

May 15, 1945.

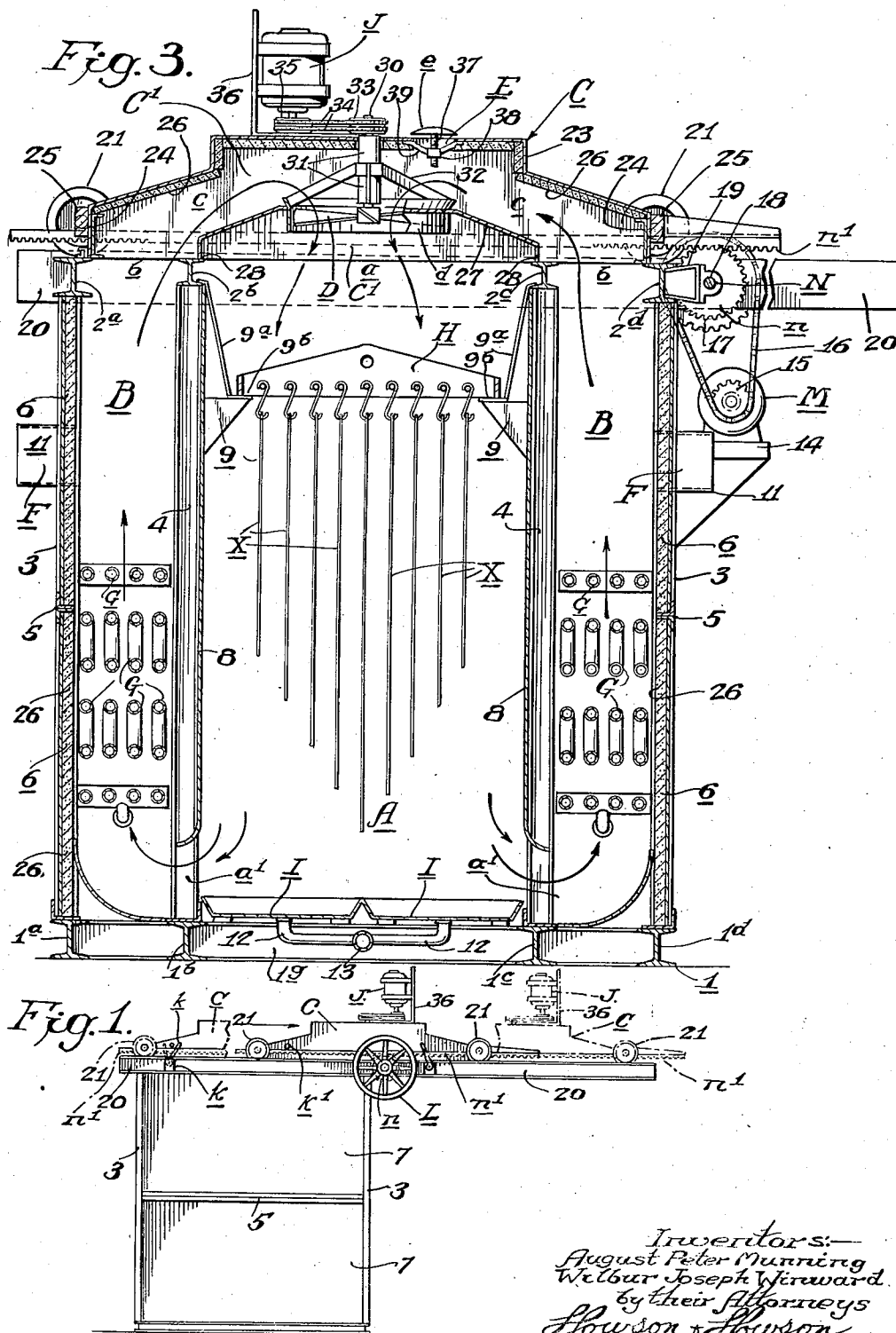
A. P. MUNNING ET AL

2,376,174

DRIER

Filed Aug. 26, 1942

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

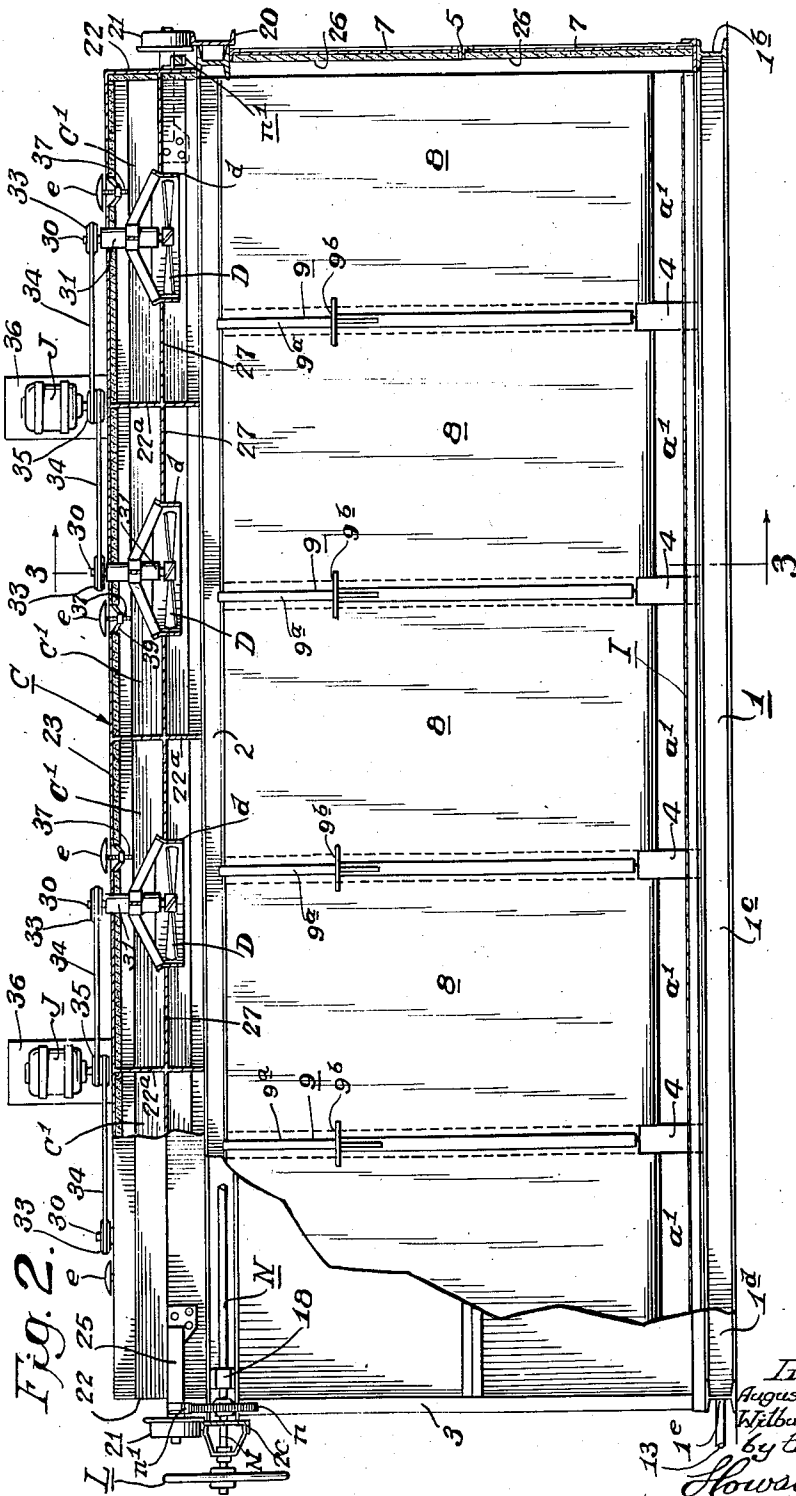


Fig. 2.

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UNITED STATES PATENT OFFICE

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DRIER

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2 Claims. (Cl. 34—87)

This invention relates to a drier for plate, sheet, strip, and similar materials, and for articles of various kinds adapted to be suspended from overhead supports during drying thereof.

The drier of the present invention is of the "well" type, as distinguished from tunnel and other driers, i. e., the drier of the present invention includes a drying chamber which is closed at its bottom, sides and ends, and is open solely at its top to receive racks or other overhead supports from which the units to be dried are suspended within the drying chamber.

The drier also includes a laterally shiftable cover for closing the open top of the drying chamber, and the cover carries impellers for circulating a drying or other gaseous conditioning medium through the drying chamber around the articles hanging therein.

