

(No Model.)

3 Sheets—Sheet 1.

S. N. SMITH.
SMOKE PREVENTING FURNACE.

No. 527,895.

Patented Oct. 23, 1894.

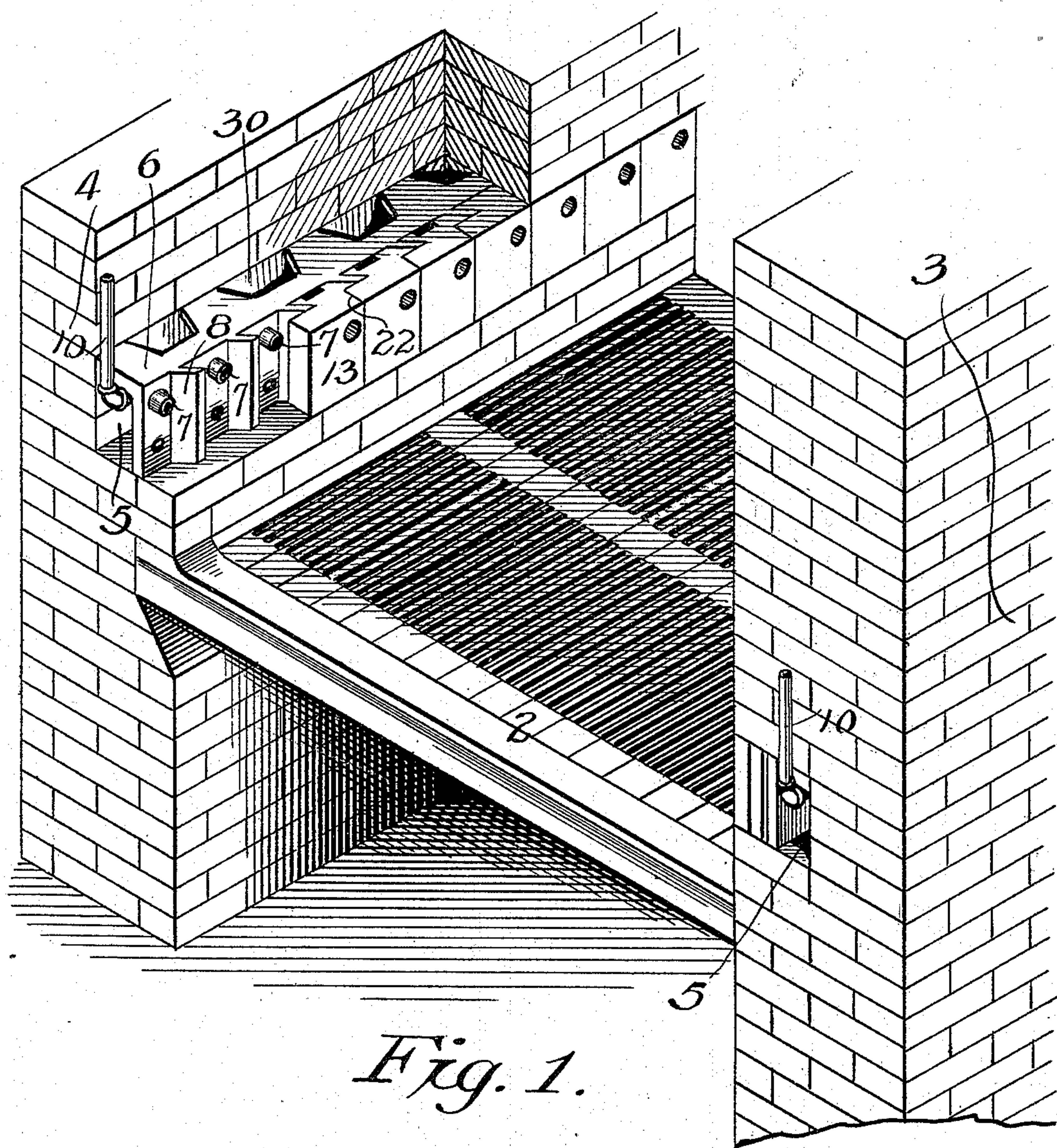


Fig. 1.

Witnesses.

Chas. E. Van Doren.

C. E. Van Doren

Inventor,

Samuel N. Smith.

By *Paul & Hawley*
his Att'ys.

(No Model.)

3 Sheets—Sheet 2.

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Fig. 2.

