A. FISHER.

METAL FURNACE.

APPLICATION FILED JULY 20, 1908.

958,384.

Patented May 17, 1910.

4 SHEETS—SHEET 1.

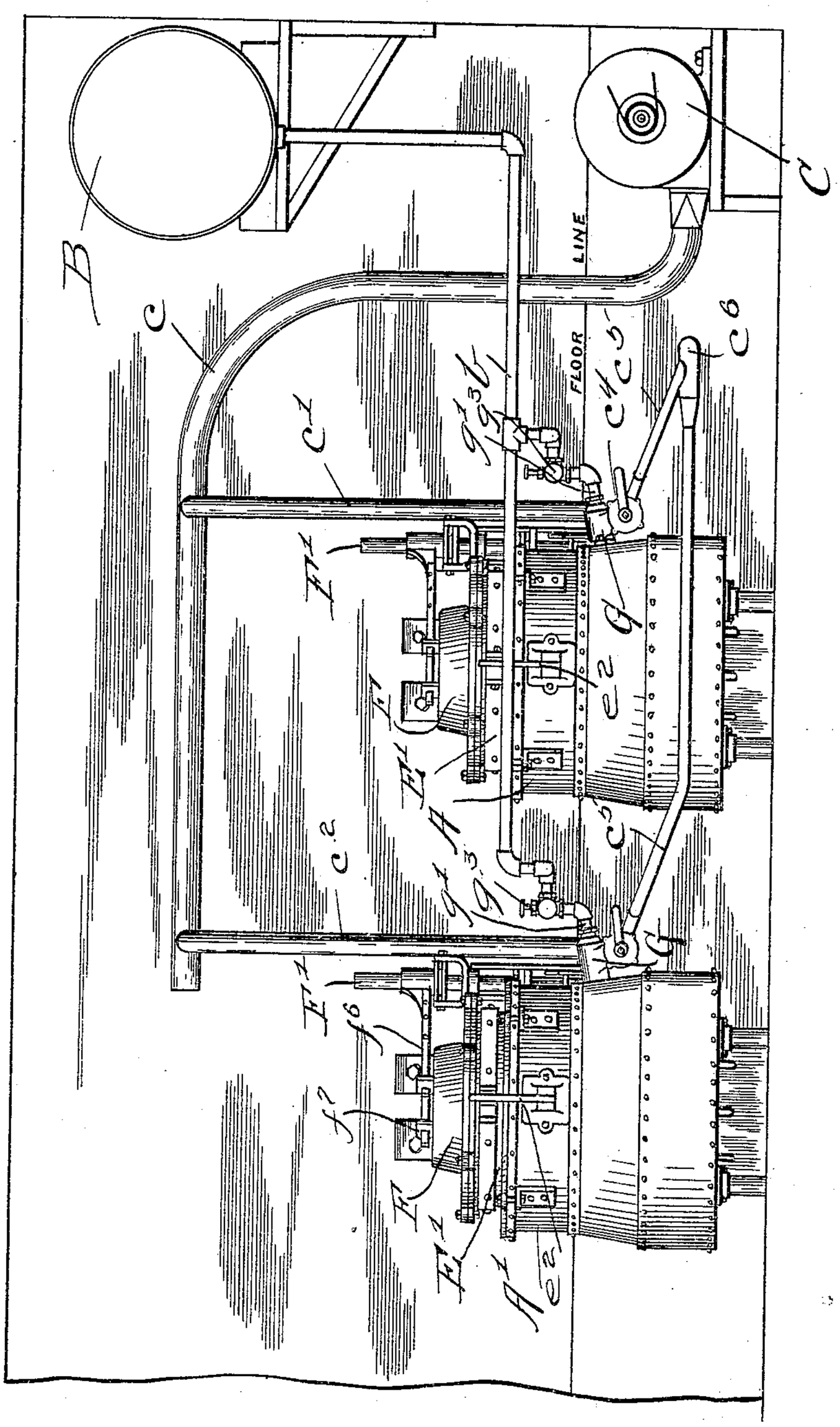

FIG. 1.

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4 SHEETS—SHEET 2.