Another feature of the present invention resides in the provision of means for automatically stopping the impellers when the cover of the drying chamber is shifted laterally, in uncovering the top of the drying chamber, and for restarting the impellers when the cover is replaced in proper alignment with the drying chamber.

The device is particularly adaptable for drying metal plates which have been cleansed by a liquid agent prior to being plated with nickel, chromium, etc., or prior to enameling, etc. The drier is also adapted for drying any coating which may be applied to plates, strips, or other articles.

Referring to the accompanying drawings:

Fig. 1 is an end view of the drier showing the cover in the course of being shifted laterally to expose the open top of the drying chamber;

Fig. 2 is a longitudinal sectional elevation of the drier showing the shiftable cover in position closing the open top of the drying chamber; and

Fig. 3 is a transverse sectional elevation taken on the line 3—3, Fig. 2.

Primarily, the drier comprises a centrally located and preferably longitudinally elongated drying chamber A, a circulating chamber B at each side of and extending parallel to the drying chamber A, and a laterally shiftable hollow roof or cover C which normally overlies the otherwise open tops *a* and *b*, of the drying chamber A and circulating chambers B, B, respectively.

The laterally shiftable cover C carries a plurality of impellers D, by which air or other gaseous conditioning medium is circulated from the interior of the hollow cover C downwardly into and through the drying chamber A, and by which the air is caused to flow laterally from the lower portion of the drying chamber through ports *a*¹,

*a*¹ into the lower portions of the circulating chambers B, B, thence upwardly through said circulating chambers and through the open tops *b*, *b* thereof into channels *c*, *c* formed in the hollow cover C, for return of the gaseous medium to annular housings *d*, *d*, in which the impellers D, D respectively rotate, whereby the circulation of the medium is accelerated through the upper open top *a* of the drying chamber A, for a repeat of the cycle.

Fresh air is continuously admitted, in regulated volume, to the hollow cover C through ports E, E which are located above the impellers D, D, respectively, regulation of the flow being controlled by adjustable disk valves *e*, *e*, in the present instance. Substantially corresponding volumes of saturated air are continuously permitted to escape from the circulating system through ports F, F in the outside side walls of the circulating chambers B, B, respectively.

The air in circulation is heated to a desired temperature by steam coils G, G, or equivalent heating units respectively located in the circulating chambers B, B.

Plates, sheets or other units X, X, which are to be dried, are suspended within the drying chamber A from suitable racks or other overhead supports H, which are adapted to be located in the upper portion of the drying chamber A near the open top *a* thereof.

The drying medium, as it is driven downwardly through the drying chamber A by the impellers D, entrains excess moisture from the surfaces of the units X, X, and deposits it in suitable pans or trays I, I, which are located in and extend over substantially the full length and width of the lower portion of the drying chamber A. After removing the excess free moisture from the units X, the circulating heated air effects drying of the surfaces of the units, by evaporation of the remaining moisture.

Upon completion of the drying of each charge of the units X, X, hanging in the drying chamber A, the top C is shifted laterally, as shown in Fig. 1, to a position completely exposing the open top *a* of the drying chamber A, after which the supports H, H, and the units respectively supported thereby, are raised in and removed from the drying chamber A, through the open top *a* thereof. After a new charge of units has been placed in the chamber A, through the open top *a* thereof, the cover C is shifted back into position, with the impeller housings *d*, *d* in alignment with the median vertical plane of the chamber A, and with the air passages *c*, *c* of said cover aligned

with the open tops *b, b* of the circulating chambers *B, B*, respectively.

The impellers *D, D* may be collectively or independently driven by any suitable mechanism, preferably by electric motors *J, J* mounted on the removable cover *C*. In order to stop and start the impellers *D*, any suitable system of electric control for the motors *J* may be provided.

Preferably the electric circuit for the motors *J* will include a switch *K* which is provided with an operating arm *k* suitably biased to open the circuit when the cover *C* is shifted in the direction of the arrow, Fig. 1, whereby rotation of the impellers *D* will be stopped immediately upon movement of the center of the cover *C* out of alignment with the center of the drying chamber *A*. As the cover *C* is replaced, by movement in the opposite direction, bringing the cover *C* into realignment with the drying chamber *A*, a suitable trip *k'*, carried by the cover *C*, is adapted to engage the switch lever *k* and effect reclosing of the circuit to the motors *J*, whereupon rotation of the impellers *D* will begin as soon as the cover has attained its normal position covering the top of the drying chamber *A*. Obviously, any suitable manually operated switch may be included in the motor circuit to effect starting and stopping of the impellers *D* as desired.

