Jan. 8, 1924. 1,480,399

F. E. KLING ET AL

DRY GAS CLEANER

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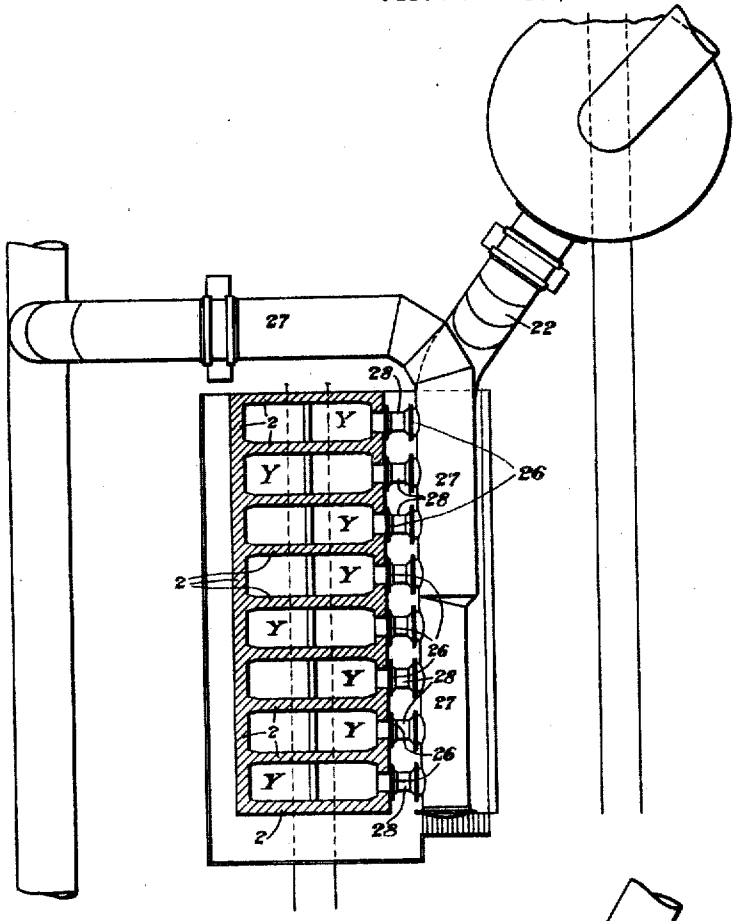


Fig. 1.

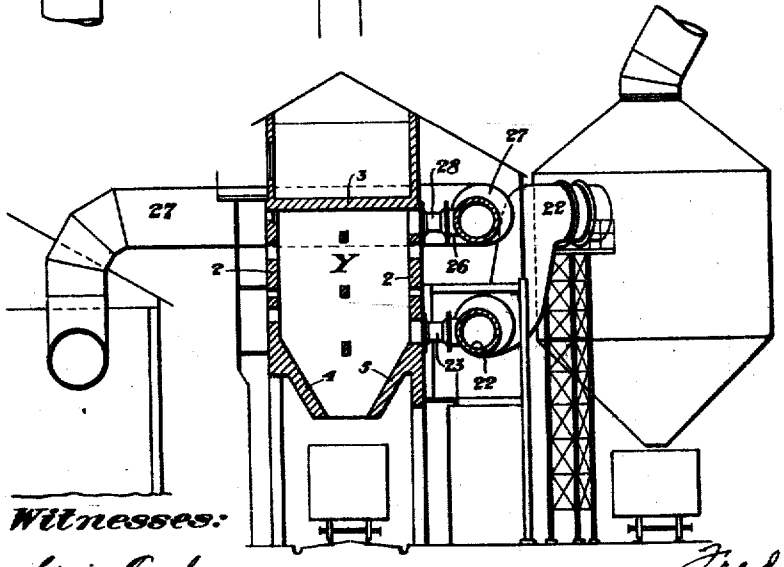


Fig. 2.

