United States Patent

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[33] Germany
[31] No. W44056

[54] **STACKING APPARATUS FOR USE WITH BAG-MAKING MACHINES**
13 Claims, 12 Drawing Figs.

[52] U.S. Cl. 271/75
[51] Int. Cl. B65h 29/34
[50] Field of Search .... 198/203, 75, 76; 74/665C, M, L, 661, 670; 271/75, 76

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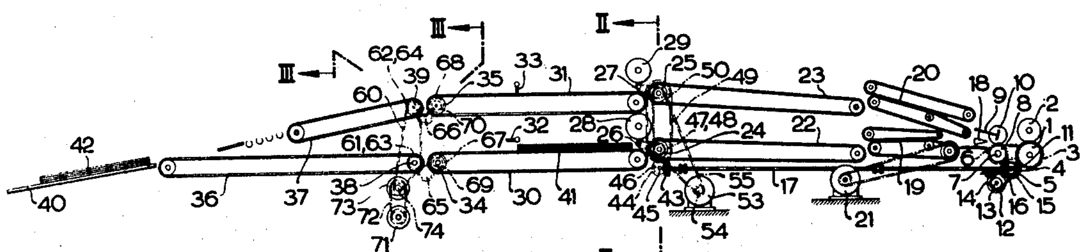
ABSTRACT: The discharged workpieces are charged by means of a deflector in alternation in a predetermined number to an upper shingling conveyor belt and in the same number to a lower shingling conveyor belt. The shingling conveyor belts revolve in normal operation at a speed which is lower than the machine speed and forward the workpieces to respective upper and lower collecting conveyor belts, which are provided with devices for forming stacks of workpieces. When the machine is running at a low speed, the shingling belts are driven at a low speed, which ensures a satisfactory conveyance to the stack-forming device and is independent of the speed of the machine. Said low speed of the shingling belts is so selected that the workpieces arriving on the shingling belts are spaced apart by a distance *d* and the workpieces are shingled on the shingling belts when the machine is running at a higher speed. The speed of the shingling belts is automatically controlled in such a manner that after an increase of the speed of the machine from a low value almost to a value at which the workpieces would closely succeed each other on the shingling belts the speed of the latter is suddenly reduced to such a value that the workpieces are shingled on the shingling belts, whereas a deceleration of the machine from a high speed almost to a value at which the shingling of the workpieces on the shingling belts would cease results in a sudden increase of the speed of the shingling belts to such a value that the workpieces arriving on the shingling belts are spaced apart.