Lateral shifting of the cover *C* may be effected manually, by operation of a hand wheel *L*, Fig. 1, or by operation of an electric motor *M*, Fig. 3, each of which is adapted to effect rotation of a shaft *N*. The shaft *N*, through gears *n* secured to said shaft and which mesh with gear racks *n'* carried by the cover *C*, effects horizontal lateral movement of the cover *C* as a whole.

The drier may be of any desired construction and, in the present instance, includes a bottom frame *1* which is composed of longitudinal beams *1a, 1b, 1c* and *1d* connected by transverse end beams *1e* and *1f* and transverse intermediate beams *1g*.

The drier also includes a top frame *2*, which comprises longitudinal beams *2a, 2b, 2c* and *2d*, which are respectively aligned with the beams *1a, 1b, 1c* and *1d* of the bottom frame *1*.

The bottom frame *1* and top frame *2* are connected by uprights *3, 3* and *4, 4*. The uprights *3, 3* connect the outermost of the horizontal longitudinal beams *1a, 2a, 1d* and *2d*, while the uprights *4, 4* connect the longitudinal horizontal beams *1b, 2b, 1c* and *2c*. The outside uprights *3, 3* are connected by intermediate horizontal members *5, 5*, which together with the uprights *3, 3* support wall panels *6, 6*. The panels *6, 6* constitute the outer side walls of the drier. As shown in Fig. 1, the opposite ends of the drier are respectively closed by similar wall panels *7, 7* supported by the end uprights *3, 3* and a transversely extending intermediate cross bar corresponding to the intermediate members *5, supra*.

Transversely of the drier, the drying chamber *A* is defined by longitudinal partitions *8, 8* which are supported by the uprights *4, 4*, and which extend from the longitudinal beams *2b, 2c*, of the upper frame *2*, to a level spaced above the beams *1b* and *1c* of the bottom frame *1*, thus providing the air ports *a'*, *a'* in the lower part of the chamber *A*.

Secured to the uprights *4, 4* are brackets *9, 9* which extend laterally from said uprights into the drying chamber *A*, for supporting a work-supporting rack *H*, said brackets *9* including downwardly converging portions *9a* which function as guides for substantially centering the

racks *H* in the drying chamber *A* as said racks are lowered into position on the supporting shoulders *9b* of the brackets *9*.

As shown in Fig. 3, the exhaust ports *F, F* are formed in the uppermost of the panels *6, 6*, and discharge into horizontal conduits *11, 11* by which the moist air is conducted away from the drier.

The drip pans *I, I*, as shown in Fig. 3, are adapted to rest on the intermediate transverse beams *1g* forming part of the bottom frame *1*. These pans are connected by lateral pipes *12, 12* to a main drain *13* extending longitudinally of the drier and supported by the transverse beams *1g*, by which the free moisture removed from the articles *X* is conveyed away from the drier.

The motor *M*, by which lateral shifting of the cover *C* is accomplished, is mounted on a suitable frame *14* which, in the present instance, is carried by the uprights *3, 3* adjacent one end of the drier. The shaft of the motor *M* is provided with a suitable sprocket wheel or pulley *15*, which is connected by a sprocket chain or belt *16* to a sprocket wheel or pulley *17* secured to one end of the shaft *N*. The shaft *N* is supported in bearings *18* which are carried by brackets *19* secured to the longitudinal beam *2d* of the upper frame *2* of the drier.

The upper frame *2* includes transverse girders *20, 20* at opposite ends respectively of the drier, which function as rails for flanged wheels *21, 21*, by which the cover *C* is supported for its lateral shifting movement. As shown in Fig. 1, the beams *20, 20* overhang the drier, at one side thereof, to provide for shifting of the cover *C* to its extreme broken line position, shown in Fig. 1, wherein the cover is clear of the drying chamber *A* and the circulating chambers *B, B*.

As shown in Fig. 2, the cover *C* comprises an outer shell which includes end plates *22, 22*, and a top and side plate *23*. The cover *C* also includes intermediate transversely extending partitions *22a, 22a*, by which the interior of the cover *C* is divided into a plurality of compartments *C'*. These compartments *C'* respectively house the impellers *D, D*. The opposite longitudinally extending side walls formed by the plate *23* which extend from end to end of the cover are reinforced by longitudinal stringers *24, 24* to which stationary axles *25, 25* for the wheels *21, 21* are rigidly secured, at the opposite ends respectively of the cover.

