United States Patent

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[73] Assignee **J. Bobst & Sons, Inc.**
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[33] **Switzerland**
[31] **9770/68**

[54] **SHEET MATERIAL FEED CONTROL APPARATUS**
8 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **271/35**
[51] **Int. Cl.** **B65h 3/34**
[50] **Field of Search** 271/35, 41

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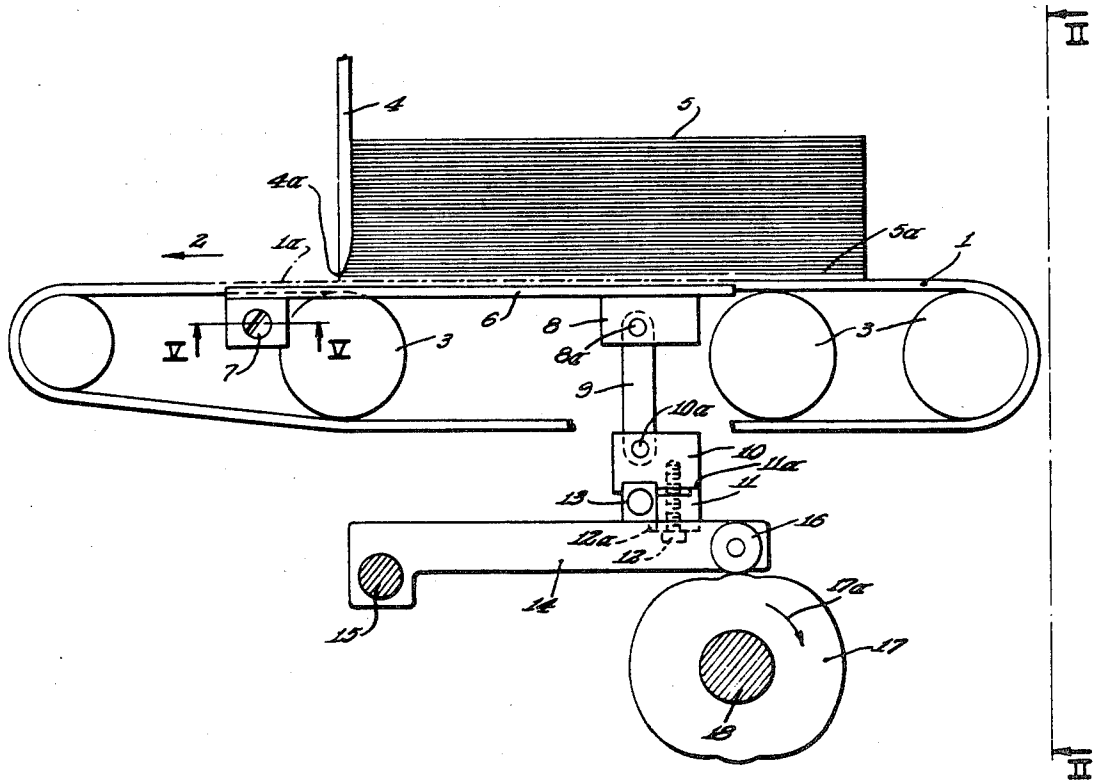
ABSTRACT: Feeding sheet material on a conveyor means continuously moving in a first direction past a gauge means is efficiently accomplished by means of a feed control means comprising elongated lifting members positioned adjacent and in some cases between the conveyor means behind the gauge means whereby when the lifting member upper surface is below the upper surface of the conveyor means the sheet material may be fed past the gauge means and when the upper surface of the lifting member is above the upper surface of the conveyor means the sheet material is out of engagement with the conveyor means and feeding is halted. Synchronized movement of the lifting members is provided by a lifting assembly which includes a pair of rotating cams, a pair of follower means riding on said cam, a rod connecting the follower means with the lifting member and a transverse beam connecting the follower means whereby movement of the cam is transmitted through the follower arms and the connecting rods to the lifting members to cause them to move together into and out of engagement with the sheet material, thereby controlling the feeding of the sheet material past the gauge means.



