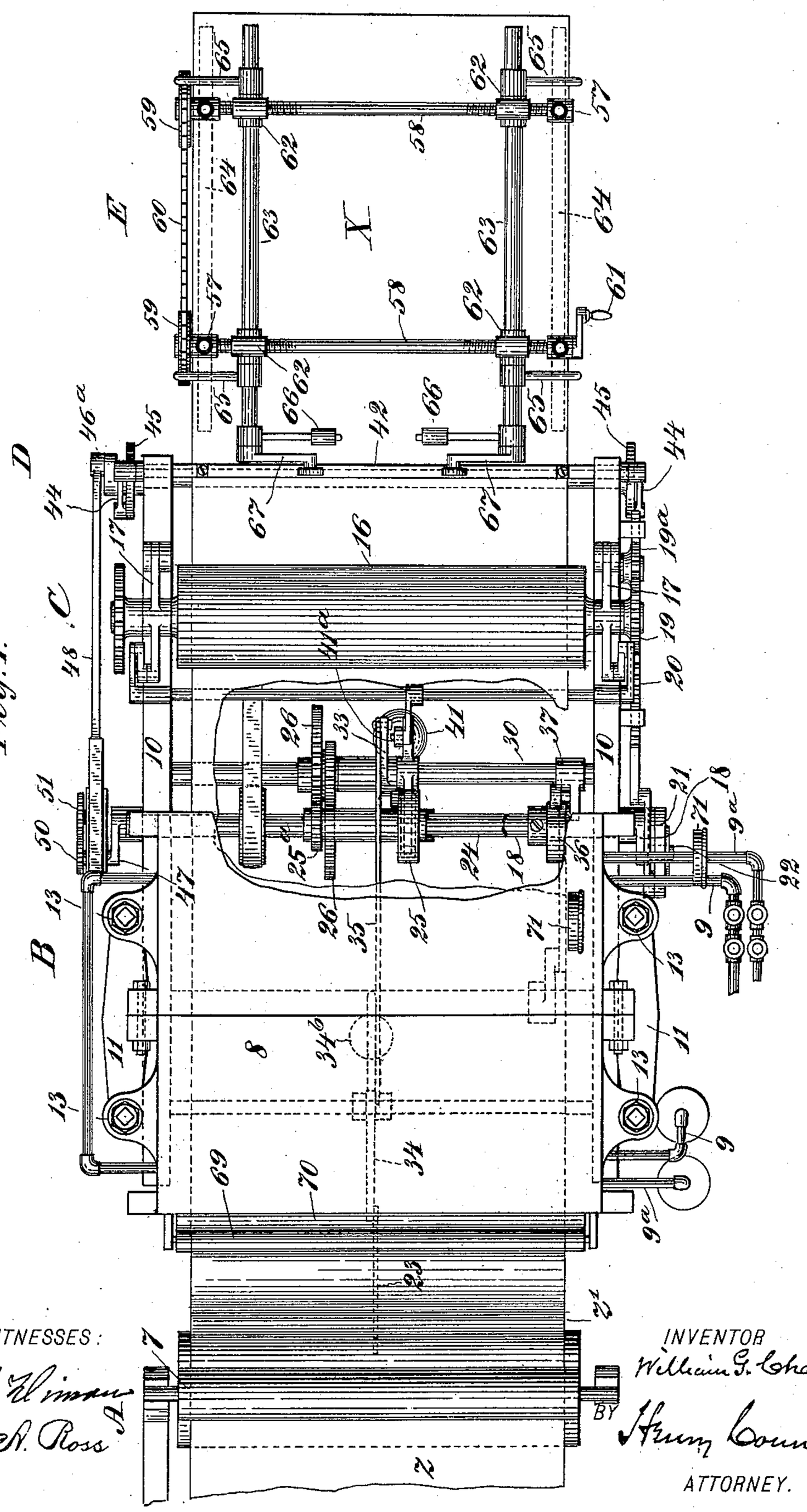
No. 618,376. Patented Jan. 24, 1899.

W. G. CHAPIN.

MANUFACTURE OF CELLULAR BOARD.

(Application filed Dec. 9, 1897.)

(No Model.) 3 Sheets—Sheet 1.



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(Application filed Dec. 9, 1897.)

(No Model.) 3 Sheets—Sheet 2.

