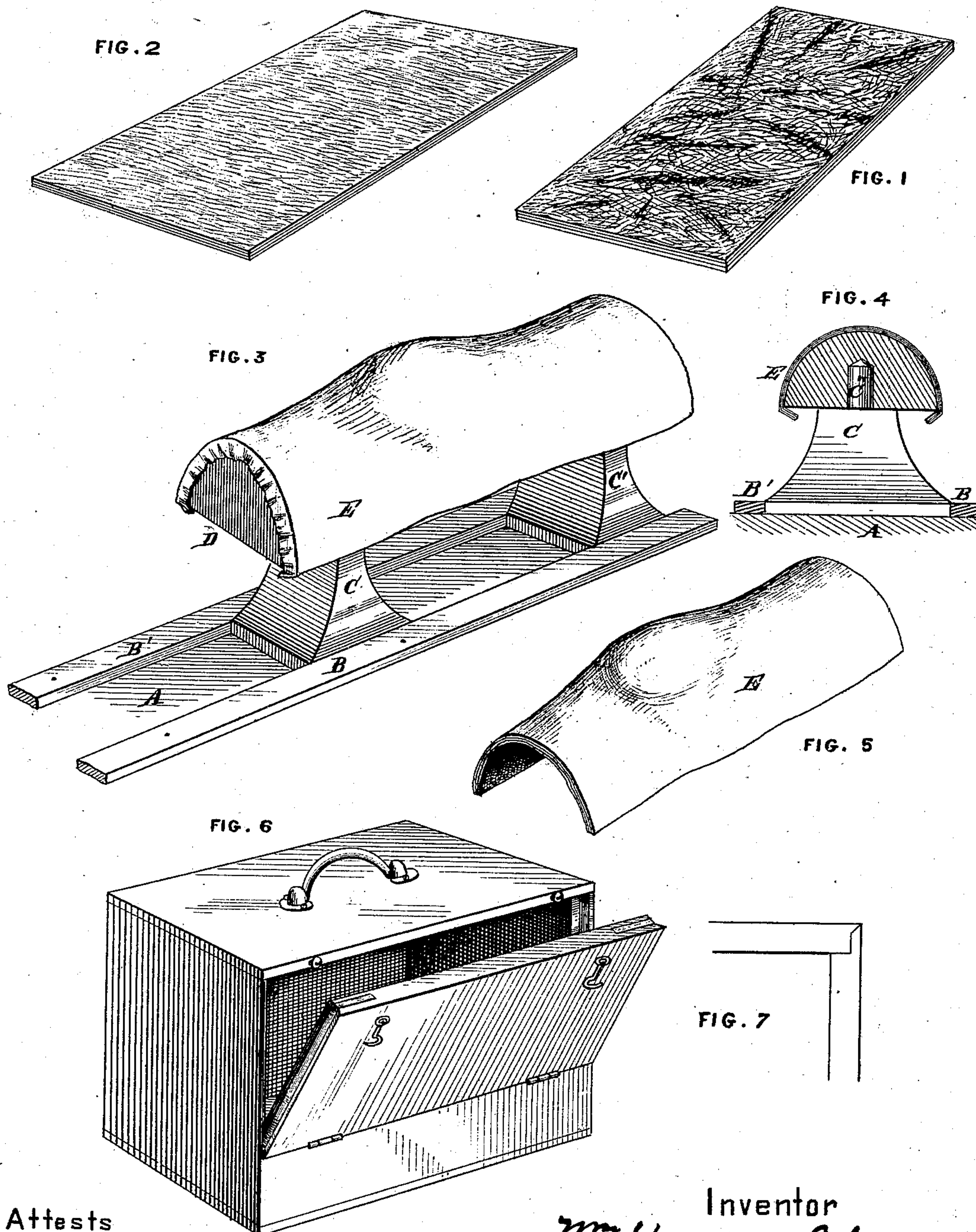


W. H. JOHNSTONE.  
Manufacture of Surgical Splints.

No. 224,783.

Patented Feb. 24, 1880.



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per *George E. Buckley*  
att'y.



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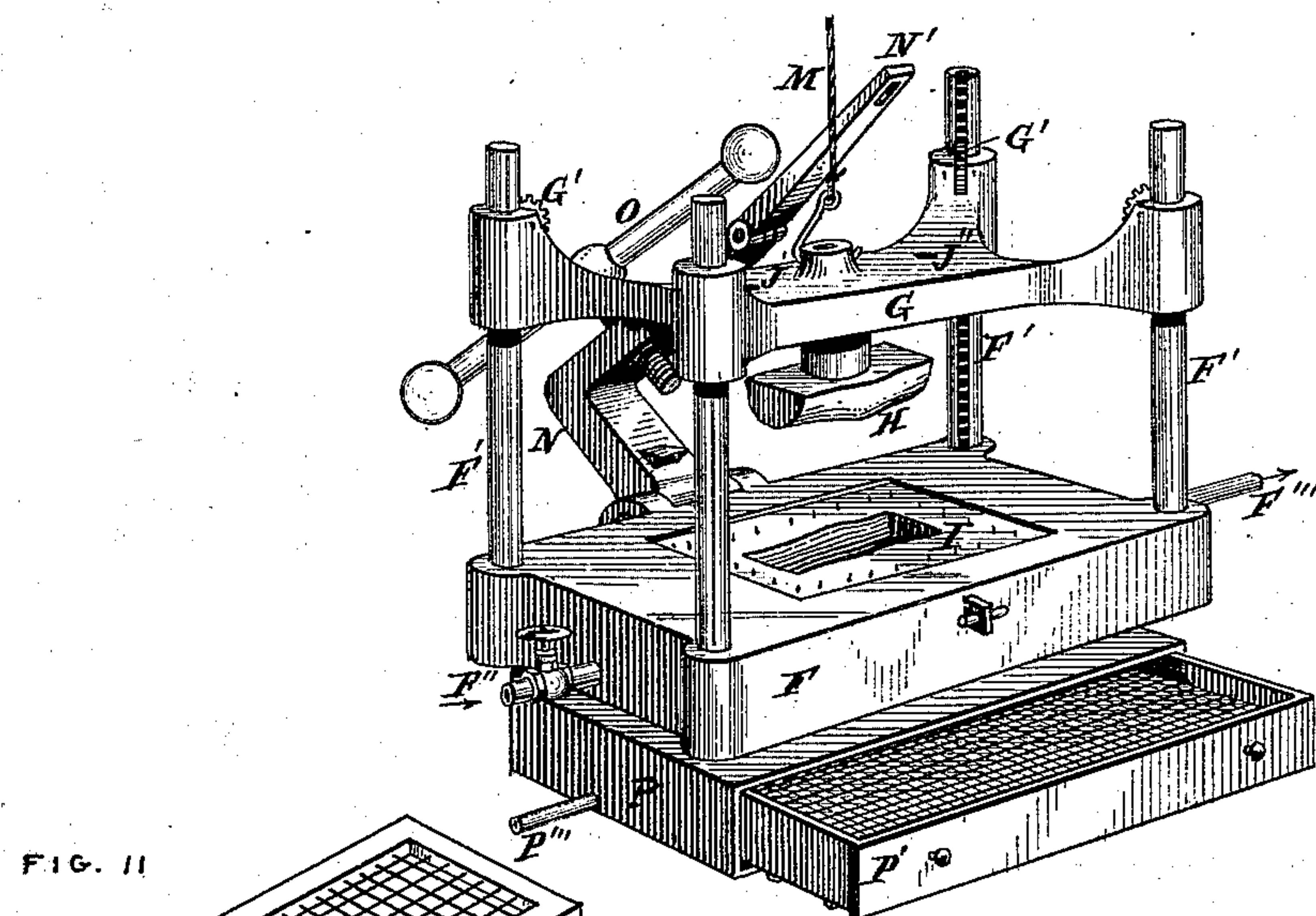