Fig. 2

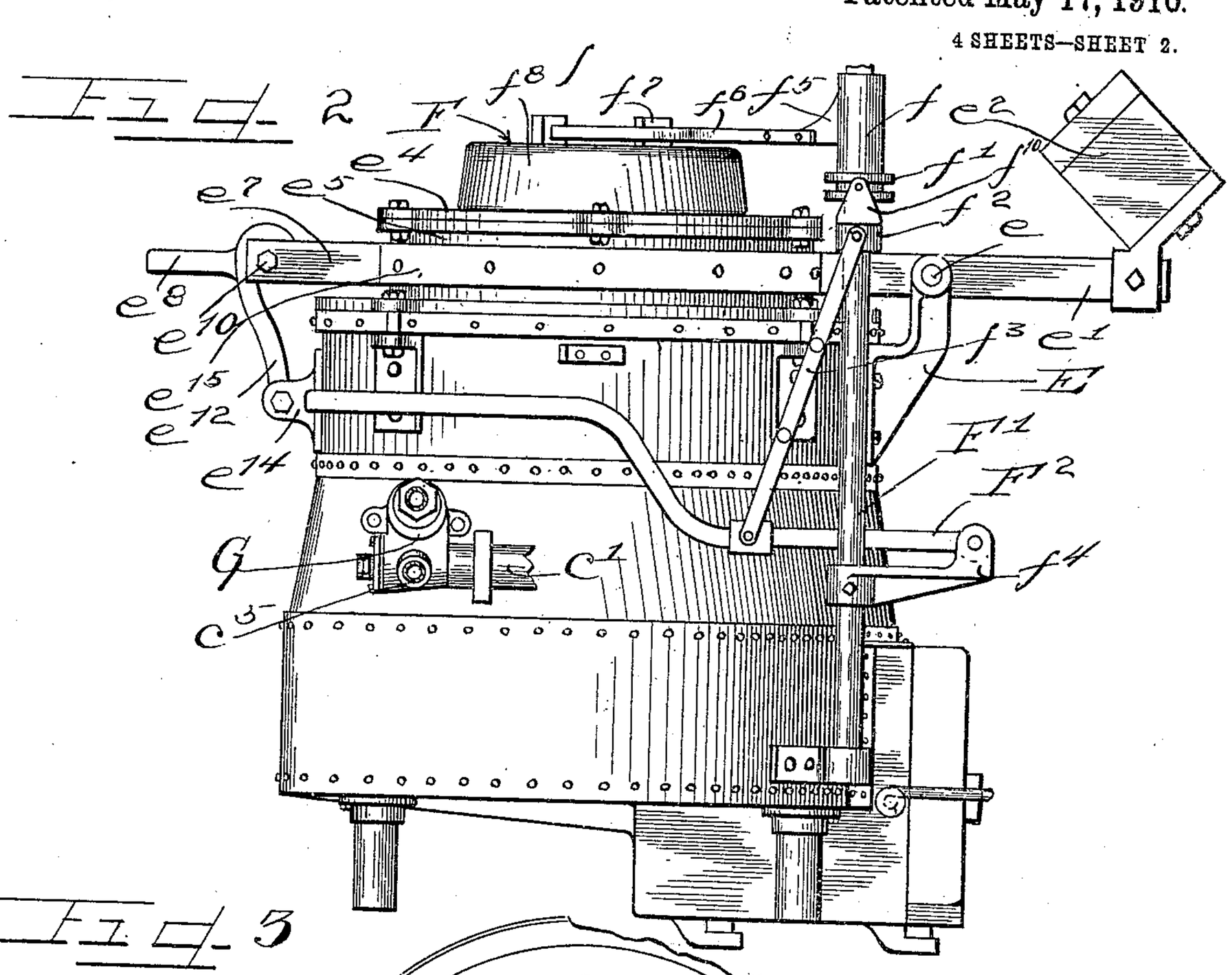
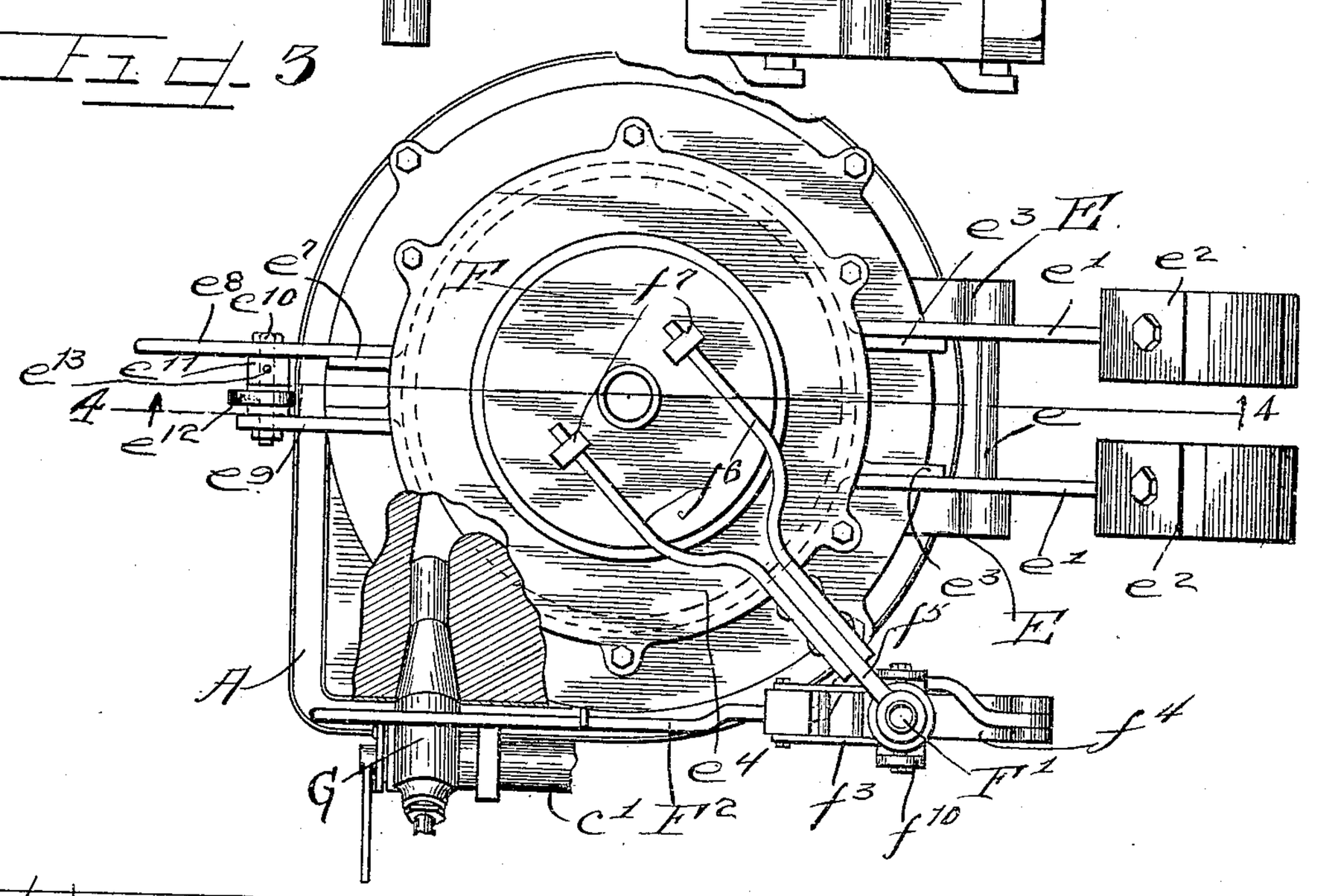


Fig. 3



Witnesses

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[illegible]

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4 SHEETS—SHEET 3.

