

No. 630,392.

Patented Aug. 8, 1899.

F. R. MORRIS.

DRYING KILN.

(Application filed Nov. 21, 1898.)

(No Model.)

2 Sheets—Sheet 1.

Fig. 1.

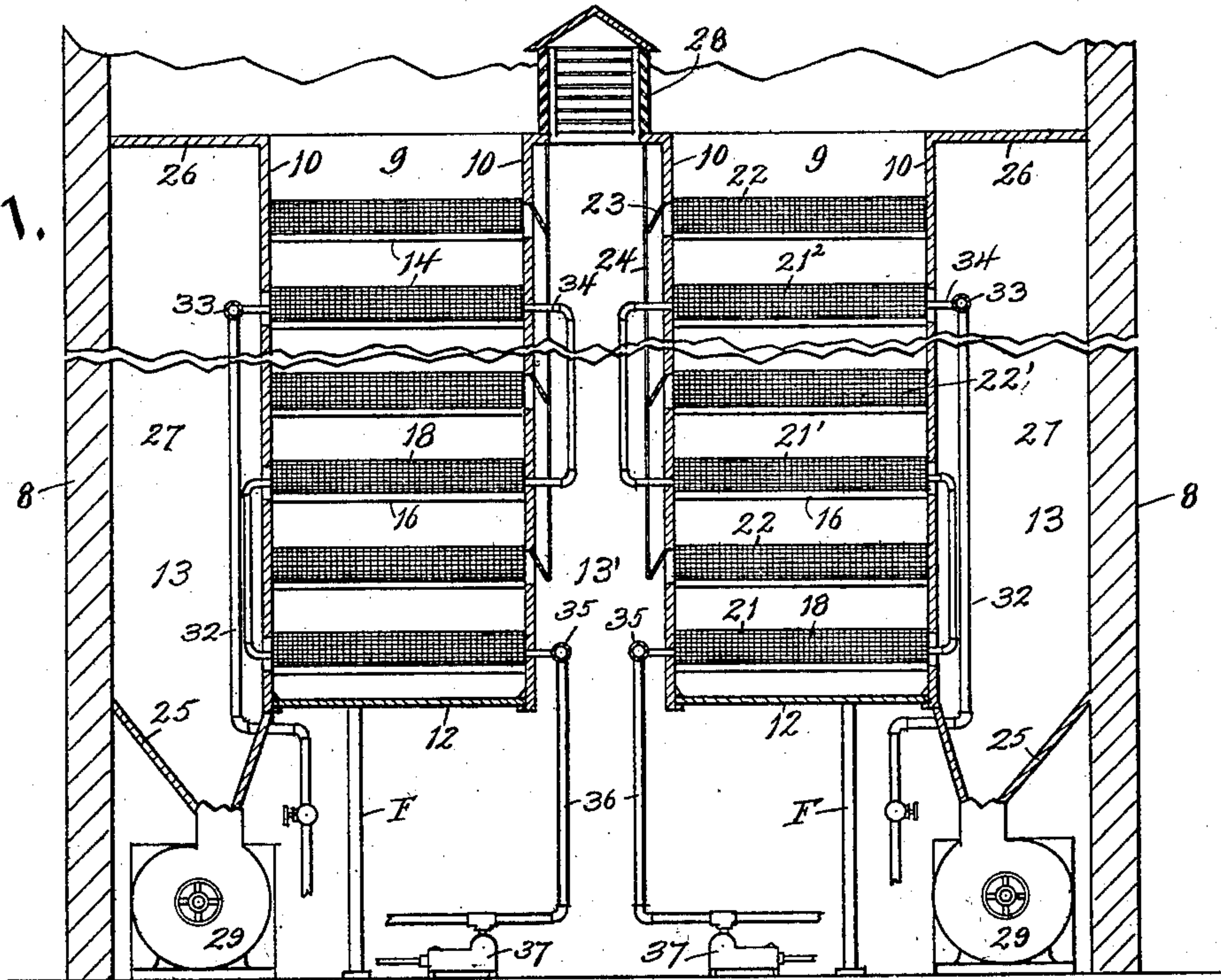
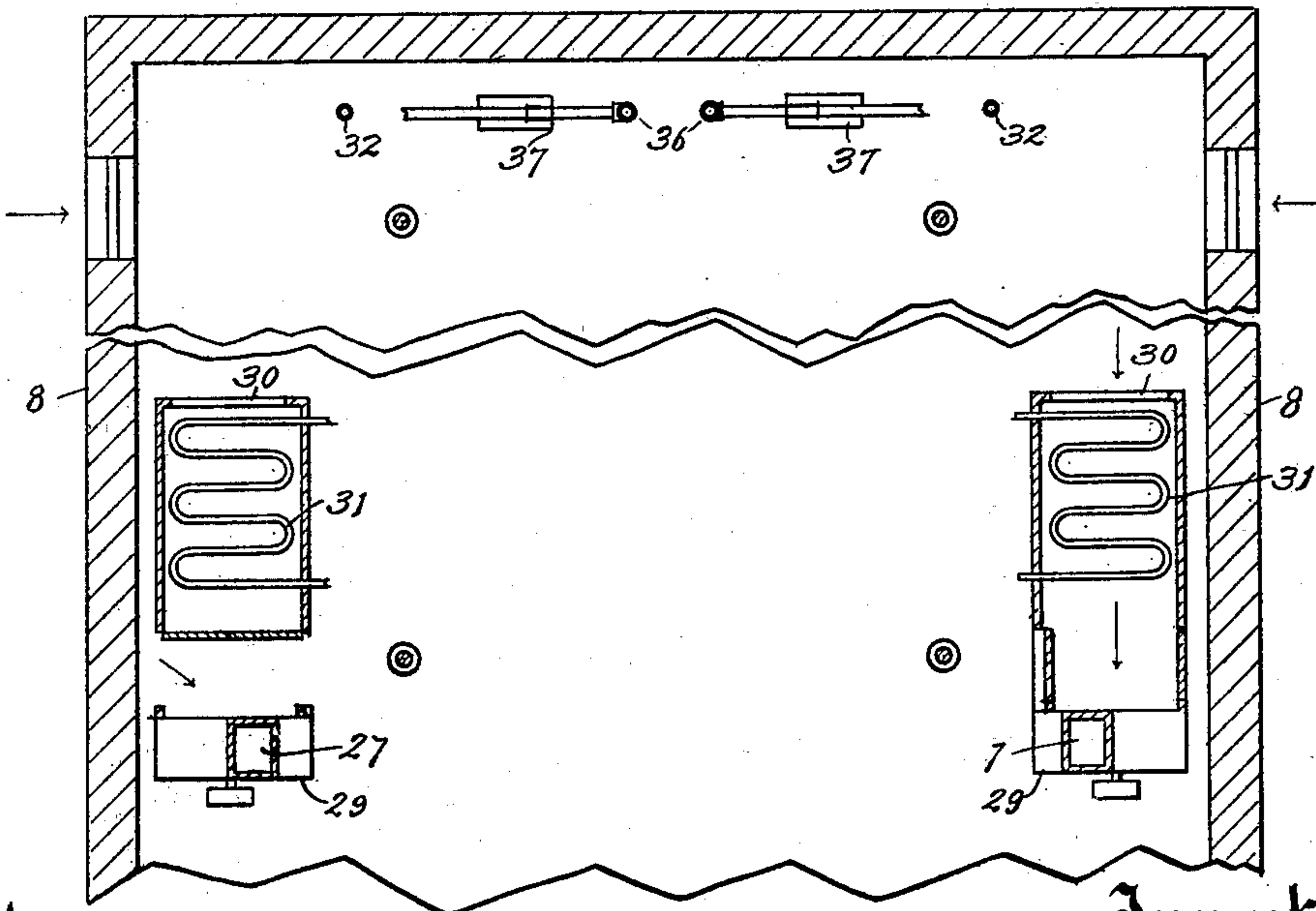


