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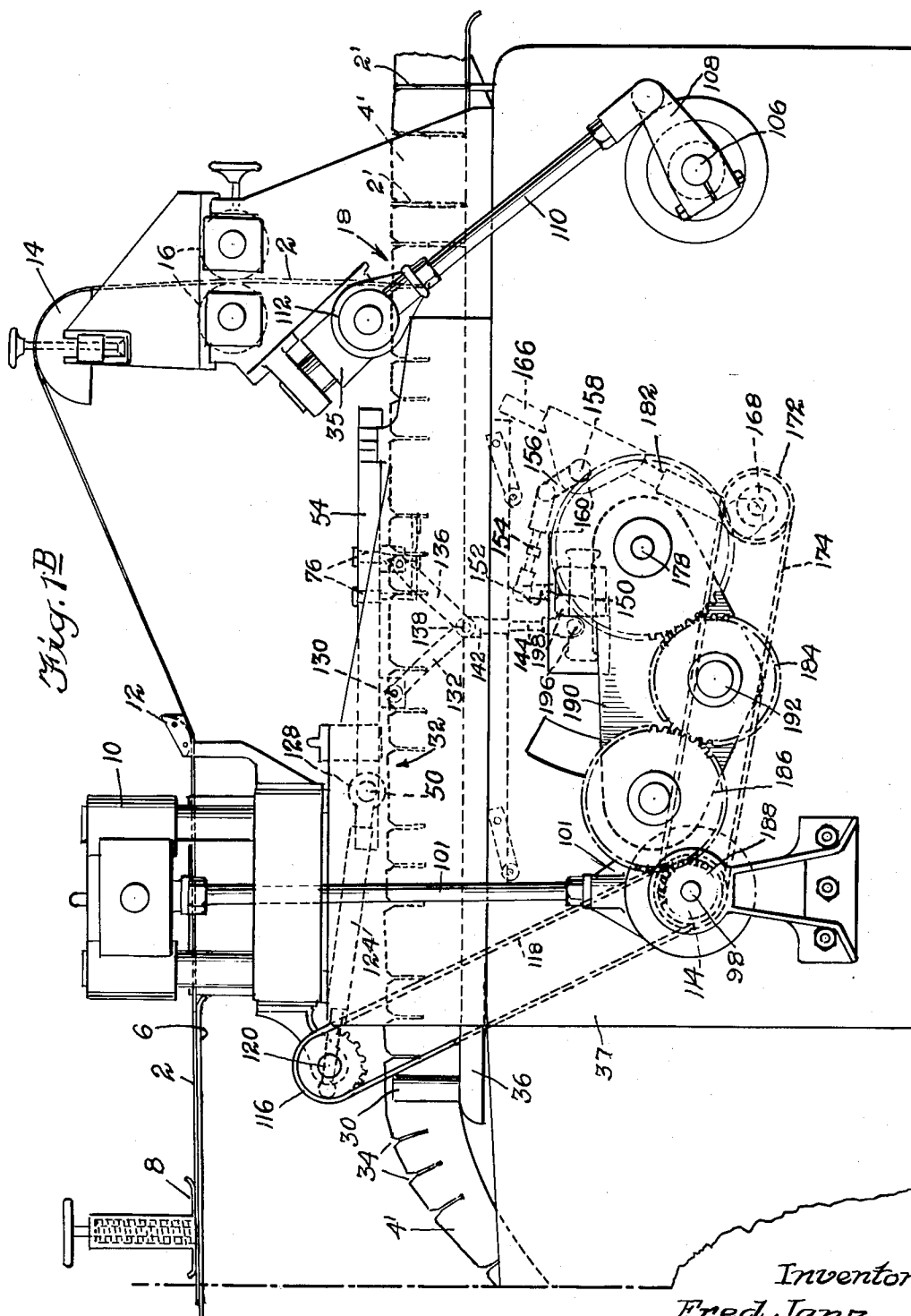


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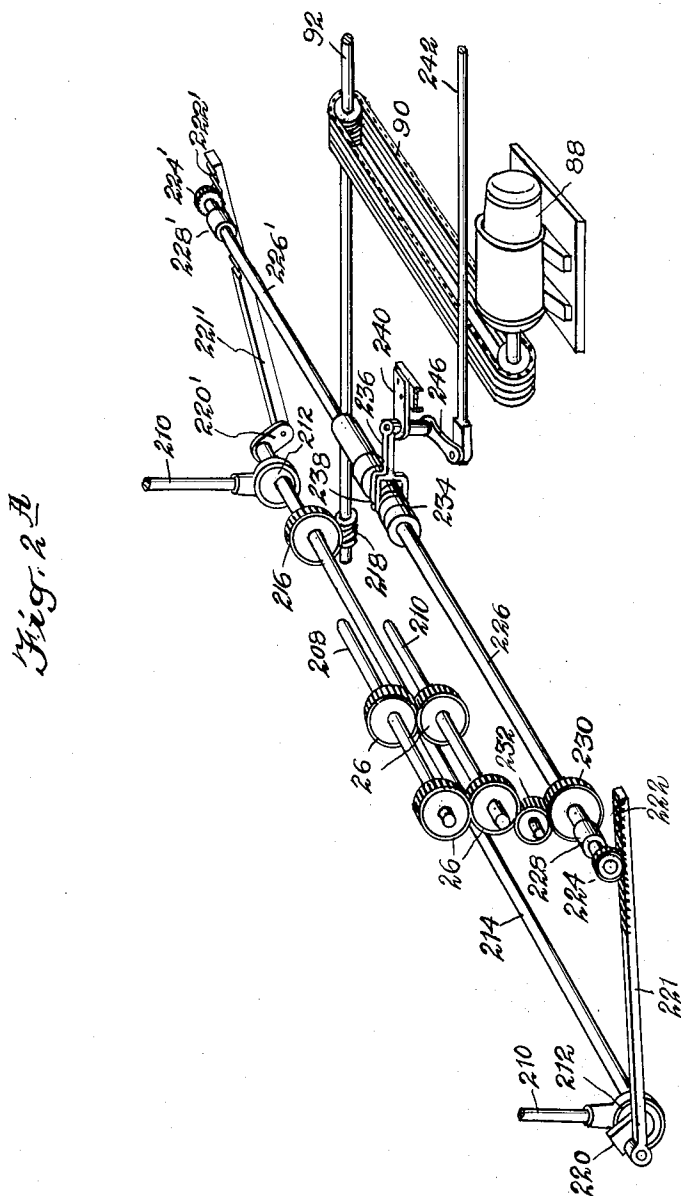
May 8, 1956

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PARTITION STRIP FEEDING MECHANISM FOR
A PARTITION ASSEMBLING MACHINE

