

Oct. 20, 1942.

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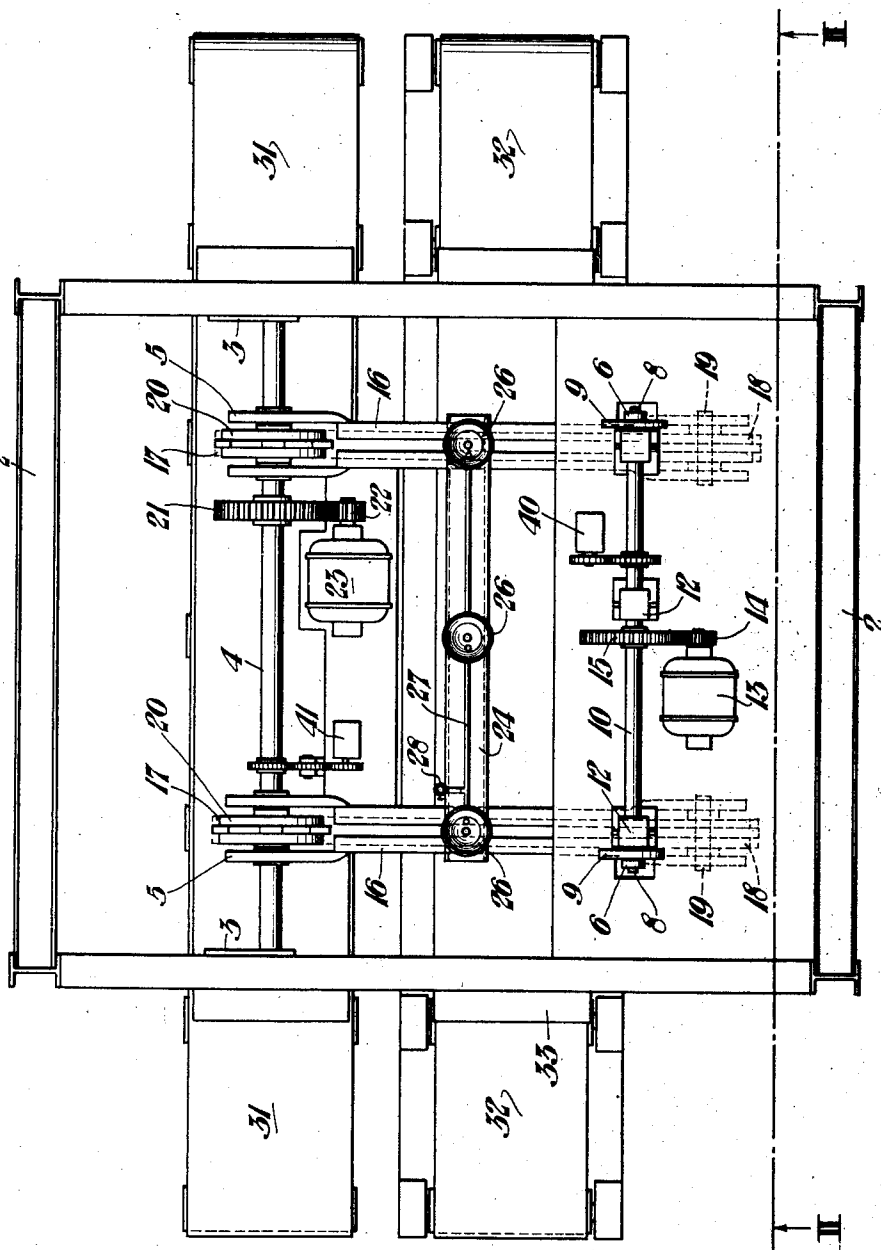
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METHOD OF AND APPARATUS FOR TRANSFERRING SHEET MATERIAL

Filed Dec. 27, 1940

3 Sheets-Sheet 1

FIG. 1.