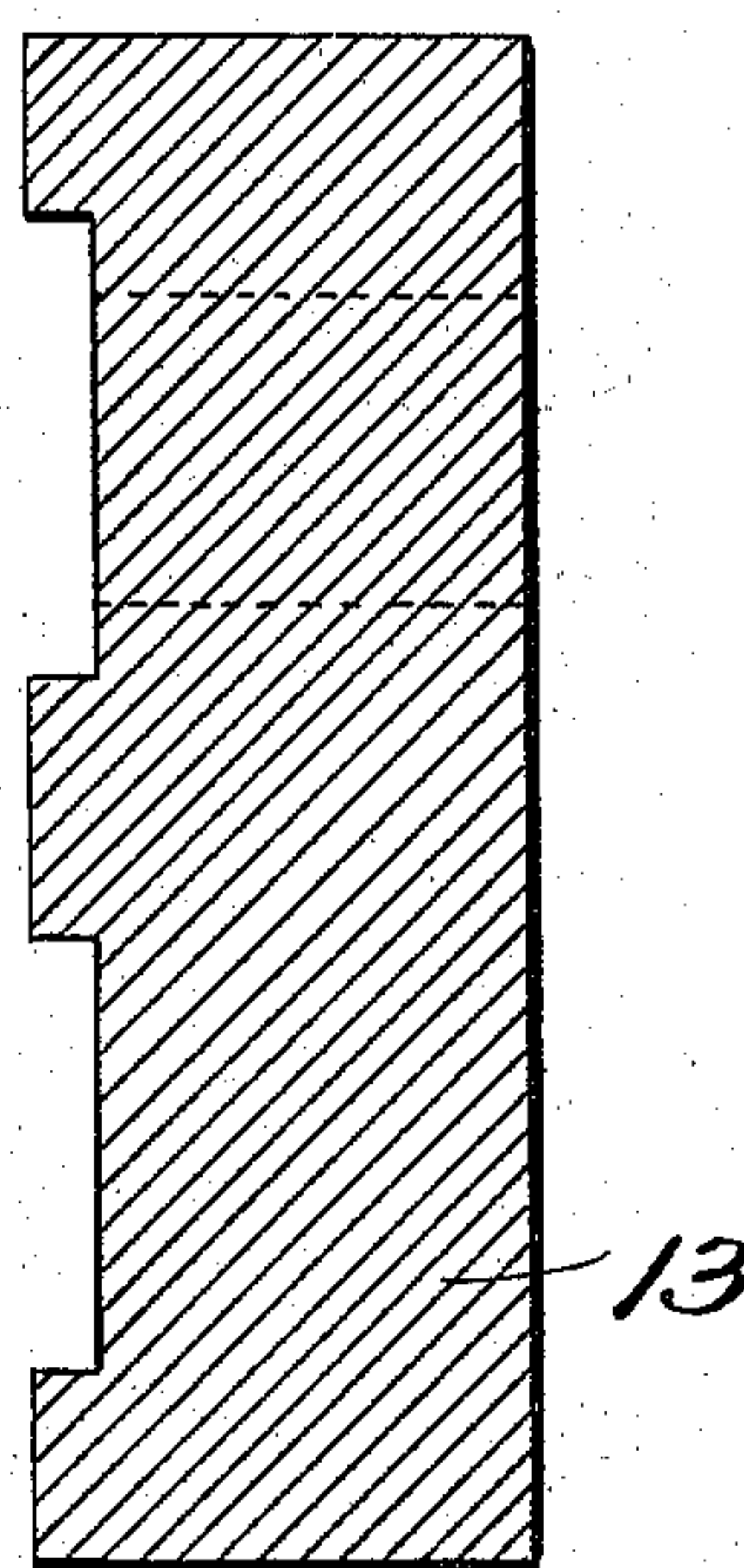
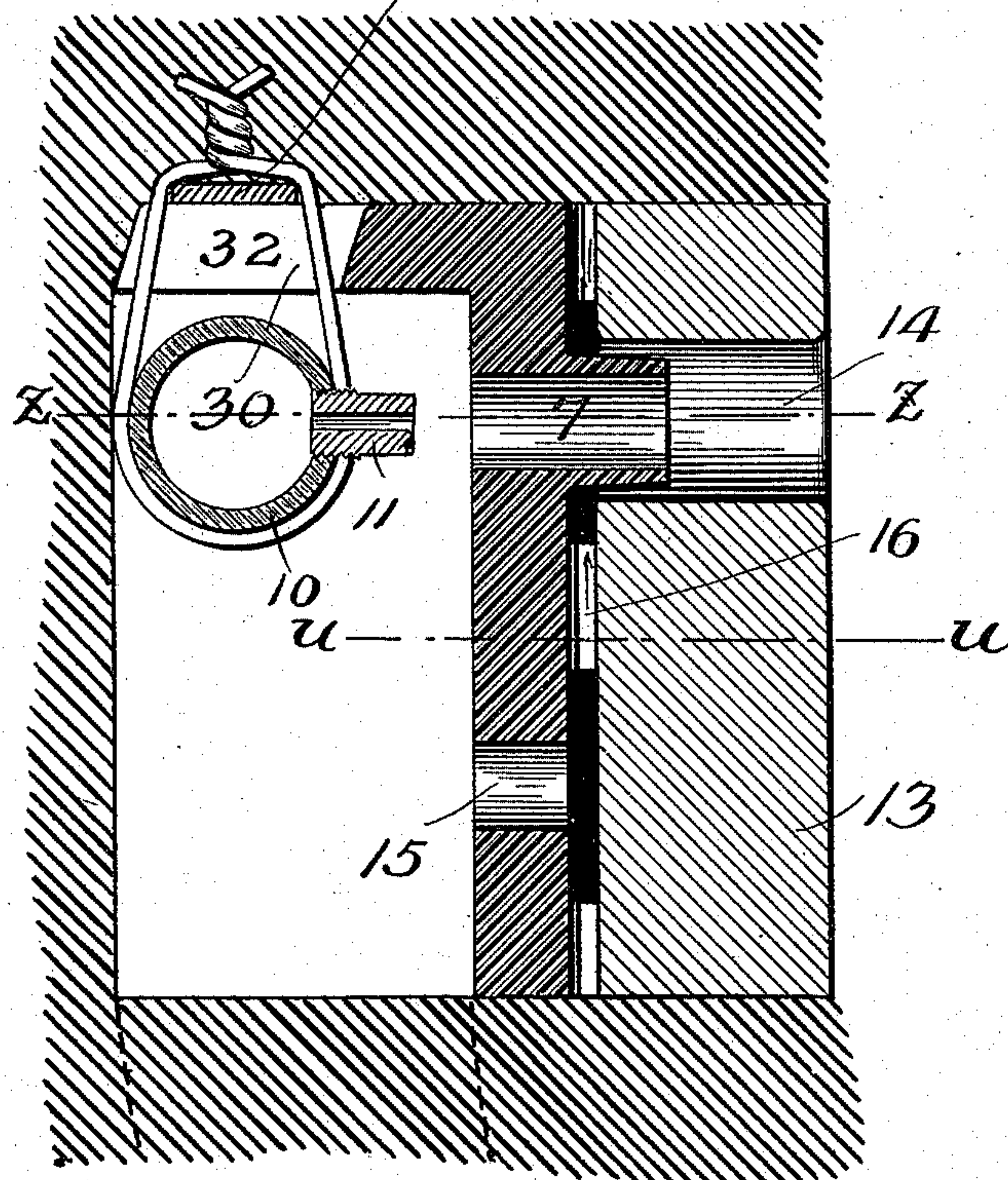
