

[54] **APPARATUS FOR FORMING AND CONVEYING STACKS OF FLAT WORKPIECES**

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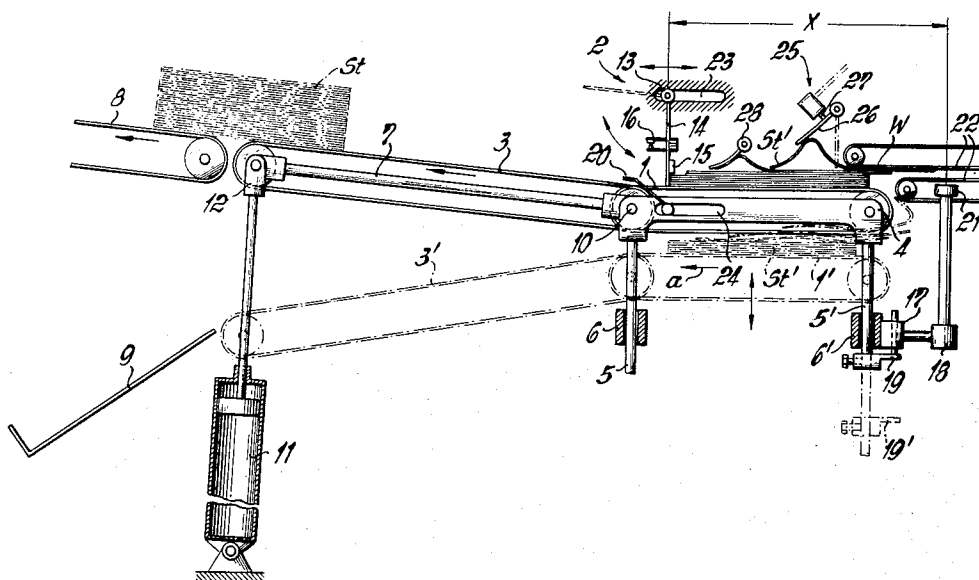
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[57]

ABSTRACT

In an apparatus for forming and conveying stacks of flat workpieces on a vertically reciprocable stacking conveyor, a sensor is provided above the stacking conveyor at substantially the same height as the upstream end of a supply conveyor on which the individual workpieces arrive. Upon contact with an incorrectly deposited workpiece on the stack, the sensor is effective to actuate immediate lowering of the stacking conveyor to a lower limiting position and to start the stacking conveyor so as to remove the incomplete stack to a discharge conveyor of which the downstream end is lowerable together with the stacking conveyor.

4 Claims, 1 Drawing Figure



APPARATUS FOR FORMING AND CONVEYING STACKS OF FLAT WORKPIECES

The invention relates to an apparatus for forming and conveying stacks of flat workpieces, particularly flattened tube sections of paper or plastic film for use in the manufacture of sacks or bags, or stacks of such sacks or bags. In the apparatus with which this invention is concerned, workpieces arriving on a supply conveyor are successively deposited in superposed relation on an intermittently driven stacking conveyor against a stop to form a stack, the stop being displaceable to free the stack after completion and allow it to be moved by the stacking conveyor to a discharge conveyor. The stacking conveyor is progressively lowerable during stack formation so that the uppermost workpiece of the growing stack will always be at a substantially constant level slightly below the upstream end of the supply conveyor, and is raisable again as the completed stack is being discharged.

