steel plate 63 whose under surface is faced with a foam rubber pad 63a, supported on an arm 64 which moves vertically up and down between spaced rollers 65 fixed to the movable end of a pneumatic ram 65a. The other end of the ram 65a is fixed to the machine frame.

A vertical back plate 66 is also fixed to the movable end of the ram 65. The top control plate 63 and its arm 64 can slide up and down in the rollers 65, without the back plate 66 moving; but when the ram 65a is actuated, the back plate 66 is lifted with the rollers 65 until all the lost-motion between the moving ram-end and the arm 64 has been taken up, and the arm 64 is then lifted a relatively short distance with the back plate 66.

The operation of this second-embodiment machine can best be described from the point where the top control 63 and back plate 66 are lifted and held by the ram 65a in their uppermost position. The pad 63a will then be just off the top of the elevated stack, which is itself supported on the plate 23, and the plate 66 will not obstruct the entrance to the dump flaps 41. The stack can thus be swept onto the dump flaps from the plate 23.

Once the stack has been transferred into the dumping position, the plate 23 moves across to the right (in Figure 8), the secondary latches 16a, 17a start to descend under the control of their ram 62, and the ram 65a starts to lower the top control 63 and the back plate 66. The elevating bars 15 will already have descended to lift the next incoming row of packages.

The various operations are so synchronised that as the first row of the next stack is latched by the elevating bars 15, the secondary latches 16a, 17a have almost but not quite completely descended onto a level with the primary latches. The descending secondary latches thus act as a "top control" for this first row of latched packages. The top control proper, 63, is lowered to a position in which its foam pad sits just far enough above the latched row of packages to be contacted by them when they are automatically raised by virtue of the second row being latched into place beneath them. The secondary latches, which effectively acted as a top control for the first latched row only, will have reached their Figure 10 position long before the second row is latched into place.

With each successive latching movement of a row of packages, the top row of the thus-formed stack pushes the pad 63a and plate 63 up the lost-motion connection represented by the arm 64 and rollers 65, without the ram 65a moving. The back plate 66 does not move during this sequence, but prevents any packages being inadvertently pushed sideways towards the dump flaps 41. As the sixth row is latched onto the primary latches 16, 17, the secondary latches 16a, 17a elevate the whole stack and hold it for the plate 23 to travel across and support the stack. At the same time, the ram 65a raises the back plate 66 and, when the lost-motion connection has been fully taken up, also lifts the plate 63 a short distance off the top of the fully-elevated and supported stack.

The stack can then be transferred onto the dump flaps 41, and the whole cycle repeated.

The elevating bars can be lifting the next incoming row without having to wait for the secondary latches to descend fully. The whole operating cycle is thus quicker than the previous one.

CLAIMS

1. Apparatus for automatically stacking and boxing a flow of elongate packages each of generally non-cylindrical cross-section, the apparatus comprising means to count off from the flow a desired number of packages; means to collate the counted-off packages into a generally horizontal row with their respective longitudinal axes mutually parallel and their respective corresponding ends substantially in-line; means to orientate the row of packages into an echelon formation; means to lift the row in that formation and to deposit it across a pair of spaced-apart supporting surfaces; means to repeat the above steps automatically and thus build up, from beneath, a row-on-row stack of nested packages; and means to transfer the stack, without substantially altering its built-up form, from the stacking station for dumping into a waiting box.

2. Apparatus according to Claim 1 and in which the stack-transferring means comprise means to lift the built-up stack off the supporting surfaces, and means to hold the thus-lifted stack temporarily above those surfaces, before transferring the stack to the waiting box.

3. Apparatus according to Claim 2 and in which the same means is used both to lift and deposit each row onto the supporting surfaces and to lift the bottom row of each built-up stack off the supporting surfaces, said means comprising a two-stage ram-operated elevating beam.

4. Apparatus according to Claim 2 and in which one means is used to lift and deposit each row onto the supporting surfaces, and a separate means is used to lift the bottom row of each built-up stack off

the supporting surfaces, said one means comprising a ram-operated elevating beam, and said separate means comprising a pair of spaced-apart supporting surfaces which are additional to and normally lie level with or below the first-mentioned supporting surfaces, and which rise in unison from the first-mentioned surfaces to lift the bottom row of the stack off those first-mentioned surfaces.

5. Apparatus according to Claim 4 and in which both pairs of supporting surfaces comprise spaced-apart latches with the secondary, stack-lifting, latch surfaces movable up and down in unison away from and back to the level of the primary, row-supporting, latch surfaces.

6. Apparatus according to any of the preceding Claims and in which the row-elevating means descend in a curve, after depositing each row on the supporting surfaces, to travel around and beneath the incoming packages of the next row.

7. Apparatus according to any of the preceding Claims and in which a top-control surface spans and bears against the packages in the top row of the stack and is automatically pushed upwards by those packages as the stack is built up.

8. Apparatus according to Claim 7 and in which a back plate keeps the package ends in-line as the stack is built up, with a lost-motion connection enabling the top-control surface to be pushed up without moving the back plate, and wherein the back plate and top-control surface are both moved automatically out of contact with the stack when the stack is ready for transfer.

9. Apparatus for stacking a flow of packages and for transferring the built-up stacks from the stacking station, the apparatus being constructed and arranged to operate substantially as described herein with reference to and as illustrated in Figures 1 to 7 of the accompanying drawings.

10. Apparatus according to Claim 9 when modified substantially as described herein with reference to and as illustrated in Figures 8, 9 and 10 of the accompanying drawings.

11. A method of automatically stacking and boxing a flow of elongate packages each of generally non-cylindrical cross-section, the method comprising the steps of counting off from the flow a desired number of packages; collating the counted-off packages into a generally horizontal row with their respective longitudinal axes mutually parallel and their respective corresponding ends substantially in-line; orientating the row of packages into an echelon formation; lifting the row in that formation and depositing it across a pair of spaced-apart supporting surfaces; repeating the above steps automatically and thus building up, from beneath, a row-on-row stack of nested packages; and transferring the stack, without substantially altering its built-up form, from the stacking station for dumping into a waiting box.

12. A method according to Claim 11 and comprising the step of lifting the built-up stack off the supporting surfaces, and holding the thus-lifted stack temporarily above those surfaces, before transferring the stack to the waiting box.

13. A method according to Claim 11 or Claim 12 and in which the stack is compressed from above, as it is built up, to assist in retaining its form.

14. A method according to any of Claims 11 to 13 and in which the respective corresponding ends of the packages in the stack are positively kept in-line as the stack is built up.

15. A method of stacking a flow of packages and transferring the built-up stacks from the stacking station, substantially as described herein with reference to and as illustrated in the accompanying drawings.

Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1983.
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.