

May 2, 1933.

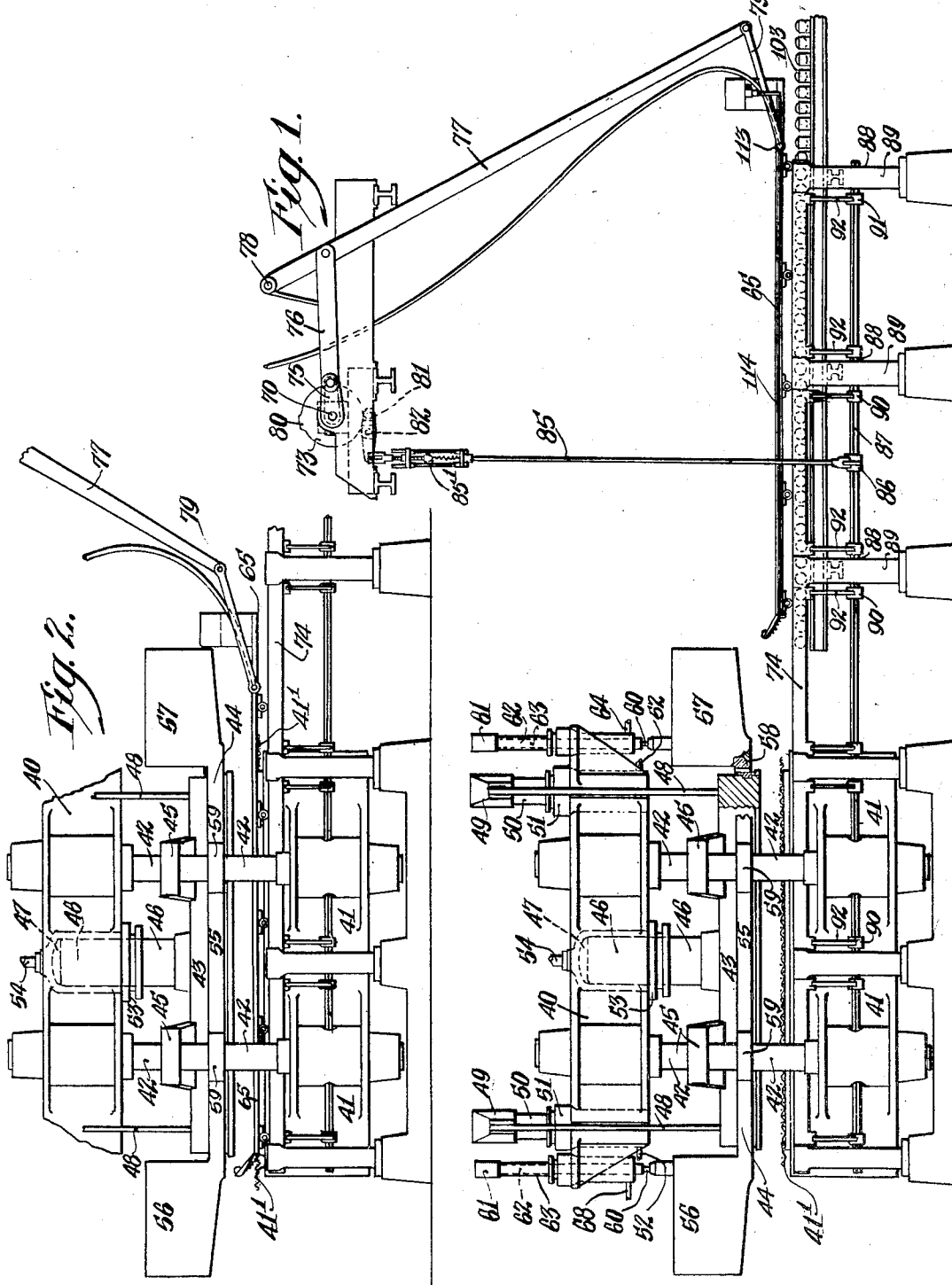
H. P. L. LAUSSUCQ

1,907,207

SHEET TRANSFER METHOD AND APPARATUS

Filed Aug. 15, 1931

12 Sheets-Sheet 1



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May 2, 1933.

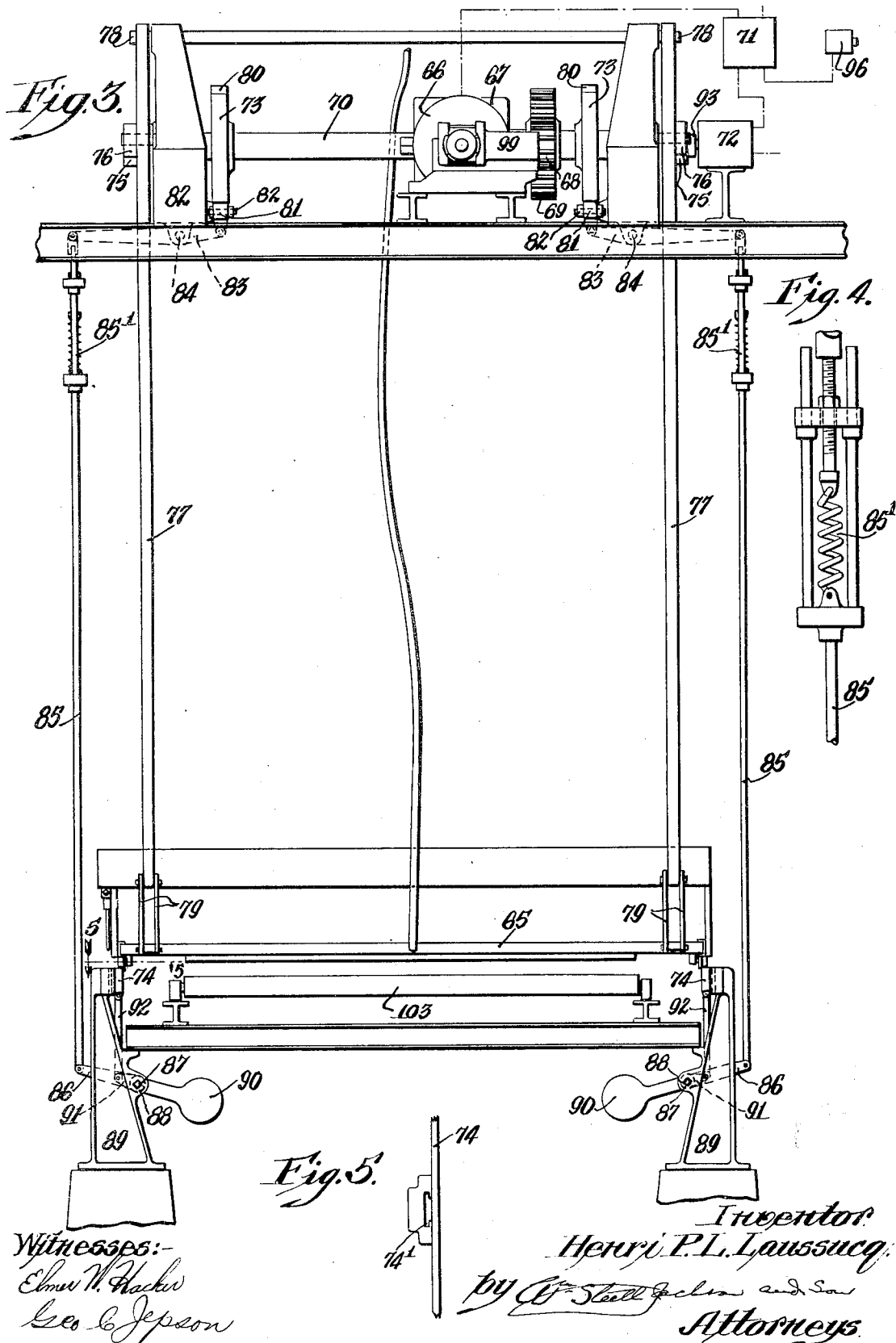
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SHEET TRANSFER METHOD AND APPARATUS

Filed Aug. 15, 1931

12 Sheets-Sheet 2



May 2, 1933.

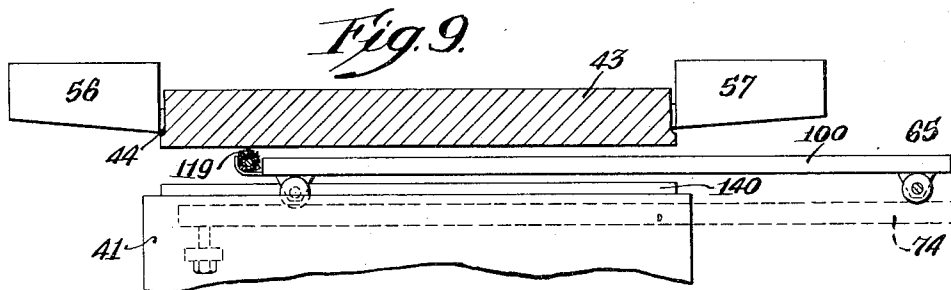
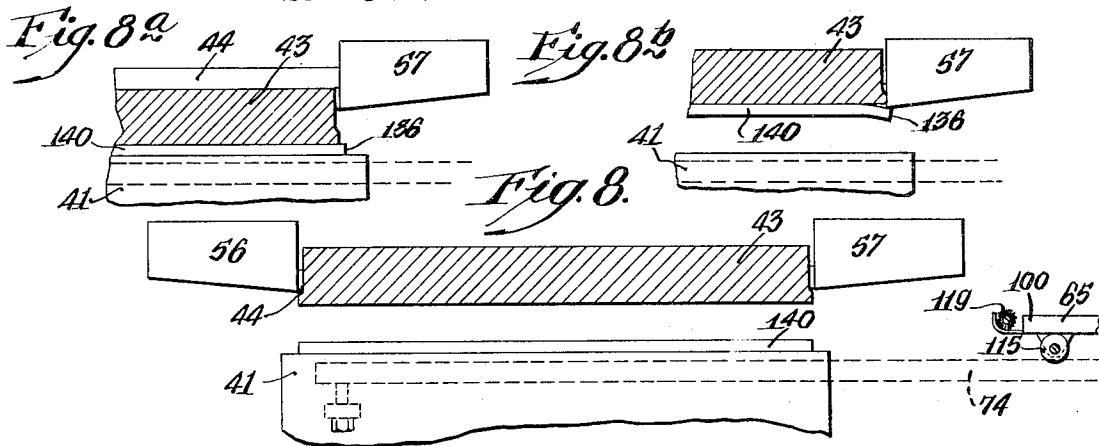
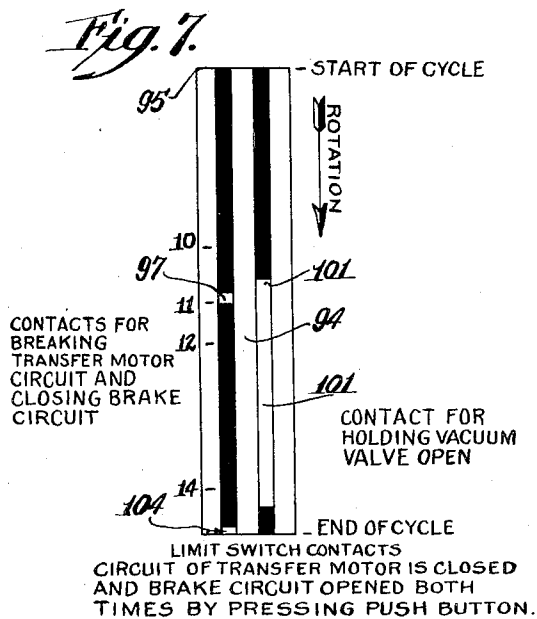
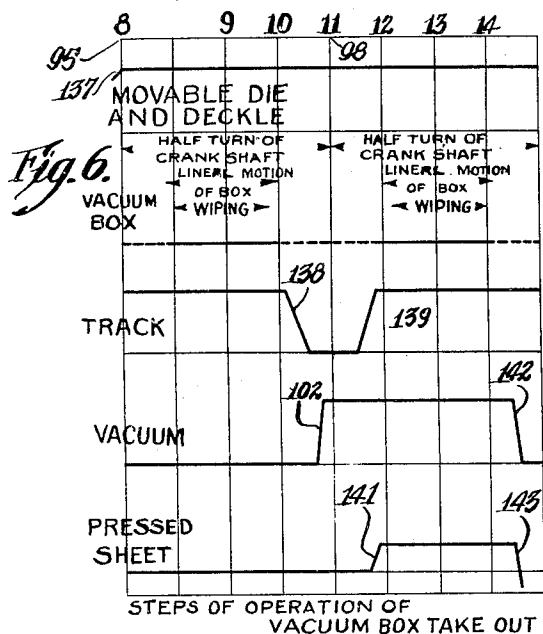
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SHEET TRANSFER METHOD AND APPARATUS

Filed Aug. 15, 1931

12 Sheets-Sheet 3



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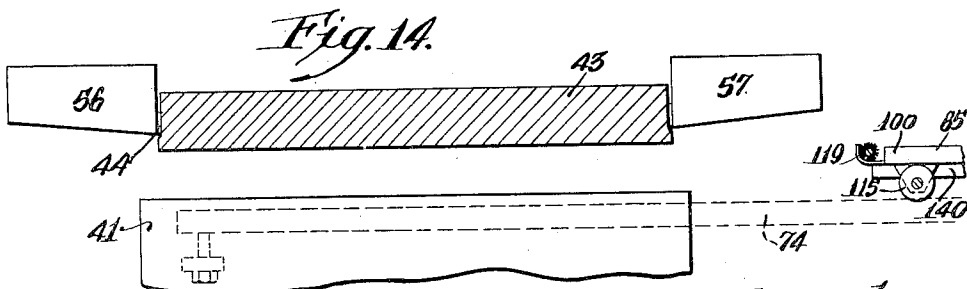
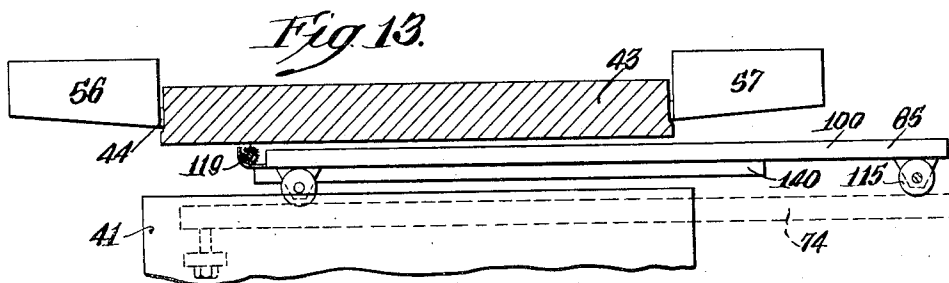
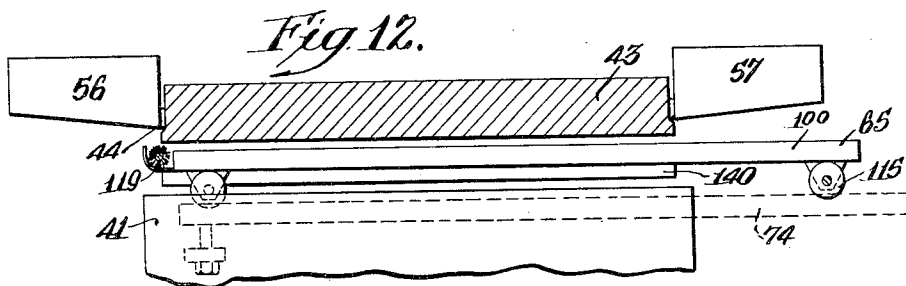
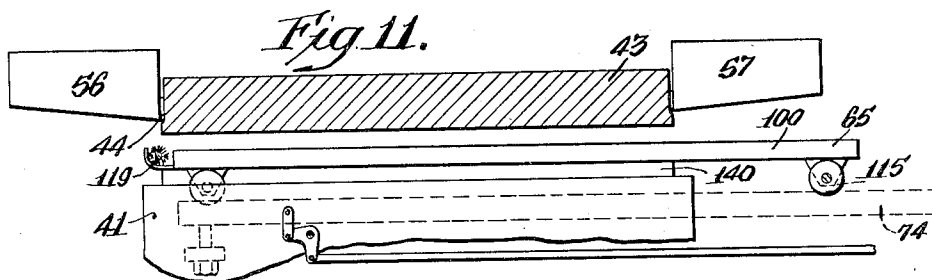
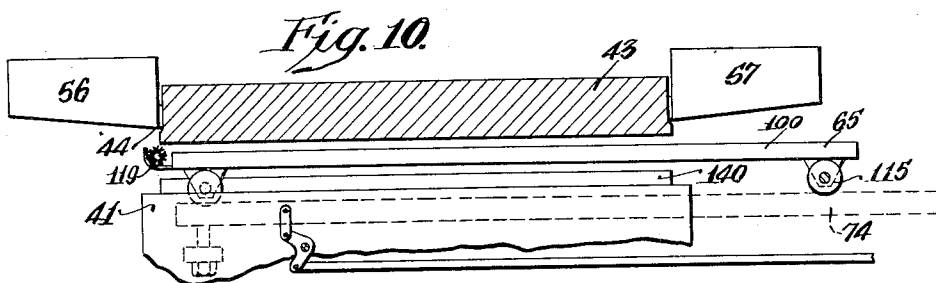
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1,907,207

