

No. 698,799.

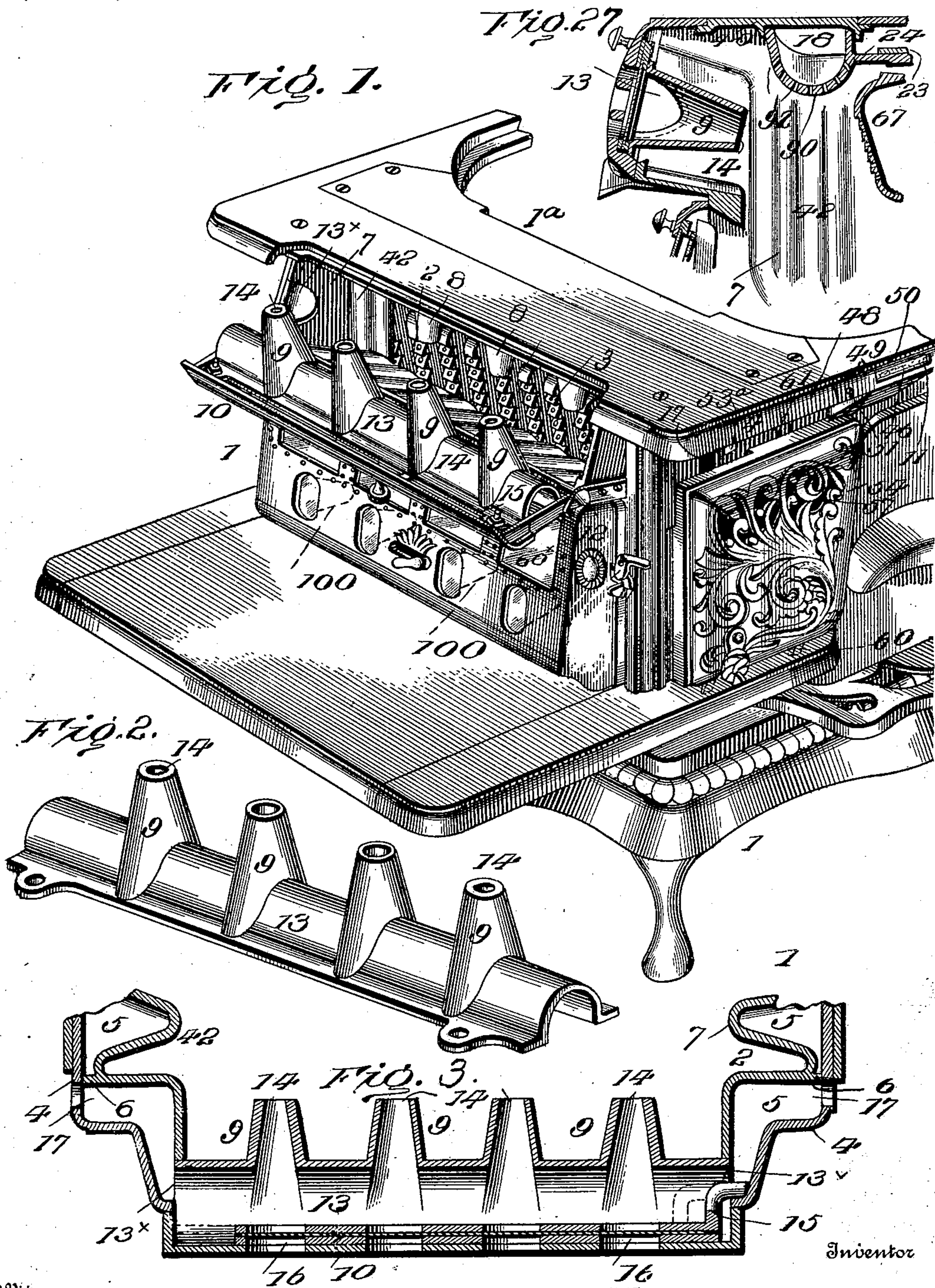
Patented Apr. 29, 1902.

E. R. CAHOONE.
STOVE.

(Application filed Dec. 14, 1899.)

(No Model.)

6 Sheets—Sheet 1.



Witnesses
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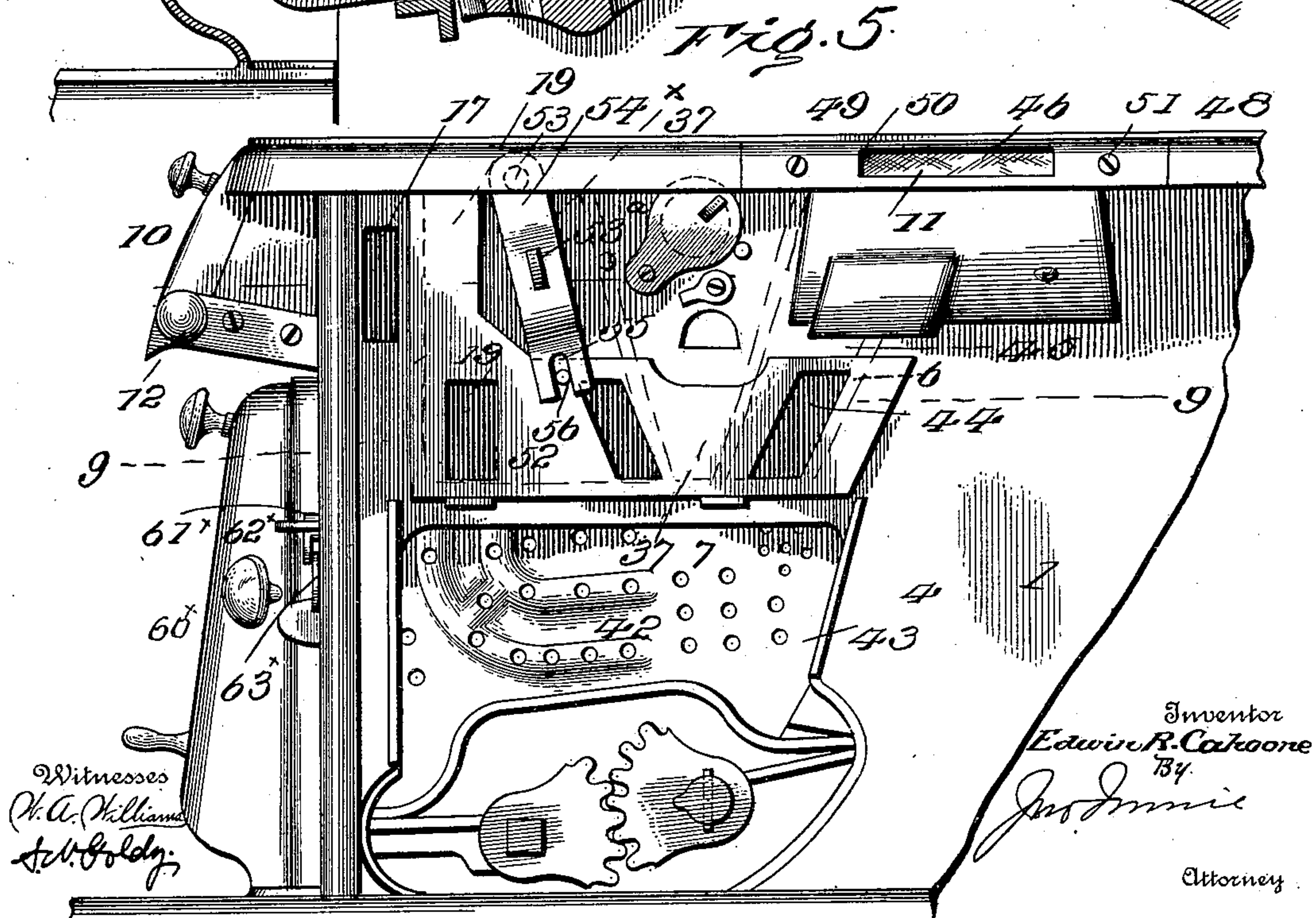
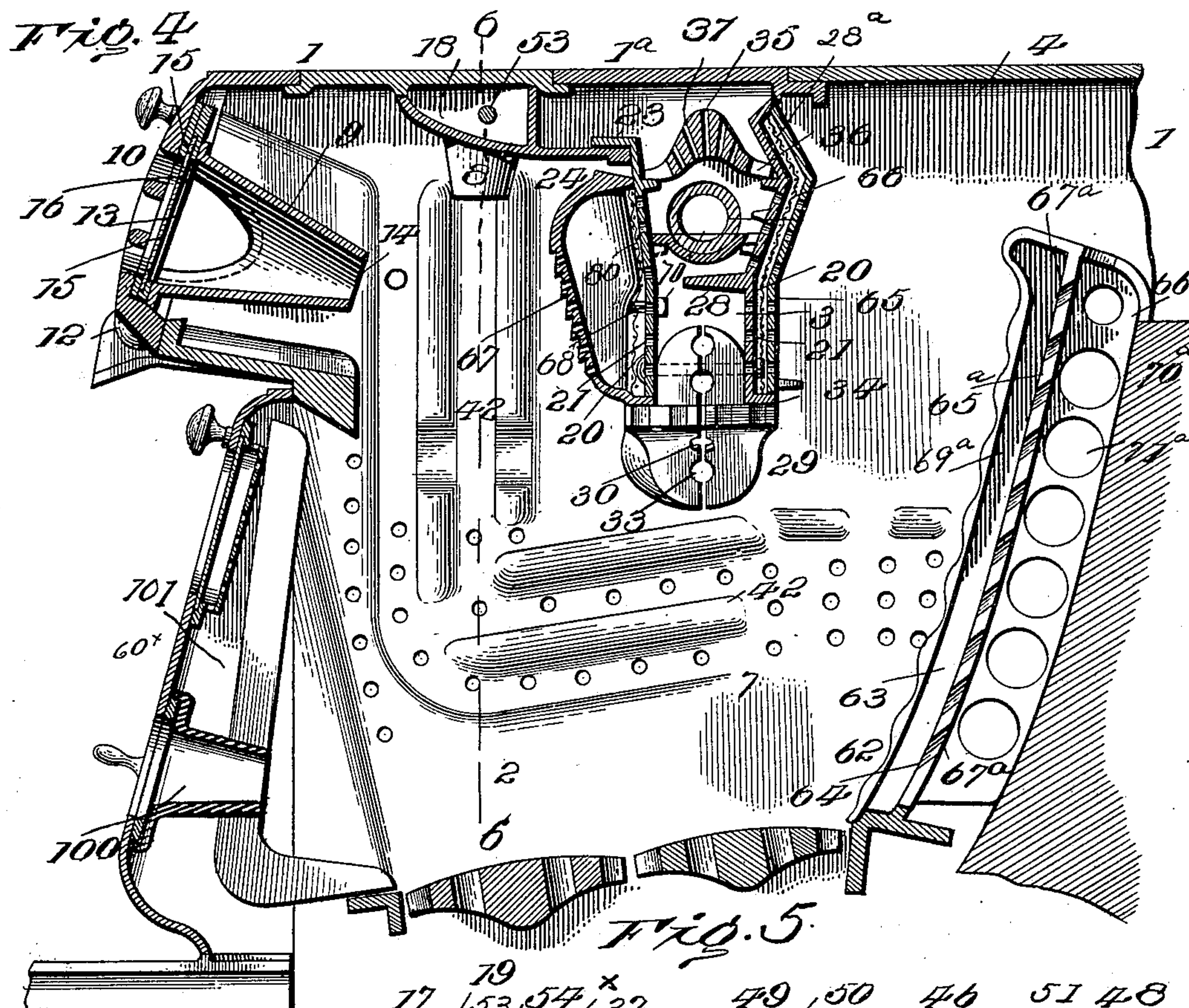
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6 Sheets—Sheet 2.