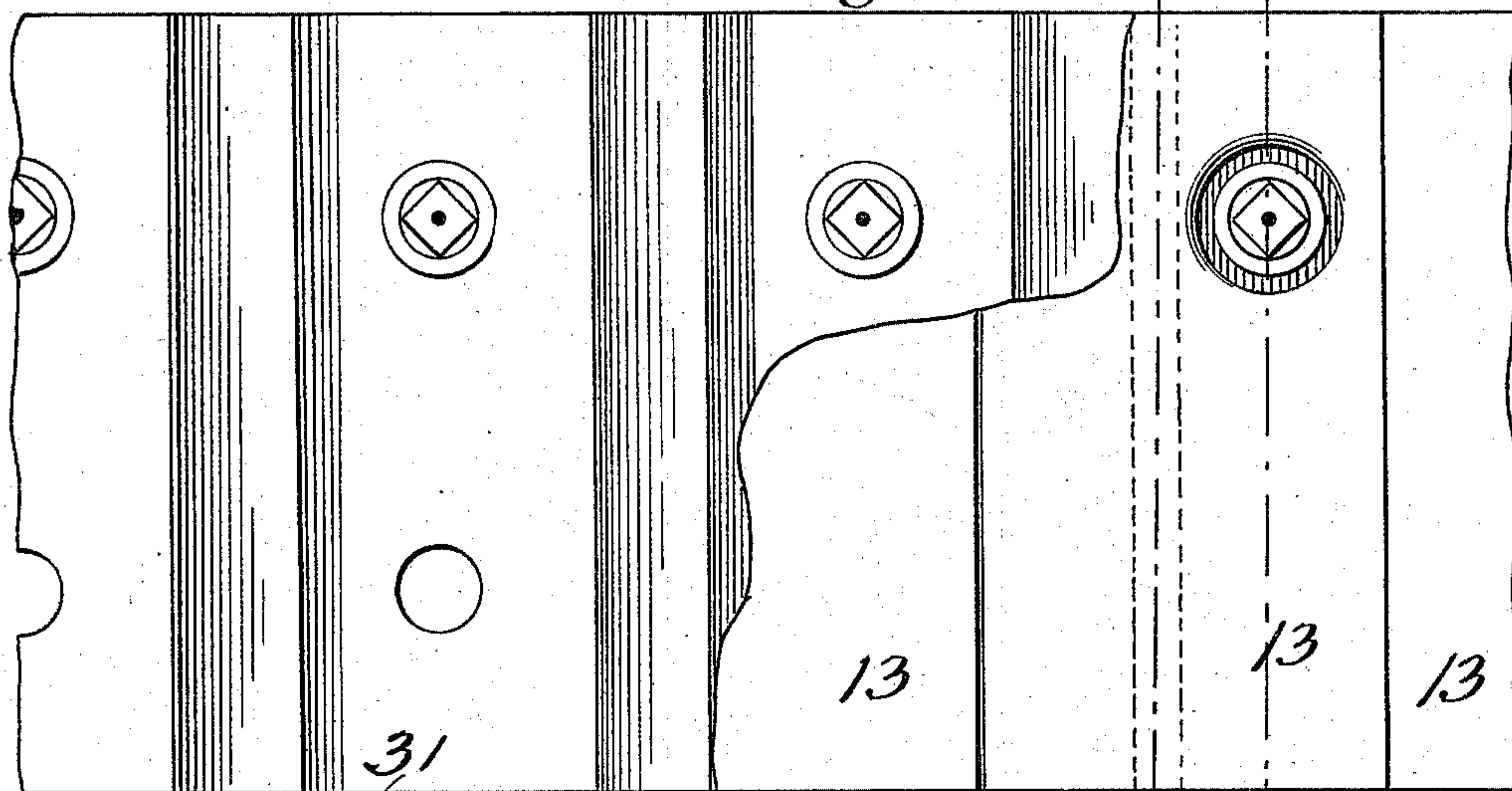


