

March 28, 1933.

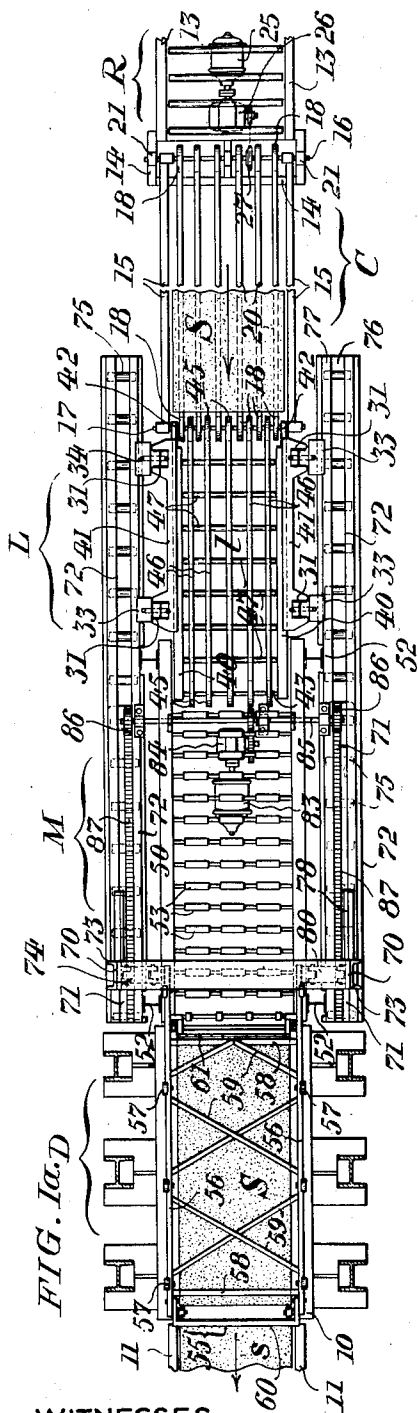
F. S. FARLEY

1,903,102

FIBER BOARD MANUFACTURE AND APPARATUS THEREFOR

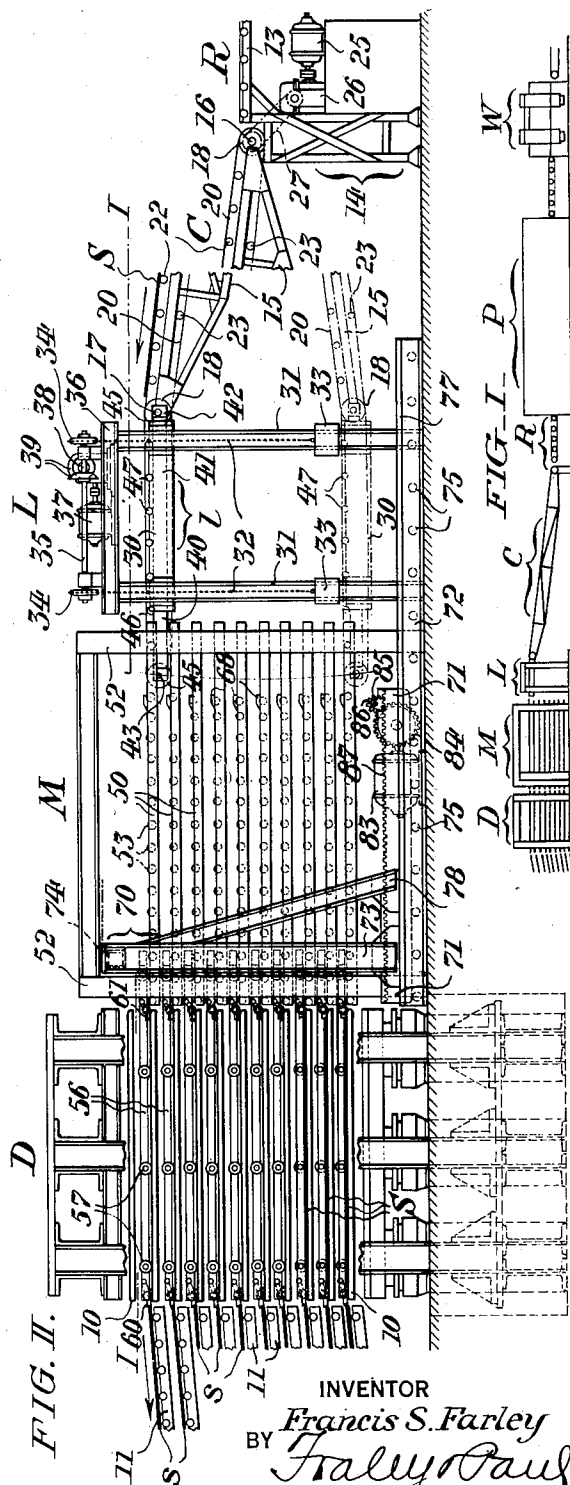
Filed Oct. 31, 1930

2 Sheets-Sheet 1



WITNESSES

