

[54] **APPARATUS FOR THE CONTINUOUS FORMATION OF REGULAR STACKS OF FLAT WORKPIECES SUCH AS FLATTENED BAGS OR SACKS**

[72] Inventor: **Richard Feldkamper**, Lengerich, Westphalia, Germany

[73] Assignee: **Windmoller & Hofscher**, Westphalia, Germany

[22] Filed: **Jan. 19, 1971**

[21] Appl. No.: **107,739**

[30] **Foreign Application Priority Data**

Jan. 27, 1970 Germany.....P 20 03 553.4

[52] **U.S. Cl.**.....93/93 DP, 214/6 D, 271/46

[51] **Int. Cl.**.....B65h 33/00

[58] **Field of Search**.....93/93 DP, 93 C, 93 R, 93 M; 271/46; 214/6 D; 198/35

[56] **References Cited**

UNITED STATES PATENTS

3,191,927 6/1965 Hartbauer et al. ..93/93 R UX

3,194,127 7/1965 Larsson 93/93 DP
3,359,874 12/1967 Stegenga et al.....93/93 DP

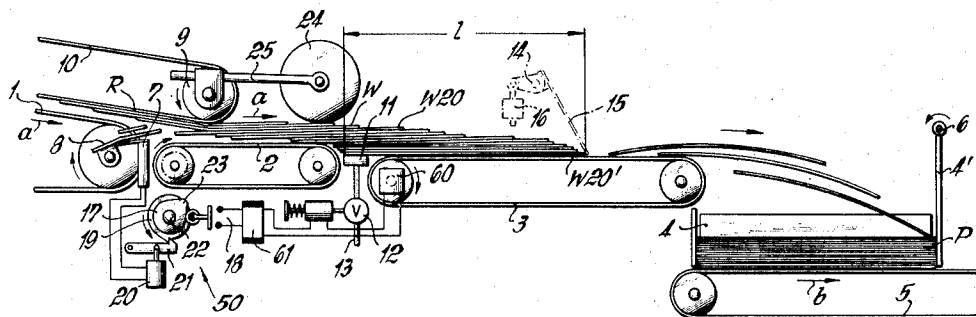
Primary Examiner—Bernard Stickney

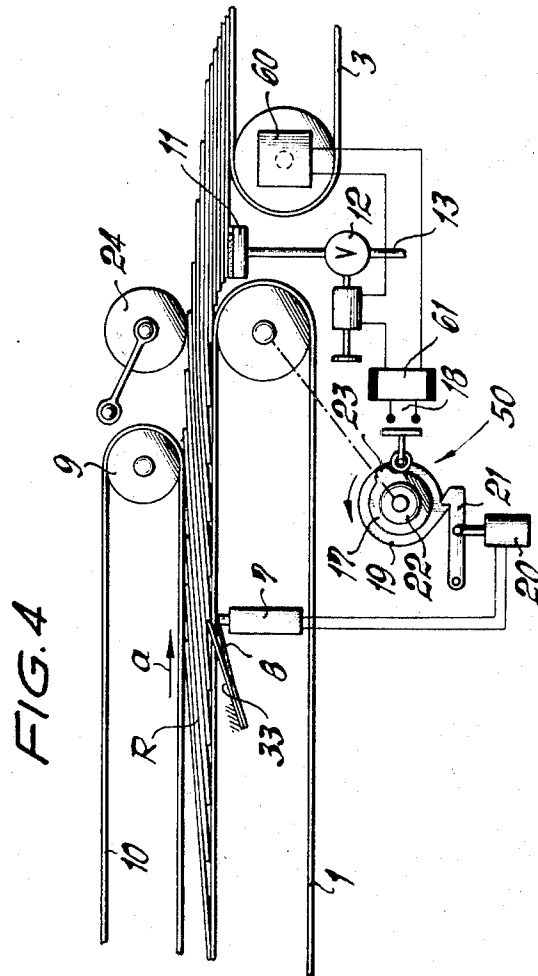
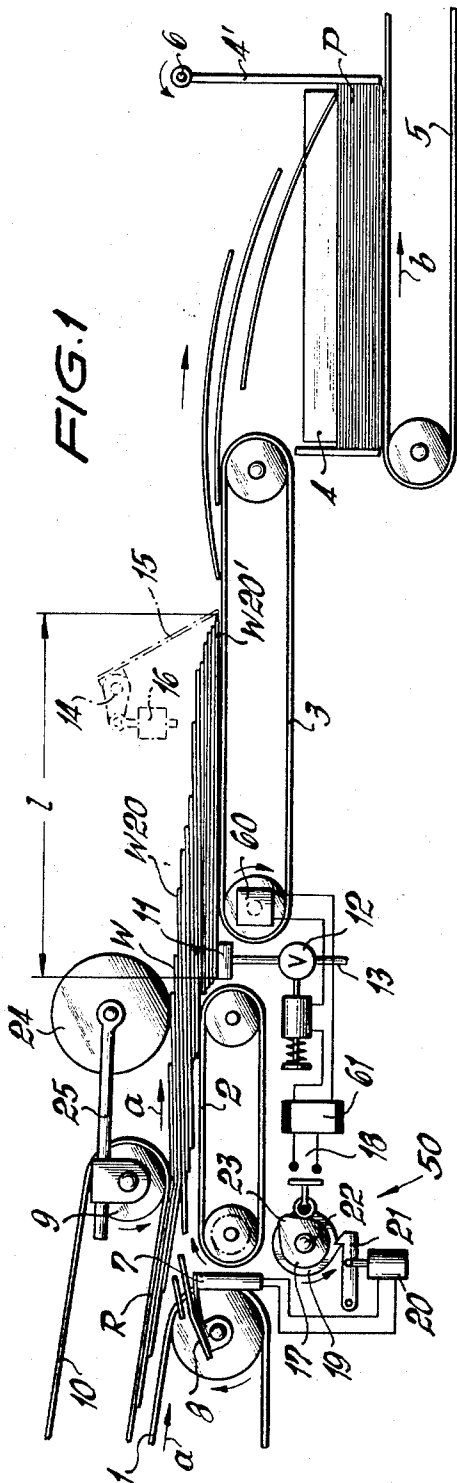
Attorney—Fleit, Gipple & Jacobson