Fig. 2.



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2 Sheets—Sheet 2.

Fig. 3.

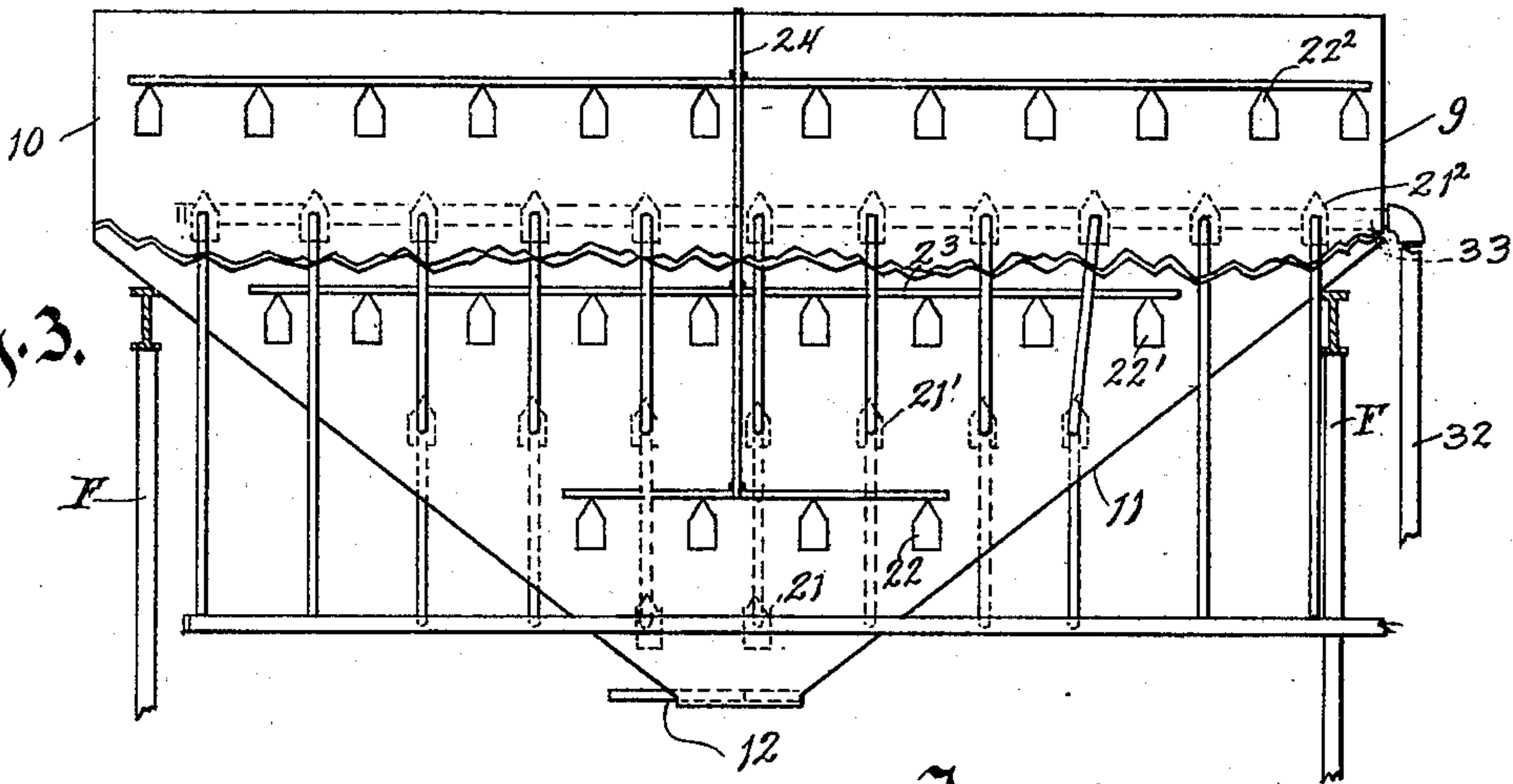


Fig. 4.