Fig. 4.

Witnesses. Fig. 3. Samuel N. Smith.
Chas. E. Van Doren. By Paul & Hawley,
his Attorneys.

(No Model.)

3 Sheets—Sheet 3.

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Fig. 6.

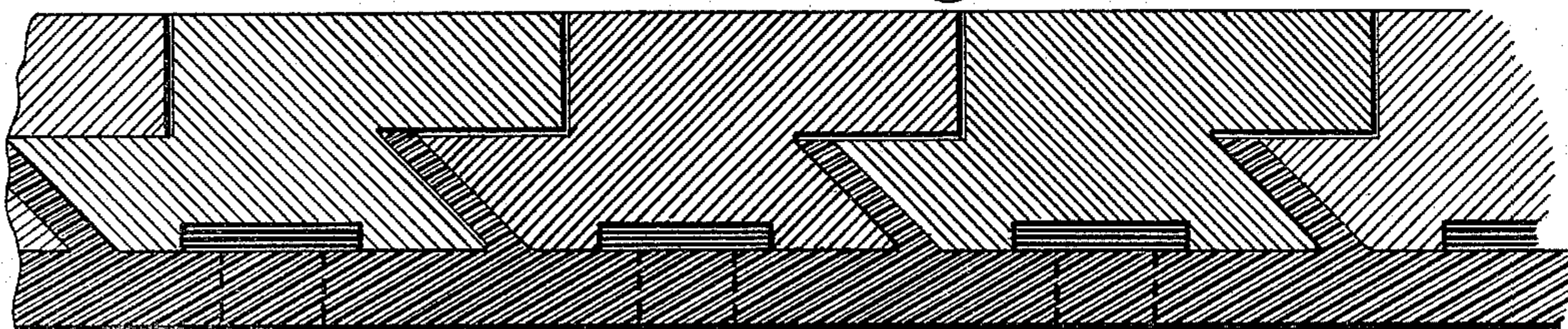


Fig. 5.

