

975,688.

Patented Nov. 15, 1910.
 2 SHEETS-SHEET 1.

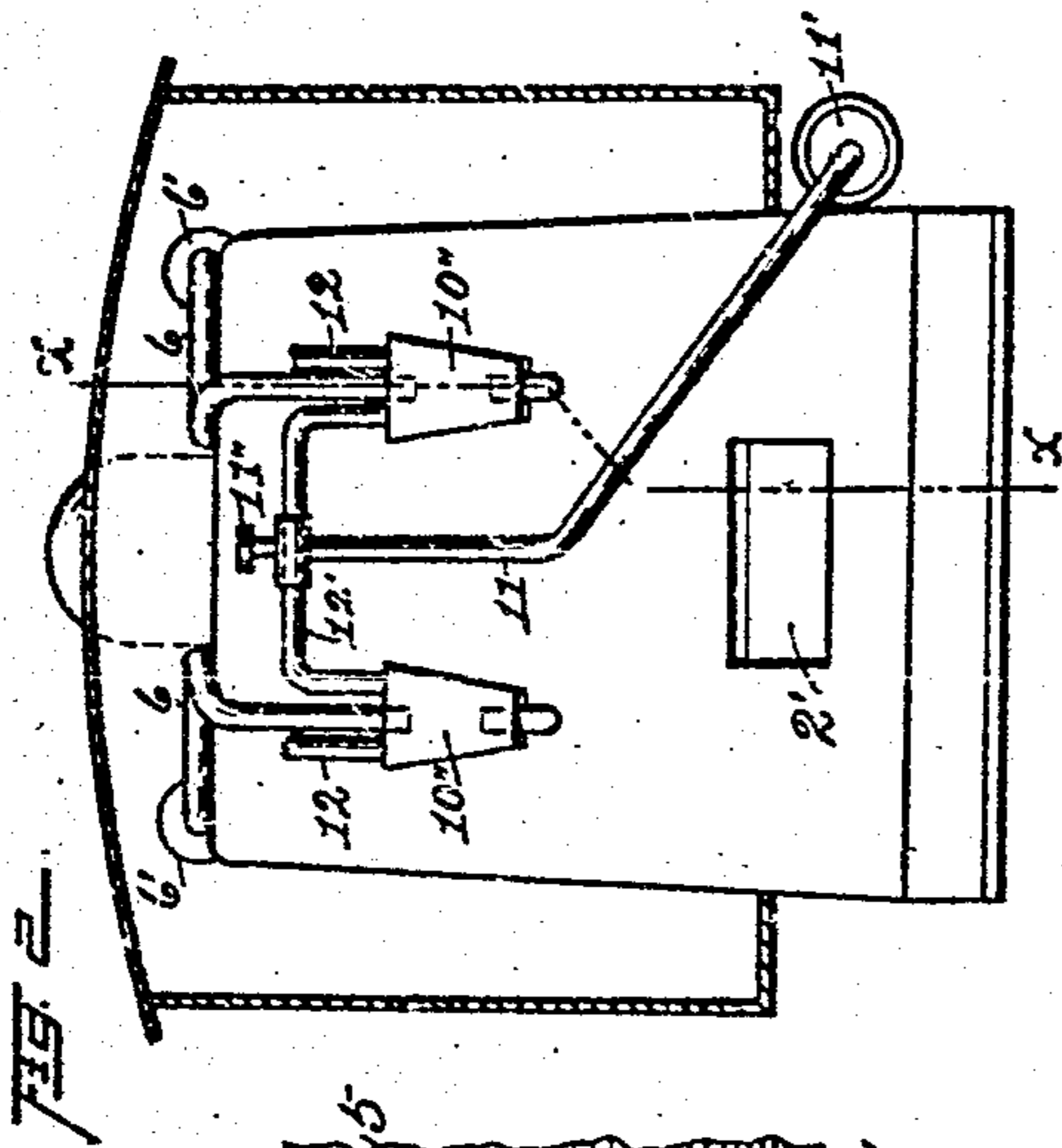


FIG. 4.

