2 Sheets—Sheet 1

C. WHEALEN & L. KNERR, Jr.

Machinery for Making Paper-Boards.

No. 203,684. Patented May 14, 1878.

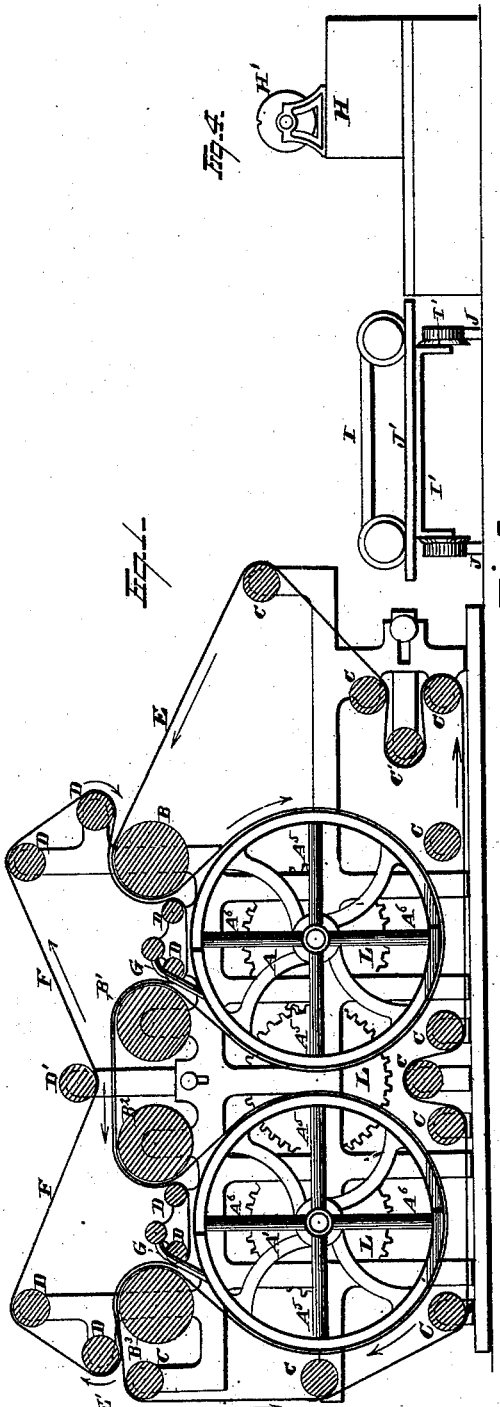

Fig. 1.

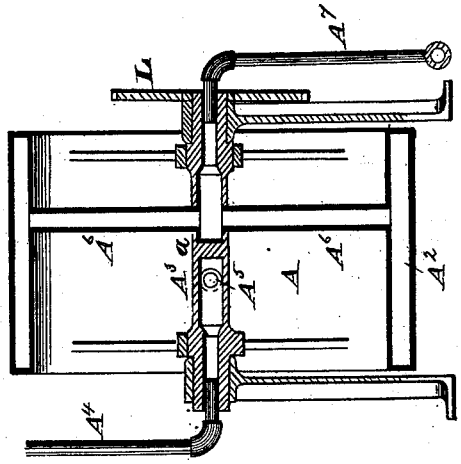

Fig. 3.

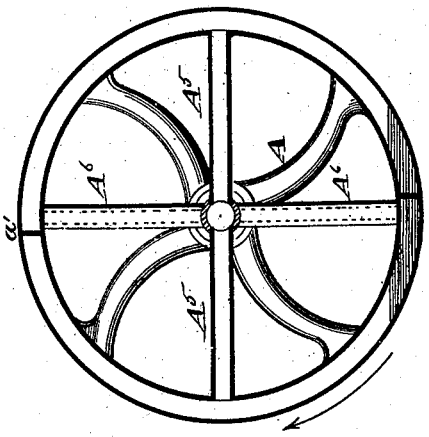

Fig. 2.

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2 Sheets—Sheet 2.