FIG. 11

FIG. 8

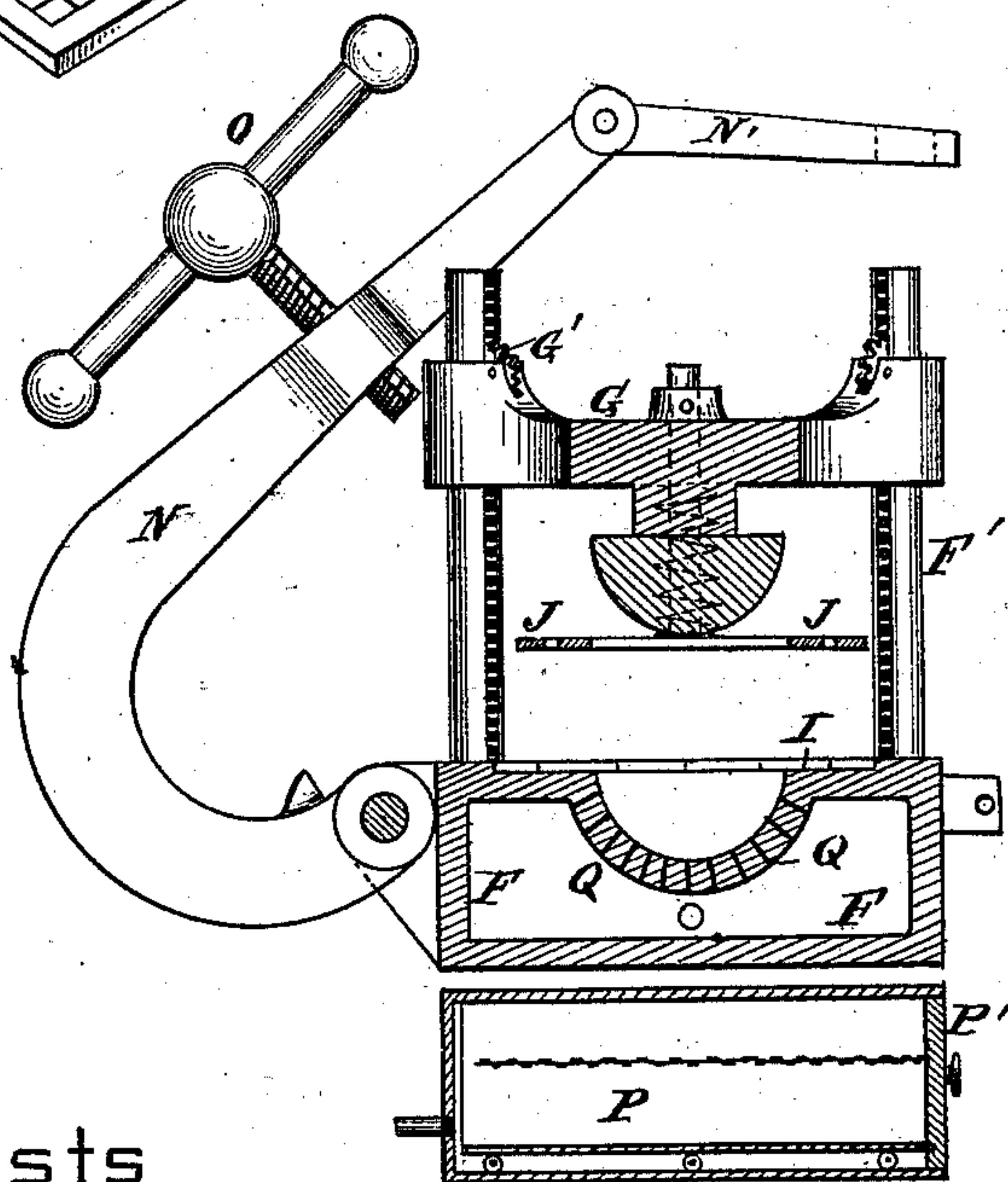


FIG. 9

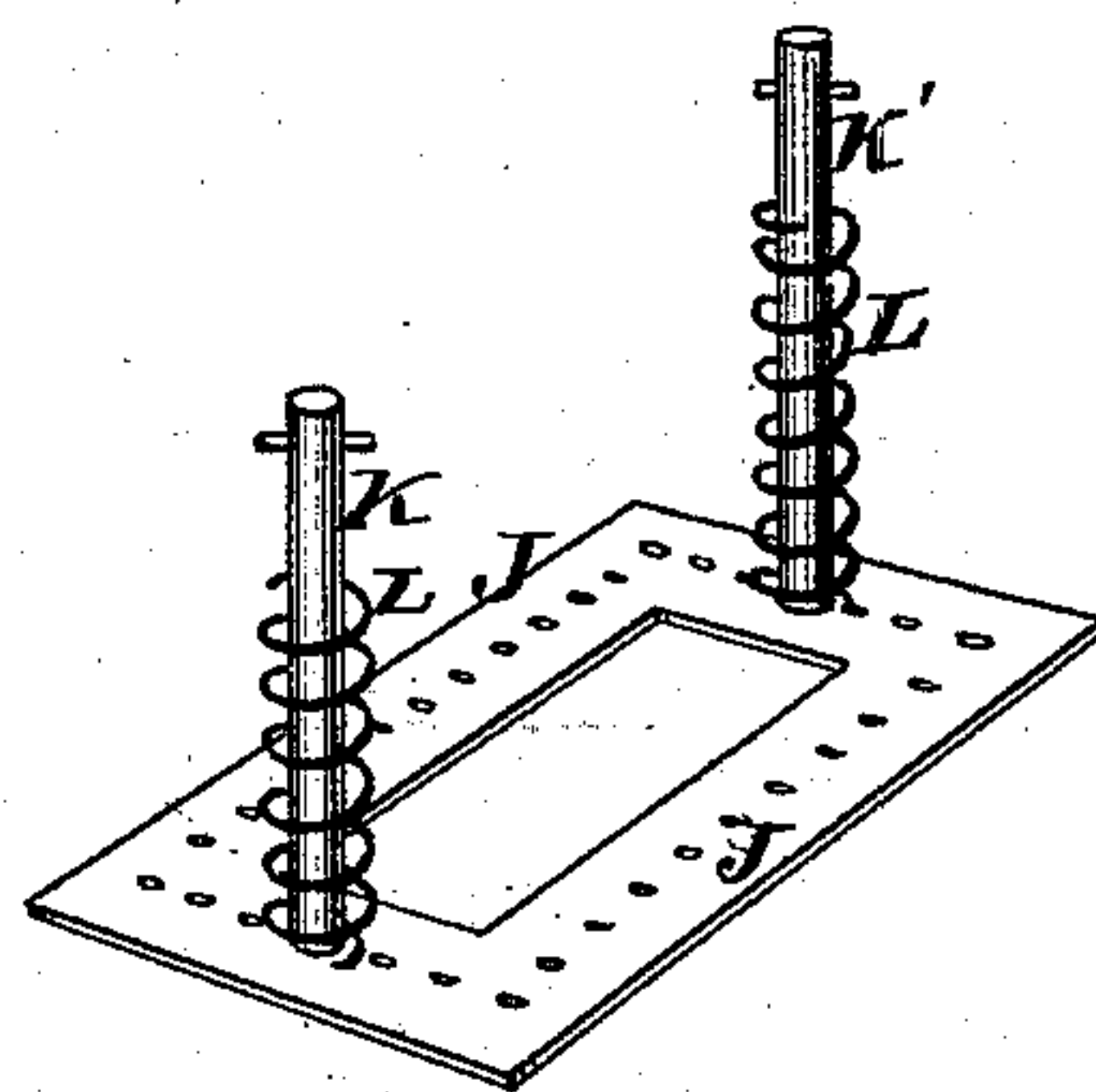