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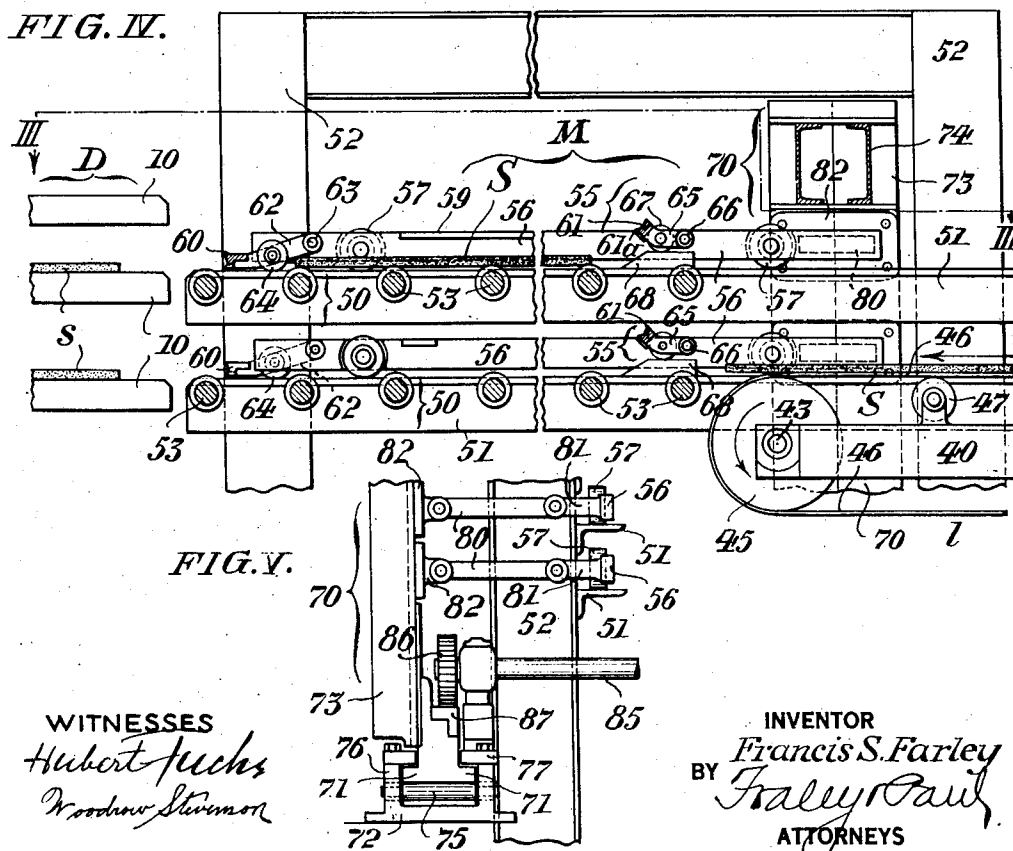
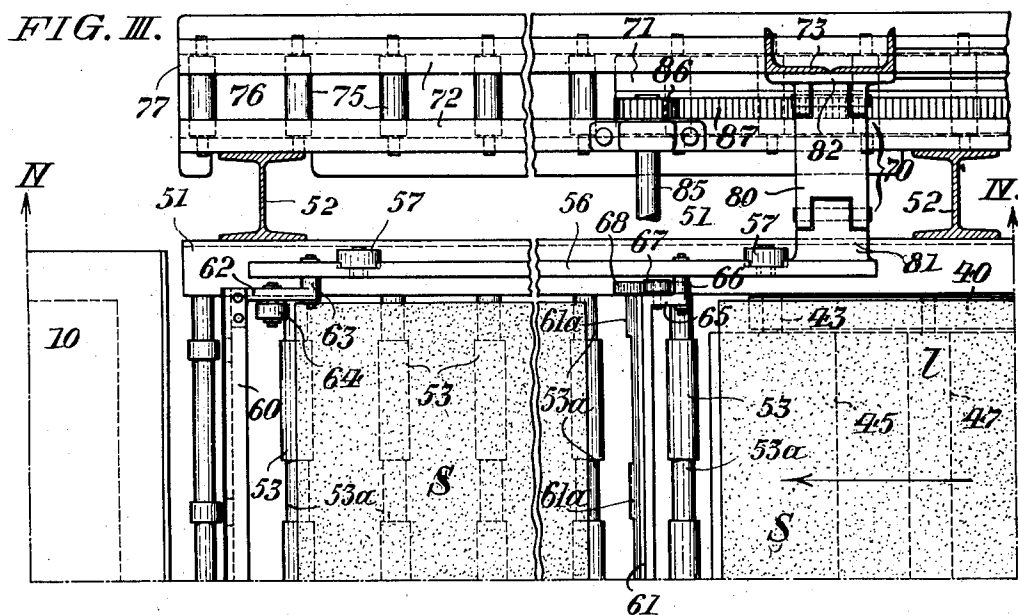
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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