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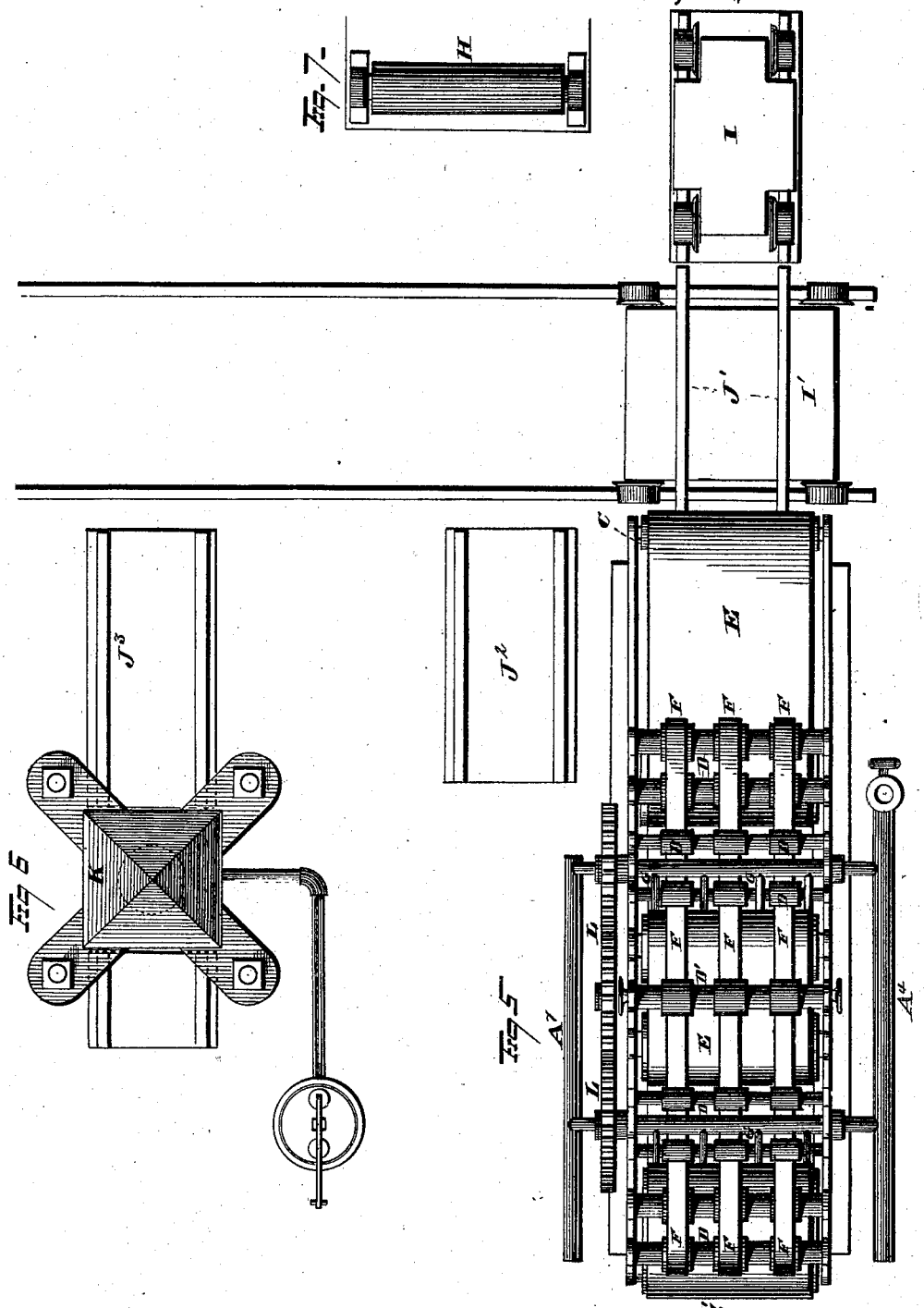

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UNITED STATES PATENT OFFICE.

CHARLES WHEALEN AND LEWIS KNERR, JR., OF DAYTON, OHIO.

IMPROVEMENT IN MACHINERY FOR MAKING PAPER BOARDS.

Specification forming part of Letters Patent No. **203,684**, dated May 14, 1878; application filed April 9, 1878.