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6 Sheets-Sheet 3



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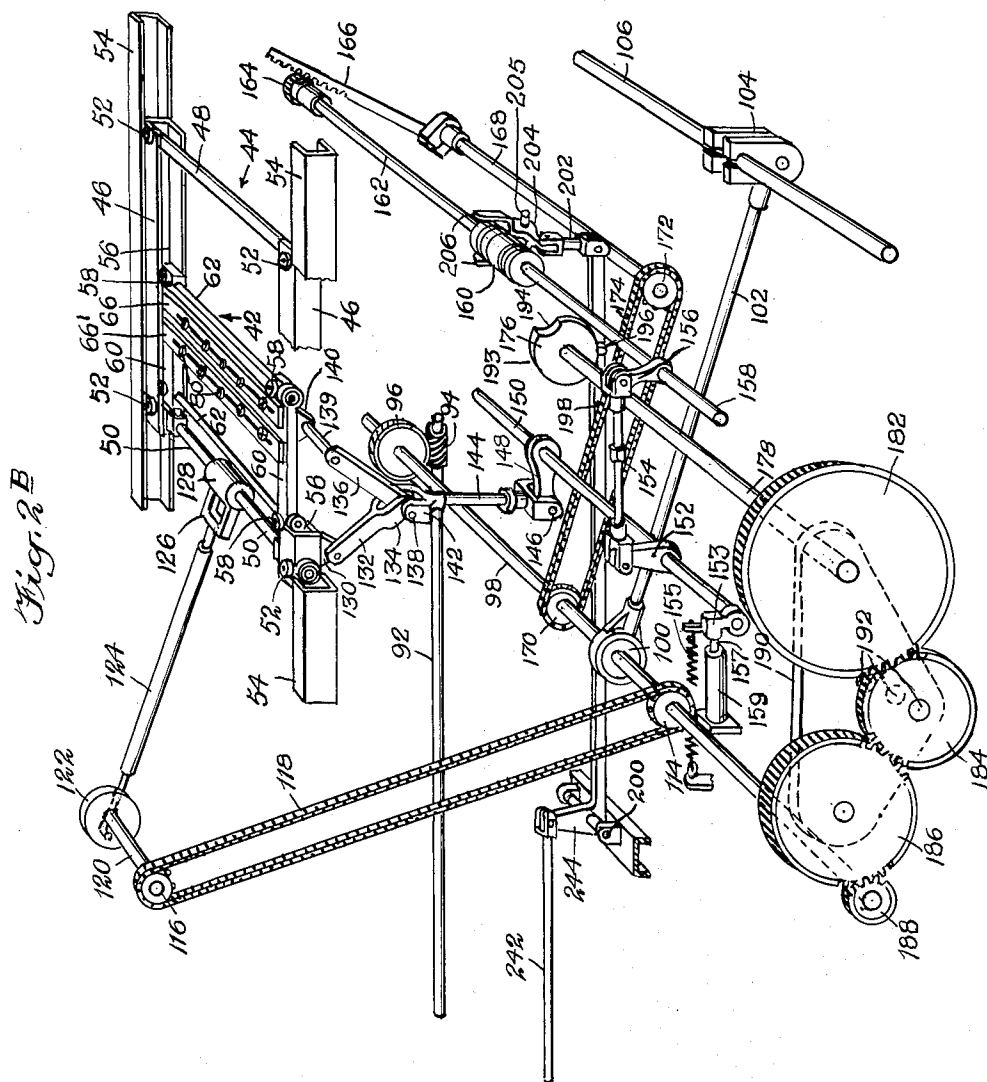
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6 Sheets-Sheet 4



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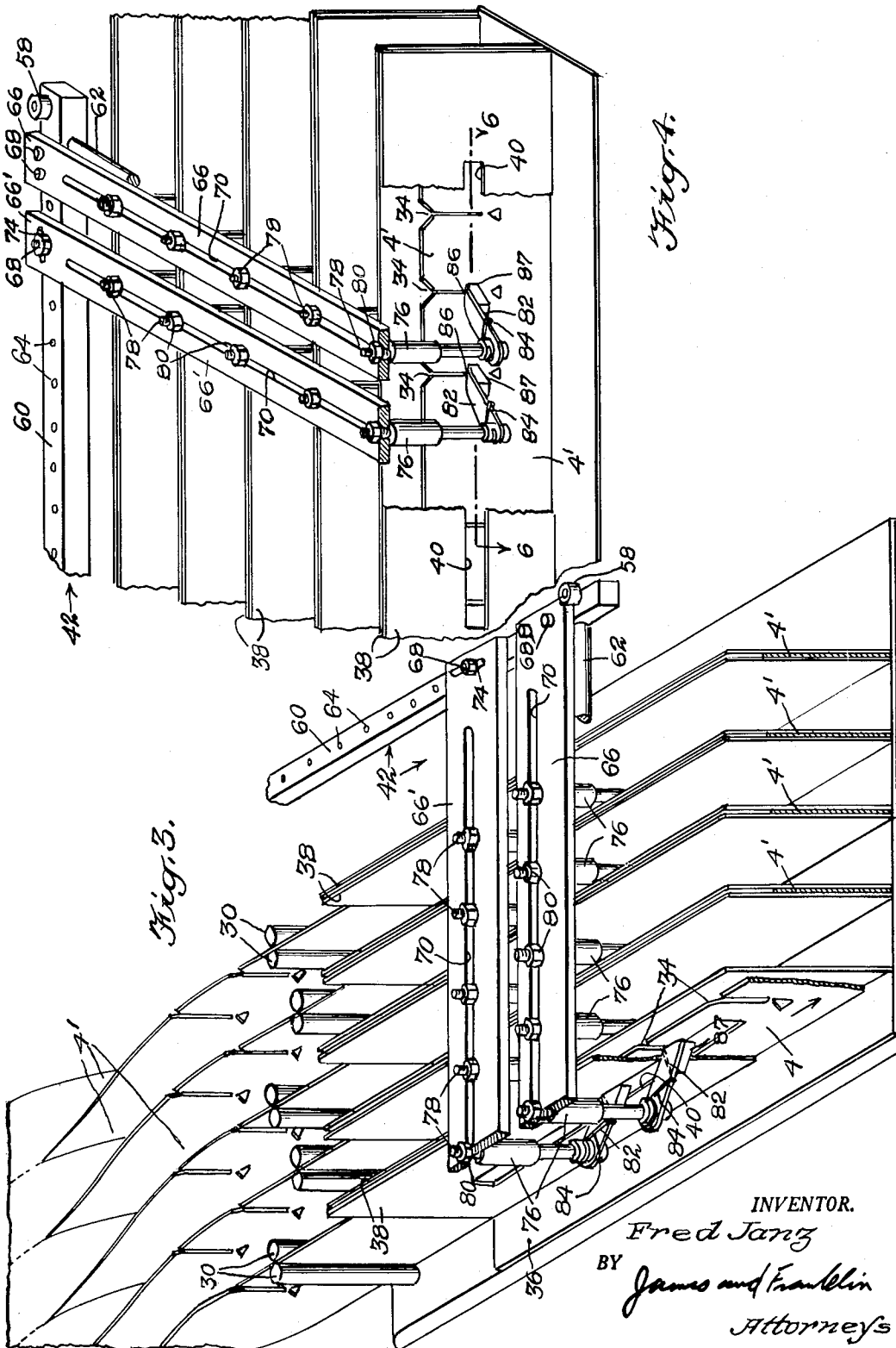
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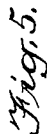


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PARTITION STRIP FEEDING MECHANISM FOR A PARTITION ASSEMBLING MACHINE

6 Sheets-Sheet 6



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PARTITION STRIP FEEDING MECHANISM FOR A PARTITION ASSEMBLING MACHINE

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Application August 9, 1952, Serial No. 303,577

25 Claims. (Cl. 271—2.5)

The present invention relates to an improved means for feeding partition strips in a partition assembling machine.