FIG. 10

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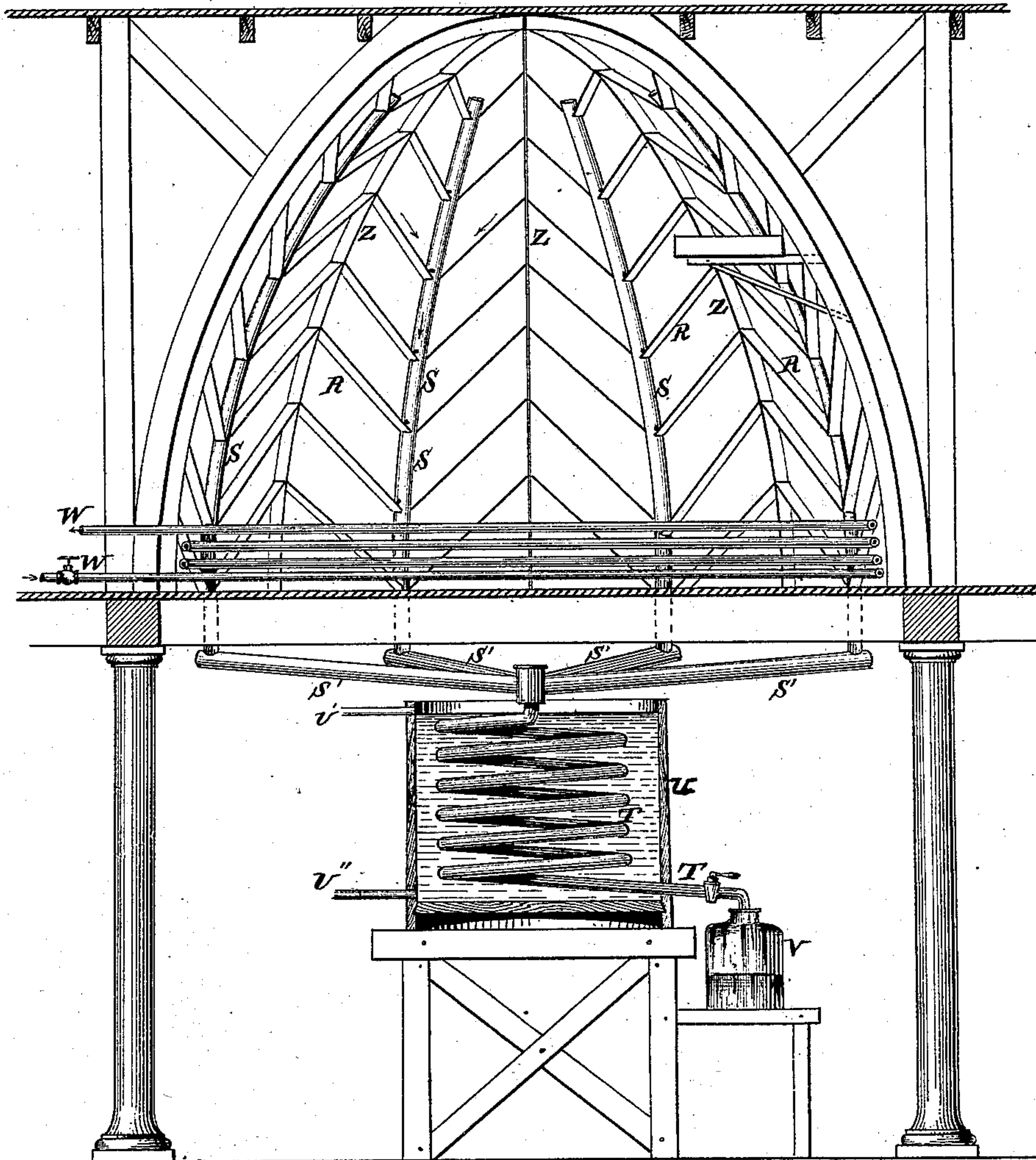


FIG. 12.