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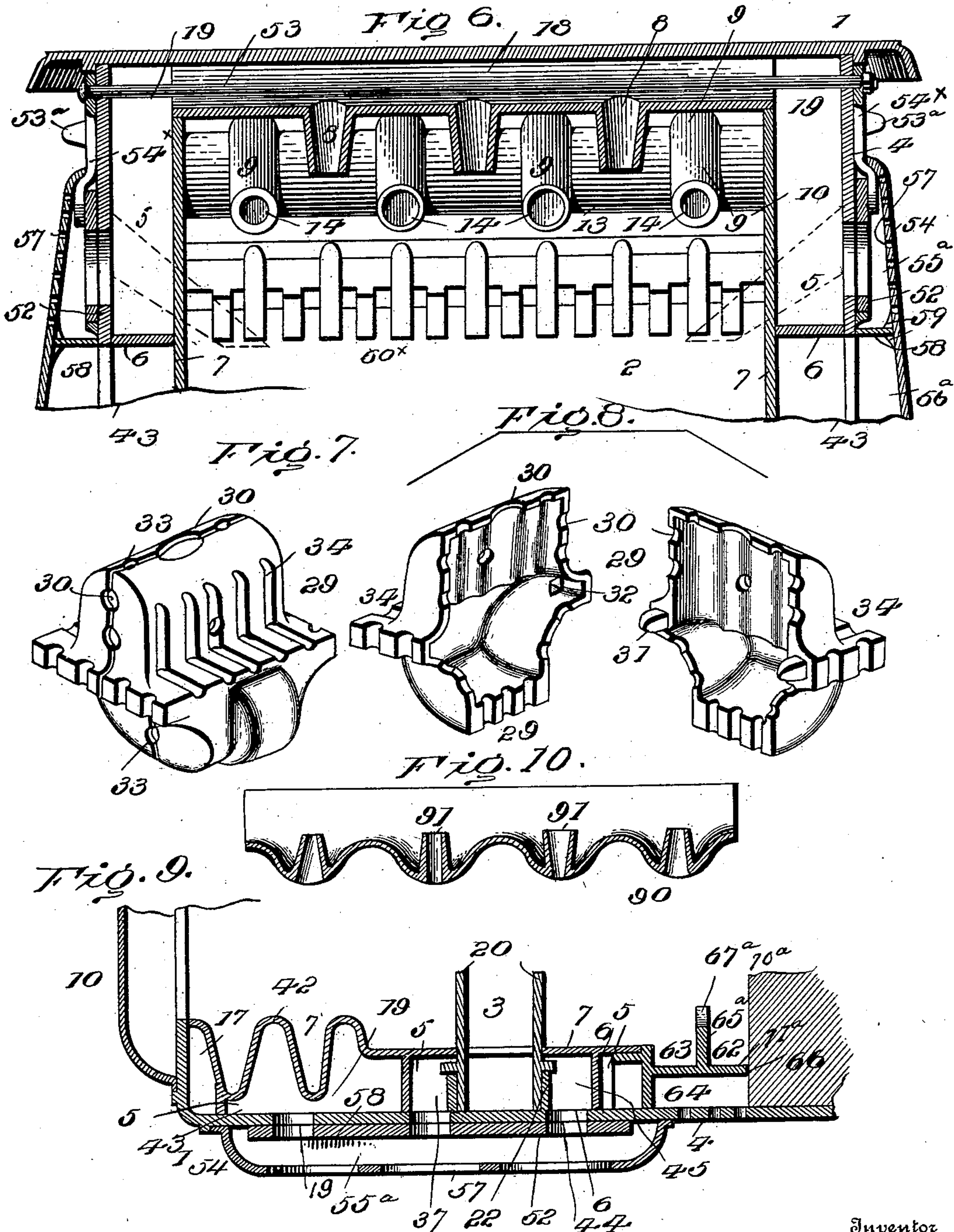
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6 Sheets—Sheet 3.

(No Model.)



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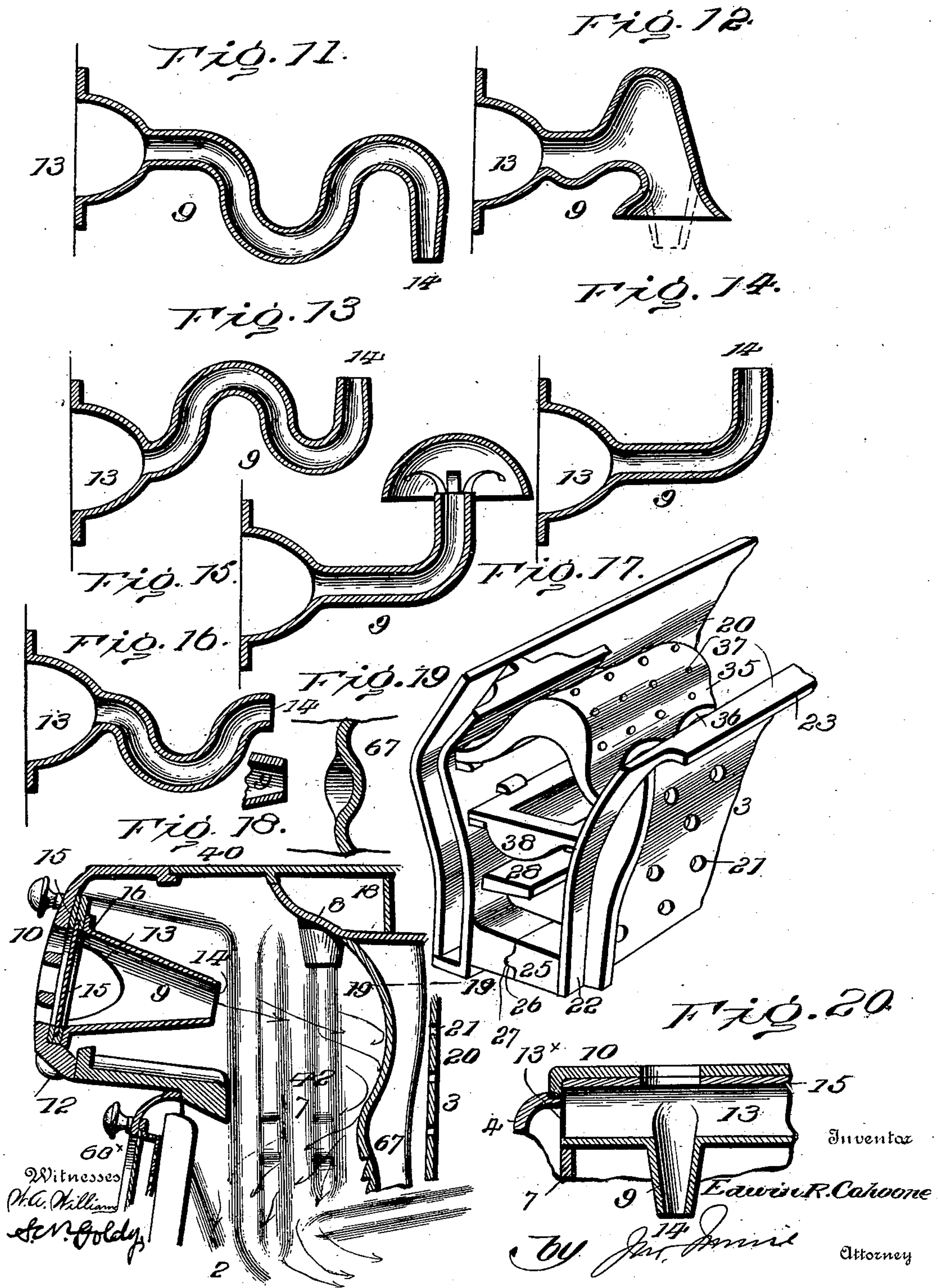
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6 Sheets—Sheet 4.