[57] **ABSTRACT**

Apparatus for the continuous formation of regular stacks of flat workpieces such as flattened bags which initially arrive in the form of a row in overlapping formation on a supply conveyor. The apparatus includes a feed conveyor for taking the workpieces to a stacking station which is controlled by a retainer for intermittently and periodically halting workpieces on the conveyor. A counter operates the retainer by transmitting an impulse to it when actuated by the first workpiece to form such stack. A time switch releases the retainer, and a sensor associated with the counter is provided to count off, downstream of the discharge end of the supply conveyor, the number of workpieces which are to form each stack. An impulse storer is operatively interposed between the counter and the retainer to store the impulse for a period equal to the time taken by the first workpiece to be moved from the sensor to the retainer.

18 Claims, 4 Drawing Figures





INVENTOR
Richard FELD KÄMPER
BY

Fleit, Lippel + Jacobson
his ATTORNEYS

FIG. 2

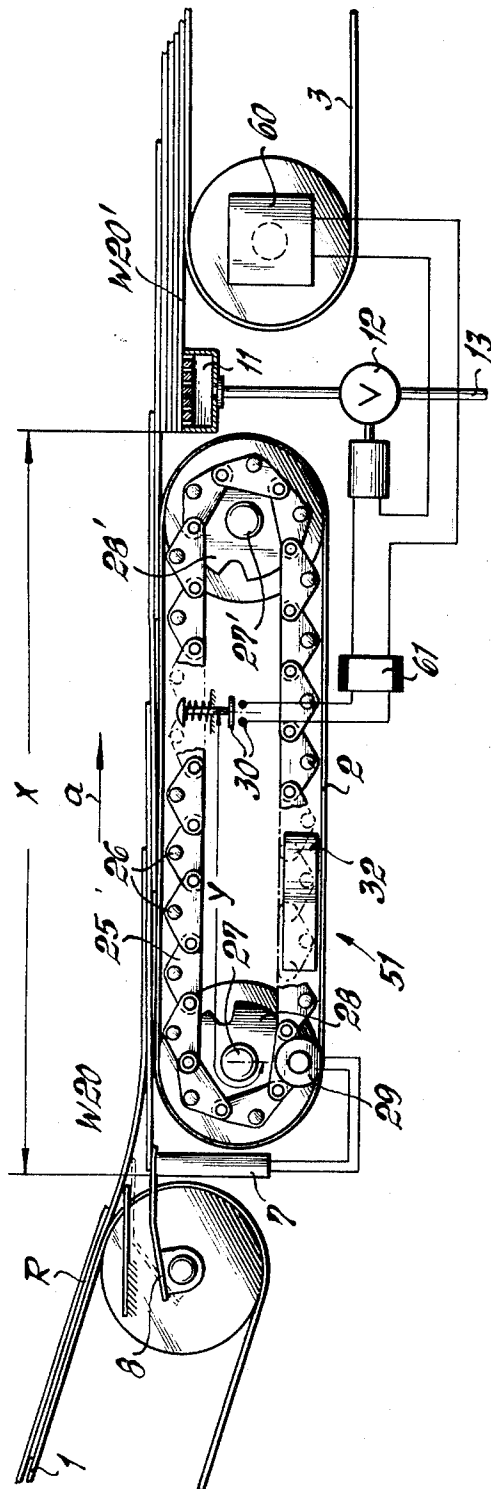
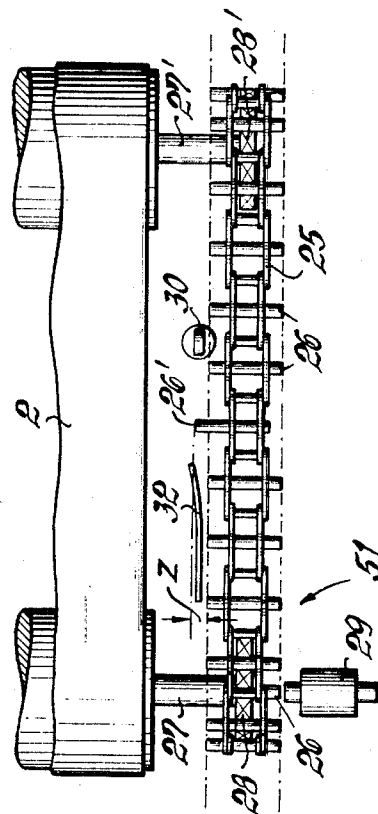