SHEET TRANSFER METHOD AND APPARATUS

Filed Aug. 15, 1931

12 Sheets-Sheet 4



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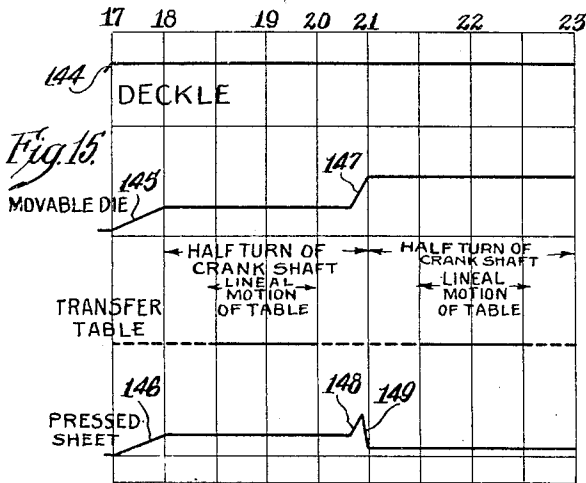
H. P. L. LAUSSUCQ

1,907,207

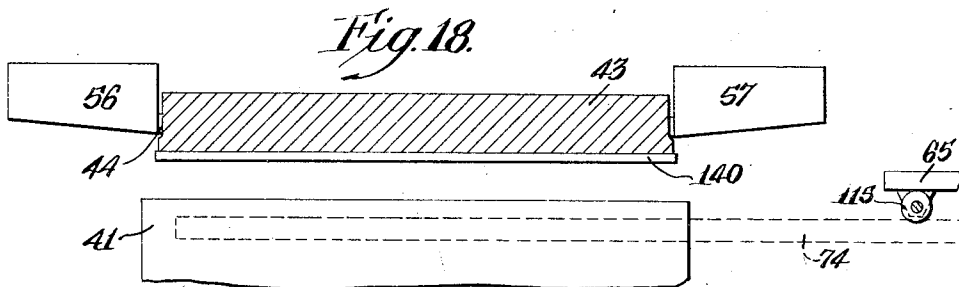
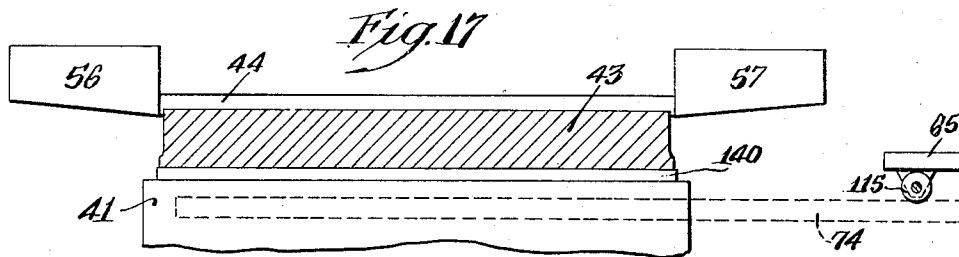
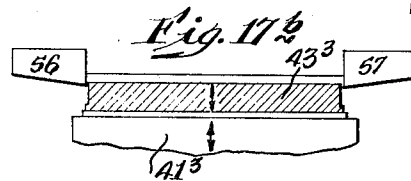
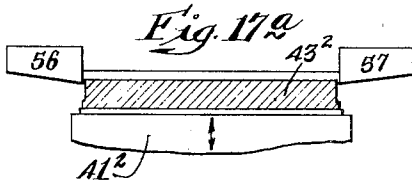
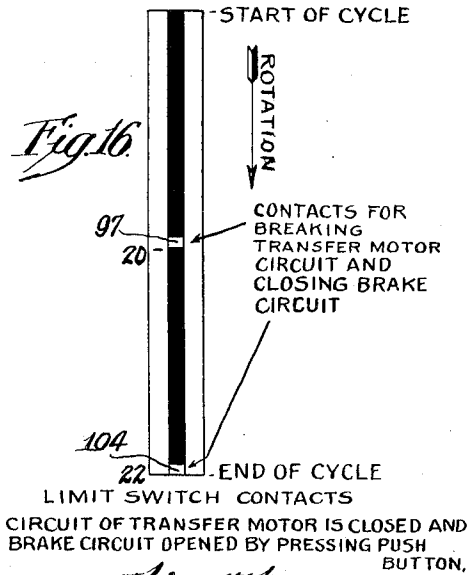
SHEET TRANSFER METHOD AND APPARATUS

Filed Aug. 15, 1931

12 Sheets-Sheet 5



STEPS OF OPERATION OF
TRANSFER TABLE TAKE-OUT



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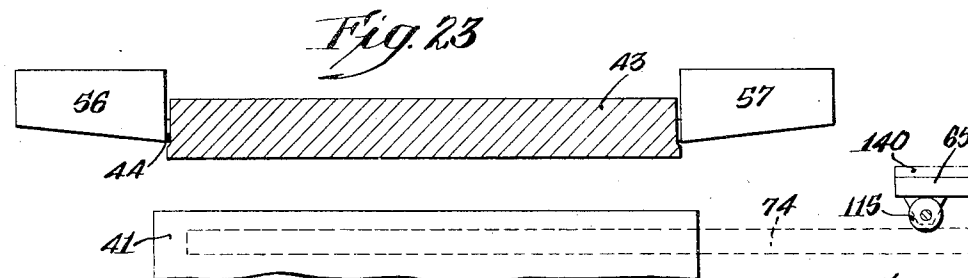
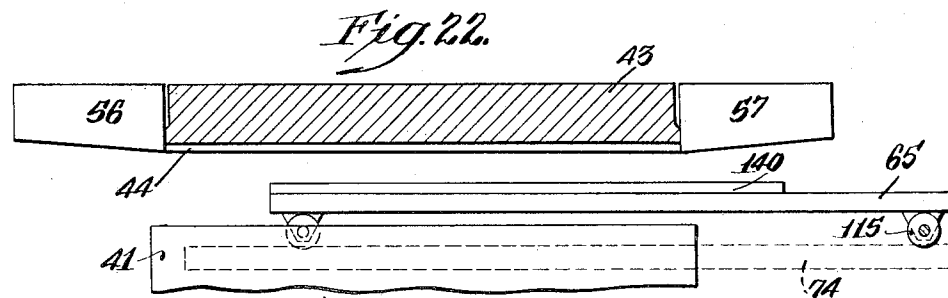
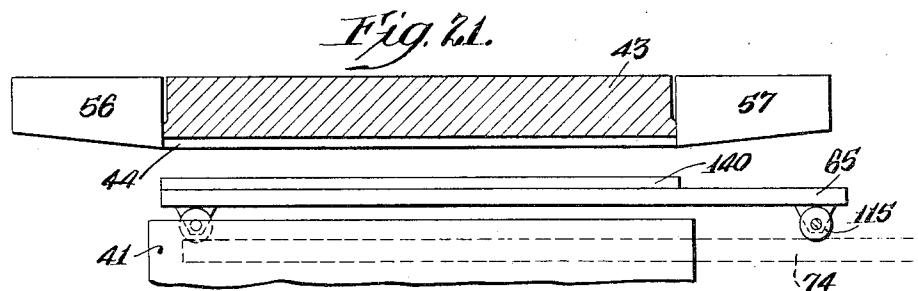
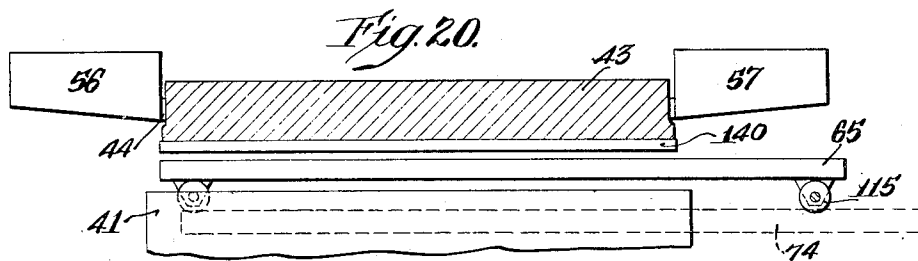
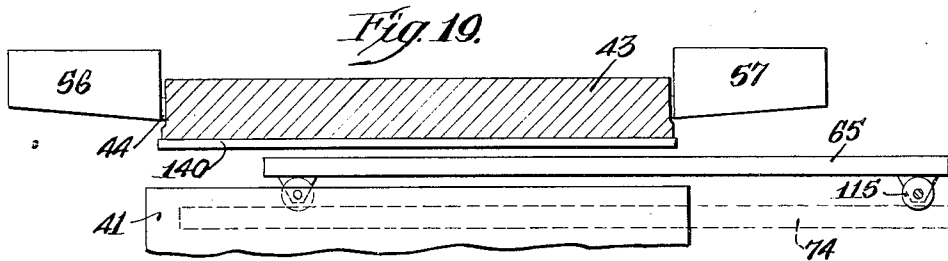
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1,907,207

SHEET TRANSFER METHOD AND APPARATUS

Filed Aug. 15, 1931

12 Sheets-Sheet 6



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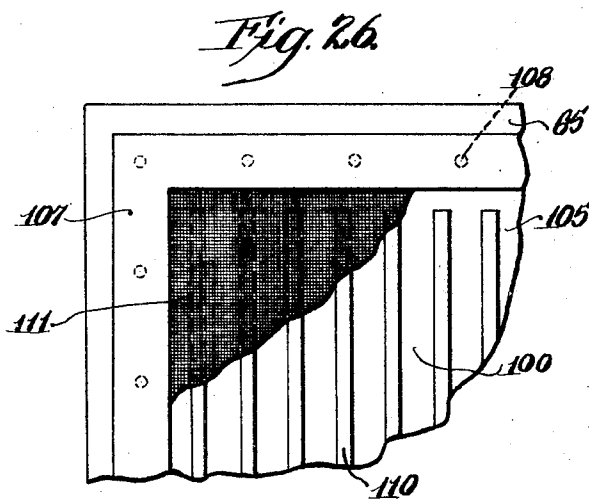
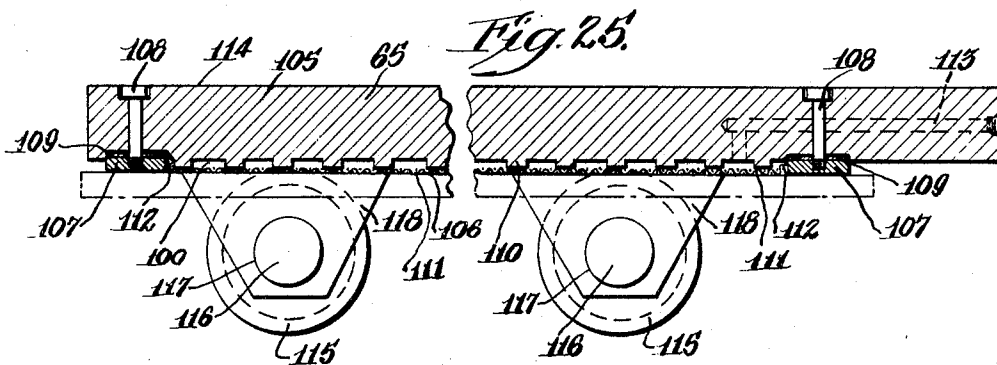
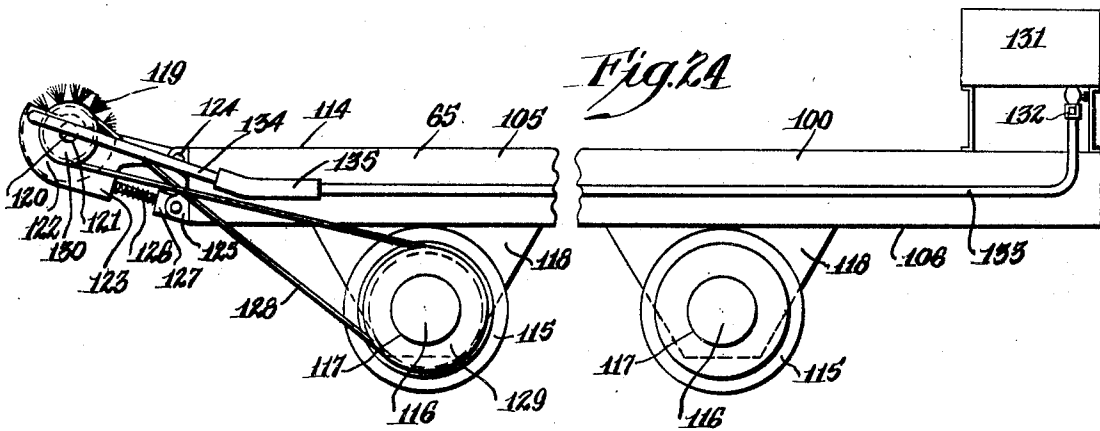
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SHEET TRANSFER METHOD AND APPARATUS

Filed Aug. 15, 1931

12 Sheets-Sheet 7



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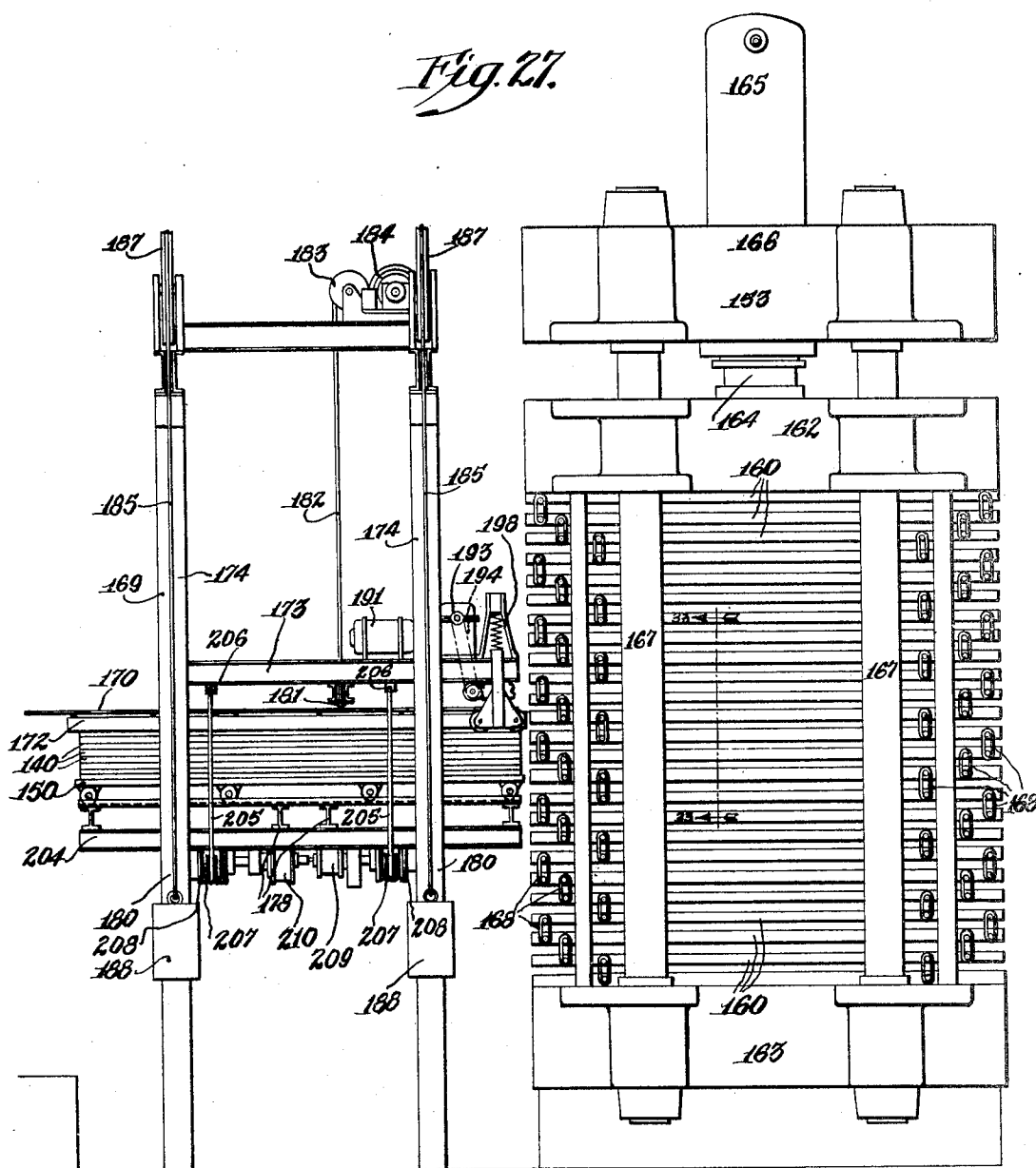
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1,907,207