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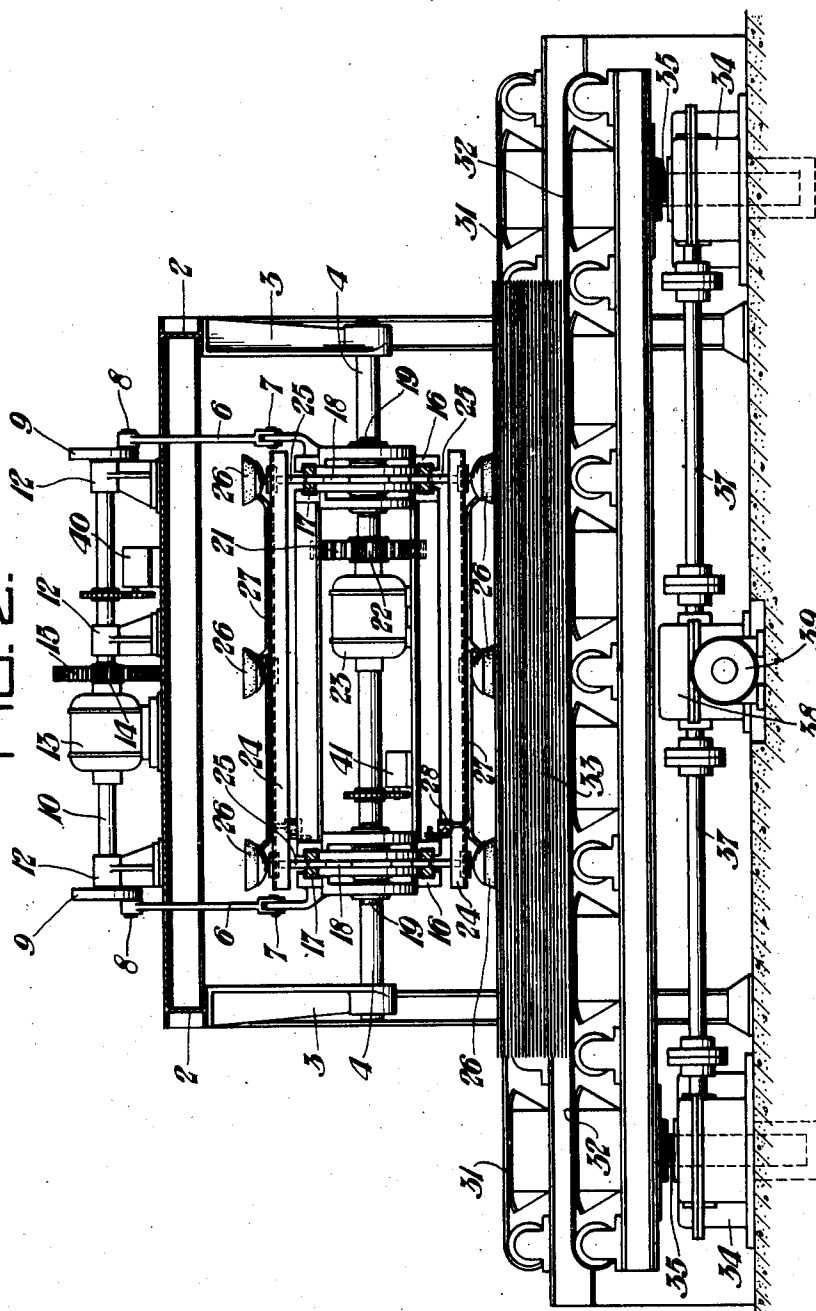
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3 Sheets-Sheet 2

FIG. 2.