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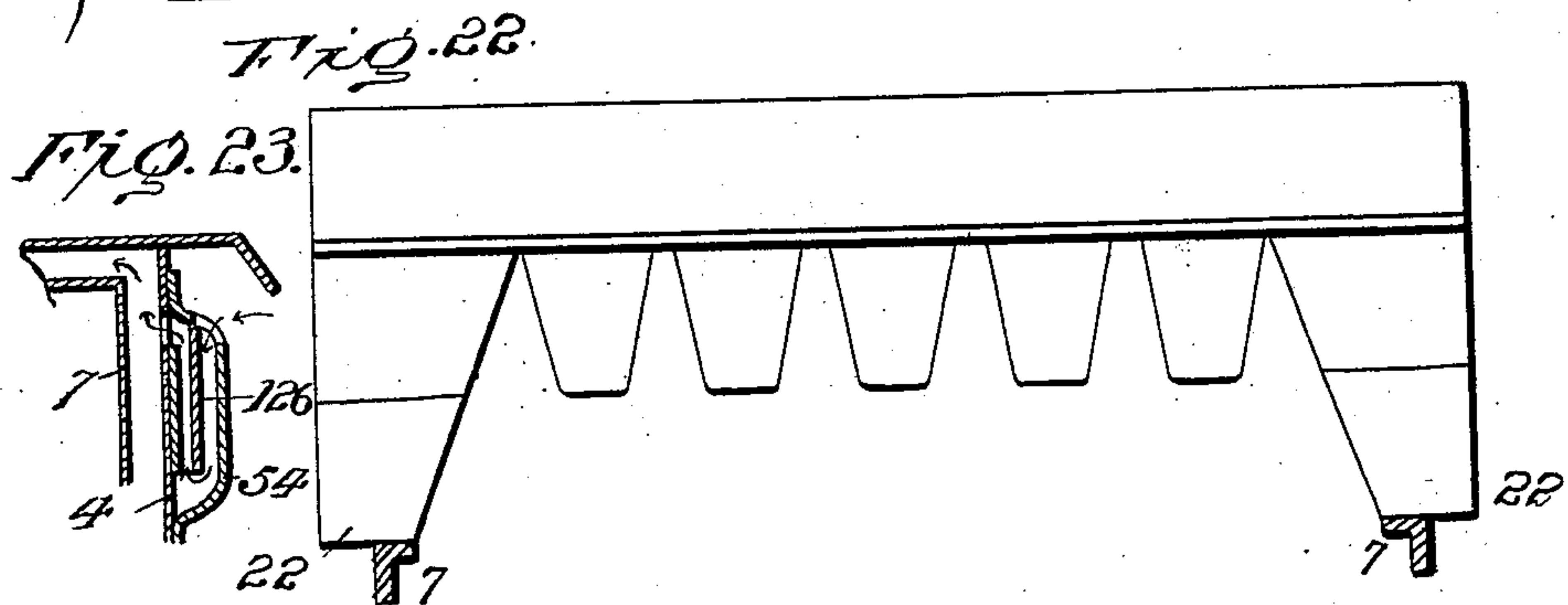
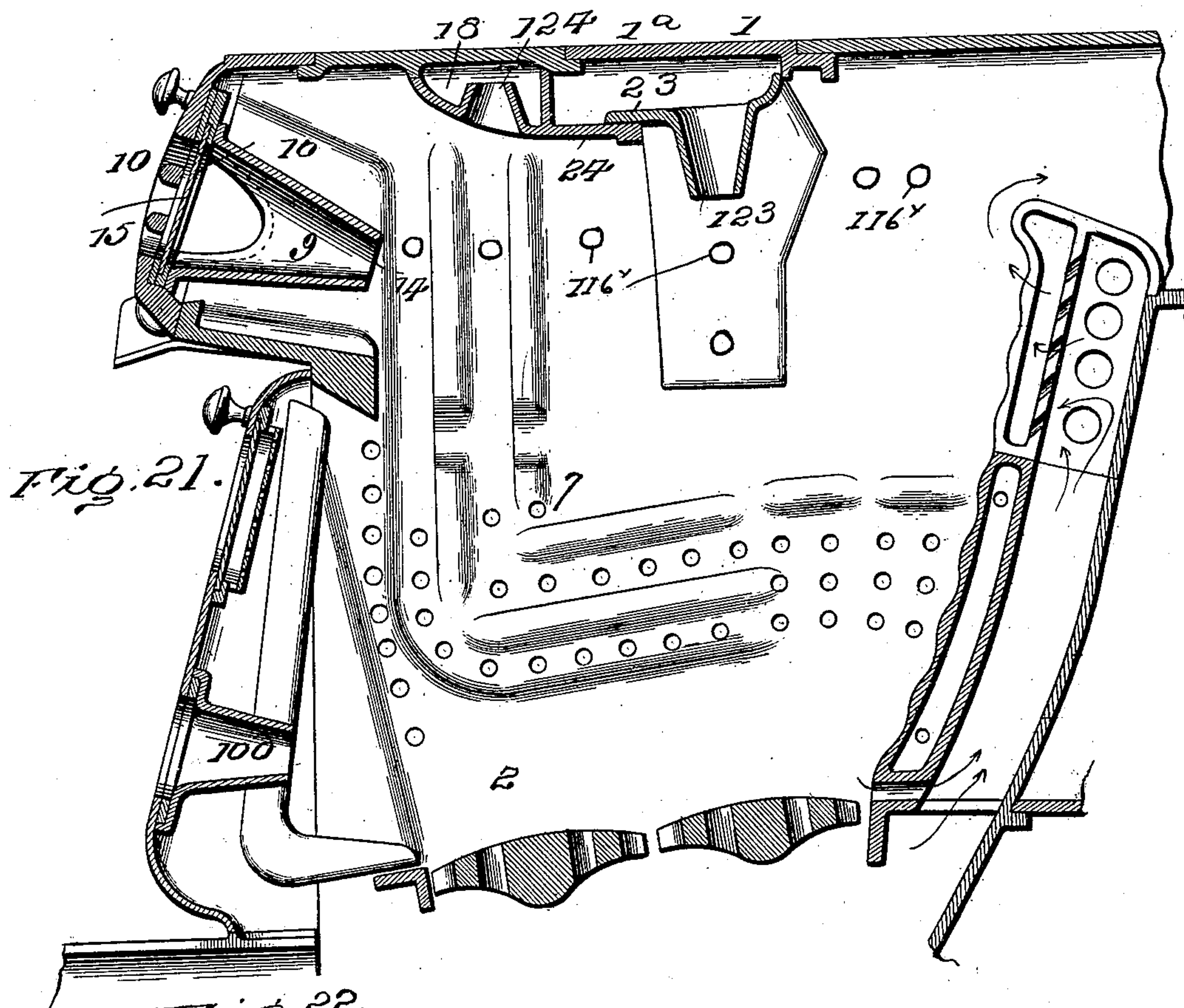
E. R. CAHOONE.

STOVE.

(Application filed Dec. 14, 1899.)

6 Sheets—Sheet 5.

(No Model.)



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No. 698,799.

Patented Apr. 29, 1902.