Witnesses:
Edwin Trusk

Inventors:
Fred E. Kling
Luther B. Weidlein
by D. Anthony Jr.
Attorney

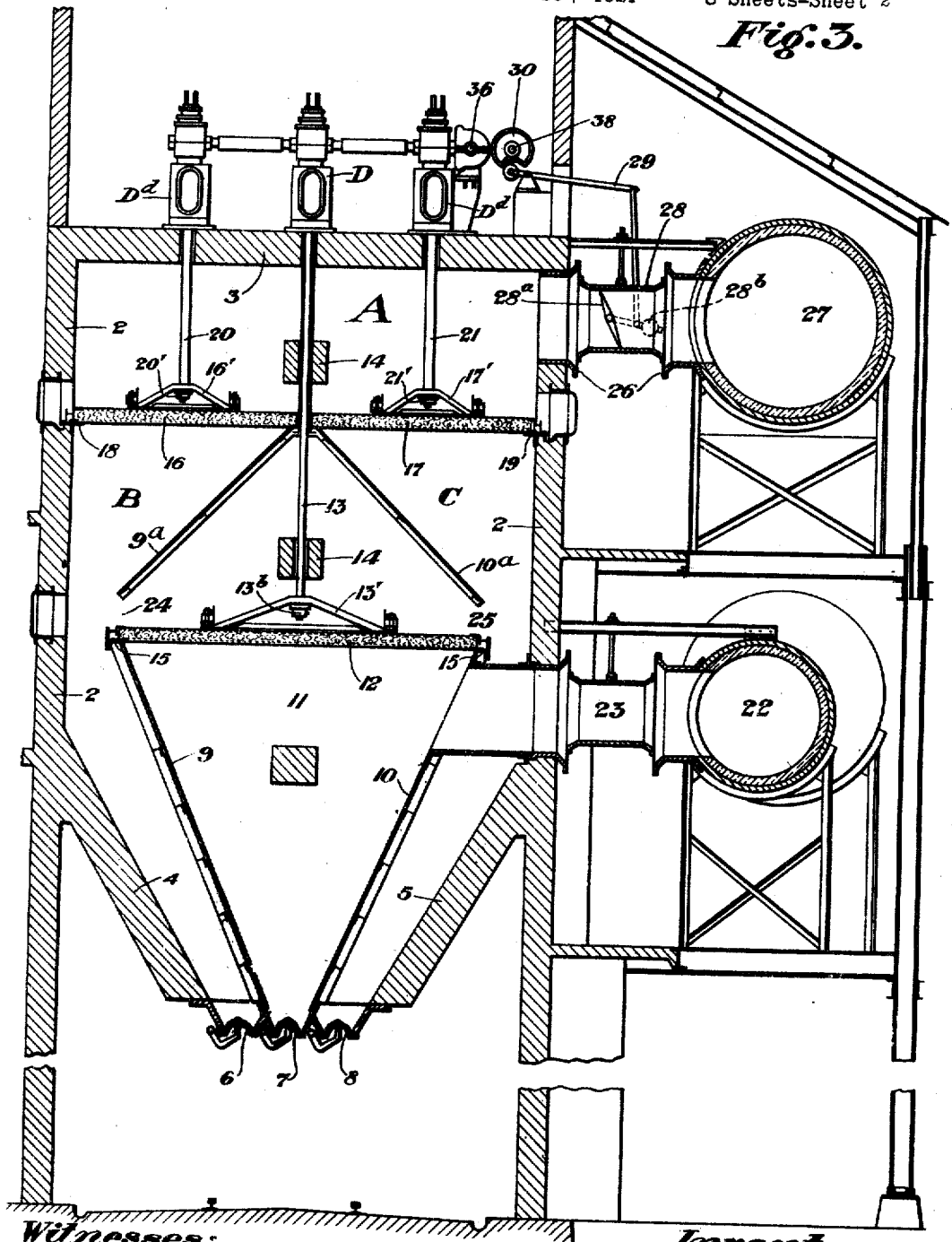
Jan. 8, 1924. 1,480,399

F. E. KLING ET AL

DRY GAS CLEANER

Filed Jan. 13, 1921 8 Sheets-Sheet 2

Fig. 3.