Fig. 4

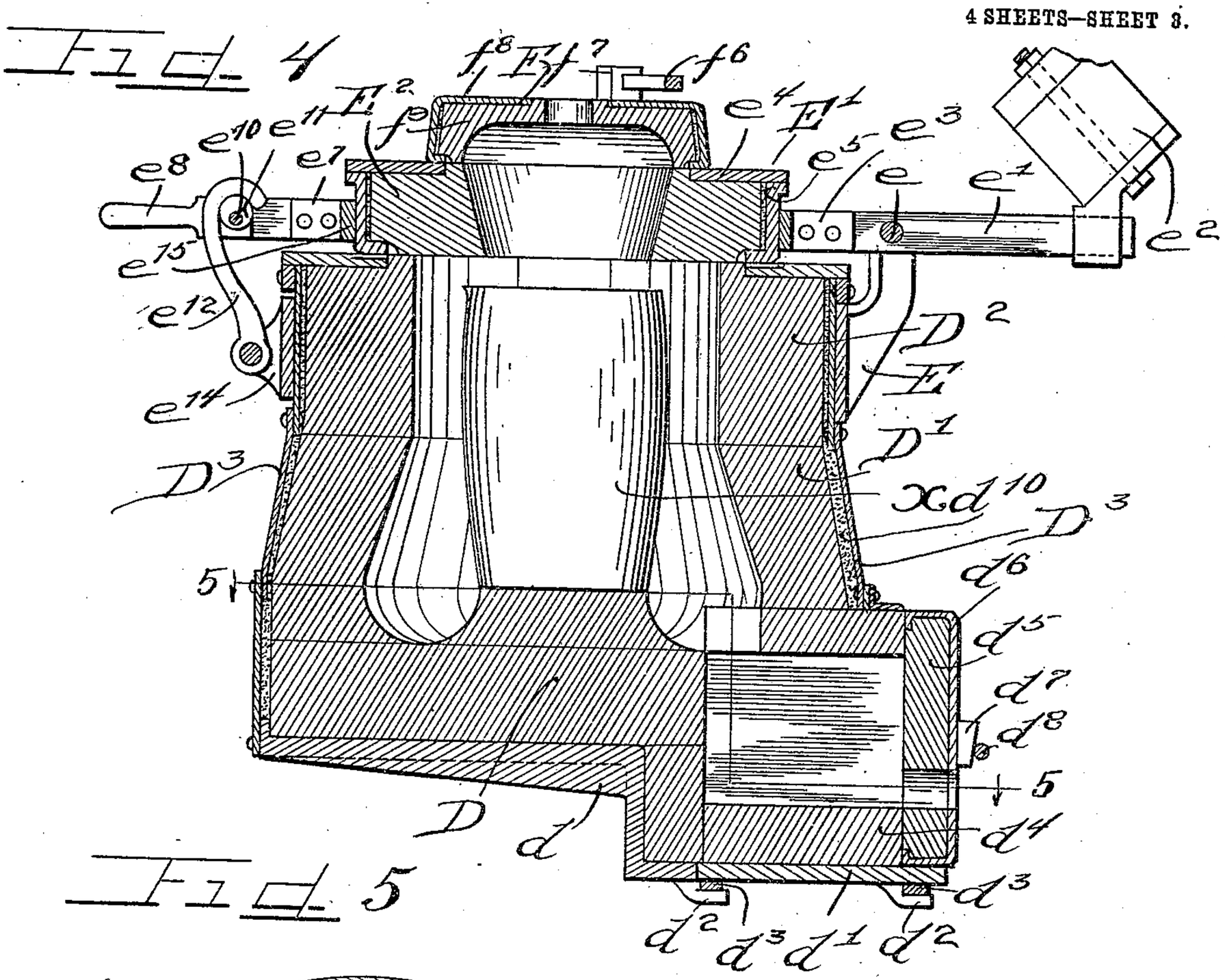
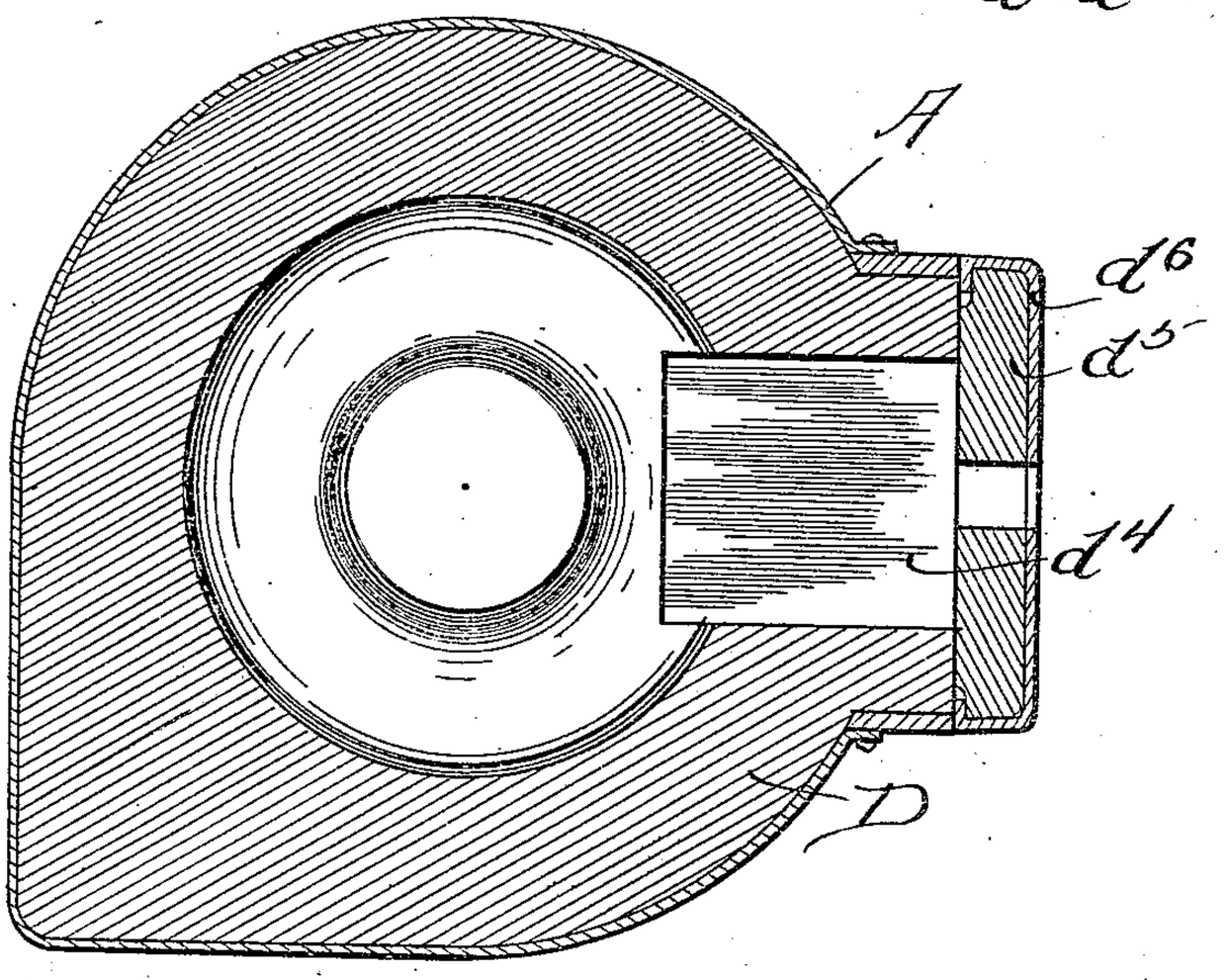


Fig. 5



Witnesses

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4 SHEETS—SHEET 4.