To all whom it may concern:

Be it known that we, CHARLES WHEALEN and LEWIS KNERR, Jr., of Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Process and Machinery for Making Paper Boards; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification.

This invention relates to new and useful improvements in the process of making paper boards, and in machinery by which the process is carried into effect.

Heretofore, in the manufacture of paper boards from straw or other fibrous material, it has been customary, after the sheet has been taken from the forming mechanism, to dry the separate boards by spreading them upon the ground under the action of the sun, or by laying them upon frames and submitting them to heat from steam-pipes, or by spreading them upon the surfaces of hollow plates through which steam is passed. So, also, paper has been formed into a thick sheet by the addition of different plies or layers of pulp at different points along its course, the moisture then expressed partially by passing the sheet, at intervals, between rolls, and finally dried by passing in contact with a series of heating or drying cylinders, after which the continuous sheet emerged in dry form ready for market, either in the form of a roll or severed into sheets; but such mechanism was incapable of operating from the start upon separate sheets or boards. Moreover, any process which forms the boards in separate layers, or which at any stage dries or partially dries the board by rolling pressure between rolls, is objectionable, as it gives direction to the fibers or laminations to the structure, and, as a consequence, the strength of the board is not uniform in all directions. For these reasons, among others, it is desirable to adapt the drying mechanism to operate upon successive sheets or boards that may be fed to it, and adapt the whole process so that, as the separate sheets are formed into thick, wet, and pulpy form, they may be preferably piled, retained at the sides, and submitted to direct pressure to eradicate the excess of water and mat and compact the fibers before they are dried.

This invention consists in an improved process of making the paper boards, which process embraces, first, machinery for forming the sheet from the pulp; secondly, a series of movable heating-surfaces, preferably revolving drums, which will take the sheets or boards as they are fed to it successively, and while they are yet moving forward will dry them to any desired degree, and deliver them at the required point in smooth condition and as dry as may be desired; and, thirdly, a suitable press, whereby, as an intermediate step between the forming and the drying, the sheets, as they come from the forming-machine, may be subjected to pressure to remove a portion of their moisture and to compact the texture of the boards. This third step in the process may or may not be employed, but is preferable, and especially so when the boards are delivered in a very wet condition from the forming machinery.

The invention consists, also, in the mechanism employed for drying, which mechanism consists, essentially, in drying-surfaces movable in their nature, adapted to permit the boards to be fed to them continuously at the entrance to the machine, which will carry them continuously forward, dry them while thus moving, and deliver them from the machine as dry as may be desired; also, in the combination of the forming and the drying machinery with or without intermediate pressing mechanism; also, the combination, with the forming and drying mechanism, or the forming, pressing, and drying mechanism, of suitable vehicles and ways whereby the sheets from the forming machinery may be conveyed to the drying machinery direct, or to the press and then to the drying machinery, as may be required.

In the drawings, Figure 1, Sheet 1, is a longitudinal central sectional view of the drying machinery, and also showing at the right the vehicles and ways by which it is connected with the forming machinery shown in Fig 4.

Figs. 2 and 3 are sectional views of one of the heating-drums of the drying mechanism. Fig. 4 is the end of the forming machinery adjacent to the drying mechanism. Fig. 5, Sheet 2, is a plan view of the machinery shown in Fig. 1, with the carriages and ways. Fig. 6 represents an ordinary hydraulic or other press. Fig. 7 is the end of the forming machinery, as shown also in Fig. 4.

The whole of Sheet 2 of the drawings presents the different portions of the machinery necessary for carrying out the process arranged in such manner, with respect to the vehicles and ways, as to enable them to be worked in common.

In the drawings, A and A^1 represent the heating-drums of the drying-machine. These drums are double, or composed of outer and inner shells, between which steam or other heating medium is caused to circulate. B, B^1, B^2, &c., are guide rollers or pulleys, as are also the rollers C and D. C′ and D′ are adjustable rollers, which serve as tighteners to compensate for any slack in the belts or aprons. E is a continuous apron passing around the guide-roller B, thence around drum A over guide-rollers B^1 and B^2, drum A^1, &c., back beneath along the pulleys C and C′ to the place of beginning. F is another continuous apron, or, as shown in the drawings, Fig. 5, it may be a series of belts. This passes, as shown, over the pulleys or rollers B B^1, &c., and back along the pulleys D D′, &c., above to the place of beginning. This latter belt serves simply to hold the paper to the belt E, and to guide it in its passage through the machine. G G are strippers for stripping the paper from the drums A A^1, &c., and directing it upward until caught between the two belts E and F.