In machines of the type under discussion two sets of strips of paperboard or the like, which ultimately define the interlocked longitudinal and transverse strips of the completed partition assembly, are fed continuously through the cutting and assembling machine, and in many cases the slots by means of which the strips are interlocked are formed therein during their travel through that machine.

At the output end of the machine the strips are interlocked and if necessary severed, the machine thus producing complete partition assemblies consisting of a predetermined number of longitudinal and transverse strips.

In forming a complete partition assembly it is generally desired that the free ends of the one set of strips should extend from the other set of strips for a predetermined distance, and usually for the same distance that the strips of said other set are spaced from one another. This involves a variation in the feeding distance of the strips of said one set, said strips being fed a given distance for each strip of the other set to be interlocked therewith and then being fed a greater distance, preferably twice said given distance, so as to permit the next strip of said other set to be interlocked at a point appropriate to the next complete partition assembly. This cyclical variation in feeding distance is particularly significant where the strips of said one set are formed by and severed from continuous strips, the severing action occurring between the last strip of said other set for a given complete partition assembly and the first strip of said other set of the next complete partition assembly.

If the longitudinal and transverse partition strips are to be accurately and automatically interlocked, the feeding of the strips and the spacing of the interlocking slots formed therein must be exceedingly precise. Slippage between the feeding mechanism and the strips is inadmissible. Machines of the type under discussion, if they are to have a satisfactory output, must be operated at high speed, and this places a strain upon the operative parts of the machine. Various complex mechanical arrangements have been suggested in the past in an attempt to satisfy the requirements of accuracy and dependability which such machines must realize, but the more complicated the apparatus, the higher is its cost and the greater is its susceptibility to breakdown. Needless to say, a substantial economic loss is realized when a machine is shut down for repairs.

The necessity for repetitive acceleration of feed of one set of strips accentuates all of the above problems. The machine necessarily becomes more complex, and hence more subject to breakdown. The starting and stopping of the feeding mechanism and the acceleration of that mechanism at an increased rate when greater feeding distance is required has in the past given rise to stresses and strains in the machine which could be compensated for only with great difficulty and at considerable expense.

The apparatus of the present invention provides for the accurate feeding of strips, and particularly continuous

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strips, through a machine in a cyclical varying manner by means of a mechanism which is positive in operation, simple and inexpensive in construction, sturdy and not subject to breakdown, and readily accessible for repair.

In addition, the apparatus of the present invention readily lends itself to adjustment for changes in the desired spacing between the strips of one or both sets and changes in the length of the free ends of the fed set of strips in the complete partition assemblies. The movements of the various parts of the apparatus are accurately synchronized in a simple and dependable manner and these balanced synchronized motions can be greatly accelerated without adversely affecting the required feeding accuracy. The apparatus provides for positive grip of the strips to be fed, but without damage to or distortion of the surfaces of those strips. It achieves these results through the use of a minimum number of parts, all simple in construction and positive in operation, and eliminates a multiplicity of delicate and complex parts and sub-assemblies which the prior art has suggested in order to accomplish the desired results. The apparatus in question is extremely compact, thus reducing the size, weight and expense of the overall machine.

The above results are accomplished by eliminating the use of feed rolls adjacent the strip assembling station, and by substituting therefor reciprocable fingers which positively engage the strips, preferably by means of the interlocking slots previously formed in the strips, the strips being supported when engaged by the fingers so as to facilitate engagement and feeding. The fingers in turn are operatively connected to a member reciprocally mounted on the machine frame. A first driving means includes the driving motor of the machine and acts to reciprocate the member to which the fingers are operatively connected. The amplitude of reciprocation is determined by the desired distance which the strips must be fed, and the apparatus is so designed that said amplitude can be readily adjusted to conform to different partition designs. A second driving means is employed, also powered by the machine motor, which is operatively connected to the finger-moving member, said second driving means being operable to increase the amplitude of reciprocation of said member whenever the strips are to be fed an increased distance corresponding, according to the above explanation, to the spacing between one completed partition assembly and the next. This second driving means is therefore only intermittently effective on the finger-moving member, control means being provided to cut said second driving means in and out according to a predetermined sequence of reciprocation as derived from the first driving means. This control means is also readily adjustable so that the increased feed will occur after any desired number of normal feeds, in accordance with the design of the particular partition assembly.

In order to make the operation of the feeding mechanism as smooth as possible, the second driving means is preferably active on the finger-moving member to move it in a feeding direction at the same time as the first driving means is active thereon to move it in the same direction thus producing a continuous movement of that member with an increased amplitude, rather than producing two discrete movements thereof.

As here specifically disclosed, this driving arrangement is effectuated by causing the first driving means to be active upon a carriage, the finger-carrying member being reciprocally mounted on that carriage and being operatively connected thereto by means of a linkage of variable length. When the length of that linkage remains constant, as will be the case during normal feed steps, the finger-carrying member will reciprocate with the car-

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riage and with an amplitude determined only by the amplitude of reciprocation of said carriage. The second driving means is active upon said linkage so as to vary its effective length, and when the second driving means is cut in by the control means active thereupon, which will preferably be during the very time that the first driving means is moving the carriage in a feeding direction, it will cause the effective length of the linkage to increase while the carriage is reciprocated in a feeding direction and will cause the length of that linkage to resume its normal value while the carriage is being retracted by the first driving means. When this occurs the finger-moving member will be reciprocated through a distance greater than normal as determined by the variation produced in the effective length of said linkage, thus giving rise to an increased feed of the partition strips.

The strip-feeding fingers preferably engage the partition strips in the interlocking slots previously formed therein. It is usually not desired that those slots be formed at the place where the continuous strips are to be severed so as to separate one complete partition assembly from the next. Accordingly, additional feeding means for the continuous strips is provided adjacent to the punching mechanism which forms those slots, said additional feeding means being synchronized with the feeding means previously described, preferably by being driven by the same motor and controlled by the same means which controls the cutting in and out of said second driving means, so that the strips are fed through the punching mechanism in uniform steps where the slots for one complete partition assembly are to be formed and then in a step of increased length between complete partition assemblies. In this way the slot spacing and sequence will be automatically accommodated to the design of the particular partition assembly and will cooperate with the feeding mechanism in order to ensure accurate and positive feeding at the stations where the partitions are to be assembled and interlocked and where the completed partition assemblies are to be severed from the uncompleted assemblies.