Fig. 6

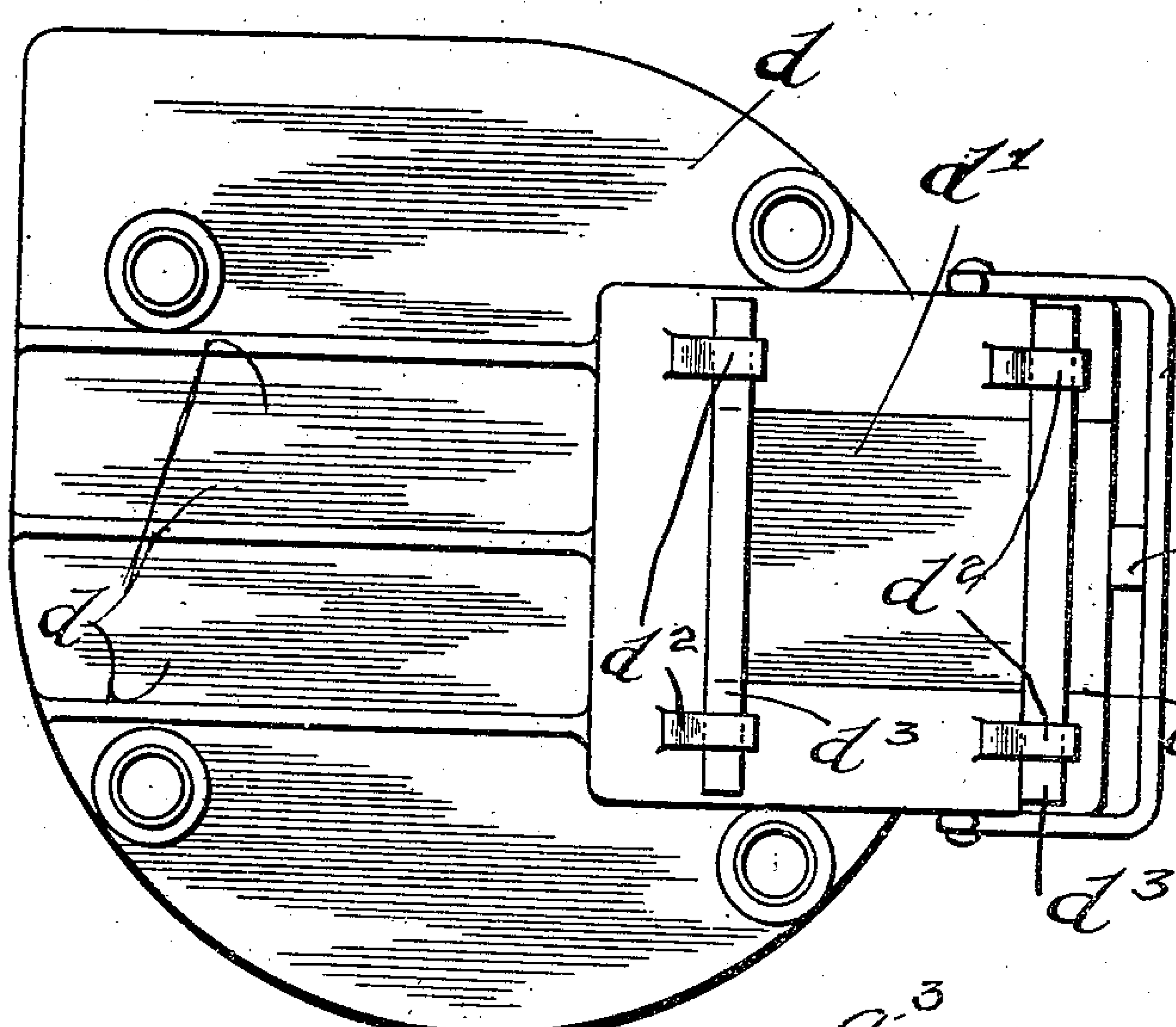


Fig. 7

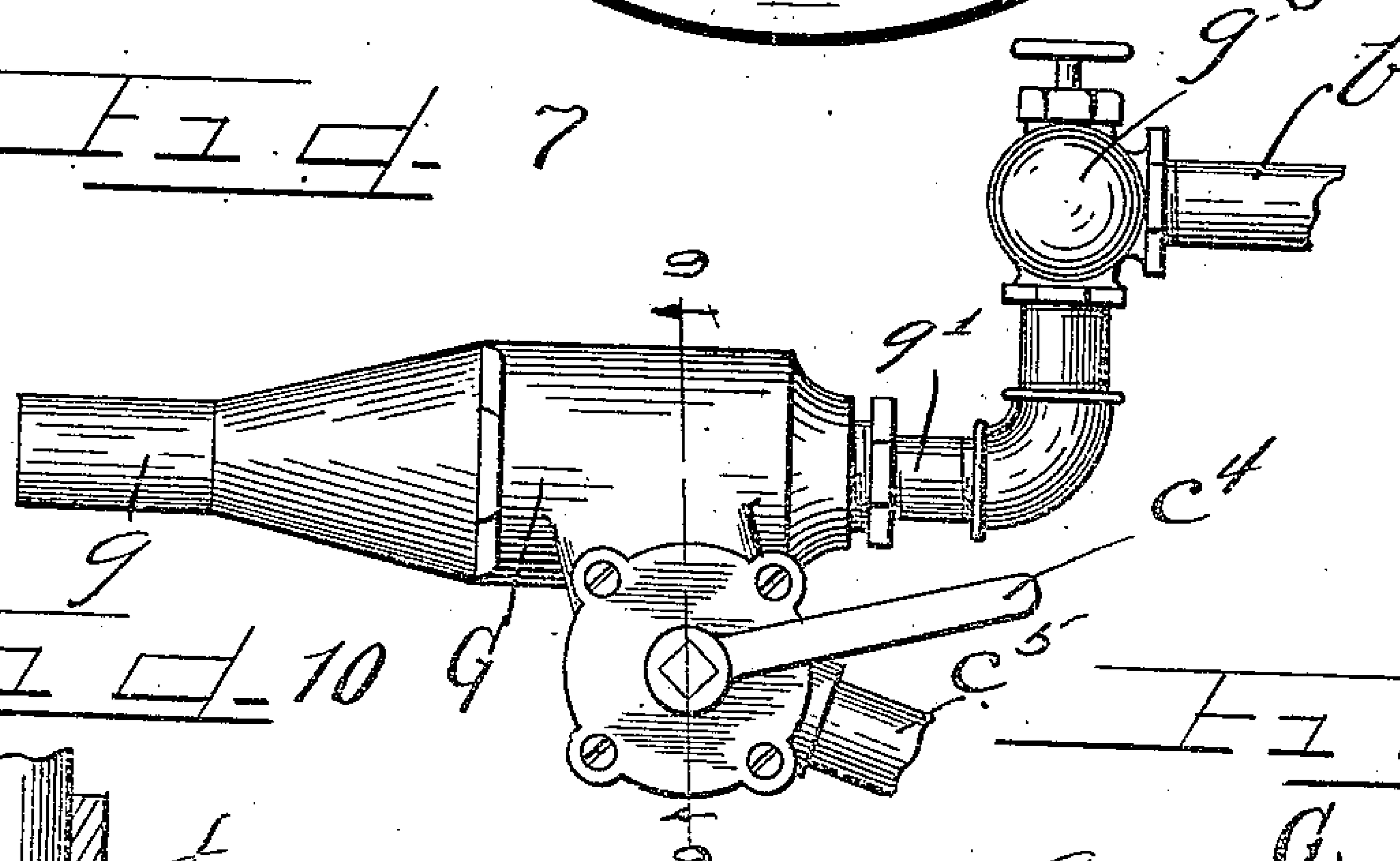


Fig. 10