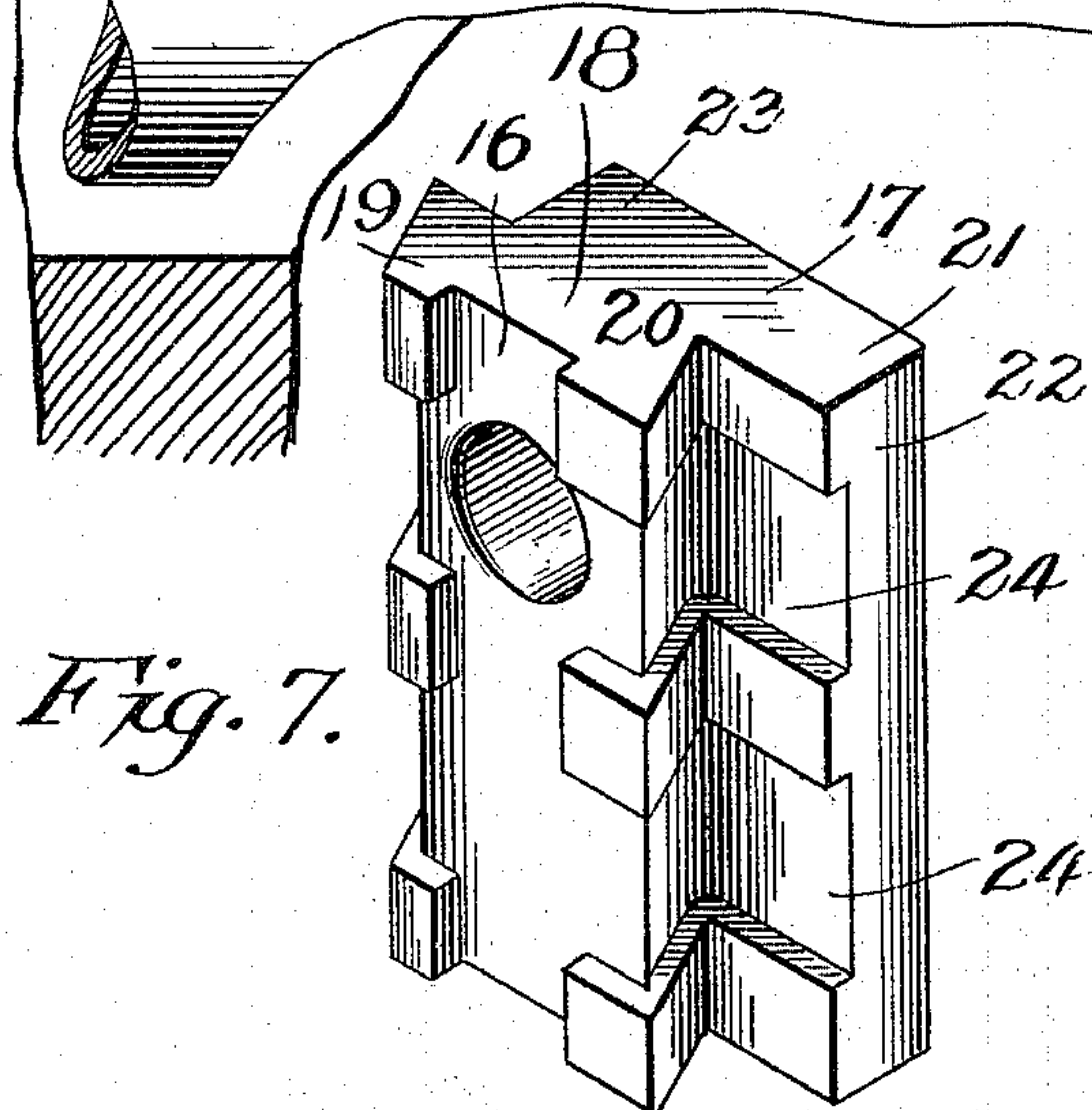
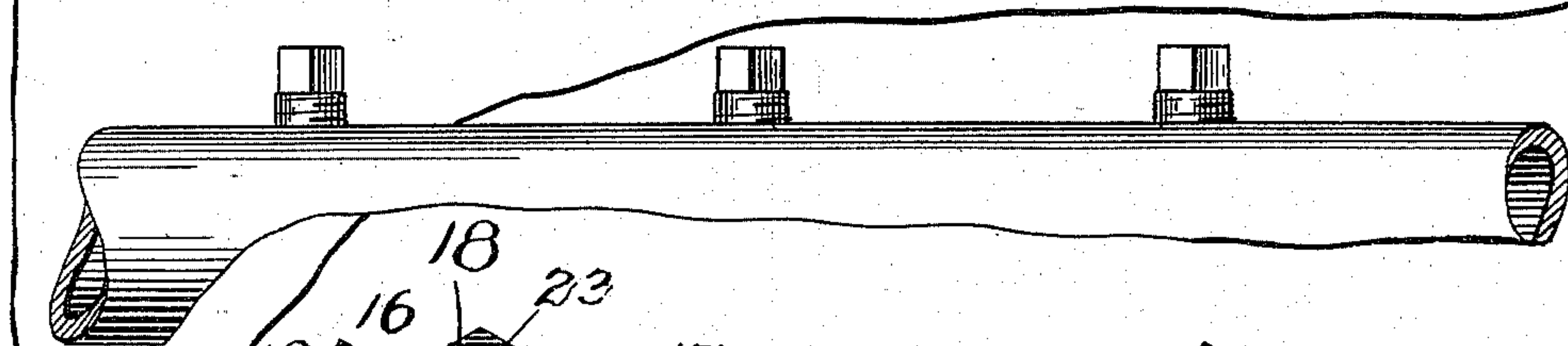
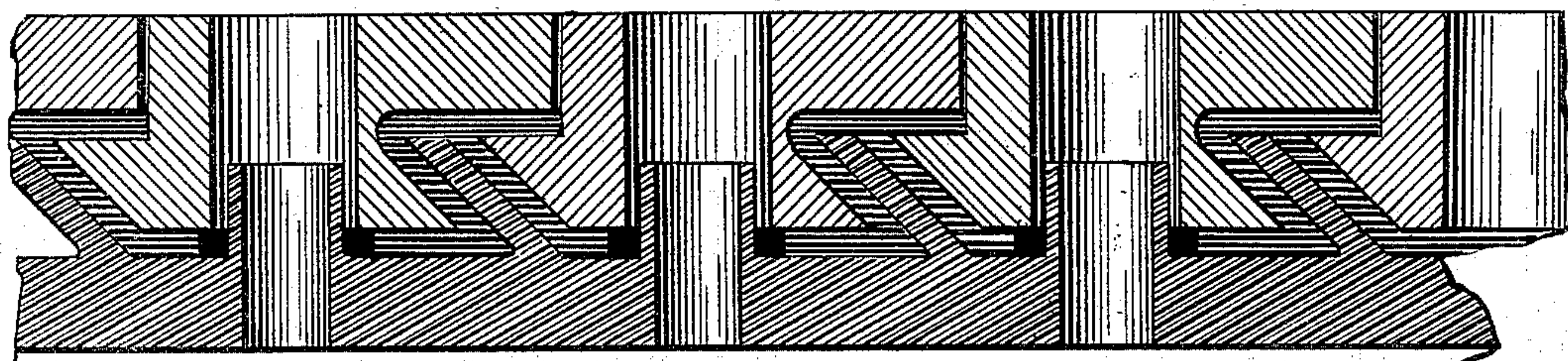


Fig. 7.