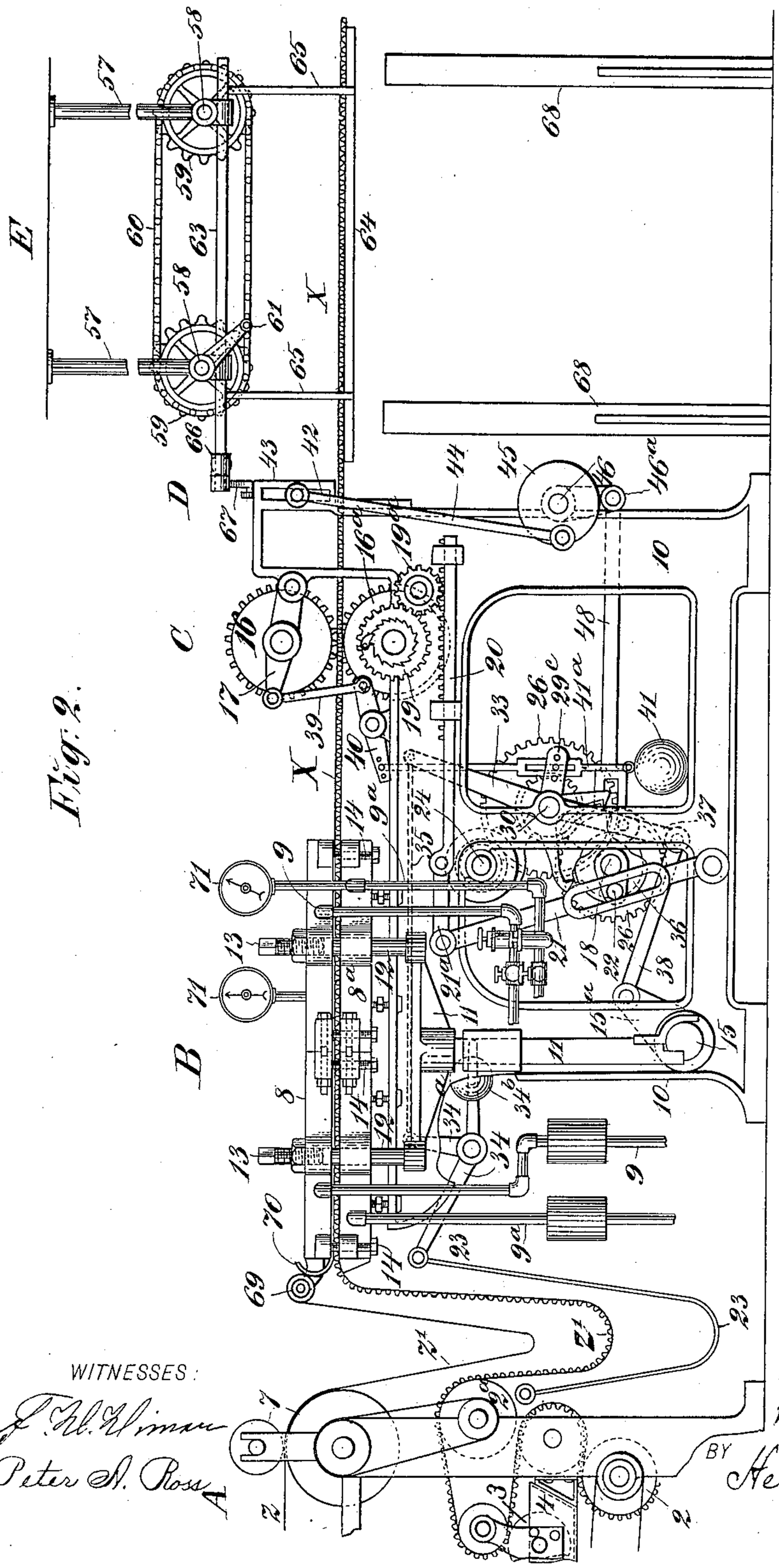

Fig. 2.

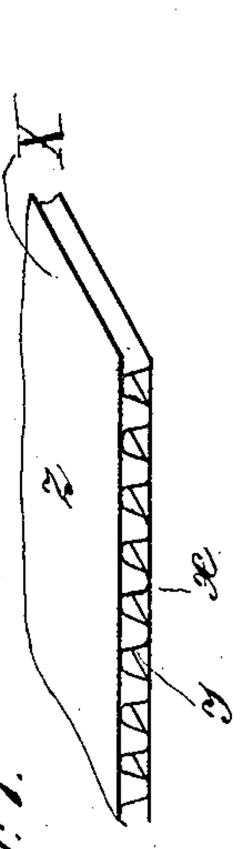

Fig. 7.

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MANUFACTURE OF CELLULAR BOARD.

(Application filed Dec. 9, 1897.)

(No Model.) 3 Sheets—Sheet 3.

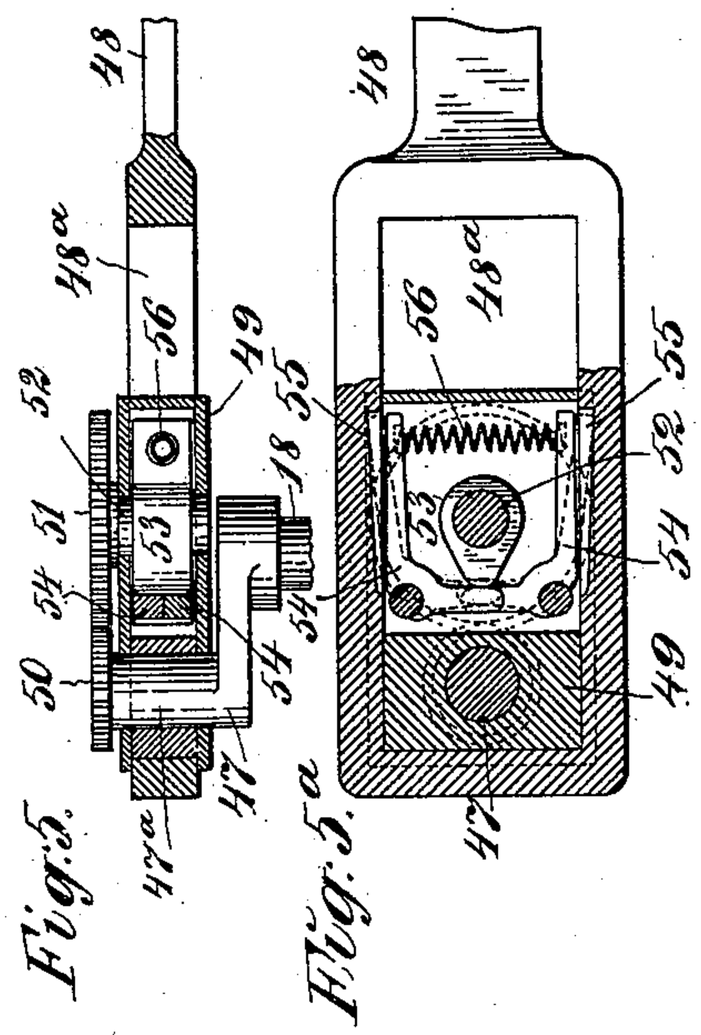

Fig. 5.

Fig. 5a.