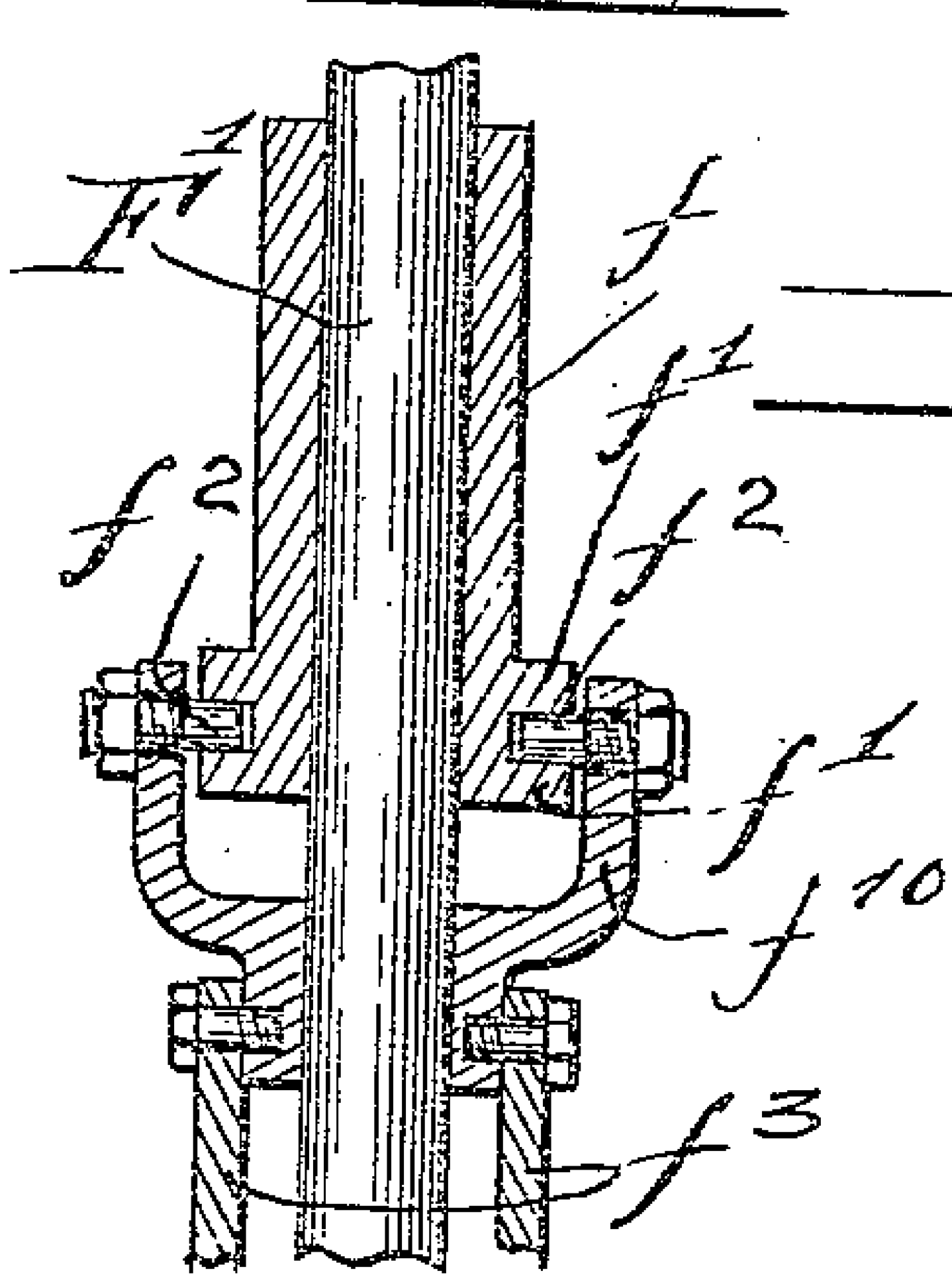


Fig. 9

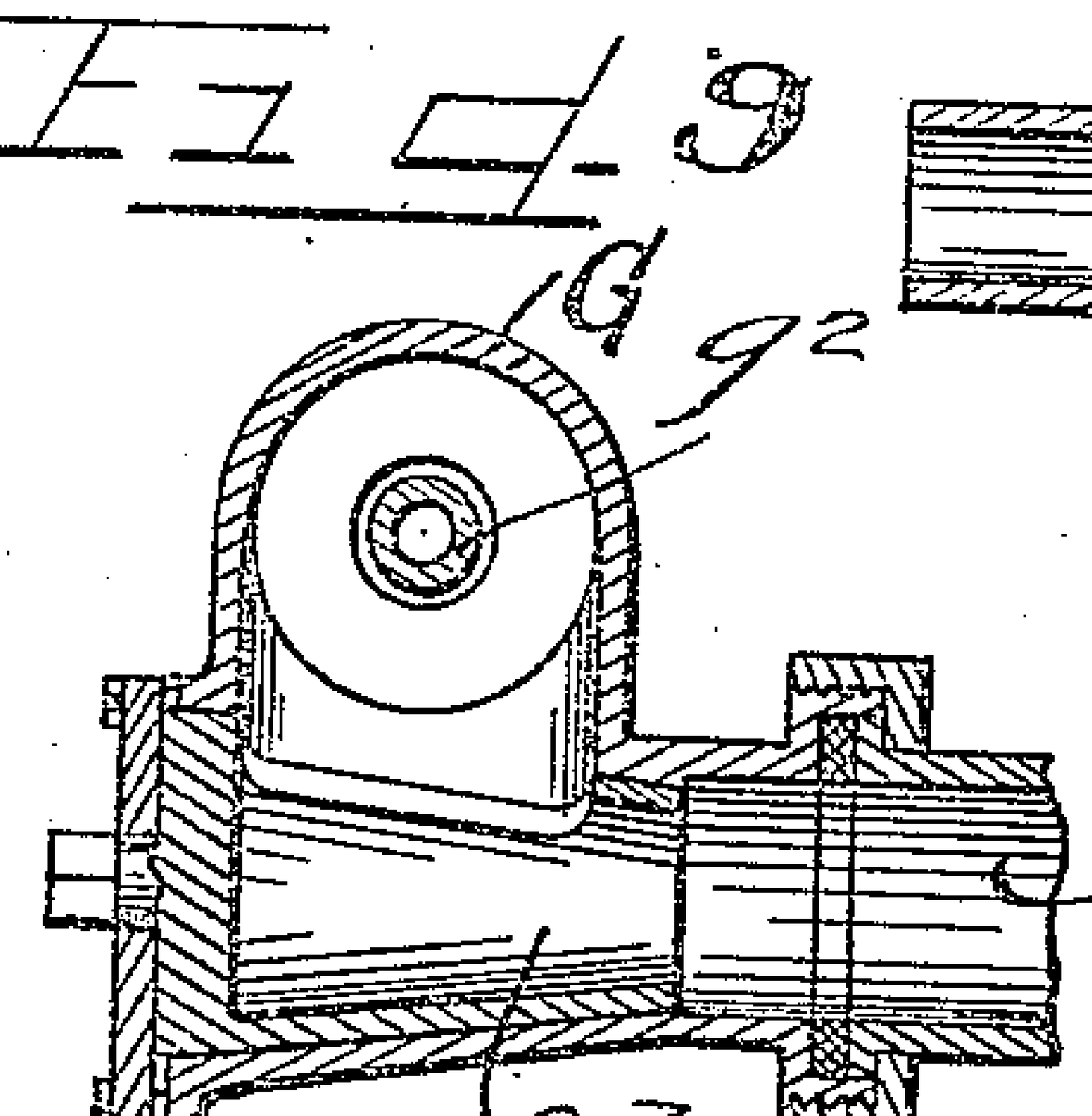
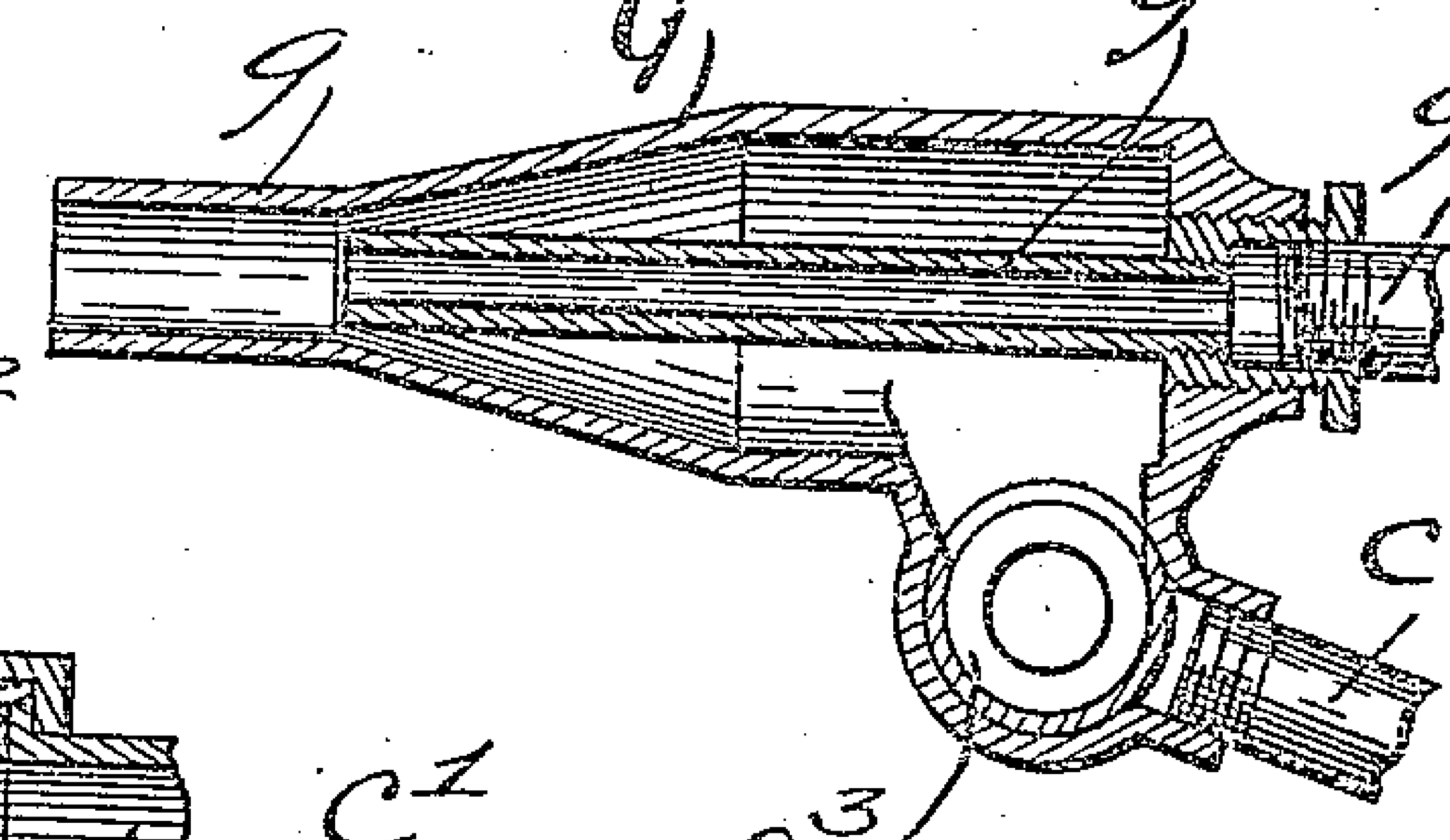