Witnesses:

Edwin Trueb

Inventors:

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Luther B. Weidlein

by D. Anthony Usina

Attorney

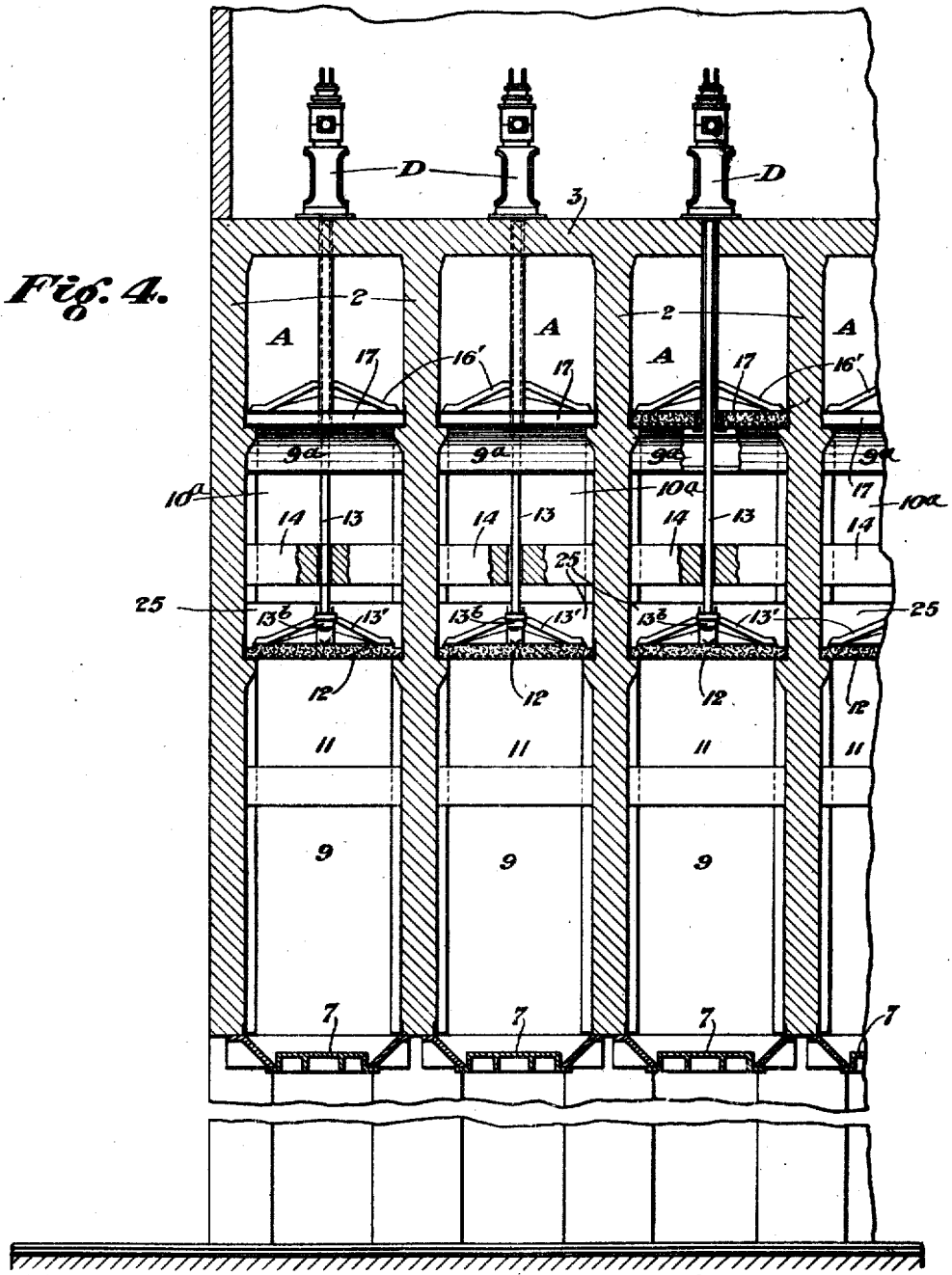
Jan. 8, 1924. 1,480,399

F. E. KLING ET AL

DRY GAS CLEANER

Filed Jan. 13, 1921 8 Sheets-Sheet 3

Fig. 4.