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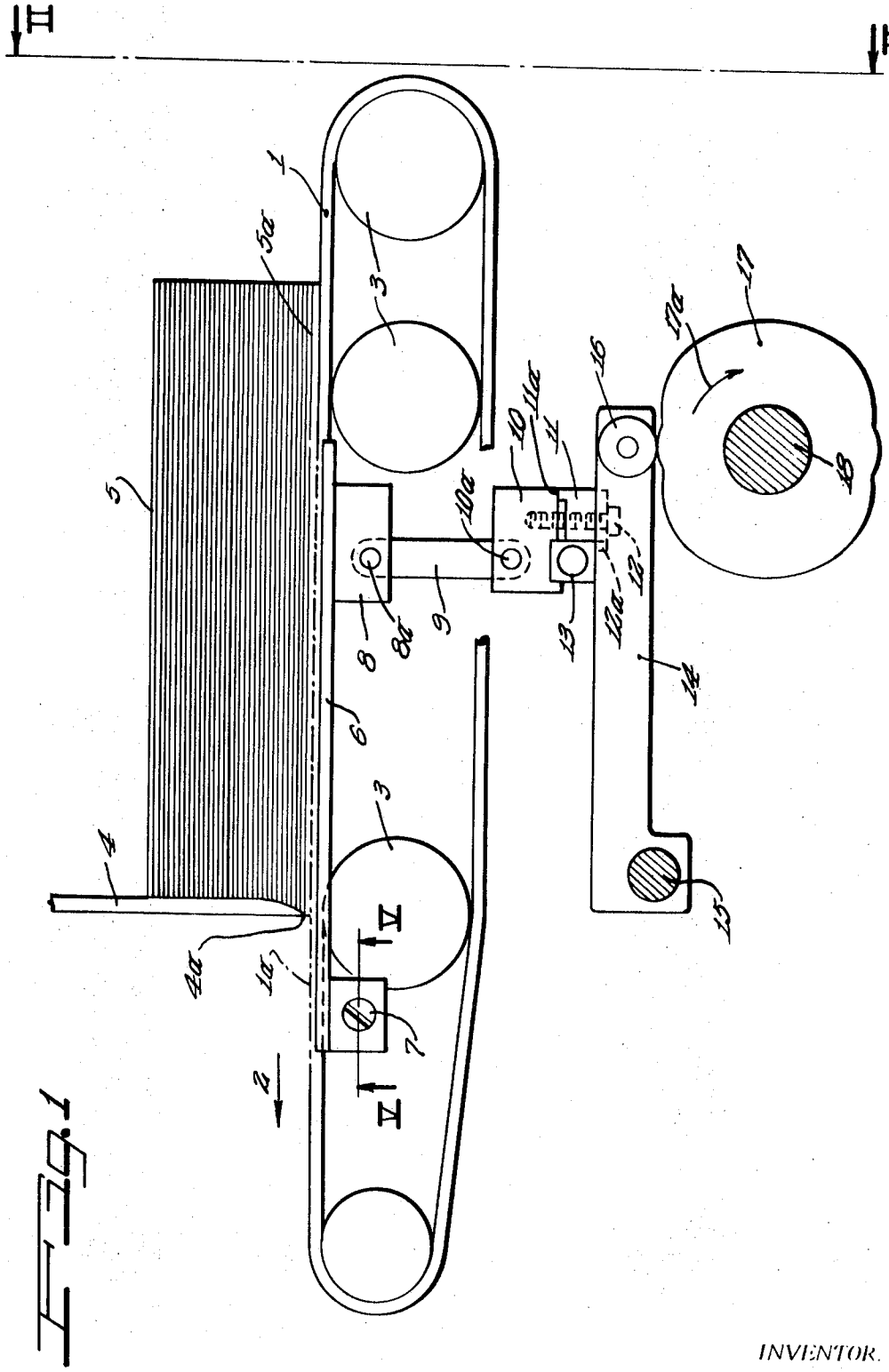