Such an apparatus is disclosed in German Patent Specification No. 2,024,398 and is particularly useful in the fabrication of sacks or bags or of tube sections to be made into sacks or bags. For this purpose it is necessary to stack a predetermined number of the sacks or bags ready for packaging or to pile up the tube sections into handy stacks which are subsequently fed to an applicator of a base-forming machine. By reason of the fact that the top of the stack will always be at the most favorable spacing from the supply conveyor on which the workpieces arrive in an overlapping scale formation, there is little danger of the workpieces folding or turning over as a result of being thrown onto the stacking conveyor through excessive heights and consequently this danger no longer sets a limit to the height of the stack that can be formed. Nevertheless, on occasions it is possible for a workpiece to fold over or turn over and buckle at the stacking station if it was being incorrectly conveyed on the supply conveyor or somehow deflected out of its correct position. Such a workpiece cannot be correctly deposited on the stack that is being formed on the stacking conveyor. Since the machine upstream of the supply conveyor, for example a tube-drawing machine, produces workpieces at the rate of 250 to 300 pieces per minute, any buckling occurring at the stacking station will result in the deformation of four to five workpieces per second and will be pressed down by subsequently arriving workpieces. To correct this defect, the machine must be stopped. The deformed workpieces are then removed, which is time-consuming and cumbersome. Very often, guide means provided above the stacking conveyor must be bent out of the way to obtain access to the buckled workpieces and these guide means must be reset before the machine can be started again and accelerated to its previous production rate. The workpieces that are removed are usually scrapped not only because of the buckling that has taken place but also because they are usually damaged as they are being removed manually from the stacking conveyor. Further, the formation of the stacks must be constantly supervised with the known apparatus so as to minimize severe damage to the stacking conveyor and other equipment that would give rise to even longer periods of standstill.

The invention aims to provide an improved apparatus in which any incorrectly deposited workpiece on the stack will not result in an interruption in production,

and in which the operator need not constantly supervise the stacking operation.

According to the invention, there is provided an apparatus for forming and conveying stacks of flat workpieces, wherein workpieces arriving on a supply conveyor are successively deposited in superposed relation on an intermittently driven stacking conveyor against a stop to form a stack, the stop being displaceable to free the stack after completion and allow it to be moved by the stacking conveyor to a discharge conveyor. The stacking conveyor is progressively lowerable during stack formation so that the uppermost workpiece of the growing stack will always be at a substantially constant level slightly below the upstream end of the supply conveyor and is raisable again as the completed stack is being discharged. A sensor is provided above the stacking conveyor at substantially the same height as the upstream end of the supply conveyor, said sensor, upon contact with an incorrectly deposited workpiece on the stack, being effective to actuate immediate lowering of the stacking conveyor to a lower limiting position and starting of the stacking conveyor for removal of the incomplete stack to the discharge conveyor, and wherein the downstream end of the discharge conveyor is lowerable together with the stacking conveyor.

Since the very first incorrectly deposited workpiece that buckles at the stacking station will make contact with the sensor, the stacking conveyor will immediately be lowered to its lower limiting position and the stacking conveyor will be set into operation so that no blockage can occur at the stacking station. Further, since the downstream end of the discharge conveyor is lowerable together with the stacking conveyor, the partially formed stack together with the incorrectly deposited workpiece can be carried away on the discharge conveyor without the need for interrupting production. The rest of the workpieces that were destined to form the partially completed stack can be transferred via the now lowered and moving stacking conveyor to the discharge conveyor in the original overlapping relationship. After the predetermined number of workpieces has been reached, the stacking conveyor is returned to its uppermost position and switched off, whereupon a new stack can be formed on it. To this extent, stacking need no longer be constantly supervised. In addition, most of the workpieces for completing a partially formed stack can continue to be used because by means of the apparatus according to the invention no marked blockages occur and the partially formed stack need no longer be manually removed from the stacking conveyor. This also avoids the need for re-aligning the guide means above the stacking conveyor. Finally, there are no production losses occasioned by stopping the apparatus, removing the deformed stack and restarting the apparatus.

