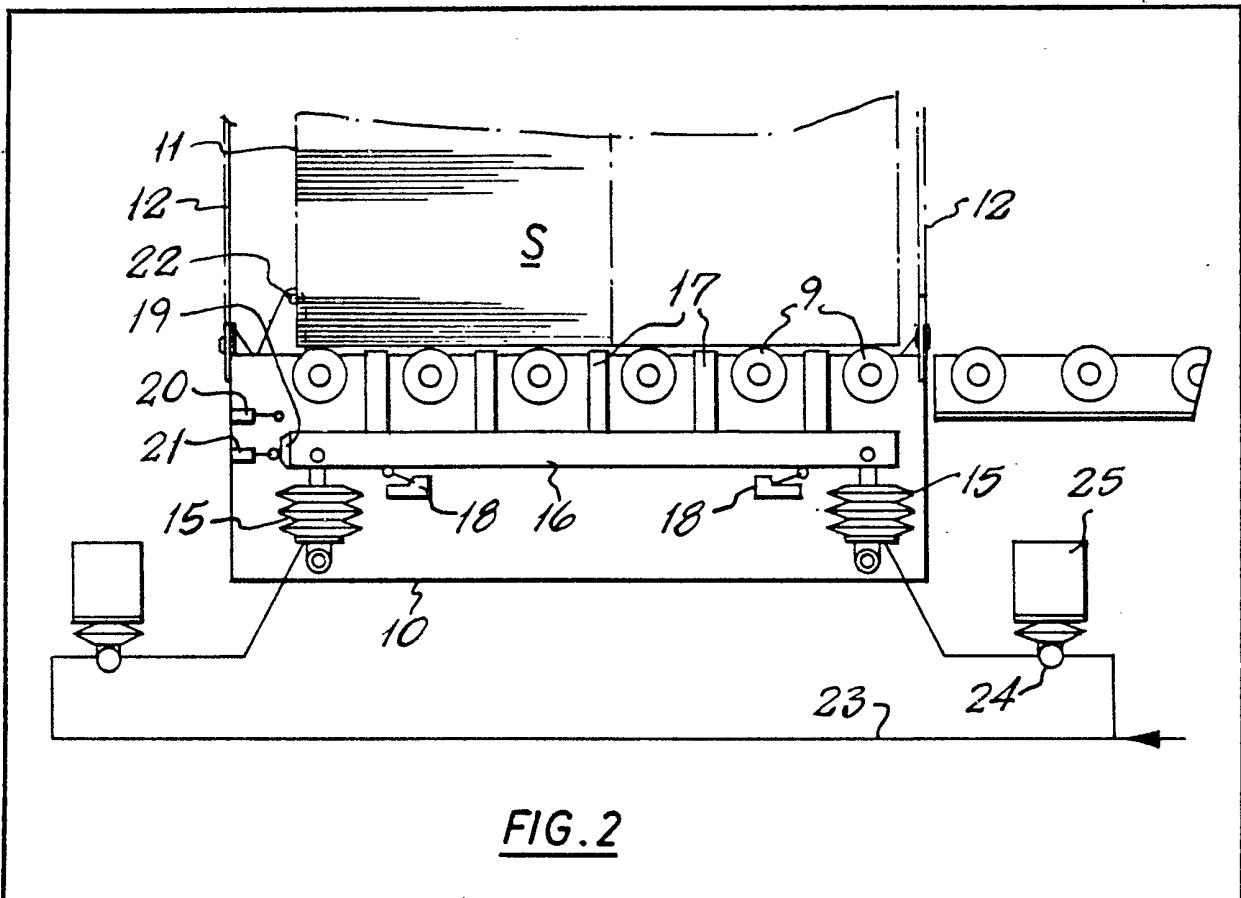


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- (71) Applicant Simon Container Machinery Limited, Birdhall Lane, Cheadle Heath, Stockport, Cheshire, SK3 0RT
- (72) Inventor Frederick Paul Johnson
- (74) Agent M. J. Ajello

(54) **A Stack Elevating Device**

(57) Apparatus for presenting a stack of sheets to a datum line above the stack, along which line the sheets are removed in turn from the top of the stack the apparatus including a carriage (10) for supporting the stack, drive means (12) for elevating the carriage from a base position towards the datum line, fluid pressure means (15) on the carriage serving to lift a platform (16) having lifting bars (17) for raising the stack above the

carriage, there being a plurality of limit switches (18, 20, 21) which are adapted to cause initial raising of the stack on the platform (16) the stack being continuously elevated by the pressure means (15), and intermittent elevation of the carriage as the platform strikes the limit switches (20, 21) as the stack diminishes, whereby a constant lifting pressure is applied to the stack and the top of the stack is maintained level for uniform contact with the feeding means at the datum line.