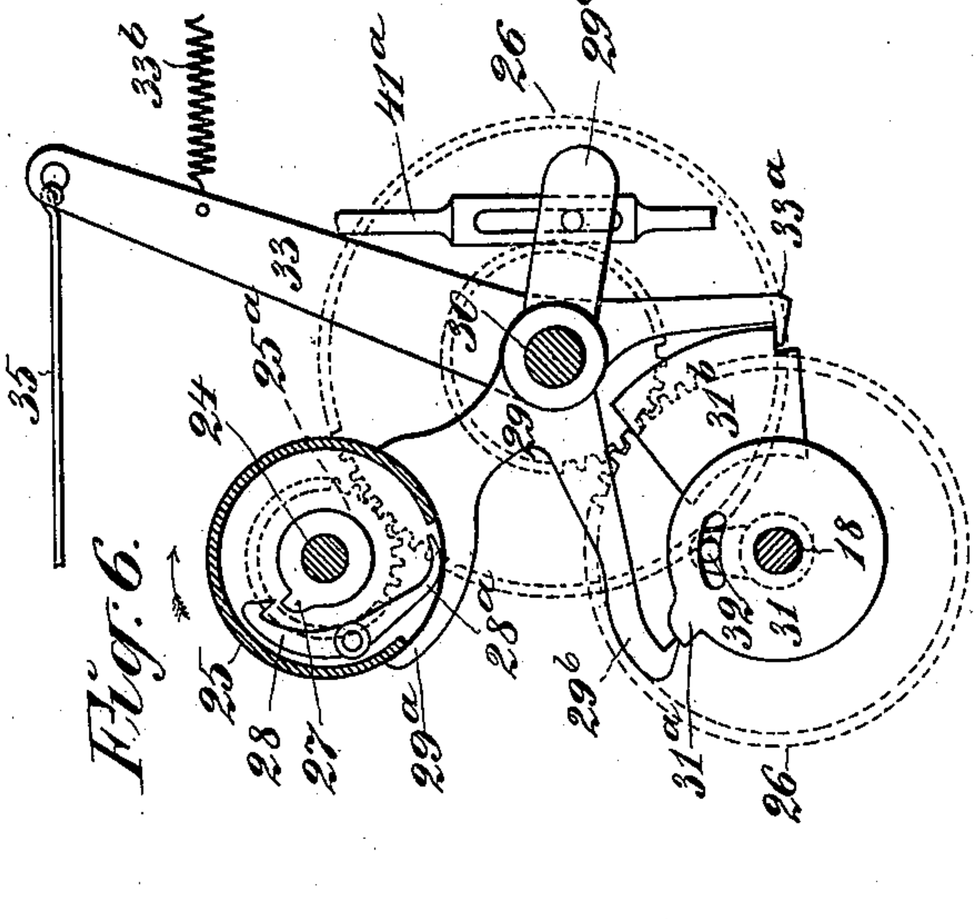

Fig. 6.

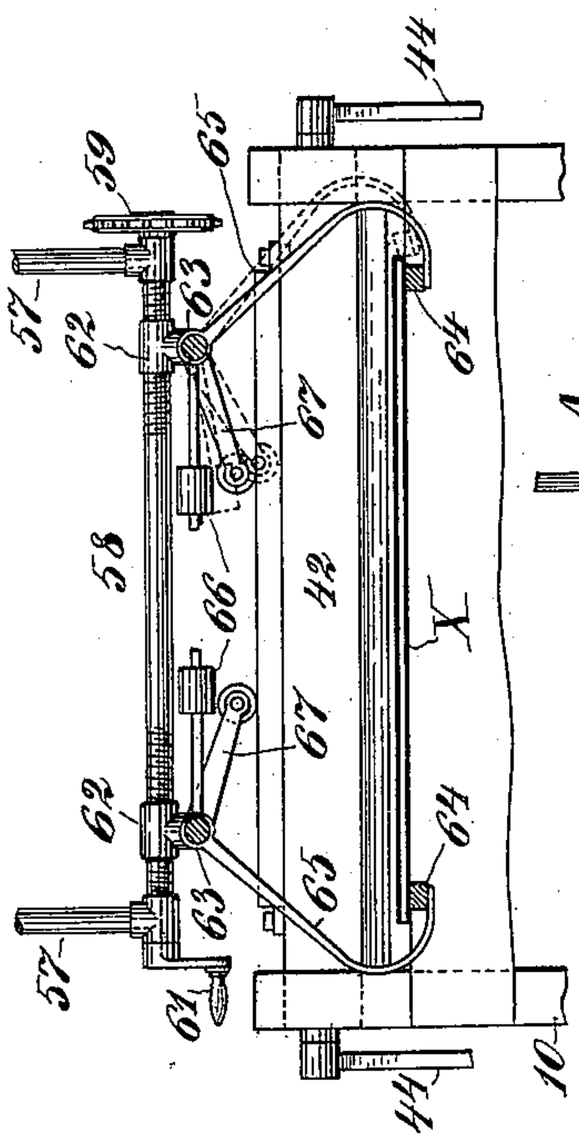

Fig. 3.

