

June 13, 1933.

A. H. BRUNNER

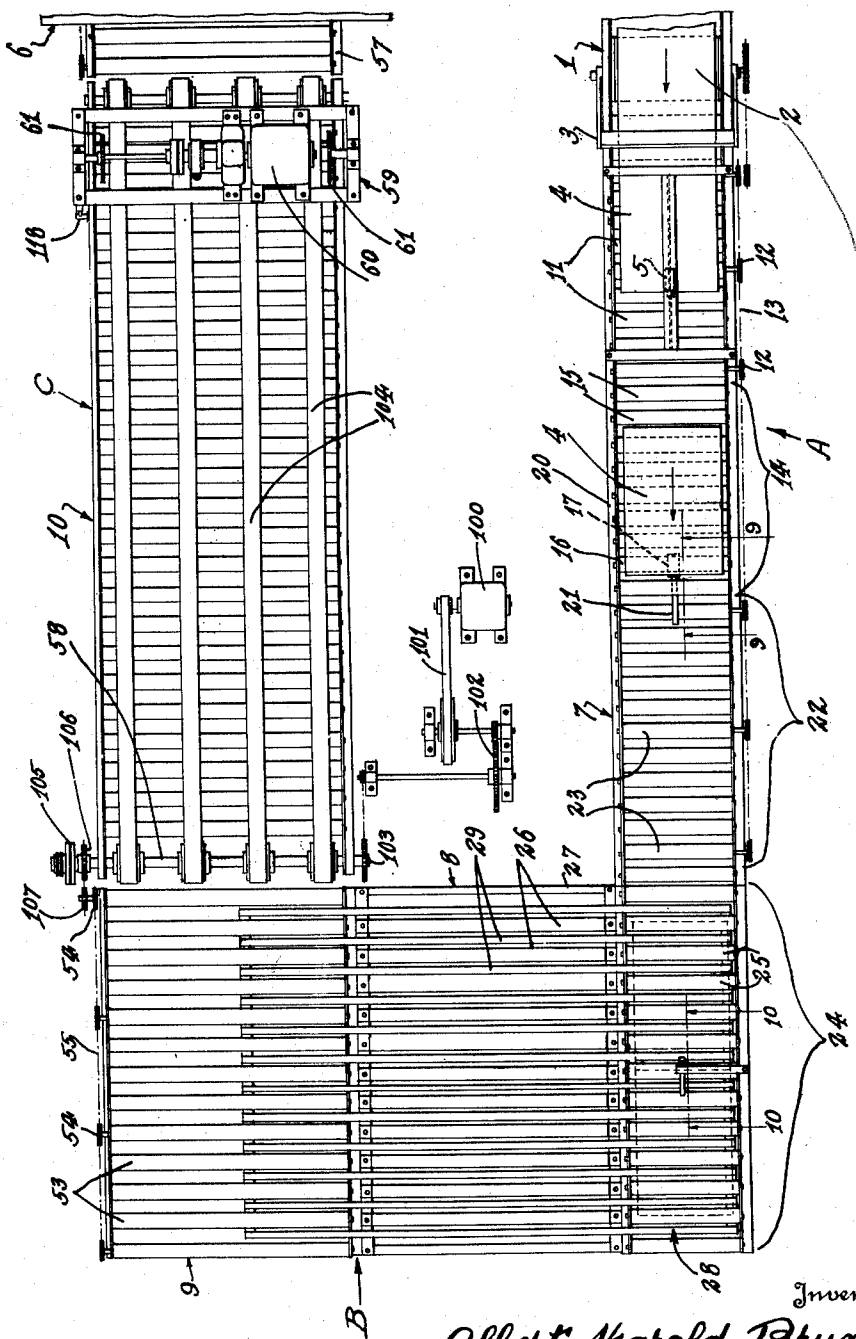
1,913,533

MATERIAL HANDLING SYSTEM

Filed April 4, 1930

5 Sheets-Sheet 1

Fig. 1.



Inventor
Albert Harold Brunner

334 Lyon & Lyon
Attorneys

June 13, 1933.

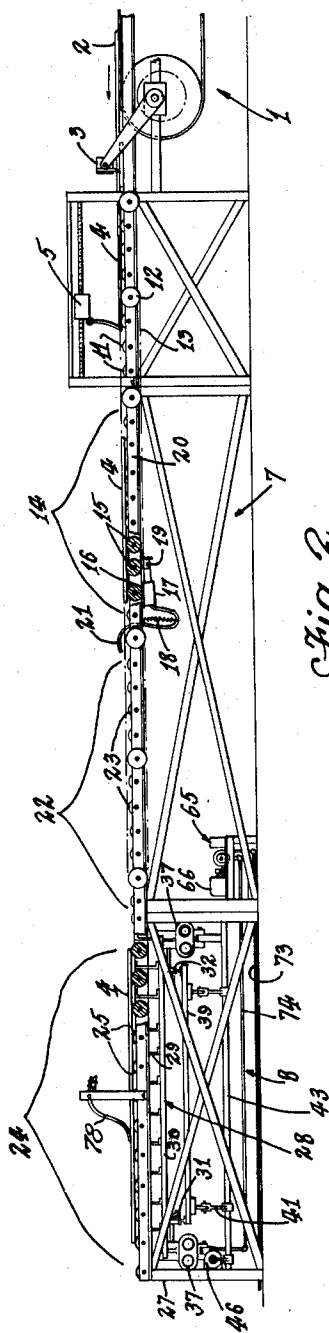
A. H. BRUNNER

1,913,533

MATERIAL HANDLING SYSTEM

Filed April 4, 1930

5 Sheets-Sheet 2



June 13, 1933.