Fig. 1

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Fig. 5

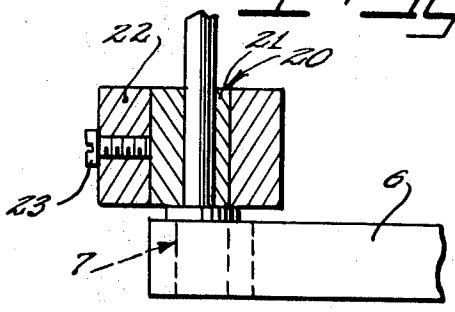


Fig. 2

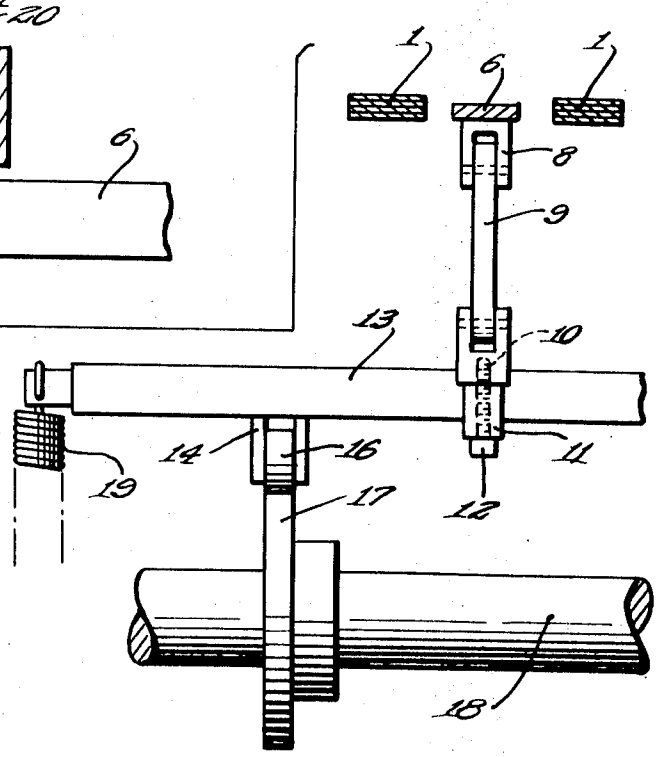


Fig. 4

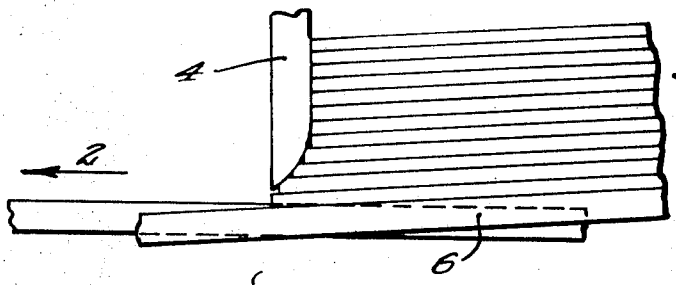
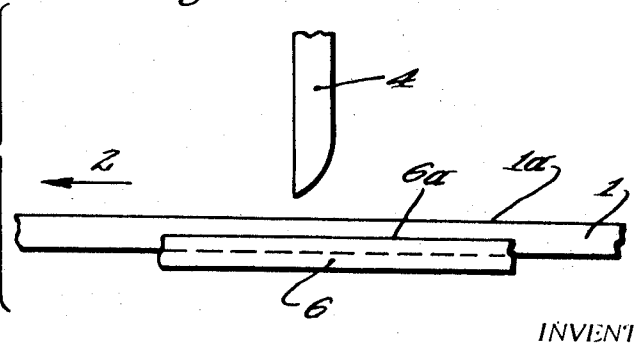


Fig. 3



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SHEET MATERIAL FEED CONTROL APPARATUS

BACKGROUND OF THE INVENTION

Field of the Invention

This invention generally relates to a transport mechanism for sheet material with a feed control means therefor and more particularly this invention contemplates apparatus for controlling the feeding of the bottom sheet of a stack of sheet material onto a continuously moving conveyor means past a gauge means in a single direction.