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FIBER BOARD MANUFACTURE AND APPARATUS THEREFOR

Application filed October 31, 1930. Serial No. 492,474.

My invention relates to fiber board manufacture and apparatus therefor, including the charging of multiplate driers with fiber pulp sheets that are to be converted into fiber board. In suitable forms of embodiment, such as hereinafter described, my invention affords a means of handling the rather delicate sheets safely and rapidly, and also keeping the drier in almost continual operation, with minimum idleness for discharge and recharging. How these and other advantages can be realized will appear from my description of a selected and preferred form of embodiment.

Raw fiber pulp sheets may be formed in a wet machine of a "press" type, or in any other type of machine suitable for forming such sheets. From the press machine, the sheets issue with a moisture content of about 65% to 70% by weight, more or less, distributed substantially uniformly, so that they are exceedingly frail and difficult to handle.

In my preferred process, therefore, I harden or strengthen these raw sheets somewhat, at least superficially, before attempting to introduce them into a plate drier. This hardening is best effected by skin drying the sheets, for which purpose I prefer to pass the sheets through a roll type of air drier. By thus greatly reducing the moisture in the outer layers of a sheet while leaving its interior comparatively unaffected, it is given a degree of strength (and even stiffness) sufficient for easy handling, without reducing its total water content below about 30% to 50%; whereas if it were dried uniformly, a much greater total reduction of moisture content would be required. At the same time, the reduction of the moisture content in the skin-drying operation is sufficient to reduce materially the heat and time required for treatment of a batch of sheets in the plate drier. This is doubly advantageous, inasmuch as several driers are still required to deal with the sheets from a single wet machine.

Under the heat of the plate drier, the moisture content of a sheet is further reduced and redistributed uniformly and the sheet is converted into a strong, coherent board, of any density and surface smoothness desired.

In the drawings, Fig. I is a schematic side elevation of a fiber board plant adapted for the purposes of my invention.

Fig. Ia is a plan view of a drier and loader installation conveniently embodying my present invention, with certain upper portions above the line Ia—Ia in Fig. II broken away and removed.

Fig. II is a corresponding side elevation.

Fig. III is a fragmentary plan view of certain parts and mechanisms, on a larger scale than Figs. I and II, with certain parts in horizontal section on the line III—III in Fig. IV.