A. H. BRUNNER

1,913,533

MATERIAL HANDLING SYSTEM

Filed April 4, 1930

5 Sheets-Sheet 3

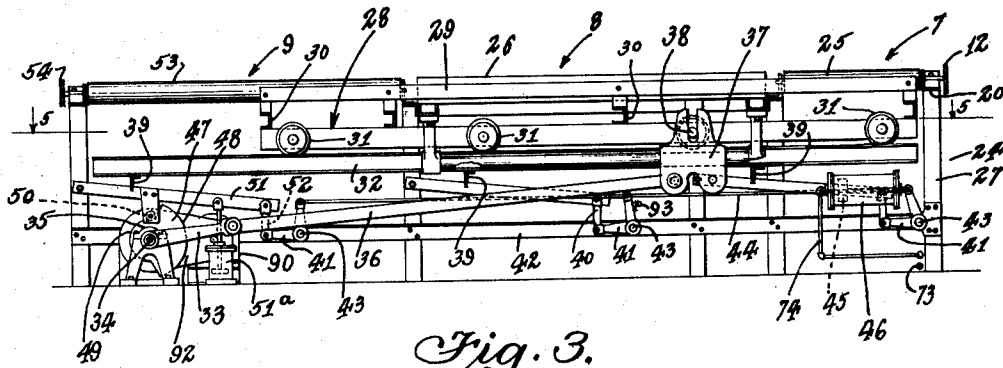


Fig. 3.

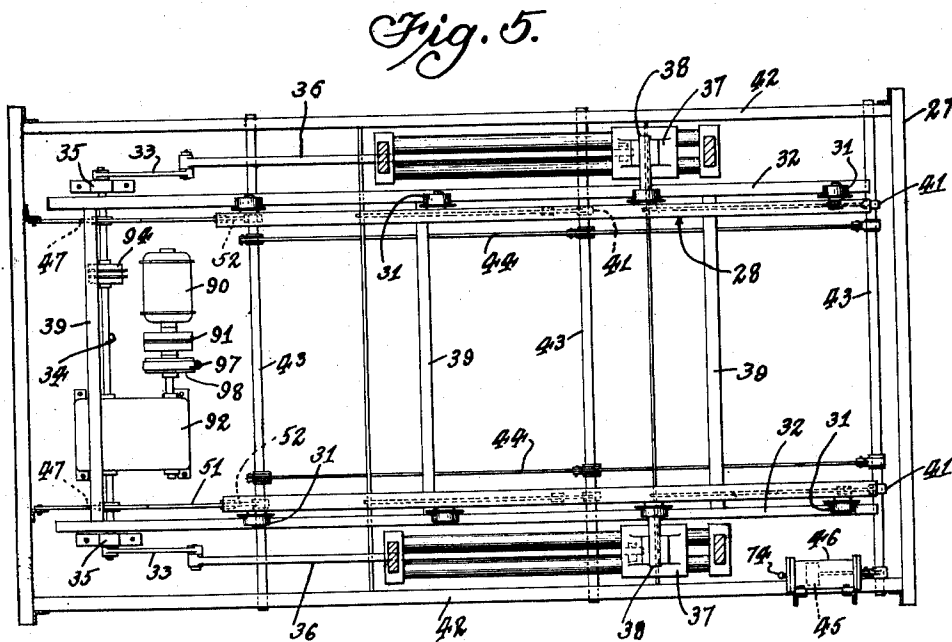


Fig. 5.

Inventor

Albert Harold Brunner

By Lyon & Lyon

Attorney

June 13, 1933.

A. H. BRUNNER

1,913,533

MATERIAL HANDLING SYSTEM

Filed April 4, 1930

5 Sheets-Sheet 5

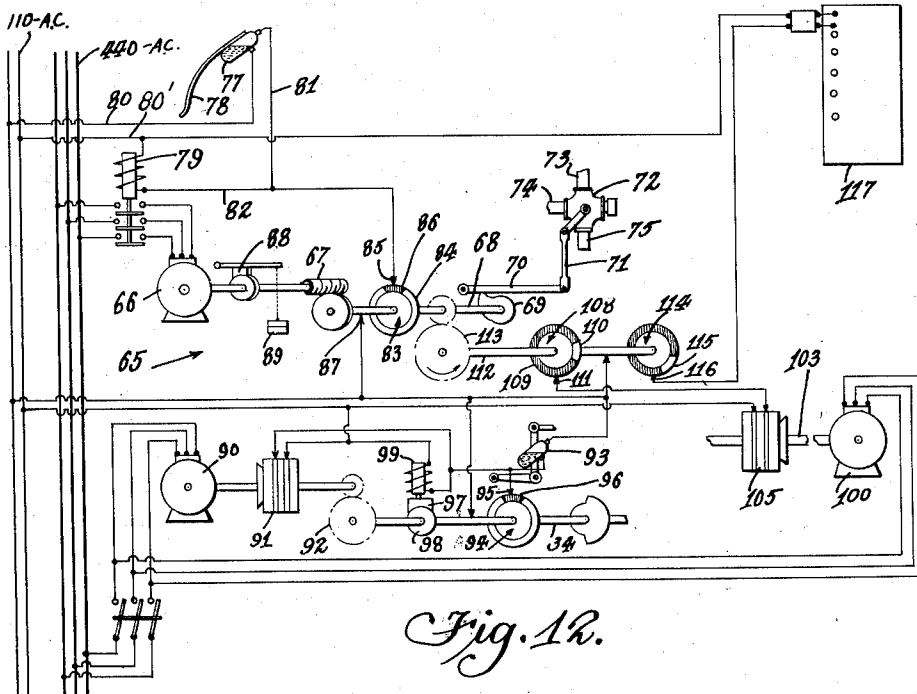


Fig. 12.

Fig. 9.

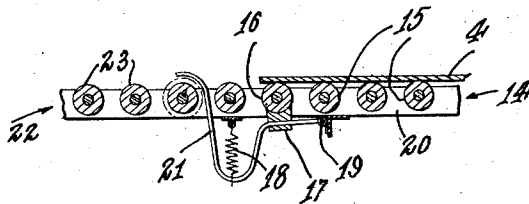


Fig. 11.

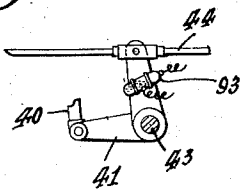
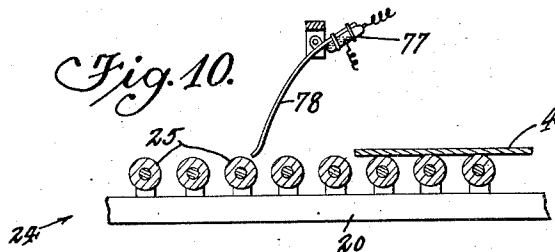


Fig. 10.