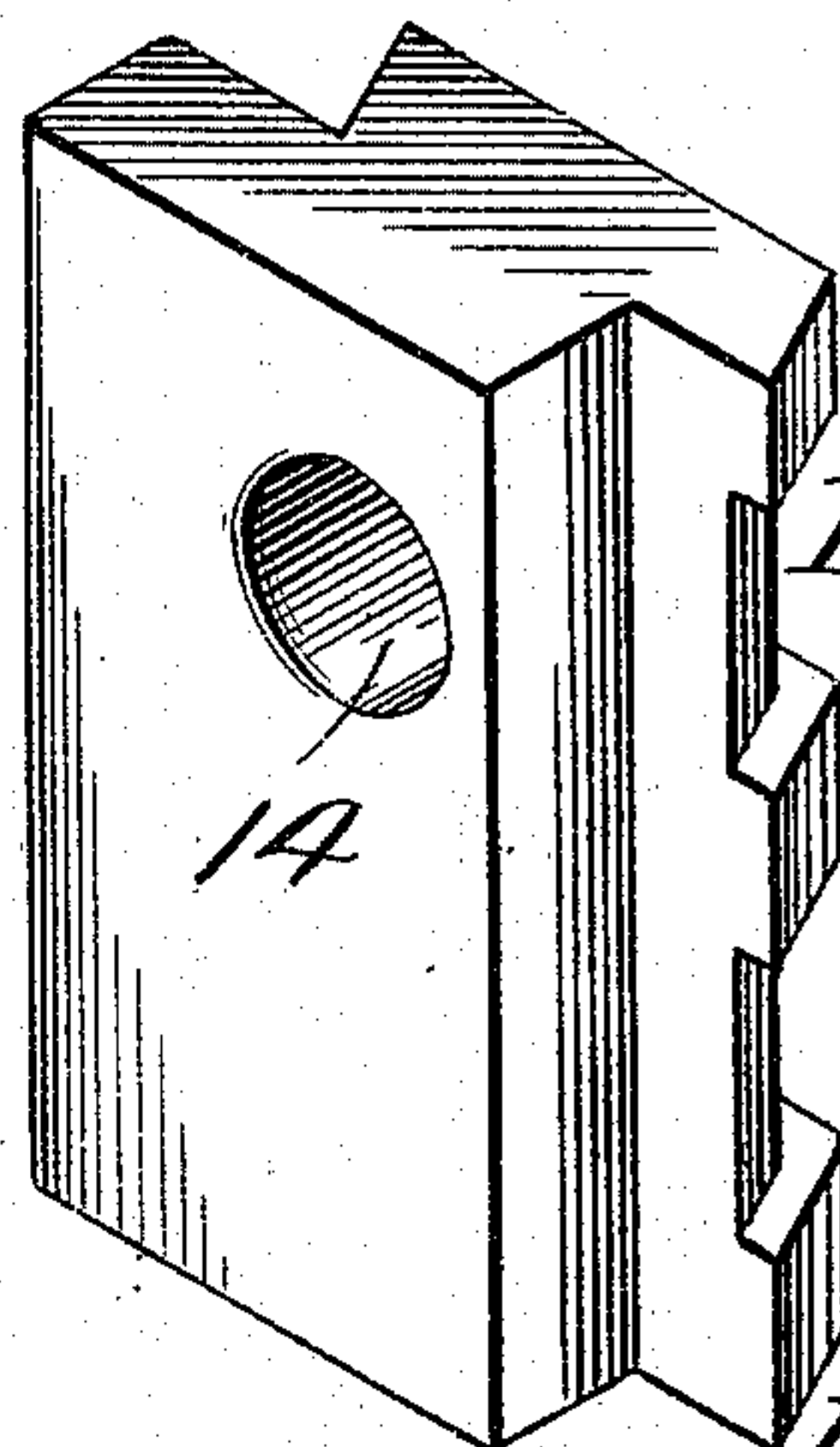


Fig. 8.

Witnesses,
Chas. E. Van Dorn,
J. B. Lyon

Inventor,
Samuel N. Smith.
By Paul & Hawley
his Attorneys.

UNITED STATES PATENT OFFICE

SAMUEL N. SMITH, OF MINNEAPOLIS, MINNESOTA, ASSIGNOR TO THE
MINNESOTA SMOKELESS FURNACE COMPANY, OF SAME PLACE.

SMOKE-PREVENTING FURNACE.