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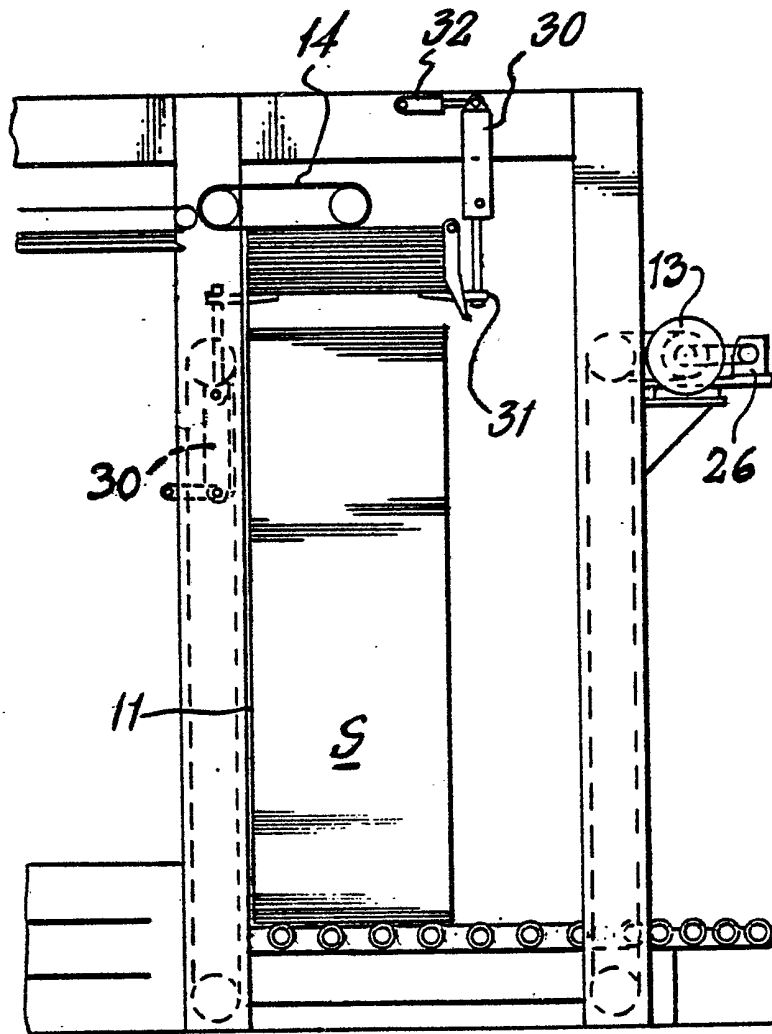