To the accomplishment of the above, and to such other objects as may hereinafter appear, the present invention relates to the construction of a partition stripping feed mechanism and structure for driving and controlling the same as defined in the following claims and as described in this specification, taken together with the accompanying drawings, in which:

Figs. 1A and 1B are front elevational views of a machine of the present invention;

Figs. 2A and 2B are perspective schematic views of the operative portions of the feeding, driving and control mechanisms of the instant invention;

Fig. 3 is a three-quarter perspective view, partially broken away, taken from above and to the left, showing the manner in which the feeding mechanism engages the partition strips;

Fig. 4 is a side perspective view, taken partially from above, showing a different view of the same mechanism;

Fig. 5 is a partial top plan view of the said mechanism; and

Fig. 6 is a cross sectional view taken along the line 6-6 of Fig. 4.

The overall machine

The present invention is here shown as incorporated in a partition cutting and assembling machine of familiar type in which continuous sheets 2 and 4 of paperboard or the like are fed into the machine from the left hand end thereof and are appropriately punched, cut, interlocked and severed to form complete partition assemblies, the sheet 2 ultimately defining the longitudinal partition strips 2' and the sheet 4 ultimately defining the transverse partition strips 4'. As may best be seen from an examination of Figs. 1A and 1B, the sheet 2 is fed over an elevated table 6 and beneath an adjustable tension drag 8

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to a punching mechanism 10 where slots are formed therein, the number and spacing of said slots corresponding with the number and spacing of the transverse strips 4' to be incorporated into the complete partition assembly. From there the slotted sheet 2 passes under guide 12 and over adjustably mounted curved guide 14, the sheet 2 then passing between appropriately intermittently rotated feed rollers 16 so as to be pushed vertically downward in a step by step manner at the assembly station generally designated 18.

The sheet 4 passes over a lower table 20 and under an adjustable tension drag 22 to a punching mechanism 24 which forms slots in the sheet 4 corresponding in number and spacing to the number and spacing of the longitudinal strips 2' to be included in the complete partition assembly. Thereafter the sheet 4 passes between combined feeding and slitting rollers 26 which serve not only to pull the sheet 4 along through the punching mechanism 24 but also to continuously slit it longitudinally so as to define the desired number of transverse strips 4'. The separated and continuous transverse strips 4' fall into a well 28, each is twisted 90 degrees so as to extend vertically instead of horizontally, and the thus oriented continuous strips 4' pass between spaced guide posts 30 to the feeding station generally designated 32, the details of which will be set forth hereinafter. It is at the feeding station 32 that the continuous transverse strips 4' are fed so that when they arrive at the assembling station 18 the slots 34 formed therein and extending to their upper edges will register with the downwardly depending edge of the sheet 2 and with the slots formed in that sheet. During normal feed the transverse strips 4' will be fed in successive steps each of a distance equal to the spacing between the slots 34 of a given complete partition assembly. After each such step the sheet 2 will be fed downwardly through actuation of the feed rolls 16 so as to cause the slots in the free edge of the sheet 2 to interlock with the slots 34 exposed at the upper edges of the strips 4', and the thus interlocked portion of the sheet 2 will be severed from the body of the sheet by any suitable cutting mechanism 35 so as to define a longitudinal partition strip 2'. As here specifically disclosed, each completed partition assembly will consist of three equally spaced longitudinal strips 2'. After the first of such longitudinal strips 2' has been interlocked with the transverse strips 4', there will be two subsequent feeding steps of normal length for the strips 4' so that the second and third longitudinal strips 2' can be interlocked therewith and severed from the sheet 2. Thereafter it is necessary to feed the transverse strips 4' over an increased distance, and preferably over twice the normal distance, so that the third longitudinal strip 2' of one partition assembly is comparatively widely spaced from the first longitudinal strip 2' of the next adjacent partition assembly. This increased spacing is indicated in the figures by the increased spacing between each three sets of slots 34 in the strips 4'. Thereafter a completed partition assembly may be severed from the continuous strips 4', either manually or by any appropriate automatically actuated cutting mechanism, the cutting preferably taking place midway between the widely spaced slots 34, thus producing a complete partition assembly in which the free edges of the transverse strips 4' extend from the extreme longitudinal strips 2' for an equal and uniform distance.

The feeding mechanism

The sheet 2 which produces the longitudinal partition strips 2' is fed the same distance for each cycle of operation for the machine. Accordingly, the feed mechanism therefor may take any conventional form and is not here specifically shown.

However, for the reasons outlined above, the continuous transverse partition strips 4' must be fed different distances at different times in the overall cycle of the

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machine. It is with respect to the transverse strips 4' that the specific feeding mechanism of the present invention is directly associated.

The details of the structure at the feeding station 32 may best be seen from Figs. 3-6. That structure comprises a base plate 36 mounted on the frame 37 of the machine, pairs of guide posts 30 being mounted thereon through which the continuous transverse strips 4' are adapted to pass. A pair of spaced guide plates 38 are provided for each pair of guide posts 30 and aligned therewith, the plates 38 preferably having a height greater than the height of the strips 4' and being spaced from one another by a distance only slightly greater than the thickness of the strips 4' so that said strips 4' will be firmly supported in vertical condition as they pass there-through. One of the plates 38 of each pair, here shown as the left hand plate as viewed in Fig. 3, is provided with a slot 40 or other opening opposite a portion of the other plate 38, this opening having a length greater than the maximum desired distance of feed of the strips 4', the feeding mechanism engaging the strips 4' via the slots 40.

The feeding mechanism per se comprises an inner carriage generally designated 42 and an outer carriage generally designated 44. The outer carriage 44 comprises side members 46 and cross bars 48 and 50, the side members 46 carrying rollers 52 by means of which the carriage 44 is reciprocally mounted in horizontal rails 54 which form a part of the machine frame 38 and which are oriented parallel to the direction of feed of the strips 4'. The side pieces 46 of the outer carriage 44 also carry internally directed rails 56 on which ride side rollers 58 secured to the side pieces 60 of the inner carriage 42, said side pieces 60 being connected by means of cross bars 62. Hence the inner carriage 42 can be reciprocated with respect to the outer carriage 44 and the outer carriage 44 can be reciprocated with respect to the machine frame 38.

The side pieces 60 of the inner carriage 52 are provided with a series of spaced apertures 64 and plates 66, 66' are adapted to be secured thereto by means of fastening devices 68 of any conventional type. Each of the plates 66 and 66' is provided with a longitudinal slot 70. The plate 66 is here shown as provided with a pair of apertures 72 adapted to overlie the end pieces 60, the spacing between the apertures 72 being equal to the spacing between the apertures 64 so that the plate 66 may be secured in position on the inner carriage 42 in any one of a predetermined number of discrete positions. The end portions of the plate 66' are provided with an elongated slot 74 adapted to register with the apertures 64 in the side pieces 60 of the inner carriage 42, thus permitting adjustment of the position of the plate 66' along the side pieces 60 of the inner carriage 42 at any desired position. By reason of the elongated slot 74, the spacing between the plates 60 and 66' may be adjusted at will to correspond to the spacing between the slots 34 of a particular set of strips 4'.