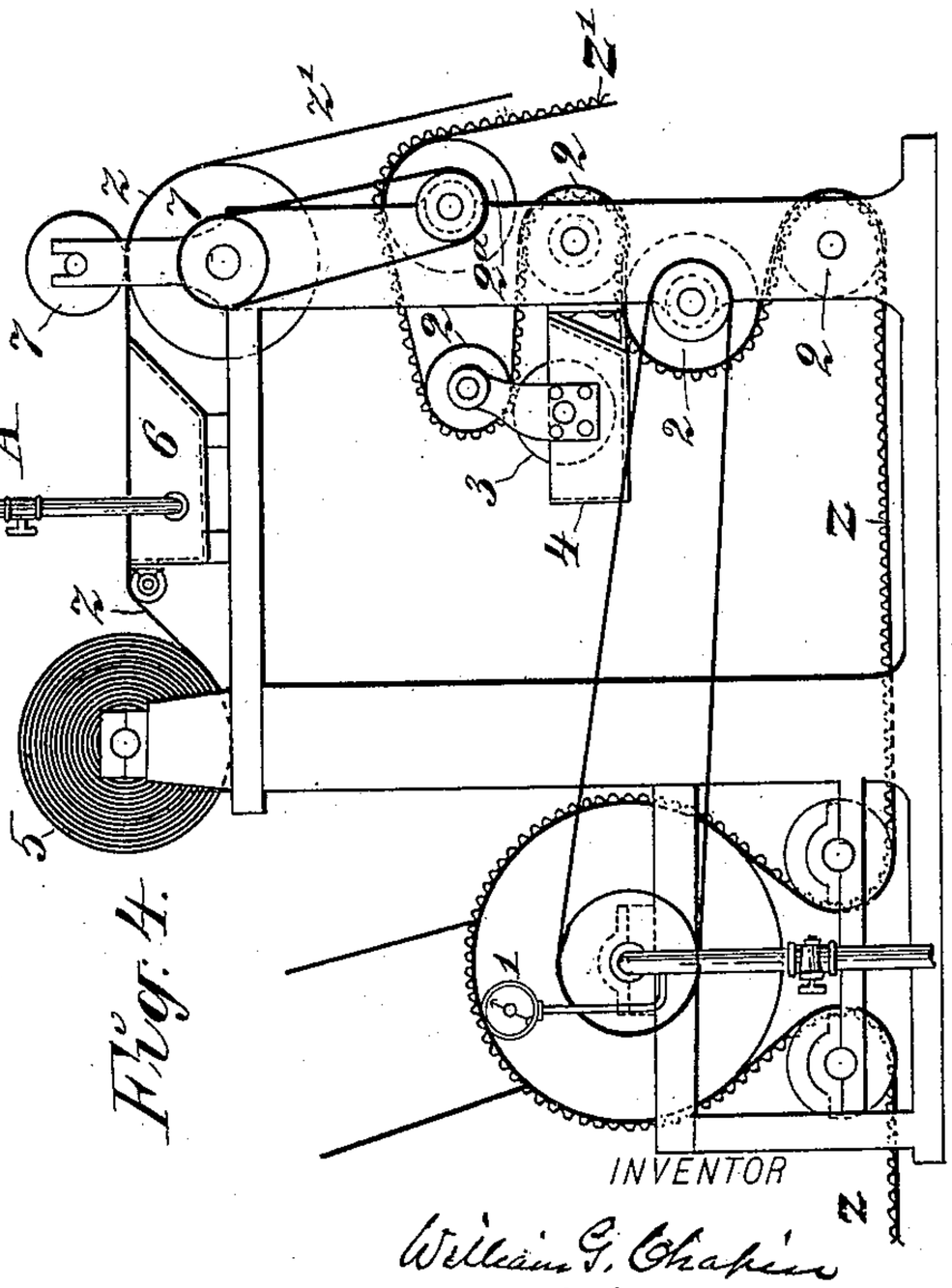

Fig. 4.

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UNITED STATES PATENT OFFICE.

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MANUFACTURE OF CELLULAR BOARD.

SPECIFICATION forming part of Letters Patent No. 618,376, dated January 24, 1899.

Application filed December 9, 1897. Serial No. 661,217. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM G. CHAPIN, a citizen of the United States, residing at New York, (Brooklyn,) Kings county, New York, have invented certain new and useful Improvements in the Manufacture of Cellular Board, of which the following is a specification.

This invention relates to the manufacture of a fabric consisting of two sheets of paper or the like inclosing between them a corrugated sheet, the three elements being secured together to form a cellular sheet. A fabric of this general character has been in use for some years as a packing about glassware and the like, the fabric being usually so constructed that it is comparatively flexible and capable of being wrapped about the article to be protected when it is bent in the direction of the corrugations of the intermediate sheet. It is desirable, however, to produce such a cellular fabric which shall be smooth, flat, and quite stiff or rigid both transversely and longitudinally of the corrugations, and to effect this is the object of the present invention.

A machine for making the board is illustrated in the accompanying drawings, wherein—

Figure 1 is a plan of the machine proper. Fig. 2 is a side elevation of the same. Fig. 3 is an end view of the delivery end of the machine, and Fig. 4 is a side elevation of the pasting mechanism and the devices for feeding the sheets to the machine proper. Figs. 5 and 5ª are detail sectional views, on a larger scale than the main views, of the device for regulating the cutting of sections or sheets from the continuous board. Fig. 6 is an enlarged detail view of the starting and stopping mechanism. Fig. 7 is an enlarged view of the finished cellular board produced by the machine.

Before proceeding to describe the machine illustrated it may be said that the board shown in Fig. 7 comprises a base sheet or facing x, a corrugated sheet y, secured to said sheet x, and, facing a sheet z, secured to the opposite face of the corrugated sheet y in a manner to form of the three sheets a stiff, flat, and relatively thick cellular board X.

In the making of a cellular fabric consisting of three sheets x, y, and z if the corrugations of the intermediate sheet be crushed and their rigidity thus destroyed, as by the passing of the strip between crushing-rollers, the resulting fabric will be flexible along the lines of the corrugations, as these latter will yield and flatten readily when the fabric is flexed or bent. In the fabric contemplated by this invention, however, the corrugations are not crushed, and the final sheet z is applied while the fabric is held flat and firm and while the paste or gum which secures this sheet is being dried, thereby producing a faced or surfaced, flat, stiff, and rigid board.

The machine which will now be described has to do mainly with the placing and securing with paste or gum the final facing-sheet z, the drying of the fabric while in a flat state, and the delivery and cutting off of sections or lengths from the finished fabric or board.

The machine operates intermittently insomuch that the continuous fabric is finished in lengths or sections and delivered in sections as finished.

The machine comprises, as to its major features, a feeding and paste-applying mechanism for the securing of the final facing-sheet, a feeding mechanism, which operates intermittently to draw the fabric into the drying and finishing device, the said drying and finishing device, which consists of two plane-surfaced heaters adapted to close upon and embrace the fabric, operating alternately with the intermittent feeding operations, the feeding mechanism for the finished board, and the cutting and delivery mechanisms, which latter also operate alternately with the main feed.