SHEET TRANSFER METHOD AND APPARATUS

Filed Aug. 15, 1931

12 Sheets-Sheet 8



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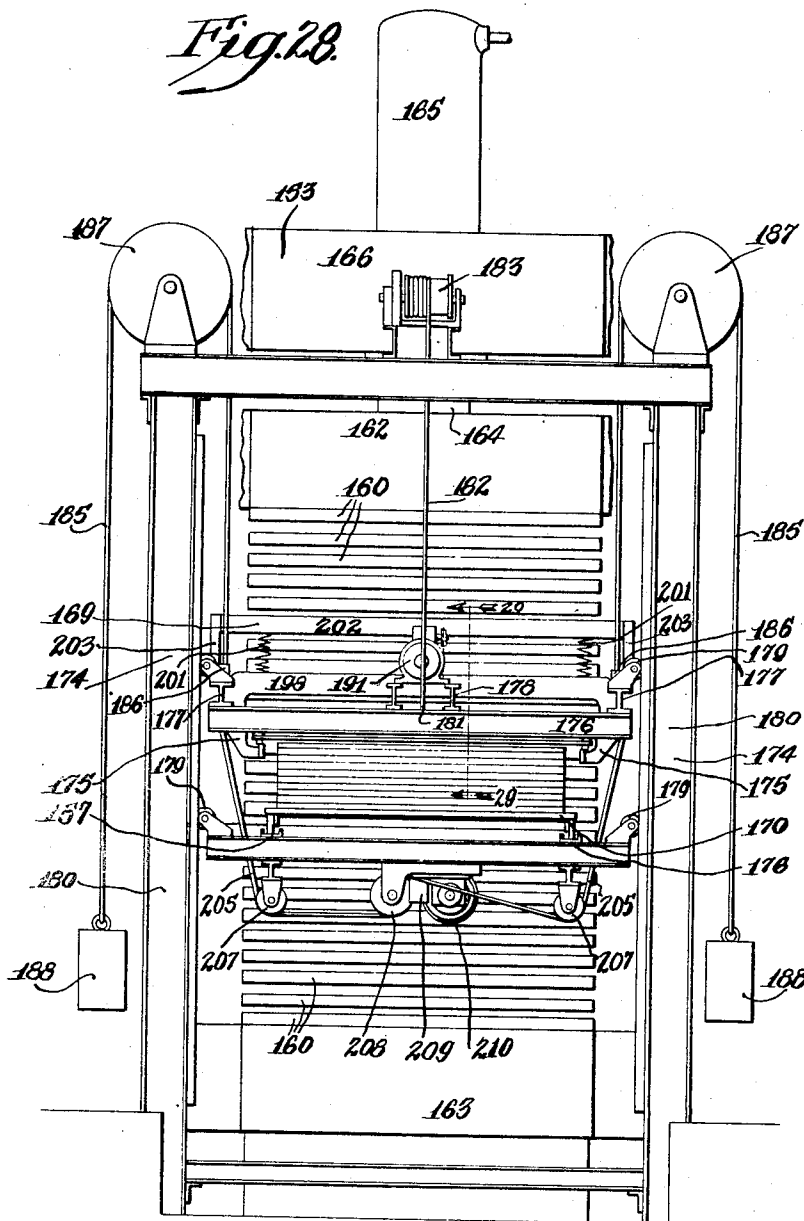
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1,907,207

SHEET TRANSFER METHOD AND APPARATUS

Filed Aug. 15, 1931

12 Sheets-Sheet 9



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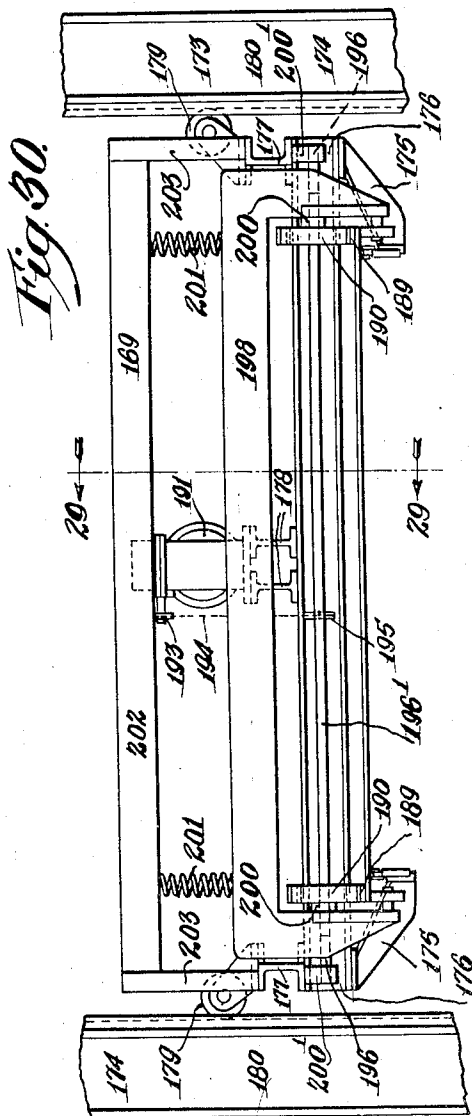
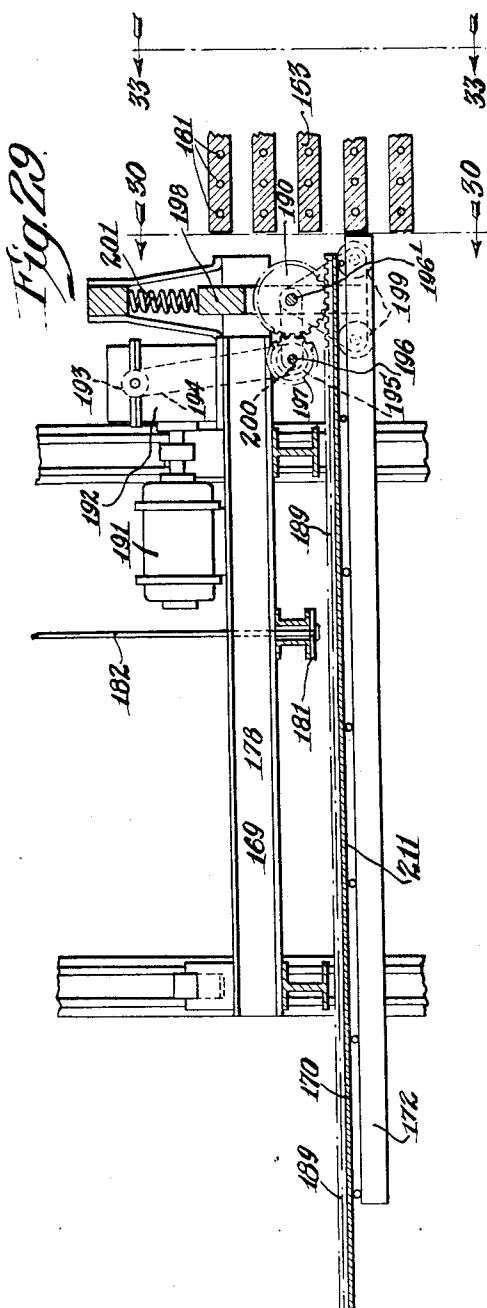
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SHEET TRANSFER METHOD AND APPARATUS

Filed Aug. 15, 1931

12 Sheets-Sheet 10



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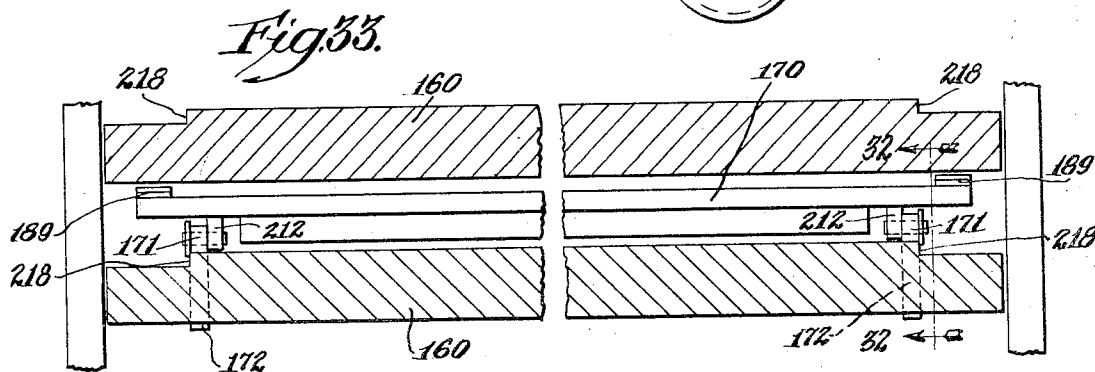
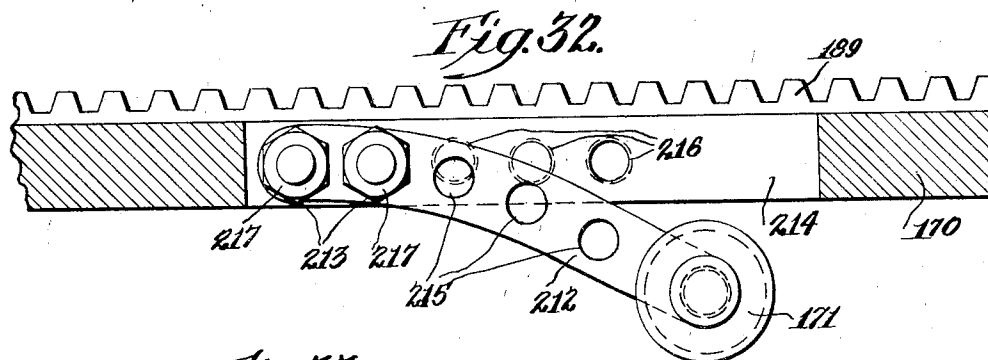
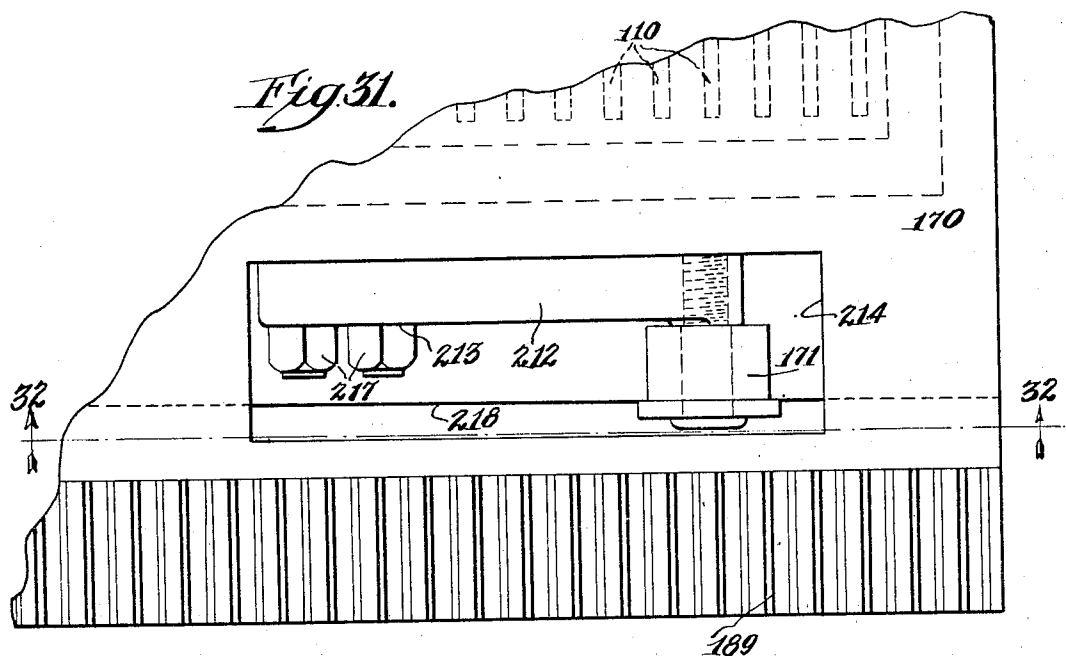
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1,907,207

SHEET TRANSFER METHOD AND APPARATUS

Filed Aug. 15, 1931

12 Sheets-Sheet 11



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1,907,207

SHEET TRANSFER METHOD AND APPARATUS

Filed Aug. 15, 1931

12 Sheets-Sheet 12

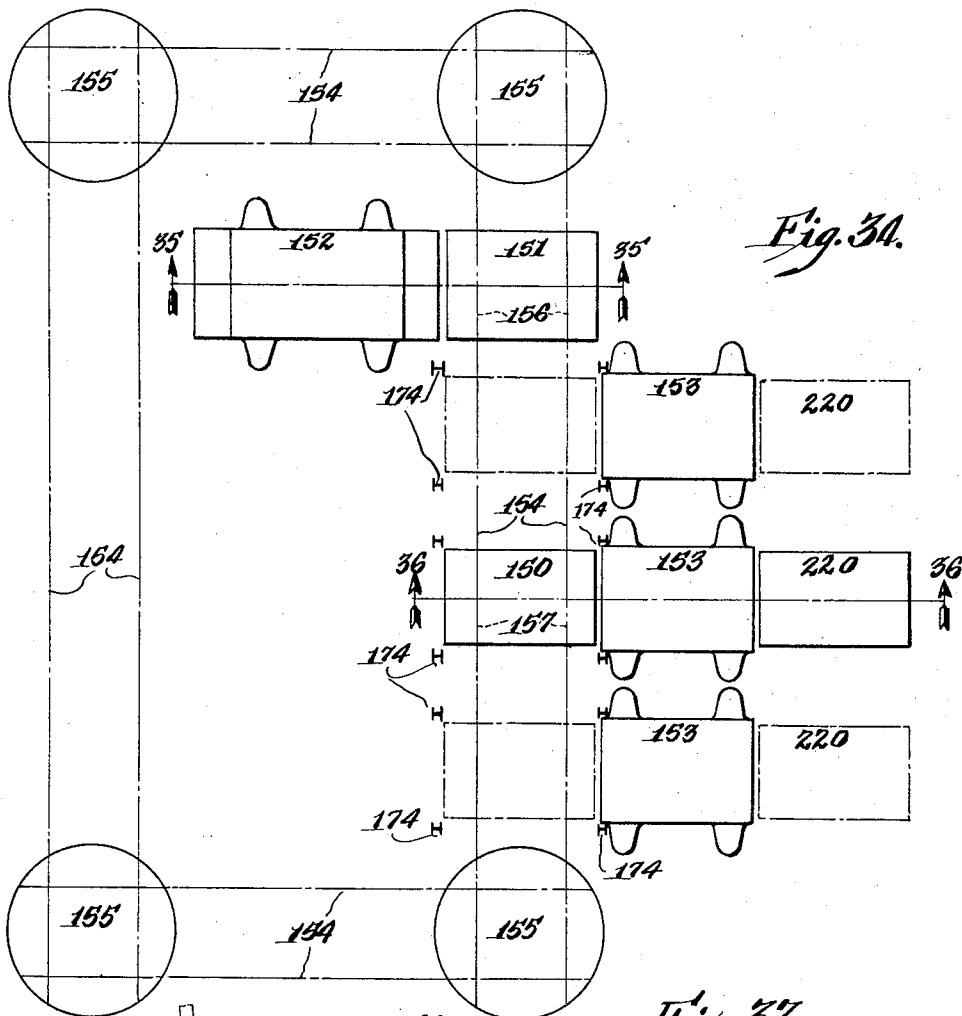


Fig. 34.