Secured to each of the plates 66 and 66', and depending therefrom so as to extend to one side of each pair of guide plates 38, are a series of arms 76, one for each pair of plates 38, each arm 76 having a screw 78 projecting up therefrom through the slot 70, the arm 76 being appropriately clamped in place along the length of the slot 70 by means of a nut 80. Pivotally mounted at the lower end of each arm 76 and opposite the slot 40 in the appropriate guide plate 38 is a finger 82, a spring 84 being active between the arm 76 and the finger 82 so as to cause that finger to pivot toward and into the slot 40, the tip of that finger, as defined by a resilient strip 86 mounted in housing 87 (see Fig. 6), passing through the slot 40 and engaging the exposed surface of the strip 4', said strip 4' being rigidly held against movement away from the spring urged finger tip 86 by means of the unslotted guide plate 38. The plates 66 and 66' are so

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mounted along the length of the inner carriage 42 that at the extreme left hand of travel of the carriage 42 the resilient finger tips 86, or at least one of them, depending upon the particular stage of the machine cycle involved, will enter a slot 34 in the strip 4'. When the carriage 42 is moved to the right the finger tips 86, being resiliently urged by the springs 84 to pivot in a counter-clockwise direction as viewed from above, will positively feed the strips 4' in the same direction and for exactly the same distance as the inner carriage 42 is moved. When the inner carriage 42 is next moved to the left, the finger tips 86 will ride out of the slots 34 in the strips 4' and will slide back along the exposed surface thereof, but without moving the strips 4', until they engage with the next succeeding slot or slots 34. In this way each movement of the fingers 82 to the right will feed the strips 4' and each movement of the fingers 82 to the left will merely bring those fingers to position for the next succeeding feed stroke but without affecting the position of the strips 4'.

Control and driving mechanism

This arrangement and construction of the control and driving mechanism for the feeding structure just described, and the manner in which that control and driving mechanism serves to control and synchronize the feed of the sheet 4 through the feeding station 32, the punching mechanism 24 and the slitting arrangement 26, can best be seen from Figs. 2A and 2B. The machine is provided with a single driving motor 88 which is connected by means of drive belt 90 to main drive shaft 92. At its right hand end as viewed in Fig. 2B the shaft 92 has a worm 94 which meshes with gear 96 on secondary drive shaft 98. That drive shaft 98, through eccentric-rod operative connections generally designated 101 (see Fig. 1B) can actuate the punching mechanism 10 for the sheet 2. The shaft 98 is connected, by eccentric 100, rod 102, and offset clamp 104, to shaft 106 which (see Fig. 1B), pivotally reciprocates arm 108 which is connected by means of rod 110 to mechanism generally designated 112 which is operatively connected in any suitable manner to the cutting mechanism 35 employed to sever the body of the continuous strip 2 from that portion thereof which is interlocked with the transverse strips 4' at the assembling station 18 in order to define a longitudinal strip 2'. The same shaft 106, through conventional mechanism (not shown) may also actuate the feed rolls 16 for the sheet 2 in a uniform and synchronized step-by-step manner.

The shaft 98 is also connected, by means of pulleys 114 and 116 and belt 118, to shaft 120. Disk 122 is rotated by the shaft 120 and rod 124 is adjustably eccentrically connected thereto, so that the rotation of the shaft 120 by the shaft 98 will cause reciprocation of the rod 124. The other end of the rod 124 terminates in yoke 126 which is in turn connected to collar 128 attached to the cross bar 50 of the outer carriage 44 of the feed mechanism per se. Hence the motor 88 will cause the outer carriage 44 to reciprocally slide back and forth along the rails 54, the frequency of that reciprocation being determined by the speed of the motor 88 and the ratio of the gears 94 and 96, and the amplitude of that reciprocation being determined by the distance from its axis that the rod 124 is secured to the disk 122.

Depending from the outer carriage 44 is a bracket 130 to which arm 132 is pivotally secured, that arm terminating in yoke 134 which surrounds an end of arm 136 and which is pivotally connected thereto by means of pin 138. The other end of the arm 136 is pivotally connected by means of rod 139 to bracket 140 depending from the inner carriage 42. The pin 138 which pivotally connects the arms 132 and 136 is mounted in yoke 142 supported by rod 144 which is in turn pivotally attached at 146 to arm 148 fast on shaft 150. So long as the shaft 150 is held in position the linkage defined by the arms 132, 136, 144 and 148 will, insofar as its connec-

tion between the outer and inner carriages 44 and 42 is concerned, have a fixed effective length, and by reason of that linkage reciprocation of the outer carriage 44 will be transmitted to the inner carriage 42, the latter moving with and preferably to the same extent as the former.

The position of the bracket 140 attached to the inner carriage 42 can be changed relative to the bracket 130 by varying the distance between the pin 138 and the carriages 42 and 44. Thus if the pin 138 is moved upwardly toward the carriages 42 and 44, the angle subtended between the arms 132 and 136 will increase, and the inner carriage 42 will consequently be moved to the right (a feeding direction) with respect to the outer carriage 44. Conversely, if the pin 138 is moved downwardly away from the carriages 42 and 44 the angle subtended between the arms 132 and 136 will decrease, the bracket 140 will be moved toward the bracket 130, and consequently the inner carriage 42 will be moved to the left with respect to the outer carriage 44. Furthermore, the effect of the position of the pin 138 on the relative positions of the carriages 42 and 44 is substantially independent of motion of the outer carriage 44 itself, that motion being transmitted to the inner carriage 42 whether the pin 138 is stationary or moving as above described. It therefore follows that if the pin 138 is held stationary and the outer carriage 44 is reciprocated through a given amplitude, the inner carriage 42 and with it the feeding fingers 82 will be moved back and forth with a given amplitude corresponding to the normal distance which the transverse strips 4' are adapted to be fed. When, however, the strips 4' are to be fed a greater distance, the pin 138 may be moved upwardly toward the carriages 42 and 44 at the same time that the outer carriage 44 is being moved to the right (in a feeding direction) through its customary amplitude. The inner carriage 42 on which the feeding fingers are mounted will then be moved in a feeding direction a distance corresponding to the distance moved by the outer carriage 44 plus an incremental distance corresponding to the distance that the pin 138 has moved upwardly, that is to say, corresponding to the increase in the effective length of the linkage 132, 138, 142, 136. When the outer carriage 44 is moved to the left, the pin 138 is moved back down to its original position relative to the carriages 42 and 44, thus positioning the inner carriage 42 and the fingers 82 carried thereby appropriately for the next feeding stroke, which will be of normal amplitude.