Fig. IV shows a vertical section through the portions of the machine illustrated in Fig. III, taken as indicated by the line IV—IV in Fig. III.

Fig. V is a fragmentary end view of certain parts at one side of the loader, from the left of Fig. III.

Fig. I illustrates diagrammatically a plant comprising a wet machine W for forming raw pulp sheets, an air drier P for roll type in which the raw sheets are skin-dried and hardened, and conveying rolls R on which the partly dried sheets S are successively received from the preliminary drier P, and over which they travel (to the left), at one level and, in general, at spaced intervals. Near the left of Fig. I is shown a plate drier D in which the sheets are further dried and consolidated. These several instrumentalities may be of any suitable known commercial types and construction. In connection with these instrumentalities is also shown my loader C—L—M.

As shown in Figs. I and Ia, the drier D consists of a vertical stack of steam-heated plates 10. The dried D is shown "opened": i. e., its plates 10 are separated to receive between them a charge of fiber sheets S, to be dried as well as for the ejection or discharge of finished boards s produced from a previous batch of sheets. As indicated in Fig. Ia, the ejected boards s pass off to the left on to sloping roll-racks 11, down which they may travel by gravity. The roll-racks 11 are spaced apart at vertical intervals corresponding to those of the drier plates 10 when the drier is "opened" as shown.

In practice, the sheets to be dried, arriving or supplied in succession at the right by any suitable means such as the horizontal set of rolls R, pass over conveyor and elevator means C—L into a "magazine" M (as it may be termed), where they are successively received and accumulated, at levels corresponding to the plates 10 of drier D when "open". The conveyor or elevator means C—L serves to take care of the varying differences in level between the supply rolls R and the levels in the magazine M that receive sheets S from time to time. When all the levels in the magazine M have thus been charged with sheets S, the latter are concurrently delivered and introduced from the magazine M into the drier D, as hereinafter explained. At the same time, the finished boards *s* in the drier D are discharged, as already indicated, onto the delivery roll-racks 11.

Thus, it will be seen, the drier plate intervals are all charged (and discharged) simultaneously, so that the "idle" periods during which the drier must be open are reduced to a minimum. Moreover, the charging of the magazine M goes on even while the drier D is "closed" drying a batch of sheets S, so that the drier never has to wait on the accumulation of a full charge in the magazine.

Still referring to Figs. Ia and II, it will be seen that the supply rolls are mounted between horizontal frame members 13 which are supported at one end by a pedestal frame structure 14, on which one end of the conveyor C is also mounted. This conveyor C comprises a frame 15 including longitudinal members of trussed construction, with transverse shafts 16, 17 mounted in bearings at their ends, and carrying pulleys 18 for belts 20. The right-hand shaft 16 is also mounted in bearings 21 on the pedestal 14; and thus the conveyor C and its frame 15 are pivoted at this end with freedom to swing up and down about the shaft 16 as an axis. Intermediate idle rolls or pulleys 22 may be mounted on the frame 15 to support the upper runs of the belts 20 that carry the fiber sheets S, and idle rolls or pulleys 23 may likewise be provided above the lower runs of the belts, to keep them taut. The conveyor C may be driven from any suitable source of power, such as an electric motor 25 connected to the shaft 16 through reduction gearing 26 and a sprocket chain or belt drive 27.

The elevator L raises and lowers the left-hand end of the conveyor C to serve the various levels of the magazine M, and in the present instance also includes a horizontal conveyor 1 to assure proper introduction of the sheets S into the magazine M notwithstanding the varying slope of the conveyor C. The elevator L comprises a vertically movable platform or frame structure 30 guided by uprights 31, and raised and lowered by counterweighted sprocket chains 32

(one at each corner of the frame 30) passing to counterweights 33 over sprockets 34 on horizontal shafts 35 mounted on a superstructure 36 supported by the uprights 31. The shafts 35 may be driven by a reversible electric motor 37 mounted on the super-structure 36 and geared to a cross-shaft 38, which is connected by bevel gearing 39 to the shafts 35.