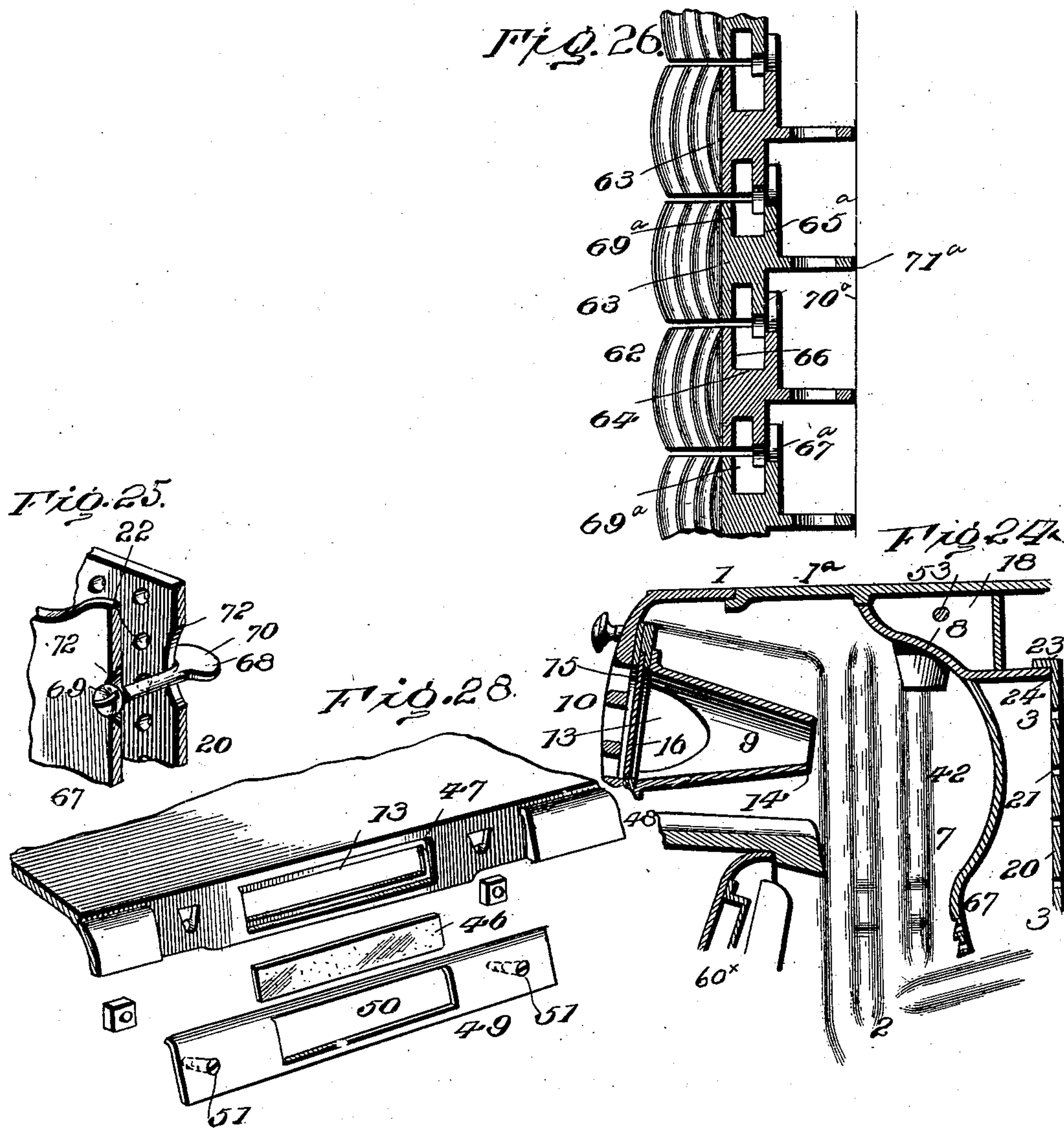
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(Application filed Dec. 14, 1899.)

6 Sheets—Sheet 6.

(No Model.)



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UNITED STATES PATENT OFFICE.

EDWIN R. CAHOONE, OF NEWARK, NEW JERSEY.

STOVE.

SPECIFICATION forming part of Letters Patent No. 698,799, dated April 29, 1902.

Application filed December 14, 1899. Serial No. 740,313. (No model.)

To all whom it may concern:

Be it known that I, EDWIN R. CAHOONE, a citizen of the United States, residing at Newark, in the county of Essex and State of New Jersey, have invented new and useful Improvements in Stoves, of which the following is a specification.

My present invention relates to improvements in stoves designed more especially for burning soft or bituminous coal.

The invention has for its object to provide, first, means for introducing jets of highly-heated air into the fuel-chamber; second, to provide means for uniformly jetting heated air into the fire-pot at different inclinations; third, to provide in a stove structure air-heating chambers wherein the air is heated and directed to a superheater, from whence it is delivered to the fuel; fourth, to provide means for equalizing the heated air delivered to the bed of fuel from a series of pipes or tubes; fifth, to provide in a stove a structure which will assist toward producing more uniform and perfect combustion, this result being brought about by the arrangement of the series of jet-tubes, the means for introducing superheated air to said tubes, the particular construction of the air-duct, and the equal distribution of heated air to the fuel from the sides.

Many other objects and advantages will be hereinafter referred to and be particularly pointed out in the claims.

In the drawings forming a part of this specification, Figure 1 is a perspective view of my improved stove, the feed-door being open. Fig. 2 is a detail view of an air-superheater. Fig. 3 is a horizontal section through the feed-door. Fig. 4 is a vertical section of a stove, showing more clearly my improvements. Fig. 5 is a side elevation with parts removed. Fig. 6 is a section on line 6 6, Fig. 4. Fig. 7 is a view of a tip. Fig. 8 is a detail perspective view of a tip, the parts being separated. Fig. 9 is a horizontal section on line 9 9 of Fig. 5, showing the air-heating chambers in the sides of the stove. Fig. 10 shows a modified form of a superheater and tubes. Figs. 11, 12, 13, 14, 15, and 16 are views of different forms of pipes or tubes for delivering air to the fuel. Fig. 17 is a detail perspective view of the end of the air-duct. Fig. 18 is a view of a modi-

fied form of means for delivering air to the fuel. Fig. 19 is a detail cross-section on line 19 19 of Fig. 18. Fig. 20 is a cross-section of the feed-door, showing the mica window omitted. Fig. 21 is a sectional view showing the application of several modifications. Fig. 22 is a front view of the air-superheater disclosed in Fig. 21. Fig. 23 is a diagrammatic view showing a baffle-plate in the panel in the side of the stove. Fig. 24 is a sectional view of a still further modified form for directing heated air to the fuel, the shield or burner-plate having a concave smooth surface. Fig. 25 is a detail view showing one form of securing the front burner plate or shield to the air-duct. Fig. 26 is a horizontal sectional view of the device for furnishing currents of air to the rear of the fuel. Fig. 27 is a modified form showing a structure for injecting heated air through perforations in a superheater depending from the stove-top. Fig. 28 is a detail perspective view of a peep-window and its parts.

The numeral 1 represents a cooking-stove constructed more especially for burning soft or bituminous coal. However, I do not desire to limit myself to the use of any particular kind of fuel or stove. A fuel-magazine 2 and an air-duct 3 are employed, the details of which will be hereinafter referred to.

The term "fuel-magazine" as used throughout this description and the claims is intended to refer to a fuel-magazine as generally understood or to a fire-pot.

Between the stove sides 4 and the lining of the fuel-magazine are chambers 5, formed by ribs 6, which project from the inner sides of the stove-lining 7. There will preferably be passages or subchambers in said chambers, through which air is admitted to, first, the air-duct 3; second, a series of tubes 8, which depend from a superheater secured to the under side of the stove-top; third, the tubes 9, depending from a superheater secured to the feed-door 10, and, fourth, the inner face of the mica around a peep-hole 11 and a flue adjacent thereto and which enters the fuel-magazine behind the air-duct 3.

The feed-door 10 is hinged, as at 12, in the usual manner and is preferably cast or provided with a concave seat on its inner side to accommodate a superheater 13, having pro-

jecting therefrom into the fuel-magazine 2 and toward the bed of fuel the series of pipes 9, the exits 14 of the end tubes 9 being slightly smaller in diameter than the exits of the tubes nearest the center for the purpose of equalizing the air, as will be hereinafter referred to. Between the superheater 13 and the back of the feed-door 10 is seated a combined mica-window carrier and lock 15, so constructed as to provide means for holding windows opposite the depending pipes or tubes 9, which will when the slide is thrown to the right lock the feed-door in a closed position and at the same time bring said windows 16 opposite the pipes or tubes, so that the attendant may see the condition of the fuel.

I do not desire to be limited to the exact construction of the superheater and the tubes projecting therefrom, as it is evident that the superheater and the tubes may be made separately and be secured together in any suitable or well-known manner.

Air is admitted to the air-heating chambers located, preferably, on both sides of the stove through inlets 17, and the exits 13^x of said air-heating chambers being in alinement with the ends of the superheater 13 when the feed-door is closed a continuous supply of first heated and then superheated air is delivered to the fuel.

The tubes 18, depending from the stove-top, have formed on their upper ends a superheater 18, which extends over the fuel-magazine and above the bed of the fuel. This superheater communicates with passages 19 of the heating-chamber 5.

The air-duct 3 is composed of two sections, forming a main frame 20, perforated, slotted, or the equivalent, as at 21, whereby the air will be broken as it is distributed or jetted to the fuel. The sections 20 have flanges 22 at their ends, seated when the parts are assembled in integral supports projecting inwardly from the sides of the stove, said supports being shown and described in my co-pending application, No. 621,994, filed February 14, 1899. A horizontal flange 23 projects forwardly from the front section and is seated upon a flange 24, extending from the superheater 18. By this arrangement—that is, the integral supports for the ends of the air-duct, together with the horizontal support 24—a secure and convenient means is provided for not only locking the two sections of the main frame 20 of the air-duct together, but also for rigidly holding the parts in a relative position and dispensing with separate means for holding said frame together. Furthermore, such a construction enables the removal of the air-duct from the stove for repairs, or if it is desired to repair the fuel-magazine the air-duct can be quickly removed and full access to the inside of the magazine can be had, the stove-top having a removable section 1^a to enable said duct to be withdrawn. Sections 20 at the meeting ends (see Fig. 17) have lugs 25. In one is a

slot 26, into which a tang 27 of the opposite section is seated, providing one way of positioning the parts while assembling the duct structure, at the same time affording an additional means for maintaining the duct in a rigid position. Located on the inside of the frame 20 are baffle-plates 28, forming an additional heating-surface for the air to act upon and be broken as it is being drawn to the fuel.