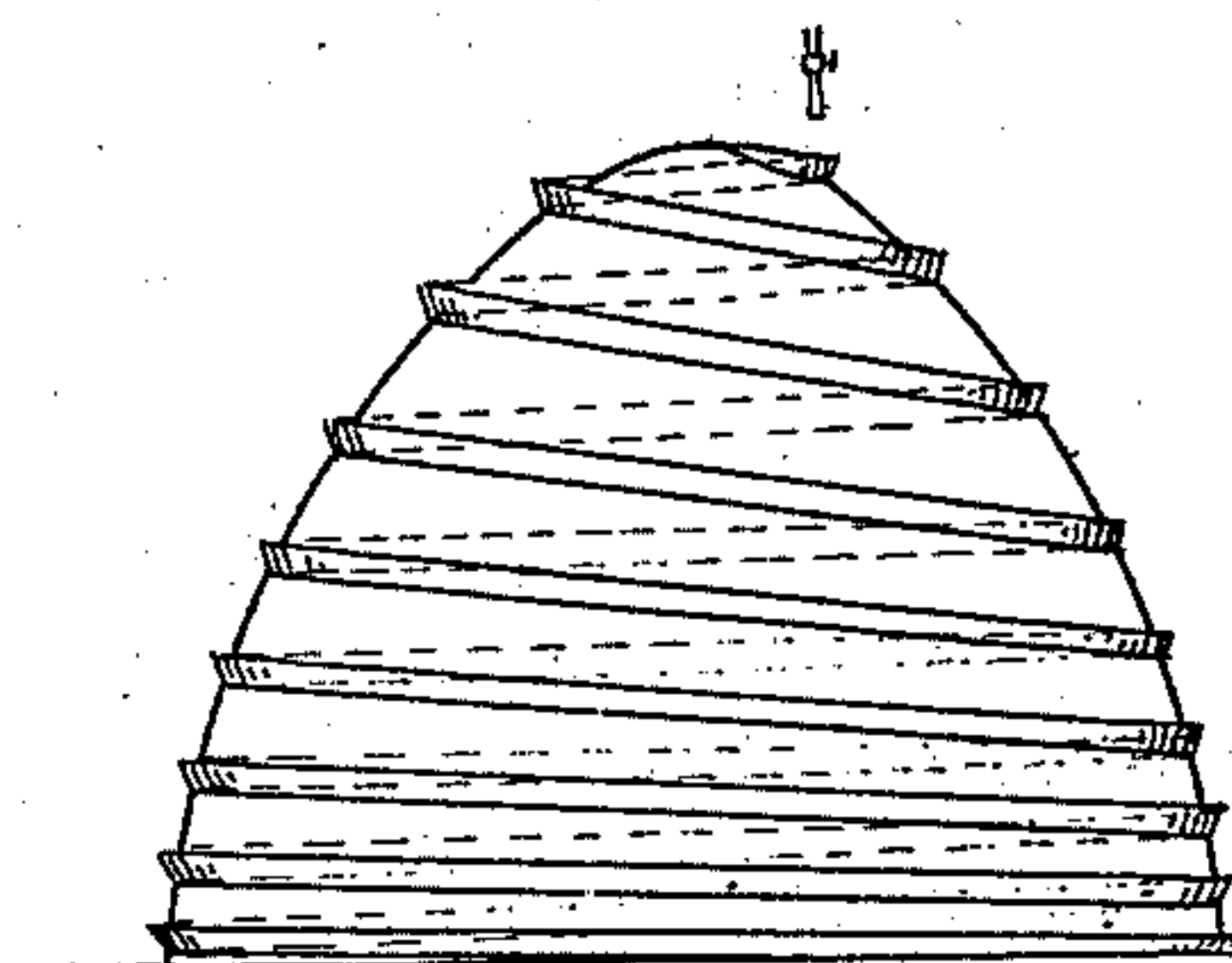


FIG. 13.

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# UNITED STATES PATENT OFFICE.

WILLIAM HAMPDEN JOHNSTONE, OF PHILADELPHIA, PENNSYLVANIA.

## MANUFACTURE OF SURGICAL SPLINTS.

SPECIFICATION forming part of Letters Patent No. 224,783, dated February 24, 1880.

Application filed January 9, 1880.

*To all whom it may concern:*

Be it known that I, WILLIAM HAMPDEN JOHNSTONE, of Philadelphia, Pennsylvania, have invented certain new and useful Improvements in the Manufacture of Surgical Splints; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the annexed drawings, making part hereof.

My invention relates to the manufacture of that class of surgical splints commonly known as "Ahl's splints," and made of felt or its equivalent, such as heavy cloth.

The nature of my invention will fully appear from the following specification and claims.

In the drawings, Figure 1 is a view of the class of felt which I prefer to use, composed of three distinct layers—an intermediate loosely-felted layer between two closely-felted layers—it being shown there as uncalendered; Fig. 2, a similar view of a sheet of the felt after being calendered, the shellac having been thereby driven away from the surface into the interior; Fig. 3, a perspective view of my blocking or conforming apparatus, showing a piece of my felt stretched over and conformed upon it; Fig. 4, a cross-sectional view of the same, showing the dowel or pin with which each of the bases or standards is furnished to secure the block in place; Fig. 5, a finished or blocked splint; Fig. 6, the box in which the splints are shipped; Fig. 7, a detached sectional view of one of the joints of the box; Fig. 8, a perspective view of my stamp-blocking machine; Fig. 9, a cross-sectional view of the same, showing, also, the spring-clamp frame in position; Fig. 10, a detached view of the spring-clamp frame; Fig. 11, a detached view of the corded frame for sustaining the felt while it is being steamed; Fig. 12, a vertical cross-sectional view of my combined drying and condensing apparatus. Fig. 13 shows a view of the outer part or shell of my condenser and drier, showing a spiral trough to carry a running stream of water to cool the shell and assist condensation thereby.

A, Fig. 3, is a base-plate or platform; B B', two guides or tracks secured thereto; C, a movable standard having a pin, C'', Fig. 4, upon its upper surface; C', a stationary standard, also provided with a pin, C''; D, a mold-block, the convex surface of which is shaped

like a longitudinal section of a human limb; E, Figs. 3 and 4, a piece of my felt saturated with shellac, bent over at all the edges of the said convex surface and conformed thereto by hand; E, Fig. 5, the same piece of felt, having the edges which were bent over cut off, thus forming a splint.