The conveyor 1 has a frame 40 including longitudinals mounted in horizontal ways 41 afforded by the platform 30. The conveyor frame 40 has bearings 42 at its right hand end for the shaft 17 of the conveyor C, and a transverse shaft 43 is mounted in bearings at the left-hand end of the frame 40. The shafts 17, 43 have corresponding pulleys 45 for conveyor belts 46, and intermediate idle rolls 47 are mounted on the frame 40 to support the upper runs of the belts 46.

It will be seen, therefore, that the conveyor C and its frame 15 are hinged or pivoted to the conveyor 1 and its frame 40 by the shaft 17, to accommodate the angular variation of the conveyor C as the elevator L rises and descends. The frame 40 shifts or slides horizontally in the ways 41 as required by the angular variation of the conveyor C.

Referring, now, to Figs. III and IV as well as to Figs. Ia and II, it will be seen that the magazine M comprises a vertical series of horizontal roll-racks 50 corresponding to the plates 10 of the drier D when open. Each rack 50 comprises angle-bar side members 51 (see also Fig. V) whose vertical flanges are attached to the uprights of the magazine frame 52, and a set of transverse idle rolls 53 whose ends are rotatably mounted in or on the vertical flanges of said angle-bars 51, beneath their inward-extending horizontal flanges. The rolls 53 are grooved or reduced in diameter at intervals in their length, as shown at 53a. As the top runs of the belts 46 of the conveyor 1 are level with the tops of a set of the rolls 53, a sheet S is propelled forward by the conveyor L on to these rolls 53, travelling forward on them under its own momentum clear off of the belts 46. Thus each set of rolls 53 is in turn "charged" with a sheet S, till the magazine M is full.

Any suitable means may be employed for transferring and introducing the sheets S from the magazine M into the drier D, as well as for discharging the previously dried boards *s* from the drier D to make room for the sheets. As here shown, this is done by a multiplicity of pushers 55, one for each magazine level or roll-rack 50. Each pusher 55 is shown as comprising a pair of side bars 56, 56 arranged to travel along the tracks afforded by the horizontal flanges of the rack sides 51, and preferably provided with anti-friction rollers 57 to run on the rack sides 51 and on the drier plates 10. These side bars 56, 56 are connected by cross-bars 58 and

diagonals 59 (Fig. 1a), so as to form a horizontally rigid but light frame. Between the side bars 56, 56 extend two transverse pusher-bars 60, 61, the front one 60 for pushing the previously formed board *s* out of the drier D, and the rear one 61 for pushing the sheet S from the magazine M into the drier. The front edges of these pusher-bars 60, 61 are shown obtusely hollowed (Fig. IV), to engage the board and sheet edges more securely. The front bar 60 is mounted on arms 62 which are pivoted to the side bars 56 at 63, and are provided with anti-friction rollers 64 for riding on the drier plates 10. The rear bar 61 is mounted on arms 65 which are pivoted to the side bars 56 at 66, and are provided with anti-friction rollers 67 for riding on the rack sides 51 and on the drier plates 10. This bar 61 has on its bottom "finger" members 61a that project forward from its front edge below the edge of a sheet S resting on the rolls 53 (being accommodated in the clearances afforded by the roll-grooves 53a), so as to take under the edge of the sheet S and give the bar a better hold on it. However, when the pusher is withdrawn entirely from the drier D into the magazine M, as shown in Fig. IV, the pusher bar 61 is lifted up out of the way by cam blocks 68 fixed to the rack sides 51, in the path of the rollers 67 as the bar 61 approaches the end of its return movement, so as to allow a sheet S from the conveyor 1 to ride under the bar 61 on the rolls 53 to the full-line position shown in Fig. IV.