In Fig. 4, 28^a represents a wire-gauze interposed in the air-heating chamber 66, formed between the air-duct and the shield or burner-plate attached to the air-duct. While this is only used in some cases, it is under certain circumstances a most efficient means for breaking up the air.

The frame 20 is open at its lower end and accommodates one or a series of separable tips 29, secured in a fixed position by means of bolts or any other preferred locking devices. Each tip-section is hollow and has a series of notches 30 around the inner edges, and one section has lugs 31 fitting openings 32 in the opposite section. In this way the parts of the tips are relatively held together, and the notches 30 being in alinement with each other air-exits 33 are formed. While I have shown the grooves in the sections when placed together forming round air-exits, I would have it understood that the notches 30 can be cut out any desired length and shape to form enlarged air exits or passages, as the condition of the fuel might warrant. The lugs 31 are so proportioned as to prevent the sections from abutting against each other, leaving a slight air-space 33 between the walls of said sections when the tips are assembled. I provide this air-space 33 as an additional means for delivering air in some cases by jets, in other cases by diffusion, which will depend on the condition of the lay of the fuel in or to which the air is being delivered, the grooves 34 on the outside of the tip-sections being provided for the purpose of directing air-currents to the fuel from the air-duct.

In the air-duct at a point near the upper end is a baffle-plate 35. In general construction and for the purpose of this invention it is approximately concave below and is provided on its outer edge with a series of notches 36 to permit air to pass and be broken into particles, that it may become more readily and thoroughly heated as it is delivered to the main air-chamber in the air-duct from the passage 37 in the air-heating chamber 5.

Before the air-duct is positioned a burner plate or shield 65 is applied to the rear side, forming between said plate and the duct the air-chamber 66. By constructing this shield with relation to the duct it is held in place by the integral supports in which the air-duct is located, thus avoiding separate means for holding said plate.

The shield or burner-plate 67, applied to the front of the duct, is secured in place, preferably, by separate means, and the means I

prefer to employ consists of a bolt or pin 68, provided with a head 69, having a kerf therein and a T-head 70 at the opposite end. A slot 71 is formed in the burner-plate large enough to permit the head 70 to pass through, but not the head 69. An oblong slot 72 in the front wall of the air-duct permits of the entrance of the head 70, whereupon the bolt is given a turn, so that the wings of the T-head rest against the duct-wall, holding the burner-plate securely in position.

The fire-pot lining 7 is grooved, as at 42, and is constructed, preferably, of a single perforated piece slightly set in a short distance from the sides of the stove, forming air-heating chambers 43 below the air-heating chamber 5, said chambers 43 being supplied with air from the ash-pit. The flanges or ribs 6 are preferably cast on the lining, forming, with the stove structure, the air-passages 17, 19, and 37.

An opening 44 communicates with a passage 45, which admits air to the peep-opening to prevent soot accumulating on the mica window. In connection with this peep-opening novel means for securing the mica 46 in position is provided. A seat or slight depression 47 is formed in the flange 48 around the top of the stove to receive the mica, the latter being retained in position by a plate 49, having a slot 50, corresponding to the peep-opening. This plate 49 is secured or clamped to the flange of the top in any preferred manner, but preferably by bolts 51 passing through the ends of said plates and the flange.

On each side of the stove is a damper 52, being so constructed as to cover each of the openings of the passages 17, 19, 37, and 44 simultaneously, one in proportion to the other. This damper, as shown in Fig. 5, is L-shaped and has three openings in the horizontal portion thereof, which register with the three inlet-ports leading, respectively, to the superheater 18, the air-duct 3, and the peep-opening 44, the vertical portion closing the air-passage 17 leading to the superheater attached to the feed-door.

A rod 53 extends across the stove and has on each end a depending arm 54^x, each of which has a slot 55 at the lower end engaging a pin 56, the latter projecting from the damper-plate 52. Suitable thumb-pieces 53^a on the damper provide a ready means for operating the device.

While I have described the damper-plates as being approximately L-shaped, I have done so merely for convenience in structure, it being evident the location of the openings can be at any convenient place and the damper adapted in shape to conform to the location of said openings. This construction enables me to admit air to the various openings which lead to the superheaters and air-heating chambers proportionately and simultaneously.

Panels 54 are applied to each side of the stove and are designed more especially as a finish. However, they have an additional pur-

pose, in that they provide air-chambers 55^a and 56^a, the lower chamber 56^a being the chamber in which the air is heated that is ejected through the openings in the stove-lining to and through the fuel. The upper chamber 55^a has openings or slots 57, through which the air from the atmosphere is admitted. This chamber communicates with the inlet-openings 19, 37, and 44. Each panel is divided into two chambers by a division-plate 58, held in place by lugs 59, cast on the inner side. However, I propose to either cast this partition with the panel or make it separate. Lugs 60 project from the lower end of the panel and fit in slots in the stove structure, and a catch-button 61 at the top serves to maintain said panel in proper position.

The back wall of the combustion-chamber or fire-box is made up of a series of bars or sections 62, as in Fig. 26, each preferably composed of a vertical body portion 63, a neck portion 64, having lateral wings or flanges 65, and a pendent rearwardly-projecting perforated flange 66. The vertical body portion 63 is preferably fluted, either horizontally or vertically, and is continued up over and forming the head of each section. One of the wings or flanges 65^a of each section is somewhat displaced from the flange on the adjoining section and is slightly wider. The wings or flanges 65^a have notches 67^a, which when the sections are placed together form air-exits. The head or upper portion 68^a of each section is made a trifle wider than the main body portion, so that when the sections are placed in position side by side a vertical slot is formed between each two sections. With this formation an air-chamber 69^a is formed between two or more sections and the perforations in the wings communicate therewith, the hot air coming up from the ash-pit being introduced between the wall 70^a and the back of the wings or flanges 65^a. This structure forms a series of chambers or channels 71^a, so that the air is heated and broken up into particles before it is introduced through the perforations in the wings, by which time it is more thoroughly heated when delivered to the chamber 69^a, formed between the wings and the body portion, and there commingles and ejects itself through the vertical spaces formed between the sections into the combustion-chamber above and below the fuel, where it materially assists in producing more perfect combustion. These sections are seated on the upper edge of the top of the back of the stove and rest on a receptacle-piece in the bottom of the magazine. However, they may be supported in any suitable way.

In the modification shown in Fig. 10 I have shown a superheater having protuberances cast on its lower side and flanges 91 projecting upwardly into the superheater and surrounding the openings of said protuberances.

In the modifications shown in Fig. 27 the tubes 8 are dispensed with, and heated air is

ejected under the influence of the draft directly from a superheater through a series of perforations 92.

In the modifications shown in Figs. 11 to 16 5 different forms of pipes for delivering and jetting heated air to the fuel in the combustion-chamber are illustrated. While the result obtained from each of these structures is substantially the same one with the other under certain circumstances, I prefer to use a 10 tapered tube.

In the modifications shown in Figs. 18 and 19 the heated air is delivered to a deflector 15 formed on the shield 67, if desired, where it is directed toward the center of the fuel-bed, the result being substantially the same as a straight tube.

In Fig. 24 the surface of the deflector is made smooth, and the air is delivered to it 20 from the tubes; but by the time it reaches the fuel-bed it is diffused in a sheet and a greater area of fuel is acted upon.

I may dispense with the mica windows in the feed-door and have the slots therein to admit 25 air direct to the tubes in addition to the heated air delivered from the side passages, as clearly disclosed in Fig. 20. By this construction I am enabled to supply a larger volume of air to the fuel.

I do not desire to limit myself to supplying 30 air to the various heated-air exits, as herein shown, as it is evident I may provide a brick with passages leading from a convenient point of the stove structure, or I may use pipes. In 35 other words, my invention consists of broadly, first, heating the air and then superheating said air in combination with the means employed for delivering said heated air to the fuel.

I desire to have it distinctly understood that 40 while I have termed a "heater" and a "superheater," the principle involved is broadly gradually heating the air to such a temperature as to effectually promote combustion 45 and that where I have used such terms it is to be applied to any means whereby the air can be heated. In other words, the chamber and the superheater while designated individually they are practically one, and I desire 50 to reserve this right.

The dampers are regulated, and the fuel-magazine is supplied with green fuel, whereupon a light is applied and the feed-door is 55 closed; but the slide therein is not moved until the fuel becomes incandescent, after which the slide can be thrown over, bringing the mica windows into alinement with the pipes or tubes, so as to enable the attendant to note the condition of the fire.

The air passing through the various heated 60 passages becomes highly heated by the time the fuel is reached. This heated air is jetted or delivered from the pipes or tubes directly to the bed of the fuel under the influence of the draft. The jetting or delivering of heated 65 air from the depending tubes alone does not give the best grade of combustion. On the

other hand, by the distribution of the air jets or currents from the stove-lining and the air-duct a more perfect and uniform combustion 70 is produced. The heated jets or blasts of air drawn in all instances to all parts of the fuel are necessarily brought together by the main draft.