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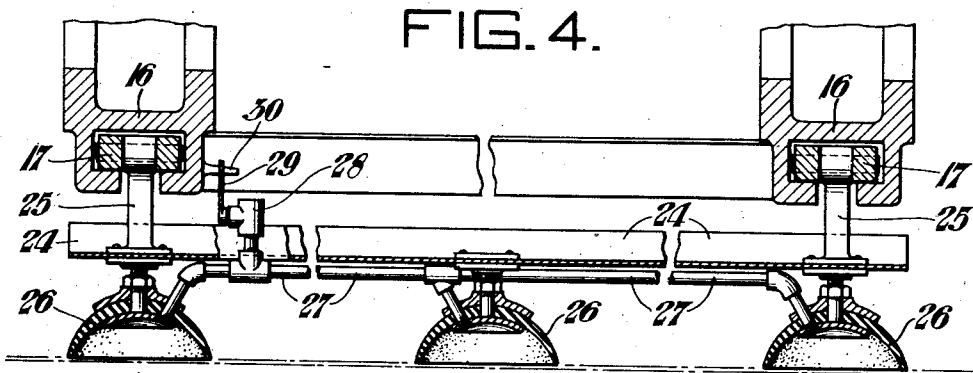
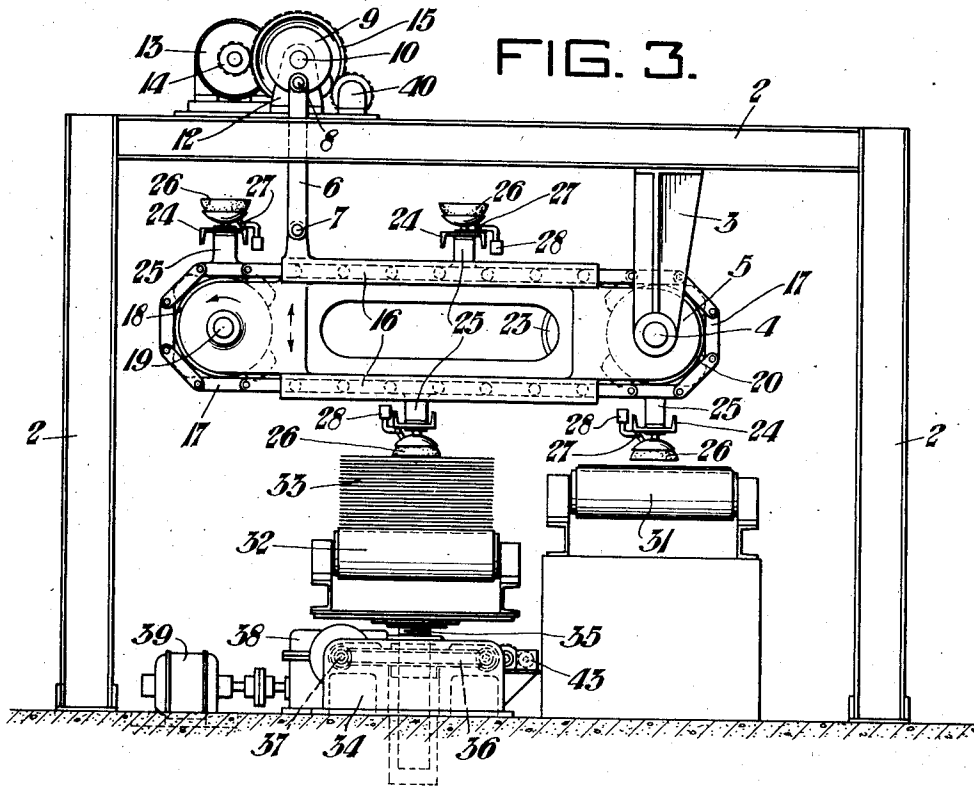
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METHOD OF AND APPARATUS FOR TRANSFERRING SHEET MATERIAL

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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METHOD OF AND APPARATUS FOR
TRANSFERRING SHEET MATERIAL

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8 Claims. (CL 271—11)

This invention relates to a means for transferring sheet material from one point to another and, particularly, to an improved method of and apparatus for transferring metallic sheets.

With the advent of the continuous rolling of strip steel and the like and its consequent high tonnages and sheets resulting therefrom, the handling and finishing of such sheets through their various stages of processing has presented a serious and difficult problem to the industry. Such processing usually consists of resquaring, pickling, annealing, skin rolling and normalizing the sheets, and the sheets are usually introduced individually to each step by hand which is both tedious and inefficient. For instance, after a sheet has been cut, squared, and pickled, it may be necessary to pass it between rolls to impart a certain hardness and luster to it. In such a case the pile of sheets is transported by means of a crane to the mill in which the sheets are to be rolled, and usually laid on a table adjacent thereto. The sheets are taken from the pile one at a time by three or four workmen and slid by them upon the entry table leading to the mill from which they pass between the rolls of the mill. By this method many of the sheets are bent and scratched which in many cases render them unfit for the use for which they are intended and have to be scrapped. Such a method is also dangerous to the workmen and oftentimes injuries result. Also, the mill through which the processing is being done is usually capable of handling many more sheets in a certain length of time than can possibly be delivered to it by hand which, of course, is not using the mill in the most efficient manner and seriously affects the output of the entire mill. For instance, such a mill is usually capable of processing thirty sheets a minute and it is possible to feed thereto only from six to eight sheets a minute to the mill by hand.