The box-joint shown at Fig. 7 is so formed that the edges of the fibers of the slabs of which it is formed do not show, thus rendering it capable of being colored evenly.

F, Fig. 8, is a hollow-box platform having a steam-entrance pipe, F'', and a steam-exit pipe, F'''. F' F' F' F' are four posts provided with cog-racks upon their inner surfaces. G is a plate which receives the posts F' at its four corners, and is provided with four cog-wheels, G', to engage with the said cog-racks, respectively.

H is an inverted male mold-block, similar to that shown in Fig. 3, attached by a short column to the under surface of plate G. I is a slightly-depressed space in the upper surface of the base F, having in its middle a sunken or female mold to correspond in shape with and to receive the male block H. This female die is surrounded on the surface I with pins to hold the piece of felt to be molded.

J is a perforated clamp-frame, held suspended by its posts K K' from the under surface of plate G, the spiral springs L L keeping it pushed away from the lower surface of plate G. It surrounds the block G as it descends, and its perforations each receive one of the pins upon surface I, thus holding the felt fast while the male die or block H continues its descent to mold the piece. As the plate G descends to accomplish this the frame J remains stationary after striking surface I, and its posts project upward through the holes in plate G, (shown at J' J'', Fig. 8.)

M is a chain, rope, or band run over a pulley above to raise and lower plate G. N is a bent standard hinged at the side of base F, and having a hinged arm, N'. When the plate G descends as far as it will go this standard is swung over it, and the hinged arm is secured to a staple or catch on the opposite side of base F.

O is a revolving screw, having a corresponding female thread in the top of standard N,



and when the latter is in the position last described the lower end of this screw rests upon the central point of the plate G, and a few turns of the screw will send the plate G farther down, and consequently drive the male die H home into the female die. P is a steam or dry heating box having a steam or hot-air entrance pipe, P''', and an exit-pipe at its other end. P' is a drawer to the box P. P'' is an open-work or corded frame to receive one of the felts to be heated. There are a number of these frames of the same general shapes as the cut felts, respectively.

Q Q are perforations in the female die for the passage to the felt, while being pressed, of steam or hot air from the hollow base F.

Fig. 12 shows a dome-shaped drier and condenser. R R R are series of inclined troughs, set against the insides of the condenser, emptying into hollow upright tubes or pipes S S S. These tubes, by means of connections S' S' S' S', converge below the drying and condensing chamber, and all empty into a single-coiled pipe, T, which is surrounded with running or constantly-changed cool water in the closed tank U. This coil, after passing through tank U, empties into a receptacle or bottle, V. U' U'' are two pipes to admit and carry away water from tank U; W W, a coil of pipe in the condensing-chamber, through which hot air or steam is passed to evaporate and dry the felts to be blocked. I purpose having a large rack in this chamber, sustaining open-work frames, like that shown at Fig. 11, for holding the saturated felts which are to be dried, from which the alcohol is to be evaporated.

I will now explain the various stages of the manufacture.

Guided by a number of patterns, I first cut the felt or material from which the splints are to be made into such various shapes as will be required in subsequently forming the pieces of splints upon the molds or blocks D and H. I leave a margin of the material to overlap the block, as shown in Fig. 3. These patterns are named and numbered as follows: No. 1, inferior maxillary, (one piece;) No. 2, clavicle, (one piece;) No. 3, shoulder-cap, (one piece;) No. 4, humeral, (one right and one left;) No. 5, elbow, (one or two blocks, as desired, one right and one left;) No. 6, radial, (two blocks, one right and one left;) No. 7, ulnar, (two blocks, one right and one left;) No. 8, femoral, (four splints;) No. 9, anterior knee-joint, (two blocks, one right and one left;) No. 10, posterior knee-joint, (two blocks, one right and one left;) No. 11, anterior tibial, (two blocks, one right and one left;) No. 12, posterior fibular, (two blocks, one right and one left;) No. 13, fingers and toes, (two pieces;) a complete set consisting of fifty pieces—twenty-five pieces for adults and twenty-five pieces for youths. The youths' are numbered the same from one to twelve, the only difference being that No. 13 in the adults' set is for fingers and toes, while the No. 13 in the youths' is for club-foot. These pieces, as de-

scribed, are cut out in sets. These sets are subjected to a bath of stiffening solution—such as dissolved shellac—and when thoroughly saturated they are separately and singly passed between rolls, (cold.) This process tends to remove any superfluity of the stiffening agent and to equalize and distribute it properly throughout the piece, and, further, to drive the major portion of said shellac to the center of the felt or material, leaving the two surfaces soft and smooth. As these pieces appear from beneath the rolls they are laid out on racks covered with canvas or laced with cords, great care being taken that the pieces shall not come in contact with the wood-work of the frame, or that they shall not overlap or touch one another, the reason for this being that if the pieces of felt thus saturated do touch anything of a solid nature or lap over one another while wet the stiffening agent will be thereby drawn again to the surface, leaving a dark, unsightly stain, and causing also roughness at that point of contact. When thoroughly dry and hard the corresponding pieces of the various sets then being treated are taken from the racks—that is, if twenty-five sets are being formed, then the twenty-five maxillary pieces are taken from the racks and treated together, and so on with all the pieces. No. 1 are separated from the rest; No. 2, the same, and so on until all the corresponding pieces are separated and piled up, respectively. They are then ready for blocking or conformation into the desired shape.

I will here describe the blocks or molds D upon which the splints are formed.

Heretofore the molds that were used in the manufacture of the well-known "Ahl's splints" were made of wood carved like that special part of the human limb which it was desired to cover. For example, the block or mold for making the anterior and posterior knee-joint splint was a piece of wood carved so as to show that section of the limb, say six inches below and six inches above the center part of the patella, (or knee-cap.) A notch or groove was cut on either side of this cylindrical piece of wood, lengthwise of the mold, from end to end. This groove was designed to indicate the line and size of either anterior or posterior splint, and this was ascertained by pressing the piece of material being treated into this groove, and when the material was removed an indented line formed by the groove indicated the line to be cut. This cylindrical block was unwieldy and awkward to handle, having to be held in a vise or rack for that purpose.

I make my molds or blocks D of plaster-of-paris, wood, cement, metal, or terra-cotta, or any other suitable material. I have a block for each different splint from No. 1 to No. 13, made only half the circumference front or back of the part of the limb, and the exact shape and size desired for that particular splint.