The fuel receives approximately as much 75 air from the central pipes as from the end pipes. This is by reason of the fact, as already stated, the exits of the hot-air pipes are graduated, thus insuring a greater equalization of the hot air to the bed of the fuel. The 80 tendency of the pipes nearest the supply, where the exits of said pipes are of one size, is to deliver to the fuel a greater volume of air than the tubes remote therefrom, hence making the combustion greater at particular 85 points; but by making the exits of the tubes next the supply the smallest and gradually increasing the size of the exits of the next succeeding tubes the heated air is distributed uniformly throughout the series. The air 90 coming from the superheater will naturally follow the shortest conduit in escaping, and it is my purpose to decrease the exit-opening of the tube adjacent the supply to such proportions as to retard the too-free escape and 95 cause said air to be directed to the next tube having an exit of a somewhat-greater diameter. The larger exit-openings of the central tubes compensate for the "pull of the draft" 100 through the small openings of the end tubes, which enables me to supply the same amount of air throughout the whole body of fuel.

From experiments I have found the best 105 manner of obtaining good combustion when burning soft or bituminous coal is to heat the air to a comparatively high temperature and introduce it to the fuel in this condition. This is accomplished by the structure set up, and I believe I am the first to heat the air 110 and then pass it through a superheater and deliver it in uniform blasts or jets to the fuel. Experiments have also demonstrated that a pipe or tube placed in a fuel-chamber above the bed of fuel in any position or in any direction will jet the air through the fuel-bed 115 with sufficient force to attain good results so long as the main draft is good. Moreover, this operation is made complete when used in combination with the details of construction shown and described. 120

In many instances it is desirable to introduce heated air to the magazine below the bed of fuel, and I have so illustrated a series of tubes for this purpose, as at 100 in Figs. 1, 4, and 21. It will of course be understood 125 that the tubes can be positioned on any one or all sides of the fuel-magazine, those on the side being illustrated in Fig. 6. However, those shown in Figs. 1, 4, and 21 are applied to the fire-door 60^x. A chamber 101 is formed 130 between the front fire-grate and the fire-door 60^x, which in this case affords ample means for the heating of the air as it passes through the tubes. I may, however, carry out the

same principle as shown and described for heating the air in the upper tubes—i. e., superheating it before it reaches the tubes proper. It will be understood that when this

5 principle is employed the damper for regulating the admission of air will be connected up with the damper on the sides of the stove, so as to regulate the supply of air in unison with the air passing through the other tubes.

10 In some instances, as shown in Fig. 21, it is practical as well as advantageous to use an inverted tube 124, extending upwardly in the superheater, in place of a depending tube 8, such substitution giving excellent results.

15 In Fig. 23 I have shown in a diagrammatic form a baffle-plate 126 in the panel 54. This breaks and mixes the air more thoroughly as it is being directed to the heating-chamber 5.

20 From the foregoing description, taken in connection with the accompanying drawings, it is thought the operation and advantages of my improvement will be understood.

I claim—

1. In a stove, the combination with a fuel-
25 magazine, a pendent partition therein, an exit-flue, air-heating chambers in the stove structure, and superheater located in said fuel-magazine in front of the pendent partition, said superheater communicating with
30 said air-heating chambers, the superheater having exits for delivering heated air through the body of the fuel in the magazine under the influence of the main draft.

2. In a downdraft-stove, the combination of
35 a fuel-magazine, a pendent partition therein, an exit-flue, means located in said fuel-magazine in front of the pendent partition for heating air, means for supplying air to said means for heating air, and tubes extending down-
40 wardly from the means for heating air from a plane above the level of the bed of fuel and adapted to direct currents of heated air toward the bed of fuel for its combustion, all constructed for the purpose of conducting the
45 heated air and the products of combustion downwardly through the fuel under the influence of the draft.

3. In a downdraft-stove, the combination of a fuel-magazine, a pendent partition therein,
50 an exit-flue, means located in said fuel-magazine in front of the pendent partition for heating air, and tapered tubes extending from the means for heating air from a plane above the level of the bed of fuel, and adapted to deliver heated-air currents toward the bed of
55 fuel for its combustion, all constructed for the purpose of conducting currents of heated air, and the products of combustion downwardly through the fuel under the influence
60 of the draft.

4. In a stove, the combination with a fuel-magazine, a pendent air-duct, an exit-flue, air-heating chambers formed in the stove structure means for regulating the supply of air to
65 said chambers, superheaters located in said fuel-magazine in front of the pendent air-

duct, said superheaters communicating with said air-heating chambers, and tapered tubes depending from said superheaters, for delivering heated air to and through the fuel-magazine, under the influence of the main draft. 70

5. In a stove, the combination with a fuel-magazine, air-heating chambers located in the stove structure, superheaters located in said fuel-magazine, said superheaters communi-
75 cating with said air-heating chambers, and a series of tubes depending from said superheaters, the exits of said tubes which are located near the center being larger than the tubes near the side walls of said stove, to uni-
80 formly supply heated air to the fuel-magazine.

6. In a stove, the combination with a fuel-magazine, air-heating chambers located in the stove structure, superheaters located in said fuel-magazine, said superheaters communi-
85 cating with said air-heating chambers, and a series of tapered tubes depending from said superheaters, the exits of said tubes which are located near the center, being larger than the tubes near the side walls of said stove, to
90 uniformly supply heated air to the fuel-magazine.

7. In a stove, the combination with a fuel-magazine, a pendent air-duct therein, an exit-flue, an air-heating chamber located in the
95 stove structure, a superheater, located in front of the pendent air-duct and in said fuel-magazine which communicates with the air-heating chamber, and means connected to said superheater for delivering a uniform supply
100 of heated air to and through the fuel-magazine under the influence of the main draft.

8. In a stove, the combination with a fuel-magazine, an air-heating chamber, adapted to receive air at both ends, and tapered tubes
105 depending from said chamber into said magazine, the exits of said tubes which are nearest the center of the stove being greater in diameter than the end tubes, substantially as shown and described. 110

9. In a stove, the combination with a fuel-magazine, of a hinged feed-door covering the feed-opening of said magazine, air-heating
115 chambers formed between the walls of the fuel-magazine and the stove sides, a superheater attached to said feed-door, said superheater adapted to register with said air-heating chambers when the feed-door is closed, and means on the superheater for uniformly
120 introducing currents of heated air to the fuel.

10. In a stove, the combination with a fuel-magazine, a feed-door, an air-duct in said magazine, said air-duct being provided with air-exits for delivering currents of heated air to the fuel, a superheater suspended from the
125 top of the stove and into the magazine, a series of tubes depending from said superheater, a second superheater attached to said feed-door, tubes projecting from said superheater, means communicating with the superheaters
130 for supplying heated air, and means for simultaneously and uniformly regulating the

supply of air to the chambers which supply heated air to the air-duct and the superheaters.

11. In a stove, the combination with a fuel-magazine, an air-duct in said magazine, a superheater, and a series of tubes arranged side by side and depending from said superheater, the exit-openings of said tubes nearest the supply opening or openings of the superheater, being smaller than the exits of the tubes farthest from said supply, to equalize and uniformly supply currents of heated air to and through the fuel-magazine.

12. In a downdraft-stove, the combination with a fuel-magazine, an air-heating chamber, and a plurality of tapering tubes depending from said air-heating chamber, said tubes being arranged to deliver currents of heated air toward the fuel, the exit-openings of said tubes varying in size, those nearest the supply to the air-heating chamber being the smallest, all constructed for the purpose of conducting uniform currents of heated air downwardly through the fuel under the influence of the draft.

13. In a stove, the combination with a fuel-magazine, an air-duct supported therein, said air-duct being made in sections, means projecting from the sides of the stove for supporting said sectional duct, and a plurality of spaced-apart tips supported at the lower end of the sectional air-duct.

14. In a stove, the combination with a fuel-magazine, an air-duct supported therein, said air-duct being made in two sections, supports projecting from the sides of the stove, said supports locking and holding the sections together, and a plurality of sectional tips supported at the lower end of the sectional air-duct.

15. In a stove, the combination with a fuel-magazine, an air-duct supported therein, said air-duct being made in sections, means for supporting said sections, and a plurality of spaced-apart sectional tips supported at the lower end of the sectional air-duct.

16. In a stove, the combination with a fuel-magazine, an air-duct supported therein, said air-duct being made in sections, means for supporting said sections, and a series of spaced-apart and hollow perforated sectional tips supported at the lower ends of the sectional duct.

17. In a stove, the combination with a fuel-magazine, a sectional removable air-duct, and a sectional removable tip or tips locked in the lower end of said sectional duct.

18. In a stove, the combination with sides thereof, said sides having a cut-out portion and a series of air-inlets above said cut-out portion, a fuel-magazine having a series of perforations adjacent the cut-away portions in the stove sides, and perforated panels placed on the sides of the stove covering the cut-away portion and the air-inlets, said panels having partitions on the inner sides for forming air-heating chambers for supply-

ing the perforations in the fuel-magazine and the air-inlets in the stove sides.