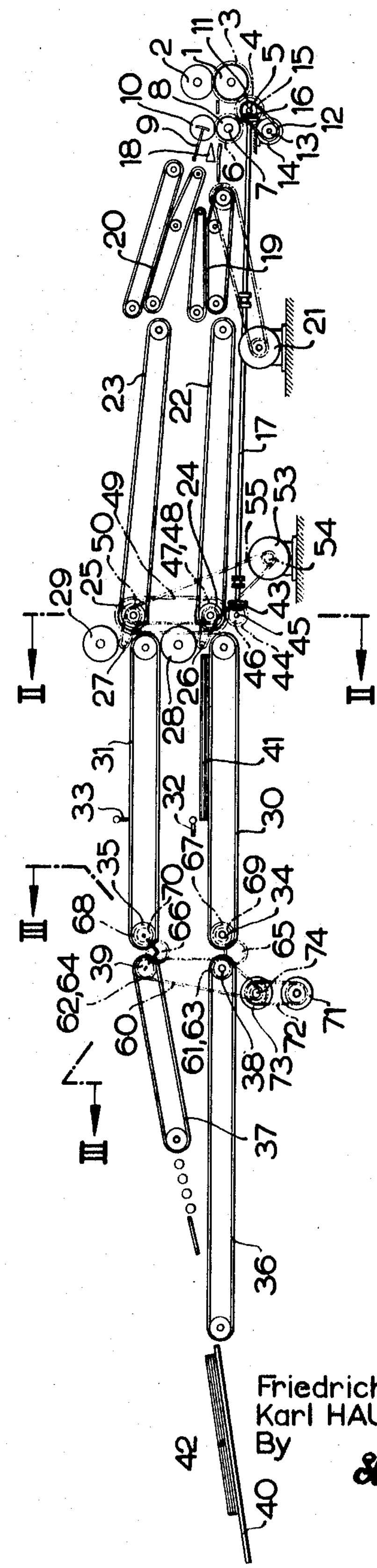


FIG. 1

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FIG. 3

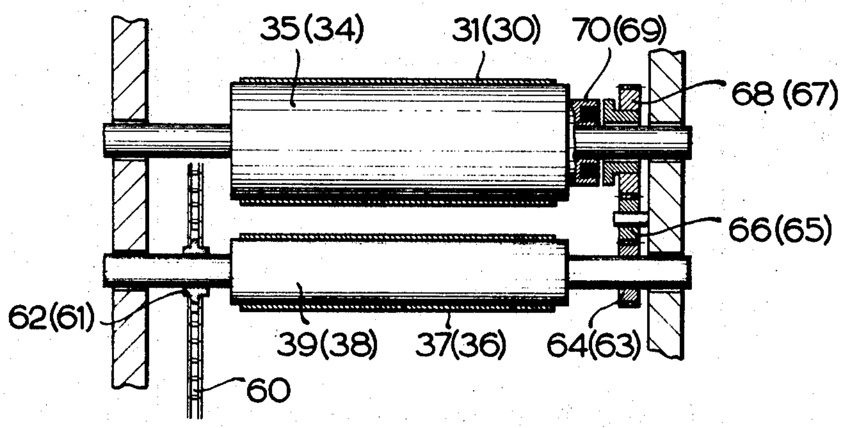

FIG. 2

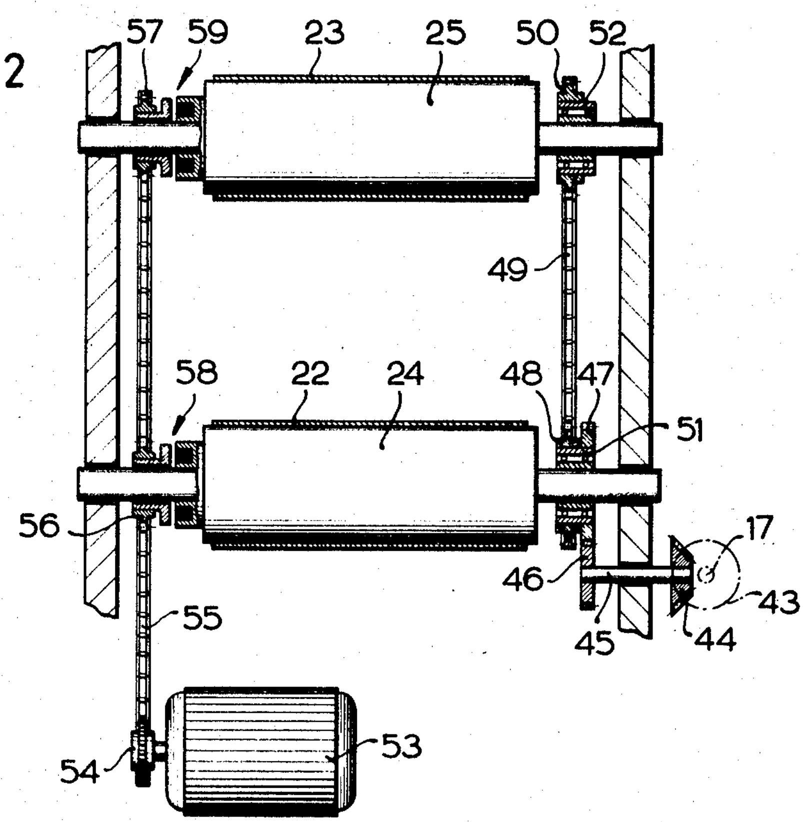

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FIG. 6

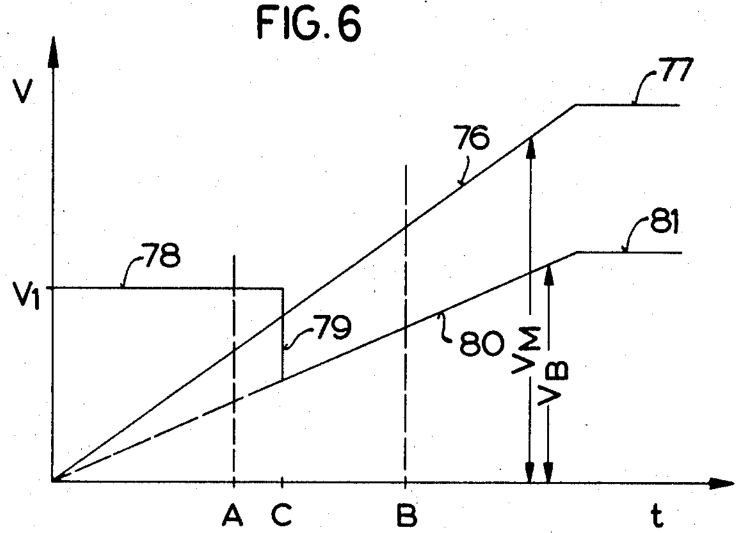

FIG. 4