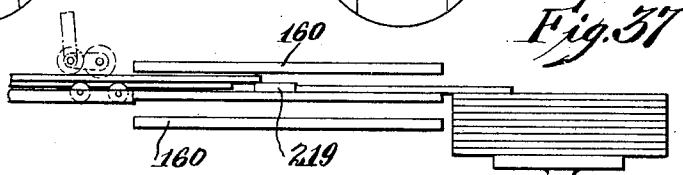


Fig. 37

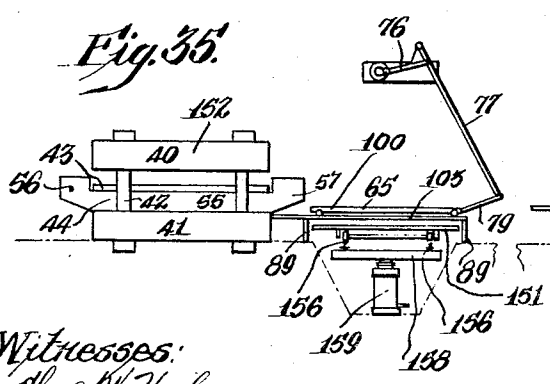


Fig. 35.

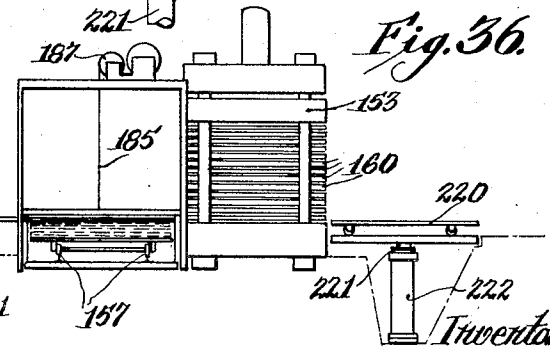


Fig. 36.

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UNITED STATES PATENT OFFICE

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SHEET TRANSFER METHOD AND APPARATUS

Application filed August 15, 1931. Serial No. 557,412.

My invention relates to the handling of pulp boards after they have been formed in a wet press.

5 A purpose of my invention is to provide novel and efficient mechanism for transferring pulp boards from a wet press to a drier.

A further purpose is selectively to charge one of a battery of driers from a single wet press.

10 A further purpose is to move vertically a delivery truck while piling wet sheets from a wet press thereon, deflecting the truck as the depth of the pile increases to register the momentarily top sheet at an elevation best
15 adapting it to receive the next sheet from the press.

A further purpose is to progressively lessen the elevation of a delivery truck while it is being piled with sheets from a wet press
20 to continuously register the receiving surface of the pile with the discharge position of mechanism transferring successive sheets from the press to the pile, and, when the truck has been loaded, to vertically move the
25 truck into registry with a suitable track running to drier delivery mechanism.

A further purpose is to pile wet sheets from a wet press upon a truck and, after the truck has received sufficient sheets for the
30 charging of a drier, to transfer the truck bodily to a position adjacent to the drier and there to vary its vertical position during unloading to best accommodate easy unloading
35 from the top of the pile into vertically different portions of the drier.

A further purpose is to suspend a delivery truck at a multiple plate horizontal drier upon mechanism for delivering the sheets
40 from the truck one at a time on to successive vertically spaced horizontal plates of the drier, varying the vertical position of the mechanism to register the unloading portion thereof at successive positions for easy delivery
45 to the successive plates and varying the height of the truck with respect to the mechanism in order to maintain a uniformly easy pick-up between the delivery mechanism and the top of the diminishing pile of wet sheets
50 on the truck.

A further purpose is to use mechanism for

inserting a fresh wet sheet on to a plate of a multiple plate horizontal drier to remove a finished dried sheet from the plate during the insertion of the new sheet, pushing out a finished sheet during the insertion of a
55 fresh sheet.

A further purpose is to horizontally reciprocate a horizontal suction plate between the vertically spaced plates of a drier and preferably upon the successive plates thereof.
60

A further purpose is to pick up a wet sheet upon the bottom of a suction plate and, while the suction plate is supporting the wet sheet, to move the suction plate horizontally into a drier between vertically spaced plates thereof, and then after releasing the wet sheet
65 within the drier to retract the suction plate horizontally outwardly to a pick-up position outside of the drier.

A further purpose is to vertically adjustably suspend a track section from a drier charging mechanism, mounting the mechanism on an elevator adjacent a multi-horizontal plate drier, and to transfer a truck piled with wet sheets to the track section and then
70 to vary the vertical position of the elevator to register the charging mechanism at its delivery positions and to vary the vertical position of the track section with respect to the charging mechanism to bring the top of
75 the pile in position for easy pick-up by the charger.

A further purpose is to provide drier loading mechanism mounted upon an elevator adjacent the drier and preferably including a suction box adapted to horizontally and suitably rollingly reciprocate into and out of the drier at successive plates thereof, with rack and pinion mechanism for reciprocating the box and desirably including upwardly directed racks along the box near opposite sides thereof and a driving pinion for each rack on a supporting arm carrying rollers beneath the box forwardly and rearwardly of the pinion for holding the pinion to its duty
85 with respect to the rack and desirably having a resilient support from the elevator permitting resilient vertical accommodation of the box with respect to the elevator.
90
95

A further purpose is to use the edges of the
100

deckle to strip the compressed sheet from the die.

A further purpose is to lift the deckles while the die is still under pressure, using a resultant lateral expansion of the sheet beyond the inside line of the deckle to adapt the deckle to strip the sheet from the die when the die carrying the sheet is passed upwardly through the deckle.

A further purpose is to provide desirable means for removing a finished board from a wet press.

A further purpose is to mount lubricating and wiping mechanism on transfer mechanism used to carry a formed sheet from the space between the dies of a wet press.

A further purpose is to remove a finished sheet from the lower platen of a wet press by a vacuum box carried upon a carriage, depressing the carriage track to bring the box into a pick-up contact with the finished sheet and then lifting the track and retracting the carriage along the track.

A further purpose is to alternatively receive a sheet from the bottom of a raised die of a wet press upon either the top or bottom of a transfer tray, desirably using the movement of mechanism carrying the loaded tray to pass a wiper and/or a lubricator across the bottom of the raised die.

Further purposes will appear in the specification and in the claims.

I have elected to illustrate one only of the main forms of my invention, illustrating however, one or more of the details in modified forms and selecting a main form and details thereof that are practical and efficient in operation and which will illustrate the principles involved.

Figure 1 is a side elevation of mechanism embodying one form of a portion of my invention showing a forming press and one of two illustrated forms of mechanism for removing wet sheets from the press for subsequent delivery to a suitable drying press, not shown in Figure 1, the transfer mechanism at the forming press being intended to deliver to any drier delivery mechanism, shown as delivery rollers, but intended for a conventional illustration of any suitable delivery mechanism.

Figure 2 is a portion of Figure 1 showing the parts in different position from that of Figure 1, the transfer mechanism being retracted in Figure 1 and in pick-up position in Figure 2.

Figure 3 is a right hand end view of the transfer mechanism of Figure 1 to enlarged scale.

Figure 4 is an enlarged fragment of Figure 1 showing a detail.

Figure 5 is an enlarged fragmentary section taken upon the line 5—5 of Figure 3.

Figure 6 is a diagram indicating a desirable cycle of operations, using the transfer mechanism of Figures 1 to 3.

Figure 7 is a diagrammatic view illustrating a developed commutator controlling the operation cycle of Figure 6, showing contacts for opening the control circuit of the transfer motor, contacts for closing and opening a circuit of an electric brake of the transfer motor and contacts controlling the vacuum in the vacuum gripping mechanism.

Figures 8 to 14 inclusive are enlarged fragmentary longitudinal sections at the wet machine illustrating, to some extent diagrammatically, different parts in successive positions for the cycle of Figure 6.

Figure 15 is a diagram similar to Figure 6 but showing a somewhat different and alternative cycle, the wet sheets being handled by the bottom of a vacuum box in the cycle of Figure 6 and by the top of a tray in Figure 15.

Figure 16 is a diagrammatic view showing a developed commutator for the switch contacts controlling the operation of the transfer tray when using the cycle of Figure 15.

Figures 17 to 23 inclusive are fragmentary longitudinal sections at the wet machine illustrating, to some extent diagrammatically, different parts in successive positions for the cycle of Figure 15.

Figure 24 is a broken side elevation illustrating a portion of the transfer mechanism of Figures 10 to 14, and of Figures 17 to 23.

Figure 25 is a vertical section in the plane of the paper of structure shown in Figure 24, omitting wiping and oil feed mechanism shown in the latter figure.

Figure 26 is a fragmentary bottom plan view of the suction box shown in Figures 24 and 25.

Figure 27 is a side elevation of mechanism at a plate drier, including a pile of sheets upon a truck and mechanism for transferring the sheets of the pile to the successive drier plates.

Figure 28 is a broken left end elevation of Figure 27 omitting some parts shown in the latter figure.

Figure 29 is an enlarged fragmentary section taken upon the line 29—29 of Figure 28 or a section upon the line 29—29 of Figure 30.

Figure 30 is a right end elevation of structure shown in Figure 29 and corresponds to a section upon the line 30—30 of the latter figure.

Figure 31 is an enlarged fragmentary top plan of loader mechanism of Figures 27 to 30 and for transferring the sheets from a pile into the drier.

Figure 32 is a section of Figure 31 upon the line 32—32 thereof or an enlarged fragmentary section of Figure 33 on the line 32—32 thereof.

Figure 33 is an enlarged broken section upon the line 33—33 of Figure 29.

Figure 34 is a diagrammatic plan assembly of structure embodying the more broad features of my invention and as illustrated comprises a wet machine, a bank of driers and auxiliary sheet handling mechanism.

Figure 35 is a sectional elevation upon the line 35—35 of Figure 34.

Figure 36 is a sectional elevation upon the line 36—36 of Figure 34.

Figure 37 is an enlarged fragmentary section illustrating mechanism pushing out a finished sheet from a drier by the insertion of a wet sheet.

Describing in illustration and not in limitation and referring to the drawings:

Wet machines for forming boards and sheets from paper pulp, leather fiber and other commercial fiber suspensions are well known, and therefore much of the illustration, although showing structure, is to be regarded as conventional. The primary purpose of all such machines is to press liquid, usually water, from the raw material suspension to form the raw material into a sheet.

For convenience in designation, I refer to the raw material suspension whatever its exact nature as fiber suspension or "mush", and to the pressed product, whatever its dimensions, as a "sheet."

A difficulty frequently encountered in wet machines is the withdrawal of the sheet from the mold. In the ordinary wet machine the upper die is smooth and the lower die is perforated for removal of water. This perforation gives air access so that the pressed sheet does not stick to the lower die but sticks to the upper die where vacuum conditions are created.

The upper surface of the lower die is ordinarily covered by a travelling wire which is often used as a conveyor. When the wire is used as a conveyor the life of the wire itself is shortened; and this wire life is unfortunately short anyhow because the forming of each sheet usually occurs on the same part of the wire. Furthermore, some sheets are still so soft at the end of the pressing operation that they have little lateral cohesion so that they can with difficulty be transferred from the wire after the wire has been withdrawn from the wet machine. As a consequence there is danger of breaking the sheets or of tearing their under surfaces.

While it is customary to construct wet machines with upper movable and lower stationary dies, and this form has therefore been illustrated in most of the figures, lower movable dies are sometimes used. It will be evident, of course, that my invention is equally applicable, whether the upper die alone, or the lower die alone, or both dies are movable.

While the upper and lower dies are of course press platens, the term platen is also applied to parts of the press located above or

below the movable die, which are used to support the rams.

The principal parts of the illustrated wet board press or wet machine (especially Figures 1 and 2; also Figures 8 to 14 and 17 to 23) include top and bottom fixed platens 40 and 41 respectively, tension columns 42, an intermediate platen 43 and a surrounding deckle 44. The intermediate platen 43 is or carries the upper die and the bottom platen 41 is or carries the lower die.

The upper die 43 is guided at 45 by the columns 42. Its upper surface receives the lower ends of one or more downwardly directed main rams 46, each operating in a cylinder 47, and is connected near each corner with upwardly extending links 48 that are supported at their upper ends in cross heads 49 from the upper ends of retracting rams 50 operating in suitable cylinders 51 provided with hydraulic connections 52.

Each main cylinder 47 is fastened at 53 to the under side of the top platen, hydraulic connections into the cylinder being indicated at 54 above the top platen.

The deckle 44 includes sides 55 rigidly connected at opposite ends of the mould by flow boxes 56 and 57 which have gates 58 between the flow boxes and mold that are in effect deckle ends vertically movable with respect to the deckle sides in suitable vertical guideways, not shown.

I use the word deckle in its broad sense to mean the lateral wall of the mold, including all inlet gates, vent gates, liners and confining walls whatsoever. I do not regard the distinction between the singular and the plural of the word deckle, nor between the side deckle and the end deckle, as critical.

The deckle sides are guided at 59 by the tension columns and are supported and positioned by vertical hangers 60.

The hangers 60 are connected at their lower ends to the deckle and at their upper ends to cross heads 61 of the deckle rams 62 operating in cylinders 63 having hydraulic connections 64.

The gates are preferably hydraulically opened when the deckle is down and the upper die raised to charge fluid mush from the flow boxes 56 and 57 into the mold and are lowered preparatory to the pressing of the mush into a wet sheet.

The mold includes the vertically variant space between the upper and lower dies outwardly bounded by the side and end deckles, that is by the interior of the deckle which includes the side and end deckles and carries the flow boxes, whose gates are also suitably the end deckles of the mold.

Although not illustrated, it will of course be evident that my mold will be provided with any suitable air vent and water lock, as well known in the art.

During each cycle of the press a definite

charge of the fluid mush enters the mold from the flow boxes and, after the temporarily raised gates have been closed, is pressed between the upper and lower dies, water escaping downwardly through foraminations of the lower die until the compressed residue is a wet sheet comprising the finished product of the press.

Thus far described, the illustrated mechanism is intended to comprise a conventional showing of any wet machine adapted to form the pressed sheet.

An important feature of the present invention however, includes the combination between the mechanism for transferring the wet sheet from between the dies and that for removing the sheet from the bottom of the lower die.

In the ordinary wet machine the upper die is smooth and the lower die foraminated for expression of water. This foramination permits air access between the sheet and lower die, so that when the dies separate, as by raising the upper die, the sheet has little tendency to stick to the lower die, but sticks strongly to the upper die where vacuum conditions hold the wet sheet firmly against the upper die, and as a result the sheet lifts when the upper die is lifted, strongly adhering to the bottom of the upper die until the vacuum between the die and sheet fails.

In the past this has resulted in a lack of definiteness as to the time of the release of the sheet from the lower surface of the upper die after the die moves upwardly, with a resultant inability to synchronize transfer mechanism for carrying the sheet away from the space between the dies with the movements of the press. One feature of the present invention includes the provision of means for exactly timing the removal of the sheet from the under surface of the upper die with the upward movement of the die which permits exact synchronism between the movements of the sheet transfer mechanism and the press.

In accord with this feature I raise the deckle somewhat before releasing the pressure between the upper and lower dies and thereby secure a small lateral expansion of the sheet which is still under compression, and has unconfined edges.

When the hydraulic pressure upon the upper die is finally released and the upper die raised, the sheet will have grown slightly at the unconfined edges of the mold, being now too large to reenter the deckle.

The sheet moves upward with the die, adhering to the bottom surface thereof as before and I deliver it from the bottom of the upper die by causing the die to slowly reenter the deckle, the lower edges of the deckle engaging the expanded edges of the sheet, deflecting these edges away from the surface of the die, thereby instantly releasing the

vacuum condition between the sheet and die and letting the sheet drop either to the lower die or to a transfer tray, at a time definitely synchronized with respect to the operation of the press.

The pressure against the grown edges of the sheet may occur because the upper die is moved upward into the deckle, or because the deckle is moved downward around the upper die. In fact, if desired, the pressure against the grown edge may be from any other means.

I alternatively catch the sheet upon my carrier, which I move in between the dies as the upper die moves upwardly with the adhering sheet out of the way or drop the sheet to the lower die and then pick it up from above by means of the carrier for transfer from the mold.

In either of these operations, I synchronize the press and transfer operations, being enabled to accomplish this synchronization by reason of my synchronized delivery of the wet sheet from the raised upper die.

The downward separation of the sheet from the bottom of the upper die by the engagement of the deckle upon its grown edges serves as a positive controllable release for the sheet whereby I can reliably determine the release at a definite phase of the press cycle and I catch the sheet on or above the lower die for transfer from the mold in any suitable manner.

Coordinated mechanism for removing the finished sheets from beneath the dies and for oiling or wiping the bottom of the upper die is best seen in Figures 1, 2, 3, 24, 25 and 26.

I effect transfer of the formed sheet from the mold in a novel manner by means of a carriage 65 which moves into the mold when the deckle and upper die are raised, and travels from the mold with the sheet.

It will be evident that the supporting, moving and control means for the carriage 65 are subject to wide variation. I have selected means from among the many types of apparatus which could be used, such as hydraulic, pneumatic, mechanical, electrical and various combinations of these, because I consider the form shown to be the most simple and satisfactory in operation, and not because the other forms available would not be suited to perform this function.