FIG. 1

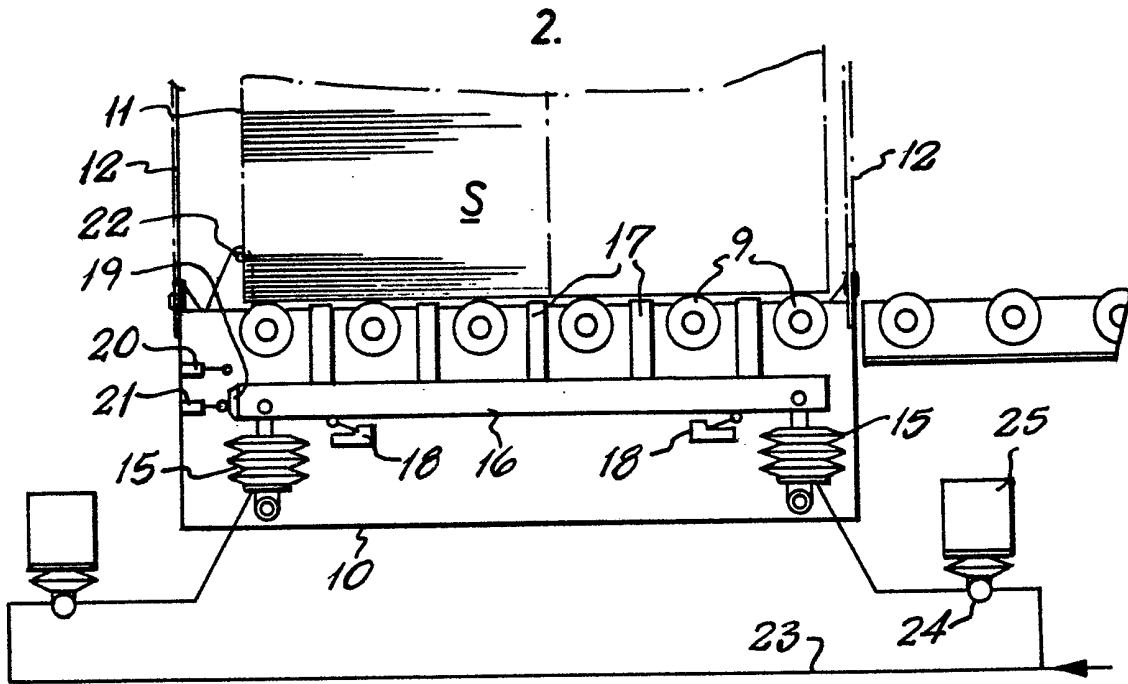


FIG. 2

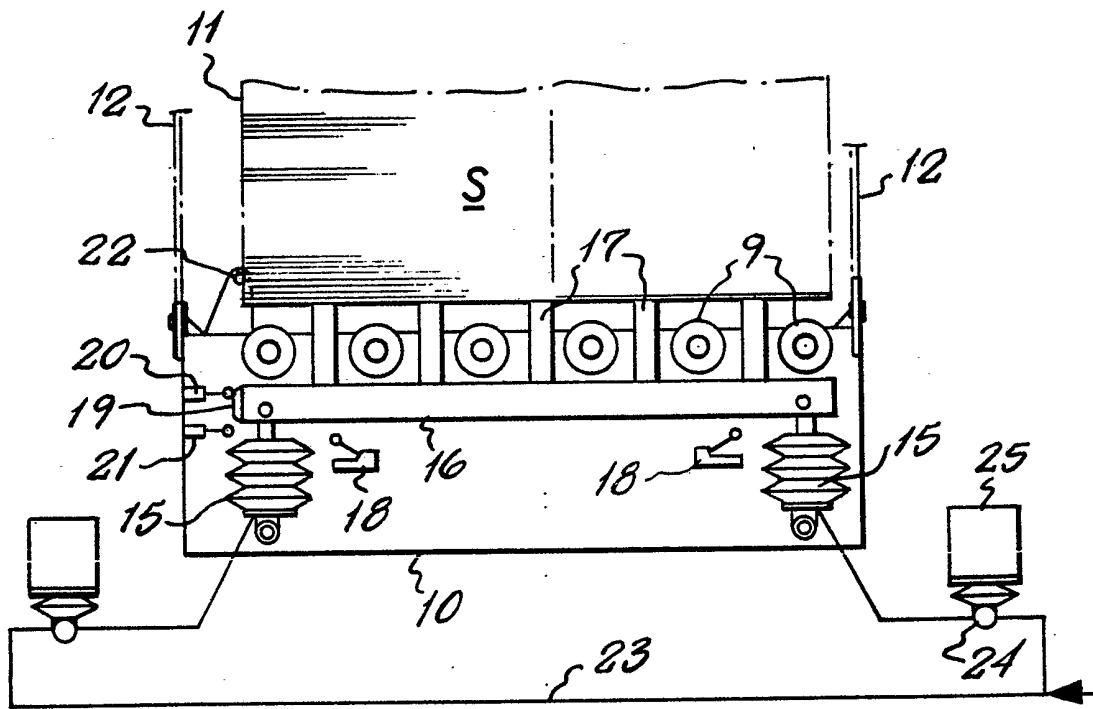


FIG. 3

SPECIFICATION

A Stack Elevating Device

This invention relates to apparatus for presenting a stack of sheets of, for example, corrugated board to a datum feed line at which the sheets are fed from the top of the stack. Particularly though not exclusively, apparatus of this kind is used in the box making industry wherein corrugated board is cut into rectangular box blanks which are arranged in vertical stacks for supply to a line of box making machinery. In many cases it is preferable to feed the blanks from the top of the stack, and it is an object of the present invention to provide apparatus for presenting a stack of sheets of board to a datum feed line, wherein a substantially overall contact is maintained between successive top sheets in the stack and means adapted to feed the sheets therefrom.

According to the present invention there is provided apparatus for presenting the top sheet of a stack of sheets of, for example, corrugated board to a datum feed line provided by the undersurface of a feed member above the stack and along which line the sheets are fed from the top of the stack, the apparatus including a carriage for receiving and supporting the stack, drive means for elevating the carriage from a base position towards the feed member, means on the carriage for resiliently supporting and lifting the stack relative thereto, said supporting and lifting means permitting the base of a stack to be tilted relative to the carriage when the upper sheet of the stack is not level thus to place the upper sheet in level contact with the feed member, and sensing means on said carriage for detecting the position of the stack thereon and connected to the drive means to effect intermittent operation thereof as the stack diminishes.