The operation of the drying machinery is very simple. The paper resting upon the car I, or in any other convenient form adjacent to the machine, the separate sheets or boards are fed successively upon the apron at the right at E. The machinery having been set in motion, as indicated by the arrows, the sheets are carried forward until caught between the belts E and F on the guide-roller B. Carried around this, it is delivered on the surface of the heated drum A, and is held in contact therewith by the belt E until it is brought near the guide-pulley B^1. The edge of the paper being here released, it comes in contact with the stripper G, which rests on the surface of the roll. This stripper guides the paper up between the aprons or belts E and F on the guide-rollers B^1 and B^2. It passes in the same way around each of the heating-drums A^1, &c., and is finally delivered in smooth and sufficiently dry condition at E′.

It is apparent that the paper can be delivered with no moisture left in it, or it can be left with any desired amount of moisture, dependent altogether upon the speed with which the belt E is caused to move, the degree of heat given to the drums, and the number of heating-drums employed. Thus, with a two-drum machine, such as is shown in the drawings, a drier product could be obtained, either by the same speed with higher heat or by a slower speed and the same heat; and it is apparent, also, that the diameters of the drums determine in a proportionate degree the drying powers of the machine for a given speed. This machine may be much varied without departing from the principles of our invention. Thus the paper might be caused in many ways to travel from the place of feeding to the place of delivery, and in its passage be constantly subjected to a drying heat; but we would have it understood that our invention contemplates, broadly, a drying-machine adapted to receive the boards successively, and continuously bear them forward under the influence of heat, and deliver them at the end of the course in partially or completely dry condition, and preferably in smooth form.

The heating-drums are caused to revolve in the same direction by any suitable gearing—as, for instance, by the spur-gears shown in Figs. 1, 3, and 5, at L.

The drums A A^1, &c., may be of any convenient construction. That shown in the drawing is regarded as simple and efficacious, and is shown more particularly in Figs. 2 and 3, A^2 being a steam-space between inner and outer shells. This space is divided by the partitions *a′*. A^3 is a hollow axle divided by the partition *a*. A^5 and A^6 are the steam supply and exhaust conduits, respectively. A^7 is a drain-pipe to carry off the water of condensation. A^4 is the pipe through which steam is fed to the drum. The course of the steam is as follows: Entering at A^4, thence into the hollow axle, it passes into the steam-space A^2 through the pipes A^5. Here it gives off its heat to the drum, the steam condensing more or less into water. This water of condensation collects in the lower part of the steam-space, and in the further revolution of the wheel, as indicated by the arrow, Fig. 2, this water is carried up by the partition *a′*, and by the time the waste-pipe or exhaust-conduit A^6 has risen to a horizontal level the water has all drained off through the axle and pipe A^7, and the cylinders are therefore kept free of water by the action of its gravity alone, and therefore, by requiring no power for this purpose, there is effected economy of power and steam, and consequently of fuel.

H is any ordinary paper-forming machine, and H′ represents a roller, upon which a sheet may be formed and then stripped off after slitting the fabric along the notch or slot shown at its upper side.

I is a car, upon which the sheets as they are removed may be piled and alternated, if necessary, with felts and plates, as is customary, preparatory to pressing the excess of water from the paper. I′ is a car, provided with tracks J^1 for receiving the car I, and carrying

it along the traversing ways J to the hydraulic or other press K, the car I′ simply serving to bring the car I into proper position to be run off upon either of the tracks J^1, J^2, or J^3. It will be seen by examining sheet 2 of the drawings that the cars I and I′, with their ways, serve to bring the forming-machine H, the press, and the drying-machine all into one co-operative system, so that they may be all worked together and constitute one continuous process, extending from the crude formation of the paper boards until they are delivered at the ends of the drying-machine in merchantable condition. This is effected without wastage, and with the greatest economy of time, space, and labor, and the sheets or boards are delivered in smooth and unwarped condition.