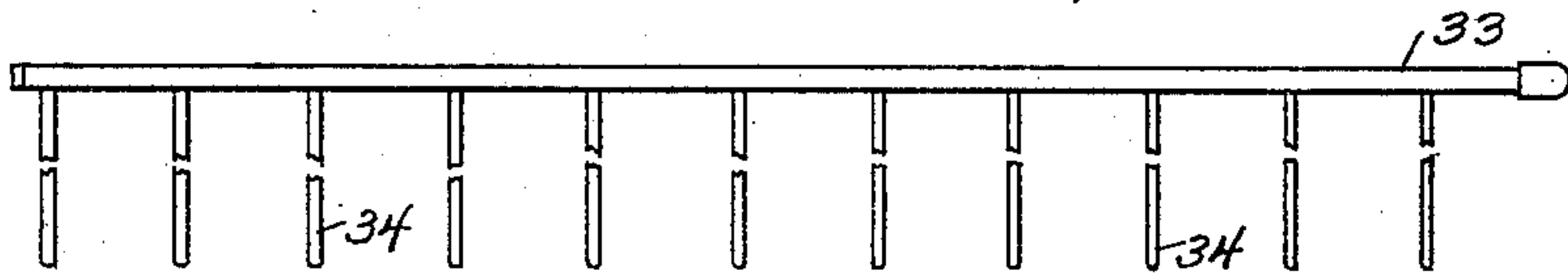


Fig. 5.

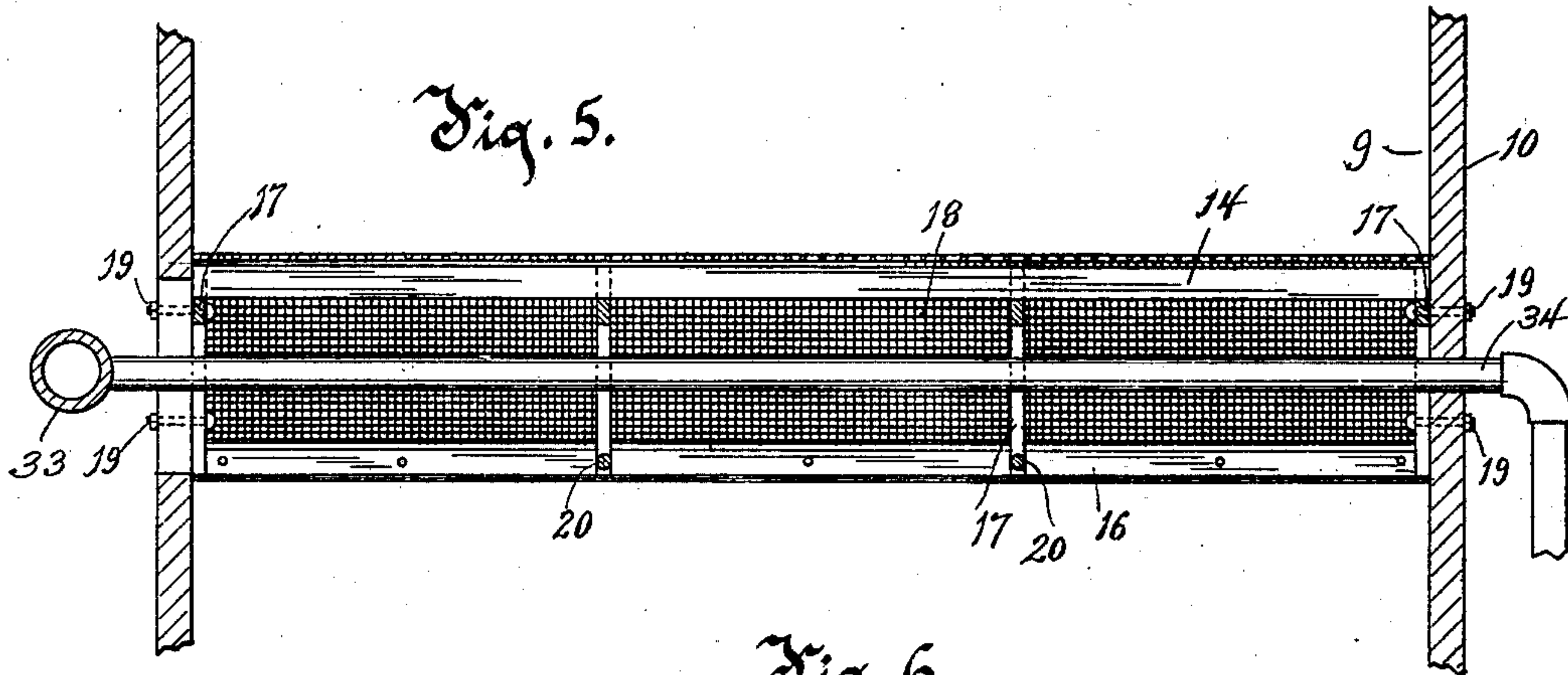
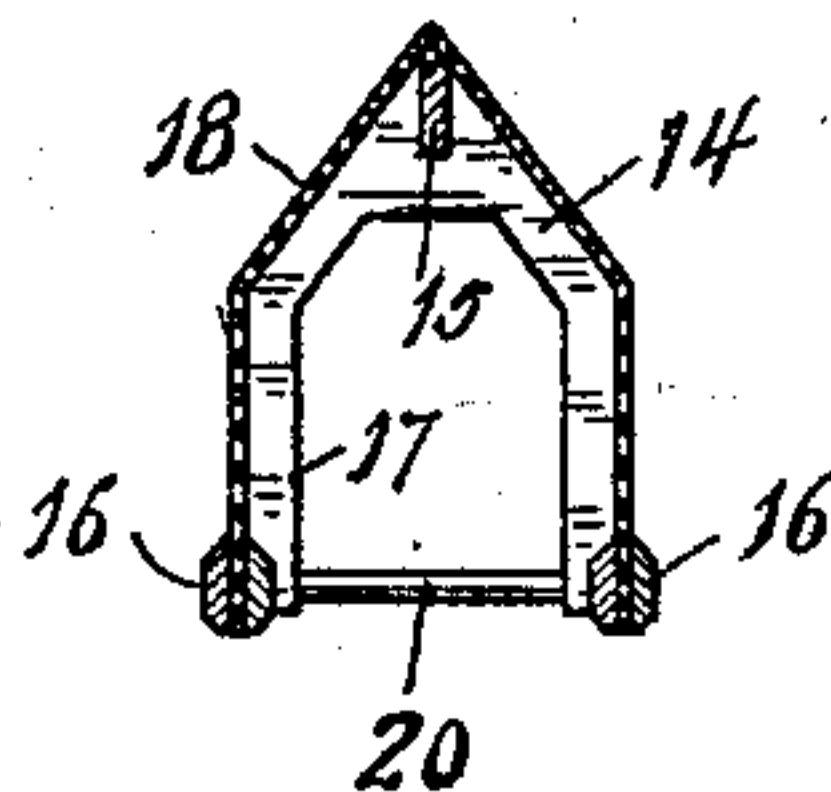