The discharge conveyor may be a belt conveyor comprising at least one endless belt passing over guide rollers mounted on a shaft at each end of the discharge conveyor. Preferably, the discharge conveyor is pivotable about the shaft at its downstream end, and the upstream end of the discharge conveyor is displaceable between a first limiting position in operative communication with a processing machine for the workpieces and a second limiting position in operative communication with a depositing table. If the stack formation proceeds smoothly, the stacks with a predetermined

number of workpieces are fed to the processing machine by the discharge conveyor when the upstream end of the latter is in the first limiting position. The processing machine may be a base-forming machine. On the occurrence of a deformed stack, or rather a partially completed stack containing a deformed workpiece, the partially completed stack and the subsequently arriving workpieces that were intended for the same stack are taken to the depositing table when the upstream end of the discharge conveyor is in its second limiting position. Movement to this second limiting position takes place at the same time as the stacking conveyor is lowered to its lower limiting position and as the stacking conveyor is switched on. The workpieces collected on the depositing table can later be sorted out and sent to the processing machine downstream of the stack-forming apparatus. After all the workpieces intended for a single stack have been collected at the depositing table, the stacking conveyor is raised and stopped and at that time the upstream end of the discharge conveyor is returned to its first limiting position where it is again in communication with the processing machine.

On the occurrence of a blockage in the stack formation, the stop may be displaceable simultaneously with lowering of the stacking conveyor to its said lower limiting position, so that removal of the partially completed stack is not hindered because at the same time as the stacking conveyor is lowered it is started up to transport the partially completed stack thereon. Of course if the stacking conveyor is lowered very rapidly, it may not be necessary for the stop to be displaced simultaneously.

An example of the invention will now be described with reference to the accompanying drawing in which the single FIGURE is a part-sectional side elevation of a stacking apparatus.

This apparatus comprises a stacking conveyor 1 consisting of a plurality of parallel belts, a displaceable stop 2, and a discharge conveyor 3 which also consists of a plurality of parallel belts. The stacking conveyor 1 is mounted in a frame 4 having guide rods 5, 5' which are displaceable in sleeves 6, 6', respectively, and which are displaceable up and down by a suitable reciprocating drive (not shown). A frame 7 of the discharge conveyor 3 has its downstream end hinged to a shaft 10 at the upstream end of the stacking conveyor 1. The upstream end of the discharge conveyor 3 is pivotable between a further conveyor 8 which leads to a processing station and a depositing table 9. Workpieces W which are stacked on the stacking conveyor 1 can therefore be selectively fed to either of two positions by pivoting the upstream end of the discharge conveyor about the shaft 10. This shaft also provides a common rotary axis for the guide rollers of the individual belts of the conveyors 1 and 3. Pivoting of the upstream end of the discharge conveyor 3 is effected by a pneumatic cylinder 11 having a piston rod 12 hinged to the discharge conveyor. When the piston rod is retracted, the discharge conveyor is in the position 3' shown in chain-dotted lines.

The stop 2 is adjustable in the feeding direction of the completed stacks, as indicated by the arrow *a*, or oppositely thereto, so as to adapt the apparatus to workpieces of different dimensions. The stop consists of a flap 14 hinged at 13 and carrying near its lower end a feeler 15. The feeler 15 actuates a switch 16 in the cir-

cuit of the drive for lowering the stacking conveyor 1. The stop 2 is actuated by any suitable means, such as a pneumatic drive (not shown), so that it can be swung from the position shown in full lines, where it serves as an abutment for the arriving workpieces W, to the position shown in broken lines, where it is no longer in the path of a completed stack of workpieces so that the stack can be removed by the conveyor 1.