FIG. 3



INVENTOR
Richard FELD KÄMPER
BY

Heit, Gipple & Wachtman
his ATTORNEYS

APPARATUS FOR THE CONTINUOUS FORMATION OF REGULAR STACKS OF FLAT WORKPIECES SUCH AS FLATTENED BAGS OR SACKS

The invention relates to an apparatus for the continuous formation of regular stacks of flat workpieces such as flattened bags or sacks arriving in a row in overlapping or scale formation on a supply conveyor.

The high production capacities of modern bag or sack-making machines make it necessary to deposit the rapidly discharged bags onto a slowly moving conveyor belt where they are superposed in a row in overlapping or scale formation and then carried away in this formation. The comparatively slow speed of the row of overlapping workpieces permits a predetermined number of workpieces to be removed by hand from the leading end of the row and to be pushed together to form a regular stack, i.e. with the edges of the workpieces aligned, the stack then being packaged for dispatch.

Apparatuses have been suggested with which the stacking of the workpieces can be alternated. For example, German Pat. No. 1,179,090 and U.S. Pat. No. 3,390,619 disclose apparatuses which, with the aid of a rapidly moving pair of centrifugal rolls or a rapidly moving pair of conveyor belts, pull the leading workpiece out from the slowly moving row of overlapping workpieces and fling it onto a catching apparatus which stacks the workpieces and which is mounted above a conveyor belt for carrying the stacks away. The individual workpieces withdrawn from the overlapping formation are counted by a counter which momentarily opens the catching apparatus for the purpose of dropping a completed stack onto the conveyor belt as soon as the catching apparatus has received a certain number of workpieces as preset on the counter. In these known constructions, the time available for opening and closing the catching apparatus is at the most equal to the time interval between two successive workpieces leaving the machine, such as a bag-making machine, behind which the stacking means are provided. These known constructions are therefore not suitable for high-speed bag-making machines.

Another stacking apparatus which is known from German Pat. No. 1,148,437 separates the workpieces to be stacked by means of two or more consecutive conveyor belts located downstream of the supply conveyor. One of these conveyor belts is an intermediate belt of which the speed can be temporarily varied. Whilst the intermediate belt is moving slowly, the workpieces which are arriving at a spacing from one another accumulate on the intermediate belt to assume an overlapping formation. Simultaneously, workpieces located on a more rapidly moving downstream conveyor belt are pulled out from the overlapping formation and fed to a stacking box. This creates a gap in the flow of workpieces during which a horizontal slide is moved into the stacking box for the purpose of subdividing the stack of workpieces. The number of workpieces contained in each sub-divided package is therefore determined by the conveying period of the slowly and rapidly moving intermediate conveyor belt. The period is changed whenever there are irregularities in the sequence of workpieces, i.e. if a workpiece happens to be missing or if the spacing between workpieces varies.

Finally, U.S. Pat. No. 2,919,789 discloses apparatus for the continuous formation of regular stacks of flat workpieces arriving in a row in overlapping formation on a supply conveyor, comprising a feed conveyor downstream of the supply conveyor and retaining means for the workpieces which are operated in constant rhythmic sequence and are located between the feed and supply conveyors for halting one of the workpieces in the row during this rhythmic sequence. A number of workpieces is thereby pushed together to form a stack on the halted workpiece, this number being equal to the number of workpieces that have been advanced in the row during one sequence. However, since this number can vary at any time if a workpiece happens to be omitted or if the disposition between adjacent overlapping workpieces changes, it is never certain that the number of workpieces in each stack will be the same. In any case, the number of workpieces that can be efficiently pushed together on top of the workpiece that is being held by the retaining means is quite limited and the whole procedure is possible only if the workpieces are made from sufficiently stiff material. This known apparatus is therefore not suitable for forming stacks of any desired number of workpieces made from very flexible material such as plastics film.