Referring to the principal views, A represents as a whole a mechanism for supplying from rolls the strip Z (comprising the base-strip x and corrugated strip y, secured thereto) and the strip z, means for applying paste to the corrugations of the strip Z for securing the strip z thereto, and means for drying and moistening, all as will be described. These devices may be constructed in any convenient manner; but as here shown they comprise the features following: The partly-finished

strip Z is led around a steam-drum 1 to dry it and passes thence about a series of carrying-rollers 2 2^a, which may be driven by the usual means. In its passage paste is applied to the crowns of the corrugations of the strip Z by means of a paste-roller 3 in a fountain 4. The strip of plain paper *z* from a roll 5 is led over a steam-box 6, whereby it is slightly and uniformly dampened, and then between feed-rollers 7, driven at the proper speed. After emerging from the rollers 7 the surplus of the strip *z* forms a sagging loop *z'*, and the strip Z after passing the roller 2^a forms a sagging loop Z'. At their other ends these strips *z* and Z pass into the heater or drying and finishing device. This drying device (designated as a whole by B) consists of two faced heaters or steam-boxes 8 and 8^a, arranged one above the other on the machine-frame 10. The lower box 8^a is fixed in the frame and presents a plane smooth upper surface. It is supplied with steam through a suitable pipe or pipes 9^a from any source, as a boiler, for example. The upper steam-box 8 has a plane smooth lower surface and is supplied with steam through a suitable pipe or pipes 9. This upper box or heater is adapted to be raised and lowered to a slight extent by any suitable means, that now to be described serving the purpose.

Mounted on and at the repective sides of the frame 10 are lifters 11, each of which has two lifting-pins 12, which play through guides on the stationary heater 8^a and enter sockets on the upper heater 8, in which are screwed from above screws 13, which bear on the ends of the lifting-pins 11 and serve as a means of regulating the clearance or space between the faces of the heaters 8 and 8^a. There are or may be also screws 14, driven upwardly through lugs on the stationary heater 8^a and forming bearings on which rest lugs on the upper movable heater 8 when the latter is seated. These screws 14 serve, with the screws 13, to regulate the operative space or clearance between the opposed faces of the steam-boxes. The lower extremities of the lifters 11 rest on shoulders formed on a rock-shaft 15 in the frame, whereby when this shaft is rocked the movable upper heater 8 will be raised to a sufficient extent and then lowered. The means employed for rocking the shaft 15 will be hereinafter described.

C represents as a whole the intermittent-feeding mechanism for the finished board X, and it comprises two rollers 16 and 16^a, the latter rotatively mounted in the frame 10 and the former mounted rotatively in a pair of hinged arms 17, so that it may be raised and lowered to a slight extent. These two feed-rollers are geared together, and the lower one is the driver, it being driven intermittently from an intermittently-rotated operating-shaft 18 of the machine through the medium, as here shown, of a gear-wheel 19, ratcheted on said roller 16^a, a pinion 19^a, gearing with the wheel 19, a slidable rack 20, in gear with the pinion 19^a and coupled by a link 21^a with an operating-lever 21, this lever being vibrated by a crank 22 on the shaft 18. Rotation of the crank 22 by engagement with a slot in the lever 21 reciprocates the rack 20 and by reason of the ratcheting of the wheel 19 on the roller 16^a causes intermittent rotation of the feed-rollers in one direction.

The strips of material Z and *z* are fed continuously and at a relatively slow speed, and as the loop Z' descends or sags while the machine proper is at rest it will eventually strike and rest upon a starting-loop 23, adapted to set the machine in motion. When set in motion, the upper heater 8 rises, and the feed-rollers 16 16^a then draw the finished and dried board X out from the heater, replacing it by the material of the loops *z'* and Z'. When this is effected, the feed motion ceases, the heater 8 descends, and the motion of the machine is automatically arrested, to be again started by the descent or sag of the loop Z'.

24 is the main or driving shaft of the machine, which rotates continuously in the direction indicated by the arrow in Fig. 6. On it is loosely mounted a hollow casing 25, on which is fixed a gear-wheel 25^a, which drives the shaft 18 through the medium of a train of gears 26, the shaft being geared to make about twelve revolutions to one of the shaft 18. On the shaft 24, within the casing 25, is a collar which has a tooth 27, and within the casing 25 and pivotally mounted thereon is a spring-dog 28, adapted under certain conditions to engage the tooth 27, and thus lock the casing 25 (through said dog) to the shaft 24, compelling it to rotate therewith and through the train 26 to drive the shaft 18. When the shaft 18 is at rest, as in Fig. 6, the dog 28, which has a tail 28^a, adapted to project out through a slot in the casing 25, is held out of engagement by an arm 29^a of a rocking lever 29, mounted on a fixed bar or shaft 30 in the machine-frame. This arm 29^a is curved to fit about the casing 25 and press in the tail of the dog 28, the rocking lever 29 being held in this position by a hook on its lower arm 29^b, resting on the crown of a beveled tooth or projection 31^a on a cam 31 on the shaft 18 and mounted loosely thereon, a stud 32, carried by a collar on the shaft and engaging a slot in the cam, permitting the latter some movement about the shaft. On the cam 31 is a weight 31^b, which sets back of the plane of the lever-arm 29^b, so as to clear it, and this weight is adapted to engage a hook 33^a on a lever 33, loosely mounted on the shaft 30, whereby the parts are held in the position seen in Fig. 6. From the upper end of the lever 33 a wire or cord 35 extends under the heater and is coupled to an upright arm 34^a of a lever 34, fulcrumed in the frame. To one arm of this lever is secured one end of the starting-loop 23, and on a third arm is a counterweight 34^b. Now supposing the main shaft 24 to be rotating and the shaft 18 to be at rest, as in Fig. 6, when the sagging loop Z'

of the strip Z comes to rest with sufficient weight on the starting-loop 23 the lever 34 will be rocked, and this motion will be communicated through the wire 35 to the lever 33 in such a manner as to withdraw the hook 33ª and allow the weight 31ᵇ to fall as far as the stud 32 will permit. This shift of the cam 31 removes the tooth 31ª from under the hook on the arm 29ᵇ and allows the arm 29ª to fall away by gravity from the casing 25. The spring-dog 28 instantly engages the tooth 27, carried by the rotating main or driving shaft, and locks the casing 25 and its gear thereto, which sets operating-shaft 18 to rotating slowly.