Various machines and apparatus have been suggested and used for handling such sheets as an aid to increasing the rate of handling of the sheets and production but most of these have been not only cumbersome and inconvenient to use but were also expensive in their construction and maintenance and were practically of no advantage over manual handling. Also, oftentimes with the use of such machines the handling of the sheets thereby has been even slower than by the old hand method and it can be said that none of these machines or apparatus was entirely satisfactory.

Accordingly, it is one of the objects of the pres-

ent invention to provide an improved method of and apparatus for handling sheet material which is simple and inexpensive in its construction and operation and apparatus by which the sheets can be transferred from one point to another quickly and conveniently in a minimum amount of time.

It is another object of the invention to provide an improved method of and apparatus for handling sheet material which is safe and one in which scratches and bent edges have been eliminated and apparatus which quickly facilitates the handling of the sheets generally.

It is a further object of this invention to provide an improved method of and apparatus for handling sheet material in which the sheets are firmly gripped by means of pliable vacuum rubber cups and transferred from one point to another and apparatus which is completely automatic in its operation.

Various other objects and advantages of this invention will become more apparent in the course of the following specification and will be particularly pointed out in the appended claims.

In the accompanying drawings, there is shown for the purpose of illustration one embodiment which my invention may assume in practice.

In said drawings:

Figure 1 is a plan view of the improved apparatus of my invention for handling sheet material;

Figure 2 is a vertical section taken on the line II—II of Figure 1;

Figure 3 is a side elevation of my improved apparatus; and

Figure 4 is an enlarged section through the conveyor chains and vacuum cups showing the vacuum cup releasing means.

Referring more particularly to the drawings, the improved apparatus of my invention for transferring sheet material from one point to another comprises a structural steel framework 2 which is suitably anchored on the ground or floor at the place where it is to be used. There is carried by the framework 2 a pair of spaced apart downwardly extending bracket members 3 having a horizontally disposed shaft 4 rotatably mounted therebetween in suitable bearings arranged in the lower end thereof. There is suspendingly arranged within the framework between the bracket members 3 a longitudinally extending body member 5 having one end thereof supported by the shaft 4. The opposite end of the body member 5 is supported by means of a pair of vertically disposed crank arms 6 which

have their lower ends pivotally attached to the body member 5 at 7 with the opposite ends thereof pivotally attached to pins 8 carried by crank wheels 9. The crank wheels 9 are disposed on the opposed ends of a horizontally disposed shaft 10 which is mounted preferably on the top of the framework in suitable bearings 12 arranged thereon. There is also mounted on the top of the framework 2 a motor 13 having a gear 14 arranged on the shaft thereof which meshes with a gear 15 securely carried by the shaft 10 and which rotates the same. Thus it will be seen that when the motor 13 is set in motion the shaft 10 together with the crank wheels 9 carried thereby is rotated and the crank arms 6 connected thereto will impart an oscillating movement to the body member 5 in a vertical plane about its pivotal connection with the brackets 3 through shaft 4.

There is integrally carried by the body member 5 around the opposed edges thereof conveyor chain housings or guideways 16 in each of which there is disposed an endless conveyor chain 17 which is adapted to pass around the idler sprocket wheels 18 securely mounted on stud shafts 19 rotatably arranged in the rearward portion of the body member 5. The conveyor chains 17 are also adapted to pass over respective sprocket wheels 20 securely arranged on shaft 4 in the forward end of the body member and which are adapted to drive the same. There is also securely mounted on the shaft 4 a gear 21 which is adapted to mesh with a gear 22 carried by the shaft of a motor 23 mounted preferably on a supporting plate arranged on top of the body member 5. That is, the shaft 4 together with the sprocket wheels 20 carried thereby and the chains 17 are driven by the motor 23 through the cooperation of the gears 22 and 21.