Preferably the apparatus includes further sensing means for detecting the height of the carriage above the said base position, the further sensing means being operably connected to the supporting and lifting means and adapted to vary the supporting pressure applied thereby as the stack diminishes.

Further according to the invention there is provided holding means operable when the stack is almost consumed and when the carriage is approaching its uppermost position, to capture the remaining sheets and to continue applying a resilient supporting pressure thereto whilst the carriage is permitted to descend to its base position to receive a replacement stack.

An embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:—

Fig. 1 is a general view of the apparatus to be described showing a stack of sheets supported on a carriage, and means for feeding sheets from the top of the stack;

Fig. 2 is an enlarged view of the carriage with a stack supported thereon;

and Fig. 3 is a view similar to Fig. 2 showing

the stack supported above the carriage by fluid pressure means.

Referring now to the drawings, there is provided a roller carriage 10 having a plurality of rollers 9 providing a conveying surface and which can be driven to direct a stack *S* of sheets up to a stop or front datum line indicated at 11. The carriage 10 is suspended by a plurality of chains 12 which by means of a motor 13 are capable of elevating the carriage 10 from the base position in which it receives a new stack, towards a datum feed line provided by, for example, an endless feeding belt 14 arranged to remove the sheets from the stack and to feed them to a subsequent work station.

Mounted on the carriage 10 are four air bags 15, one at each corner which support a freely movable platform 16 having lifting bars 17 which, when the air bags 15 are inflated, rise between the rollers 9 to support the stack *S* above the rollers. Four limit switches 18 are provided, one adjacent each air bag 15. The switches are closed by contact with the platform 16 when the air bags 15 are deflated. The platform 16 carries at its end adjacent the front datum line 11 a cam 19 which, as the platform rises and falls relative to the carriage 10 actuates further switches 20 and 21 mounted on the carriage midway between the air bags 15 below the front datum line 11.

A photocell or other position sensing means indicated at 22 is attached to the carriage to sense the presence at datum line 11 of a stack *S*.

A pneumatic feed line 23 supplies air under pressure to the front and rear pairs of air bags 15 via two individual pressure regulators 24 controlled by electric pressure converters 25 mounted thereon.

An electrical control system whose details do not form part of this invention and which is therefore not described here in detail, is provided such that sensing means 22 and limit switches 18 are operably connected to converters 25 to control operation of the regulators 24. Also connected to the converters 25 is a transducer 26 driven by the motor 13 and thus capable of detecting the instantaneous height of the carriage 10.

In operation, a stack *S* is fed onto the carriage 10 by the driven rollers 9 until the sensing means 22 detects the presence of the front edge of the stack on the datum line 11 and stops the drive to the rollers 9, whereupon regulators 24 are actuated by the control system to commence supplying air under pressure to air bags 15 so that platform 16 and lifting bars 17 start to rise to support the stack above the rollers 9, when a stack of lesser depth than the carriage 10 is being handled, as illustrated in Fig. 1, a greater air pressure is required in the front pair of air bags than in the rear pair. Thus the pressure in each air bag is allowed to build up until the limit switches 18 are released. When each pair of switches 18 associated with the front or rear pair of air bags is released, its associated pressure regulator 24 is thus set to supply the required supporting

pressure. A lifting pressure is then applied as a fixed percentage of the supporting pressures, and the platform 16 continues to rise.

As the platform rises limit switch 20 is actuated by the cam 19 which causes the drive motor 13 to be energised, and the whole carriage 10 to be elevated. When the uppermost sheet in the stack reaches the datum feed line provided by the under surface of the feeder 14, further elevation of the stack and the platform 16 is prevented, but the carriage continues to rise until the limit switch 21 is actuated by the cam 19, whereupon the motor is de-energised and the carriage stops.

As sheets are fed from the top of the stack by the feeder 14, the pressure in the air bags 15 continues to raise the stack to the datum feed line until the limit switch 20 is once again actuated by the cam 19, and again the carriage commences to rise under the action of the motor 13 until the limit switch 21 is actuated. The transducer 26 provides a signal dependent upon the height of the carriage 10 and this signal is fed to the converters 25. Thus, as the weight of the stack diminishes the pressure applied by the regulators 24 to the air bag 15 is also reduced thereby providing a substantially constant pressure of the uppermost sheet against the surface of the feeder 14.