The necessary splint-incasement to treat a fracture of the knee-joint consists of two



troughs, one made the shape of the anterior, D, and the other the shape of the posterior portions of the leg, for when used in treating a case of fracture they are always used conjointly, one trough being placed anterior, the other posterior, and maintained in proper position by bandages, rubber bands, &c. The block D will resemble in form a human limb split up the middle from the side. These separate blocks are all convex, and have the shape of half the limb upon the top, the bottom being perfectly flat, forming a horizontal plane surface. The convexity of the top terminates in sharp edges where it meets the plane of the bottom. These edges form the finish-line markers. (See Figs. 3 and 4.) These blocks are raised by means of a pedestal or standard at either end, CC', or one running under the whole length of said block, the object of such standards being to permit the material to be lapped well under the sharp edges of the bottom of the block to get a full and sharp indication of the "finish-line" of the mold, which line is used as a guide to be followed in cutting away the ragged and rough edge which shall have passed or lapped over and beyond said finish-edge. I have twenty of these blocks D, all numbered and named precisely the same as the patterns and pieces of material cut thereby—viz., from No. 1 to No. 13. Where there is right and left of the same shape I have two blocks numbered the same, one right and one left.

In practice I have found that the most convenient mode of constructing the blocks is to have their flat bottom free from any appendage. On the top of each pedestal C', I have a pin, C'', of about one inch in diameter, say one inch long, with a square shoulder, which is the top of the pedestal at the bottom of the pin where it joins the pedestal. In either end of each block or mold I bore a hole of a size to admit and receive the pin of the pedestal. One of these pedestals, C', I fasten securely to a table, bench, board, or any convenient support. I then place a guide strip or track, B B', upon each side of the base of the pedestal. These tracks are as long as the longest mold, and between these two tracks I slide the other pedestal, C.

The various blocks are of different lengths. When any block, by means of its hole at one end, is placed upon the stationary pin in pedestal C', the other pedestal, C, can be quickly brought up between the guide-tracks to the spot directly under the hole in the other end of the block, and the latter can be dropped down onto the pin C'', making it ready for work.

When I have concluded using that particular block I simply lift it off the pins, set another one on, and continue as before. The holes in all the twenty blocks are of the same size, but only one pair of pedestals with pins is necessary.

In order to conform the piece of material

E, as described hereinbefore, into its special form and shape as a splint, it having been made stiff and hard by saturation in suitable gums, it is made soft by subjecting it to a great heat. This can be done by immersion in hot water; but I prefer steam or radiated heat, because these two latter are more convenient to apply, they do not soak the piece of material with water, and they leave it porous, and the piece cools more rapidly, all of which tends to admit of more expeditious handling, thereby reducing the cost. Such treatment also has a tendency to open the interstices in the material, rendering the porosity certain.

I have a steam box or chest, P, into which I admit live steam. In this box I place a piece or pieces of the material, Fig. 2, and turn on the steam for a short time. I then turn it off, open the box P, and remove the piece of material, which when placed therein was hard and stiff, but on coming out is perfectly soft and pliable. While in this state it is quickly pressed into shape by the hands over the mold D, which is then on the pins for that particular number of piece. It yields readily to the perfect contour of the block or mold and rapidly cools during the operation, and when removed preserves the exact shape into which it is pressed or conformed upon the block.

The necessary pressure required to force the conformation causes an overlap (see Figs. 3 and 4) around or under all the finish-edges of the block. These edges, being sharp and fine, as described above, leave a very decided crease deeply indented in the felt or material, which, when removed from the block, clearly defines the size and shape and where the splint is to be cut to finish it.

When No. 1 has been blocked that mold is lifted from the pins, and No. 2 block is placed upon them, and so on until all the pieces have been conformed which belong to that batch, as described. I then remove the overlap or superfluous edges of the material by paring with a sharp knife or shears, or any suitable implement that will answer the purpose. After all these overlapping edges are removed the splints are of the desired shape. In order to give them a perfect finish I then dress all the cut edges with a keen sand or emery paper. I then put these up in sets of fifty pieces—twenty-five pieces for adults and twenty-five pieces for youths—as follows: Adults, one piece for the inferior maxillary, or No. 1; one piece for the clavicle, or No. 2; one piece for the shoulder-cap, or No. 3; two pieces for the humeral, or No. 4; two pieces for the elbows, (one right and one left,) or No. 5; two pieces for the radial, (one right and one left,) or No. 6; two pieces for the ulnar, (one right and one left,) or No. 7; four pieces for the femoral, (two right and two left,) or No. 8; two pieces for the anterior knee-joint, (one right and one left,) or No. 9; two pieces for the posterior knee-joint, (one right and one left,) or No. 10; two pieces for the anterior tibial, (one right and



one left,) or No. 11; two pieces for the posterior fibular, (one right and one left,) or No. 12; two pieces for the fingers and toes, or No. 13.

The youths' are put up precisely as the adults', with the exception of No. 13. In youths' I omit finger or toe pieces, but use two pieces conformed specially for the treatment of club-foot, or varus, and numbered 13. I then nest these splints, which are in the form of troughs—the adults' splints in one bundle and the youths' in another.

The adults' splints are as follows: I start with the four femoral splints, (No. 8,) one within the other. I then place the two right and left posterior knee-joint splints within one another, and place their convex sides within the concave side of the last of the four femoral splints, making a close and perfect nest. I do likewise with the two right and left anterior knee-joint splints, placing them within the posterior splints. I then place the two right and left tibial splints within one another, and then place their convex side within the concave side of the last of the two anterior knee-joint splints. In like manner I place the two right and left posterior fibular splints within the trough of the tibial splints. Then follows in like manner the two ulna pieces, then within the trough of the ulnas the two radial splints. Upon the concave face and edges of the radial splints I place the two humeral splints, with their concave side down. I then place the concave side of the inferior maxillary splint transversely across the convex side of the last two humeral splints, much the form of a saddle for a horse. The whole bundle up to this stage rises like a pyramid from a broad base to a small narrow top, with this inferior maxillary piece crossing the top like a saddle, binding the whole well together, and confining themselves to a very small space. I telescope the edges of the two obtuse-angled elbow-splints over the extreme edges of the concave side of the radial splints, making with these a complete covering.

Under either lap of the inferior maxillary splints, as it saddles over the bundle, as described, I place one of the two short straight pieces for fingers and toes, these laps binding them closely to the side of the bundle. I then, with a piece of string or broad tape, (tape being preferable,) bind the whole, as described, firmly together.