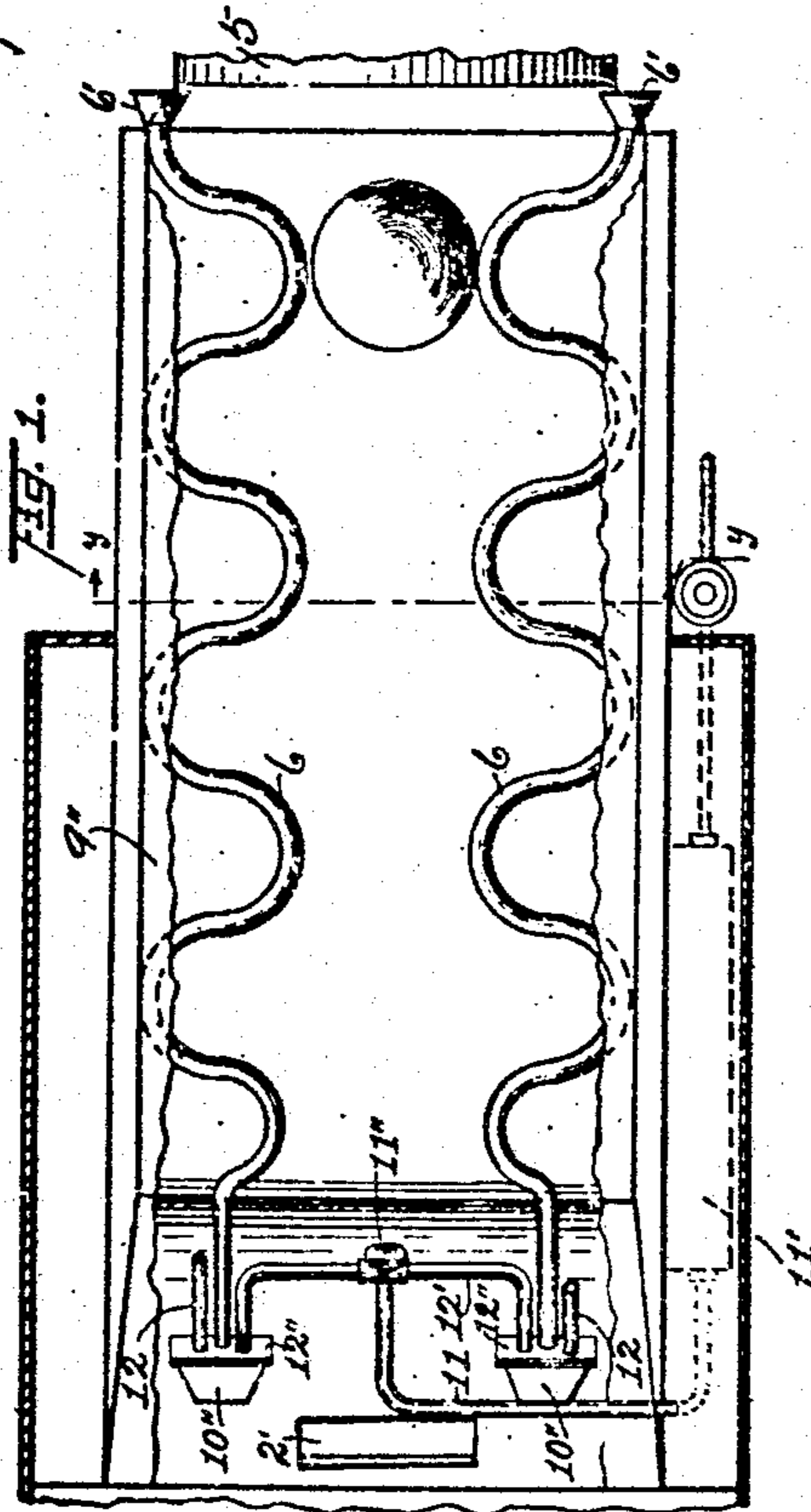
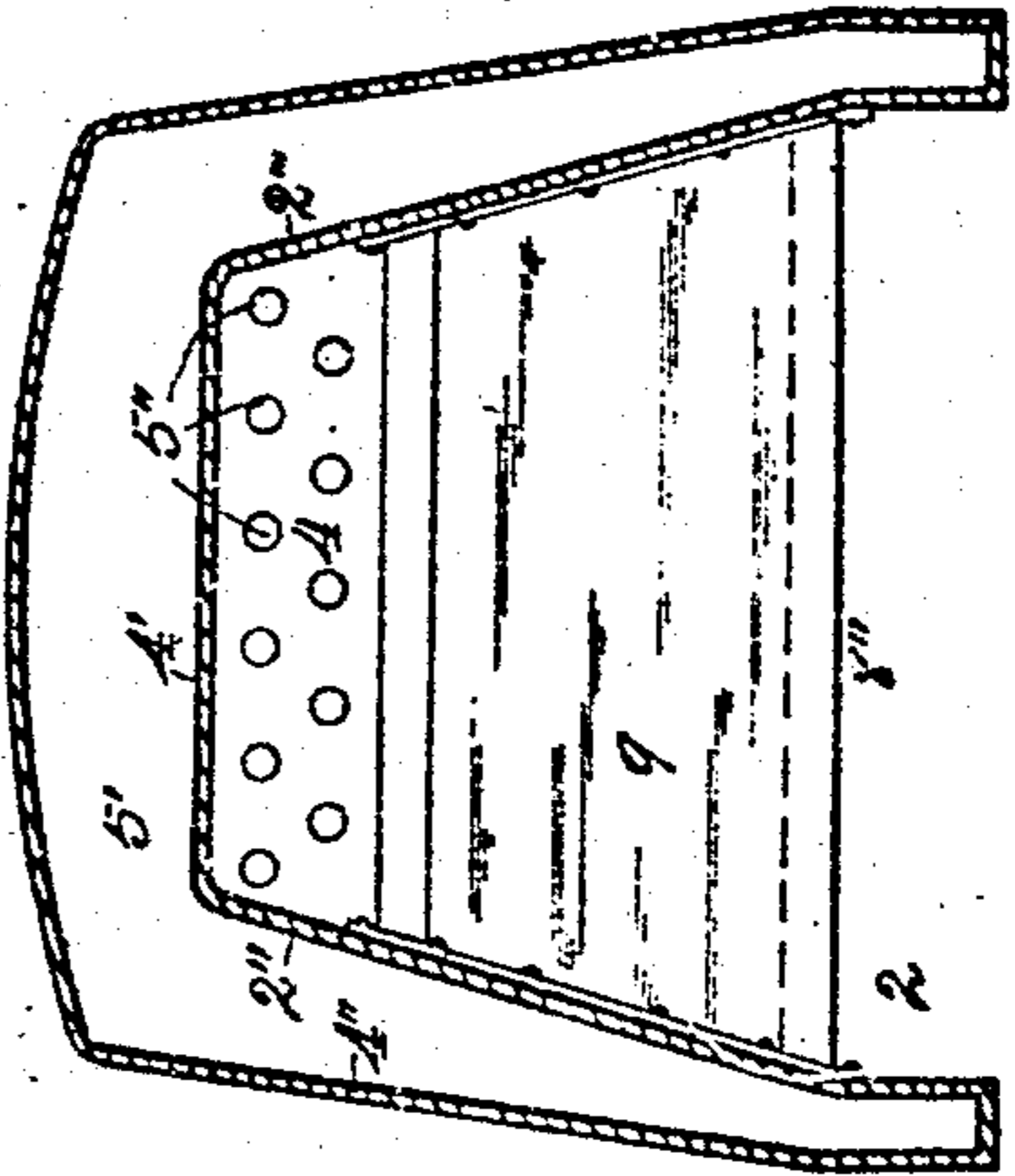