The drives for the stacking apparatus, namely the drive for the belts of the conveyor 1, the reciprocating drive for the conveyor 1, and the drive for the stop 2, are actuated by a switch 17 which is alternately operated by an impulse generator 18 such as of a counter and by an abutment 19 on the guide rod 5'. The impulse generator 18 determines the number of workpieces to be contained in each stack St and hence the lowermost position 1' of the stacking conveyor as shown in chain-dotted lines, at which time the stop 19 will be in the position 19'. When this lowermost position has been reached, the reciprocating drive for the stacking conveyor and the drive for the belts thereof as well as the drive for pivoting the stop 2 out of the way are started. The abutment 19 limits the uppermost position of the stacking conveyor by switching off the reciprocating and belt drives of the stacking conveyor and switching on the lowering drive for the stacking conveyor. However, this lowering drive remains inoperative until the feeler 15 is also actuated. For the purpose of returning the stop 2 to its full-line position, a feeler 20 is provided in the path of the stacks. The feeler is operative as soon as it has moved upwardly under spring force after it has been released by a stack passing over it. The impulse generator 18 is associated with a counting feeler 21 which is actuated by the workpieces arriving on a supply conveyor 22 in overlapping scale formation.

Upon commencement of each stacking cycle, the belt conveyor 1 is in its upper limiting position shown in full lines. Its conveying run is disposed so closely below the upstream end of the supply conveyor 22 that the workpieces W delivered by the latter will not normally turn or fold over as they are deposited on the stacking conveyor. The stop 2 is in its full-line position in the path of the workpieces so that each workpiece will be stopped and aligned thereby. After a very few workpieces have been deposited on the stacking conveyor, the subsequently arriving workpieces will strike the feeler 15 and actuate same to cause lowering of the stacking conveyor. As soon as the stacking conveyor has been lowered to a position where the workpieces thereon no longer contact the feeler 15, lowering of the conveyor is terminated; it is not restarted until more workpieces have been supplied and superposed on the stack to actuate the feeler 15 again. This progressive automatic lowering of the stacking conveyor 1 ensures that the distance through which the workpieces from the supply conveyor 22 must drop onto the stack is kept reasonably constant and in this way the danger of the workpieces turning over during stacking is minimized during the entire stacking cycle.

When a predetermined number of workpieces as set on the impulse generator 18 has been counted by the counting feeler 21, the switch 17 is operated to effect the aforementioned removal of the completed stack by starting the belt drive for the conveyor 1 and at the same time the reciprocating drive for the conveyor 1 is started to return the conveyor to its elevated position.

Since the discharge conveyor 3 is hinged to the conveyor 1 and follows its reciprocating movement, the completed stack can be discharged while the stacking conveyor 1 is being raised and this leads to a considerable saving of time. Raising of the stacking conveyor 1 is terminated when the abutment 19 operates the switch 17. The stop 2, which had been swung out of the path of the completed stack, is returned to the full-line position as soon as the trailing edge of the stack has released the feeler 20.

By adjusting the distance x of the stop 2 from the counting feeler 21 with the aid of a slot 23 or a suitable time delay device in the electric circuit, removal of a completed stack as previously described can be set for all lengths of workpieces to commence as soon as the last workpiece for the stack has arrived at the stop 2. During adjustment of the pivot 13 of the stop 2 in the slot 23, the position of the feeler 20 is simultaneously adjusted in a slot 24 of the frame 4.

The belts of the conveyors 1, 3 and 8 preferably move at equal speeds. The belts of the conveyors 3 and 8 may in fact be driven by the processing machine downstream of the conveyor 8 so that these belts will continue to circulate and feed any stacks thereon while the belts of the stacking conveyor 1 are stationary.

If a workpiece W is incorrectly conveyed on the supply conveyor 22 it will, as soon as it has left the latter, actuate a sensor 25 provided above the stacking conveyor. The sensor comprises a lever 26 which is displaced by the deformed workpiece to actuate a micro-switch 27 which immediately actuates a bypassing operation for the partially completed stack S' as hereinafter described, so as to avoid possible jamming of the incorrectly deposited workpieces at stationary guide means 28 provided above the stack or to prevent defective stacks from reaching the processing machine downstream of the conveyor 8.

The bypassing operating takes place as follows. Upon actuation of the micro-switch 27, the sensor 25 transmits an impulse to the switch 17 which actuates the reciprocating and belt drives for the conveyor 1 and the drive for swinging the stop 2 out of the way. Simultaneously, the pneumatic cylinder 11 is caused to lower the upstream end of the conveyor 3 to the position 3' so that a path is established between the conveyor 1 and depositing table 9.