According to the invention, apparatus for the continuous formation of regular stacks of workpieces such as flattened bags arriving in a row in overlapping formation on a supply conveyor comprises a feed conveyor for taking the workpieces to a stacking station, intermittently operable retaining means preferably located upstream of the feed conveyor for periodically halting workpieces on the feed conveyor, counting means for operating the retaining means by transmitting an impulse thereto when actuated by the first workpiece to form each stack, a time switch, preferably a time relay, for releasing the retaining means, a sensor associated with the counting means for counting off, upstream of the discharge end of the supply conveyor, the number of workpieces which are to form each stack, and an impulse storer which is operatively interposed between the counting means and the retaining means and which is adapted to store the said impulse for a period equal to the time taken by the said first workpiece to be moved from the sensor to the retaining means.

In this way, the rhythmic sequence with which the retaining means are operated is determined by accurately counting the workpieces arriving in overlapping formation. The number of workpieces to form a stack is set on the counting means and is accurately maintained even if there are irregularities in the overlapping formation caused by a missing workpiece or by variations in the degree of overlap.

The time relay permits the duration during which a workpiece is held by the retaining means to be selected independently of the number of workpieces to form each stack and to be so short that the previously counted workpieces that are already located on the feed conveyor beneath the workpiece that is being held by the retaining means are pulled out from beneath the retained workpiece and advanced to have a spacing therefrom which is adequate to enable them to be stacked and led away before the next set of workpieces

arrives at the stacking station. During each cycle only a small number of workpieces at the leading end of the overlapping formation will be caused to accumulate at the retaining means and this small number will remain constant independently of the number of workpieces to be counted by the sensor and is not liable to cause disruption in the smooth operation of the stacking apparatus. The extent of such accumulation of workpieces can be minimized if the feed conveyor is adapted to move faster than the supply conveyor during the time when the retaining means are operative. This reduces the time necessary for moving the set of workpieces located on the feed conveyor and thus also the number of workpieces arriving from the supply conveyor and accumulating on the retaining means.

The supply conveyor may form part of the stacking apparatus or, if as in one form of the invention the supply conveyor comprises first and second conveyor sections, at least the second section may form part of the stacking apparatus. The first and second supply conveyor sections are preferably disposed at an obtuse angle to one another, the sensor being provided in a gap between the two sections. This angular disposition causes the overlapping workpieces to be bent gently in the region of the sensor and to be leafed through. As the workpieces are leafed through they strike the sensor and enable the latter to record a positive counting pulse which minimized the danger of counting errors.

Leafing through the workpieces can be facilitated by a pressing drum disposed above the second supply conveyor section adjacent the receiving end thereof to lie on the overlapping workpieces and rotate at a circumferential speed equal to the speed at which the workpieces are conveyed by the supply conveyor.

In another form of the invention, a gently ascending stationary step is provided onto which the overlapping workpieces ride whilst moving on the supply conveyor and the end of which projects above the conveying plane so that the trailing ends of successive overlapping workpieces are leafed through as they drop from the step, the sensor being arranged directly downstream of the step. The step may be formed by a rod, the sensor being a leaf spring which extends beneath the rod to beyond the projecting end of the rod. The step lifts the overlapping workpieces from the supply conveyor and leafs them through at their trailing edges as they drop from the step onto the sensor.

The conveying run of the feed conveyor may be disposed at a lower level than the conveying run at the discharge end of the supply conveyor, the retaining means comprising a stationary suction box upstream of the feed conveyor in the plane of the conveying run thereof. This ensures trouble-free superpositioning of the workpieces following the set that is in the process of being counted even if the workpieces are bags made from thin plastics film. This superpositioning of the workpieces can be facilitated by providing a pressing drum above the discharge end of the supply conveyor to lie on the overlapping workpieces.

When stacking stiff workpieces such as sacks or bags of paper, the retaining means may comprise a displaceable baffle plate disposed above the conveying run of the feed conveyor to engage the leading ends of the workpieces thereon at a distance from the

discharge end of the supply conveyor of at least equal to one workpiece length.

The impulse storer between the counting means and the retaining means may comprise a cam disc driven through a friction clutch by the supply conveyor for operating the retaining means and for operating a control mechanism for the feed conveyor by means of a switch, and locking means controlled by the counting means for releasing and locking the cam disc after each complete revolution thereof, the drive transmission ratio of the cam disc and the disposition of a cam thereon being such that operation of the retaining means and control mechanism after opening of the locking means by the counting means occurs only after a period adequate for enabling the supply conveyor to move a workpiece from the sensor to the retaining means.

In another construction, the impulse storer comprises an endless chain which is driven in synchronism with the supply conveyor and is equipped with transversely displaceable operating pins, means actuated by the counting means being provided at one side of the chain adjacent the path of the operating pins for transversely displacing the operating pins, and a switch for operating the retaining means and a control mechanism for the feed conveyor being provided on the other side of the chain at a spacing from the displacing means substantially equal to the distance between the sensor and the retaining means, the lateral spacing of the switch from the chain being such that it can be actuated only by an operating pin that has previously been displaced by the displacing means.