Inventor

Albert Harold Brunner

By Lyon & Lyon

Attorneys

UNITED STATES PATENT OFFICE

ALBERT HAROLD BRUNNER, OF LOS ANGELES, CALIFORNIA, ASSIGNOR TO SCHUMACHER WALL BOARD CORPORATION, OF LOS ANGELES, CALIFORNIA, A CORPORATION OF DELAWARE

MATERIAL HANDLING SYSTEM

Application filed April 4, 1930. Serial No. 441,495.

My invention relates to material handling systems and has particular reference to systems for transporting partially formed products between various steps in a manufacturing process.

In the manufacture of articles by the continuous process method it frequently happens that partially prepared material is required to be transported from one machine to another machine for the purpose of completing another of the steps of the process of manufacture. Frequently, it happens that the machine for performing the initial steps of the process and the machine for performing other steps of the process are not in such alignment as will allow a continuous conveying of the material in a single plane, thus preventing the use of the usual belt or roller type of conveyor for such transportation. In the manufacture of products in sheet form, the changing of the direction or changing of the plane at which the various steps of the process are performed introduces serious problems in changing the direction of the movement of the sheets from one machine to the other.

This is particularly true in the manufacture of plastic sheet material, since transportation of the sheets in their plastic or semi-plastic state requires special handling to prevent distorting the partially formed sheets during the transfer. Such distortion would be most likely to occur during the change in direction of motion of the sheets as they pass from one machine to the other.

A specific problem of this character is represented in the manufacture of wallboard of the type in which a plastic material is interposed between layers of relatively thin casing material, such as paper, or the like. These sheets, when formed with the moist plastic material, are readily distorted or broken if not handled with extreme care.

Machines for conveying such material from the initial forming machine to a machine for performing other steps of the process, such as drying machines, etc., are well known and are usually arranged to receive the material from a continuous forming machine and transport it to the second ma-

chine in the system, but all of the known systems depend upon the skill of an operator for insuring the transferring of the material without breakage and without interference of the material under transfer with the material being fed from the forming machine.

It is therefore an object of my invention to provide a transporting system of the above named character in which all of the steps of receiving the material from one machine, transferring the material to the plane of the second machine, and conveying the material to the second machine are accomplished in a completely automatic manner, obviating the necessity for a skillful operator for performing these functions.

Another object of my invention is to provide a material handling system in which material moving in one plane is transferred to a machine in another plane by means of a conveying system which automatically synchronizes the transfer of the material with the feeding of the material from the first machine so as to prevent interference between the feeding material and the material under transfer.

Another object of my invention is to provide a system of the above named character in which the transfer of material from the first plane to the second plane will occur without the necessity of interrupting the operation of or slowing down the operation of the continuously feeding forming machine.

Another object of my invention is to provide a material transporting system for receiving material from a continuously feeding source, wherein the continuously feeding material is divided into spaced groups of elements as it feeds from the forming machine and wherein the groups of elements so divided are transferred during the passage of the next succeeding group of elements through the space between succeeding groups of elements.

My invention will best be understood with reference to an embodiment in a specific machine for manufacturing wallboard illus-

trated in the accompanying drawings, wherein

Figure 1 represents a plan view of a portion of the forming machine and the conveying and transferring apparatus required to transport the material to a second machine;

Figure 2 is a side elevational view of the feeding table of the conveying system as viewed in the direction of the arrow A in Figure 1;

Figure 3 is a side elevational view of the transfer portion of the system shown in Figure 1 as viewed in the direction of the arrow B in that figure;

Figure 4 is a side elevational view of the portion of the conveying system shown in Figure 1 as viewed in the direction of the arrow C in that figure.

Figure 5 is a plan view partly in section of the transfer carriage and its operating mechanism illustrated in Figures 1 and 3;

Figure 6 is an end view partly in section of the transfer carriage and transfer machine illustrated in Figures 1, 3 and 5;

Figure 7 is a detail side elevational view of a time controlled controlling device for synchronizing the movements of the material to be transported between the entry of the material to the transporting machine and the transfer of the material to the second machine;

Figure 8 is a detail plan view of the controlling mechanism illustrated in Figure 7;

Figure 9 is a detailed view illustrating a brake used to assist in timing the passage of material from one of the machines to another;

Figure 10 is a detailed view illustrating the type of material operated switch which is utilized in synchronizing the movements of material;

Figure 11 is a detailed view of another switch utilized for controlling the movements of the transfer carriage; and

Figure 12 is a diagrammatic view of the electrical wiring and the interconnection of the various controlling devices utilized for controlling the transfer of the material.

Referring to the drawings, I have illustrated in Figure 1 a layout of two machines required in the manufacture of plaster wallboard. At the upper right hand corner of Figure 1 I have shown a fragmentary portion of a wallboard forming machine 1, of a construction well known in the art, from which a continuous strip 2 of partially formed, moist wallboard is fed.

Adjacent the forming machine 1 is illustrated a cutter 3, which divides the strip of board 2 into sheets 4 of predetermined length. The cutter 3 is arranged in the usual manner to operate in synchronism with the feeding of the strip 2 from the machine 1 in such manner that a continuous supply

of sheets of material 4 are fed from the machine. An adjustable control device 5 for actuating the cutter 3 may be adjusted to determine the length of the sheets cut from the strip.

While a single strip of material 2 is illustrated as being divided into sheets 4, it will be understood that the strip 2 may comprise several parallel strips in place of the single sheets 4 and a group of several sheets may be formed upon each operation of the cutter 3.

The moist sheets 4 must be dried, preferably in a drying oven 6 such as is fragmentarily illustrated in the upper left hand corner of Figure 1.

To convey the sheets 4 from the cutter 3 to the oven 6 I have illustrated a conveying system comprising a feeding conveyor 7, which passes the sheets 4 to a transfer table 8, which shifts the sheets laterally to a receiving table 9 from which they are passed to a receiving conveyor 10 and so are fed into the oven 6.

The feeding conveyor 7 is illustrated as of the driven roller type comprising a plurality of rollers 11 upon which the sheets of material 4 rest, certain of these rollers being positively driven by means of sprockets 12 and chain 13. In order that the material cut off by the cutter 3 shall move out of the way of the succeeding section of the continuous strip of material 2, the conveyor rollers 11 will be driven at a speed somewhat in excess of the speed at which the continuous sheet of material 2 is fed from the forming machine.