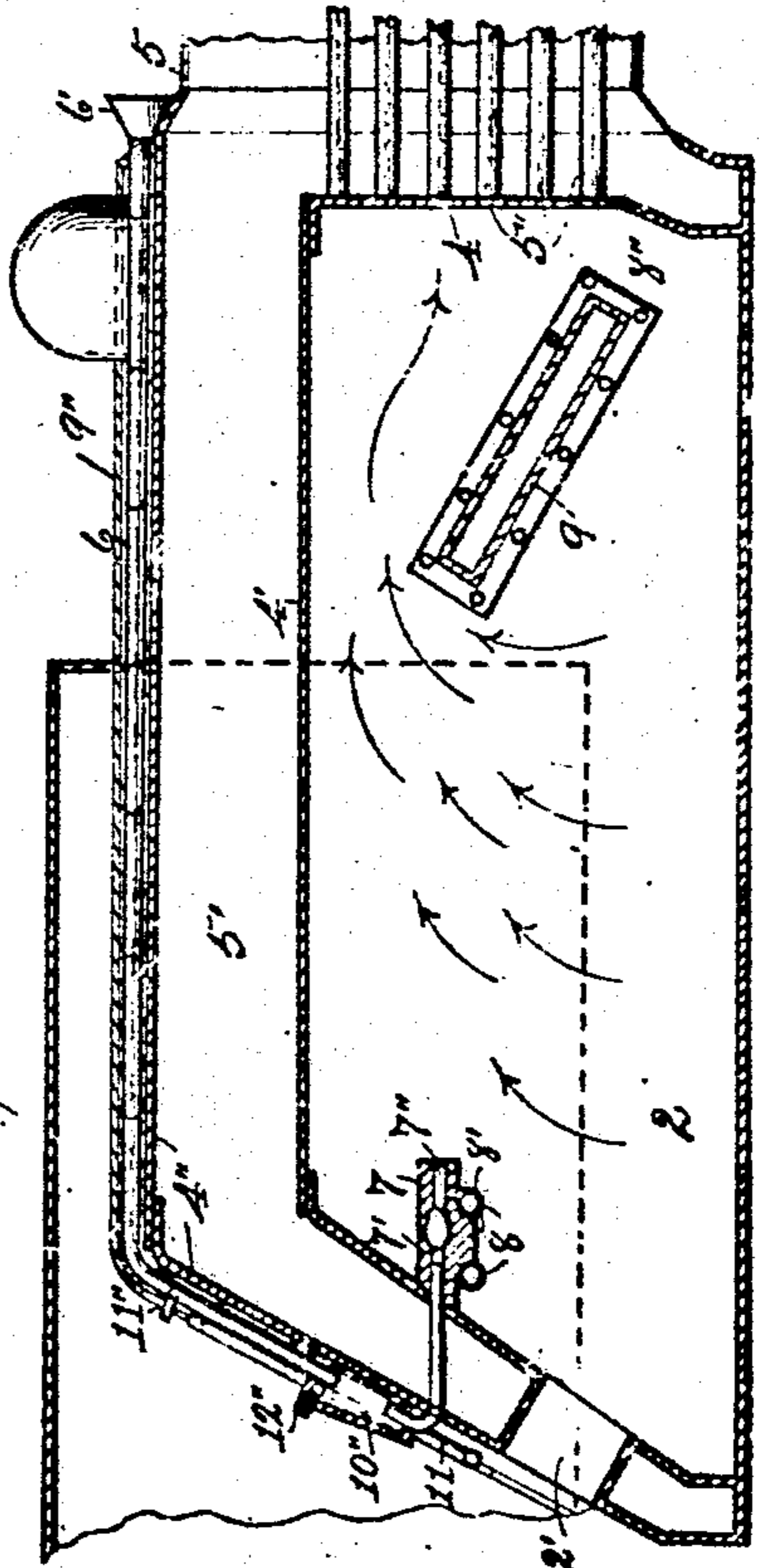