On the shaft 18 is a cam 36, which bears on a roller carried by an arm or lever 37, which swings loosely from the shaft 30 and is coupled at its free end by a link 38 with an arm 15ª on the rock-shaft 15. This cam 36 thus acts to lift the upper heater 8 sufficiently to free the board X, so that the feed-rollers 16 16ª may draw it out and feed in materials for a new section, and to hold the heater elevated.

While the heaters have been acting on the board, the feed-rollers have not only been at rest, but the upper roller has been slightly elevated, so as not to rest upon and mar the board X. The means for thus operating the upper feed-roller will now be described.

The arms 17, which carry the upper feed-roller 16, are connected together at their free ends by a cross-rod and are coupled by a link 39 to one arm of a rocking lever 40, fulcrumed on the frame. On the other arm of this lever is hung a counterweight 41, suspended by a rod 41ª, which has in it a slot engaged by a stud on an arm 29ᶜ on the same boss with the rocking lever 29. The weight 41 is sufficient to overcome the weight of the upper roller 16 and hold it slightly elevated or out of contact with the board X, as in the drawings; but when the lever 29 is rocked at starting up the machine the arm 29ᶜ moves upward and the stud therein, engaging the upper end of the slot in the rod 41ª, lifts the rod and weight 41, so that the roller 16 may descend into contact with the board to be fed. It will be understood that the lifting effort of the arm 29ᶜ is not necessarily very great, as the weight of the feed-roller and its accessories nearly counterbalances the weight. As the shaft 18 continues to rotate slowly the weight 31ᵇ on the cam 31 is carried around to the upper side, and as it passes over the center it falls, catching on the hook on the starting-lever 33. The momentum of the parts carries the cam 31 on far enough for the hook on the arm 29ᵇ to ride up onto the tooth 31ª, and thus rock the lever 29, so as to bring the arm 29ª up to the casing 25. The parts are so timed that this movement occurs at the moment the dog 28 reaches about the position seen in Fig. 6, so that the arm 29ª releases the dog, and thus stops the rotation of the cam-shaft 18.

It should be observed that when the starting-lever 34 has been pulled over by the weight of the loop Z′ in starting the machine and the weight has been taken from the starting-loop 23 by the feeding in of the strip Z′ the lever 33 is returned to its normal position by a spring 33ᵇ.

It now remains to describe the board-cutting device or mechanism and the delivery mechanism for the boards cut off. The first-named mechanism is indicated by D and the last named by E.

The cutting-blade 42 is mounted to play up and down in guides 43 on the machine-frame, and its reciprocating movements are produced by means of two connecting-rods 44, which couple the blade to cranks 45 on a rock-shaft 46, and this shaft is rocked by a crank 47 on the shaft 18, Figs. 1 and 5, and a rod 48, which connects this crank 47 with a crank-arm 46ª on the rock-shaft 46. Obviously with this construction the blade will make one cut at each revolution of the shaft 18 and so cut off sections of the board X equal in length to the amount fed out at the delivery end of the machine at one operation of the intermittent feed; but as it is desirable sometimes to cut off sections of double this length means are provided for causing the crank 47 to actuate the rock-shaft 46 only at alternate rotations of the shaft 18. This device is illustrated in detail in Figs. 5 and 5ª and seen in plan on a smaller scale in Fig. 1.

In the end of the rod 48 where it is coupled to the crank 47 is a slot 48ª, in which slides a block 49, in which the pin 47ª of the crank has a bearing. When the block 49 is free to play in the slot, the crank imparts no movement to the rock-shaft 46, and consequently no movement to the blade 42; but when the block is locked against movement in the slot the crank 47 actuates the blade. On the crank-pin 47ª is fixed a pinion 50, which gears with a wheel 51 of twice its size fixed on a short shaft 52, which rotates in bearings in the block 49. Fixed on the shaft 52 within a hollow in the block is a cam 53, which at one point in the revolution of the shaft 52 bears on the transverse arms of a pair of L-shaped lever-latches 54, fulcrumed in the block, and by pressure thereon withdraws the locking-arms of said latches from recesses 55 in the side walls of the slot 48ª, and thus sets the block free. A spring 56 between the locking-arms of the latches tends to press them outward and into engagement with the locking-recesses. The effect of this device is to release the block 49 at each alternate revolution of the crank 47, and this release is effected when the blade 42 is elevated.

The delivery mechanism E is illustrated in Figs. 1, 2, and 3 and comprises a laterally-spreading receiving and dropping device. Supported, preferably from above, are bearings 57, in which are rotatively mounted two cross-shafts 58 58, connected for driving one

from the other by sprocket-wheels 59 and a chain 60. One of the shafts has a crank 61. The shafts 58, have right-and-left screws cut on them to receive pairs of bearing-nuts 62, in which are mounted, one at each side, a shaft 63, which is capable of rocking in the bearings in the nuts. Each shaft 63 has a supporting-strip 64, carried by curved arms 65. These strips are situated so as to receive the board X as it comes from the machine, taking under the respective edges thereof, and when the section is cut from the board by the blade 42 the shafts 63 are rocked (see dotted lines in Fig. 3) so as to withdraw the strips 64 from under the edges of the board and allow it to drop to the floor. This spreading movement is effected by weights 66 on arms which project inwardly, one from each shaft 63, and the weights are raised and the strips 64 held in supporting position by arms 67, one on each shaft 63 and resting on the back of the blade 42. In practice each arm 67 carries a roller that rests on the back of the blade to avoid undue friction.