At a point further advanced in the direction in which the sheets of material 4 are to be fed I have illustrated a section 14 of the conveyor 7 as comprising a plurality of adjacent rollers 15 which are idle, that is, these rollers are not connected to the driving chain 13, so that the sheets of material 4 will pass over this idle section of the conveyor only by virtue of the momentum of the moving sheet of material.

A brake roller 16 constituting one of the idle rollers 15 is provided with a brake 17 normally spring pressed, as by means of spring 18, into engagement with the roller 16 so as to exert a retarding force preventing the movement of the sheet 4 of the conveyor section 14, except when the brake 17 is released.

The brake 17 is pivoted at 19 to the underside of the conveyor supporting frame 20. A releasing device for the brake 17 may be provided comprising a bar 21 extending above the level of the conveyor rollers 15 in such position as to be engaged and depressed by the moving sheet of wallboard 4. Hence, if the sheet 4 is moved sufficiently far over the idle section 14 of the con-

veyor, the brake will be released and passage of the sheet will be permitted.

Immediately beyond the idle section 14 of the conveyor is a second driven portion 22 of the conveyor, having its rollers 23 suitably driven by means of the chain 13 so that the sheet of material 4 will be passed to the transfer table 8, which is immediately adjacent to and has one end thereof in alignment with the conveyor 7. A section 24 of the conveyor 7 lying within the outer limits of the transfer table 8 is provided with a plurality of rollers 25 which, like rollers 14, are not driven but are idle so that the sheets 15 4 will pass over this section of the conveyor 7 by momentum only.

A transfer table 8 is provided with a plurality of stationary supporting bars 26 stationarily mounted upon a supporting frame 27 in such manner as to constitute a stationary supporting table extending between the feeding conveyor 7 and a receiving table 9.

The transfer table 8 is further provided with a movable carriage 28 comprising a plurality of supporting bars 29 interspaced between adjacent stationary supporting bars 26, and mounted upon crossheads 30 which in turn are supported upon wheels or rollers 31. The wheels 31 are movable along tracks 32 which extend laterally throughout the entire length of the transfer table 8. The above described carriage constitutes a transfer device which is utilized to move sheets 4 from the feeding conveyor 7 to the receiving table 9.

The carriage 28 is moved between alignment with the conveyor 7 and alignment with the table 9 by means of a crank arm 33 rigidly mounted upon a crankshaft 34 journaled in bearings 35 and connected by means of a connecting rod 36 to a sliding cross-head 37 which engages a pin 38 secured to the movable carriage 28. A complete rotation of the crank arm 33 (see Figure 3) will first move the carriage 28 from its illustrated position to a position at the extreme left hand side of Figure 3, and back again to the initial illustrated position, thus moving sheets 4 which may be upon the transfer table 8 from the conveyor 7 to a position to the left of the conveyor 7, upon each movement of the carriage 28. The extent of the movement of the sheets at each operation of the carriage 28 may be determined by the length of the crank-arm 33 and may be adjusted to any suitable value.

In order that the sheets 4 which have been moved to the transfer table can be laterally transferred by means of the carriage 28, the carriage is lifted such distance above the position illustrated in Figures 3 and 6 that the supporting bars 29 of the carriage are lifted to a height above the level of the idler rollers 25, thus lifting the sheet from engagement with the rollers 25 during the trans-

fer. The lifting motion of the carriage 28 is accomplished by supporting the tracks 32 upon which the carriage operates, upon a vertically movable set of cross-beams 39, which are in turn supported upon links 40 70 connected to bell-cranks 41 pivoted upon stationary beams 42 secured to the supporting frame 27, so that motion of the bell-cranks 41 about their pivots 43 will cause the track 32 to be moved in a vertical direction. 75

The bell-cranks 41 are rotated by means of rods 44 which are actuated by a piston 45 movable within a pneumatic cylinder 46 so that fluid pressure applied to the cylinder 46 will rotate the bell-cranks and cause the lifting of the carriage. 80

It will be apparent that during the entire time the carriage is moving from its right hand position, as illustrated in Figure 3, to the left hand position, the carriage must be maintained in the lifted position and for this reason I have provided a cam 47 secured to crankshaft 34 which has an outer level 48 and an inner level 49 so arranged with respect to the crank-arm 33 that a roller 50 carried upon a lever 51 will be maintained at one height during one-half of the rotation of the crank-arm 33 and at a lower height during the remaining port of the rotation of the crank-arm. The lowering of the carriage may be cushioned if desired by a suitable dash-pot 51^a. 85 90 95

The lever 51 is connected as by links 52 to one of the bell-cranks 41 so that the position of the lever 51 maintains the position of the bell-crank 41 independent of the fluid pressure in the cylinder 46, once the crank-arm 33 has been set into motion. It will be observed that the above described construction constitutes a mechanism which will insure that the carriage shall be in the lifted position during the passage of the carriage from the right hand side of the transfer table 8 to the left hand side thereof and will insure that the carriage is in a lowered position at which the supporting bars 29 are below the level of the stationary supports 26 and the rollers 25 during the return motion of the carriage from the left hand side of the table to the initial position illustrated in Figure 3. 100 105 110 115

From the foregoing description it will be understood that sheets 4 which have been moved upon the transfer table will be laterally shifted or transferred across the transfer table in steps, each step constituting the distance traversed by the carriage 28 upon each rotation of the crank 33. 120

The receiving table 9 comprises a plurality of rollers 53, which may be driven by means of sprockets 54 and chain 55, and constitutes a receiving device to which the sheets 4 may be readily transferred for movement to the machine for performing the second 125 130

step in the manufacturing process, in this case oven 6. The rollers 53 constituting a part of the receiving table 9, are so interspaced with respect to the movable supporting bars 29 of the movable carriage that the movable carriage may transport the sheets 4 laterally with respect to the rollers, and deposit them thereon during the motion of the carriage.

10 In the illustrated embodiment of my invention the drying oven 6 is illustrated in Figure 4 as being provided with a plurality of passages 56 through which material to be dried may be conveyed over suitable roller or chain conveyors 57. The receiving elevating conveyor 10 is used to transport the sheets of material 4 from the receiving table 9 to the various passages 56 of the drying oven 6, and comprises a roller and belt conveyor having one end thereof pivoted as at 58 adjacent the level of the receiving table in such manner that that end of the conveyor 10 will be in alignment with the rollers 53 of the receiving table.