There is carried by the conveyor chains 17 and extending therebetween a plurality of spaced apart bar-like members 24 which are connected to the conveyor chains in any suitable manner. In the present instance the ends of the bars 24 are connected to a downwardly extending portion 25 of a link member of the chains 17. There is mounted on each of the bar-like members 24 a plurality of pliable vacuum rubber cups 26, namely, three in number in the present instance. There is mounted by each of the bar-like members 24 preferably a pipe line 27 having a relief valve 28 arranged therewith adjacent one side of the body member. The pipe line 27 is arranged so that it communicates with the interior of each of the vacuum cups 26 carried by the particular bar member to which the pipe line is attached. It will be understood that it is the purpose of this pipe line to release the vacuum under each of the cups, as will hereinafter be more fully described. If desired, however, a relief valve 28 may be incorporated with each of the vacuum cups 26 for relieving the vacuum thereunder, thereby eliminating the need of the pipe line 27. There is arranged with the relief valve 28 an upwardly extending lever or operating handle 29 for opening and closing the same and which is adapted to cooperate with an outwardly extending finger-like portion 30 arranged on the inner side of one of the chain housings 16 of the body member. It will be understood that the handle 29 and portion 30 are constructed and arranged relative to each other so that when the conveyor chains 17 pass around the body member 5 the handle 29 carried by the relief valve 28 will strike the finger-like member 30

at the desired position thereby opening the valve. There is arranged with the operating handle 29 of the valve preferably a suitable spring (not shown) for actuating the handle 29 so as to close the valve after it has passed out of contact with the finger-like portion 30.

There is arranged below the body member 5 within the framework 2 preferably a table 31 or conveyor or other means for receiving the sheet material and to which the same are to be transferred.

There is also positioned below the body member 5 within the framework 2 next to the table 31, another table 32 or conveyor or other means from which the sheet material is to be transferred. In the present instance there is shown a table 32 for holding a pile of metallic sheets 33 which are adapted to be transferred one at a time from the top of the pile to the table 31. It will be understood that when a sheet is taken off the top of the pile 33 the entire pile will have to be moved upwardly a distance at least equal to the thickness of one sheet so that the next sheet will be in position to be gripped by the vacuum cups 26 in a manner to be described for transferring the sheets. Such a means for elevating the table automatically or manually to compensate for the thickness of each sheet as it is taken off the pile consists preferably of two worm driven screw-type elevators 34 with one positioned at each end of the table. The elevating screws 35 of each of the elevators 34 are driven preferably by means of inner threaded gears 36 carried by each of the screws 35 which are, in turn, driven by a shaft 37 arranged below the table preferably through a suitable reducer 38 by means of a motor 39.

The improved apparatus of my invention operates in the following manner:

The pile of sheets 33 is placed on the table 32 which is then moved to the proper elevation for transferring the topmost sheet therefrom by means of motor 39. One of the bar-like members 24 together with the vacuum cups 26 carried thereby, is then positioned directly over the pile of sheets so that the vacuum cups 26 are substantially over the center of the pile. The motor 13 is then started which, in turn, rotates the shaft 10 together with the crank wheels 9 carried thereby so that the crank arms 6 connected thereto will move the rear end of the body member 5 in a downward direction until the vacuum cups 26 are forced into contact with the topmost sheet of the pile thereby forcing the air out from under the cups so that they firmly grip the sheet due to suction. This downward movement of the body member 5 continues until all the air is forced out from under the vacuum cups 26 at which time the continued movement of the crank wheels 9 moves the rear end of the body member 5 upwardly.

After the air has been forced out from under the vacuum cups 26, thereby creating an automatic vacuum, the top sheet only is picked up from the pile by means of the cups until the circuit for the motor 13 is interrupted preferably by a limit switch 40 arranged therewith and at which time the top sheet has been moved to position a slight distance above the pile. At this time the circuit is then automatically closed for setting the motor 23 in operation, thereby setting the conveyor chains 17, together with the bar-like members 24 and vacuum cups 26 carried thereby, in motion so that the conveyor chain will carry the sheet towards the table 31.