The partially completed stack is taken to the depositing table. So are all the subsequently supplied workpieces that were intended for the same stack, these travelling along the discharge conveyor in their original overlapping scale formation. In this way the entire group of workpieces containing one or more deformed workpieces effectively bypasses the conveyor 8 leading to the processing machine. As soon as all the relevant workpieces have arrived at the depositing table 9, the components are returned to their starting positions in readiness for a fresh stacking cycle. The belts of the conveyor 1 are stopped, the reciprocating drive for the conveyor 1 is brought into readiness and the stop 2 is swung back into the path of the workpieces arriving on the supply conveyor 22. The pneumatic cylinder 11 is switched over to swing the conveyor 3 into the upper limiting position to re-establish a continuous path to the processing machine for the next correctly formed stack.

It will be evident that the invention is not restricted to a direct path being established to a processing ma-

chine by means of the conveyors 3 and 8. The upstream end of the conveyor 3 may be permanently associated with the depositing table. If a workpiece is then incorrectly deposited on the stack, the only difference in the previously described operation will be that the upstream end of the discharge conveyor is no longer lowered.

We claim:

1. Apparatus for forming and conveying stacks of flat workpieces, where the workpieces arriving on a supply conveyor are successively deposited in superposed relation on an intermittently driven stacking conveyor against a stop to form a stack, the stop being displaceable to free the stack after completion and allow it to be moved by the stacking conveyor to a discharge conveyor, comprising means to progressively lower the stacking conveyor during stack formation so that the uppermost workpiece of the growing stack will always be at a substantially constant level slightly below the upstream end of the supply conveyor and means to raise the stacking conveyor as the completed stack is being discharged, sensor means positioned above the stacking conveyor at substantially the same height as the upstream end of the supply conveyor, which upon sensing an incorrectly deposited workpiece on the stack, actuates immediate lowering of the stacking conveyor to a lower limiting position and starting of the stacking conveyor for removal of the stack containing the incorrectly deposited workpiece to the discharge conveyor, with the downstream end of the discharge conveyor being lowerable together with the stacking conveyor.

2. Apparatus according to claim 1, wherein the discharge conveyor is a belt conveyor comprising at least one endless belt passing over guide rollers mounted on a shaft at each end of the discharge conveyor, said discharge conveyor being pivotable about the shaft at its downstream end, and displaceable at its upstream end between a first limiting position in operative communication with a processing machine for the workpieces and a second limiting position in operative communication with a depositing table.

3. Apparatus according to claim 1 wherein the stop is displaceable simultaneously with lowering of the stacking conveyor to its said lower limiting position.

4. Apparatus for forming and conveying stacks of flat workpieces, where workpieces arriving on a supply conveyor are successively deposited in superposed relation on an intermittently driven stacking conveyor against a stop to form a stack, the stop being displaceable to free the stack after completion and allow it to be moved by the stacking conveyor to a connected discharge conveyor, comprising a stacking conveyor mounted on a reciprocating frame means said stacking conveyor being lowered progressively below said supply conveyor during stack formation so that the uppermost workpiece of the growing stack will always be at a substantially constant level slightly below the upstream end of the supply conveyor, means to raise the stacking conveyor to its original position before workpieces were deposited on the stacking conveyor and to start the conveyor in motion to discharge the stack onto the discharge conveyor, sensor means positioned above the stacking conveyor at substantially the same height as the upstream end of the supply conveyor, which, upon contact with an incorrectly deposited workpiece on the stack, actuates immediate lowering of the stacking conveyor to a lower limiting position and starting of the stacking conveyor for removal of the incorrectly stacked stack to the discharge conveyor, the downstream end of the discharge conveyor being lowerable together with the stacking conveyor.

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