The means by which the pin 138 is moved up and down, thus varying the effective length of the linkage connecting the inner and outer carriages 42 and 44, is best shown in Fig. 2B. The shaft 150 is provided with rocker arm 152 which is connected by means of rod 154 to rocker arm 156 on shaft 158, an end of that shaft being connected to one end of engageable and disengageable clutch 160. The input shaft 162 of that clutch has a gear 164 at the end thereof which is engaged with rack 166 eccentrically mounted on shaft 168 which is constantly rotated by the drive shaft 98 through pulleys 170, 172 and belt 174. The rack 166 is moved up and down, thus causing the shaft 162 to rotate in one direction and the other. So long as the clutch 160 is disengaged, the shaft 158 remains stationary. However, when the clutch 160 is engaged, the shaft 158 will be similarly rotated in a reciprocable manner, a corresponding rotation will be imparted to the shaft 150, and the pin 138 will be moved up and down.

Engagement and disengagement of the clutch 160 is controlled by means of cam 176 mounted on shaft 178 which is connected, by means of the gear train defined by gears 182, 184, 186 and 188, to shaft 98. The gears 182 and 184 are removable and replaceable with pairs of gears having different turns ratios, the mounting bracket 190 therefore having a plurality of spaced apertures 192 for the reception of gears 184 of different diameter. By

a choice of proper gear train, the cam 176 will be rotated at a predetermined ratio with respect to the operation of the machine.

The cam 176 has a cam track 193 including a depressed area 194, a cam follower 196 mounted on arm 198 being engageable with the cam track. When the follower 196 enters the depressed cam track area 194, the arm 198, which is pivotally mounted at 200, will rise, and will lift the rod 202 articulately carried at its end. The rod 202 is in turn pivotally connected to arm 204, the latter being pivotally mounted at 205 and operatively connected to the clutch 160 by means of yoke 206. Lifting of the rod 202 will move the arm 204 so as to engage the clutch 160.

In order to ensure proper positioning of the pin 138 when the clutch 160 is disengaged, that is to say, when the second driving means is out, and to smooth the action of the driving means active on the pin 138 and minimize strain and shock, an arm 153 is secured to shaft 150, frame-anchored spring 155 being resiliently active thereon to tend to move it and the shaft 150 in a given direction. In addition, the arm 153 may be attached to piston 157 of air shock absorber 159.

The sequence of operation of the control and driving arrangement for the feeding mechanism located at station 32 may be summarized as follows, assuming that, as illustrated, each complete partition assembly is to have three longitudinal strips 2', and the free ends of the transverse strips 4' are to extend from the extreme longitudinal strips 2' by a distance equal to the spacing between adjacent longitudinal strips 2' in a completed partition assembly: As the motor 88 rotates the outer carriage 44 will be reciprocated through a uniform amplitude, and this reciprocation will be transmitted to the inner carriage 42. Assuming that the cycle starts after the first longitudinal strip 2' has been inserted in place, there will be two subsequent feeds of normal length, so that the second and third longitudinal strips 2' may be interlocked with the transverse strips 4' at the station 18. While this is going on the cam 176 is being rotated, and the gear train which drives it is so designed that during this portion of the cycle the cam follower 196 will be riding on the raised portion 193 of the cam track. After the carriages 44 and 42 have been retracted from their second feed stroke, the cam 176 will have been rotated sufficiently so that the depressed cam portion 194 will come opposite the follower 196, thus causing the clutch 160 to engage. During the next reciprocation of the outer carriage 44, the inner carriage 42 will move therewith, and an additional increment of movement will be imparted thereto by reason of the movement of the pin 138 upwardly, as driven by the rack and gear 166, 164 through the engaged clutch 160. As a result, the transverse strips 4' will be moved through a distance equal to twice their normal feed. As the driving motor 88 continues to rotate, the outer carriage 44 will be moved back to its original position, and at the same time, since the rack 166 reciprocates past the gear 164, the pin 138 will be moved back to its original position. Hence the inner carriage 42 will be returned to its normal position for beginning a feed stroke. As this point the cam 176 will have been rotated sufficiently so that the cam follower 196 will rise up onto the raised portion 193 of the cam track, the clutch 160 will become disengaged, and a new cycle will commence.

The cam 176 is here illustrated for purposes of illustration as having an external cam track 193, 194. However, in actual construction it is preferred that the cam track be internal, and in the form of a groove in which the cam follower 196 is snugly received, so as to make the operation of the arm 198 positive and eliminate the necessity for additional mechanism to ensure that the cam follower 196 engages the cam track.

The flexibility and advantage of the driving mechanism above described will be apparent. The feeding elements

and their driving mechanisms are always in motion, in the nature of smooth and flowing simple harmonic motion. The main driving amplitude, as derived through the outer carriage 44, is uniform whether the strips 4' are being fed through their normal distance or through a greater distance. The drive connection is positive and simple, requiring no expensive or complex parts. The amplitude of reciprocation of the outer carriage 44 may be readily controlled and adjusted through selection of an appropriate size of disc 122 and by the connection of the rod 124 thereto at an appropriate distance from the center of rotation thereof. Thus the movement of the carriages 42 and 44 for a normal feeding stroke may be readily adjusted to correspond to the particular design of the partition strips involved. The number of normal feed strokes which occur before a longer feed stroke takes place can be readily controlled through selection of appropriate gears 182 and 184. The incremental amplitude of reciprocation imparted to the inner carriage 42 through movement of the pin 138 so as to vary the effective length of the linkage connecting the outer and inner carriages 44 and 42 may be readily controlled through selection of an appropriate size of gear 164 to cooperate with the rack 166 or through the connection of the rack 166 to the shaft 168 at an appropriate distance from the axis of rotation thereof.

Because the feeding mechanism per se is always in movement, the strains to which it is subjected are minimized. The incremental amplitude of reciprocation periodically required is imparted thereto in a smooth manner, at the same time as its normal reciprocation is effected, and in an additive manner with respect to that normal reciprocation, thus making for exceedingly smooth movement without requiring appreciable force or exerting serious strains upon the apparatus. Even when the second driving means which adds said incremental amplitude to the reciprocation of the inner carriage 42 is cut in, its effect is so smoothly blended with the other operations of the machine that vibration and noise are minimized and no appreciable shock is experienced by the apparatus.

Since with different specific designs for partition assemblies, different spacing between the slots 34 formed in those partitions will be required, and since the dies for cutting the slots 34 are very expensive and require an appreciable time to install in the punching mechanism 24, it is desirable that the feed of the sheet 4 through the punching mechanism 24 be accurately correlated with the feeding which occurs at the station 32 and with the desired variations in spacing between the slots 34. When this is done a single die may be employed which cuts but a single slot in each portion of the sheet 4 corresponding to a given transverse strip 4', no matter what the desired spacing between the slots 34. In addition, the feed of the individual strips 4' to the feeding station 32 will be uniform, thus reducing the maximum tension exerted on the strips as they pass through the well 28. The mechanism by which this is accomplished is best shown in Fig. 2A.