PRIOR ART

I have discovered that feed control means of the prior art lack the efficiency and the reliability very necessary for new high-speed sheet-material-processing apparatus. With newly developed cutters and creasers processing more than 5,000 sheets per hour, the efficiency and reliability of the sheet-feeding apparatus therefor must be equal to the task to avoid very expensive "downtime" which may result from improper feeding. It is known to employ a flat member above which is placed a stack of the sheet material and from which, by a reciprocal motion, the flat member carries the lowermost piece of sheet material under a gauge in each working cycle, so as to introduce the sheet to a processing machine. With the increasing speed of the processing machines, however, the inherent limitation of the reciprocating-type feed apparatus which include for example, the disproportionate increase in wear and tear caused by the change in the direction of the mass of the reciprocating table, become apparent and dictate a different and more efficient mode of sheet feeding.

SUMMARY OF THE INVENTION

The problems and disadvantages associated with the prior art are overcome by my invention in which a conveyor means continuously moving in the same direction below a stack of sheet material to be fed has associated therewith a sheet feed control mechanism which operates to stop the feeding of the sheet material by lifting the stack of sheet material off of the continuously moving conveyor. The conveyor means moves in a first direction and has a substantially coplanar upper gripping surface which pulls a bottom-contacting sheet below a gauge means spaced at least a predetermined first distance above the upper surface of the conveyor means. This first distance is at least equal to the thickness of a sheet of material. The conveyor means may comprise at least one endless belt and may be as many as 10 or more parallel spaced endless belts.

Engagement of the bottom sheet of the stack of sheet material with the conveyor means is controlled by a feed control means comprising a plurality of elongated lifting members positioned alongside and between said conveyor means. Each of the lifting members moves between a first position in which the upper surface of the lifting member is below the upper surface of the conveyor means and a second position in which the upper surface of the lifting member is above the upper surface of the conveyor means so that the sheet material is kept out of engagement with the conveyor means. In an embodiment of my invention, the lifting member is a lever pivotally connected at a first end to an adjustable pivot means located forward of the gauge means in relation to the direction of the movement of the conveyor means. Adjacent the other end or second end of the lifting member a lifting assembly is connected thereto to pivot the lifting member about its first end. The lifting assembly includes a rotating cam means with a roller on a second end of a follower arm riding thereon. The first end of the follower arm may be pivoted at a point away from the cam. A connecting rod between the lifting member and the follower arm transmits the movement of the follower arm in response to the cam movement of the cam up to the lifting member to cause the lifting member to move the sheet material into and out of engagement with the conveyor means. Since the conveyor means is at least one endless belt and since the lifting members are positioned alongside and on opposite sides of each of the belt or belts there are at least two outermost lifting members. To provide synchronized movement of the lifting members and to keep the number of elements to a minimum there are provided in the preferred embodiment of the invention only a pair of cams and follower arms, one of each being positioned adjacent the outermost lifting members with a transverse beam extending across and between the follower arms so that the connecting rods may extend between the transverse beam and each of the lifting members. The cam means may be a wheel configured to give two liftings of the lift members per revolution. When the conveyor means is an endless belt riding on at least two drive wheels there may be provided at least one wheel at a position below the gauge means to insure that the first distance between the conveyor means and the gauge is maintained constant.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features and advantages of the invention will be readily apparent from the following description of certain preferred embodiments thereof, taken in conjunction with the accompanying drawings, although variations and modifications may be effected without departing from the spirit and scope of the novel concepts of the disclosure, and in which:

FIG. 1 is an elevational schematic side view illustrating the cooperation between the elements of the combination when the lifting member and lifting assembly are in a feed position;