25 The opposite end of the conveyor 10 is suitably arranged in the well known manner to be selectively aligned with various passages 56, as by means of an elevating mechanism 59 of the usual construction utilized for this purpose. The elevating mechanism 59 is illustrated as constituting a motor 60 driving a suitable pulley 61 over which a rope or chain 62 passes, the rope or chain 62 being connected at one end to the conveyor 10, as at 63, and at its other end to a suitable counter-weight 64. Selective control devices 118 may be utilized to determine the stopping point of the conveyor 10 in its movements up and down adjacent the passages 56 of the oven 6. The construction just described is that usually used in conveying material to ovens of this character and will be understood by those skilled in the art.

40 The assembled mechanism thus far described constitutes a conveying and transferring system to which material may be fed from the forming machine 1 and which transports the material first to a transfer table and thence to a receiving table, from which the material may be passed by means of the elevating conveyor 10 to the next machine utilized in the process, such as the drying oven 6.

50 There remains, however, the problem of suitably timing the passage of the material from the forming machine to the oven without interference of the sheets of material during the transfer.

55 The primary consideration here is the coordinating of the movements of the material fed from the forming machine with the movements of the transfer mechanism, and as a solution to this problem, I have provided a transfer control device 65 illustrated in Figure 7 as comprising a constant

speed motor 66 connected as by means of suitable reduction gearing 67 to a shaft 68. Mounted upon the shaft 68 is a cam 69 which engages and operates a lever 70 to control, by means of suitable links 71, a pneumatic valve 72.

70 The valve 72 is connected in the conduit system which supplies fluid pressure to the cylinder 46, which system comprises a pipe 73 leading from a suitable source of fluid pressure (indicated by the legend) to the valve 72, an inlet pipe 74 connecting the valve 72 to the cylinder 46 so that lifting of the lever 70 will cause the valve 72 to admit fluid pressure to the cylinder 46 to thereby cause the lifting of the carriage 28 through the agency of the bell-cranks 41, while depression of the lever 70 will cause the valve 72 to assume a position connecting the inlet pipe 74 with an exhaust port 75, allowing the fluid which is in the cylinder 46 to be exhausted to the atmosphere.

A spring 76 may be utilized to maintain the lever 70 in its normal illustrated position.

Referring to Figures 10 and 12, it will be observed that a mercury contact switch 77 is suitably pivotally secured above the transfer table 8 with an operating arm 78 therefor, depending downwardly into a position to engage sheets of material which enter upon the transfer table.

Referring particularly to Figure 12, it will be observed that the switch 77 is in circuit with a control relay 79 which controls the supply of current to the motor 66. Entry of a sheet of material 4 upon the transfer table, engaging the operating arm 78 will cause a tilting of the switch 77 to cause the motor 66 to start. The relay 79 and switch 77 may be supplied with current from a suitable control circuit extending from one of a pair of supply conductors designated by the legend 110—AC by way of a conductor 80, switch 77, conductors 81 and 82, the coil of relay 79 and conductor 80' to the other of the supply conductors.

Energization of relay 79 causes this relay to close its contact members to connect the motor 66 to a suitable power line designated by the legend 440—AC. The motor 66 when started drives, through the gearing 67, and shaft 68, the valve operating cam 69, and at the same time rotates a collector ring structure 83 which is provided with a conducting surface 84 which extends throughout the major part of the circumference of the collector ring structure 83.

A suitable contact brush 85 engages the ring 83 and is arranged to conduct current therefrom when in contact with the conducting portion of the ring. An insulating segment 86 is interposed in the conducting surface 84 so as to break the circuit controlled thereby when this segment is moved under

the brush 85. A supply brush 87, illustrated as contacting with the shaft 68, supplies current from one of the conductors of the control supply source 110—AC to the shaft 68.

Hence, when the motor 66 is started the engagement of brush 85 with the contacting surface of ring 83 will complete a circuit to the relay 79, which circuit parallels that closed by mercury switch 77 and the operation of the motor 66 is continued throughout a complete revolution of the shaft 68, independent of the fact that the sheet of material which operated switch 77 may be moved away from the switch. In order that the speed of the motor 66 may be suitably adjusted, a brake 88 may be provided to retard the motor, and its effect may be varied by means of adjusting suitable weights 89.

Hence, entry of sheets of material 4 upon the transfer table 8 will automatically start the transfer control device 65 to cause the transfer carriage to be lifted.

Referring again to Figure 5, it will be observed that the crank-arm 33 which causes the lateral movement of the carriage 28 is arranged to be driven by means of a motor 90. Motor 90 may be arranged to be started each time it is desired to have the carriage 28 moved through its cycle of operations. I prefer, however, to have the motor 90 constantly energized and to connect the shaft 34, which carries the crank-arm 33, to the motor only when it is desired to have the carriage moved. The time required to start a motor and bring it up to speed is variable and since it is necessary that the movements of the carriage be synchronized with the feeding of the sheets 4, it is not desirable to depend upon the variable starting time of the motor.

The connection of the motor 90 to the shaft 34 is therefore preferably made through a magnetically operated clutch 91 which in turn is connected through suitable gearing 92 to the shaft 34.

In order to control the time at which the shaft 34 and the crank-arm 33 are to operate, I have illustrated a switch 93, preferably of the mercury contact type, mounted upon one of the bell-cranks 41 and having its contacts in circuit with the magnetically operated clutch 91 so that the movement of the bell-crank 41 to lift the carriage 28 will cause energization of the operated clutch 91.

Since it is necessary that carriage 28 shall be moved to the left and back again to its normal position upon each operation, the shaft 34 must operate through a complete revolution each time it is desired to operate the carriage, I have, therefore, provided a collector ring structure 94 similar to that described in the collector ring structure 83, having a brush 95 engageable therewith in such manner that once shaft 34 has been started into rotation, the brush 95 will

complete a circuit for the clutch 91, parallel with that controlled by switch 93 and this circuit will be maintained throughout the remainder of the revolution of shaft 34.