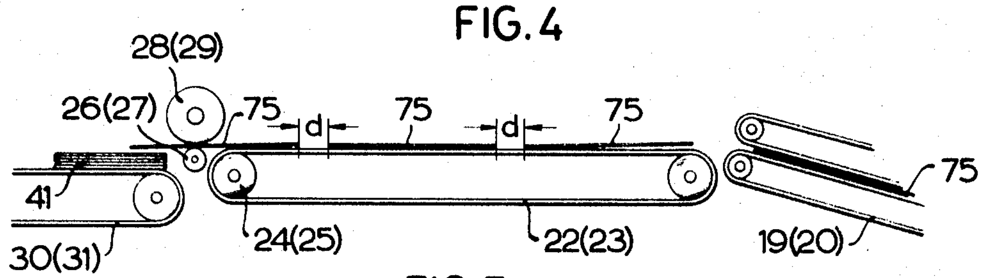

FIG. 5

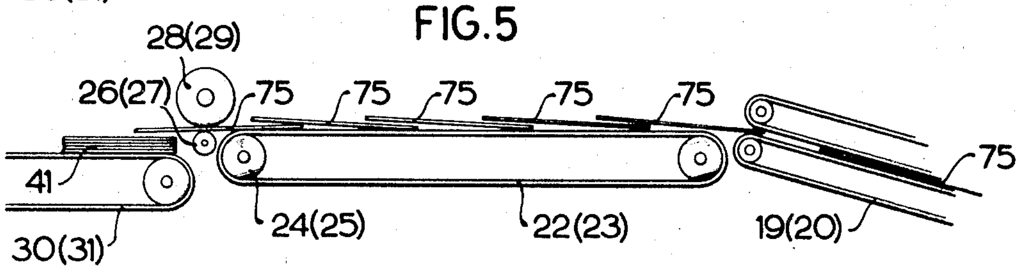

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FIG. 7

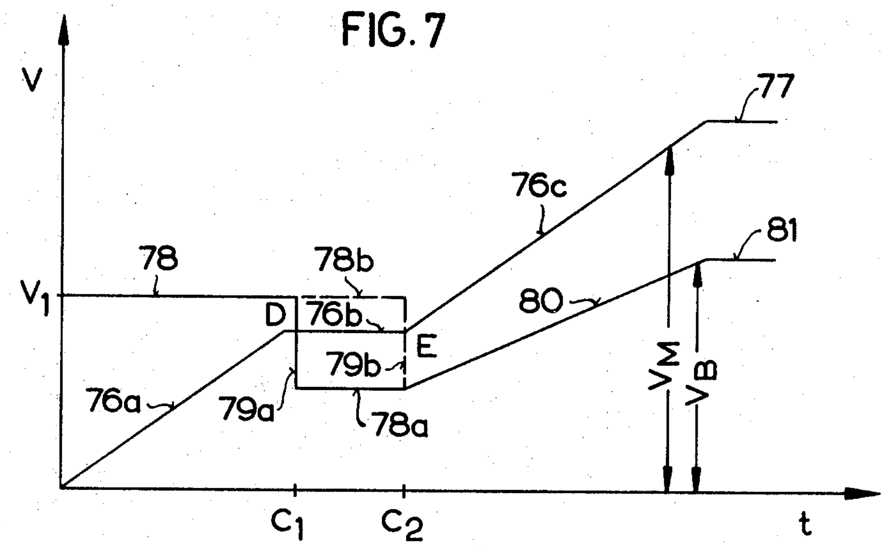
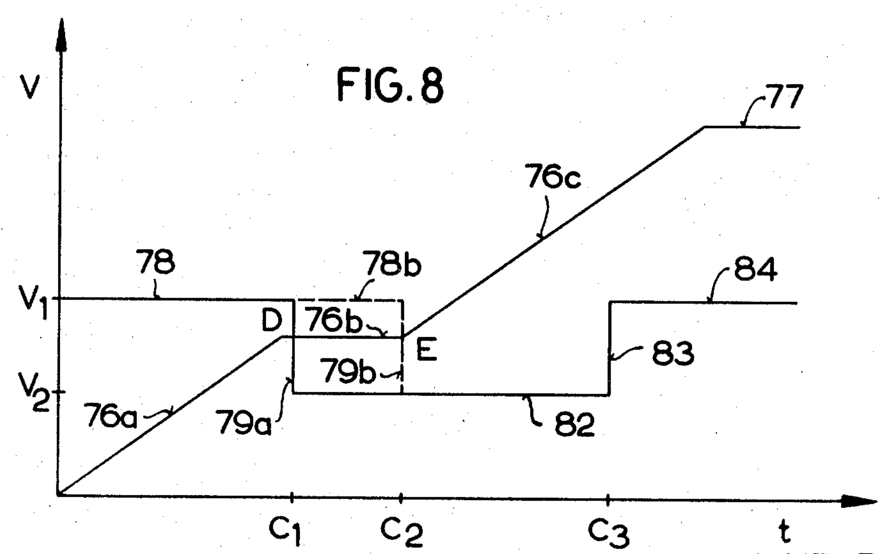


FIG. 8



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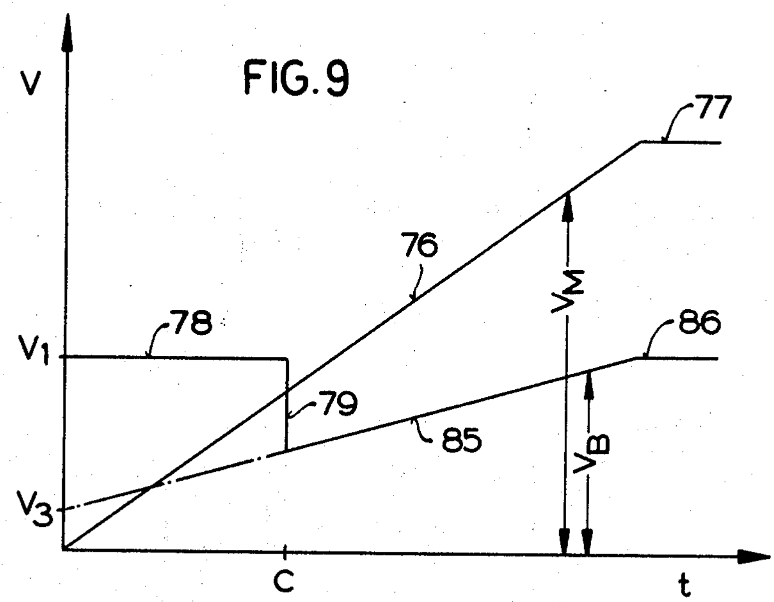