It will be seen that the individual air bags 15 can cause each corner of the platform 16 to lift independently. In this way, should the uppermost sheet in the stack not be level, then, as the carriage 10 is elevated, the highest part of the stack will contact the feeder surface first and the corresponding air bag or bags will be depressed progressively until the top sheet is level and the platform 16 assumes a correspondingly out of level position.

In order to maintain continuity of feed of sheets to the subsequent work station it is necessary, before the stack is completely consumed, to maintain a small stack of sheets in contact with the feeder whilst allowing the carriage to descend to its base position to receive a replacement stack. For this purpose, a plurality of air cylinders 30 are pivotally mounted on a machine frame member in the upper region of travel of the carriage. The ram of each cylinder 30 carries an arm 31 which when the cylinder is pivoted by means of one of a number of auxiliary cylinders 32, moves inwardly towards the centre of the stack to grip and support a number of sheets positioned above the lifting bars 17.

Operation of cylinders 30 and 32 is effected by a signal from the transducer 26 reporting a condition in which the carriage 10 has reached a predetermined maximum height. When the limit switch 20 is actuated by the rising platform so that the stack is then supported above the rollers 9, the arms 31 move inwards, and the cylinders 30 then apply an upwards pressure on the sheets which is equivalent to the pressure applied by air bags 15 immediately preceding actuation of cylinders 32. Thus the remaining part of the stack

continues to be lifted to give constant supply to the feeder 14 whilst the carriage 10 returns to the base position to receive a new stack. It should be noted that withdrawal of the arms 31 is to be synchronised with initial elevation of the replacement stack and when limit switch 21 is first actuated by cam 19 so that a continuous feed is ensured.

Claims

1. Apparatus for presenting the top sheet of a stack of sheets of, for example, corrugated board to a datum feed line provided by the undersurface of a feed member above the stack and along which line the sheets are fed from the top of the stack, the apparatus including a carriage for receiving and supporting the stack, drive means for elevating the carriage from a base position towards the feed member, means on the carriage for resiliently supporting and lifting the stack relative thereto, said supporting and lifting means permitting the base of a stack to be tilted relative to the carriage when the upper sheet of the stack is not level thus to place the upper sheet in level contact with the feed member and sensing means on said carriage for detecting the position of the stack thereon and connected to the drive means to effect intermittent operation thereof as the stack diminishes.
2. Apparatus according to claim 1, including further sensing means for detecting the height of the carriage above the said base position, the further sensing means being connected to the supporting and lifting means and adapted to vary the supporting and lifting pressure applied thereby accordingly as the weight of the stack diminishes.
3. Apparatus according to claim 1 or claim 2, including holding means operable when the stack is almost consumed and when the carriage is adjacent its uppermost position, to capture the remaining sheets in the stack and to continue applying a resilient supporting pressure thereto whilst the carriage is permitted to descend to the base position to receive a replacement stack.
4. Apparatus according to any one of the preceding claims, wherein the carriage is provided with a set of rollers forming a conveying surface onto which the stack is initially fed, the supporting and lifting means supporting said stack on a platform having lifting bars adapted to be raised between the rollers of the carriage.
5. Apparatus according to any one of the preceding claims, wherein the supporting and lifting means comprising a plurality of air bags disposed in spaced relationship on the carriage, each air bag being connected to a source of compressed air via a controllable pressure regulator.
6. Apparatus according to any one of the preceding claims, wherein the sensing means for sensing the position of the stack relative to the carriage comprises a pair of limit switches at different levels on the carriage and adapted to detect the height of the stack relative thereto.

7. Apparatus according to claim 2, wherein said further sensing means comprises a transducer adapted to monitor the height of the carriage above said base position.
- 5 8. Apparatus according to claim 3, wherein said holding means comprises one or more fluid pressure devices capable of being moved into position thus to capture the said remaining sheets in the stack and to continue applying a resilient
- 10 supporting pressure thereto.
9. Apparatus according to any one of the preceding claims, wherein said carriage is suspended on a plurality of chains or like members, there being an electric motor adapted
- 15 to drive the said chains or like members thus to elevate said carriage from said base position.
10. Apparatus according to any one of the preceding claims, including yet further sensing means on said carriage capable of sensing the arrival thereon of a replacement stack and operably connected to said supporting and lifting means thus to commence elevation of the stack relative to the carriage and presentation of the top sheet of the stack to the feed member.
- 20 11. Apparatus for presenting the top sheet of a stack of for example, corrugated board to a datum feed line provided by the undersurface of a feed member above the stack and along which line the sheets are fed from the top of the stack,
- 25 substantially as hereinbefore described, with reference to and as illustrated in the accompanying drawings.
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