In yet another form of impulse storer, it comprises an endless magnetic recording tape which is driven in synchronism with the supply conveyor and is equipped with a recording head actuated by the counting means for transmitting the impulse from the counting means to the tape, a scanning head for transmitting the impulse from the tape to a switch for operating the retaining means and a control mechanism for the feed conveyor, and an erasing head for erasing the impulse from the tape, the spacing of the scanning head from the recording head in the direction of tape movement being equal to the distance of the sensor from the retaining means and the erasing head being disposed downstream of the scanning head in the direction of tape movement.

The impulse storer in any of the above-mentioned forms will enable the first workpiece that is of a form each stack to actuate the impulse from the counting means and be halted by the retaining means in the region of the feed conveyor. The time for which the workpiece is halted is determined by the time relay which releases the retaining means again and which also operates the feed conveyor to return to its lower conveying speed equivalent to the speed of the supply conveyor. The switch of the impulse storer can for this purpose be disposed in an electric control circuit for the time switch of which the main circuit contains the retaining means and the control mechanism for the feed conveyor. The control mechanism may be electromagnetically operable.

Examples of the invention are illustrated in the accompanying diagrammatic drawings, wherein:

FIG. 1 is a side elevation of a stacking apparatus;

FIGS. 2 and 3 are respectively a side elevation and plan of a different form of impulse storer for the stacking apparatus, and

FIG. 4 is a side elevation of a different arrangement and construction of senser for the counting means.

Referring to FIG. 1, a supply conveyor comprises two sections 1 and 2. Downstream of the supply conveyor section 2 there is a feed conveyor 3. Retaining means 11 for the workpieces are provided between the supply and feed conveyors, the retaining means being operable by counting means 7. The supply conveyor section 1 may form part of a bag-making machine or of a separate apparatus for delivering workpieces from the machine to the stacking apparatus. Workpieces W arrive on the section 1 in an overlapping or scale formation and are conveyed in the direction of the arrow *a* along the supply conveyor section 2 which extends at an obtuse angle to the section 1. A senser 8 of the counting means 7 is arranged in a gap between the two supply conveyor sections so that it lies against the underface of the row R of overlapping workpieces. The counting means 7 are equipped with a switch which is closed by an impulse after a certain number of workpieces as preset on the counting means has been counted by the senser 8 the switch then opens again. This operating impulse of the counting means 7 is transmitted with a time delay to the retaining means 11 through an impulse storer 50 and a time relay 61. The arrangement of the components is such that the counting means 7 operate the retaining means 11 to halt a workpiece W whilst the time relay 61 releases the retaining means 11 again after a preselected time interval.

The feed conveyor 3 is driven by a two-stage electromagnetically operable control mechanism 60. During one stage, the control mechanism drives the feed conveyor at the same speed as the supply conveyor 1, 2 and during the second stage it drives it at a higher speed. The control mechanism 60 is operated simultaneously with the retaining means 11 so that the feed conveyor 3 will move at the higher speed when the retaining means 11 are operative.

The conveying run of the feed conveyor 3 is at a lower level than the conveying run of the supply conveyor section 2. The retaining means 11 may be in the form of a stationary suction box arranged between the conveyor section 2 and the feed conveyor 3 so that its suction face lies in the conveying plane of the conveyor 3. The suction box 11 preferably extends over the entire width of the row R of overlapping workpieces. Its vacuum chamber is connected alternately to a vacuum conduit 13 and to atmosphere by means of an electromagnetically controlled valve 12.

Downstream of the feed conveyor 3 there is a stacking magazine 4 into which the feed conveyor discharges the counted workpieces and in which the workpieces are formed into regular stacks with the edges of the workpieces aligned. The base of the stacking magazine is formed by a conveyor belt 5. The downstream wall 4' of the magazine is rotatable about a horizontal pivot 6 so that the wall will move in the same direction as that indicated by the arrow *b* in which the conveyor belt 5 moves. During each rotation of the wall 4', a stack of workpieces that has been formed in the magazine is released for being carried away by the belt

5 and at the end of its rotation the magazine becomes closed again.

For more positive guiding of the row R of overlapping workpieces at the place where the latter move from one conveyor section to the other, a pressure drum 9 is provided above the receiving end of the conveyor section 2 to lie on the overlapping workpieces and rotate at the same speed as the supply conveyor. This pressure drum presses the workpieces into the angle between the two supply conveyor sections. In the illustrated example, an upper belt 10 which forms part of the supply conveyor section 1 is passed over a direction-changing roll 9 and this roll at the same time serves as the pressure drum. Further, a pressure drum 24 is provided above the discharge end of the supply conveyor section 2 to prevent premature tilting of the workpieces onto the retaining means 11 which are disposed at a lower level and to cause the trailing ends of the workpieces to be applied to the retaining means.