Upon a completion of a complete revolution of shaft 34, that is, when the insulating segment 96 on ring 94 is re-positioned under brush 95, it is desirable that the shaft 34 should be immediately stopped so as not to cause an over-running of the carriage to the extent of starting another cycle of movement thereof. For this reason I have provided a brake 97 normally engageable with a brake drum 98 carried by the shaft 34, the brake 97 being arranged to be withdrawn from the brake drum through the agency of an electromagnet 99, the circuit to which is in parallel relation with the circuit to the clutch 91. Hence, whenever the clutch 91 is energized to cause movement of shaft 34, the brake 97 will also be released but immediately upon deenergization of clutch 91, the brake will be applied and shaft 34 will be stopped.

The operation of the system thus far described is as follows:

Assuming that the forming machine 1 is operating and is feeding a continuous strip of wallboard material 2 beneath the cutter 3 which separates the continuous strip into sheets 4, the conveyor 7 moves the cut sheets at a speed greater than the speed with which the strip 2 is feeding from the forming machine. Hence, the sheets are fed by the conveyor 7 in succession with a space between each of the cut sheets. The sheets 4 then proceed by momentum upon the idler section 14 of the conveyor to the point at which the sheet would engage the retarded roller 16 and would there come to rest. The next succeeding sheet 4 would then overtake the first sheet and since the second sheet is still upon the driven rollers 11 of the conveyor 7, the second sheet will abut the first and will push the first forward to engage and depress the operating arm 21 of the brake 17, thereby allowing the two abutting sheets to pass freely to the next driven section 22 of the conveyor 7. It will be observed that the effect of the brake 17 will be to create a pause in the feeding of the sheets from the cutter 3.

As the sheets 4, now arranged in units or groups of two abutting sheets, each proceed from section 22 of the conveyor onto the transfer table 8, the first sheet of each group will engage the operating arm 78 for switch 77, closing the circuit for control device of motor 66.

Motor 66 then starts to rotate and through the action of cam 69 and lever 70, the valve 72 will be operated to cause lifting of the carriage 28. However, the time required for the valve 72 to operate and for the piston 45 to move sufficiently to raise the car-

riage will be such that at the time the carriage is raised to bring the supporting bars 29 above the level of idler rollers 25, the group of sheets will have moved by momentum to such position that both of the abutting sheets will be upon the transfer table. The carriage, now in lifting position, will pick the groups of sheets from the transfer table and move them off the rollers 25.

However, as soon as the carriage 28 was lifted, switch 93 was closed and hence, clutch 91 will be energized to connect the carriage driving motor 90 to start the lateral movement of the carriage through the action of crank-arm 33. The initial movement of the crank-arm 33 and its shaft 34 will cause the collector ring 94 to be brought into engagement with the brush 95 so that the clutch 91 will remain energized until the crank-arm has completed a full revolution.

Hence, the group of sheets which had been moved upon the transfer table will now be moved laterally to the left (see Figure 3) until the crank-arm 33 has reached its extreme left hand position, whereupon the cam 47 will allow the carriage 28 to again be lowered, depositing the group of sheets upon the stationary supporting bars 26, in a new position, displaced from alignment with the feeding conveyor 7. The amount of movement may be variable through wide limits, but must be sufficient to move the first group of sheets fed from the feeding conveyor 7 to a position such that the next group of sheets may pass freely to the transfer table.

It will be observed that the lateral motion of the transfer carriage will be so controlled by the transfer control device 65 and timed by switch arm 78 that the transfer occurs during the pause created in the feeding of sheets from the cutter 3. In other words, the continuous feeding of the sheets 4 to the transfer table is interrupted by just such amount of time as is required to displace the previously fed group of sheets out of the way of the succeeding group.

In the embodiment of my invention illustrated, the carriage moves the group of sheets one-quarter of the total distance between the feeding conveyor 7 and the receiving table 9 upon each cycle of operations of the carriage. It is to be remembered, however, that the extent of the lateral movement of the sheets may be varied to suit the conditions of location of the receiving table.

The return movement of the carriage to pick up the next succeeding group of sheets fed from the conveyor 7 will be insured since the collector ring 94 continues the energization of the clutch 91 until the carriage has been moved back to its original position.

It will thus be observed that the sheets of material are continuously fed from the forming machine in successive groups of two sheets each, and that these sheets are transferred laterally during the time the next group of sheets is delayed by the brake 17. It will also be observed that the operation of the transfer occurs automatically upon the entry of the group of sheets to the transfer table, the transfer carriage being operated through a cycle of operations including the lifting of the sheets from the transfer table and, second, lateral movement of the sheets, third, lowering of the transfer carriage to deposit the sheets upon the transfer table and, fourth, the return of the carriage in its lowered position to its original starting point.

It will also be observed that the use of my system for automatically creating the pause in the feeding of the sheets from the cutter and automatically initiating the transfer action during the pause of the next succeeding group of sheets, insures the co-ordination of the operations and dispenses with the services of a skilled attendant for manually timing the operations.

The use of my system also permits increasing the speed of the forming machine since if the boards were allowed to pass to the transfer table without grouping it would be necessary to so space them that there is an interval between each two boards of the length required for the transfer table to move through its cycle to take previously fed boards out of the way. By grouping the boards, the interval between groups is sufficient to permit preceding groups to be moved out of the way and one-half of the intervals is saved, allowing the forming machine to be operated at that much greater speed.

After the material has been deposited upon the receiving table 9 it should be removed therefrom at a sufficient rate to allow for the passage of the next group of sheets from the transfer table. In order to accomplish this result, it is only necessary to provide for the driving of the receiving table rollers 53 by any suitable means, operating at a sufficient speed to remove the deposited sheets before the next group of sheets is transferred to the receiving table.

However, it is the usual construction of the drying oven 6 that it should be sufficiently wide to receive several groups of sheets arranged alongside each other.

Also, it is necessary that there should be some interruption in the feeding of the sheets to the receiving elevating conveyor 10 in order to give this conveyor time to move from one of the oven passages 56 to the next passage.

I have arranged the receiving table 9 and the conveyor 10 to carry two groups of

5 sheets to the oven simultaneously, and in order to automatically coordinate the movement of the receiving table rollers 53 with the arrival of sheets from the transfer table to accomplish this result, I have arranged for driving the receiving table rollers 53 intermittently.