FIG. 3.



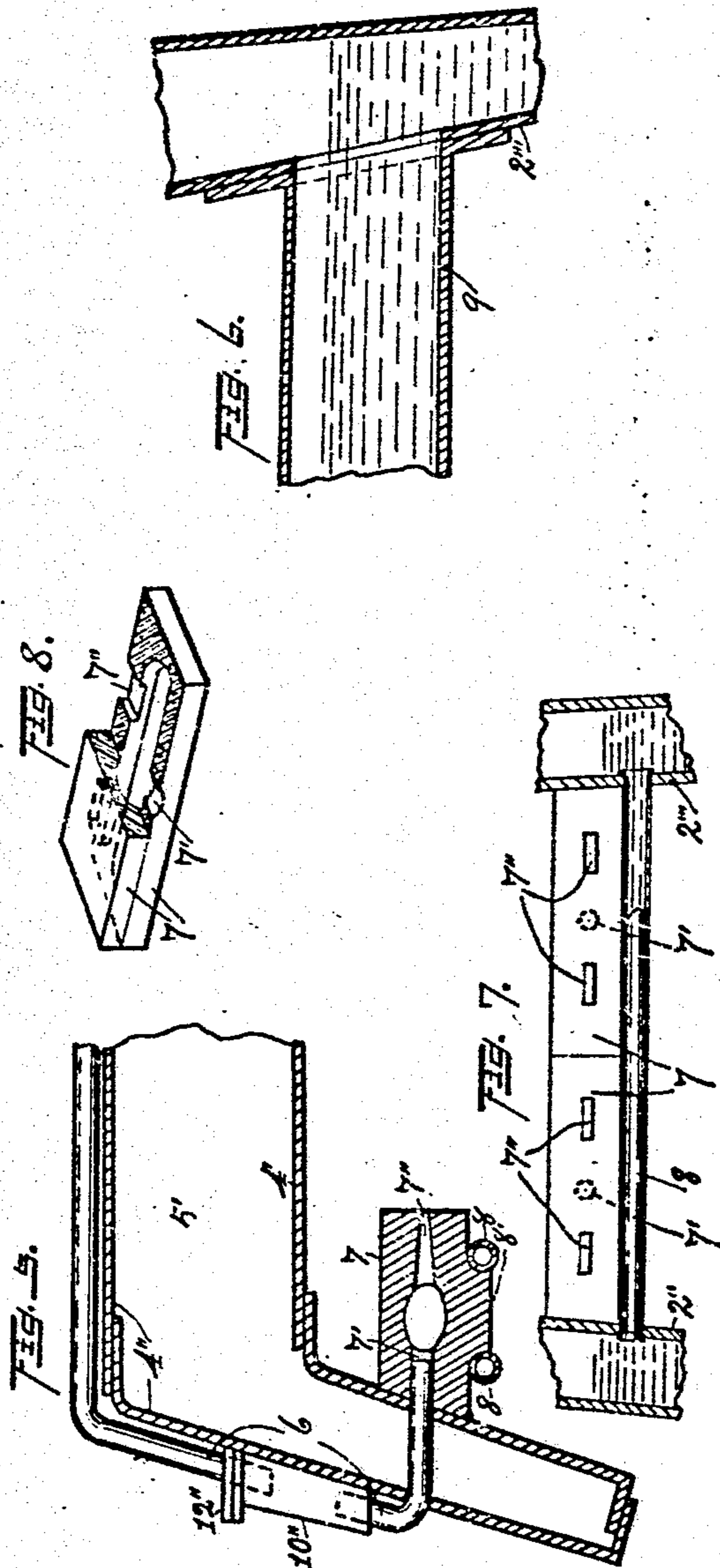
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Inventor:
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975,688.