SPECIFICATION forming part of Letters Patent No. 527,895, dated October 23, 1894.

Application filed January 22, 1894. Serial No. 497,643. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL N. SMITH, of the city of Minneapolis, county of Hennepin, State of Minnesota, have invented certain new and useful Improvements in Smoke-Preventing Furnaces, of which the following is a specification.

My invention relates to means for completely consuming all of the combustible gases and materials in or generated from fuel in furnaces and thereby avoiding the making of smoke.

The object of my invention is to provide means directly in connection with the fire-box of the furnace whereby the smoke and gases as generated from the fuel, and part of which would not otherwise be burned, will be thoroughly charged with oxygen from heated air and steam and to such a degree as to render them highly and completely combustible.

To this end my invention consists in general in the constructions and combinations all as hereinafter described and particularly pointed out in the claims.

The invention will be more readily understood by reference to the accompanying drawings, in which—

Figure 1 is a perspective view generally illustrating my invention. Fig. 2 is an enlarged front view of a section of the side of the fire-box, a portion of the fire-brick being broken away to show the inner metal retaining bar. Fig. 3 is an enlarged vertical cross-section on the line $x-x$ of Fig. 2. Fig. 4 is a vertical section of one of the fire-brick, the section being taken on the line $y-y$ of Fig. 1. Fig. 5 is a horizontal section on the line $z-z$ of Fig. 3. Fig. 6 is a similar horizontal section on the line $u-u$ of Fig. 3. Figs. 7 and 8 are perspective views of one of the fire-brick.

In Fig. 1 of the drawings I have shown a fire-box provided with the grate 2 and with side walls 3 and 4, built up of brick. These side walls may, however, be constructed in any desired manner as my invention is not restricted in its use to stationary furnaces. In either or both of the side walls I provide an air duct 5 which is preferably formed

partly of the side wall itself and by the angle bar 6. The outer face of this angle bar is provided with nipples 7 arranged at equidistant points thereon, and between these several nipples are the inclined ribs or wings 8. Holes are made through the nipples to connect with the air duct 5. Within the air duct I suspend or otherwise secure a steam-pipe 10 which is provided with a number of jets 11, one jet being placed before the opening of each nipple 7 and the end of the jet being placed some distance away from the opening while preferably concentric therewith. The iron plate is protected by a series of brick 13 of the particular form shown, and each of which is provided with an exhaust opening or port 14 concentric with the nipple, into which the nipple extends a considerable distance, and which opening is of considerably greater diameter than the nipple. In the lower part of the angle bar 6 and beneath the nipples are a series of holes 15. The inner side of each brick is provided with a vertical channel 16 arranged immediately in front of the opening 15 and leading upward therefrom to the exhaust port 14 in the brick.

The facing or fire brick are arranged to interlock with one another and with the inclined ridges or ribs 8 upon the inclined bar, so that with the last of the series of brick secured, all of the others will be firmly held in place. This is accomplished by providing upon the rearside of the rectangular forward portion 17 an offset and angular portion 18. The shoulders 19 and 20 thereof have the same incline as the sides of the ribs 8 and the distance between said shoulders is the same as that between adjacent inclined ribs. Hence the shoulders 19 and 20 fit snugly against the same, the shoulder 20 lapping in behind its rib 8 and preventing that end of the brick from drawing away from the bar. The other end of the brick is held in place by the overlapping edge 21 of the rectangular part 17, the shoulder or end 22 of which makes a good joint with the shoulder 23 of the next brick. The size of the opening 14 admits the insertion of the brick over the nipple and behind the rib. Lateral channels 24, preferably two in number, are provided in the back of each

brick and passing around the forward edges of the ribs 8 form communicating passages between the several vertical channels 16, the inner sides of all of the channels being completed by the angle bar and its inclined ribs or feathers.

I guard against the bad effects of expansion and contraction of the angle bar by making a series of large notches 30 in the top thereof, and I further take advantage of this construction as a means for suspending the steam pipe 10, placing a bar 31 across the top of the angle bar and suspending the pipe 10 from this bar by loops or hooks 32, as shown in Fig. 3.

The operation of the furnace when completed, is as follows: Air is supplied to the air duct in any suitable manner, the air being preferably taken from the ash box beneath the grate. At the same time steam is admitted to the steam pipe 10 and is blown through the jets 11 thereof, a small jet passing through the nipple opposite it and through the port 14 in the fire brick or facing. The force of the steam exhausting through these openings serves to draw a considerable volume of the air from the air duct through the nipple and also serves to draw air through the opening 15 beneath and thence up through the channel 16 and out around the nipple and into the port 14, from whence the thoroughly mixed steam and air is discharged across the top of the burned fuel upon the grate, which mixing with the gases from the fuel and forming a highly combustible compound is ignited directly in the fire box by the flames from the fuel. The heat from the fire raises the temperature of the fire brick or facing to a high degree so that the air passing upward through the channel 16 is intentionally heated and better results obtained therefrom than could be obtained if the steam and air admitted through the nipple were alone relied upon. Furthermore, the annular stream of air discharged through the opening around the nipple serves to mix the air and steam thoroughly, the heat from the current of air acting favorably upon the steam to completely vaporize the same. The quantity of air and steam thus discharged into the fire box from one or both sides thereof may be in a great measure regulated by the pressure of steam from the jets 11, the sizes and numbers of the various openings being originally calculated for given furnaces.