FIG. 2 is a fragmentary cross-sectional schematic elevational end view generally taken along the lines II—II in FIG. 1;

FIG. 3 illustrates the feed control means in the area of the gauge means with the lifting member in its lowered position;

FIG. 4 illustrates the feed control means with the lifting member raised in the area of the gauge means; and,

FIG. 5 is a detailed cross-sectional view of the lifting member suspension means taken along the lines V—V of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

There is shown in FIG. 1 a conveyor means 1 moving in a first direction 2 over a plurality of rollers 3 which conveyor means is adapted to transport the lowermost sheet 5*a* of a stack of sheet material 5 below a gauge means 4 to a processing machine not shown. The movement of the remainder of the stack 5 is controlled by the gauge 4. The conveyor means 1 may advantageously be in the form of an endless belt having a substantially coplanar upper gripping surface 1*a* and which moves over a series of rollers 3. Further, it may comprise a single endless belt or a plurality of spaced generally parallel belts show schematically in FIG. 2. The gauge means 4 is spaced above the upper surface of the conveyor means 1*a* a first distance 4*a* that should be at least equal to the thickness of the sheet material pieces 5*a*. The first distance or slit 4*a* is of an adjustable height so that only the bottom sheet of the stack may be allowed to escape and be drawn along by the conveyor means into the processing apparatus.

To control the feeding of the sheets from the bottom of the stack 5 I have provided an efficient and reliable feed control means comprising a plurality of lifting members 6 which may be positioned on opposite sides of the belt or belts which comprise the conveyor system. While they may be adjacent each belt side edge it must be understood that other arrangements may be suitable. The lifting member 6 is movable between a first position as shown in FIG. 3 in which the upper surface 6*a* of the lifting member 6 is below the upper surface 1*a* of the conveyor means and a second position as may be seen in FIG. 4 in which the upper surface 6*a* of the lifting member 6 is above the upper surface 1*a* of the conveyor means 1 and is in contact with the stack of sheet material 5 to thereby hold the lowermost sheet of the stack above the continuously moving conveyor means 1 so that feeding of the material is stopped. While the lifting member 6 may be of various configurations, I have found it advantageous to pivot a first end of the lift

member 6 about a point 7 which pivot point is positioned forward of the gauge means 4 relative to the direction of movement of the conveyor means 1. As will be explained later this pivot means 7 allows adjustment of the spacing between the upper surface of the lift member 6 and the lower edge of the gauge 4. With the first end of the lift member 6 pivoted at the pivot the second end has associated therewith a lifting assembly that serves to move the lift member between the aforementioned first and second positions.

The lift assembly is connected to the lift member 6 adjacent its second end with an attachment means 8. A connecting rod 9 is pivotally secured to said attachment means 8 by means of a pivot point 8*a* as may be clearly seen in FIGS. 1 and 2. The other end of the connecting rod 9 is connected to a block-mounting means 10 which includes a clamp portion 11 that pivots about a point 11*a* and employs a screw means 12 to clamp onto a transverse beam 13. With each of the lifting members 6 being provided with a lifting assembly portion identified by the numbers 8, 9, 10, 11 and 12 clamped to a common transverse beam 13, which beam in turn is attached to a follower arm 14, the lift members 6 will move in response to the pivotal movement of a follower arm 14 about a pivot 15 on the first end of said follower arm 14. A roller means 16 at a second end of said roller arm 14 rides on a cam 17 that is operatively connected to a drive means 18 to rotate in a direction as shown for example by the arrow 17*a*. As the cam 17 turns, it pivots the follower arm 14 about the pivot point 15 and by means of the connecting rod 9 pivots the lifting member 6 about the pivot 7 to raise the stack of sheet material 5 out of contact with the continuously moving belt 1.