A motor 66, Figure 3 connects through a suitable speed reducer 67 and gears 68 and 69 with a control shaft 70. The electrical controller of the motor at 71 in cooperation with a limit switch at 72, automatically stops the motor at the end of each one-half rotation of the control shaft 70, as later explained.

The control shaft 70 carries cams 73 for shifting the vertical height of a track 74 that supports the carriage 65 used in removing the finished sheets and preferably also in wiping or oiling the bottom of the upper die.

The control shaft 70 is also provided with

crank 75 which connect by links 76 to long-stroke rockers 77 that pivot at 78 and make link connections 79 at their lower ends to the carriage 65.

5 When the deckle 44 is raised, rotation of the control shaft 70 counterclockwise 180° from the position shown in Figure 1 moves the carriage 65 into the mold beneath the upper die and above or below the finished sheet, depending upon whether the sheet still adheres to the upper die 43, or has dropped to the lower die 41.

15 One form of transfer mechanism involves the use of a vacuum box to lift the sheet from the lower die. For this to be most effective the vacuum box must be brought into close contact with the surface of the sheet and then the sheet must be relatively moved away from the bottom die. I preferably accomplish this by vertically shifting the track 74 and carriage 65 by the track cams 73.

25 The track cams 73 are of variant form, depending upon how the sheet is to be removed from between the dies and how it is to be delivered from the transfer mechanism.

30 As illustrated, cam lugs 80 (Figure 1) depress the track by depressing the ends of rockers 81 which are pivoted at 82 and connect through short horizontal rockers 83, (Figure 3), pivoted at 84, to the upper ends of long links 85.

35 The lower ends of the long links 85 are connected to rocker arms 86 upon shafts 87 journaled at 88 in the track support 89. On the shafts 87 rocker arms counterweighted at 90 (Figure 3) support the track 74 through crank arms 91 and links 92, serving to vertically position the track in guides 74'.

40 The motor 66 is switched out of the circuit after each counterclockwise 180° rotation of the shaft by a suitable limit switch 72 operatively connected at 93 to one end of the control shaft 70.

45 While the switch 72 may be a commercial unit, and therefore not in itself part of the invention, the angular positions of the contacts of the switch are illustrated in the developed commutator 94 of Figure 7.

50 As indicated, beginning the sheet transfer cycle at the line 95, Figures 6 and 7, the control shaft 70 starts to rotate counterclockwise when a suitable starting button 96, Figure 3, in the circuit of the motor 66 has been pushed by an operator or by mechanism synchronized with the operation of the press.

55 The motor rotates the cranks 75 to a position 180° removed from that of Figure 1, bringing the carriage to its extreme inward position within the mold, a suitable contact 97, (Figure 7) of the switch mechanism 72 stopping the motor 66 at the line 98, (Figure 6) when this position is reached, as by opening the motor circuit and applying a suitable brake 99 (Figure 3) to bring the motor promptly to rest.

Just before the cranks 75 come to the end of their 180° travel, the cam lugs 80 may depress the track through the long links 85 and other connections bringing a vacuum box 100 carried by or forming a portion of the carriage 65 to position upon the top of the finished sheet. As a precaution against injury to the carriage 65 in case the upper die 43 is lowered while the carriage is in the mold, I provide a resilient connection 85' (Figure 4) in the link 85, allowing the carriage to move downwardly under pressure until it gains the support of the lower die.

70 The vacuum will preferably be applied to the box 100 at or a little before the coming to rest of the control shaft 70, at which time the box 100 has come into contact with the sheet, the application of the vacuum being suitably effected by a contact 101 on the switch commutator 94, (Figure 7) at the line 102 of Figure 6.

80 The motor 66 is then again started, as from the starting button 96 either by an operator or by suitable mechanism synchronized with the press and the further rotation of the control shaft 70 first lifts the track 74 and therefore the carriage 65, the vacuum box 100 and the finished sheet when the cam lugs 80 pass out of contact with the ends of the rockers 81, and then retracts the carriage.

95 The carriage 65 is retracted from the mold maintaining vacuum connection with the vacuum box 100 to support the sheet as shown by the extent of the contact 101 (Figure 7). The sheet may be handled, after removal from the box 100 by any suitable mechanism adapted to best cooperate in the ultimate delivery of the wet sheets to a drier, such mechanism being illustrated in Figure 1 conventionally by a roller transfer 103.

100 The switch 72 stops the motor 66 by a suitable contact 104 (Figure 7), operating upon the controller 71 to simultaneously open the circuit of the motor and to close the circuit of a suitable electrically operated brake 99, when the carriage 65 reaches its initial position, first cutting off the vacuum when the switch commutator passes the end of the vacuum contact 101.

115 The carriage 65 may, if desired, be again depressed as it reaches its retracted position to deposit the sheet upon the transfer mechanism 103, the vacuum being broken in any suitable way to drop the sheet upon the transfer mechanism by means of the switch 72 or optionally by using the depression of the carriage to close the suction valve and open to atmosphere, actuated at or a little before the picking up of the sheet.

120 The movable screen or wire 41' (Figures 1 and 2) forms the effective upper surface of the lower die, and should be washed after each forming operation.

125 A desirable feature of the invention is the form of vacuum box 100, illustrated in Fig- 130

ures 1, 2, and 24 to 26, and optionally used in picking up the sheet after the sheet has been delivered from the bottom of the upper die.

5 As illustrated, the main body of the box 100 comprises a heavy metal plate 105, desirably steel or an aluminum alloy.

The downwardly directed lifting surface 106 of this plate is externally bounded by a sealing strip 107 fastened to the bottom 10 of the plate by screws 108, preferably upon rubber or fiber gasket strips 109.

Spacers 110 are welded at intervals to the lifting surface of the plate 105 and a suitably 15 perforated sheet metal or woven wire cover 111 lies below the spacers and is secured at the edges by the metal strip 107 as at 112. I may dispense with the gasket strips 109 by closing the perforations at the edge of 20 the cover 111.

The sealing strip 107 preferably extends downwardly slightly further than the lowest portion of the lifting surface, and particularly lower than the bottom of the perforated 25 cover 111. Vacuum connection is illustrated at 113 to the space between the plate surface 106 and the perforated cover 111.

Vacuum may desirably be applied directly or indirectly by cam mechanism on the 30 control shaft 70 or by other suitable means, automatically or by hand, timed to apply vacuum when the box is ready to pick up a sheet from beneath the die and to release the vacuum when the carriage is supporting 35 the sheet in proper position to deposit the sheet upon suitable transfer mechanism 103.

The upper surface 114 of the vacuum box 100 is made flat so that, alternatively, it may catch a sheet adhering to the upper die and 40 transfer it from the mold.

The carriage 65 is desirably provided with wheels 115 mounted on outboard stub axles 116, fastened at 117 in brackets 118 extending from the carriage. The wheels 115 move 45 on the track 74, which shifts vertically as previously explained.

Another desirable feature of the invention includes provision for wiping and for lubricating the bottom of the upper die.

50 In the illustrated forms the carriage 65 carries, in cooperative relation with transfer mechanism that may comprise either a vacuum box 100 or a tray surface 114, suitable mechanism for wiping and for oiling the bottom of the upper die. 55

Figures 1, 2, 24 and 25 illustrate a suitable vacuum box and tray which may be used. The two may be considered as alternative or in combination. For example, if the tray 60 transfer is to be employed, the vacuum box may still be used where, as sometimes happens, the sheet does not adhere to the upper die. The structure of Figures 24 and 25 may be a tray, a vacuum box, or both.

65 As shown in Figure 24, the wiping and

oiling mechanism includes a rotary brush or aluminum roller 119 on a shaft 120 journaled at 121 in sides 122 of an oil basin 123. The oil basin 123 is pivoted at 124 to brackets 125 from the carriage 65. Springs 126 acting 70 against spring sockets 127 at opposite ends force the oiling brush resiliently upward, so that, when the carriage is in the mold, the oil brush will maintain contact with the lower surface of the upper die 43. 75

The brush or roll 119 may be operatively connected to the wheels 115 of the carriage, as by a resilient belt 128 in pulleys 129 and 130 on the respective shafts 116 and 120, so that the brush or roll rotates during travel 80 of the carriage and preferably has a direction of rotation such that the engaging portion of the brush is moving opposite to the direction of travel of the carriage, thereby making the wiping action more effective. 85

The brush or roll dips into the oil pan or basin 123, the lower bristles picking up oil from the bottom of the pan and depositing it upon the lower surface of the upper die 43.

Desirably the oil is supplied continuously 90 to the pan or basin 123 during the operation of the wet machine, an oil supply tank 131 delivering oil to the pan or basin 123 through a sight feed 132 and through pipes 133 and 134, connected resiliently at 135. 95

Whenever removal of the sheets is to be by vacuum pick-up, the sheet will have been already delivered from the upper die before the carriage and vacuum box move in under 100 the die.

In this event, the progressive wiping or oiling of the bottom of the upper die takes place during the inward movement of the carriage and also during the outward movement thereof, the upper die having been 105 brought to rest in a vertical position such that it may be engaged by the brush during the inward and outward travels of the carriage.

When I elect to use tray removal of the finished sheets, the carriage moves in under 110 the upper die while the sheet is still adhering to the bottom of the upper die, and, to avoid danger of the sheet falling prematurely from the bottom of the die it may often be well to omit oiling the bottom of the upper 115 die.

If operating conditions are such that the sheet will reliably stick to the upper die until stripped by engaging the deckle, as for example when the sheets are relatively thin, it 120 may be desirable to oil the upper die to make stripping more easy and rapid. Or, if preferred, the upper die and deckle may be moved up far enough to clear the oiler while the carriage is moved in, and then the upper 125 die may be lowered into the path of the oiler before the carriage is moved out of the mold.

In tray removal, after the carriage reaches its inner position beneath the sheet, while the sheet is still adhering to the upper die, the 130

upper die is raised into the deckle or the deckle is lowered about the upper die, to force the grown edges of the sheet away from the upper die, thus permitting air to enter between the upper die and the sheet, releasing the vacuum condition between the sheet and die and allowing the sheet to drop upon the tray.

If the bottom of the upper die is to be oiled, the deckle should preferably rise to get out of the way of the oiler after the sheet has dropped upon the tray, the track and carriage rising preparatory to retracting and the carriage, in retracting, progressing the lubricator or wiper 119 across the bottom of the upper die, as before.

When the carriage and the sheet are near their outer positions, the track may be again depressed, permitting transfer rollers 103 to receive and carry away the sheet.

Desirable sequences of operations with respect to the removal of formed sheets from between the separated dies of a wet press are indicated diagrammatically in Figures 6 and 15, suitable notations on the drawings relating the lines of the diagrams to the respective operating members of a machine assumed to be carrying out the selected cycles. Various positions of the most important operating members are shown diagrammatically in Figures 8 to 14 and in Figures 17 to 23 inclusive.

Figures 6 and 15 must be understood as not showing the relative durations of the different stages of the illustrated cycles—being merely illustrations, each subject to considerable variation, of suitable simultaneous relations with respect to position and rest or movement of principal operating members.

The illustrated cycles may be considered to be intermediate successive operating cycles of a wet press, or to include a later portion only of the press cycle during which the press members are either merely cooperating with transfer members or idling in position to begin the next press cycle.

Figures 6 and 15 carry at their tops markings of the numbers of the diagrammatic figures to which the various positions on Figures 6 and 15 correspond.

Figure 6 contemplates removal of the finished sheets by a vacuum box, a cycle in which the finished sheets are picked up and removed while adhering to the bottom of the vacuum box, and Figure 15 shows a cycle in which the finished sheets are received and removed on the top of a tray.

In practice either of the cycles shown in Figures 6 and 15 may be desirably effected automatically by means of a suitable cam shaft controlling the different operations of the press, one cycle for each rotation of the shaft, the cycle starting by an operator closing a suitable switch of an operating circuit and ending at the end of the cycle by an automatic opening of the switch.

In view of the fact that the cycle need not be and often will not be controlled by a cam shaft, and that the different modifications of the cycle can all be readily effected by suitably variant manual operation of the various controls of the system, a cam shaft has not been shown.

The removal of the sheet from the wet machine by vacuum transfer really begins in the position shown in Figure 8 with the formed sheet resting upon the upper surface of the bottom die 41. In many instances, however, an additional step is required before the sheet reaches the position shown in Figure 8. As previously noted, the bottom die 41 is usually foraminated and the upper die 43 is often free from foramination, so that the sheet, after forming, will frequently stick to the upper die.

To avoid this difficulty, and to insure rapid, controllable transfer of the sheet, I raise the deckle, including the closed flow gates, after forming the sheet, while maintaining the position of the formed sheet between the dies.

During the upward movement of the deckle the sheet is under considerable pressure, since desirably the full pressure of the main cylinders is applied, while the edges of the sheet are unsupported by the deckle. The pressure at this time squeezes the sheet out laterally, causing the sheet to grow slightly beyond the original confines of the mold.

While the lateral growth of the sheet is slight in extent, it is extremely important in its function, since it makes possible automatic and accurately timed separation of the sheet from the upper die by pressure of the grown edge of the sheet against some engaging surface, preferably the bottom of the deckle.

In Figure 8a I show a sheet in position between the dies, the edges 136 having grown as there exaggerated.

Between the positions of Figures 8a and 8b, the upper die and the adhering sheet are raised, and, at some point in the upward travel of the upper die, the grown edges of the sheet engage the deckle, slightly bending the edges of the sheet away from the upper die as exaggerated in Figure 8b. The bending down of the edges permits the entrance of air between the upper die and the sheet, so that the sealing vacuum is broken. Furthermore, the deckles mechanically force the sheet away from the upper die.

The stripping action is illustrated by the line 137 in Figure 6, in advance of the position of Figure 8. As soon as the sheet is separated or stripped from the upper die, the sheet drops from the position of Figure 8b to that of Figure 8. In the mode of operation now being described, the sheet falls upon the screen 41'. The sheet is relatively fragile at this stage of its manufacture, so that the dropping distance should be very small. The

distance is of course proportionately exaggerated in Figure 8b.

During the dropping of the sheet, the deckle and closed gates move up as a unit a short distance from the position of Figure 8b to that of Figure 8, in order to be out of the way of the wiper or oiler mounted upon the transfer mechanism which moves inward to withdraw the sheet from the mold.

Between the positions of Figures 8 and 9, the carriage 65 moves into the mold, and the oiler lubricates the lower surface of the upper die. The dies and deckles do not move at this time. The motion of the carriage into the mold is completed between the positions of Figures 9 and 10, thus finishing the first wiping and oiling of the lower surface of the upper die. The relative lineal movement of the vacuum box and the length of the wiping step, are shown on Figure 6.

The track 74 depresses along the line 138 between the position of Figure 10 and that of Figure 11, bringing the suction face of the vacuum box against the top of the sheet (Figure 11). The vacuum is turned on at the line 102 by contact mechanism upon the switch commutator 94.

The track 74 elevates along the line 139 between the positions of Figures 11 and 12, lifting the suction box 100 and with it the sheet 140, along the line 141, so that the sheet is supported from above free from engagement with the upper surface of the lower die.

Withdrawal of the sheet 140 from the mold is completed by movement of the carriage 65 from the position of Figure 12 through that of Figure 13, to the position for beginning the next cycle, Figure 14. During movement of the carriage from the position of Figure 12 to that of Figure 14, the oiler lubricates the lower surface of the upper die 43 for a second time, as shown on Figure 13.

Figure 13 shows the carriage retracting outwardly, supporting the finished sheet upon the bottom of the vacuum box, and simultaneously wiping the bottom of the die as it progresses outwardly.

Beyond the position of Figure 14 the vacuum is released along the line 142, and the sheet drops as indicated by the line 143, Figure 6.

In the cycle illustrated in Figures 15, 16 and 17 to 23 inclusive, the growing of the sheet takes place, after the deckle is raised along the line 144; in the position of Figure 17, the die then being raised along the line 145, and with it the sheet along the line 146, before the inward travel of the carriage.

The 180° inward cycle of the transfer mechanism takes place between the positions of Figures 18 and 20 as shown in Figure 15. After the carriage comes to rest at its inward position, the upper die moves up at the line 147, between the positions of Figures 20 and

21, first raising the sheet along the line 148, and then stripping the sheet from the bottom of the upper die along the line 149 by pressure against the deckle, the sheet dropping down upon the tray.

During retractive movement of the carriage the bottom of the die may or may not be oiled or wiped depending upon operating conditions, the diagram of Figure 15 indicating that there is no wiping during the retraction of the carriage.