Fig. 6.



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UNITED STATES PATENT OFFICE.

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DRYING-KILN.

SPECIFICATION forming part of Letters Patent No. 630,392, dated August 8, 1899.

Application filed November 21, 1898. Serial No. 697,010. (No model.)

To all whom it may concern:

Be it known that I, FULTON R. MORRIS, of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a new and
5 useful Improvement in Drying-Kilns, of which the following is a description, reference being had to the accompanying drawings, which are a part of this specification.

10 The object of my invention is to provide improved means for drying grain.

The drying-kiln embodying my invention is especially adapted for use in connection with a grain-elevator, alongside of which the kiln may be located and into which kiln grain may
15 be discharged from the elevator. The invention may be used for any other purpose for which it is adapted.

20 The invention consists of the devices and apparatus in which the devices are embodied, their parts and combinations, as herein described and claimed, or their equivalents.

In the drawings, Figure 1 is a vertical section of a fragment of a grain dry-kiln in which my invention is embodied. Fig. 2 is a plan
25 or horizontal section of the lower portion of the dry-kiln, a fragment of which is shown in Fig. 1. Fig. 3 is an elevation of the side of a grain-bin in the kiln of Fig. 1, with which bin features of my invention are embodied.
30 Some parts are broken away for convenience of illustration. Fig. 4 is a plan of parts of the piping for steam employed in my invention, parts being broken away for convenience of illustration. Fig. 5 is a vertical cen-
35 tral section longitudinally of an air passage or duct transversely of one of the bins of the dry-kiln. Fig. 6 is a transverse section of the frame and walls of the duct or passage shown in longitudinal section in Fig. 5.

40 As considerable heat is frequently required in a dry-kiln of this character, it is desirable to construct the building and apparatus in it chiefly of non-combustible material to obviate its destruction by fire.