19. In a stove, the combination with a fuel-magazine having a series of openings in its walls, means for delivering air to various points in the fuel-magazine, a panel fitting over the perforations in the fuel-magazine having its upper portion perforated and having a cavity on its inner side and a partition for dividing said cavity into two chambers so that air is furnished independently through the perforations in the fuel-magazine and through the said means for delivering air to various points therein.

20. In a stove, the combination with a fuel-magazine, an air-duct therein, means for jetting heated air to the front of the fuel-chamber, means for delivering currents of heated air to the fuel in rear of said air-duct, said means consisting of a plurality of bars provided with notched flanges, one of said flanges overlapping the flange on the next succeeding bar, air-heating chambers arranged in the front and rear of said flanges and means for directing heated air to said chambers to commingle with the air in the fuel-chambers delivered from the air-duct and the jetting means.

21. A sectional air-duct for a stove made in two sections, flanges projecting from the sides of said stove, said sections being locked together and seated in and by said flanges, lugs at the lower ends of the sections, and a baffle plate located between the upper ends of the sections.

22. In a stove, the combination with a fuel-magazine, an air-heating chamber, a superheater having depending tubes and a rearwardly-extending flange, means for supporting said superheater at its ends, an air-duct having a forwardly-projecting flange, said flange being supported on the rearwardly-extending flange of the superheater and means for supporting said air-duct.

23. In a stove, the combination with an air-superheater provided with a rearwardly-extending flange, an air-duct having a forwardly-projecting flange, said flange being supported on the rearwardly-extending flange of the superheater, and integral supports projecting from the stove sides for supporting said air-duct.

24. In a stove, the combination with an air-superheater provided with a rearwardly-extending flange, an air-duct made in two sections, one of said sections having a forwardly-projecting flange, said flange being supported on the rearwardly-extending flange of the superheater, and supports projecting from the stove sides for supporting said air-duct.

25. The combination with an air-duct for a stove, a burner plate or shield, and supports projecting from the stove sides, the air-duct and the shield being held in fixed relation to each other by being seated in said supports.

26. The combination with an air-duct having a perforated body portion, a burner plate

or shield, a gauze or perforated plate inserted between said perforated body portion and said burner plate or shield, and means at the lower meeting ends of the duct and shield for distributing heated air.

27. In a stove, the combination with a fuel-magazine, a series of heated-air-introducing tubes, a corresponding series of heated-air-introducing tubes arranged at an angle and approximately between the aforesaid series of tubes, a series of air-introducing tubes below the line of the bed of the fuel, and means for regulating the supply of air introduced through said tubes.

28. In a stove, the combination with a sectional air-duct made in two sections, means for locking said sections together, and sectional tips supported in the lower open end of said air-duct, said tip-sections being slightly spaced apart for the exit of air.

29. In a stove, the combination with a perforated air-duct, perforated shields on said air-duct, means for supporting the air-duct and shields, a series of baffle-plates in the air-duct, a gauze interposed in the space formed between the air-duct and one of the shields, and a plurality of sectional tips supported in the lower end of the air-duct, said tips having air-exits.

30. In a stove, the combination with a perforated air-duct made in two sections, supports projecting from the stove sides, said supports locking and holding said sections of the air-duct, and shields secured to the front and rear of said duct.

31. In a stove, the combination with a fuel-magazine, an air-duct, tip or tips being secured to said duct, each of said tips being made in sections, means for spacing apart said sections, and means for locking said sections together.

32. A hollow tip made in sections, said sections having notches in their edges, lugs projecting from one section and adapted to enter a seat in the opposite section to form spaces between said sections, and means for locking said sections together.

33. In a stove, the combination with a fuel-magazine, a feed-door, an air-heating chamber secured to said feed-door, means for supplying air to said chamber, and tubes depending from the chamber into said magazine, the exits of said tubes which are nearest the means for supplying air to the air-heating chamber being of smaller area than those remote from said supply.

34. In a stove, the combination with a fuel-magazine, of a hinged feed-door covering the feed-opening of said magazine, an air-heating chamber, a superheater attached to said feed-door, said superheater adapted to register with said air-heating chamber when the feed-door is closed, and means on the superheater for uniformly introducing currents of heated air to the fuel.

35. In a stove, the combination with a fuel-magazine, a pendent perforated air-duct

therein, an air-heating chamber, a superheater in said fuel-magazine, said superheater communicating with said air-heating chamber, and means attached to the superheater for delivering currents of heated air to and through the fuel in the magazine under the influence of the main draft.

36. In a stove, the combination with a fuel-magazine, a pendent perforated air-duct therein, an air-heating chamber, a superheater in said fuel-magazine, said superheater communicating with said air-heating chamber, and means attached to the superheater for delivering uniform currents of heated air to and through the fuel in the magazine under the influence of the main draft.

37. In a stove, the combination with a fuel-magazine, a perforated pendent partition, an air-heating chamber, a superheater in said fuel-magazine, said superheater communicating with said air-heating chamber, and a series of tubes depending from the superheater, the openings of the tubes nearest the supply of the superheater being smaller than the exits of the tubes remote from said supply, all for the purpose of delivering uniformly-heated air to and through the fuel under the influence of the main draft.

38. In a stove, the combination with a fuel-magazine, a pendent partition in said magazine, a superheater depending from the top of the stove and into the magazine, a series of tubes depending from said superheater, a second superheater attached to the stove at an angle to the aforesaid superheater, tubes projecting from said angularly-disposed superheater, means communicating with the superheaters for supplying heated air, and means for regulating the admission of air to the superheaters.

39. In a stove, the combination with a fuel-magazine, a pendent partition in said magazine, a superheater depending from the top of the stove and into the magazine, a series of tapered tubes depending from said superheater, a second superheater attached to the stove at an angle to the aforesaid superheater, tapered tubes projecting from said angularly-disposed superheater, means communicating with the superheaters for supplying heated air, and means for regulating the admission of air to the superheaters.

40. In a stove, the combination with a fuel-magazine, an air-duct supported therein, means for supporting said duct, and a plurality of spaced-apart sectional tips in the lower end of said duct.

41. In a stove, the combination with a fuel-magazine, an air-duct supported therein, means for supporting said duct, and a plurality of spaced-apart sectional tips in the lower end of said duct, having air-exit spaces or notches formed between and in the edges of said sections forming the tip.

42. In a stove, the combination with a fuel-magazine, a pendent partition in said magazine, air-heating chambers, superheaters, two

sets of tapered tubes communicating with said superheaters, one of said sets of tubes being arranged at an angle to the other, flues connecting the superheaters with the air-heating chambers, said tubes being positioned to deliver heated air to and through the bed of the fuel from the top, and means for delivering heated-air currents below the bed of the fuel.

43. In a stove, the combination with a fuel-magazine, a pendent partition therein, means for delivering a plurality of uniform currents of heated air to and through the fuel from the top, a series of tubes for delivering heated air below and through the bed of the fuel, and means for regulating the supply of air.

44. In a stove, the combination with a fuel-magazine, a pendent partition therein, means for delivering a plurality of heated-air currents to and through the fuel from the top, and a plurality of air-heating chambers having air-exits in rear of the pendent partitions for supplying currents of heated air to the body of the fuel.

45. In a stove the combination with a fuel-magazine, a pendent partition therein, means for delivering a plurality of heated-air currents to and through the fuel from the top, a plurality of air-heating chambers having air-exits in rear of the pendent partition, and a plurality of tubes for delivering currents of heated air to and through the fuel from the front and below the bed of the fuel.

46. In a stove, the combination with a fuel-magazine, a pendent partition therein, means for delivering a plurality of heated-air currents to and through the fuel from the top, a plurality of air-heating chambers having air-exits in rear of the pendant partition, air-heating chambers having air-exits on the side of the stove, and a plurality of tubes for delivering currents of heated air to and through the fuel from the front and below the bed of the fuel.

47. In a stove, the combination with a fuel-magazine, a pendent perforated air-duct, spaced-apart perforated tips in the lower end of said duct, an air-heating chamber, a flue or flues connecting said air-heating chamber and the air-duct, a second air-heating chamber and superheater, and means connected to said superheater for delivering a plurality of uniform currents of heated air to and through the fuel.

48. In a stove, the combination with a fuel-magazine, a pendent perforated air-duct, spaced-apart perforated tips in the lower end of said duct, an air-heating chamber, a flue or flues connecting said air-heating chamber and the air-duct, a second air-heating chamber and superheater and a plurality of tubes connected to said superheater, the tubes nearest the supply to the superheater being smaller than those remote therefrom for delivering uniform currents of heated air to and through the fuel.

49. In a stove, the combination with a fuel-

magazine, a pendent perforated air-duct, spaced-apart perforated tips in the lower end of said duct, an air-heating chamber, a flue or flues connecting said air-heating chamber and the air-duct, a second air-heating chamber and superheater, and a plurality of tapered tubes connected to said superheater, the tubes nearest the supply to the superheater being smaller than those remote therefrom, for delivering uniform currents of heated air to and through the fuel.