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

1. The combination, in a smoke preventing furnace, of the grate, with the walls of the fire-box surrounding the same, an air duct in one of said walls and above the grate level, openings for admitting air and steam into said duct, the double facing of said duct, air spaces between said facings, the two openings in the inner facing, and the single opening in the outer facing, said single opening

being concentric and opposite the upper opening for the steam in the inner facing, whereby air and steam are mixed in the outer opening and discharged into the fire-box, the air being heated in the space between said facings and drawn into the discharge opening by the action of the steam jet, substantially as described.

2. The combination, with the grate, of the walls of the fire-box, an air duct in one or more of said walls, a metal facing for said duct, the brick facing therefor, the vertical channels provided between said facings, the nipples projecting from the metal facing into larger openings in the brick facing, and the lower air holes provided in the inner or metal facing and communicating with said channels which in turn communicate with the openings in the brick facing, all substantially as described.

3. The combination, with the grate, of the walls of the fire-box, an air duct in one or more of said walls, a metal facing for said duct, the brick facing therefor, the vertical channels provided between said facings, the nipples projecting from the metal facing into larger openings in the brick facing and communicating with said channels which in turn communicate with the openings in the brick facing, and the steam pipe provided in said air duct and having small jets opposite the openings in said nipples and in the brick facing, substantially as described.

4. The combination, with the fire-box and its walls, of an angle bar arranged on at least one of said walls and having the inclined ribs or lugs, and the facing formed of fire-brick having the inclined rear parts to lock behind said ribs or lugs and also having the overlapping parts, whereby succeeding bricks serve to lock the others, substantially as described.

5. The combination, with the fire-box and the walls thereof, of the angle bar arranged upon or in the wall, the air duct formed beneath said angle bar, said bar provided with openings and with the inclined vertical ribs or lugs, and the fire-brick provided with the inclined shoulders adapted to project back of said ribs and also having overlapping edges or surfaces to engage one another, whereby the brick are locked in place, and said brick having openings, substantially as and for the purpose specified.

6. The combination, with the fire-box and the side walls thereof, of the angle bar arranged in said wall, the duct formed beneath said angle bar, the outer side of said bar provided with the inclined vertical ribs or lugs, and the fire-brick provided with the inclined shoulders adapted to project back of said ribs and also having overlapping edges or surfaces to engage one another, whereby the brick are locked in place, and exhaust openings in said angle bar and in said brick, said brick being provided on their rear sides with feet whereby channels are formed between

the angle bar and the brick, and said angle bar provided with a lower series of air holes leading from the duct into said channels.

7. The combination, with the fire-box and
5 the side walls thereof, of the angle bar arranged in said wall, the duct formed beneath said angle bar, the outer side of said bar provided with the inclined vertical ribs or lugs, and the fire-brick provided with the inclined
10 shoulders adapted to project back of said ribs and also having overlapping edges or surfaces to engage one another, whereby the brick are locked in place, and exhaust openings in said angle bar and in said brick, said
15 brick being provided on their rear sides with feet whereby channels are formed between the angle bar and the brick, and said angle bar provided with a lower series of air holes leading from the duct into said channels, and
20 steam jets provided in said duct and concentric with the upper holes in said angle bar and the larger holes in the fire-brick or facing, all substantially as described.

8. The combination, with the fire-box and
25 a wall thereof, of an air duct arranged in said wall, the facing bar of said duct, said bar provided with an upper and a lower series of holes, the fire-brick forming a facing for said bar, the vertical and the horizontal channels between said fire-brick and bar, the nipples forming extensions of the upper row of
30 openings in said bar, and the larger openings

in the fire-brick into which said nipples project, and steam jets provided in said duct opposite the upper row of holes in said bar, substantially as described. 35

9. The combination, with the side wall of a fire-box, of an air duct arranged therein, the angle bar forming the top and front side of said duct, said angle bar having a notched
40 upper side, the steam-jet pipe arranged in said duct, the front side of the angle bar being provided with an upper and a lower series of openings, the fire-brick facing for the angle bar, channels between the same, and
45 an upper row of holes in said fire-brick concentric with and larger than the holes in the upper row within the angle bar, substantially as described.

10. The combination, with the bar provided
50 with the vertical ribs or lugs, of the fire-brick provided with the inclined parts conforming to the said ribs or lugs and having the outer longitudinal and overlapping parts and the vertical and horizontal channels formed upon
55 the inner side of each brick, substantially as described.

In testimony whereof, I have hereunto set my hand this 4th day of January, 1894.

SAMUEL N. SMITH.

In presence of—

C. G. HAWLEY,
M. E. GOOLEY.