The removal of the sheet from between the dies can be effected by either type of mechanism illustrated, using wholly distinct mechanism, one of which operates as a suction-supporting carrier of a sheet which has already dropped to the lower die before insertion of the carrier, and the other of which operates as a tray whose upper surface receives the sheet, or—as illustrated—a single mechanism capable of performing both functions.

Very obviously, my various steps and cycles may be carried out in wet machines of different types. While I prefer to use a machine having a stationary lower die and a movable upper die, as shown in most of the figures, I may employ a machine having a stationary upper die 43² and a movable lower die 41² as shown in Figure 17a, or having movable upper and lower dies 43³ and 41³, as shown in Figure 17b.

Where the lower die is the movable die for press purposes the wire screen and its operating mechanism should be supported along with the lower die and should move upwardly with it. This is contemplated in the structure of Figure 17b, as are also intended such changes of deckle relation with the upper die as are desirable in view of the changed conditions of motion. The deckle movement with respect to the upper die is still of course desirable for the purpose of freeing the mold space between the dies for removal of the sheet, and further to permit advantage to be taken of the growth of the sheet after the deckle has been raised out of the way, and the subsequent separation of the sheet from the upper die by relative movement of the deckle and upper die, which where the upper die is stationary, will then be due to downward movement of the deckle. The lower die can be stopped in any position desired to determine the extent of drop of the sheet after its release and can subsequently be moved further to the position of transfer of the sheet, if that be different and/or to the final open position of the mold.

Where the removal of the sheet is to be effected by a suction carrier, movement of the lower die can be used to cause engagement of the sheet with the suction surface of the carrier, avoiding need for carrier supporting means to lower the position of the carrier for this purpose. The same advantage of move-

ment of the lower die to secure suction engagement with the sheet is available in the form of Figure 17b where the lower die, which need not be the pressing die, is movable and where its movement can be used for this purpose.

In both of the forms of Figures 17a and 17b the lower die is dropped, of course, after lifting movement to secure vacuum engagement between the sheet and carrier in order that the carrier may move the sheet freely from between the dies of the press.

With both of the forms of Figures 17a and 17b the capability of using the lower die to secure sheet and carrier suction engagement does not make it necessary that the dies be so used as these devices are fully operative with other means of securing this engagement and in individual cases it may prove better to use some other means than to interrupt the operation of the die for such a purpose.

With the suction carrier it has been the intention to indicate that many different means and methods of securing suction contact with the sheet can be used, and to suggest several different methods and means among many, such as the depression of the track and the movement of the lower die.

These are the simpler ways and in particular involve less expense and complication than would be required if the carrier-lowering mechanism must itself be supported by and moved with the carrier, but the carrier means would of course be fully operative.

Whether the suction carrier system be used or the tray system, the distance which the sheet drops to the lower die or to the top of the tray, respectively, is fully within the control of the designer, who can cast off the sheet at any level desired by merely lifting the upper die to that level—the height best suited for his design—and then the deckle or other stripper, separately supported and moved or supported and moved by the deckle, can be set at the height at which it is to strip the sheet from the upper die and the upper die and stripper can be moved vertically with respect to one another to cause the stripping. Both with the carrier and with the tray, therefore, the distance through which the sheet is dropped can not only be predetermined very exactly, but it can be altered by alteration of upper die or deckle or stripper position at which their final relative movement takes place.

It will be evident that the discussion above as to free choice of use of carrier or tray and control of the height through which the sheet is to be dropped as well as the question of whether die or deckle or stripper movement shall cause this dropping applies to presses having deckle movement and not to presses having upper die movement alone.

Wiping and oiling can of course be inde-

pendently performed and the oiling need not be done by brush or other contact means. Though I have shown brush (contact) means of oiling this is shown because of application of my press to flat sheets in the illustrations and not because for other sheets, for example, I consider brush oiling superior to spray oiling.

With corrugated or relieved, or embossed board, spray oiling has many advantages and can easily be effected by the simple expedient of locating spray nozzles at the end of the carrier or tray at a suitable distance below the upper die face and connecting these nozzles with a source of oil under pressure preferably always outside of the mold space.

The mechanism thus far described has illustrated the application of my invention to a wet machine alone. In Figures 29 to 37 I show additional important features of my invention.

While in Figure 1, I have shown the transfer mechanism 65 from the wet press as delivering to conventional mechanism 103 for subsequent delivery to a drier, I prefer the mechanism 103 of Figure 1 to comprise one of the duplicate trucks, as 151 and 150, one of which loads at the wet press while the other unloads into a drier.

Desirably each wet press supplies wet sheets to a plurality of driers, for example as illustrated in Figures 34 to 36, where a wet press 152 is in cooperating relation with a plurality of driers 153 to maintain a capacity operation of the press and of the driers.

A truck 150 is loaded with wet sheets as the sheets are delivered from the press and then moved to one of the driers where the truck 150 is unloaded into the drier while the press is loading a second truck 151.

The track 154 for the trucks is desirably effectively endless to avoid any interference between the trucks, and as illustrated includes turn tables 155 to provide a return to the wet press without the introduction of curves.

Preferably short track sections 156 and 157 respectively at the loading and unloading positions are vertically adjustable for more easy loading and unloading respectively.

As illustrated in Figure 35, the truck 151 in loading position at the press 152 is supported on a track section 156 capable of vertical adjustment to accommodate gradual increase in the depth of load on the truck.

The transfer mechanism 65 at the wet press piles the successive wet sheets on to the truck which is directly beneath the outermost position of the suction box 100, the sheets being dropped on to the truck or on to the top of a pile of other sheets upon the truck, and an elevator table 158 which carries the truck section 156, supporting the loading truck 151 being progressively lowered suitably by hydraulic mechanism 159 to maintain the top

of the pile at the level most suited to easy delivery on to the top of the pile from the piler mechanism 65.

When the truck at the wet press is loaded with the proper number of sheets the elevator table drops the track section until it is on the same level as the adjacent portions of the track 154 and the truck is then rolled to charging position at one of the driers as upon a vertically adjustable track section 157.

The driers may be all alike and are preferably of the multiple plate horizontal type illustrated conventionally in the figures, especially Figures 27 to 31.

As illustrated, each drier includes a plurality of vertically spaced horizontal plates 160, suitably steam heated as by interior passages 161, and adapted to be hydraulically pressed together between an upper movable and a lower stationary platen 162 and 163, as by one or more hydraulic rams 164 in cylinders 165 supported in an upper fixed platen 166. The platens 162 and 163 are held together by tension columns 167. Links 168 limit the spacing of the plates 160 in separated position.

The operating mechanism of the drier is to a considerable extent irrelevant to the present invention, the drier being any drier of the multiple plate horizontal type including vertically spaced horizontal plates each adapted to receive a wet sheet upon its upper surface for drying and optionally being adapted to be compressed during drying by relative movement of a die with respect to a press platen.

The mechanism for charging the sheets into the individual driers may be widely varied, the illustrated preferred form being one of many that may be used. Each charging movement of this mechanism preferably pushes out a finished sheet from the drier on to a receiving surface, as for example a truck at the rear of the drier.

The chargers 169 are desirably alike at the different driers, and consist of a horizontal suction plate 170 supported upon rollers 171 that are in turn supported, when the plate is in its retracted position, upon rails 172 and wholly or partially upon any one of the drier plates 160 when the charger plate 170 has run inward on its rollers to its delivery position, the rails 172 being made to register vertically with the successive plates of the drier during the charging thereof with successive wet sheets.

The rails 172 are a portion of an elevator 173 operated in and vertically guided by stationary frame structure 174.

The rails are carried by brackets 175 from cross beams 176 that are rigidly connected by side beams 177 and middle beams 178. The side beams present guiding rollers 179 to run along the vertical corner standards 180

of the stationary structure and make a suspension connection at 181 with a cable 182.

The elevator is vertically positioned by the cable 182 which is attached at its lower end to the elevator and at its upper end winds over a drum 183 adapted to be rotated in either direction by a reversible motor 184 operatively connected to the drum by suitable reduction gearing, not shown in detail.

The elevator is partially counterweighted at each of the standards, cables 185 at each standard being connected at 186 to the elevator, passing upwardly over pulleys 187 on the superstructure of the frame and carrying suitable weights 188 at their lower end.

The mechanism for moving the suction plate or charger 170 horizontally into and out from a position between the drier plates is shown as comprising inwardly directed racks 189 along opposite sides of the plate 170, pinions 190 meshing in the racks and a reversible drive for the pinions including a reversible motor 191, reduction gearing 192, sprocket wheel 193, sprocket chain 194, sprocket wheel 195, shaft 196 and pinions 197 thereon meshing with the pinions 190.

The motor 191 and reduction gearing 192 are mounted on the middle beams 178 of the elevator and the shaft 196' and pinions 190 have journal supports on the downwardly directed ends of a yoke beam 198.

Each downwardly directed arm of the yoke beam 198 flares downwardly in a direction lateral of the beam length to provide journal support for wheels 199 which are spaced forwardly and rearwardly of the pinion 199 and in cooperation with the pinions 190 function merely to hold the pinions to their duty. Each of the downwardly directed arms of the yoke beam 198 provides pivot support for a link 200, which carries a journal for the shaft 196, which also journals at 200' on the frame structure. The link 200 serves to hold the pinions 190 and 197 in mesh, and permits adjustment of the level of the vacuum box 170 with respect to the track 172, and also adjustment of the tension of the sprocket chain.

The yoke beam 198 is supported from moving downwardly by its engagement with the charger plate 170 at the pinions 190, and the pinions 190 upwardly engaged by the racks 189 in cooperation with the wheels 199, in rolling engagement with the underneath side of the charger plate, prevent the yoke beam from undue angular movement and thereby maintain the pinions 190 in continuous proper driving relation with the racks.

The yoke beam 198 is pressed resiliently downwardly by springs 201 which are compressed between the yoke beam at their lower ends and a relatively high front beam 202 rigidly fastened by brackets 203 to the side beams 177.

The resilient connection at the springs 201 permits the plate 170 to yield upwardly

when engaged by the top wet sheet of the pile on the truck 150, permits the plate 170 to accommodate itself readily and effectively to small vertical irregularities at the drier plates or to imperfect registration between the charging plate and drier plates, whether due to any carelessness of an operator or to unevennesses of the cooperating structures, and holds the plate 170 upon the track 172 during clockwise rotation of pinion 190.

The truck 150 suitably piled with wet sheets 140 from the wet press is vertically adjustably supported from the elevator 173, and as illustrated is carried upon a track section 157 that in turn rests upon a structural frame 204. The frame structure 204 carrying the track section 157 is suspended near the corners by cables 205.

These cables are fastened at their upper ends to the super-structure of the elevator at 206 and, extending downwardly, pass under the downwardly directed pulleys 207 and inwardly under the frame 204 to drums 208 operatively connected through reduction gearing 209 to a reversible motor 210.

It will be seen that the rotating of the drums in one direction will move the track section and therefore the truck load of sheets upwardly and that rotating of the drums in the other direction will move it downwardly.

It will be evident that the direction of the rail section 157 carrying the truck 150 may be either parallel to the side of the drier as illustrated in Figures 34 to 36 or may be perpendicular thereto as illustrated in Figures 27 and 28, either arrangement being preferable according to the floor lay-out of the plant.

In Figure 34 the individual wet press has supplied a plurality of driers by means of an endless track section. Obviously the track need not be endless and in this event a convenient arrangement is frequently one in which a main track from the wet press has individual sidings to the driers with perhaps a turn table on the main track at the entrance of each siding.

The suction plate 170 for lifting sheets from the top of the pile on the truck 150 may be formed on the under side at the lifting surface thereof at 211 exactly as already described for the vacuum box 100, Figures 24 to 26 inclusive.

Details of the plates 170 are illustrated in Figures 31 to 33. The downwardly directed rollers 171 are spaced along the sides a little inwardly from the racks 189 and preferably adjustable with respect to the bottom of the plate 170.

Each roller 171 is carried on the end of a downwardly curving arm 212 removably bolted at 213 to the plate within a suitable vertical slot 214 through the plate. It will be seen that the curving arm 212 is provided with a curved line of bolt holes 215 which

selectively match holes 216 in the plate to permit easy variation of the vertical setting of the roller 171 by selectively varying the hole position of one of the bolts 217.

It will be understood that the wheels or rollers 171 may need different vertical settings with respect to the bottom of the suction plate 170 in order to adapt the plate to suit different requirements with respect to different thicknesses of wet sheets and different vertical spacings between the drier plates.

The drier plates may desirably be provided with roller guideways as indicated at 218, Figure 33, in order to definitely register the suction plate 170 with the drier plate 160 at the time of delivery of the wet sheets.

An operator at one of the driers, having received a truck load of wet sheets on the track section 157, and having vertically spaced the drier plates, first by suitable operation of the motor 184, raises the elevator 169 into position to register the suction plate 170 at an elevation such that it can roll inwardly upon one of the drier plates, for example the top plate of the drier.

The operator then by means of the motor 210 raises the track section 157 and the truck carried thereon until the top sheet of the pile strongly engages the bottom of the suction plate 170.

A small upward movement of the truck beyond that needed to merely bring the top wet sheet into contact with the bottom of the suction plate lifts the suction plate and yoke beam against the retraction of the springs 201 and insures close engagement between the suction plate and the top sheet.

The suction is then applied to the suction plate in any suitable way not shown, after which the track section 157 and therefore the truck is moved a small distance downwardly by reversing the motor 210, leaving the top sheet of the pile held to the bottom of the suction plate.

The suction plate is next run horizontally on to the adjacent drier plate by means of the motor 191, rolling on its rollers 171, first along the rails 172 and then along the roller guides 218 of the drier plate, and may come momentarily to rest in the drier. Then, having deposited the sheet 140 by releasing the suction or vacuum of the plate, the suction plate moves back to its pick-up position vertically above the pile of sheets on the truck.

The elevator is then adjusted by the motor 184 for registering the charger 170 in position for charging the next plate of the drier, where the described operation is repeated, and so on at each plate of the drier.

Desirably each inward movement of the suction plate is also used to discharge a dried sheet from the drier plate, the suction plate then carrying a suitable pusher 219. Figures 36 and 37, adapted to engage the nearer edge

of the finished sheet on the drier plate, pushing the finished or dried sheet off the back of the plate on to a suitable support presented at the rearward side of the drier. Desirably this support comprises truck 220 having vertical adjustment at 221.

As illustrated in Figure 36 this truck is carried upon a hydraulic elevator 222 which is vertically adjusted to bring the truck in position to best receive sheets from the drier as these are pushed out by and ahead of the charger 170.

Assuming that the charging begins at the top of the drier, the charging elevator 173 is moved downward after each charging a distance to bring the charger into position for charging the next plate of the drier and the receiving elevator at the rearward side of the drier is likewise moved downwardly to bring the top of the increasing pile of dried sheets into position for the best receipt of another sheet from the drier.

It will be evident that my preferred mechanism is particularly well suited to the peculiarities of wet machines and dryers. Wet machines produce only one sheet at a time, but do so rapidly. Dryers handle a large charge, but operate upon a long cycle. I collect the individual sheets from the wet machine into piles, using the piles as a unit for loading into the driers.

In handling a pile, I support it from below at a vertically adjustable height, and operate upon the topmost sheet which of course is the most accessible. Instead of attempting to slide or push the fragile wet sheet laterally into the space between the drier plates, I carry the sheet in while supporting it fully from the top, and deposit it carefully in the exact position in which it is to be dried. Advantage is taken of the increased strength of the dried sheet, which is pushed out ahead of the incoming wet sheet.

All of these desirable features cooperate. The piling of the sheets makes them easy to handle as a unit, and the suction support is well suited to use upon a pile of sheets. The pile is carried vertically and then, after suction support has been applied to its topmost sheet, is lowered, so that the topmost sheet may be reciprocated to its final position. Thus I have an efficient combination of vertical shifting, vertical support from above and lateral travel in handling the sheets of a pile.

It will of course be evident that the particular mechanisms by which the pile is formed in the first place, by which it is shifted bodily, by which the position of the suction carrier is varied, and by which the suction carrier is laterally shifted, are subject to wide variation, and the particular form shown is at most only one desirable embodiment of my invention.

The sheet which is formed in the wet ma-

chine contains considerable moisture, and is extremely fragile on that account. In the past it has been customary to remove the sheet from the mold on the wire, and then to slide the sheet over a roller or other similar transfer to a point near the drier. The past practice has been to load the sheet into the drier by sliding the sheet over a drier plate to the position in which the sheet is to be dried.

In spite of every effort to keep the roller transfer free moving, to eliminate friction in the sliding transfer and to have the drier plate as smooth as possible, there is nevertheless a marked tendency to erode the sheet by sliding contact, and to roughen the surface fibers at individual points. The past practice has been to expect this condition, and to consider the surface which passes across the transfer to be the "wrong" side of the sheet, which must not be exposed in the wall during use.