The whole process is briefly as follows: The paper-pulp is formed into sheets on the forming-machine. These sheets are delivered upon the car I. If dry enough for the drying-machine, they may be shifted upon the car I′, and transferred to the station J^2, where they are fed successively to the apron E of the drying-machine. But if too wet and pulpy for the drying-machine, the car I is run off upon the tracks J^3, the excess of water is expressed by the press K, and the material of the paper is at the same time matted and compacted firmly together. The car is then shifted to the tracks J^2 and the boards passed through the drying-machine.

Instead of the cars and ways, other means might be employed as the vehicle for conveying the paper board from the forming-machine to the press and drying-machine—as, for instance, a crane.

The belt E is preferably of such material, open in its nature, as will permit the moisture to escape through it and be evaporated from its surface.

By this process paper boards can be made of uniform quality at all seasons, and their manufacture is not limited to dry and pleasant weather. Accumulation of stock is therefore unnecessary, much handling is avoided, the boards are smooth and even, not liable to warp under changes of the weather, and they do not possess the bleached appearance that injures the market value of paper board.

What we claim is—

1. The process herein described of making straw board or other paper board, consisting of first forming the sheet from pulp by suitable machinery; second, submitting it thereafter to the action of a press; and, third, passing it through a drying-machine, whereby it is sufficiently dried and delivered, substantially as and for the purposes described.

2. In the manufacture of paper boards, a drying-machine consisting of two or more drying-cylinders and two or more continuous belts, adapted to receive the separate boards that are fed to it successively, bear them along in contact with the drying-cylinders, pass the sheets successively from cylinder to cylinder, and finally deliver them sufficiently dried at the exit-point, substantially as described.

3. The within-described means for the manufacture of paper boards, consisting of machinery for forming the sheets from the pulp, a press for expressing the excess of water and for compacting and matting the fibers, a drying-machine for receiving the sheets successively, drying, and delivering them, and an intermediate vehicle for conveying to and supplying the press and drying-machine with the material upon which their functions are to be wrought, the whole constituting a co-operative mechanism whereby the pulp may be formed into sheets, pressed, dried, and delivered in merchantable condition, all at one continuous operation, substantially as and for the purposes described.

4. The machine for drying paper boards, consisting of drying cylinders or drums, with means for maintaining them in a heated state, and a belt or apron adapted to receive the boards successively and carry them forward in contact with the heated drum or cylinders until sufficiently dry, substantially as and for the purposes described.

5. A machine for drying paper boards, consisting of revolving drums and appliances for maintaining them in a heated condition, and, in combination therewith, a continuous apron or belts for receiving successively the boards to be dried, carrying them continuously forward in contact with the heated drums, and delivering the boards from the incline when sufficiently dried, substantially as and for the purposes described.

6. The combination, with the heating-drums, of the belts E and F, with suitable guide-pulleys, substantially as and for the purposes described.

7. The combination, with the heating-drums A A^1, &c., and the belts or aprons E F, of the strippers G, for lifting the paper from the drums and guiding it forward between the belts, substantially as and for the purposes described.

8. A heating-drum provided with steam-chamber A^2, with partitions a', hollow axle A^3, with partition a, steam-supply pipes A^5, and outlet-pipes A^6, substantially as described, whereby the water of condensation is drawn off by the action of its own gravity.

9. The combination of forming-machine H, press K, and drying-machine with cars I I′ and tracks J J^1, &c., substantially as and for the purposes described.

10. In the manufacture of paper boards, a drying-machine consisting of one or more drying-cylinders and two or more continuous belts, the belts so arranged relatively to the drying-cylinders as to bear the separate boards continuously forward in contact with the drying-cylinders, and deliver them at the exit, the feeding-belt also so arranged as

to form a convenient surface to receive the boards as they are fed to it, and so arranged relatively to another continuous belt at the exit that the boards shall be delivered from between the two in smooth and flat form, substantially as and for the purposes described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

CHARLES WHEALEN.
LEWIS KNERR, JR.

Witnesses:
J. O. ARNOLD,
SAML. B. SMITH.