The object of suspending the shafts 63 from nuts on the cross-shafts 58 is to enable the supporting-strips 64 to be shifted readily and accurately to suit boards of different widths. This adjustable feature is not essential, however, nor is it essential that the weight 66 shall be on a separate arm. It might be on the arm 67 as well. Indeed the important feature is the automatic spreading of the supports simultaneously with the cutting off of the board. The uprights 68 (seen in Fig. 2) are side guards for the pile of sheets.

It is very important in the making of this cellular board that the sheet *z* be kept perfectly smooth and free from warpings, puckers, and wrinkles, and hence it is passed over a steam-box 6, which has a foraminous cover and permits the steam or watery vapor to slightly and uniformly dampen the sheet, which is then passed between the rollers 7, where it is smoothed and rolled. This steaming and smoothing prepares the sheet to take the paste properly and equally when it is pressed upon the crowns of the corrugations in the heating apparatus B.

The space between the heaters is open all around their edges so as to permit the free escape of steam or vapor during the drying, and the peculiar character of the board facilitates this, as the corrugation-channels form natural passages for the vapor. To prevent the steam which is emitted at the front where the sheets *z* and Z enter between the heaters from condensing on the sheet *z* and producing damp spots and consequent warpings, puckers, or blisters, the sheet *z* on coming from the rollers 7 is made to pass over an elevated roller 69 and thence about and under a curved shield 70, fixed to the upper heater 8. This shield and roller serve to protect the sheet against the direct action of the steam, and the shield, being practically a part of the heater 8, will of course be quite hot and will prevent the collection of any moisture on the sheet. The heaters are or may be provided with pressure-gages 71, and they may be made up of sections. In the principal views they are each represented as made up of two sections fitted together accurately edge to edge. Parts of the heaters and of the fabric X are broken away in Fig. 1 to show some of the mechanism below them in plan.

The space between the two heaters is carefully regulated, so that when closed on the board X to finish and dry it they will not crush the corrugations of the sheet *y*, but simply flatten their crowns slightly, and thereby form flat surfaces for the adhesion to the sheet *z*.

The treatment of a cellular fabric or board, as X, requires that the space between the two heaters 8 and 8ª when closed shall be fixed and of course uniform throughout, and the space should be such that when the movable heater is lowered on the fabric for heating and finishing the crowns of the corrugations of the intermediate sheet shall be slightly flattened, as before stated. The weight of the movable heater is such that when compared with the relatively fragile character of fabric it may be considered fixed when closed on the fabric. This treatment is wholly different from that used in pressing cloth, for example, where the pressure is very great and the bed-plate is backed by powerful springs, no limiting-stops being employed to gage the space.

Another important feature in the treatment over that heretofore employed in making cellular fabrics of paper is the application of the heat and gaged pressure while the fabric or board is at rest, the material being treated in sections instead of being carried along in a continuous manner, whereby, as will be obvious, one part of the length being treated will be thoroughly dry, another partly dried, and another wet with paste. It is believed that a celluar board of uniform character and finish cannot be made in this manner.

The word "cellular" is not used herein as descriptive of the fabric, but because fabrics of this class have become well known to the trade and consumers as "cellular" fabrics.

It remains to be pointed out that when the parts are arranged as herein shown a guide-roller 69 is required to lead the paper *z* to the shield 70; but it will be obvious that where such a guide is not needed it may be omitted.

It will be noted that the heaters 8 and 8ª are supplied by separate pipes 9 and 9ª and have each a steam-gage 71. This is very important. It will be noted also that the fabric Z is passed about a steam drying-drum 1, while the sheet *z* is moistened by passing it over a steam-box 6. The reason for this is that it is necessary, in order to produce a finished fabric X that is flat and will not curl or bend up when it comes from the machine, that both faces shall be dried equally

or that the fabric shall be uniformly dry throughout, and it is found that the lower or corrugated sheet Z takes up more moisture than the upper sheet *z;* but this varies considerably with the quality of the paper used. Hence it is important to be able to carefully regulate the heat of the drum 1; but it is very important also that means shall be provided for independently regulating the temperature of the two heaters 8 and 8ª, and hence the independent means for supplying them with steam and the two gages, these latter showing the temperature through the pressure of steam. As the fabric when the heaters first close on it is not uniformly damp and it is necessary to dry it uniformly, it may be necessary to raise the temperature of one heater above that of the other. Otherwise the finished fabric is apt to come out unevenly dried.

It is not absolutely necessary that the feed-rollers 7 for the sheet *z* shall be pressure-rollers for smoothing the sheet after it has passed over the steam-box, nor is it essential that they shall be situated precisely as shown in the drawings. The steam-box need only serve to very slightly moisten or dampen the sheet.

Having thus described my invention, I claim—

1. The herein-described method of drying and finishing stiff, cellular board of the character described, which consists in applying to the entire surface of the board being treated, at the same time, a uniform degree of heat maintained at all parts of said surface during the same period of time, and simultaneously applying to the surface of the board a light pressure in a direction perpendicular to said surface, whereby all parts of the board treated are dried simultaneously.

2. The herein-described method of drying and finishing stiff, cellular board of the character described, which consists in applying to the entire surface of the stationary board a uniform degree of heat, and simultaneously applying to said surface a light, uniform pressure, sufficient only to slightly flatten the crowns of the corrugations of the intermediate sheet, whereby the integrity of the corrugations is maintained and the moisture is driven off while the board is held immovably.

3. The herein-described method of drying and finishing stiff, cellular board of the character described, which consists in applying to the entire surface of the board a uniform degree of heat, and simultaneously applying to said surface, in a direction perpendicular thereto, a light, uniform pressure, sufficient only to slightly flatten the crowns of the corrugations of the intermediate sheet, whereby the integrity of the corrugations is maintained and the moisture is driven off at the edges of the board.