FIG. 9

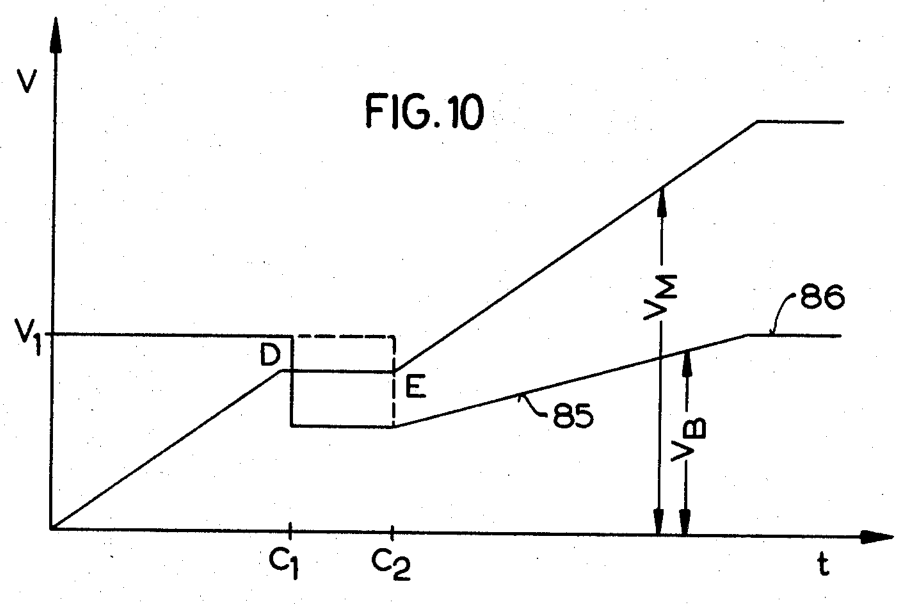

FIG. 10

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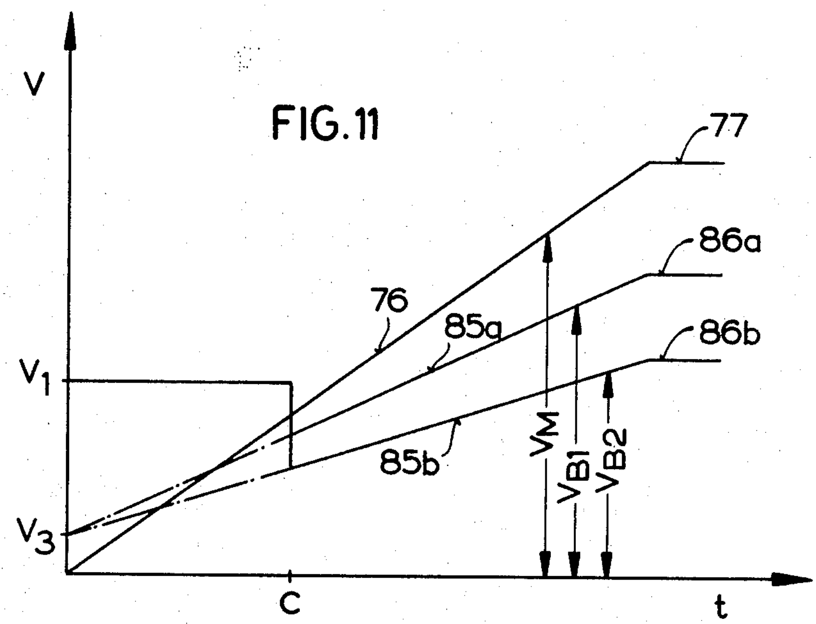
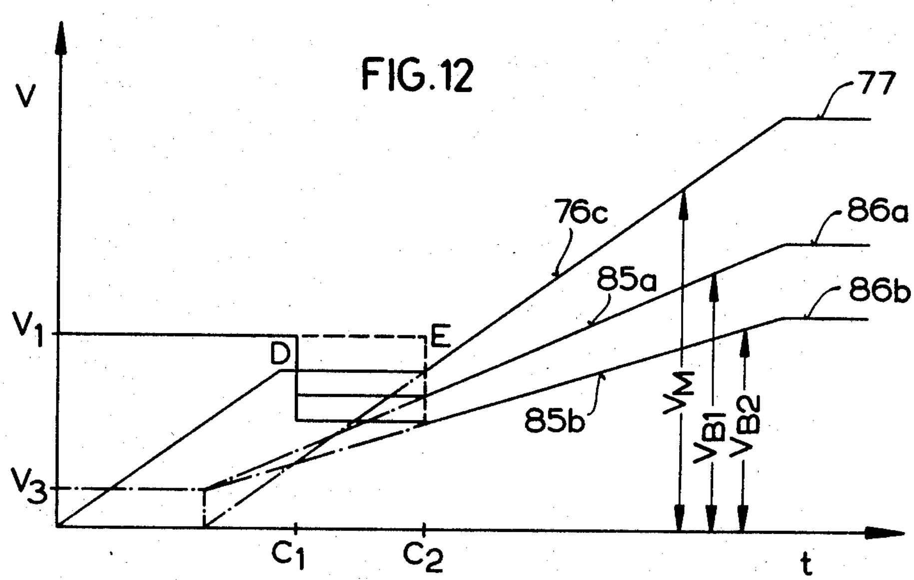


FIG. 11

FIG. 12



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STACKING APPARATUS FOR USE WITH BAG-MAKING MACHINES

It is known to use a deflector for delivering the paper tube section discharged from the discharge rolls of a tube-making machine in desired numbers in alternation to upper and lower shingling belts in the manufacture of paper bags. The shingling belts move at a lower speed than the machine and deliver the tube sections to respective upper and lower collecting conveyor belts, on which the tube sections are collected in stacks, *e.g.*, by running against a stop or in a different manner, and these stacks are then forwarded.

The previously known plants have the disadvantage that with the machine running at a low speed the shingling belts move so slowly that, particularly with tube sections which are long and very soft, difficulties are involved in the formation of stacks on the succeeding collecting conveyor belts because the tube sections are not reliably conveyed to the hinged stop plate, which can be swung back, or to similar means. Exact stacks can be formed from such tube sections only when the tube sections are transferred at least at a certain minimum speed from the shingling belt to the collecting conveyor belt.