With the lifting members of the feed control means being positioned alongside and on opposite sides of each of the conveyor belt or belts 1 of the conveyor system there will always be at least two outermost lifting members with the possibility of one or more interior lifting members. To provide synchronization of all the lifting members and to provide for an efficient and reliable drive means, I have found it highly effective to provide only two cams and follower arms by positioning these adjacent the outermost lifting members and extending a transverse beam thereacross so that the lifting members are connected to the transverse beam rather then to the follower arm 14. In this manner also the spacing and adjustment of the conveyor means is readily affected in a minimum of time by merely moving the mounting blocks along the transverse beam. Also of course, the movement of the lifting members 6 is synchronized. While it is possible to use a greater or lesser number of cam and follower arm members I have not found this to be necessary. Referring to FIG. 2 it may be seen that a drawback spring 19 disposed at the ends of the transverse beam 13 will urge the roller 16 on the follower arm 14 into contact with the cam 17.

Referring now to FIG. 5 there may be seen an eccentric connection means generally indicated at 20 which allows a variation in the elevation of the pivot point 7 and consequently the lifting member 6. This means is provided so that when a sheet 5*a* of the stack 5 is moved forward hy the conveyor means 1 as indicated above, the pinching or clamping of the tail end of the sheet between the conveyor means 1 and the abutment 4 will be avoided when the lifting member 6 moves the remainder of the stack out of engagement with the conveyor means. Thus, the first distance 4*a* must be maintained to be at least equal to the thickness of the sheet material. Moreover, the distance between the upper surface of the lifting members 6 and the bottom edge of the gauge means 4 must in fact be greater then the thickness of the sheet material so that when the lift member 6 is moved upwardly to its second position it will remain spaced from the gauge means by a distance at least equal to said sheet material thickness. To provide for this adjustment the pivot member 7 for the lift members 6 is bushed in an eccentric connector 21 that turns in a support member 22 affixed to the apparatus 10 foundation which eccentric member 21 is capable of being secured by a stop screw 23 in any desired position within the range of the eccentric.

Operation of the above-described apparatus is briefly set forth with respect to the drawings in FIG. 1 of which it may be seen that the bottom sheet 5*a* of the stack of sheets 5 acting under the weight of the stack, will be gripped by the upper surface 1*a* of the continuously moving endless belt means 1 and moved in the direction of movement 2 below the gauge means 4 into a machine not shown for further processing. Control of the removal of the bottom sheet 5*a* is affected by moving the stack 5 into and out of engagement with the conveyor means 1. This control is affected by lift members 6 coextensive at least with the width of the stack 5 and positioned initially in a first position below the level of the upper surface of the conveyor means 1 but pivoted upwardly by means of a lifting assembly 8–16 to a position above the upper surface 1*a* of the conveyor means 1, whereby the lowermost sheet 5*a* and the stack 5 are lifted out of contact with the moving belt.

Suitable drive means not shown convey their power through a shaft 18 to turn the aligned pair of cams 17. A roller 16 on each of the follower arms 14 rolls on the cam surface, raises and lowers the follower arm 14 which follower arm 14 in turn operates through the connecting rod 9 attached to a transverse beam 13 to move the lifting members 6 up or down together, thereby raising and lowering the stack of sheet material out of and into engagement with the conveyor means 1. The drive means for the conveyor means 1 and the cam means 17 may be synchronized with the operation of the sheet-material-processing machine not shown so that synchronized feeding is obtained.

By positioning the pivot means 7 in front of the gauge means 4 it assures that the entire lower surface of the bottom sheet 5*a* can be moved out of contact with the conveyor means 1. It is to be understood, however, that it is possible for a small portion of the sheet 5*a* to remain in contact with the conveyor means since the frictional force will not be sufficient to move the sheet 5*a* from beneath the stack 5.

It is pointed out that the pivot axis 7 may be common to all of the lifting members 6 so that an eccentric pivot connection means such as shown in FIG. 5 need be provided only on opposite sides of said pivot axis 7 to thereby keep the number of parts necessary to a minimum and further to assure the synchronization of operation between the lifting members 6. This synchronization is evident inasmuch as the lifting members 6 are pivoted about a common pivot point 7 and moved by identical connecting rods 9 attached to a common transverse member 13 that moves in response to aligned cams 17 attached to a common drive shaft 18.