4. The herein-described method of making stiff, cellular board, which consists in applying paste to the crowns of the corrugations of a sheet Z, then placing on the sheet Z a sheet *z*, and then, while the superposed sheets are at rest on a smooth surface, applying uniform heat and pressure to the face of the sheet *z*, such pressure being sufficient to slightly flatten the crowns of the corrugations to which the paste has been applied, whereby the integrity of the corrugations is maintained and the moisture completely eliminated while the fabric is at rest.

5. The herein-described method of making cellular board, which consists in first uniformly steaming the sheet *z* and then passing it between rollers, before applying it to the base fabric Z, substantially as set forth.

6. In a machine for making cellular board, the combination with plane-surfaced heaters provided with means for positively gaging and limiting the space between them, whereby the crushing of the board is avoided, means for separating the heaters sufficiently to admit the materials of the board, a feeder for supplying the materials to the heaters, and an intermittently-operating mechanism for drawing out the finished board while the heaters are separated, substantially as set forth.

7. In a machine for making cellular board in lengths or sections, the combination with plane-surfaced heaters provided with means for positively limiting and gaging the space between them, whereby the crushing of the board is avoided, means for feeding the materials in a continuous manner to the heaters, means separating the heaters sufficiently to admit the materials fed to it, and intermittently-operating mechanism for drawing out the finished section of the board while the heaters are separated, substantially as set forth.

8. In a machine for making cellular board, the combination with plane-surfaced heaters superposed, the lower being fixed or unyielding and the upper one a gravity-heater, means for supplying the materials for the board to said heater, means for raising the upper heater so as to free the finished board and permit it to be drawn out, and intermittently-operating mechanism for drawing out the finished board while said heater is raised, substantially as set forth.

9. In a machine for making cellular board in lengths or sections, the combination with plane-surfaced heaters provided with means for positively limiting and gaging the space between them, the lower heater being unyielding and the upper heater resting thereon by gravity, means for feeding the materials of the board to the heater in a continuous manner, means for raising the upper heater at intervals to permit the finished board to be drawn out, and intermittently-operating mechanism for drawing out the finished board when the upper heater is raised, substantially as set forth.

10. In a machine for making cellular board, the combination with a lower, unyielding plane-surfaced heater and an upper, gravity-heater, said heaters having means for positively limiting the space between their faces

when closed on the board and means for regulating said space, mechanism for feeding the materials of the board to said heaters, means for raising the upper heater to permit the finished board to be drawn out, and intermittently-operating mechanism for drawing out the board when said upper heater is raised, substantially as set forth.

11. In a machine for making cellular board, the combination with heaters between which the board is dried, of a shield attached to one of the heaters at the point where the sheet *z* enters, and heated by said heater, said shield being so situated that the sheet *z* is drawn over its surface, substantially as and for the purpose specified.

12. In a machine for making cellular board, the combination with plane-surfaced heaters, means for separating said heaters and allowing them to close intermittently, means for feeding the materials of the board in a continuous manner, so as to form loops Z′ and *z*′ while the heaters are closed, intermittently-operating board-withdrawing mechanism, which removes the board from the heaters when they are opened, an automatic stop mechanism which stops the machine, and starting mechanism, substantially as described, which starts the machine through the descent of the loop Z′, substantially as set forth.

13. In a machine for making cellular board in lengths or sections, the combination with the intermittently-opening heaters, of the intermittently-operating means for withdrawing the finished board from the heaters, said means comprising a lower roller, an upper, gravity-roller adapted to be raised up, a counterweight and intermediate mechanism which supports said gravity-roller in its elevated position, a starting mechanism for the machine, and mechanism between said counterweight and starting mechanism whereby the latter assists in lifting the weight when the machine is started, thus permitting the gravity-roller to descend, substantially as set forth.

14. In a machine for making cellular board, a cut-off mechanism for the board comprising a movable blade, a rock-shaft having cranks coupled by connecting-rods with said blade, and a crank coupled by a connecting-rod 48, with a crank 47 on the rotating shaft of the machine, in combination with means for causing the crank 47 to actuate the blade at alternate rotations only, said means comprising the block 49 in a slot in the rod 48, in which block the pin of the crank 47 has a bearing, the locking-latches and spring in said block, the shaft 52 in said block, the cam 53 on said shaft and adapted to release the latches, the pinion 50 on the crank-pin, and the wheel 51, on the shaft 52 and gearing with said pinion, substantially as set forth.

15. In a machine for making cellular board, the combination with a reciprocating blade for cutting off sections or lengths from the board, of a delivery mechanism for receiving and dropping said sections, said mechanism comprising two rock-shafts extending parallel with the line of movement of the board, pendent supports for the lateral margins of the board attached to the respective rock-shafts, and mechanism between said rock-shafts and the reciprocating blade whereby the shafts are rocked, substantially as set forth.

16. The combination with the main, continuously-rotating shaft, and the operating-shaft to be driven intermittently thereby, of an automatic stop mechanism comprising a casing rotatively mounted on the main shaft and connected by gearing with the operating-shaft, means in said casing for normally locking the casing to the main shaft, a rocking lever, one arm of which is adapted to unlock the casing when the lever is rocked, and a weighted cam on the operating-shaft and having some loose play thereon, said cam being adapted to take under an arm of the rocking lever and rock it when the operating-shaft shall have completed one rotation, substantially as set forth.

17. A machine for making cellular board having two hollow heaters between which the board is pressed and dried, said heaters having independent regulable means of heating whereby they may, if required, be heated to different temperatures, substantially as and for the purpose set forth.

18. A machine for making cellular board having heaters for compressing and drying the fabric, means for slightly moistening, in a uniform manner the upper sheet *z*, before it enters the heaters, and a feeder for said sheet, substantially as specified.

19. A machine for making cellular board having heaters for compressing and drying the fabric, means for slightly moistening, in a uniform manner and for afterward pressing the upper sheet *z*, and means for heating the said upper sheet after it has been dampened and pressed, and before it enters between the heaters, substantially as set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

WILLIAM G. CHAPIN.

Witnesses:
MARTIN H. DAY,
GEORGE J. RIEGLER.