Fig. 8



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UNITED STATES PATENT OFFICE.

ALFRED FISHER, OF CHICAGO, ILLINOIS.

METAL-FURNACE.

958,384. Specification of Letters Patent. **Patented May 17, 1910.**

Application filed July 20, 1908. Serial No. 444,566.

To all whom it may concern:

Be it known that I, ALFRED FISHER, a citizen of the United States, and a resident of Chicago, Cook county, Illinois, have invented certain new and useful Improvements in Metal-Furnaces; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention is an improvement on the metal furnace for which United States patent was issued to me on the 21st day of August, 1906, No. 828,881. In the furnaces, the subject matter of said patent, provision was made for but a single furnace and often, indeed usually, it is desirable to connect a plurality of such furnaces in battery and to operate the same by means of a blast and fuel supply from a common source. Heretofore this has been somewhat difficult owing to the fact that shutting down one furnace of a battery to pour or to charge has resulted in increasing the blast in the remaining furnaces of the battery thereby seriously affecting the action and preventing the operator from calculating with exactness the operation of his furnace. Furthermore while provision was made to discharge the molten metal from the furnace, should a crucible be broken, yet it usually became necessary to reline the furnace in the event of the breakage of a crucible because of the hardening or solidifying of the metal in the bottom of the furnace before it could be drawn therefrom.

The object of this invention is to greatly improve furnaces of the class described and to so connect a plurality of the same that the heat in each can at all times be perfectly regulated independently of the operation or non-operation of one or any number of the furnaces in the battery thereby insuring an even action and enabling the operator at all times to know the condition of the metal in each of his furnaces.

It is a further object of the invention to construct a furnace so that should breakage of a crucible occur the molten metal falling into the bottom of the furnace is delivered therefrom into a suitable reservoir to hold the same and from which it may be readily dumped or drawn either after or before solidification.

It is also an object of the invention to afford means for quickly and easily manipulating the shield or closing cover to open the furnace for charging and to swing the same away from the apertured cover or lid of the furnace to permit the insertion or the removal of the crucible.

It is finally an object of the invention to simplify, improve and perfect the furnace in all particulars and to afford a durable, economical and easily operated furnace whereby the application of the heat may be regulated with exactness and the furnace operator may be able to rely upon maximum efficiency with minimum expenditure of fuel and loss of time both in charging, in pouring and in reheating.

The invention consists of the matters hereinafter described and more fully pointed out and defined in the appended claims.

In the drawings: Figure 1 is a front elevation of a battery of two furnaces embodying my invention and illustrating the means whereby the blast in each is maintained at a constant pressure independently of the operation or non-operation of the other. Fig. 2 is a side elevation thereof. Fig. 3 is a top plan view broken away to illustrate the connection of the burner with the furnace pot. Fig. 4 is a central vertical section on line 4—4 of Fig. 3. Fig. 5 is a section on line 5—5 of Fig. 4. Fig. 6 is a bottom plan view of a furnace embodying my invention. Fig. 7 is an enlarged side elevation of the burner and valves. Fig. 8 is a longitudinal vertical section of the burner and air valve. Fig. 9 is a section on line 9—9 of Fig. 7. Fig. 10 is an enlarged vertical section of the shaft for hoisting and swinging the closing cover or shield.