Witnesses:

Edwin Treat

Inventors:

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Jan. 8, 1924. 1,480,399

F. E. KLING ET AL

DRY GAS CLEANER

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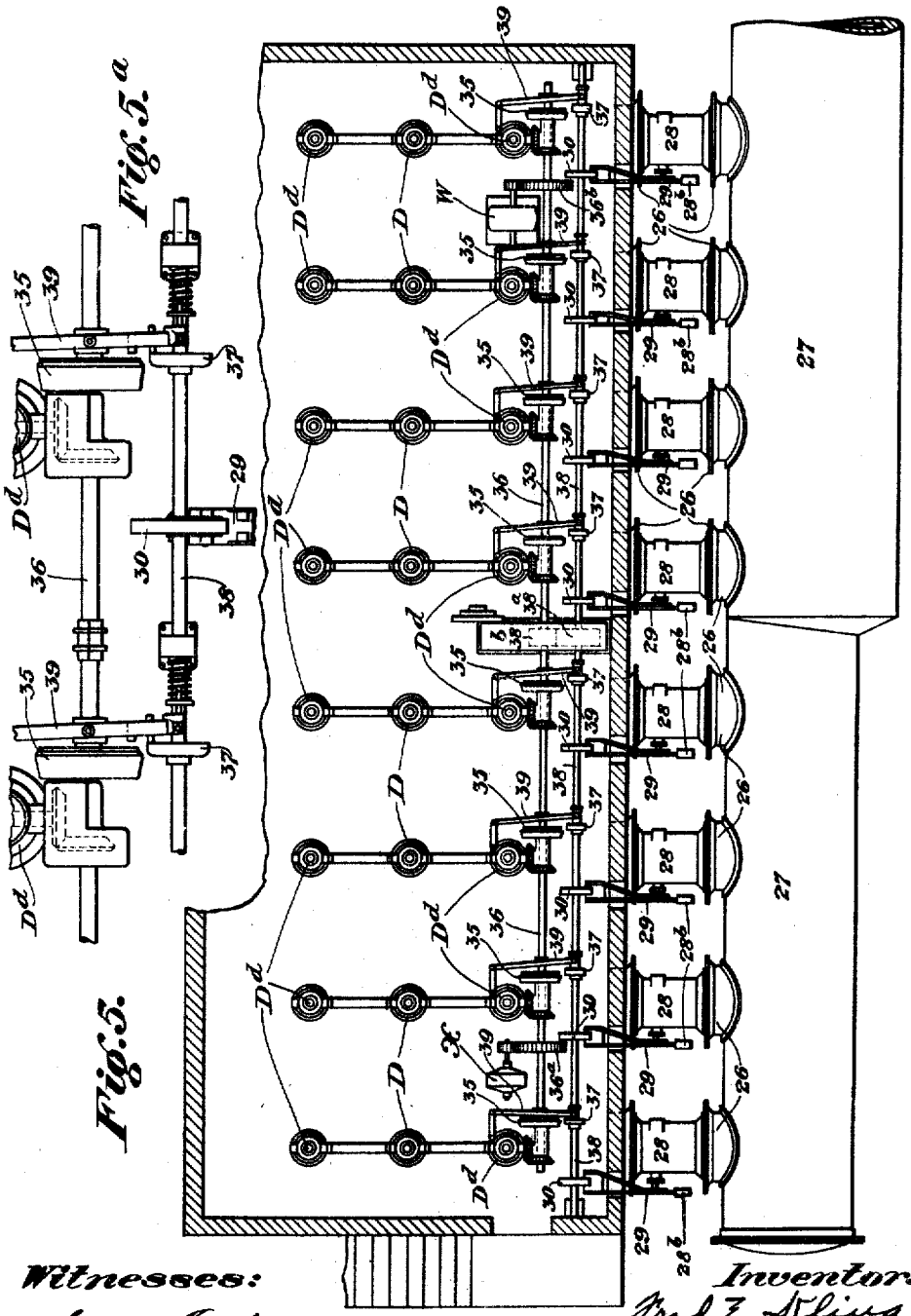


Fig. 5.a

Fig. 5.