The same nesting system is carried out as regards the youths' set, except I first place, one within the other, the foot portion of the club-foot splints, and place them on the bundle exactly as I have described for the elbow-splints. I then top the youths' bundle off with the two elbow-pieces, forcing their concave side down upon the convex side of the club-foot splint, bring the point of the angle or heel portion of the club-foot splint directly within the convex point of the obtuse angle of the elbow-splint; or I reverse these last two, (elbow and club-foot,) placing the club-foot splint on the

bundle first, and the elbow-splints under, as described. Both bundles are tied up in paper in separate packages strongly secured with string.

I will now describe another plan for rapidly blocking or molding my splints. I make a set of dies, H, and counter-dies I, of iron or other suitable material, of the shapes above described, or now in public use, though I may change and improve their shapes and forms from time to time.

The concave or female dies I arrange in any desired order upon a strong platform or table, F, about the height of a man's middle, and firmly fasten, so that the dies cannot move from a shock. I prefer to arrange them in the order described in the first part of this specification—viz., from number 1, in sequence, to number 13, adults' and youths', respectively.

The convex or male dies H, in the same order, swing immediately over their respective concave or female die I, and in such exact position that when lowered the male die shall fit exactly into the female die.

I fasten all these male dies to a rigid frame, G, and each one is nicely adjusted as to the depth of the bottom of the female die, into which it is to fit—that is, each individual male die is adjusted as much higher or lower than the neighboring male dies as may be necessary, when they are all brought down at one time, by means of the rigid frame G, for it to evenly touch the bottom and sides of its female die. If one male die struck the bottom of its female die before the others did, then only that one die would mold its splint to a correct shape.

I construct this rigid frame G of male dies H between four perpendicular posts, F' F' F' F', the four posts forming a square. Each corner of the rigid frame is provided with a cog-wheel, G', and each of the four posts is supplied with a track or perpendicular cog-rack to correspond, upon which I elevate and lower the frame G, which carries the male dies. By having a reverse weight hung by a pulley to this frame, to counterbalance and aid in lowering and raising it, I can do so with rapidity and ease.

When the frame is completely lowered and the male dies are all within their corresponding female dies, I release the counter-weight by detaching the cord, or in any manner most convenient so to do, and thus allow the entire weight of the male dies and frame to bear within the female dies. Then I add to this a power-screw, O, with which I can apply all the additional pressure necessary.

Having described the blocking apparatus, I shall now describe its particular use in practice, and at the same time show some additional features in its construction.

The upper plane, I, of each female mold or die is about one-quarter ( $\frac{1}{4}$ ) inch below the general level of the horizontal plane of the top of the base-frame F, in which it is set, the purpose



being that the edge or descent from one plane to another shall act as a guide and a stay to the piece of material which is to be blocked, this declivity in each individual die being the same in size and shape as the piece of material cut for that particular mold. Around the edges of this declivity, and just back of the edges of the female die, I have firmly fastened several small sharp pins, made of metal, steel being the best and most durable. These pins stand up to a height of about one-half inch.

I will now describe the process of blocking or molding the splints with the above last-described apparatus.

15 Beneath the blocking-table or other convenient place I construct a steam-box, P, in which to soften the felt by heat preparatory to shaping it. Any tight box of any material will do; but I prefer a box as follows: I erect  
20 a metal box, P, the length of the table of female dies or molds, as described. This box contains a drawer, P', on rollers, and when closed shall be steam-tight, or nearly so, but yet remain easy to open and shut. I divide  
25 this drawer up into divisions from 1 to 13, each division being the same in shape as the piece of material which it is to hold—that is, as it is first cut from the whole piece for making any special splint or number from 1 to 13.  
30 No. 1 division shall be directly under No. 1 block, No. 2 under No. 2, &c., to the end. The whole interior of the drawer shall be very open to permit free circulation of heat. I would prefer cane or strings interlaced. This per-  
35 mits a perfectly free circulation of the steam or radiated heat. Into this box I inject live steam or raise the temperature to 200° Fahrenheit, and over, by hot air, or other means which shall accomplish the purpose. Within each of these  
40 divisions I place the special piece of felt or material intended for that space or division, treated as hereinbefore described. I then close the drawer and admit the steam or heat. If the box P is always heated to the necessary  
45 degree by other means than steam the result will be the same. I then allow them to remain subjected to this heat for a few minutes or a sufficient length of time to become well heated, at which time the piece will be thor-  
50 oughly soft. At this juncture the drawer is opened, each piece of material quickly removed and placed, according to its number, on the corresponding number of the female mold, adjusting it nicely within the declivity, margin,  
55 or boundary of the mold proper, as described, and the edges of each piece are forced down upon the sharp pins before described.

As a means to insure perfect conformation of each of the various numbered and shaped  
60 splints, as described, I proceed as follows: In addition to the little pins that stand up in each declivity surrounding each female die, I construct a metal clamp-frame, J, which shall surround the male die. Each of these frames  
65 shall be of a shape and size exactly to correspond with the shape of the declivity under

it, and it is pierced with holes in size, shape, number, and depth exactly to correspond with the small pins standing erect in the recess around the female die, as described. These  
70 frames J are hung around each male die and suspended from the plate G, holding the male dies themselves by stout guide-rods K through holes in plate G, in which these guide-rods  
75 freely pass up and down, held suspended by cross-pins in their ends. Spiral springs L L around these rods are long enough to allow the bottom line of the frames J, in their inactive state, to hang about on a line with the bot-  
80 tom of the male dies.

As hereinbefore described, when each numbered piece of prepared felt or cloth has been removed from the steam-box P, as described, and placed on its special number of female die I, and within the declivity and on the upright  
85 pins, as described, all being ready, the plate G, supporting all the male dies, and the accompanying frames J, just described, are lowered onto the hot soft pieces of cloth lying ready for the male die to conform them into  
90 their respective shapes.

As the male dies descend, the frames J being on the line of the bottom of said male dies, they will reach the sunken surface or recesses surrounding the female dies some little time  
95 before the male dies will have reached the bottom of the female dies. Therefore, as the weight of the plate G continues to descend and force the male dies down to the bottom of the female dies, these frames J will be firmly fitted into  
100 each recess, as described, and each little upright pin in said recess will have penetrated into its corresponding hole in the bottom of each of said frames J. Each spring will be  
105 pressing tighter and tighter as the plate G continues to descend, and when the pressure of the power screw or lever may be added the frames J are forced to give forth more and  
110 more pressure, rendering it impossible for the pieces of cloth to move from the position in which they are first placed, and insuring the perfect formation of the splint, according to the die.