The combination feed and slitter rolls 26 are mounted on shafts 208 and 210, and rotation of the rolls 26 serves to pull the sheet 4 through the punching mechanism 24, the vertically reciprocable punching head of which is mounted on rods 210 which are in turn moved up and down by eccentrics 212 on shaft 214. The shaft 214 is provided with gear 216 which meshes with worm 218 on the shaft 92 driven by the motor 88. Hence the punching mechanism 24 will be operated in timed relation to the action of the feeding mechanism located at station 32, since the shaft 92 also serves to drive and control the latter. At one end of the shaft 214 an eccentric arm 220 is mounted to which arm 221 carrying rack 222 is adjustably pivotally mounted, that rack engaging gear 224 connected to shaft 226 by means of an overrunning clutch 228, rotation of the shaft 214 thus causing step-

by-step rotation of the shaft 226 in a given direction, the clutch 228 transmitting rotation of the gear 224 only in that direction. A gear 230 on the shaft 226 meshes with gear 232 which in turn meshes with one of the lower feed rolls 26, and consequently the same incremental rotation in a feeding direction will be imparted to the feed rolls 26. The amplitude of this incremental rotation will be determined by the distance from the axis of rotation of the shaft 214 which the arm 221 is secured to the arm 220.

The above driving arrangement serves for feed of the sheet 4 over the normal distance. For adding an increment of feed so that the last slot 34 of one partition assembly may be further spaced from the first slot 34 of the next succeeding partition assembly, a similar arrangement, including arm 220', arm 221', rack 222', gear 224', overrunning clutch 228' and shaft 226', is provided at the other side of the apparatus. An engageable and disengageable clutch 234 serves to connect and disconnect the shafts 226 and 226'. Engagement of the clutch is controlled by arm 236 having yoke 238 connected to the clutch 234, the arm 236 being pivotally mounted on bracket 240 and being connected to rod 242 by means of link 246. The arm 242 (see Fig. 2B) is connected to a finger 244 which forms a part of the arm 198 the position of which is controlled by the cam 176. When the cam follower 196 engages the depressed cam track portion 194, thus causing the clutch 160 to connect shafts 158 and 162 and cause the inner carriage 42 at the feeding station 32 to move with an increased amplitude, the finger 244 will position the rod 242 so as to cause the clutch 234 to connect the shafts 226' and 226, and as a result the feed rolls 26 will be rotated to a greater degree corresponding to the increased amplitude of feed to the station 32.

Thus a single driving motor 88 and a single cam 176 control the accurate finger feeding at the station 25 adjacent the assembling station 18 and also control the feed adjacent the punching mechanism 24. At said punching mechanism 24, as well as at the finger feeding station 32, the means for providing feed at normal amplitude is always effective, an incremental amount of feed being periodically imparted thereto in an independent manner so as not to interfere with the normal feed.

By reason of these novel feeding arrangements a machine has been produced which is not only extremely accurate insofar as feeding is concerned and which not only is highly simplified, steady and positive in operation, but which also may be operated at much higher speeds than has been previously considered feasible with machines of this general type. A measure of the improvement which this mechanism produces may be realized from the fact that when the mechanism of the present invention was incorporated into an already existing partition feeding machine utilizing a previously known feeding arrangement 70 fewer parts were used, dependability and accuracy of feeding were greatly enhanced, and the balanced synchronized motions of the various feeding parts were greatly accelerated without endangering feeding accuracy. In addition the susceptibility of the machine to breakdown was markedly reduced. The elimination of numerous parts and the simplifying of the driving arrangement also reduced the power requirements of the machine considerably, thus making it much more efficient in operation.

While but one embodiment of the present invention has been here specifically disclosed, it will be apparent that many variations can be made thereof without departing from the spirit of the invention as defined in the following claims.

I claim:

1. In a partition strip feeding mechanism, a support, a member reciprocably mounted on said support, a strip-engaging element operatively connected to said member for movement therewith, first driving means permanently operatively connected to said member for reciprocating

it with one amplitude, second driving means operatively connectable to said member for reciprocating it with an incremental amplitude in addition to said one amplitude, and control means operatively connected to said second driving means and active to render the latter effective and ineffective cyclically on each n reciprocations caused by said first driving means, where n is an integer greater than one.

2. In a partition strip feeding mechanism, a support, a first member reciprocably mounted on said support, a strip engaging element, a second member to which said strip engaging element is operatively connected, said second member being reciprocably mounted with respect to said first member, a linkage between said members comprising a pair of arms, each pivotally connected to one member and being pivotally interconnected by an element movably mounted on said support, whereby reciprocation of said first member will correspondingly reciprocate said second member, and means for moving said element toward and away from said members, whereby said second member is caused to move with respect to said first member.

3. In a partition strip feeding mechanism, a support, a first member reciprocably mounted on said support, a strip engaging element, a second member to which said strip-engaging element is operatively connected, said second member being reciprocably mounted with respect to said first member, a linkage between said members comprising a pair of arms, each pivotally connected to one member and being pivotally interconnected by an element movably mounted on said support, whereby reciprocation of said first member will correspondingly reciprocate said second member, and means for reciprocating said element toward and away from said members, whereby said second member is caused to reciprocate with respect to said first member.

4. In the mechanism of claim 3, a driving motor, an operative connection between said motor and said first member whereby the latter is reciprocated, and an operative connection between said motor and said element, whereby said motor reciprocates said element toward and away from said members.

5. The mechanism of claim 4, in which the operative connection between said motor and said element comprises an engageable and disengageable clutch and an element-reciprocating linkage driven by said motor through said clutch when the latter is engaged, a cam driven by said motor, and a clutch control mechanism operated by said cam and operatively connected to said clutch so as to engage and disengage said clutch in timed sequence with the reciprocation of said first member.

6. The mechanism of claim 3, in which said first member comprises an outer carriage reciprocably mounted on said support, and said second member comprises an inner carriage reciprocably mounted on said outer carriage.

7. In a partition strip feeding mechanism, a support, a first member reciprocably mounted on said support, first driving means operatively connected to said first member for reciprocating it with one amplitude, a strip-engaging element, a second member to which said element is operatively connected, said second member being reciprocably mounted with respect to said first member and operatively connected to said first member so as to reciprocate therewith, second driving means operatively connected to said second member and causing it to reciprocate with respect to said first member in addition to reciprocating therewith, and control means for cutting said second driving means in and out in cyclically timed relation to the action of said first driving means.

8. The mechanism of claim 7, in which said operative connection between said members is variable in effective length and in which said second driving means is active on said operative connection to vary the effective length thereof.

9. In combination with the mechanism of claim 7, a

second strip feeding mechanism positioned remote from said first strip feeding mechanism and comprising a feed member, a drive shaft operatively connected to said feed member, regular driving means including an overrunning clutch operatively connected to said drive shaft for moving said shaft a given distance, special driving means operatively connected to said drive shaft through a disengageable clutch for moving said shaft an incremental distance, and control mechanism active on said disengageable clutch to control the engagement thereof and operatively connected to and controlled by said control means for cutting said second driving means in and out, said control mechanism being active to cause said clutch to be engaged only when said control means is active to cut in said second driving means.