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2 SHEETS-SHEET 2.



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UNITED STATES PATENT OFFICE.

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SMOKE-CONSUMER.

975,688.

Specification of Letters Patent.

Patented Nov. 15, 1910.

Application filed November 26, 1909. Serial No. 529,908.

To all whom it may concern:

Be it known that I, JOHN S. GREEN, a citizen of the United States, and a resident of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Smoke-Consumers, which improvements are fully set forth in the following specification.

10 This invention relates to improvements in devices of that class commonly known as smoke consumers, the function thereof being the practical consumption of products of combustion, particularly in the form of smoke, and as produced in the fire-box of a steam or heat generator.

The object of this invention is to provide a smoke consumer which shall be simple and comparatively inexpensive as regards construction; durable, reliable, and of marked efficiency in practical service; which shall embody means whereby may be conveniently effected the introduction to and into the fire-box of a steam or heat generator of a supply of a superheated fluid, as air, and under various degrees of pressure, as the user may elect; and which shall possess certain well defined advantages over prior analogous constructions.

30 The invention consists in the novel combinations, details and parts whereby, together with the novel relative arrangement of said parts, the attainment of the foregoing object is rendered practicable, all of which will be hereinafter more specifically referred to and set forth in the appended claims.

The invention is clearly illustrated in the accompanying drawings, wherein similar reference-numerals denote corresponding parts throughout the several views, as to which:

Figure 1 is a plan view of a smoke consumer embodying my said improvements, the same being shown as applied to a steam generator of the locomotive type, and the roof of the cabin and external casing of the latter being removed and partially broken away, respectively. Fig. 2 is a rear end elevation of the construction shown in Fig. 1. Fig. 3 is a view of same, mainly in longitudinal section along the line $x-x$ of Fig. 2. Fig. 4 is a transverse section thereof, as along the line $y-y$ of Fig. 1, the casing be-

ing removed, and scale enlarged. Fig. 5 is an enlarged, detail sectional view, showing more clearly the relative disposition of the intake conduit and the superheating distributor which I make use of. Fig. 6 is an enlarged, detail sectional view, showing more clearly the manner in which my improved circulatory baffle-wall is preferably attached to the opposite side-walls of the fire-box. Fig. 7 is a detail view showing in front elevation my improved superheating distributor, and in section the parts supporting the same. Fig. 8 is a view showing in perspective and detached the superheating distributor which I make use of, a portion of the upper section thereof being broken away.

While I have shown my improved smoke consumer as applied to a heat and steam generator of the locomotive type, which essentially comprises a fire-box and boiler, it will be apparent that the same is applicable to other forms of heat and steam generators, and likewise to constructions available for the generation of heat alone, its prime function being that hereinbefore stated.

Hence, in a general sense, my present invention comprises a fire-box; an intake fluid-conduit leading outwardly from the interior of said fire-box and along the external surface thereof, within the field of heat radiating therefrom, thus obtaining a measurable action of heat on the fluid primarily moving inwardly by way of said conduit; and means for superheating said incoming fluid immediately prior to its entrance or discharge into said fire-box.

It further comprises, in a general sense, a fire-box and boiler; an intake fluid-conduit, arranged as above stated with reference to the fire-box, and preferably extending externally along said boiler, within the field of heat radiating from said fire-box and boiler; and a subsidiary conduit, leading from an appropriate supply of a fluid under pressure, as said boiler, or a tank or cylinder containing air under pressure, and communicating with said intake fluid-conduit.

It still further comprises, in a general sense, a fire-box; means for accumulating and primarily measurably heating a supply of atmospheric air for ultimate delivery into said fire-box; means for superheating

said air immediately prior to its entrance or delivery into said fire-box; and a circulatory baffle-wall, the latter arranged within said fire-box and serving to divert products of combustion in the direction of said incoming, superheated air.

In carrying out my invention, reference being had to the accompanying drawings, I essentially make use of a fire-box 2, and, in this instance, have shown in conjunction therewith, a boiler 5.