The impulse storer 50 shown in FIG. 1 comprises a cam disc 17 having a switch 18 and a locking disc 19 with a pull 21 which is controlled by a lifting magnet 20. The cam disc 17 and the locking disc 19 are fixed to one another and driven through a friction clutch 22 at a speed commensurate with that of the supply conveyor. The pull 21 and locking disc 19 hold the cam disc 17 against the action of the friction clutch 22. The pull 21 is released by the lifting magnet 20 in response to an operating impulse from the counting means 7 so that the cam disc 17 can be turned by the friction clutch 22 and is locked again only after one complete revolution. The drive transmission ratio of the cam disc 17 and the arrangement of a cam 23 thereon are such that, after the pull 21 has been released by the operating impulse from the counting means 7, the cam 23 closes the switch 18 only after the time required for the supply conveyor 1, 2 to move the trailing end of a workpiece from the senser 8 up to the retaining means 11. The switch 18 of the impulse storer 50 lies in a control circuit of the time relay 61 whilst the electromagnetic valve 12 of the suction box 11 and the electromagnetically operable control mechanism 60 are included in the main circuit of the time relay. Operation of the parts 12, 60 is such that, upon closing of the switch 18, the electromagnetic valve 12 of the suction box 11 is operated to halt the workpiece that is located on the suction box and at the same time the control mechanism 60 is operated to increase the speed of the feed conveyor 3. The suction box 11 is operated to release the workpiece again and the control mechanism is operated to return the feed conveyor to its lower speed equivalent to that of the supply conveyor after a predetermined time set on the time relay 61. This time is predetermined so that the preceding set of counted workpieces located on the feed conveyor beneath the workpiece that is being held by the retaining means is pulled out from the latter and advanced a sufficient distance to enable a stack formed in the magazine 4 to be taken away by opening the wall 4'.

The operation of the FIG. 1 apparatus is as follows:

The workpieces W are advanced in overlapping or scale formation along the supply conveyor sections 1, 2, the leading ends of the workpieces projecting at the top and the trailing ends at the bottom of the row R. At the transition between the sections 1 and 2, the row of

workpieces is gently bent so that the workpieces are leafed through at their trailing ends. Each trailing end strikes the sensor 8 and thereby transmits a counting pulse to the counting means 7.

Assuming that the row R of overlapping workpieces is to form stacks of 20 workpieces in each stack, the counting means 7 will be set so that every 20th counting pulse from the sensor 8 will release an operating impulse to release the locking means 19, 20, 21 of the impulse storer 50. Accordingly, a set of 20 workpieces W will be counted off from the row R, the first workpiece W20 of each set being instrumental for releasing the operating impulse from the counting means 7 and thereby actuating the impulse storer 50 by releasing the pawl 21. Whilst the set of workpieces in the process of being counted continues to be conveyed in the unchanged overlapping relationship along the conveyor section 2, the cam disc 17 of the impulse storer executes one rotation and closes the switch 18 by means of the cam 23 at the instant in which the workpiece W20 has its trailing end located over the suction box 11, i.e. when it has reached the position W20'. Closing the switch 18 will cause the suction box to grip and stop the workpiece W20' and at the same time operate the control mechanism 60 to cause the feed conveyor 3 to move faster. As a result, the preceding set of workpieces that has already been counted and that is located on the feed conveyor below the workpiece W20' is pulled out from underneath the latter and thereby separated from the overlapping workpieces in the row R accumulating on top of the workpiece W20'. As soon as the aforementioned preceding set of previously counted workpieces has been drawn forwardly by a certain distance, the time relay 61 operates the suction box 11 to release the workpiece W20' and also operates the control mechanism 60 to return the feed conveyor 3 to its lower speed equivalent to the speed of the supply conveyor sections 1, 2. The feed conveyor 3 now feeds the counted set of workpieces into the stacking magazine 4 and at the same time receives the row R released by the suction box or the next set of workpieces which are being counted, whilst maintaining the spacing therebetween which permits the stack formed in the magazine 4 to be withdrawn by the conveyor belt 5 before the first workpiece of the next set reaches the magazine.

Since the feed conveyor 3 most of the time moves at the same low speed as the conveyor sections 1, 2, it being accelerated for only a short period to advance the set of workpieces below the workpiece that is being held by the retaining means, the row R of overlapping workpieces will accumulate on top of the stationary workpiece for only a short time even if large numbers of workpieces are being counted to form each stack. By appropriately dimensioning the length of the feed conveyor one can therefore ensure that the entire set of counted workpieces is flung from the feed conveyor 3 into the magazine 4 at the low speed so as to prevent damage to the leading ends of the workpieces as they strike the wall 4'.

To alter the number of workpieces that is to form each stack, it is only necessary to set the counting means 7 to the new number. Since it is always the workpiece which actuates the operating impulse of the counting means 7 that is also halted by the suction box

11, the degree of overlap of the workpieces in the row R is immaterial. Miscounts as would otherwise occur by a missing workpiece or a different degree of overlap are therefore impossible.