To eliminate this difficulty, it is a feature of the present invention that the shingling belts can be driven at a certain minimum speed, which is independent of the machine speed and ensures a satisfactory conveyance for a formation of stacks, even when the bagmaking machine is moving at a low speed. When the machine is running at a low speed, the tube sections moving on the shingling belts in succession are spaced apart whereas they will be shingled on the shingling belt and dropped from the latter in shingled form onto the collecting conveyor belt when the machine is moving at a higher speed, particularly at the usual speed. The workpieces will then be shifted on the collecting conveyor belt relative to each other as they strike the hinged stop plate. When the speed of the machine is increased from a low value, a critical condition will exist at the time when the machine and the shingling belt have approximately the same speed. At this time, the leading and trailing edges of the tube sections dropped onto the shingling belts strike each other so that no stacks can be formed on the succeeding collecting conveyor belts because each succeeding tube section cannot be thrown against the hinged stop plate individually or while moving over the preceding tube section but will strike against the preceding tube section and cannot move relative thereto. For this reason, the realization of the above-mentioned concept of the invention necessitates an automatic control of the speed of the shingling belts in such a manner that the acceleration of the machine from a low speed results in a sudden reduction of the speed of the shingling belts just before the workpieces closely succeed each other on the shingling belts and this sudden reduction has the result that the workpieces are shingled on the shingling belts, whereas the deceleration of the machine from a high speed results in a sudden increase of the speed of the shingling belts just before the shingling of the workpieces on the shingling belts ceases, and this speed increase results in a deposition of workpieces in spaced apart relation on the shingling belts. As a result of the invention, the speed of the shingling belts is so high when the machine is running at a low speed that a formation of stacks on the succeeding collecting conveyor belts is ensured, the speed of the shingling belts when the machine is running at a high speed is so low that the paper tube sections discharged at a high velocity are sufficiently braked and a satisfactory formation of stacks is ensured also under this condition, and, particularly, the transition from one speed of the shingling belts to the other will be effected without a disturbance.

The sudden change of the speed of the two shingling belts cannot be effected at any desired time because this would result for a short time in an undesired close succession of the workpieces on the shingling conveyor which is receiving tube sections when the speed is changed and such close succession could result in a disturbance. For this reason it is a feature of the invention that the change of the speed of both shingling belts can be effected simultaneously during the shifting of the deflector so that the previously charged belt has been completely charged with tube sections in one mode and the belt which is to be subsequently charged is charged from the beginning with tube sections in the other mode.

Because the time when the speed is changed must be most exactly chosen in the embodiment of the invention which has just been described, and the change of speed must be effected within an extremely short time, it is more desirable, in accordance with another proposal of the invention, to effect the change of speed of the two shingling belts in succession, more particularly, to effect the change of speed of each shingling belt while the other shingling belt is being charged. In order to prevent an undesired close succession of workpieces on one conveyor belt during the charging period in which the speed of the other conveyor belt is being changed, the change of the speed of the shingling belt which is to be changed in speed first must be effected at a time which precedes by a full stack-forming period the time when the close succession of workpieces would be obtained so that the speed of the other conveyor belt can also be changed in time before that condition obtains, or, in accordance with another proposal of the invention, the speed of the machine must be maintained constant from the change of the speed of the first shingling belt to the change of the speed of the second shingling belt. This means that the increase or decrease of the speed of the machine is blocked until the speed of both shingling belts has been changed.

The change of the speed of the shingling belts may preferably be initiated by an actuating element, which is controlled by the machine speed and may consist of an electric generator tachometer, which is coupled to the means for driving the machine and cooperates with a suitable electric controller.

It will also be desirable if the speed of the shingling belts is increased after the sudden deceleration when the speed of the machine is increased further and the speed of the shingling belts in this speed range is always kept below the discharge velocity of the machine. In this case, the overlap of the shingled tube sections on the shingling belts will not be so large, even at a very high production rate of the tube-making machine, that the smooth conveyance by the collecting conveyor belts into engagement with the hinged stop plates will be endangered.

According to another proposal of the invention, the drive which is independent of the machine is imparted by an electric motor which operates at a constant, preferably adjustable speed, and the operation of the shingling belts during the high-speed operation of the machine is preferably derived from the means for driving the machine so that additional drive means are not required during normal operation. Alternatively, the operation of the shingling belts may be independent of the operation of the machine when the same is running at a high speed when a predetermined speed of the shingling belts is of primary significance rather than the overlap of the shingled workpieces.

It is also proposed in accordance with the invention that the means for driving the shingling belts independently of the machine are connected to the drive pulleys for the shingling belts by clutches, preferably solenoid clutches, which are disengageable and/or engageable by a control signal in response to the machine assuming a limiting speed, and the further drive means are connected to the drive pulleys for the shingling belts by freewheel clutches. As soon as the critical speed is reached, the clutches between the electric motor and the drive pulleys for the shingling belts are disengaged, *e.g.*, in that the solenoid clutches are deenergized by a switching device controlled by an electric generator tachometer, whereafter the drive pulleys for the shingling belts are automatically driven by the freewheel clutches, which previously transmitted no torque but acted as overrunning clutches.

Further details of the invention will become apparent from the following description of embodiments which are shown by way of example in the drawings, in which:

FIG. 1 is a diagrammatic view showing a tube section delivering station provided with means for an automatic formation of stacks,

FIG. 2 is a sectional view taken on line II–II of FIG. 1 and shows the basic arrangement of the means for driving the shingling belts.

FIG. 3 is a sectional view taken on line III–III in FIG. 1 and shows the basic arrangement of the means for driving one of the collecting conveyor belts which succeed the shingling belts.

FIGS. 4 and 5 show one of the shingling belts of FIG. 1 at different speeds of the tube-making machine.

FIG. 6 is a graph in which the speed of one of the shingling belts of FIG. 1 is plotted as a function of the machine speed.

FIG. 7 is a graph in which the speed of both shingling belts is plotted as a function of the speed of the tube-making machine.

FIG. 8 is a graph in which the speed of both shingling belts is plotted as a function of the speed of the tube-making machine according to another embodiment of the machine.

FIG. 9 is a graph in which the speed of one of the shingling belts of FIG. 1 is plotted as a function of the speed of the machine in a third embodiment of the drive means according to the invention.

FIG. 10 is a similar representation which applies to both belts.