Referring again to Figure 1, I have illustrated a driving motor 100 continuously operating, and connected by means of suitable belting or gearing 101 and 102 to drive a shaft 103 to which are attached the conveying belts 104 of the receiving elevating conveyor 10.

15 Suitably connected to the shaft 103 is a magnetically operated clutch 105 which, when energized, connects a sprocket 106 to be driven by the shaft 103. The sprocket 106 is suitably geared to the driving sprockets 20 107 for the conveying rollers 53 of the receiving table 9, so that these rollers may be driven by the motor 100.

The coordination of the application of driving power through the receiving table rollers 53 with the depositing of the transferred sheets upon the receiving table is accomplished by the provision of a suitable switching device 108 which is controlled by the transfer control device 65.

30 The switching device 108 comprises a collector ring similar in construction to that described with reference to the collector ring 83, except in this case the major portion 109 of the collector ring is made of insulating material, while a segmental conducting surface 110 is arranged upon the ring so as to be brought into engagement with a suitable contact brush 111.

40 The entire switch structure 108 is mounted upon a shaft 112 which in turn is driven by means of suitable reduction gearing 113 by the shaft 68.

The ratio of the gearing 113 is such that the shaft 68 which makes two complete revolutions to one revolution of the shaft 112, thus insuring that the transfer carriage will go through two of its cycles of operation to arrange two groups of sheets upon the receiving table before the conveyor rollers 53 will be driven to feed these sheets to the conveyor 10. Since it is only necessary that the rollers 53 be driven sufficiently long to insure passage of the groups of sheets 4 to the elevating belts 104, the length of the segmental contacting surface 110 of the switch 108 may be arranged to maintain clutch 105 energized only for the proper length of time.

In addition to the control of the receiving rollers 53 at the proper time, it is desirable that the conveyor 10 shall be caused to shift its position from one passage 56 in the oven 6 to another passage at the proper time, I have arranged on shaft 112 an additional collector ring 114, similar in construction to

switch 108 but having its segmental contact surface 115 arranged to engage its brush 116 just after the energization of clutch 105. The collector ring 114 is suitably connected in circuit with the control mechanism 117 for the elevating motor 60 to cause the conveyor 10 to assume its next position. The control of the elevating motor 60 is assumed to be of standard construction and will not be described in detail herein, it being sufficient to note that with this type of elevator control an impulse of current being supplied to the control mechanism 117 will cause the conveyor 10 to move from its then position to the next adjacent level, as determined by the switches 118.

To continue the operation of my system it will be observed that after the group of sheets 4 has been transferred by successive operations of the transfer table to the receiving table, and the proper number of groups are arranged upon the receiving table, the receiving table rollers 53 will be started and the adjacent groups of sheets will pass to the conveyor 10. During some portion of the passage of the groups of sheets along the elevating conveyor belts 104, the elevating motor 60 will be started to align the conveyor 10 with the proper passage in the drying oven 6.

It will thus be observed that I have provided a system for transporting partially formed materials from one machine lying in one plane to one machine lying in another plane, the transfer of the material occurring without interrupting of the continuous feeding of material from the first machine, and the entire operation being so automatically controlled as to avoid the necessity of employing a skilled operator to coordinate the various steps required during the transportation.

While I have illustrated and described a machine for manufacturing wallboard, it is evident that my system is applicable to other types of manufacturing apparatus and I therefore do not desire to be limited to any of the details shown herein, except as defined in the appended claims.

I claim:

1. In a material handling system for conveying continuously fed material from a feeding table to a receiving table positioned out of alignment therewith, a transfer table extending into alignment with both said feeding table and said receiving table, a movable carriage thereon, means for moving said carriage from alignment with one of said tables to alignment with the other of said tables and return, a conveyor on said feeding table, for moving the material from the feeding source to the transfer table, operable at a speed greater than the speed with which the material is fed, to thereby divide the material into spaced elements, means on

said conveyor for causing alternate elements of material to pause in their movements to the transfer table for a predetermined interval of time, and means for operating the transfer carriage from alignment with the feeding table to alignment with the receiving table during said interval.

2. In a material handling system for conveying continuously fed material from a feeding table to a receiving table positioned out of alignment therewith, a transfer table extending into alignment with both the feeding table and the receiving table, a movable carriage thereon, means for moving said carriage from alignment with one of said tables to alignment with the other of said tables and return, a conveyor on said feeding table for moving the material from the feeding source to the transfer table operable at a speed greater than the speed with which the material is fed, to thereby divide the material into spaced elements, means on said conveyor for causing alternate elements of said material to pause in their movements for a predetermined interval to allow the next succeeding element to join the first, means for continuing the movements of the two elements to the transfer table, and means operable by the entry of the material to the transfer table for causing the carriage to move from the alignment with said receiving table to alignment with said receiving table during the next pause.

3. In a material handling system for conveying continuously fed sheet material from a feeding table to a laterally displaced receiving table, a transfer table extending into alignment with both the feeding table and the receiving table, a movable carriage thereon, means for moving said carriage from alignment with said feeding table to alignment with said receiving table and return, a conveyor on said feeding table for moving said sheet material from the feeding source to said transfer table operable at a speed greater than the speed of feeding of said sheet material to thereby divide the sheet material into spaced sheets, means on said conveyor for causing each alternate sheet to pause in its movement onto the transfer table for a predetermined interval of time, permitting the succeeding sheet to overtake the first to form the sheets into units of two sheets each and means responsive to the entry of a unit onto the transfer table for starting operation of said carriage moving means, said carriage starting means and said means for causing said sheets to pause being so located with reference to each other that the transfer movement of a unit upon the transfer table occurs during the pause of the next following unit.

4. In a material handling system for conveying continuously fed sheet material from a feeding table to a laterally displaced re-

ceiving table, a transfer table extending into alignment with both the feeding table and the receiving table, a movable carriage thereon, means for moving said carriage from alignment with said feeding table to alignment with said receiving table and return, a roller type conveyor on said feeding table for moving said sheet material from the feeding source onto said transfer table, driven at a speed greater than the speed with which the material is fed from said source, whereby the material is divided into succeeding spaced sheets, an idler section in said roller conveyor and a brake therefor causing said sheets to pause in passage over said section for an interval of time necessary for the next following sheet to overtake and abut the first, means operable by the abutment of the two sheets for releasing said brake, allowing said two sheets to be passed to the transfer table as a unit, and means operable during the pause for operating said carriage to cause the preceding two sheets to be displaced from alignment with said conveyor.