Witnesses:
Edwin Trueb

Inventors:
Fred E. Kling
Luther B. Weidlein
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1,480,399

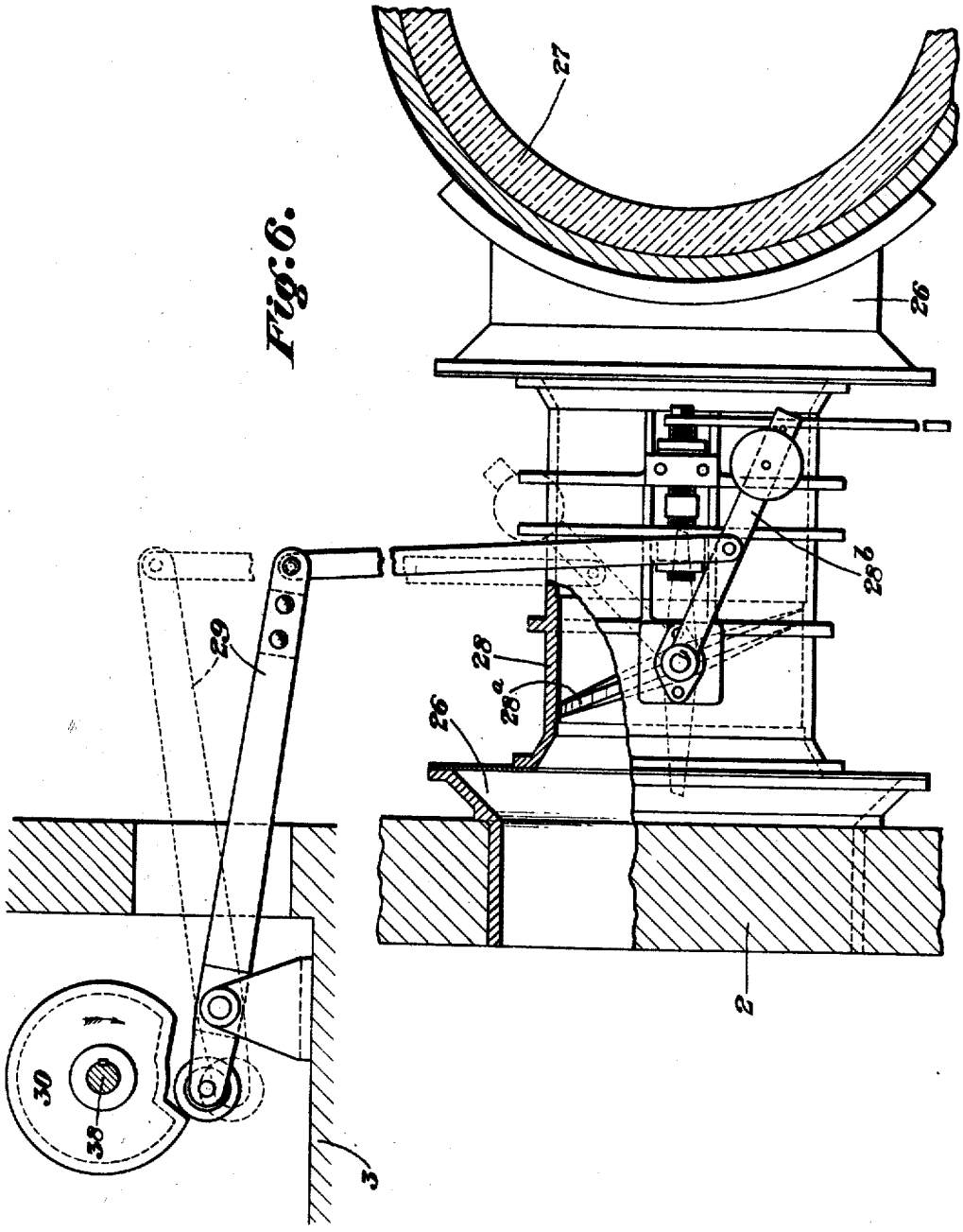
F. E. KLING ET AL

DRY GAS CLEANER

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8 Sheets-Sheet 5

Fig. 6.