45 In the drawings, 8 8 are the side walls of the dry-kiln in and with which my improved devices and apparatus are constructed. Within the building large grain-bins 9 9 are provided, which are conveniently constructed
50 with parallel walls 10 10, preferably of sheet-steel, extending across the building from side

to side, each having a bottom 11, preferably inclined downwardly from the walls of the building inwardly, forming a hopper-like bottom, provided with a throat or discharging-
55 aperture closed by a gate 12. These bins are supported by a frame F, preferably constructed of structural iron. The arrangement of these bins in the building forms upwardly-extending air-chambers 13 13 between them and
60 the walls of the building and also an air chamber or passage 13' between the bins. In the drawings a construction is shown in which there are two bins; but it should be understood that one bin may be provided, or a greater
65 number of bins may be employed, with only such changes in construction as any mechanic would employ. Through the side walls of these bins and through the interior of the bins from
70 side to side I provide channels or ducts for the passage of air from the adjacent air-chambers into and through the grain in the bin. These channels or ducts are preferably arranged in
75 horizontally-disposed regular series, one series above another series, the ducts or channels in each series being advisably arranged to alternate in vertical planes with the ducts or
80 channels of the adjacent series above and below them, as best shown in Fig. 3. These air ducts or channels, extending across each bin from wall to wall, are constructed individually of a steel or iron frame 14, consisting of a ridge-bar 15 and sills 16, (each in
85 two members,) extending from end to end of the conduit or channel, and ribs or posts 17, secured at their lower extremities to the sills 16 and extending upwardly therefrom vertically a short distance and thence converging to and meeting at the ridge-bar 15, to
90 which they are also rigidly secured. Two of these ribs or posts are located one at each extremity of the conduit-frame, and others are located intermediate thereof in such number as are required for properly supporting the structure. A grated covering 18, conveniently of strong woven steel wire with fine
95 mesh, is placed over the top and sides of this conduit-frame and is secured thereto at its lower edges by being placed between the two members of the sills 16, which are then bolted
100 or riveted together, thereby clamping the screen-like cover of the conduit securely to

the frame. The wire-screen cover of the conduits is of such strength as to support the pressure of grain against it and is of so fine mesh as to prevent the escape of grain through the cover, while permitting of the free movement of air through it. These screen-covered conduits, with their bottoms opening downwardly, are secured in place across the bins by bolt-like extensions 19 of the ridge-bar and sills projecting through the walls of the bin, provided with nuts thereon turning against the walls of the bin. This construction not only supports the conduits in the bin, but the conduit frame-bars being thus bolted to the walls of the bin serve as stays, holding the sides of the bin against bulging out laterally. Brace-rods 20, secured to the lower ends of the ribs 17, extend across the conduit and hold the lower edges of the conduit in place outwardly against being crushed or collapsed by the weight of grain in the bin around the conduits. The conduits in every other horizontal series 21 21' 21² are open through the wall of the bin at that end that opens to an air-chamber 13 and are closed at the other extremity. The conduits of the other alternate series 22 22' 22² are open through the wall of the bin at their other extremities into the air-exhaust passage 13' and are closed at their extremities adjacent to the air-chamber 13. The conduits of the series 22 22' 22² are provided with swinging doors 23, adapted to close the open ends of the conduits, and these are preferably provided with means for opening several of them concurrently, which is conveniently accomplished by means of a rod 24, attached to the lower free edges of the doors, which rod extends upwardly above the top of the bin and serves as a means by which the attendant can open or close the doors.

In the kiln as constructed the bin or bins are of considerable height and have many series of conduits corresponding to the several series shown in the drawings or series 21 22, &c., which, by reason of the breaking away of medial portions of the bins in the drawings for convenience of illustration, are not shown therein.

The air-chambers 13 are continuations upwardly of the flues 27, flared outwardly at 25, and are closed at the top by floors 26. The exhaust-passage is open at the top for the purpose of ventilation, a ventilator 28 being preferably provided therefor.

For supplying hot air to the chamber or chambers 13 and forcing it through the grain in the bins one or more blowers or rotary fans 29 29 are provided, each of which is located in the lower portion of the building and provided with an air-intake 30 of a box-like construction, in which are located the pipe-coils 31, connected to any suitable source of steam-supply, and, being supplied with live steam, heat the air that is drawn past them through the intake 30 and is discharged through a flue 27 into the chamber 13. The

heated air thus forced into the chamber 13 passes into the conduits of the series 21 21' 21² and escapes therefrom through the screen-like walls of the conduits into and through the mass of grain in the bin, around and above the conduits, and escapes from the bin either through the conduits of the series 22 22' 22² into the passage 13' or upwardly and out at the top of the bin.