5. In a material handling system for conveying continuously fed sheet material from a feeding table to a laterally displaced receiving table, a transfer table extending into alignment with both the feeding table and the receiving table, a movable carriage thereon, means for moving said carriage from alignment with said feeding table to alignment with said receiving table and return, a roller type conveyor on said feeding table for moving said sheet material from the feeding source onto said transfer table, driven at a speed greater than the speed with which the material is fed from said source, whereby the material is divided into succeeding spaced sheets, an idler section in said roller conveyor and a brake therefor causing said sheets to pause in passage over said section for an interval of time necessary for the next following sheet to overtake and abut the first, means operable by the abutment of the two sheets for releasing said brake allowing said two sheets to be passed to the transfer table, and means operable by the entry of the preceding two sheets upon the transfer table for operating said carriages to displace the said preceding sheets from alignment with said table.

6. In a material handling system for conveying continuously fed sheet material from a feeding table to a laterally displaced receiving table, a transfer table extending into alignment with both the feeding table and receiving table, a movable carriage thereon, means for moving said carriage from alignment with said feeding table to alignment with said receiving table and return, a conveyor on said feeding table for moving said sheet material from the feeding source to said transfer table operable at a speed great-

er than the speed with which the material is fed from said source, whereby the material is divided into spaced sheets, means on said conveyor for causing each alternate sheet to
 5 pause in its movement onto the transfer table for a predetermined interval of time, and means controlled by the movement of sheets on said conveyor for controlling said carriage moving means to synchronize the
 10 lateral movement of said carriage with the pause of the next succeeding sheets of material on said conveyor.

7. In a material handling system for laterally transferring continuously fed material from a feeding table to a laterally displaced receiving table, a transfer table connecting the feeding table and the receiving table, a movable carriage thereon having motion through a cycle of operation including, lifting the carriage from a normal position below the level of the feeding table to a position above the feeding table, moving the lifted carriage laterally from alignment with the feeding table to a position displaced therefrom, lowering the carriage to its first level and returning the lowered carriage to alignment with the feeding table, means operably responsive to the entry of material upon the transfer table for starting the cycle, a continuously operating driving motor, a magnetically operable clutch normally disengaging the carriage driving means from the motor, a circuit therefor, and switch means operable upon the initial
 35 lifting of the carriage for energizing said clutch.

8. In a material handling system for laterally transferring continuously fed material from a feeding table to a laterally displaced receiving table, a transfer table connecting the feeding table and the receiving table, a movable carriage thereon having motion through a cycle of operation including, lifting the carriage from a normal position below the level of the feeding table to a position above the feeding table, moving the lifted carriage laterally from alignment with the feeding table to a position displaced therefrom, lowering the carriage to its first level and returning the lowered carriage to alignment with the feeding table, means operably responsive to the entry of material upon the transfer table for starting the cycle, a continuously operating driving motor, a magnetically operable clutch normally disengaging the carriage driving means from the motor, a circuit therefor, switch means operable upon the initial lifting of the carriage for energizing said clutch, and switch means operable with said carriage moving means for maintaining the clutch circuit energized through the remaining portions of the cycle.

9. In a material handling system for laterally transferring continuously fed material

from a feeding table to a laterally displaced receiving table, a transfer table connecting the feeding table and the receiving table, a movable carriage thereon having motion through a cycle of operation including, lifting the carriage from a normal position below the level of the feeding table to a position above the feeding table, moving the lifted carriage laterally from alignment with the feeding table to a position displaced therefrom, lowering the carriage to its first level and returning the lowered carriage to alignment with the feeding table, means operably responsive to the entry of material upon the transfer table for starting the cycle, a continuously operating driving motor, a magnetically operable clutch normally disengaging the carriage driving means from the motor, a circuit therefor, switch means operable upon the initial lifting of the carriage for energizing said clutch, switch means operable with said carriage moving means for maintaining the clutch circuit energized through the remaining portions of the cycle, and a magnetically releasable brake on said carriage moving means for preventing overrunning of said means, the magnet of which is in the circuit to said clutch.

10. In a material handling system for conveying continuously fed material from a feeding table to a laterally displaced receiving table, a transfer table extending into alignment with both of said tables, a movable carriage thereon, a conveyor on said feeding table for moving the material from the feeding source to the transfer table operable at a speed greater than the speed with which the material is fed, to thereby divide the material into spaced elements, means on said conveyor for causing alternate elements of material to pause in their movements to the transfer table for a predetermined interval of time, means for operating the transfer carriage from alignment with the feeding table to alignment with the receiving table and return during said interval, a receiving conveyor for transferring material from said receiving table to a receptacle, a normally idle feeder conveyor on said receiving table for passing material to said receiving conveyor, and means operable upon entry of material upon said transfer table for causing the transfer of the material to the receiving table and for operating said idle feeder conveyor to pass previously received material to said receiving conveyor.

11. In a material handling system for conveying continuously fed material from a feeding table to a laterally displaced receiving table, a transfer table extending into alignment with both of said tables, a movable carriage thereon, means for moving said carriage from a position in alignment with said feeding table to a position in alignment

with said receiving table and return, a conveyor on said feeding table for moving the material from the feeding source to the transfer table, and operable at a speed greater than the speed with which the material is fed, to thereby divide the material into spaced elements, means on said conveyor for causing alternate elements of material to pause in their movement to the transfer table for a predetermined interval of time, means operably responsive to the entry of material upon said transfer table for controlling said carriage moving means to move the carriage from alignment with the feeding table to alignment with the receiving table and return during the interval of said pause, a receiving conveyor for transferring material from said receiving table to a receptacle, a normally idle feeding conveyor on said receiving table for passing material to said receiving conveyor, driving means for said receiving conveyor, clutch means for connecting said idle feeding conveyor to be driven by said receiving conveyor driving means, and timed control mechanism operably responsive to two successive actuations of said carriage controlling means for actuating said clutch, whereby two loads of material are transferred successively to the receiving table and then are simultaneously fed to the receiving conveyor.

Signed at Los Angeles, California, this 20th day of March, 1930.

ALBERT HAROLD BRUNNER.

40

45

50

55

60

65