10. The mechanism of claim 7, in which said control means cuts said second driving means in and out cyclically on each n reciprocations caused by said first driving means, where n is an integer greater than one.

11. The mechanism of claim 7, in which said first driving means is permanently operatively connected to said first member and said second driving means is operatively connectible to said second member, said control means being effective to connect said second driving means to and disconnect said second driving means from said second member.

12. The mechanism of claim 11, in which said control means connects said second driving means to said second member while said first driving means is moving said first member.

13. The mechanism of claim 11, in which said control means connects and disconnects said second driving means with respect to said second member cyclically on each n reciprocations caused by said first driving means, where n is an integer greater than one.

14. The mechanism of claim 7, in which said control means cuts said second driving means in and out so as to cause said second member to reciprocate with respect to said first member during the time that said first driving means is reciprocating said first member.

15. The mechanism of claim 7, in which said control means cuts said second driving means in and out so as to cause said second member to reciprocate with respect to said first member during the time that said first driving means is reciprocating said first member, but only once for each n reciprocations caused by said first driving means, where n is an integer greater than one.

16. In a strip feeding mechanism, a support, guiding means on said support for guiding said strip thereover, a reciprocable carriage on said support, a finger articulately mounted on said carriage, said finger being resiliently urged toward said strip so as to engage the latter and, when said carriage is reciprocated, alternately feed said strip and slide back thereover, first driving means operatively connected to said carriage for reciprocating it with one amplitude, second driving means operatively connected to said carriage for reciprocating it with a greater amplitude, and control means operatively connected to at least one of said driving means to render the latter effective and ineffective.

17. In a strip feeding mechanism, a support, guiding means on said support for guiding said strip thereover, a reciprocable carriage on said support, a finger articulately mounted on said carriage, said finger being resiliently urged toward said strip so as to engage the latter and, when said carriage is reciprocated, alternately feed said strip and slide back thereover, first driving means permanently operatively connected to said carriage for reciprocating it with one amplitude, second driving means operatively connectible to said carriage for reciprocating it with an incremental amplitude in addition to said one amplitude, and control means operatively connected to said second driving means and active to render the latter effective and ineffective.

18. The mechanism of claim 17, in which said control

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means is active to render said second driving means effective cyclically on each n reciprocations caused by said first driving means, where n is an integer greater than one.

19. In a strip feeding mechanism, a support, guiding means on said support for guiding said strip thereover, a reciprocable carriage on said support, a finger articulately mounted on said carriage, said finger being resiliently urged toward said strip so as to engage the latter and, when said carriage is reciprocated, alternately feed said strip and slide back thereover, driving means permanently operatively connected to said carriage for reciprocating it, said driving means including a linkage of variable effective length, second driving means operatively connected to said linkage and active to vary its effective length and thus vary the amplitude of reciprocation of said carriage, and control means operatively connected to said second driving means and active to render the latter effective and ineffective, said control means being active to render said second driving means effective cyclically on each n reciprocations caused by said first driving means, where n is an integer greater than one.

20. In a strip feeding mechanism, a support, guiding means on said support for guiding said strip thereover, a reciprocable carriage on said support, a finger articulately mounted on said carriage, said finger being resiliently urged toward said strip so as to engage the latter and, when said carriage is reciprocated, alternately feed said strip and slide back thereover, said carriage comprising an inner carriage reciprocably mounted on an outer carriage, said outer carriage being reciprocably mounted on said support, a first driving means operatively connected to said outer carriage for reciprocating it with one amplitude, an operative connection between said carriages for causing said inner carriage to reciprocate with said outer carriage through said one amplitude, and a second intermittently operated driving means operatively connected to said inner carriage for causing it to reciprocate with respect to said outer carriage in addition to reciprocating therewith.

21. In a strip feeding mechanism, a support, guiding means on said support for guiding said strip thereover, a reciprocable carriage on said support, a finger articulately mounted on said carriage, said finger being resiliently urged toward said strip so as to engage the latter and, when said carriage is reciprocated, alternately feed said strip and slide back thereover, said carriage comprising an inner carriage reciprocably mounted on an outer carriage, said outer carriage being reciprocably mounted on said support, first driving means operatively connected to said outer carriage for reciprocating it with one amplitude, an operative connection between said carriage for causing said inner carriage to reciprocate with said outer carriage through said one amplitude, a second driving means operatively connected to said inner carriage for causing it to reciprocate with respect to said outer carriage in addition to reciprocating therewith, and control means for cutting said second driving means in and out.

22. In a strip feeding mechanism, a support, guiding means on said support for guiding said strip thereover, a reciprocable carriage on said support, a finger articulately mounted on said carriage, said finger being resiliently urged toward said strip so as to engage the latter and, when said carriage is reciprocated, alternately feed said strip and slide back thereover, said carriage comprising an inner carriage reciprocably mounted on an outer carriage, said outer carriage being reciprocably

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mounted on said support, first driving means operatively connected to said outer carriage for reciprocating it with one amplitude, an operative connection between said carriages for causing said inner carriage to reciprocate with said outer carriage through said one amplitude, a second driving means operatively connected to said inner carriage for causing it to reciprocate with respect to said outer carriage in addition to reciprocating therewith, and control means for cutting said second driving means in and out in cyclical timed relation to each n reciprocations caused by said first driving means, where n is an integer greater than one.

23. In a strip feeding mechanism, a support, guiding means on said support for guiding said strip thereover, a reciprocable carriage on said support, a finger articulately mounted on said carriage, said finger being resiliently urged toward said strip so as to engage the latter and, when said carriage is reciprocated, alternately feed said strip and slide back thereover, said carriage comprising an inner carriage reciprocably mounted on an outer carriage, said outer carriage being reciprocably mounted on said support, first driving means operatively connected to said outer carriage for reciprocating it, an operative connection including a linkage of variable effective length between said carriages for causing said inner carriage to reciprocate with respect to said outer carriage, second driving means operatively connected to said linkage and active to vary its effective length and thus vary the amplitude of reciprocation of said inner carriage, and control means operatively connected to said second driving means and active to render the latter effective and ineffective.

24. The mechanism of claim 23, in which said control means is active to render said second driving means effective cyclically on each n reciprocations caused by said first driving means, where n is an integer greater than one.

25. In a strip feeding mechanism, a support, a strip-engaging element, a member reciprocably mounted on said support to which said element is operatively connected, driving means permanently operatively connected to said member for reciprocating it, said driving means including a linkage of variable effective length, second driving means operatively connected to said linkage and active to vary its effective length and thus vary the amplitude of reciprocation of said member, and control means operatively connected to said second driving means and active to render the latter effective and ineffective, said control means being active to render said second driving means effective cyclically on each n reciprocations caused by said first driving means, where n is an integer greater than one.

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