The devices and apparatus thus described are quite sufficient and capable of drying damp or even wet grain in a bin or bins, especially in ordinary weather; but it sometimes occurs that grain is thoroughly saturated with wet and when very cold it needs some additional means of heating the air that is passed through the grain, and for this purpose I provide a system of heating the air when close to or in immediate contact with the grain. This means for additionally heating the air consists of a system of piping for carrying steam therein, whereby the air in contact with the pipes can be readily and greatly raised in temperature. In such a system of steam-heating of the air a steam-pipe from any convenient source of supply leads to a distributing pipe or header in front of a series of the air-conduits near the top of the bin open at that end into a chamber 13, and therefrom separate smaller pipes run lengthwise through that series of conduits and thence down to the second series of conduits below, and through them to the chamber 13, and thence down to the second series of conduits below and through them, continuing thus to or near the bottom of the bin, and thence into a gathering-pipe or header from which the water of condensation and the exhaust-steam are discharged. In the drawings, by reason of the breaking away and omission of a medial portion of the bin, this complete system of steam piping or tubing is not shown, but it is substantially shown by the supply-pipe 32, leading to the distributing pipe or header 33, the separate conduit-pipes 34 leading through the series of conduits 21² and down at the rear to the series of conduits 21', thence through these conduits, and thence down to and through the conduits 21 into the gathering pipe or header 35, from which a discharge-pipe 36 leads to and past the drip-trap 37, to which it is so connected as to discharge therein the water of condensation, the steam and water of condensation being led away and discharged therefrom.

In use the bin or bins are usually filled with grain nearly or quite to the top, and the warm air entering the conduits from the chamber 13 passes through the grain and is discharged mostly through the conduits above into the passage 13'. If it be found that the air is escaping too freely from the bins into the passage 13' or it is for any purpose desired to prevent such escape of the air rapidly, the doors 23 can be partially or entirely closed for such

length of time as is found necessary or desirable.

What I claim as my invention is—

1. In a kiln for drying grain, the combination with a bin having opposite vertical walls with an air-supplying chamber exteriorly at one side and an air-exhaust chamber exteriorly at the other side, of a plurality of series of screen-covered air-supplying conduits extending from the air-supplying chamber through the bin substantially horizontally to and closed at the distant wall adjacent to the exhaust-chamber, a plurality of series of air-exhaust conduits extending from the air-exhaust chamber through the bin substantially horizontally to and closed at the opposite wall adjacent to the air-supplying chamber, the said air-exhaust conduits of each series being disposed alternately above the series of air-supplying conduits, a main heat-supplying pipe in the air-supplying chamber extending transversely thereof at the open ends of an upper series of air-supplying conduits, pipes leading from the main pipe in said upper series of air-supplying conduits through the bin thence down to and through the series of air-supplying conduits below an intermediate series of air-exhaust conduits, thence down to and through another series of air-supplying conduits below an intermediate series of air-exhaust conduits and ultimately into a general discharge-pipe.

2. In a kiln for drying grain, the combination of a bin of considerable height having opposite vertical walls with an air-supplying

chamber at one side and an air-exhaust chamber at the other side, a plurality of series of screen-covered conduits extending from the air-supplying chamber through the bin to and closed at the opposite wall, a plurality of series of air-exhaust conduits extending from the air-exhaust chamber through the bin to and closed at the opposite wall the air-exhaust conduits being arranged alternately above the several series of air-supplying conduits, and doors at the discharging ends of the air-exhaust conduits whereby the escape of the air into the exhaust-chamber that had been taken into the bin through the air-supplying conduits may be limited or prevented and held to escape directly upwardly through the grain in the bin partially or wholly.

3. An air-conduit transversely of a grain-bin, comprising a rigid frame secured at its ends to the walls of the bin and having longitudinally-disposed sills and a ridge-bar, a plurality of transverse bent ribs at distances apart secured to the sills and converging and secured to the ridge-bar, and a screen-like cover on the sides and top of the frame the conduit being wholly unclosed at the bottom and the ribs and screen-like cover being so arranged as to form a slanted roof to the conduit.

In testimony whereof I affix my signature in presence of two witnesses.

FULTON R. MORRIS.

Witnesses:

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