The fire-box 2 has the usual door opening 2', by way of which fuel is supplied thereto and access is had to the interior thereof for other well-known purposes. Said fire-box has a suitable rear wall, opposite side-walls 2'', 2''', a front wall 4, and the usual crown-sheet 4'; and as here shown, it is mainly inclosed by a portion of the boiler-shell 4'', suitably removed therefrom, and forming at its opposite sides, ends and top a circulation space 5', which communicates with the interior of the boiler 5, proper, the latter being provided with a series of flues 5'', as in common practice.

6 denotes an intake fluid-conduit, leading outwardly from the fire-box 2, through the rear wall thereof and the contiguous portion of the boiler-shell 4'', thence turned upwardly and extended externally along, and in close juxtaposition to, the rear portion of said boiler-shell, and thence, in this instance, turned and accordingly extended, and terminated at a suitable point forwardly, along the upper surface thereof, thereby forming an initial intake portion, said conduit being provided at its free end, by preference, with a flared or funnel-shaped mouth-piece, 6'. Hence, the conduit 6 occupies a position, at all times, within the field of heat radiating directly from the boiler aforementioned, and, in this instance, indirectly from the fire-box 2. This is important for the reason that the fluid, as atmospheric air, primarily entering and moving or flowing inwardly along said conduit, becomes measurably heated in advance of its reaching the fire-box aforementioned. In this connection, and with a view to enhancing the volume of the incoming fluid which shall be thus subjected to the action of the heat radiating from the boiler and fire-box, as above stated, I purpose giving to the intake conduit 6, and particularly the initial intake portion thereof which, as here shown, extends along the top of the boiler 5, a sinuous, or other analogous, appropriate form, substantially as indicated in Fig. 1 of the drawings.

It is desirable that the incoming, measurably-heated fluid be superheated just prior to its entrance into the fire-box, and accordingly I provide a superheating distributor 7, formed from material, as fire-brick, adapted to withstand a high degree of heat, and preferably comprising flattened, box-like

sections, formed separately and thereafter joined together, as under the application of heat, thereby forming an elongated expansion chamber, having an inlet opening 7', into which snugly projects and fits the inner end of the conduit 6, and having at its opposite side a delivery opening 7'', or plurality thereof, all as clearly shown in the drawings. The area of the expansion chamber aforementioned exceeds the total area of the delivery opening or openings 7''.

The superheating distributor aforementioned is seated by its own gravity on a circulatory support 8, and is horizontally disposed within the fire-box in a plane somewhat above the door 2', and transversely along the inner face of the rear wall of said fire-box, with its expansion chamber arranged parallel with said support.

The support 8 consists of tubes having a water-tight juncture, each at its respective ends, with the opposite side-walls of the fire-box, being arranged continuously crosswise within the same, near the rear wall and above the fuel-bed thereof, and hence, for the circulation of water therethrough, is in constant communication with the space 5', this construction best serving to resist the action of the intense heat generated within said fire-box.

The foregoing advantage is materially enhanced by providing, as I do, said distributor with a face, here shown as the rear face thereof, adapted to abut fairly against the adjacent wall, here shown as the rear wall, of said fire-box, said distributor face being, accordingly, adapted to conform to said wall, whether the same be arranged vertically, or arranged at an inclination as indicated in the drawings.

The distributor aforementioned spans and rests by its own gravity directly on said support, and is formed with a downward extension 8' fitting between and partially surrounding the members thereof, this construction insuring the holding of said distributor against displacement forwardly along the interior of said fire-box.

With the construction thus far described, if the fire-box and boiler be moved forwardly, as on wheels along track-rails, a prescribed course, or otherwise, and at a greater or less rate of speed, atmospheric air will enter the conduit 6, at its free end, move inwardly therealong and at the same time receive more or less heat from the boiler 5, then pass into the distributor, where it is superheated, and then, in this superheated condition, enter the fire-box 2, where it serves to supply oxygen for the practical consumption of the products of combustion produced in the latter; and here it becomes desirable that means be provided for diverting or deflecting more or less of such products of combustion, particularly such as are

produced at the forward portion of said fire-box, backwardly in the direction of the incoming superheated air, thus insuring a more thorough commingling of said incoming, superheated air with said products of combustion. In this connection I make use of a circulatory baffle-wall 9, preferably in the form of a rectangular, box-like structure, arranged transversely within the fire-box, near the front wall 4 thereof, and inclined upwardly and rearwardly therefrom. The wall 9 surrounds at its opposite ends suitable openings formed one in each of the walls 2'', 2''', and is attached to the latter walls, at its opposite ends, in any manner suitable to afford a water-tight juncture, as by means of rivets, as in common practice, said baffle-wall being approximately flanged at its opposite ends to permit the use of such rivets, as indicated in the drawings. Hence, and for the circulation of water there-through, the baffle-wall 9 is in constant communication with the space 5', the same as the support 8; and this circulation feature is important, in that it enables said baffle-wall to effectually resist the action of the heat generated within the fire-box, and for a much greater period of time than it would in the absence of such circulation feature.