As shown in the drawings: A—A′ indicates the two duplicate furnaces connected in battery and both supplied through a common feed pipe *b* with crude oil or other suitable hydro-carbon fuel connected with a source of supply indicated as a tank B. As shown also a single blower C delivers air under pressure into a main blast supply pipe *c* from which smaller supply pipes c'—c^2 lead to the respective burners for each furnace and each connected with its respective burner as hereinafter described so that shutting off either burner will not in the least affect the operation of the other or vary the blast or the delivery of the fuel thereto.

The furnace proper as shown, comprises

a bottom or base portion having a raised central support or pedestal constructed of fire brick or other highly refractory material to support the crucible. Said combustion chamber as shown, extends below the top of said pedestal and consequently the bottom of the crucible, affording a rounded annular channel which at one side of the furnace opens into a lower chamber to receive the molten metal should a crucible break in the furnace. As shown, said lower chamber is formed by extending the base plate d of the furnace downwardly on one side to some distance below the bottom of the main portion of the furnace and providing therein a false bottom or dumping door d' which is normally held closed by means of bars d^3 engaged beneath the same and in brackets d^2 integral with the bottom of the furnace base, as shown in Figs. 4 and 6. The lining of said false bottom or dumping door and the entire interior of said chamber is fire brick d^4 and the front of said chamber is closed by means of a removable shutter or door d^5 of fire brick having an outer lining of metal d^6, and which normally rests on the projecting edge of said false bottom or dumping door and is apertured at a level with the bottom of said chamber that the molten metal may flow therefrom. As shown said shutter or door is held in place by means of a wedge block d^7, which engages within a bail d^8 pivoted on each side of said chamber and which firmly holds the door closed but permits ready removal thereof by removal of said wedge. This enables the front wall of said chamber to be removed to permit the metal to be withdrawn therefrom or if desired the false bottom may be dropped from said chamber to deliver the metal therefrom.

Supported upon the fire brick bottom D of the furnace the walls proper of the furnace taper upwardly and inwardly as indicated by D′ for about half the height of the crucible from which point the walls flare outwardly to a slight extent as indicated by D^2 with the general shape of the upper portion of the crucible but affording a considerable space between the same and said wall. The entire furnace is inclosed within a retaining shell of cast or sheet metal D^3 to protect the relatively soft fire-brick from injury and if desired heat insulating material d^{10} may be used between the fire brick and shell. Rigidly secured on said shell to project above the top thereof are parallel brackets E, connecting which is a pintle e, pivoted thereon are bars or levers e', each provided with a counterweight e^2, at the outer extremity and at their inner extremity rigidly secured to rearwardly directed arms e^3, projecting from a cover or lid indicated as a whole by E′. This as shown comprises a cast metal annular top plate e^4, rigidly bolted to a downwardly projecting annular shell e^5, with which said arms e^3 are rigidly connected and which at its lower edge is flanged inwardly to engage and retain the fire brick lining E^2 thereof. Said lining is provided centrally with a relatively large opening therethrough directly above the crucible, as shown, tapering downwardly to a diameter less than that of the top of the crucible to insure that all the metal delivered therethrough will fall into the crucible. Projecting forwardly from said lid and rigidly secured to arms e^7 is a lever e^8 and a shorter arm e^9 between which, as shown, extends a pintle bolt e^{10}, on which is rotatably engaged an eccentric or cam e^{11} provided with an aperture e^{13} to receive a lever or bar whereby the cam may be rotated. A hook e^{12} is pivotally engaged on a suitable bracket e^{14} on the front side of the furnace and in position to engage the eccentric or cam, the partial rotation of which by means of a bar or any suitable implement acts to firmly draw or jam the lid down upon the top of the furnace. Of course, any suitable arrangement for rigidly engaging said levers on the lid may be used. As shown, a frame e^{15} of structural metal is secured around said lid and rigidly bolted thereto to support all parts thereof when moving the same. Closing the opening through said lid is the cover or shield F. This as shown, is adapted to be raised vertically and to swing clear from the top of the furnace to expose the charging aperture through the lid or to permit the movement of said lid. For this purpose a mast or shaft F′ is journaled in suitable brackets at the side and rear of the furnace, and slidably supported thereon is a sleeve f, at its lower end provided with parallel flanges f' affording a groove therebetween adapted to receive therein the pins f^2 one on each side of the shaft whereby said sleeve is moved vertically and pivotally, as shown, a coupling f^{10} also slidable on the shaft and with said sleeve carries said pins and pivotally connected therewith are links f^3, which also pivotally engages a lever F^2, the fulcrum of which is a rearwardly directed bracket f^4, secured on the shaft F. Rigidly secured on said sleeve is an arm f^5 to which on each side thereof are bolted the yoke arms f^6, as shown in Fig. 3, the extremities of which engage in suitable eyes f^7 on each side of the outer shell f^8 of said cover or shield. As shown, said shell is constructed of cast metal or of plate and is flanged inwardly at its lower edge to retain the fire brick lining f^9. Said lining is concaved above the opening through the lid and is provided with a relatively small central opening to permit escape of fumes from the crucible.

The furnace is provided at one side with

a thickened wall affording an angular projection in which is set the burner, the nozzle of which is directed inwardly and downwardly and nearly tangent with the walls of the fire pot to direct the blast spirally around the crucible.

The burner comprises a shell G, cylindric at its outer end and from thence tapering to a cylindric nozzle g, into the axis of which is directed the discharge end of the fuel pipe g^2, which is threaded into a bushing secured in the head of the shell. Threaded also into said bushing and communicating with the fuel pipe g^2 is the feed pipe g' which is connected through any suitable valve g^3 with the main fuel supply pipe b.

The supply of air under pressure is admitted to the shell G through a hollow rotatable plug valve c^3. The supply pipe c' or c^2 opening into the open end of the plug closure and passing through an opening through the side of the plug into the shell G or if the plug be rotated to cut off the delivery to the shell, then into an exhaust pipe c^5, opening through the valve casing.

This construction as shown enables the blast or fuel supply to be cut off from any furnace without in the least affecting the operation of any other furnace. If desired the exhaust pipes c^5, may all connect in a single exhaust head c^6, or each may exhaust separately.

The operation is as follows: Should more than one furnace be operated with a single blower, the pressure therefrom is delivered into all or any of the furnaces through the regulating valve at the desired pressure and should this pressure be cut off from any furnace by the adjustment of said valve, thereby opening the waste pipe for that furnace, it is obvious that this cannot affect any other furnace in the battery. In charging, the cover F, is lifted by means of the lever and when clear the cover is swung laterally thereby exposing the charging aperture. Should it be desired to pour and consequently to remove the crucible the cam e^{11}, is rotated to release the hook e^{12}, which is permitted to fall and the lid is tilted up to expose the top of the furnace and the crucible may then be lifted out as is usual, and any suitable appliances for that purpose may be used and the crucible having been removed, another may be immediately inserted into the furnace, the lid closed, the crucible charged and the operation recommenced. Of course, before opening the furnace, as for instance preparatory to pouring, it is necessary to shut off the fuel supply by means of the valve g^5, and to cut off the blast by rotating the valve c^3, by means of a suitable tool c^4, and after recharging the furnace, said valves are of course, again adjusted to heat the furnace, and inasmuch as the adjustments are effected without in any degree varying the operation of any other furnace of the battery, rapid and economical operation is assured.