It will be clear that for the impulse storer 50 of FIG. 1 the total length of the set of overlapping workpieces to be counted must be greater (by about 25 percent than the distance between the sensor 8 and suction box 11 so as to ensure that the pawl 21 locks the locking disc 19 of the impulse storer 50 before it is released again by the next operating impulse from the counting means 7.

Instead of or in addition to retaining means in the form of a suction box 11 beneath the overlapping workpieces between the supply conveyor 1, 2 and the feed conveyor 3, a baffle plate 15 pivotable about a shaft 14 may be provided above the overlapping workpieces. The free edge of this baffle plate is at least one workpiece length downstream of the discharge end of the supply conveyor. The flap 15 is pendulated by a lifting magnet 16 so that in its lower dead center position it holds the leading end of the workpieces and in its upper dead center position it releases the workpieces for feeding by the conveyor 3. The lifting magnet 16 is included in the main circuit of the time relay 61 instead of or in addition to the valve 12.

An impulse storer 51 shown in FIGS. 2 and 3 may be used in place of the impulse storer 50. It comprises an endless chain 25 with transversely displaceable switching pins 26. The chain extends around sprockets 28, 28' fixed on shafts 27, 27' which also support direction-changing rolls for the supply conveyor section 2. The chain 25 therefore moves at the same speed as the supply conveyor. At one side of the chain 25 there is a lifting magnet 29 which is controlled by the counting means 7 and is located along the path of movement of the pins 26 so as to displace the 26 by a distance z. At the other side of the chain 25 a switch 30 is provided at a distance y from the lifting magnet 29 substantially equal to the length of the path x followed by a workpiece from the sensor 8 to the retaining means 11. The lateral spacing of the switch 30 from the chain 25 is such that it can be actuated only by a pin 26' that has been displaced by the lifting magnet 29. The switch 30 of FIGS. 2 and 3 corresponds to the switch 18 of FIG. 1. It also lies in the control circuit of the time relay 61 which operates the electromagnetic valve 12 of the suction box 11 and the control mechanism 60 of the feed conveyor 3 in the manner previously described with reference to FIG. 1. To facilitate its accurate setting, the switch 30 is adjustable along the chain 25. A stationary guide rail 32 is provided parallel to the lower run of the chain 25 for pushing the operating pins 26 back to their undisplaced positions.

As in the case of the FIG. 1 embodiment, in the FIGS. 2 and 3 construction each 20th workpiece W20 can be assumed to cause an operating impulse to be emitted by the counting means 7. This momentarily energizes the lifting magnet 29 to displace that operating pin 26 that just happens to be passing by it. Whilst the thus displaced operating pin 26' covers the path y to reach the switch 30, the workpiece W20 on the supply conveyor section 2 covers the path x to reach the position W20' at which its trailing end is located over the suction box 11. In this position of the work-

piece the switching pin 26' closes the switch 30. The remaining operation of the apparatus is the same as that already described in connection with FIG. 1.

FIG. 4 illustrates an advantageous construction and arrangement for the sensor 8 that dispenses with the second supply conveyor section 2 of FIG. 1 and permits the sensor to be mounted at any desired position along a supply conveyor that may already be provided on or adjacent to a bagmaking machine. By providing a stationary gently inclined step 33 the end of which projects beyond the conveying plane of the conveyor 1 and presents a steep drop, the row R of overlapping workpieces is temporarily lifted from the supply conveyor and, at the end of the step, leafed through before falling back onto the supply conveyor. The sensor 8 is mounted directly behind the step so that it is struck by the workpieces that are being leafed through and so that it receives strong counting pulses.

The step may extend over the entire width of the supply conveyor or be in the form of a rod, in which case the sensor 8 may be a leaf spring extending beneath the rod to beyond the upper end thereof. The rod 33 can be easily installed if, as is usual, the supply conveyor comprises a plurality of spaced parallel belts. The other components of the FIG. 4 construction are the same as in FIG. 1 and are therefore provided with the same reference numerals.

In practice, it may be desirable to provide a suction box 11 for holding the first workpiece of each stack as well as the baffle plate 15 which acts as a stop on the leading edges of the workpieces. If only the suction box 11 is used, some of the workpieces might stop short of or project beyond the stationary workpiece. Stopping short of the stationary workpiece makes no difference but projecting beyond it may cause the projecting portion to be bent as the workpieces are being introduced into the stacking magazine 4. The additional use of the baffle plate 15 would avoid this possibility. The combination of a suction box 11 and baffle plate 15 is particularly recommended for workpieces of soft material, such as single-ply bags made from Clupak or crepe paper. If only the baffle plate 15 were to be used for such materials, the friction caused by the fast moving belt B₂ of the feed conveyor 3 could cause the bags to bow upwardly and give rise to blockages or crumpling. For stiff materials such as multi-ply bags of kraft paper, the baffle plate 15 may be sufficient by itself but the suction box 11 would ensure trouble-free operation.