FIG. 11 is a graph in which the speed of one of the two shingling belts of FIG. 1 is plotted as a function of the speed of the machine in a fourth embodiment of the drive means according to the invention and

FIG. 12 is a similar representation which is applicable to both shingling belts.

Paper tube sections are fed from discharge rolls 1, 2 via conveyor rollers 8, 10 and a deflector 18 to discharge belts 19, 20. The discharge roll 1 carries a gear 3, which drives a gear 4 that is fixed to a shaft 5. The gear 4 drives a gear 6, which is fixed to a shaft 7, and conveyor rollers 8 secured to the shaft 7. By peripheral friction, the conveyor rollers 8 drive conveyor rollers 10, which are mounted on levers 9.

A V-belt pulley 11 is secured to the shaft 5 and by means of a V-belt 12 drives a V-belt pulley 13, which is secured to the shaft of a d.c. generator 14. The latter rotates in synchronism with the discharge rollers 1 and 2 and with the feed rolls of the tube-making machine so that the output d.c. voltage is proportional to the machine speed. This voltage serves for controlling the shingling belts of the delivery unit.

The discharge belts 19, 20 are driven by a motor 21, which may run at a preselected, constant speed. The speed of the discharge belts 19 and 20 may be additionally controlled in dependence on the machine speed when the latter is high. This concept is not illustrated here because it does not belong to the subject matter of the invention.

The discharge belts 19, 20 drop the tube sections onto lower and upper shingling belts 22 and 23. Tube sections are dropped in a predetermined number onto the lower shingling belt 22 and then in the same number on the upper shingling belt 23. The change is effected by a deflector 18, which is controlled in known manner by a counter to feed tube sections in a predetermined number to the lower discharge belts 19 and then in the same number to the upper discharge belts 20.

The shingling belts 22, 23 are driven by pulleys 24, 25. The means for driving these pulleys belong to the subject matter of the invention and will be described hereinafter.

From the shingling belt 22, 23, the tube sections are moved through the nip between rolls 26, 27 and backing rolls 28, 29 to conveyor belts 30, 31. The rolls 26, 27 are driven by the pulleys 24, 25 to move at least at the same speed. The tube sections accumulate on the conveyor belts 30, 31 before hinged stop plates 32, 33, which are actuated by compressed-air cylinders. In this manner, stacks are formed from the tube sections. The compressed air cylinders for actuating the hinged stop plates 32, 33 are controlled by solenoid valves, which are controlled by contacts, not shown, from the counter which controls also the deflector 18. The conveyor belts 30, 31 are driven via pulleys 34 by drive means which will be described hereinafter. The conveyor belts 30, 31 may be succeeded by conveyor belts 36, 37, which are operated by pulleys 38, 39 and feed a delivery table 40 with tube section stacks 41, 42, which have been formed on the conveyor belts 30, 31 with the aid of the hinged stop plates 32, 33 and can be removed by hand from the delivery table 40.

For a rapid change of the speed of the shingling belts 22, 23 in accordance with the invention, the pulleys 24, 25 for driving said belts may be driven by freewheel clutches at a low speed, which is lower than the machine speed, or with the aid of selectively engageable solenoid clutches from an electric motor having an adjustable, constant speed. The movement at a low speed may be derived, *e.g.*, from the tube-making machine. For this purpose, a bevel gear 15 is secured to the shaft 5 and in driving mesh with a bevel gear 16 on a shaft 17. A bevel gear 43 is secured to the shaft 17 at the other end thereof and drives a bevel gear 44 and with it a shaft 45 and a gear 46. The latter drives a gear 47, which is secured just as a chain sprocket 48 to the outer ring of a freewheel clutch 51. The sprocket 48 drives by a chain 49 a sprocket 50, which is secured to the outer ring of a freewheel clutch 52. The freewheel clutches 51, 52 are secured to stub shafts of the pulleys 24, 25 for driving the shingling belts 22, 23 so that the latter are driven from the tube-making machine via the shaft 17 and the freewheel clutches 51, 52 at a speed which is proportional to the machine speed but always lower than the latter in a predetermined ratio as a result of the gear ratios which have been selected.

Alternatively, the pulleys 24, 25 and with them the shingling belts 22, 23 may be driven by an adjustable electric motor 53 via a sprocket 54, a chain 55, sprockets 56, 57 and selectively engageable solenoid clutches 58, 59. The speed of the motor should be selected so that the speed imparted by it to the pulleys while the machine speed is below a predetermined value is higher than the speed imparted by the tube-making machine to the freewheel clutches 51, 52, which then act as overrunning clutches. When the solenoid clutches are disengaged, the pulleys 24, 25 will be driven by the freewheel clutches 51, 52 so that their speed will suddenly be reduced to a value which is proportional to the machine speed. It will be described hereinafter how this change is effected and at what time.

The tube sections which have left the shingling belts 22, 23 are formed into stacks on the conveyor belts 30, 31 as has been described hereinbefore. For this purpose, that belt on which a stack is being formed is preferably standing still. To this end, the conveyor belts 30, 31 may be driven via the constantly revolving conveyor belts 36, 37 from a chain 60 and sprockets 61, 62, which are secured to the stub shafts of the pulleys. Gears 63, 64 are also secured to the stub shafts of pulleys 38, 39 and by idlers 65, 66 drive gears 67, 68, which by the disengageable solenoid clutches 69, 70 drive pulleys 34, 35 and with them the conveyor belts 30, 31. To select the speed of the belts 36, 37 and of the belts 30, 31, the chain 60 may be driven from an electric motor 71 by an adjustable V-belt drive 72, a gear reducer 73 and a sprocket 74, which is secured to the output shaft of said reducer. In this case, the belts 36, 37 revolve at a preselected, constant speed and the conveyor belts 30, 31 may be operatively connected and disconnected by the solenoid clutches 69, 70. The solenoid clutch 69 or 70 is energized by the same contacts as the solenoid valves for controlling the hinged stop plates 32, 33 so that each of the belts 30, 31 will be started when the associated hinged plate 32, 33 is opened.