It is very important in furnaces of this kind to devise means for removing from the furnace any molten or partly molten metal should a crucible be broken and this is readily accomplished by means of my invention inasmuch as the molten metal of necessity flows into the lower chamber. Here it may be dumped by dropping the bottom of said chamber or may be removed by lifting away the wicket from the front of said chamber. Or, if in a thoroughly molten condition, may be drawn off through the aperture through said wicket. In any event an accident such as described can never clog or seriously affect the operation of the furnace inasmuch as the metal can be almost instantly removed, said lower chamber again closed, and the operation continued as before described.

Of course, I am aware that many details of construction may be varied. I therefore do not purpose limiting this application otherwise than necessitated by the prior art.

I claim as my invention:

1. A metal furnace comprising a combustion chamber and a laterally offset slag chamber built in the wall of the furnace and partly overlapping the combustion chamber and opening from the bottom thereof.

2. A metal furnace comprising a combustion chamber, a laterally offset slag chamber partly overlapping the combustion chamber and opening from the bottom thereof, a removable bottom door for the slag chamber and a removable side door for said slag chamber.

3. A metal furnace embracing a combustion chamber, a lower chamber communicating therewith adapted to receive therein the metal from a broken crucible, a bottom discharge door for said lower chamber, and a side discharging door for the lower chamber having an aperture therethrough.

4. A metal furnace provided with a combustion chamber, a crucible support projecting above the bottom of the chamber, burners opening into the chamber, means for directing a blast into the burner or for cutting off the blast from the burner and a slag chamber built in the wall of the furnace below and overlapping the combustion chamber providing a large opening and direct communication between the chambers.

5. In a device of the class described a battery of melting furnaces, each provided with a combustion chamber, a crucible support in each, a burner opening approximately tangentially into each combustion chamber, means supplying fuel from a single source to all of the burners, means supplying a blast to all of the burners from a single source and a valve opening into the burner

for simultaneously cutting off the blast from the burner and delivering the blast outside of the burner thereby maintaining uniform pressure in the other burners.

6. In a device of the class described a battery of melting furnaces, each provided with a combustion chamber, a crucible support in each, a burner opening approximately tangentially into each combustion chamber, means supplying fuel from a single source to all of the burners, means supplying a blast to all of the burners from a single source, an exhaust pipe, independent means for cutting off the blast from each burner and directing the blast into the exhaust pipe thereby maintaining uniform pressure of the blast in any other furnace, independent means for cutting off the supply of fuel for any burner without effecting the feed to any other burner and a lower receiving chamber communicating with the combustion chamber having its top on a level with the bottom of the combustion chamber.

7. A crude oil furnace comprising a combustion chamber having a rounded bottom, a laterally disposed chamber having part thereof overlapping one side of the combustion chamber and opening through the bottom wall of the combustion chamber, a removable side door for the lateral chamber, and a removable bottom for said lateral chamber comprising a metallic bottom plate and a removable fire brick lining for said plate.

8. In a device of the class described a battery of furnaces, blast burners opening approximately tangentially into the furnaces, a lid pivoted on the furnace provided with a charging aperture, a cover for the charging aperture, fuel supply pipes connected in series with the burners, a valve controlling the fuel supply to each burner, blast pipes connecting the burners in series, exhaust pipes connecting the burners, valves in the burners for directing the blast through the respective burner or directing the blast into the respective exhaust pipe, a slag chamber integral with each furnace adapted to receive the slag and any broken crucible from the respective furnace therein, and a bottom door for each slag chamber comprising a metallic plate and a fire brick lining detachable from the plate.

9. A melting furnace comprising a combustion chamber of greater diameter at the bottom than the top and shaped to direct the blast spirally around a crucible supported in the chamber, a removable cover for the furnace, a blast burner for the furnace having a blast nozzle, a pipe in the burner to deliver the fuel into the blast nozzle, a valve in the burner for admitting a blast around the pipe into the blast nozzle or to admit the blast to an exhaust aperture from the burner, and a laterally disposed chamber opening from the lowest end of the combustion chamber and on a lower plane than the combustion chamber.

10. A metal furnace having a combustion chamber constructed of refractory material, a crucible support therein, the walls of the chamber below the support rounded and the lower side walls inclining inwardly and upwardly for about half the height of the chamber, then the walls inclined slightly outwardly, a lining of heat insulating material inclosing the refractory material, a sheet metal casing investing the heat insulating material, a chamber formed in a wall of the furnace below the combustion chamber and at one side thereof and overlapping the combustion chamber and opening directly thereinto, and coacting discharge doors for the chamber.

11. A metal furnace having a combustion chamber, means for supporting the metal in the center of the fire chamber, the walls of said fire chamber thickened at one part and said walls shaped to direct a blast spirally around the chamber, a blast burner opening through the thickened wall and directed downwardly and a fire brick slag chamber opening from the lowest level of the combustion chamber and part of said fire bricks removable with the slag.

12. A metal melting furnace constructed of refractory material and providing a combustion chamber, a metal casing for the refractory material, a slag chamber overlapping the combustion chamber affording direct communication therewith and adapted to receive metal from the combustion chamber, and a discharging door for the slag chamber.

13. A crude oil melting furnace comprising communicating chambers, partly overlapping and directly communicating, the upper chamber being a combustion chamber having a rounded bottom and the lower chamber being a slag chamber.

14. A melting furnace comprising a plurality of communicating chambers, one adapted to receive a crucible therein and the other the slag, and all metal spilled from the crucible, a plate forming the bottom of the slag chamber, a fire brick removably secured on said plate, a side door for the slag chamber having an opening on a level with the top of the fire brick, and a blast burner for the furnace, the walls of one of said chambers constructed to direct the blast from the burner spirally and centrifugally around the crucible.

15. A melting furnace comprising a plurality of communicating chambers, one adapted to receive a crucible therein and the other the slag and all metal spilled from the crucible, a blast burner for the furnace, the walls of one of said chambers constructed to

direct the blast from the burner spirally and centrifugally around the crucible and removable side and bottom walls for one of the chambers adapted for independent removal in discharging the contents of the chamber.

16. A melting furnace comprising a plurality of communicating chambers, one adapted to receive a crucible therein and the other the slag and all metal spilled from the crucible, a blast burner for the furnace, a lid pivoted to close one of the chambers and having an aperture therethrough, a shaft secured to the furnace, a cover pivotally connected therewith adapted to close the aperture in the lid, and a lever for actuating the cover to expose the opening.

In testimony whereof I have hereunto subscribed my name in the presence of two subscribing witnesses.

ALFRED FISHER.

Witnesses:

K. E. HANNAH,

LAWRENCE REIBSTEIN.