In addition to the function, above stated, of diverting or deflecting gases and products of combustion, the baffle-wall 9 tends materially to prevent any unconsumed products of combustion from interfering with or destroying the draft needed for the fire-box, as by finding their way directly into, and in time more or less choking, the flues 5'', as will be readily understood. A space 8'' is left between the bottom of said baffle-wall and the fire-bed and the wall 4, for minor draft purposes; but practically the whole of the products of combustion will move upwardly from the fuel-bed, rearwardly of the baffle-wall 9, as indicated by the arrows in Fig. 3, thus intersecting the course of, and commingling with, the incoming fluid.

It is further desirable that means be provided for accelerating the inrush of fluid to the fire-box 2, by way of the conduit 6, and particularly when my improved smoke consumer is applied to a steam or heat generator of the stationary type, or to a heat and steam generator capable of being moved from place to place, though at rest; and in this connection I provide an accelerating drum 10'', intersecting and in direct communication with the conduit 6, constituting, as it were, an enlarged segment thereof, and here shown as disposed at the rear end of the boiler 5, above the door 2'.

11 denotes a subsidiary conduit, here shown as establishing communication between the compressed air cylinder 11' and the drum 10'', the same being controlled by means of any appropriate valve, as 11''.

The conduit 11 may lead from any appropriate source of steam under suitable pressure, as the boiler 5; or an additional subsidiary conduit, as 12, for this latter purpose, may be provided, steam under substantial pressure, or air under substantial pressure, either or both, being accordingly rendered available, at the option of, and when required by, the user.

I purpose to make use of a duplicate set of the parts hereinbefore described as involved more particularly in the delivery of superheated fluid into the fire-box 2, and hence have shown such duplicate parts and designated the same by like characters. And where such duplicate parts are made use of, I purpose to interconnect the same, as by means of an intermediate conduit 12', leading from one of the drums 10'' to the other and establishing communication between them, the valve 11'', under such an arrangement of duplicate parts, being of the two-way type.

In practice, atmospheric air will enter the fire-box 2, by way of the conduit 6, even when said fire-box is at rest; it will enter said fire-box with an increased velocity when the same is in motion, as on wheels, forwardly along any particular course; and the velocity of such incoming air may be materially enhanced, under all conditions of the fire-box, that is, whether in motion, as on wheels, or at rest, by properly adjusting the valve 11'', so as to permit fluid under pressure, as from the air-cylinder 11', to enter the drum 10''.

By the foregoing use of a fluid under pressure a suction is created within the free end portion of the conduit 6, thus causing an inrush of atmospheric air which commingles with the fluid under pressure aforementioned, and is thereby conducted with a highly enhanced velocity, to and into the distributor 7, for superheating, and from thence into the fire-box 2,—this operation taking place simultaneously in the duplicate sets of parts aforementioned, where the same are used and interconnected as stated, and valve 11'' is of the two-way type and properly adjusted, all as will be clearly understood.

The drum 10'' may be of any appropriate construction, although I have shown the same as consisting of a hollow body to which may be riveted, or otherwise secured, a cap or cover 12'; and where a casing, as 9'', is employed, the same may be suitably cut away to more or less expose the drum 10'' valve 11'', and any necessary portion of the intermediate conduit 11, the conduit 6 being arranged between said casing and the boiler-shell 4'', substantially as shown.

Where the construction is applied to a locomotive fire-box and boiler, as illustrated in the drawings, and fitted with a subsidiary conduit leading from the compressed air cyl-

inder 11', usually a permanent fixture thereof, it is contemplated to make use only of air from said cylinder under a degree of pressure in excess of that required for braking or other train purposes; and by providing means for accelerating the inrush of fluid to and into the fire-box 2; for heating and superheating such incoming fluid; and, incidentally, practically permanent means for deflecting products of combustion into the path of such incoming fluid, the efficiency of my improved consumer is materially increased, while at the same time wide variations in the velocity of such incoming fluid may be conveniently had, as the user may find desirable in practice. Hence, it will be seen that my improved smoke consumer is particularly well adapted for the purpose for which it is intended; and it will also be seen that the same may be modified to a considerable extent, particularly as regards the specific construction of the drum 10'', the specific construction of the distributor 7, and other minor details, without materially departing from the spirit and principle of my invention.