The pushers 55 may be operated concurrently by any suitable means, here shown as a carriage 70 straddling the whole set of roll-racks 50. This carriage 70 comprises a pair of longitudinals 71, 71 that travel on tracks 72, 72 at each side of the machine, and a yoke formed by uprights 73, 73 fixed to the longitudinals 71, 71 at their lower ends, and interconnected at their upper ends by a horizontal 74. Each track 72 is shown (Fig. V) as consisting of anti-friction rolls 75 mounted in a channel 76 with removable overhanging margins 77, and the longitudinal 71 is shown as of inverted T-section with the T-head resting on the rolls and under-running the margins 77. A diagonal 78 (Fig. II) braces each upright 73 to its longitudinal 71. Each pusher side-bar 56 is connected to the corresponding upright 73, with some freedom for relative vertical play, by means of a flat link 80 (Figs. III and V) which has one end pivoted to a lug 81 on the bar 56 that projects outward between the rack sides 51, and has its other end pivoted between lugs on a foot 82 attached to the upright 73.

The carriage 70 and the pushers 55 may be reciprocated by any suitable means, such as a reversible electric motor 83 (Figs. 1a and II) connected through reduction gearing 84 to a transverse drive shaft 85 mounted

in stationary bearings on the frame of the machine. This shaft 85 has gears 86, 86 that mesh with racks 87 on the upper edges of the longitudinals 71, 71.

In operation, fiber sheets S (containing, usually, about 30-50% moisture) are supplied at short intervals over the rolls R, and are brought successively to the magazine M by the conveyor C, supplemented by the conveyor 1. As each sheet S approaches, the elevator L is operated to bring the conveyor 1 (and the corresponding end of the conveyor C) to the level of one of the roll-racks 50 of the magazine M, and the sheet S is thus run on to this roll-rack, as already explained. When the magazine M has been fully charged, the motor 83 is started, and the pushers 55 are thereby advanced to the left concurrently. As each pusher 55 starts its travel, its bar 61 is let down from the position of Fig. IV on to the rack sides 51, so as to strike the sheet S on the corresponding set of rolls and push it into the drier D. As the pusher bar 60 passes from the rack sides 51 on to the drier plate 10, its rollers 64 reach the slight interval or clearance (Figs. III and IV) between the parts 51 and 10 and drop thereinto, allowing the bar 60 to scrape against the plate 10 as it reaches the edge of the dried board *s* thereon and push under the board edge slightly. Directly after, the rollers 64 ride up on to the plate 10, thus lifting the board edge and breaking its adhesion to the drier plate, so that it may be easily pushed off into the corresponding delivery roll-rack 11. When the pusher bar 60 over-travels the far edge of the drier plate 10 slightly, as shown in Figs. I and II, the motor 83 is reversed, and the carriage 70 and pushers 55 are returned to the positions shown in Figs. III and IV. During the return of the pushers 55, the pusher bar 60 will rise and ride back over sheets S that have just been introduced into the drier without any difficulty, on its roller 64. As the pushers 55 are completely withdrawn from the drier D, the latter is closed on its charge of sheets S. The charging of the magazine M is then completed again as before, and so on indefinitely.

The system above described has important advantages over installations now in general use, in that it produces boards of better quality, minimizing "seconds" and loss by breakage.

In present practice, raw, wet formed sheets (with a moisture content as high as 70-80%) are conveyed and introduced directly into a multiplate drier D by means of travelling wires, without any preliminary drying or reduction of their moisture content. Such raw sheets, however, are exceedingly frail, so that they break, skin, and crumb very readily. As there is no way of getting rid of loose crumbs, these crumbs are scattered

between the sheets and the drier plates 10 and pressed into the dried sheets, which are thus rendered defective, since such crumbs do not become permanently incorporated in the dried sheets. Moreover, the rolls and driving mechanism for the travelling wires are necessarily frail and subject to derangement, because of the small space available between the drier plates 10.

10 In my system, however, the sheets S are hardened before they are handled much, and there are no travelling wires. Thus breakage, skinning, and crumbing are very largely avoided, both before the sheets reach the drier D and in it; since by the time the sheets enter the magazine M and the drier D, they are hard enough to slide on the drier plates 10 without crumbling. Accordingly, a greater yield of first class board is obtained.

20 Having thus described my invention, I claim:—

1. An improvement in the manufacture of fiber board from raw fiber pulp sheets produced in succession and treated in batches in a multi-plate drier; which improvement comprises skin-drying and thereby hardening the raw sheets sufficiently to stiffen them for handling, and thereafter introducing the hardened sheets into the multi-plate drier.