As the sheet approaches the table 31 the lever 29 of the relief valve 27 strikes the outward projecting portion 30 carried by the body member 5, thereby opening the valve and relieving the vacuum in under the vacuum cups 26, thus permitting the sheets to drop upon the table 31. After the lever 29 has moved along and is out of contact with the finger-like portion 30, the lever is moved to its closed position by means of a spring (not shown), thereby closing the valve, and the vacuum cups 26 are then in condition for picking up another sheet.

It is preferable that the circuit controlling the motor 23 be interrupted at the same time that the sheet drops on the table 31, preferably by means of a limit switch 41 arranged therewith, thereby arresting the travel of the conveyor chains 17, together with the vacuum cups 26 carried thereby. At this time the vacuum cups 26 arranged on the next carrier bar 24 are now in position over the pile of sheets 33, arranged on the table 32. At the same time that the motor 23 is stopped, the contacts of limit switch 43 controlling the motor 39 are closed and the table 32 is automatically raised a distance equal to the thickness of the topmost sheet which has been removed from the pile. After the table 32 together with the pile of sheets 33 carried thereby has been elevated the proper height, the circuit controlling motor 39 is opened by means of the limit switch 43 which also closes the circuit controlling motor 13, thereby setting the shaft 10 together with the crank wheels 9 in motion. The rear end of the body member 5 will then be set in vertical motion, due to the action of the crank arms 6 which moves the rear end of the body member 5 downwardly so that the vacuum cups 26 carried by the next succeeding bar-like member 24 will come in contact with the second or then topmost sheet, so that the same is picked up by the vacuum cups as before and the foregoing operation becomes continuous.

It will be understood that the elevating table 32 is raised as has been described either while the sheet is being carried from the table 32 to the table 31, or, if desired, after the sheet has been dropped upon the table 31 at which time the movement of the conveyor chains 17 is arrested. It will be understood that the motor 13 which actuates the rear end of the body member 5 through the crank arms 6 in either case cannot be put into operation until the pile of sheets 33 has been elevated a distance equal to the thickness of one sheet, which has been removed from the top of the pile, at which time the circuit controlling the motor 39 is opened by contacts arranged in the limit switch 43 and which also closes the circuit controlling the motor 13 simultaneously as has been described.

While I have shown and described one specific embodiment of my invention, it will be understood that this is merely for the purpose of illustration and description and that various other forms may be devised within the scope of my invention, as defined in the appended claims.

I claim:

1. Apparatus for transferring sheet material from one point to another including, in combination, an endless conveyor which is adapted to move at least between said points to transfer the sheets one at a time, means arranged below said conveyor for supporting said sheets and from which point the same are to be transferred, a plurality of vacuum cups carried by said conveyor which are adapted to hold the sheets while said

conveyor is transferring the same, means arranged below said conveyor for receiving said sheets and to which point the same are to be transferred, means for moving at least a portion of said conveyor in a plane substantially perpendicular to the surface of the sheet to be transferred so that the vacuum cups carried thereby are forced into contact with the sheet whereby the same is firmly gripped thereby due to suction, means for actuating said conveyor, and means for releasing the grip of said vacuum cups on said sheet when the same is positioned over said sheet receiving means.

2. Apparatus for transferring a pile of sheets from one point to another including, in combination, an endless conveyor which is adapted to move at least between said points to transfer the sheets successively one at a time from the top of said pile, means arranged below said conveyor for supporting said pile of sheets, a plurality of vacuum cups carried by said conveyor which are adapted to hold the sheets while said conveyor is transferring the same, means arranged below said conveyor for receiving said sheets and to which point the same are to be transferred, means for moving at least a portion of said conveyor in a plane substantially perpendicular to the surface of the sheet to be transferred so that the vacuum cups carried thereby are adapted to be forced into contact with the topmost sheet of said pile whereby the same is firmly gripped thereby due to suction, means for moving said pile upwardly at intermittent intervals, means for actuating said conveyor, and means for releasing the grip of said vacuum cups on said sheet when the same is positioned over said sheet receiving means.