I claim:

1. In combination with a fire-box and boiler, the former having a water-space extending along the top and downwardly along the opposite sides thereof, a tubular support, arranged continuously crosswise in said fire-box, near the rear wall and above the fuel-bed thereof, and communicating at its opposite ends with the water-space aforementioned; a hollow distributor, forming an elongated expansion chamber having a contracted discharge opening, said distributor being replaceably seated by its own gravity directly on said support, with its expansion chamber arranged parallel therewith, and held by said support against forward displacement; and means for conducting outside air to and into said expansion chamber for ultimate delivery into said fire-box.

2. In combination with a fire-box and boiler, the former having a water-space extending along its top and downwardly along the opposite sides and rear end thereof, a tubular support, arranged continuously crosswise in said fire-box, near the rear wall and above the fuel-bed thereof, and communicating at its opposite ends with the water-space aforementioned; a hollow, superheating distributor, seated by its own gravity upon, and held against forward displacement by, said support; and an intake fluid conduit, the latter communicating with said distributor, extending rearwardly therefrom through and beyond the water-space at the rear of said fire-box, thence upwardly along the rear end of said boiler, exteriorly thereof, and thence merging into an initial intake portion, which extends along the top of said boiler, lies wholly in close juxtaposi-

tion thereto, and carries at its free end a flared mouth-piece.

3. In combination with a fire-box and boiler, the former having a water-space extending along its top and downwardly along the opposite sides and rear end thereof, a tubular support, arranged continuously crosswise in said fire-box, near the rear wall, and above the fuel-bed thereof, and communicating at its opposite ends with the water-space aforementioned, a super-heating distributor, seated by its own gravity directly upon, and held against forward displacement by, said support; and a fluid intake conduit, the latter establishing communication between said distributor and the outside air, and comprising an initial intake portion which extends sinuously along the top of said boiler, lies wholly in close juxtaposition thereto, and carries at its free end a flared mouthpiece.

4. In combination with a fire-box and boiler, the former having a water-space extending along the top and downwardly along the opposite sides thereof, a tubular support, arranged continuously crosswise in said fire-box, near the rear wall and above the fuel-bed thereof, and communicating at its opposite ends with the water-space aforementioned; a super-heating distributor, forming an elongated expansion chamber having a contracted discharge opening, said distributor being replaceably seated by its own gravity directly upon said support, with its expansion chamber arranged parallel therewith, and held by said support against forward displacement; an accelerating drum, arranged exteriorly of said boiler, and adapted to receive outside air; a conduit establishing communication between said drum and said distributor; and a valve-controlled subsidiary conduit, the latter establishing communication between said drum and a suitable supply of fluid under pressure.

5. In combination with a fire-box and boiler, the former having a water-space extending along its top and downwardly along the opposite sides thereof, a tubular support arranged continuously crosswise in said fire-box, near the rear wall and above the fuel-bed thereof, and communicating at its opposite ends with the water-space aforementioned; a super-heating distributor, forming an elongated expansion chamber having a contracted discharge opening, said distributor being replaceably seated by its own gravity directly upon said support, with its expansion chamber arranged parallel therewith, and held by said support against forward displacement; and an intact, hollow box-like baffle-wall, the latter arranged continuously crosswise within said fire-box, removed somewhat rearwardly from the flue-sheet thereof, inclined upwardly and rearwardly therein, and freely communicating at opposite points with the

water-space aforementioned, said baffle-wall being adapted to deflect all products of combustion arising within the area defined by its rear face into the path of the fluid incoming by way of said distributor.

6. In combination with a fire-box having a water-space at the opposite sides thereof, a pair of tubular supports arranged parallel, one with the other and continuously crosswise along a horizontal plane, within said fire-box, near the rear wall and above the fuel-bed thereof; a sectional, super-heating distributor, seated by its own gravity directly on said supports, respectively forming an expansion chamber having a contracted discharge opening, and having a portion projecting downwardly between said supports and engaging one of them at its rear side, whereby said distributor is held against forward displacement; and accelerating means for insuring the introduction of outside air into said distributor, the area of the expansion chamber aforementioned exceed-

ing the area of the discharge opening thereof.

7. In combination with a fire-box, a hollow support consisting of tubes arranged continuously crosswise therein, near the rear wall and above the fuel-bed thereof, said support being secured at its opposite ends into suitable openings formed in the opposite side-walls of said fire-box; a flattened, box-like distributor, forming an expansion chamber having a contracted outlet, said distributor being seated by its own gravity directly on, and formed with a downward extension fitting between and partially surrounding, said tubes thereby being held against displacement forwardly along the interior of said fire-box; and a conduit whereby communication is established between said distributor and the outside air.

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Witnesses:

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