Although minor modifications might be suggested by those versed in the art, it should be understood that I wish to embody within the scope of the patent warranted hereon all such modifications as reasonably and properly come within the scope of my contribution to the art.

I claim as my invention:

1. A apparatus for selectively feeding sheet material comprising a conveyor means movable in a first direction having an upper surface lying substantially in a plane, a gauge means spaced at least a predetermined first distance above said upper surface, a feed control means controlling the elevation of sheet material with respect to said conveyor upper surface whereby said sheet material may be moved into and out of engagement with said upper surface of said conveyor means, said feed control means comprising an elongated lifting member having an upper surface which lies substantially in a plane, said lifting member being movable between a first position in which said upper surface of said lifting member is below said upper surface of said conveyor means and a second position in which said upper surface of said lifting member is above said upper surface of said conveyor means in contact with said sheet material to keep it out of engagement with said conveyor means, each said lifting member being a lever pivotally connected at a first end to a pivot means located forward of said gauge means, said pivot means being an eccentric connection operable to vary the level of the point of pivot whereby said first distance may be varied.

2. An apparatus according to claim 1 wherein said conveyor means includes at least one strip having opposite side edges, a lifting member being positioned alongside and adjacent each of said side edges.

3. An apparatus according to claim 1 wherein said lifting assembly includes a rotating cam means, a follower arm pivoted about a first end and having a roller on a second end, said roller riding on said cam means, a connecting rod connected between said lifting member and said follower arm whereby movement of said follower arm in response to the rotation of said cam is transmitted to said lifting member to cause it to move into and out of engagement with said sheet material.

4. An apparatus according to claim 3 wherein said conveyor means is at least one endless belt and said lifting members of said feed means control are positioned alongside and on opposite sides of each of said belt or belts, so that there are at least two outermost lifting members, said cams and follower arms of said lifting assemblies being positioned adjacent said outermost lifting members, a transverse beam extending across said follower arms and a connecting rod extending between said transverse beam and each of said lifting members whereby the movement of all of said lifting members is synchronized.

5. An apparatus according to claim 4 wherein said conveyor means comprises 10 parallel endless belts and there are 11 lifting members therebetween and alongside whereby said belts and lifting members are coextensive in width with both said sheet material and said gauge means so that a stack of sheet material of great weight may be lifted quickly and efficiently.

6. An apparatus according to claim 3 wherein said cam means is a wheel configured to give two liftings per revolution.

7. An apparatus according to claim 4 wherein said endless belt runs on at least two driving rollers, one of said rollers being positioned below said gauge means.

8. An apparatus for selectively feeding sheet material comprising a conveyor means movable in a first direction having an upper surface lying substantially in a first plane, a gauge means spaced at least a predetermined first distance above said upper surface, a feed control means controlling the elevation of sheet material with respect to said conveyor upper surface whereby said sheet material may be moved into and out of engagement with said upper surface of said conveyor means, said feed control means comprising an elongated lifting member having an upper surface which lies substantially in a plane, said lifting member being movable between a first position in which said upper surface of said lifting member is below said upper surface of said conveyor means and a second position in which said upper surface of said lifting member is above said upper surface of said conveyor means in contact with said sheet material to keep it out of engagement with said conveyor means, each said lifting member being a lever pivotally connected at a first end to a pivot means located forward of said gauge means, said lifting member having a second end remote from said first end, a lifting assembly cooperating with said second end whereby said lifting assembly may raise and lower said upper surface of said lifting member above and below said upper surface of said conveyor means by pivoting said lift member about said pivot means, said first distance being at least equal to the thickness of a sheet or material and said pivot means comprising an eccentric connection operable to vary the level of the point of pivot so that when the upper surface of said lifting member is raised above the upper level of said conveyor means the space between said lifting member upper surface and said gauge means is at least equal to said first distance.