The cover *C*, throughout, is provided with heat insulating material *26*, similar in character to that with which the side panels *6, 6* and end panels *7, 7* are also provided.

Intermediate the end plates *22, 22* and the transverse plates *22a, 22a*, within each of the compartments *C'*, *C'* the cover *C* is provided with a bridge sheet *27* which supports the housing *d* for the impeller *D*, of that compartment, centrally thereof. The bridge sheet *27* of each compartment *C'* separates a central portion *c'* of each compartment of the cover, which overlies the drying chamber *A*, from the channels *c, c* of the cover, which communicate with the upper open ends *b, b* of the circulating compartments *B, B* respectively. The lower edges *28, 28*, of the bridge sheets *27*, align with the longitudinal beams *2b* and *2c* to complete the separation of the central and side portions *c, c*, and *c'* of the interior of the cover *C*.

The impellers *D* are mounted on the lower ends of vertical shafts *30, 30*, which are rotatably supported in bearings *31* carried by spider brackets

32 supported by the annular housings *d* of the impellers D. The upper ends of the impeller shafts 30 are respectively provided with pulleys 33 which are connected by belts 34 to pulleys 35 on the shafts of the motors J. The motors J are supported on the top of the cover C by suitable brackets 36.

The valves *e*, by which the flow of fresh air into the drier through the ports E is controlled, are each provided with a threaded stem 37 screwed into a hub 38 of a spider 39 which is located in each of the ports E. Rotation of the valve *e* will effect axial movement thereof to and from the outer shell 23 of the cover C, for regulating the amount of air entering the drier.

Obviously the details of construction of the drier may be varied to suit the desires of the designers of the driers, without departing from the spirit of the invention.

The well type of drier, hereinbefore described, lends itself admirably to use in the modern production line methods of industry, where large numbers or batches of plates or other articles are simultaneously processed, with the articles suspended from racks adapted to be raised and lowered and shifted from one position to another along the production line on overhead traveling cranes, etc., to be submerged in various liquids successively, and wherein total or partial drying of the articles between dippings and at the end of the line is required. With the present drier incorporated in the production line, handling of the individual units, in drying, is rendered unnecessary.

We claim:

1. A drier comprising a rectangular longitudinally elongated drying chamber and at least one rectangular longitudinally elongated circulating chamber parallel thereto said chambers being open exclusively at their respective tops over substantially the entire horizontal areas of said chambers, a rectangular longitudinally elongated displaceable cover normally closing said open tops of said chambers, said cover including a rectangular longitudinally elongated bridge element spanning the open top of said drying chamber and dividing the interior of said cover into a compartment communicating with said

drying chamber and a channel communicating with said circulating chamber, an impeller rotatably mounted in an opening formed in said bridge element for effecting circulation of a gaseous medium through said opening between said channel and said compartment, transversely extending rails projecting laterally beyond one side of said drier for supporting said cover for lateral horizontal movement from its drier closing position to a position exposing the open top of the drying chamber, and means for shifting said cover horizontally along said rails, out of and into covering relation with respect to the open tops of said chambers.

2. A drier comprising a rectangular longitudinally elongated drying chamber and at least one rectangular longitudinally elongated circulating chamber parallel thereto said chambers being open exclusively at their respective tops over substantially the entire horizontal areas of said chambers, a rectangular longitudinally elongated displaceable cover normally closing said open tops of said chambers, said cover including a rectangular longitudinally elongated bridge element spanning the open top of said drying chamber and dividing the interior of said cover into a compartment communicating with said drying chamber and a channel communicating with said circulating chamber, an impeller rotatably mounted in an opening formed in said bridge element for effecting circulation of a gaseous medium through said opening between said channel and said compartment, transversely extending rails projecting laterally beyond one side of said drier for supporting said cover for lateral horizontal movement from its drier closing position to a position exposing the open top of the drying chamber, means for shifting said cover horizontally along said rails out of and into covering relation with respect to the open tops of said chambers, and means automatically controlled by said cover in shifting for stopping and starting rotation of said impeller in accordance with the uncovering and recovering movements of said cover.

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