Witnesses:
Edward Knebb

Inventors:
Fred E. Kling
Luther B. Weidlein
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Jan. 8, 1924.

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F. E. KLING ET AL

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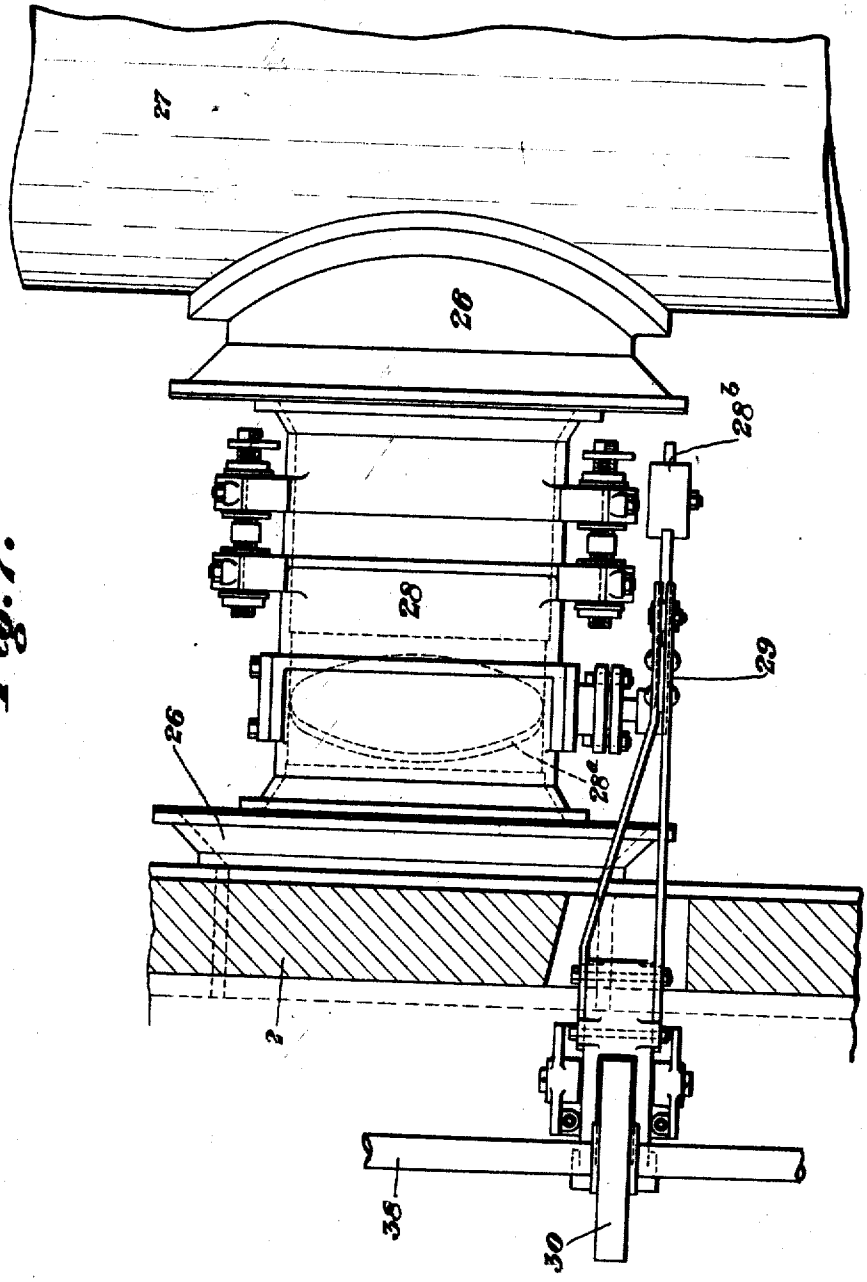


Fig. 7.

Witnesses

Edwin Teuch

Inventors

Fred E. Kling

Luther B. Waldeen

by D. Anthony Usina

Attorney.