3. Apparatus for transferring sheet material from one point to another, including, in combination, an endless conveyor unit, a plurality of vacuum cups carried by said conveyor unit which are adapted to hold the sheet material while said conveyor unit is transferring the same, means arranged below said conveyor unit for supporting the sheet material and from which point the same is to be transferred, means for moving said conveyor unit so that the vacuum cups carried thereby are forced into engagement with the sheet material at a point opposite said supporting means, means for receiving the sheet material and to which point the same is to be transferred, and means for relieving the vacuum within said vacuum cups as the conveyor passes along at a point opposite said sheet receiving means so as to permit the sheet material to drop thereon.

4. Apparatus for transferring sheet material from one point to another as defined in claim 3 wherein the means for relieving the vacuum within the vacuum cups comprises a valve arranged with the vacuum cups which is normally closed, with means for opening the valve as the vacuum cups pass along at a point opposite the sheet receiving means so as to relieve the vacuum within the cups whereby the sheet material is permitted to drop upon the sheet receiving means.

5. Apparatus for transferring sheet material from one point to another, including, in combination, an endless conveyor unit, a plurality of sets of vacuum cups carried by said conveyor unit at spaced apart intervals, with each set adapted to hold a sheet of material while said conveyor is transferring the same, means arranged below said conveyor unit for supporting the sheet material and from which point the same is to be transferred, means for moving said conveyor unit so that each set of vacuum cups carried thereby is

forced into engagement with the sheet it is adapted to carry at a point opposite said supporting means, means for receiving the sheet material and to which point the same is to be transferred, and means for relieving the vacuum within all of the vacuum cups of any one set simultaneously at a point opposite said sheet receiving means as the vacuum cups pass along so as to permit the sheet material to drop thereon.

6. Apparatus for transferring sheet material from one point to another as defined in claim 5 wherein the means for relieving the vacuum within all of the vacuum cups of any one set simultaneously comprises a valve arranged with each of said sets and connected to each of the vacuum cups thereof with means for actuating said valve as the conveyor together with the vacuum cups carried thereby pass therealong, so as to open the same to relieve the vacuum within the cups at a point opposite the sheet receiving means whereby the sheet material is permitted to drop upon the sheet receiving means.

7. Apparatus for transferring sheet material from one point to another, including, in combination, a body member, means for pivotally supporting one end of said body member, means for oscillating the opposite end of said body member about said pivotal supporting means in a plane substantially perpendicular to the surface of the sheet material to be transferred, means arranged below said body member for supporting the sheet material and from which point the same is to be transferred, means arranged below said body member and the pivotal supporting means thereof for receiving the sheet material and to which point the same is to be transferred, an endless conveyor chain carried by said body member, a plurality of vacuum cups carried by said conveyor chain which are adapted to hold the sheet material while said conveyor chain is transferring the same, said oscillating means adapted to move the

body member together with the conveyor chain carried thereby so that the vacuum cups are forced into engagement with the sheet material on said sheet supporting means whereby the same is firmly gripped thereby due to suction, and means for releasing the grip of said vacuum cups upon the sheet material when the same is carried by the conveyor to a point opposite said sheet receiving means.

8. Apparatus for transferring sheet material from one point to another, including, in combination, an endless conveyor unit, a plurality of sets of vacuum cups carried by said conveyor unit at spaced apart intervals with each set adapted to hold a sheet of material while said conveyor is transferring the same, means for pivotally supporting one end of said unit, means for oscillating the opposite end of said unit about said pivotal supporting means, means arranged below said unit for supporting the sheet material and from which point the same is to be transferred, means arranged below said unit for receiving the sheet material and to which point the same is to be transferred, said oscillating means adapted to move the conveyor unit so that the vacuum cups carried thereby are forced into engagement with the sheet material on said sheet supporting means whereby the same is firmly gripped thereby due to suction, a valve arranged with each of said sets of vacuum cups and connected to each of the cups thereof, with said valve being normally closed, and means for automatically actuating said valve as the conveyor together with the vacuum cups carried thereby moves therealong so as to open the valve to relieve the vacuum within the cups when the same are positioned at a point opposite the sheet receiving means whereby the sheet material is permitted to drop upon the sheet receiving means.

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