FIGS. 4 and 5 are diagrammatic representations of the mode of operation of the shingling belts 22, 23 in accordance with the invention for an explanation of the speed control thereof. Tube sections 75 leave the discharge belts 19, 20 at a high speed. The shingling belts 22, 23 run at a lower speed so that they brake the tube sections 75 sufficiently to ensure a neat stacking on the conveyor belts 30, 31. The braked speed will be selected in view of the length and weight of the tube sections and the softness of the material. When the machine speed is low, as is illustrated in FIG. 4, the discharge belts **19** (**20**) discharge only a small number of tube sections per unit of time so that the tube sections will be spaced apart on the shingling belt **22** (**23**). When the machine is running at a higher speed, as is shown in FIG. 5, the discharge belts **19**, **20** discharge much more tube sections **75** per unit of time and said tube sections will be shingled on the shingling belts **22**, **23** when the speed of the latter is not changed. In this case, the tube sections reach the stack **41** at the same speed. At a certain speed of the machine, there is a transition from spaced apart tube sections as shown in FIG. 4 and shingled tube sections as shown in FIG. 5. This transition represents a critical condition, under which the stacking is endangered because the leading edge of the section discharged at high speed engages the trailing edge of the braked section which is already on one of the shingling belts **22**, **23**.

According to the invention, this critical condition is avoided in that the speed of the shingling belts **22**, **23** is reduced at the time at which the machine has such a speed that the distance *d* between the individual tube sections has been reduced to a still permissible minimum. The reduced speed of the shingling belts is below the machine speed. When the machine speed increases further, the speed of the shingling belts will be increased to a value which corresponds to the original speed but is always below the machine speed.

This mode of operation is shown in the speed graph of FIG. 6, in which the speeds of the machine and of the shingling belts **22**, **23** are plotted on the vertical axis and the unit of time is plotted on the horizontal axis.

When the machine is starting up, the machine speed **76** increases with the time *t* to a maximum **77**. The speed **78** of the belts **22**, **23** remains initially constant at the fixedly adjusted value v_1 until the machine speed **76** has almost reached that value. Under this condition, represented by the point C, the speed of the belts is reduced in accordance with a line **79** to a value below the machine speed **76**. The speed of the belts **22**, **23** then increases in proportion to the machine speed in accordance with line **80**, **81**. As a result, points A and B of the graph represent approximately the conditions depicted in FIGS. 4 and 5, respectively, and the overlap of the shingled tube sections **75** on the belts **22**, **23** remains always the same above the point C, regardless of the machine speed. As the speeds are proportional, the extension of line **80** intersects line **76** at the origin of the graph.

The mode of operation which has been described hereinbefore will be performed because the solenoid clutches **58**, **59** are disengaged at the proper time, when point C has been reached, so that the shingling belts **22**, **23** are no longer driven at a constant speed by the motor **53** but are driven from the machine by the freewheel clutches **51**, **52**. The change is effected when the output voltage of the electric generator tachometer **14** is sufficient to operate in known manner a suitable switching device, such as a relay or a contact-actuating voltmeter.

Tests have shown that this time cannot be selected indiscriminately because the above-mentioned difficulties may occur on that of the two shingling belts **22**, **23** which is being charged with tube sections **75** by the deflector **18** at the time represented by the intersection of lines **76** and **79**.

To prevent these difficulties, the solenoid clutches **58**, **59** are controlled as shown on the modified graph of FIG. 7. In accordance with line **76a**, the machine speed increases to the point D, at which the change is to be initiated by the electric generator tachometer. The switching device for increasing the speed of the machine is then disabled by known measures so that the machine speed remains constant. At the point C_1, that of the shingling belts **22**, **23**, which is not being charged with tube sections from the deflector is then coupled to be driven by the machine in accordance with lines **79a**, **78a**, whereas the second shingling belt is driven from the motor **53** by the corresponding solenoid clutch, in accordance with line **78b**, as long as said second belt is charged with tube sections from the deflector **18**. When the deflector is shifted, the second shingling belt **22** or **23** is also coupled to the machine at point C_2 in accordance with line **79b**. The blocking of the means for accelerating the machine may be removed at the same time so that the machine can be further accelerated after point E in accordance with lines **76c**, **77**. The change is also effected by known switching elements in conjunction with the electric generator tachometer **14** and the above-mentioned contacts at the counter which is associated with the deflector **18**.

In a special mode of carrying out this process, the lines **79a** and **79b** may be caused to coincide under certain conditions, which means that both belts are coupled to the machine at the same time. This time must be selected most exactly to agree with the time when the deflector **18** is shifted. Points C_1 and C_2 will thus coincide so that the entire switching operation is performed in a shorter time.

The operation of the shingling belts **22**, **23** may be modified in the following ways, which are not illustrated in FIGS. 1 to 3 but will be explained with reference to the graphs of FIGS. 8 to 12.

The means for deriving the operation of the shingling belts from the machine via the shaft **17** are replaced by constant-speed drive means, which are independent of the machine speed and may consist of another electric motor. This is represented in the graph of FIG. 8. The following modification will thus be obtained compared to FIG. 7. When point C_1 has been reached, the corresponding solenoid clutch **58** or **59** is disengaged so that one of the two shingling belts **22**, **23** is changed from the speed determined by the motor **53** to the speed v_2 determined by the above-mentioned, constant-speed drive means. The same change will be analogously effected for the second belt. The constant low speed v_2 will be maintained according to line **82** until the machine has reached a predetermined speed and is changed back to the original value in accordance with line **83**, **84** when both solenoid clutches **58**, **59** are reengaged at point C_3. This mode of operation has the advantage that the belt speed does not exceed a preselected, optimum value v_1 even when the machine speed is high.