By my invention I avoid erosion or other injury to the sheet during transfer. The sheet, in position in the mold after forming is lifted bodily by my vacuum transfer, without sliding, and is carried free from sliding contact to the point of piling. There the sheet is dropped on the truck or on the next lower sheet, and the pile is conveyed bodily. At the drier the sheet is again picked up by a vacuum transfer, and is carried into the space between the drier plates, directly above the point at which it is to be dried, without dragging action over the lower drier plate of the pair.

Thus it will be evident that my transfer throughout involves vertical lifting and lowering, and translation free from sliding contact with any surface. Even if the sheet should touch a sliding surface during translation, the weight of the sheet will not rest upon that surface, as the sheet is supported from above, and therefore the erosion and roughening action will be, at the most, very slight. I am able to produce a sheet in which the side which is lowermost during transfer is equally as fit for exposure to view as the side which is uppermost, with a possible difference due to the slight regular corrugations on account of the wire. It is thus possible to employ my sheet in uses where both sides are open to view or to offer the user a selection as to the side which will be exposed.

It will be evident that the vertical position of the vacuum charger for the drier may be shifted in synchronism with the vertical position of the pile of sheets, so that the pile will raise or lower progressively as the vacuum transfer is raised or lowered, in order that the topmost sheet may be brought into contact with the vacuum transfer in each instance with a minimum of loss of time.

In the same manner, the receiving mechanism for the dried sheets may be synchronized

with the charger for the wet sheets, so that both are maintained at the same level and move from level to level concurrently.

While I illustrate the faces of the drier plates as smooth surfaces, it will be evident, of course, that screens may be placed upon the top or bottom faces of the drier plates, as well known in the art, to assist in the elimination of moisture during drying.

In referring to the transfer of a pile of sheets by means of a "truck", I mean to designate any suitable transfer for conveying a pile bodily whether the wheels or other friction-reducing means be located upon the transfer mechanism or upon the stationary mechanism over which the transfer mechanism moves. Likewise, in referring to an "elevator" I mean to include any means for raising and lowering one or more sheets whether mechanical, (screw), hydraulic, electric, pneumatic or any combination of these.

In certain aspects of my invention piling is not essential and the individual sheets may be transferred from the wet machine to the drier charging mechanism.

While the vacuum form of loading for my drier is the most desirable, other methods may be used which will support the wet sheet from every contact with the drier plates during translation, as for example, the placing of a plate beneath the sheet which is suitably supported from above.

I believe that I am the first to charge the space between drier plates with a wet sheet which is supported from above by any means during charging.

Of course, the use of additional steps in the manufacturing process, as the sub-dividing of sheets by cutting into smaller units before drying, or the coating or impregnating of sheets prior to drying will not be a departure from my invention.

In view of my invention and disclosure variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art, to obtain all or part of the benefits of my invention without copying the structure shown, and I, therefore, claim all such in so far as they fall within the reasonable spirit and scope of my invention.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In a wet machine for making sheets or boards from suspended fiber, relatively movable upper and lower dies, a deckle about the movable die and movable with respect to it, a carrier normally supported outside of the space between the dies and adapted to move into and out of the said space when the dies are separated, a track upon which the carrier moves, and means for moving the carrier upon the track to receive a sheet.

2. In a wet machine for making sheets

or boards from suspended fiber, relatively movable upper and lower dies, a deckle about the movable die and movable with respect to it, a carrier normally supported outside of the space between the dies and adapted to move into and out of the said space, a track upon which the carrier moves, means for moving the carrier upon the track to receive a sheet and cooperating means between the upper die and the deckle adapted to press against the edge of the sheet to release the sheet from the upper die when the carrier is between the dies.

3. In a wet machine for making sheets or boards from suspended fiber, relatively movable upper and lower dies, a deckle about the movable die and movable with respect to it, a suction carrier normally supported outside of the space between the dies and adapted to move into and out of the said space, supports for the carrier to sustain it when between the dies, means for giving relative vertical movement to the carrier and bottom die for suction contact, suction connections for the carrier and means for moving the carrier into and out of the space between the dies.

4. In a wet machine for making sheets or boards from suspended fiber, relatively movable upper and lower dies, a deckle about the movable die and movable with respect to it, a suction carrier normally supported outside of the space between the dies and adapted to move into and out of the said space, supports for the carrier to sustain it above the lower die when it is between the dies, means for shifting the carrier into and out of the space between the dies, suction connections for the carrier and means for varying the height of the carrier to lower it upon the sheet when between the dies for suction contact with the sheet and to lift it with the sheet for removal from the space between the dies.

5. In a wet machine for making sheets or boards from suspended fiber, relatively movable upper and lower dies, a deckle about the movable die and movable with respect to it, a carrier normally supported outside of the space between the dies and movable into and out of the space between the dies, a vacuum pick-up thereon, vacuum connections therefor and means for shifting the carrier into and out of the space between the dies.

6. In a wet machine for making sheets or boards from suspended fiber, relatively movable upper and lower dies, a deckle about the movable die and movable with respect to it, a carrier normally supported outside of the space between the dies and adapted to move into and out of the space between the dies, means for moving the carrier, a suction-gripping mechanism on the underside of the carrier, and means for engaging the sheet by the mechanism.

7. In a wet machine for making sheets or boards from suspended fiber, relatively mov-

able upper and lower dies, a deckle about the movable die and movable with respect to it, a carrier normally supported outside of the space between the dies, the carrier adapted to move into and out of the space between the dies, means for moving the carrier, a suction-gripping mechanism on the under side of the carrier and die-moving means for engaging the sheet and the carrier, the pressing being done by the upper die.

8. In a wet machine for making sheets or boards from suspended fiber, relatively movable upper and lower dies, a deckle about the movable die and movable with respect to it, a carrier normally supported outside of the space between the dies, the carrier being adapted to move into and out of the space between the dies, means for moving the carrier, a suction-gripping mechanism on the under side of the carrier, and means for moving the lower die to cause engagement between the sheet and the carrier.

9. In a wet machine for making sheets or boards from suspended fiber, relatively movable upper and lower dies, a deckle about the movable die and movable with respect to it, a carrier normally supported outside of the space between the dies and adapted to move into the said space and from it, a track for the carrier, means for depressing and lifting the track, means for moving the carrier along the track into and out of the space between the dies and suction holding mechanism on the under side of the carrier.

10. In a wet machine for making sheets or boards from suspended fiber, relatively movable upper and lower dies, a deckle about the movable die and movable with respect to it, a carrier normally supported outside of the space between the dies and adapted to move into and out of the space between the dies having an upper sheet-receiving surface and an under suction holding mechanism and means for moving the carrier into and out of the space between the dies.

11. In a wet machine for making sheets or boards from suspended fiber, relatively movable upper and lower dies, a deckle about the movable die and movable with respect to it, a carrier normally supported outside of the space between the dies and adapted to move into and out of the space between the dies and adapted to support the sheet and to withdraw it from the space between the dies, means for moving the carrier and an oiler supported upon the carrier and adapted to engage the upper die.

12. In a wet machine for making sheets or boards from suspended fiber, relatively movable upper and lower dies, a deckle about the movable die and movable with respect to it, a carrier normally supported outside of the space between the dies and adapted to move into the said space and from it, an oiler, and

means for moving the oiler back and forward beneath the upper die.

13. In a wet machine for making sheets or boards from suspended fiber, relatively movable upper and lower dies, a deckle about the movable die and movable with respect to it, a carrier normally supported outside of the space between the dies and adapted to move into the said space and from it, a wiper and means for progressing the wiper in engagement progressively across the face of the upper die while the dies are separated.

14. In a wet machine for pressing finely divided suspended fiber into sheets, upper and lower relatively movable dies, a deckle for the dies, means for charging the suspended fiber between the dies, a carrier having a suction face and adapted for movement into and from the space between the dies, means for reciprocating the carrier and automatic means for depressing the carrier to bring the suction face into engagement with the sheet at the inner end of its movement and for lifting it.

15. In a wet machine for pressing suspended fiber into sheets, upper and lower relatively movable dies, a deckle for the dies, means for charging the suspended fiber between the dies, a carrier adapted to receive the sheet on its upper surface and means for relatively moving the upper die and the deckle so as to separate the sheet from the upper die and drop the sheet upon the carrier.

16. In a wet machine for pressing finely divided suspended fiber into sheets, upper and lower relatively movable dies, a deckle for the dies, means for charging the suspended fiber between dies, a carrier adapted for movement into and from the space between the dies and adapted to receive the sheet on its upper surface, means for relatively moving the upper die and the deckle so as to separate the sheet from the upper die, and an oiler for lubricating the under surface of the upper die to facilitate the separation.

17. In a wet machine for pressing suspended fiber into sheets, upper and lower relatively movable dies, a deckle for the dies, means for charging the suspended fiber between the dies, a carrier adapted for movement into and from the space between the dies and adapted to receive the sheet on its upper surface, means for lifting the deckle before the upper die is lifted to cause the sheet to grow laterally, means for relatively moving the upper die and the deckle so as to separate the sheet from the upper die and an oiler supported upon the carrier to lubricate the under surface of the upper die during movement of the carrier to facilitate the separation.

18. In a wet machine, upper and lower relatively movable dies, a deckle, means for lubricating the under surface of the upper die and means for relatively moving the

deckle and the upper die to press the deckle against the edges of the sheet and separate it from the upper die and a reciprocating carrier movable beneath the upper die to receive the sheet and remove it from between the dies.

19. In a wet machine, upper and lower relatively movable dies, a deckle, a lubricator adapted to engage the under surface of the upper die, a support for the lubricator reciprocable into and out from the space between the dies, a pan forming a pool with whose lubricating content the lubricator is adapted to engage, a source of lubrication therefor at all times outside of the space between the dies and a feed line between the source and pool.

20. In a wet machine, upper and lower relatively movable dies, a deckle, a rotary lubricator adapted to engage the under surface of the upper die, a support for the lubricator, wheels for the support, a track upon which the wheels bear and driving means between one of the wheels and the lubricator.

21. In a wet machine, upper and lower relatively movable dies, a deckle, a rotary lubricator adapted to engage the under surface of the upper die, a support for the lubricator, wheels for the support, a track upon which the wheels bear and driving means between one of the wheels and the lubricator driving the lubricator so that its upper surface turns in a reverse direction from the direction of movement of the support.

22. In a wet machine, upper and lower relatively movable dies, a deckle, a lubricator adapted to engage the under surface of the upper die, a reciprocating carrier therefor adapted to enter and leave the space between the dies and a resilient mounting for the lubricator from its carrier.

23. In mechanism of the character indicated, a wet press and a suction gripping carrier adapted to pick up wet sheets successively as formed by the press and to deliver them successively at a delivery point removed from the press in combination with a truck receiving the successive sheets from the carrier and an elevator supporting the truck in its receiving position and vertically adjusting the elevation of the truck to register the last delivered sheet at a position to receive the next sheet from the carrier.

24. In mechanism of the character indicated, a wet press and a suction gripping carrier adapted to pick up wet sheets successively as formed by the press and to deliver them successively at a delivery point removed from the press in combination with a track, a track section, an elevator supporting the section under the said delivery point, a truck on the section and means for adjusting the elevator to register the top of a pile of wet sheets on the truck with the delivery point of

the carrier and for subsequently horizontally aligning the track section with the track for transferring the truck along the track from the said section to a drier or the like.

25. The combination of a wet press, suction gripping means for delivering the successive sheets from the press downwardly at a point removed from the press, a truck adapted to receive the sheets and mechanism for varying the height of the truck to maintain the top of a variant pile of wet sheets thereon in a substantially uniform position suitable for easy delivery thereon from the said transfer mechanism.

26. The combination of a wet press, suction gripping means for delivering successive sheets therefrom downwardly at a point removed from the press, a drier, a truck, means for positioning the truck beneath the said point in successively lower elevations to register the last received sheet in a sheet receiving position and other means operative subsequent to the first means and at the drier for positioning the truck in vertically variant positions alongside the drier to register the top sheets at vertically variant receiving parts of the drier.

27. A multiple plate horizontal drier in combination with a horizontal suction carrier and mechanism for adapting the carrier to support a wet sheet upon its lower side and to run in and out of the drier upon one of the plates thereof, depositing the wet sheet at an inner point of its movement on the said one plate.

28. A multiple plate horizontal drier in combination with a suction gripping sheet charger adapted to move inwardly and outwardly on individual plates of the drier and a pusher mounted on the front of the charger for engaging the rearwardly directed edges of dried sheets on the said individual plates to enable each inward movement of the charger to push a dried sheet forwardly out of the drier as it moves inwardly to deposit a wet sheet for drying in the drier.

29. A suction plate type of charger for a drier of the character indicated and having racks along the sides and a downwardly directed suction surface for receiving a wet sheet, means for bringing a wet sheet into contact with the suction surface, pinions operatively connected to the racks and reversible mechanism for operating the pinions.

30. A suction plate type of charger for a drier of the character indicated and having racks along the sides and a downwardly directed suction surface for receiving a wet sheet, a support for a pile of wet sheets, means for relatively moving the support and charger to bring the top sheet of the pile into contact with the suction surface, pinions operatively connected to the racks and reversible mechanism for operating the pinions.

31. A suction plate type of charger for a

drier of the character indicated and having upwardly directed racks along the sides and a downwardly directed suction surface for receiving and holding a top sheet from a pile of sheets, downwardly directed pinions operatively connected to the racks and reversible mechanism for operating the pinions in combination with an elevator presenting an upward support to the charger and a downward upwardly yieldable support for the pinions, a support for the pile of wet sheets and means for upwardly and downwardly moving the pile support with respect to the elevator to bring the top sheet of the pile upwardly into contact with the suction surface and the remainder of the pile then downwardly to avoid interference with the charger mechanism during charging.

32. A suction plate type of charger for a drier of the character indicated and having upwardly directed racks along the sides and a downwardly directed suction surface for receiving and holding a top sheet from a pile of sheets, pinions operatively connected to the racks and reversible mechanism for operating the pinions in combination with an elevator affording upward support for the suction plate against downward movement, a truck adapted to carry the pile of wet sheets vertically beneath the suction plate, suspension connections between the truck and elevator and means for varying the effective lengths thereof to upwardly and downwardly move the truck with respect to the charger, to bring the top sheet of the pile upwardly into a delivery engagement with the bottom of the suction plate and the rest of the pile then downwardly to free charging mechanism from upward pressure of the pile.

33. A suction plate type of charger for a drier of the character indicated and having upwardly directed racks along the sides and a downwardly directed suction surface for picking up a top sheet from a pile of sheets, pinions operatively connected to the racks and reversible mechanism for operating the pinions in combination with an elevator affording support for the suction plate against downward movement, a truck adapted to carry the pile of wet sheets vertically beneath the suction plate, means for vertically moving the truck with respect to the elevator to bring the top sheet of the pile upwardly into contact with the suction surface and a downward upwardly yieldable support from the elevator to the pinions adapting the pinions to yield upwardly when the charger is engaged from below by the top sheet on the truck.

34. Mechanism in accord with claim 32 including a yoke beam having downwardly directed arms providing journal support for the pinions, wheels pivotally mounted on the arms and upwardly engaging the bottom of the plate and a drive shaft operatively con-

nected to the pinions and having journal support on the said arms.

35. A suction plate type of charger for a drier of the character indicated and having upwardly directed racks along the sides and a downwardly directed suction surface for receiving a wet sheet, means for bringing a wet sheet into contact with the suction surface, pinions operatively connected to the racks, a pair of wheels near each pinion making rolling engagements with the bottom of the charger, a common mount providing journal supports for the wheels and pinions and reversible mechanism for operating the pinions.

36. A suction plate type of charger for a drier of the character indicated and having upwardly directed racks along the sides and a downwardly directed suction surface for receiving a wet sheet, means for bringing a wet sheet into contact with the suction surface, pinions operatively connected to the racks, a pair of wheels near each pinion making rolling engagements with the bottom of the charger, a common mount providing journal support for the sheets and pinions and reversible mechanism for operating the pinions in combination with an elevator presenting an upward support to the charger and a downward upwardly yieldable support for the said mount, a support for the pile of wet sheets and means for upwardly and downwardly moving the pile support with respect to the elevator to bring the top sheet of the pile upwardly into contact with the suction surface and the remainder of the pile then downwardly to avoid interference with the charger mechanism during charging.

37. Mechanism in accord with claim 32 and including a yoke beam having downwardly directed arms providing journal support for the pinions, wheels pivotally mounted on the arms upwardly engaging the bottom of the charger forwardly and rearwardly of the pinions, a drive shaft resiliently journaling in the arms and gears on the drive shaft meshing with the pinions.