I claim:

1. Apparatus for the continuous formation of regular stacks of flat workpieces such as flattened bags arriving in a row in overlapping formation on a supply conveyor, comprising a feed conveyor for taking the workpieces to a stacking station, intermittently operable retaining means for periodically halting workpieces on the conveyor, counting means for operating the retaining means by transmitting an impulse thereto when actuated by the first workpiece to form each stack, a time switch for releasing the retaining means, a sensor associated with the counting means for counting off, downstream of the discharge end of the supply conveyor, the number of workpieces which are to form each stack, and an impulse storer which is operatively interposed between the counting means and the retaining means and which is adapted to store the said im-

pulse for a period equal to the time taken by the said first workpiece to be moved from the sensor to the retaining means.

2. Apparatus according to claim 1, wherein the retaining means are provided upstream of the feed conveyor.

3. Apparatus according to claim 1 wherein the time switch is a time relay.

4. Apparatus according to claim 1 wherein the feed conveyor is adapted to move faster than the supply conveyor during the time when the retaining means are operative.

5. Apparatus according to claim 1 including the said supply conveyor.

6. Apparatus according to claim 1 wherein the supply conveyor comprises first and second conveyor sections of which at least the second section forms part of the stacking apparatus.

7. Apparatus according to claim 6, wherein the first and second supply conveyor sections are disposed at an obtuse angle to one another and the sensor is provided in a gap between the two sections.

8. Apparatus according to claim 7 including a pressure drum disposed above the second supply conveyor section adjacent the receiving end thereof to lie on the overlapping workpieces and rotate at a circumferential speed equal to the speed at which the workpieces are conveyed by the supply conveyor.

9. Apparatus according to claim 1 including a gently ascending stationary step onto which the overlapping workpieces ride whilst moving on the supply conveyor and the end of which projects above the conveying plane so that the trailing ends of successive overlapping workpieces are leafed through as they drop from the step, the sensor being arranged directly downstream of the step.

10. Apparatus according to claim 9, wherein the step is formed by a rod and the sensor is a leaf spring which extends beneath the rod to beyond the projecting end of the rod.

11. Apparatus according to claim 1 wherein the conveying run of the feed conveyor is disposed at a lower level than the conveying run at the discharge end of the supply conveyor, the retaining means comprising a stationary suction box upstream of the feed conveyor in the plane of the conveying run thereof.

12. Apparatus according to claim 11 including a pressure drum disposed above the discharge end of the supply conveyor to lie on the overlapping workpieces.

13. Apparatus according to claim 1, wherein the retaining means comprise a displaceable baffle plate disposed above the conveying run of the feed conveyor to engage the leading ends of the workpieces thereon at a distance from the discharge end of the supply conveyor of at least equal to one workpiece length.

14. Apparatus according to claim 13, wherein the retaining means include a stationary suction box upstream of the feed conveyor in the plane of the conveying run thereof.

15. Apparatus according to claim 1 wherein said impulse storer comprises a cam disc driven through a friction clutch by the supply conveyor for operating the retaining means and for operating a control mechanism for the feed conveyor by means of a switch, and the impulse storer further comprises locking means con-

trolled by the counting means for releasing and locking the cam disc after each complete revolution thereof, the drive transmission ratio of the cam disc and the disposition of a cam thereon being such that operation of the retaining means and control mechanism after opening of the locking means by the counting means occurs only after a period adequate for enabling the supply conveyor to move a workpiece from the sensor to the retaining means.

16. Apparatus according to claim 1 wherein the impulse storer comprises an endless chain which is driven in synchronism with the supply conveyor and is equipped with transversely displaceable operating pins, means actuated by the counting means being provided at one side of the chain adjacent the path of the operating pins for transversely displacing the operating pins and a switch for operating the retaining means and a control mechanism for the feed conveyor being provided on the other side of the chain at a spacing from the displacing means substantially equal to the distance between the sensor and the retaining means, the lateral spacing of the switch from the chain being such that it can be actuated only by an operating pin that has previ-

ously been displaced by the displacing means.

17. Apparatus according to claim 1 wherein the impulse storer comprises an endless magnetic recording tape which is driven in synchronism with the supply conveyor and is equipped with a recording head actuated by the counting means for transmitting the impulse from the counting means to the tape, a scanning head for transmitting the impulse from the tape to a switch for operating the retaining means and a control mechanism for the feed conveyor, and an erasing head for erasing the impulse from the tape, the spacing of the scanning head from the recording head in the direction of tape movement being equal to the distance of the sensor from the retaining means and the erasing head being disposed downstream of the scanning head in the direction of tape movement.

18. Apparatus according to claim 15 wherein the switch of the impulse storer is disposed in an electric control circuit for the time switch of which the main circuit contains the retaining means and the control mechanism for the feed conveyor.

* * * * *

25

30

35

40

45

50

55

60

65