30 2. Apparatus for the manufacture of fiber board from raw fiber pulp sheets by treatment in a plate drier; comprising means for skin-drying and thus hardening the raw sheets; means for accumulating a plurality of the thus hardened sheets in superposition; and means for concurrently introducing them between the drier plates, thereby pushing out the preceding batch of sheets.

40 3. The combination of means for successively forming raw fiber pulp sheets and for skin-drying and thereby hardening them, while still leaving them internally moist, a magazine for accumulating the skin-dried internally-moist sheets, a multi-plate drier 45 for receiving the accumulated sheets from the magazine and means for transferring the succession of sheets from the first-mentioned drying means into the magazine and for transferring the accumulated batch of sheets 50 from the magazine into the multi-plate drier.

55 4. The combination with a multiplate drier of a magazine with a multiplicity of levels corresponding to the drier plates for receiving sheets to be treated, means for forming fiber pulp sheets and for skin-drying them, means for transmitting and introducing the skin-dried sheets successively into the various levels of the magazine, and means for concurrently introducing the batch of sheets from 60 said magazine directly into the plate drier and pushing the preceding batch of sheets out.

65 5. The combination with a multiplate drier of a magazine with a multiplicity of levels corresponding to the drier plates for accumu-

lating fiber pulp sheets to be treated, and means in the magazine movable into the drier for transferring the accumulated fiber pulp sheets from the magazine to the drier and concurrently ejecting the preceding batch of 70 sheets.

6. The combination with a multiplate drier of a magazine with a multiplicity of levels corresponding to the drier plates for accumulating fiber pulp sheets to be treated, and 75 pushers in said magazine levers reciprocating between the same and the drier for concurrently pushing the accumulated fiber pulp sheets from the magazine directly into the drier and also pushing the previous batch of 80 sheets out of the drier ahead of the entering ones.

7. The combination with a multiplate drier of a magazine with a multiplicity of levels corresponding to the drier plates for accumulating fiber pulp sheets to be treated, for concurrent transfer to the drier; and means in the magazine movable into the drier to eject a preceding batch of sheets to make room for 90 the entering batch.

8. A drier loader of the character described comprising means for supplying sheets to be dried at one level; a conveyor with one end mounted at the height of said supplying means, and the other end shiftable up and 95 down to deliver sheets at various levels; a series of idle-roll racks at levels corresponding to the drier plates, for receiving sheets from said conveyor means; and means for concurrently advancing the sheets from the racks directly into the drier. 100

9. A drier loader of the character described comprising means for supplying sheets to be dried at one level; belt conveyor means with one end mounted at the height of said supplying means, and the other end shiftable up and 105 down to deliver sheets at various levels; a series of idle-roll racks at levels corresponding to the drier plates, for receiving sheets from said conveyor means; a carriage reciprocating alongside said racks, and pushers between said racks actuated by said carriage, for concurrently advancing the sheets from the racks into the drier. 110

10. A drier loader of the character described comprising means for supplying successive sheets to be dried at one level; a conveyor comprising a fixed shaft in proximity to said means and a vertically shiftable shaft remote therefrom, a frame interconnecting 120 and pivoted on said shafts, and belt means travelling around them; a vertically moving elevator comprising horizontal ways, a conveyor shiftable to and fro in said ways including a frame with bearings at one end thereof for the aforesaid vertically shiftable shaft, a shaft in bearings at the other end of said frame, and belt means travelling around 125 said shafts; a series of horizontal sets of idle rolls at levels corresponding to the plate 130

intervals of the drier, for receiving sheets
from the elevator conveyor when the latter is
brought to the corresponding levels; and re-
ciprocating means for concurrently advanc-
5 ing the sheets from the several sets of rolls
into the drier plate intervals.

In testimony whereof, I have hereunto
signed my name at Trenton, in the county of
Mercer and State of New Jersey, this 29th
10 day of October, 1930.

FRANCIS S. FARLEY.

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