38. In mechanism of the character indicated, a wet sheet charger including a suction plate, rollers spaced along and vertically adjustable with respect to the bottom thereof near opposite sides thereof, an elevator, horizontal runways for the rollers, mechanism for delivering a wet sheet to the suction bottom of the charger and means for reciprocating the charger along the runways to deliver the received sheet.

39. In mechanism of the character indicated, a wet sheet charger including a suction plate vertically slotted toward its ends near and generally parallel to opposite sides of the plate, an arm at each slot having an angularly adjustable supporting connection with the plate in the slot and a roller on the lower end of each arm.

40. In mechanism of the character indicated, a wet sheet charger including a suction plate vertically slotted toward its ends near and generally parallel to opposite sides of the plate, an arm at each slot having an angularly adjustable supporting connection with the plate in the slot and a roller on the lower end of each arm, the said arm having a row of horizontal bolt holes said row curving downwardly from a high point thereof within the slot, the plate having a row of cooperating bolt holes at the slot and the angularly adjustable supporting connections including two bolts at selectively variant corresponding holes of the rows.

41. In a wet machine, relatively movable upper and lower dies, a deckle movable with respect to the dies and means for oiling the under surface of the upper die when the deckle is elevated.

42. In a wet machine, upper and lower relatively movable dies, a deckle, means for lubricating the under surface of the upper die and means for relatively moving the deckle and the upper die to press the deckle against the edges of the sheet and separate the sheet from the upper die.

43. In the making of fiber sheets, a wet machine, a piler for the sheets from the wet machine, a multiple plate horizontal drier, transfer mechanism for the pile to the drier, an elevator for vertically shifting the pile, a vacuum support for the topmost sheet of the pile and mechanism to translate the vacuum support with the topmost sheet into a space between plates of the drier.

44. In the making of fiber sheets, a wet machine, a carrier entering the mold of the wet machine, adapted to withdraw the sheets and to pile them, a multiple plate horizontal drier, transfer mechanism for the pile to the drier, an elevator for vertically shifting the pile, a vacuum support for the topmost sheet of the pile and mechanism to translate the vacuum support with the topmost sheet into a space between plates of the drier.

45. In the making of fiber sheets, a wet machine, a vacuum support entering the mold of the wet machine, adapted to withdraw the sheets while supporting them from above and to pile them, a multiple plate horizontal drier, transfer mechanism for the pile to the drier, an elevator for vertically shifting the pile, a vacuum support for the topmost sheet of the pile and mechanism to translate the vacuum support with the topmost sheet into a space between plates of the drier.

46. In the making of fiber sheets, a wet machine, a piler for the sheets from the wet machine, a multiple plate horizontal drier, transfer mechanism for the pile to the drier, an elevator for vertically shifting the pile, a vacuum support for the topmost sheet of the pile, a pusher and mechanism to operate the pusher to remove the dried sheet and to

translate the vacuum support with the topmost sheet back to the pusher into the space between the plates of the drier.

47. In the making of fiber sheets, a wet machine, a piler for the sheets from the wet machine, a multiple plate horizontal drier, transfer mechanism for the pile to the drier, an elevator for vertically shifting the pile, a vacuum support for the topmost sheet of the pile, means for vertically shifting the vacuum support with respect to the elevator, and mechanism to translate the vacuum support with the topmost sheet into a space between plates of the drier.

48. In combination, a multiple plate horizontal drier, means for vertically shifting a pile of sheets adjacent to the drier, a vacuum support for holding the topmost sheet and means for moving the vacuum support and the topmost sheet laterally into a space between two plates of the drier.

49. In combination, a multiple plate horizontal drier, means for vertically shifting a pile of sheets adjacent to the drier, a vacuum support above the pile, means for vertically shifting the vacuum support independently of the pile and means for laterally moving the vacuum support and the topmost sheet into a space between two plates.

50. In combination, a multiple plate horizontal drier, a vertically shiftable vacuum support outside the drier and movable into the drier, means for pressing a sheet against the lower surface of the vacuum support and means for moving the vacuum support and the supported sheet into the drier.

51. In combination, a multiple plate horizontal drier, a vertically shiftable vacuum support outside the drier and movable into the drier, means acting from below the vacuum support for pressing a sheet upward against the lower surface of the vacuum support and means for moving the vacuum support and the supported sheet into the drier.

52. In combination, a multiple plate horizontal drier, a track leading to the drier, a truck upon the track adapted to carry a pile of sheets, an elevator adjacent to the drier, a track section upon the elevator for receiving a truck, a vacuum support above the elevator, means for vertically shifting the vacuum support to the level of one of the plates and means for reciprocating the vacuum support into and out of a space between the plates.

53. In combination, a multiple plate horizontal drier and suction gripping transfer mechanism for the drier bringing a sheet into the space between two plates of the drier free from sliding contact with one of the plates.

54. In combination, a multiple plate horizontal drier and suction gripping transfer mechanism for the drier bringing a sheet into a space between two plates of the drier free

from sliding contact with one of the plates and concurrently pushing out a dry sheet ahead of the incoming sheet.

55. In combination, a multiple plate horizontal drier, a vertically shiftable horizontal track adjacent to the drier, suction gripping transfer mechanism on the track and adapted to move into a space between two plates of the drier, and means for moving the transfer mechanism beyond the end of the track and into the drier along a drier plate.

56. The method of manufacturing a sheet from finely divided fiber suspended in a liquid within a mold having relatively movable upper and lower dies, which consists in charging the mold with fiber, in moving one of the dies toward the other to express the liquid from the fiber and change the fiber into a sheet, in moving one of the dies away from the other, leaving the sheet adhering to the upper die, in separating the sheet from the upper die, and in withdrawing the sheet from the mold while supporting the sheet below and independent of the lower surface of the upper die by suction from above.

57. The method of manufacturing a sheet from finely divided fiber suspended in a liquid within a mold having relatively movable upper and lower dies and a deckle movable relatively to both which consists in charging the mold with fiber, in moving one of the dies toward the other to express the liquid from the fiber and change the fiber into a sheet, in maintaining pressure upon the sheet while the edges of the sheet are unsupported by the deckle to permit growth of the edges, in moving one of the dies away from the other, leaving the sheet adhering to the upper die, in separating the sheet from the upper die, by pressure on the edges and in withdrawing the sheet from the mold.

58. In the method of claim 57, the art which consists in separating the sheet from the upper die by relatively moving the sheet and deckle.

59. In the method of claim 57, the art which consists in withdrawing the sheet from the mold while supporting the sheet below the upper die and above the surface upon which the fiber is charged.

60. In the method of claim 57, the art which consists in separating the sheet from the upper die, by pressure on the edges against the deckle and in supporting the sheet, during withdrawal, below the upper die and above the surface upon which the fiber is charged.

61. In the method of claim 57, the art which consists in lifting the sheet with the upper die and in determining the height of the upper die at which the sheet is released from the upper die by the bottom of the deckle.

62. In the method of claim 57, the art

which consists in withdrawing the sheet from the mold while supporting the sheet by suction from above.

63. In the method of claim 57, the art which consists in separating the sheet from the upper die by pressure on the edges against the deckle and in withdrawing the sheet from the mold while supporting the sheet by suction from above.

64. In the method of claim 57, the art which consists in catching the sheet after separation from the upper die above the face of the lower die upon which the fiber is charged and in transferring the sheet from the mold.

65. In the method of claim 57, the art which consists in separating the sheet from the upper die, by pressure on the edges against the deckle and in withdrawing the sheet from the mold while supporting the sheet from below.

66. The method of facilitating the separation of a sheet from the upper die of a wet machine having relatively movable upper and lower dies, which consists in maintaining pressure upon the sheet while leaving an edge of the sheet laterally unsupported to cause the edge to grow and in pressing the grown edge of the sheet away from the upper die.

67. The method of facilitating the separation of a sheet from the upper die of a wet machine having relatively movable upper and lower dies and a deckle movable relatively to both, which consists in maintaining pressure upon the sheet while the edges of the sheet are laterally unsupported by the deckle to permit growth of the edges and in pressing the edges of the sheet away from the upper die, to which it adheres, against the deckle.

68. In the method of claim 67, the art which consists in pressing the edges of the sheet away from the upper die, to which it adheres, against the deckle by upward movement of the upper die.

69. The method of withdrawing a sheet resting upon the lower die of a wet machine having a mold provided with upper and lower dies, which consists in supporting the sheet from above, in lifting the sheet until it is free from the lower die and in transferring the sheet from the mold while maintaining the sheet out of engagement with the lower die.

70. The method of withdrawing a sheet depending from the upper die of a wet machine having a mold provided with upper and lower dies, which consists in separating the sheet from the upper die by pressure around the edges of the sheet to allow the sheet to drop, in catching the sheet above the upper surface of the lower die and in transferring the sheet from the mold.

71. The method of withdrawing a sheet depending from the upper die of a wet machine mold and having a perimetral extension

beyond the upper die and into the path of a deckle which consists in separating the sheet from the upper die by pressure from the deckle upon the perimetral extension of the sheet, in then supporting the sheet from above free from the lower surface of the upper die and in thereafter transferring the sheet from the mold while so supporting.

72. The method of withdrawing a sheet depending from the upper die of a wet machine mold and having a perimetral extension beyond the upper die and into the path of a deckle which consists in separating the sheet from the upper die by pressure from the deckle upon the perimetral extension of the sheet, in catching the sheet above the mold bottom and in transferring the sheet from the mold.

73. A step in the method of facilitating the separation of a sheet from an upper die of a wet machine having relatively movable upper and lower dies, which consists in spreading a film of lubricant over the lower face of the upper die prior to forming the sheet.

74. The method of separating a sheet from an upper die of a wet machine having relatively movable upper and lower dies, which consists in lubricating the lower face of the upper die prior to forming the sheet and in pressing the edges of the sheet away from the mold top.

75. The method of manufacturing a sheet from suspended finely divided fiber in a mold having relatively movable upper and lower dies, which consists in lubricating the lower surface of the upper die, in charging the mold with fiber, in moving one of the dies toward the other to press the fiber into a sheet, in moving one of the dies away from the other, in separating the sheet from the lubricated surface of the upper die and in withdrawing the sheet from the mold while supporting the sheet below the upper die and above the face of the lower die upon which the fiber is charged.

76. In the method of claim 75, the art which consists in withdrawing the sheet from the mold while supporting the sheet by suction from above.

77. In the method of claim 75, art which consists in withdrawing the sheet from the mold while supporting the sheet from below.

78. In the method of claim 75, the art which consists in lubricating the lower surface of the upper die between the formation of a preceding sheet and its withdrawal.

79. In the method of claim 75, the art which consists in lubricating the lower surface of the upper die as the preceding sheet is being withdrawn for the purpose of preventing the adhesion of the next form sheet to the upper die.

80. The method of separating, from a mold top, a sheet prepared from suspended finely

divided fiber in a mold having relatively movable upper and lower dies and a relatively movable deckle, which consists in lubricating the upper die, in maintaining pressure upon the sheet while the edges of the sheet are unsupported by the deckle to cause growth of the sheet beyond the edge of the mold and in pressing the grown edge of the sheet away from the lubricated upper die.

81. In the method of claim 80, the art which consists in pressing the grown edge of the sheet away from the lubricated upper die by relative movement of the mold top with respect to the deckle.

82. The method of manufacturing a sheet from suspended finely divided fiber in a mold having relatively movable upper and lower dies and a movable deckle, which consists in lubricating the lower surface of the upper die, in charging the mold with fiber, in moving one of the dies toward the other to express suspending medium from the fiber and change the fiber into a sheet, in maintaining pressure upon the sheet while the edges of the sheet are laterally unsupported by the deckle to cause lateral growth of the sheet, in moving one of the dies away from the other, in separating the sheet from the upper die by pressure against the grown edges of the sheet assisted by the lubrication, in catching the sheet above the surface of the lower die engaged by the fiber in charging and in transferring the sheet from the mold.

83. The method of transferring sheets from a wet machine to a multiple plate horizontal drier, which consists in piling the sheets, in transporting a pile bodily to the drier, in vertically shifting the pile until the topmost sheet is on the level of a space between two plates, in pressing the pile upward, in charging the topmost sheet into the space while supporting it by suction from above and in pressing the pile and charging the succeeding sheets in similar manner.

84. The method of transferring sheets from a wet machine to a multiple plate horizontal drier, which consists in piling the sheets, in transporting a pile bodily to the drier, in vertically shifting the pile until the topmost sheet is on the level of a space between two plates, in pressing the pile upward, in charging the topmost sheet into the space while supporting it by suction from above, in concurrently withdrawing from the space a sheet dried during a previous cycle and in charging the succeeding sheets in similar manner.

85. The method of transferring a sheet from the mold of a wet machine to a multiple plate horizontal drier, which consists in withdrawing the sheet from the mold while supporting it free from contact with the mold top and bottom, in transporting the sheet to the drier, in vertically shifting the sheet until it is on the level of a space between

two plates and in charging the sheet into the space while supporting it from above.

86. The method of transporting a sheet from the mold of a wet machine to a multiple plate horizontal drier, which consists in withdrawing the sheet from the mold while supporting the sheet from above, in transporting the sheet to the drier, in vertically shifting the sheet until it is on the level of a space between two plates and in charging the sheet into the space while supporting it from above.

87. The method of transferring a sheet from a wet machine to a multiple plate horizontal drier without sliding the sheet in contact with a surface, which consists in withdrawing the sheet from the mold while supporting the sheet free from contact with the mold top and bottom and in subsequently charging the sheet into a space between two plates while supporting the sheet free from contact with the plates.

88. The method of transferring a sheet from the mold of a wet machine to a multiple plate drier, avoiding sliding of the sheet in contact with a surface, which consists in withdrawing the sheet from the mold while supporting the sheet from above and in subsequently charging the sheet into the drier while supporting it from above.

89. The method of charging a multiple plate drier from a pile of sheets, which consists in vertically shifting the pile until the topmost sheet is on the level of a space between two plates, in charging the topmost sheet into the space while supporting it by suction from above and in charging the succeeding sheets in similar manner.

90. The method of loading a multiple plate drier from a pile of sheets, which consists in vertically shifting the pile until the topmost sheet is on the level of a space between two plates, in charging the topmost sheet into the space while supporting it from above, in concurrently withdrawing from the space a sheet dried during a previous cycle and in charging the succeeding sheets in similar manner.

91. The method of loading a multiple plate drier from a pile of sheets, which consists in vertically shifting the pile until the topmost sheet is on the level of a space between two plates, in pressing the pile upward, in lowering the remainder of the pile while supporting the topmost sheet from above at the level of the space, in charging the topmost sheet into the space while supporting it from above and in charging the succeeding sheets in similar manner.

92. The method of inserting a sheet into the space between two plates of a multiple plate horizontal drier, which consists in charging the sheet to a position above its ultimate position while supporting the sheet

from above and in dropping the sheet upon the lower of the two plates.

93. The method of inserting a sheet into the space between two plates of a multiple plate drier, which consists in raising the sheet vertically to the level of the space, in thrusting the sheet into the space while supporting it from above free from contact with the plates and in dropping the sheet upon the lower plate.

94. The method of inserting a sheet into the space between two plates of a multiple plate horizontal drier, which consists in vertically shifting the sheet to the level of the space, in pressing the sheet upward, in thrusting the sheet into the space while supporting it from above and in dropping the sheet upon the lower plate.

95. The method of inserting a sheet into the space between two plates of a multiple plate horizontal drier, which consists in securing a vacuum-tight contact with the surface of the sheet, in vertically shifting the sheet to the level of the space without regard to time relation to the assumption of the vacuum contact; in thrusting the sheet into the space while supporting it from above and in dropping the sheet upon the lower plate.

96. The method of inserting a sheet in the space between two plates of a multiple plate drier, which consists in charging the sheet while supporting it from above and in concurrently withdrawing from the space a sheet dried during a previous cycle.

97. The method of inserting a sheet into the space between two plates of a multiple plate horizontal drier, which consists in charging the sheet into the space while supporting it from above and in pushing out ahead of the entering sheet a sheet dried during a previous cycle.

98. In the operation of a wet machine and drier press having a smooth dryer plate, the art which consists in transporting the formed sheet free from sliding contact with engaging surfaces at all times until the sheet is dried, thus avoiding injury to the surface of the fragile sheet by rubbing, in depositing the sheet directly in contact with the smooth top surface of the dryer plate and in firmly holding the sheet between adjoining plates during drying.

99. In combination, a multiple plate horizontal drier, a suction plate charger for the drier, means for vertically shifting the charger, means for moving the charger into a space between two plates, means for discharging a dried sheet from the space and means for receiving the dried sheet.

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