The time taken to remove the whole number of pieces from the drawer of the steam or  
115 heating chest or box and adjust them on the pins within the declivities, and to lower the frame of male dies down upon them, is short, yet there is a sufficient lapse of time to cool the pieces of material considerably; and  
120 as the slightest cooling renders it less pliable, it does not, in this instance, prevent partial, if not complete, conformation to the dies; but as perfect and complete conformation is necessary I attain it as follows:  
125

The female dies being concave in form, and being sunken into the table or platform, I perforate the bowl or cavity of each female die with numerous small holes Q Q. Surrounding all these female dies is a heating-box or  
130 steam-chamber, F, into which the convex lower surfaces of these female dies project.



Into this box I introduce a steam or heating pipe, F". If desired, this box can be cooled off by means of a cold current of air projected through this same pipe F", the pipe having a switch-connection for that purpose with both a steam-pipe and a cold-water or air pipe.

When the pieces of material E have been driven down into the female dies by the weight of the male dies and the counter-weight detached, as described, I admit the live steam or heat into the box under the perforated female dies, as set forth, which steam or heat almost instantly fills the box F and the bowls of the dies, thus again rendering the pieces of material perfectly soft. At this juncture I put on additional pressure by the power-screw O and force the material, in its then soft state, to take on the exact form of the die or mold.

When the male dies H on plate G are elevated the splints or conformatures are removed and are hard and ready to pare and be finished, as has been hereinbefore described.

I use alcohol to dissolve the shellac, or its equivalent. After the pieces of material are saturated in this solution they are laid out to dry, and are not conformed or blocked until the alcohol has been evaporated therefrom, all of which alcohol is lost unless some means are used to save it. My plan is to save as large a proportion of it as is possible. To accomplish this I dry the saturated pieces on open-laced racks in a chamber or condenser, Fig. 12, which I construct as follows: I line a room with tin, zinc, or any other suitable material. This room I construct somewhat in the shape of a cone or dome. On the walls of this structure I arrange little troughs R R R, all inclining downward at an angle of, say, forty-five degrees. These troughs I construct of the sheets of tin that are used in lining the room. The bottom of each sheet as it is put on shall be slightly turned up into troughs; or I can make these troughs of tin or other material and solder them onto the wall, in the manner shown in the drawings.

In order to accomplish a rapid movement of the condensed vapor as it accumulates upon the walls I arrange the troughs as follows: I divide the dome into, say, eight equal upright converging sections by the dividing-strips Z. I then solder my little troughs R R R onto the walls, inclining downward either way from one of the dividing-strips of one section to an upright tube, S, one on either side. Each of these tubes or pipes S S S has side openings at the end of each little trough. These pipes gather all the particles or drops conveyed to them by the small troughs R R R through the holes or openings where the troughs join the pipes.

This same arrangement I carry out, as described, in every section, every second line being a pipe, as described, to convey the collected and condensed vapors downward.

All of those pipes I bring to a central point

at a lower level than the floor of the condensing-room, and there join them to a single coil of pipe, T, which is inclosed in a box containing ice, ether, running water, or other cooling material, the end of which coil is so arranged as to empty any fluid which passes through it into any arranged receptacle. Thus I regain a certain proportion of the alcohol, which, by the old process, was entirely lost by evaporation or drying.

In order to gain a quick drying of my saturated material, and also rapid evaporation of the alcohol, I cause this described condensing-room to be heated by any convenient means (say by steam) to a degree which shall accomplish the object.

The pipes S S S could be passed down the outside of the shell of the condenser, if desired, the holes from troughs R communicating to the pipes through the shell of the condenser; and if a double shell were used, so as to make a cold-air or water chamber, instead of coil Z, then these pipes S S S could be thus surrounded by the cooling agent.

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

1. The blocks or molds, Fig. 3, in the form of a short longitudinal section of the human limb, whereby the splint can be formed and marked out, substantially as and for the purpose described.

2. The combination of the splint mold-block D and adjustable standards or pedestals C C', substantially as and for the purpose described.

3. The combination of the splint mold-block D and pedestals C C' to raise and sustain it, whereby the material pressed over the block can be turned thereunder, substantially as and for the purpose described.

4. The combination of the block or mold D, flat on the bottom for the purpose described, with the pedestal-pins C'' and the tracks or slides B B', to guide and to render the pedestals adjustable, substantially as and for the purpose described.

5. In the process of forming a cloth splint, softening the same by means of steam or dry heat to facilitate the molding of the same into the desired shape, and its subsequent rapid hardening, substantially as and for the purpose described.

6. The combination of the platform F, posts F', having perpendicular cog-racks, as described, plate G, cogs G', male die H, and female die I, substantially as described.

7. The combination of the mold or stamp-mill F, F', and G and the dies H and I with the power-screw O, to give additional pressure, substantially as described.

8. In combination with the stamp-mill F F' G and the dies H and I, the clamp-frame J, guided by rods K, whereby the articles being stamped are fastened down during the process, substantially as described.

9. The combination of the stamp-mill F F'



G and the dies H and I of the heating-chamber F, substantially as described.

10. In combination with the heating, steam, or air chamber F, the perforated mold or die I, whereby the article being pressed can be heated or cooled during the process, substantially as described.

11. In a stamp-mill, the combination of platform or base F, posts F', plate G, sliding upon the same, and male and female dies H and I, substantially as described.

12. The heating-chamber P and small laced or open-work frames P'', shaped respectively to receive the various-shaped felts to be blocked or molded, whereby the felts can be easily apportioned or separated to be placed on their proper dies, substantially as described.

13. On the upper face of base F, the ridge or edge formed around the sunken flat upper face of die I, whereby the operative is guided in placing the softened felt quickly in proper place, substantially as described.

14. The condenser, Fig. 12, provided with troughs R R R and closed tubes S S S, to catch and carry off the products of condensation, substantially as described. 25

15. The condenser, Fig. 12, provided with troughs R R R and tubes S S S, and an enveloping cold-conductor, Z, to cool the shell of the condenser, substantially as described. 30

16. The combined condenser and heater, Fig. 13, provided with the heat-conductor W and apparatus R R R and S S S, to catch and carry off the products of condensation of the vapors produced by the heat, substantially as described. 35

17. In combination with the heating-chamber, the supplemental condenser V, substantially as described.

WM. HAMPDEN JOHNSTONE.

Witnesses:

GEORGE E. BUCKLEY,  
WM. H. CARSON.