50. In a stove, the combination with a fuel-magazine, a pendent perforated air-duct, spaced-apart perforated tips in the lower end of said duct, an air-heating chamber, a flue or flues connecting said air-heating chamber and the air-duct, an air-heating chamber and superheater depending from the stove-top, an additional air-heating chamber and superheater, the latter being arranged at an angle to the superheater secured to the stove-top, tapered tubes projecting from the superheaters, the tubes nearest the supply of air of one of the superheaters being smaller than those remote therefrom for delivering uniform currents of heated air to and through the fuel from the top, and a plurality of air-heating chambers having air-exits in rear of the air-duct for delivering currents of heated air to the rear of the fuel.

51. In a stove, the combination with a fuel-magazine, a flue, air-heating chambers, a superheater having air-exits, the air-heating chamber and superheater communicating, said superheater being positioned in the fuel-magazine to direct currents of heated air through the fuel-bed under the influence of the draft.

52. In a stove, the combination with a fuel-magazine, a flue, air-heating chambers, a superheater located in said fuel-magazine, flues connecting the air-heating chambers and the superheater, and a series of tubes projecting from said superheater, the exits of the tubes nearest the flues connecting the air-heating chambers being smaller than those remote therefrom.

53. In a stove, the combination with a fuel-magazine, an air-duct open at its lower end, tips secured within said lower open end of the duct, means for supplying heated air to said duct, of a feed-door covering the feed-opening of said magazine, air-heating chambers, a superheater attached to said feed-door, flues connecting said air-heating chambers and said superheater when the feed-door is closed, and means on the superheater for uniformly introducing currents of heated air to the fuel.

54. In a stove, the combination with a fuel-magazine of a feed-door covering the feed-opening of said magazine, an air-duct in said magazine, said air-duct being provided with air-exits for delivering currents of heated air to the fuel, a superheater in said magazine, a series of tubes projecting from said superheater into the magazine, a second superheater attached to said feed-door, tubes projecting

from said superheater, means communicating with the superheaters for supplying heated air thereto, and means for regulating the supply of air.

5 55. In a stove, the combination with a fuel-magazine, a flue, an air-duct, means in the lower end of said duct for distributing currents of heated air, air-heating chambers within said magazine, tubes projecting from said
10 air-heating chambers into the fuel-magazine, the tubes from one air-heating chamber being arranged at an angle to and at a point between a companion set of tubes projecting from a second air-heating chamber, said tubes
15 projecting from said air-heating chambers being positioned to direct currents of heated air through the body of the fuel to the flue under the influence of the main draft.

56. In a stove, the combination with a fuel-
20 magazine, a flue, an air-duct, means in the stove structure for supplying heated air to said air-duct, and spaced-apart tips in the lower end of said air-duct.

57. In a stove, the combination with a fuel-
25 magazine, a flue, an air-heating chamber, a superheater communicating with said air-heating chamber, tubes projecting from the superheater into the fuel-magazine to direct currents of superheated air through the body of
30 the fuel, an air-duct, an air-heating chamber which communicates with said air-duct, and means in the lower end of said duct for distributing currents of heated air to the body of the fuel.

35 58. In a downdraft-stove, the combination with a fuel-magazine, an exit-flue, an air-duct in said magazine, an air-heating chamber, said chamber communicating with said air-duct, means secured within the lower end of
40 the duct for distributing currents of heated air to the fuel, and a series of tapered tubes, constructed and arranged to deliver currents of air toward the bed of fuel whereby said latter currents of air, together with the heated-
45 air currents delivered to the fuel from the means within the lower end of the air-duct, are drawn through the body of fuel under the influence of the draft.

59. In a stove, the combination with a fuel-
50 magazine, air-heating chambers, a superheater, said superheater communicating with the air-heating chambers, a series of tubes projecting from said superheater, a second superheater, said second superheater communicating with the said air-heating chambers,
55 tubes projecting from the second superheater and arranged at an angle to and approximately between the aforesaid series of tubes, a series of air-introducing tubes below the
60 line of the bed of the fuel, and means for regulating the supply of air introduced through said tubes.

60. In a stove, the combination with a fuel-
65 magazine, a perforated air-duct, a flue, air-introducing tubes located above the bed of the fuel and adapted to direct currents of heated air through the body of the fuel, and a series

of tubes below the bed of the fuel for introducing currents of heated air through the body of the fuel to mix therein with the currents of air introduced through the tubes from above. 70

61. In a downdraft-stove, the combination with a fuel-magazine, an air-duct in said fuel-magazine, air-heating chambers, a super-
75 heater, said superheater being in communication with the air-heating chambers, means for directing currents of superheated air from the superheater down upon or toward the top of the bed of the fuel and in front of the air-
80 duct whereby said currents of superheated air are drawn through the fuel under the influence of the draft.

62. In a downdraft-stove, the combination with a fuel-magazine, an air-duct in said mag-
85 azine, an exit-flue in rear of said air-duct, air-heating chambers, a superheater arranged in front of the air-duct and communicating with said air-heating chambers, tubes projecting from said superheater toward the bed of fuel,
90 and adapted to direct currents of heated air toward the bed of fuel for its combustion, said heated-air currents being drawn through the body of fuel from the top under the influence of the draft. 95

63. In a downdraft-stove, the combination with a fuel-magazine, an air-duct in said fuel-magazine, an exit-flue in rear of said air-duct, air-heating chambers, a superheater which
100 communicates with said air-heating chambers, means for uniformly and simultaneously delivering currents of superheated air from the superheater toward the top of the fuel-bed and in front of the air-duct, said super-
105 heated currents of air being drawn through the body of fuel under the influence of the draft.

64. In a downdraft-stove, the combination with a fuel-magazine, an exit-flue, and a series of tubes arranged below the plane of the
110 top of the bed of fuel and adapted to direct a series of individual currents of air toward the bed of fuel, said currents of air being drawn through the body of fuel under the influence of the draft. 115

65. In a stove, the combination with a fuel-magazine, an exit-flue, a series of tubes located below the top of the bed of the fuel to direct a series of individual currents of air
120 through the body of the fuel and a series of air-heating chambers provided with exits for introducing a plurality of heated-air currents to the fuel to mix therein, with the individual currents delivered from the tubes, the air-
125 currents being drawn through the fuel under the influence of the draft.

66. In a downdraft-stove, the combination with a fuel-magazine, an exit-flue, and a series of tapered tubes arranged below the plane
130 of the top of the bed of fuel, and adapted to direct a series of individual currents of air toward the bed of fuel, said currents of air being drawn through the body of fuel under the influence of the draft.

67. In a downdraft-stove, the combination with a fuel-magazine, an exit-flue, an air-duct in said magazine, means for delivering currents of superheated air toward the top 5 of the bed of fuel in front of the air-duct, said currents of superheated air being drawn through the body of fuel under the influence of the draft.

68. In a stove, the combination with a fuel- 10 magazine, a flue, an air-duct therein, air-heating chambers, a superheater, a series of tubes projecting from said superheater into the fuel-magazine, said superheater communicating with the air-heating chambers, a second su- 15 perheater, means for delivering currents of superheated air to the fuel from said second superheater, the air-currents being drawn through the body of the fuel under the influence of the main draft.

69. In a stove, the combination with a fuel- 20 magazine, air-heating chambers formed in the stove structure, superheaters communicating with said air-heating chambers, tubes projecting from said superheaters into the fuel- 25 magazine for delivering currents of superheated air above the bed of the fuel, a series of tubes below the bed of the fuel for directing currents of heated air through the body of the fuel, and a series of air-heating cham- 30 bers having a plurality of exits for introducing currents of heated air through the body of the fuel, said latter air-currents together with the air-currents introduced through the tubes located below the fuel-bed being drawn 35 through the fuel-bed under the influence of the main draft.

70. In a downdraft-stove, the combination with a fuel-magazine, an exit-flue, an air-heating chamber, a superheater communicating 40 with said air-heating chamber, a series of tubes extending from said superheater and arranged to deliver currents of superheated air toward the bed of fuel, said superheated-air currents being drawn through the body 45 of fuel under the influence of the draft.

71. In a downdraft-stove, the combination with a fuel-magazine, a flue, means for supplying individual currents of heated air to all sides of said magazine, and means for delivering a plurality of individual currents of 50 heated air through the fuel from the top, all of said currents being drawn through the body of the fuel under the influence of the main draft.

72. In a stove, the combination with a fuel- 55 magazine, a flue, means for heating air, a superheater, and a double series of tubes arranged intermediate each other for delivering individual currents of heated air through the fuel from the top. 60

73. In a downdraft-stove, the combination with a fuel-magazine, an exit-flue, an air-heating chamber, a series of tubes extending from said air-heating chamber, and arranged to deliver currents of heated air toward the bed 65 of fuel, said heated-air currents being drawn through the bed of fuel under the influence of the draft.

74. In a downdraft-stove, the combination with a fuel-magazine, an exit-flue communi- 70 cating with the magazine near the bottom of the latter, an air-heating chamber, means for directing currents of heated air from said air-heating chamber toward the top of the bed of fuel, and means arranged below the plane of 75 the top of the bed of fuel for delivering currents of heated air toward the fuel-bed, the currents of heated air which are delivered above the fuel-bed from the air-heating chamber, and the heated-air currents delivered 80 toward the fuel-bed below the plane of the top, being drawn through the body of fuel under the influence of the draft.

In testimony whereof I have hereunto set my hand in the presence of two subscribing 85 witnesses.

EDWIN R. CAHOONE.

Witnesses:

H. O. INGALLS,
JAS. B. EGAN.