In another embodiment, the drive transmitted by the shaft **17** may be replaced by means for driving at a constant speed, *e.g.*, the above-mentioned additional motor, and at a speed which is proportional to the machine speed. To this end, a differential gear may be incorporated in the shaft **17** and may be driven at the constant additional speed. This will result in a speed curve as shown in FIG. 9, which is modified from that of FIG. 6. Because the constant additional speed v_3 is introduced, the extended line **85** no longer intersects the line **76** at the origin of the graph. In the graph of FIG. 6, the ratio of the machine speed v_M to the belt speed v_B is still constant. In the graph of FIG. 9 that ratio will change as the machine speed increases. This enables a provision of particularly desirable conditions by a suitable selection of v_3 and of a transmission ratio for the motion that is derived from the machine.

The graph of FIG. 10 illustrates this principle in comparison to FIG. 7.

It is apparent from the above that it will be desirable for a universal system for driving the shingling belts **22**, **23**, in a further development of the invention, to enable a variation of the motion transmitted from the machine via the shaft **17** to the above-mentioned differential gear. This may be accomplished by the provision of a infinitely variable transmission or by change gears.

FIG. 11 illustrates this in a graph for comparison to FIGS. 6 and 9, and FIG. 12 is a corresponding graph for comparison to FIGS. 7 and 10. The operation of the belts **22**, **23** may now be controlled, *e.g.*, in accordance with line **85a**, **86a** or **85b**, **86b**, so that the ratio v_M to v_B may be controlled in accordance with a curve which represents an optimum for a given type of tube sections. This may be accomplished by a selection of v_1, v_3 and the transmission ratio for the motion which is derived from the machine.

It will be understood that the curves shown in FIGS. 6 to 12 will be analogously applicable to the reduction of the machine speed. In this case the curves will be followed from right to left.

We claim:

1. A stacking apparatus for use with bagmaking machines, preferably tube-making machines, and comprising: means for charging the apparatus with workpieces; upper shingling means in the form of a conveyor belt; lower shingling means in the form of a conveyor belt; said upper and lower shingling means adapted to normally rotate at a speed lower than the speed of the associated machine; deflector means operating in alternation for directing a predetermined number of workpieces to said upper shingling means and for directing the same number of workpieces to said lower shingling means; upper collecting means in the form of a conveyor belt for collecting workpieces forwarded by said upper shingling means; lower collecting means in the form of a conveyor belt for collecting workpieces forwarded by said lower shingling means; stop means on each of said upper and lower collecting means for forming stacks of workpieces on said collecting means; first drive means for driving said shingling means, when the speed of the associated machine is low, at a constant and predetermined speed, independent of the speed of the associated machine and at a speed sufficiently high to ensure satisfactory conveyance of the workpieces to said stop means; said constant and predetermined speed being selected so that the workpieces arriving on the shingling means are spaced apart by a given distance when the associated machine is running at a low speed and are shingled on the shingling means when the machine is running at a high speed; and means for automatically controlling the speed of said shingling means, the automatic control means functioning in such a manner that when the associated machine increases in speed to a level wherein the workpieces closely succeed each other on the shingling means, the speed of the shingling means is suddenly reduced to such a value that the workpieces are shingled on the shingling means, and in such a manner that when the speed of the associated machine is decelerated substantially to such a value that the workpieces would cease to be shingled on the shingling means, the speed of the shingling means is suddenly increased to such a value that the workpieces are spaced apart on the shingling means.

2. The stacking apparatus defined in claim 1, wherein the change of speed in the upper and lower shingling means is effected simultaneously and at a time during the alternation of said deflector means.

3. The stacking apparatus recited in claim 1, wherein the speed of one shingling means is changed at a time when the other shingling means is being charged with workpieces.

4. The stacking apparatus recited in claim 3, wherein the speed of one shingling means is changed at a time which precedes the condition where the workpieces would closely succeed each other by at least one full stack-forming period.

5. The stacking apparatus recited in claim 3, wherein the speed of the associated machine is maintained constant from the time when the speed of one of the shingling means is changed to the time when the speed of the other of the shingling means is changed.

6. The stacking apparatus defined in claim 1, and further comprising actuating means responsive to the speed of the associated machine for effecting a change in the speed of the shingling means.

7. The stacking apparatus defined in claim 6, wherein said actuating means comprises an electric generator tachometer cooperating with electric control means.

8. The stacking apparatus defined in claim 1, including means for increasing the speed of the shingling means after the initial speed reduction and when the speed of the associated machine increases.

9. The stacking apparatus defined in claim 1, wherein said first drive means comprises an electric motor, running at a constant speed and preferably adjustable; and further comprising second drive means for driving said shingling means when the speed of the machine is high, said second drive means being derived from the drive mechanism of the associated machine.

10. The stacking apparatus defined in claim 9, wherein said second drive means are superposed by a further drive means having a constant speed.

11. The stacking apparatus defined in claim 10, and further comprising a differential gear for effecting the superposition, the gear having first and second inputs coupled to the associated machine and to the further drive means, respectively, and an output coupled to the first drive means.

12. The stacking apparatus recited in claim 10, wherein the further drive means is infinitely variable.

13. The stacking apparatus defined in claim 1, wherein said first drive means is associated with the shingling means through drive pulleys and clutches, which clutches are disengageable and engageable in response to the associated machine reaching a predetermined limiting speed; and wherein said further drive means is connected to the drive pulleys by freewheel clutches.