Jan. 8, 1924.

F. E. KLING ET AL

1,480,399

DRY GAS CLEANER

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8 Sheets-Sheet 7

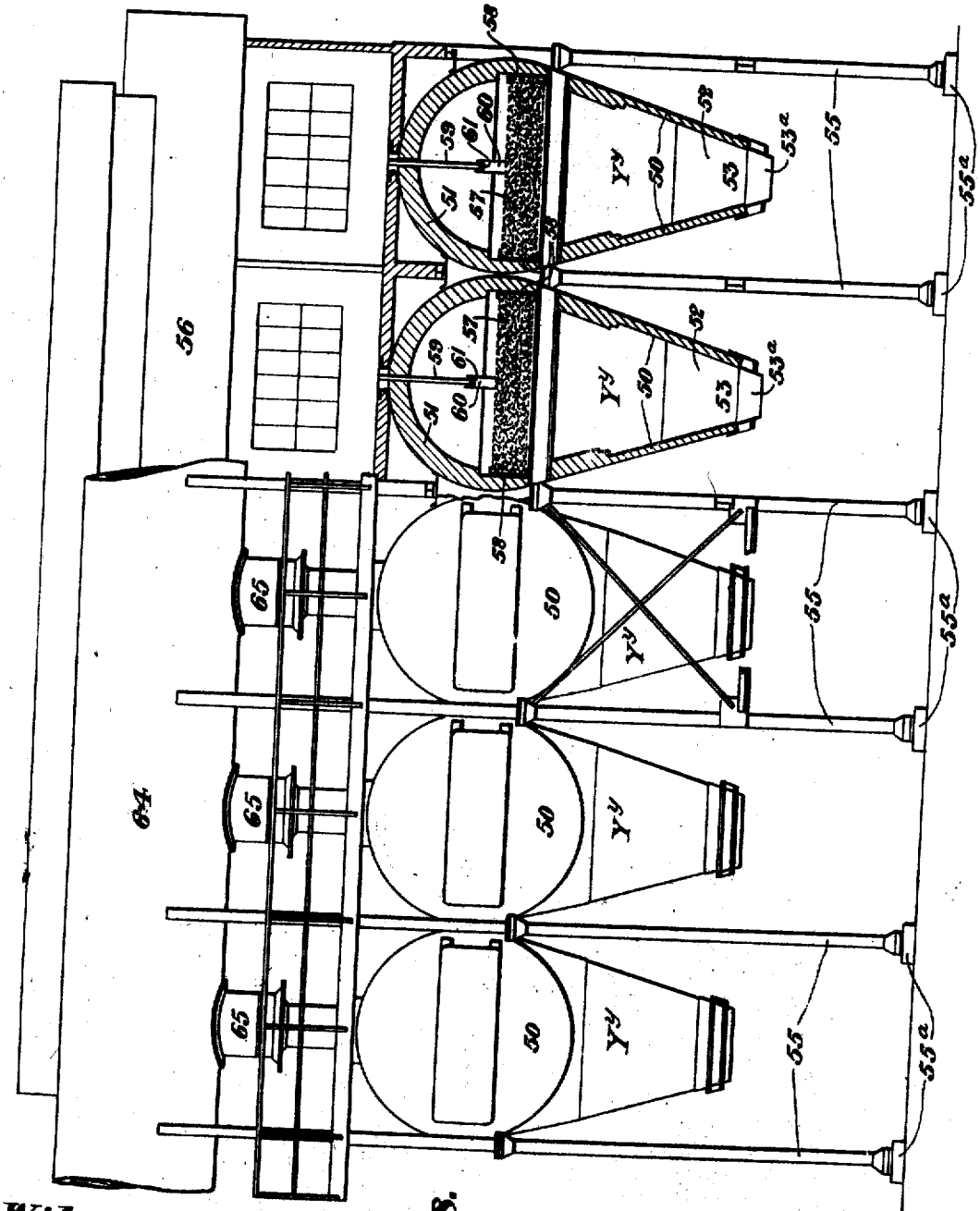


Fig. 8.

Witnesses:

Edwin Trued

Inventors:

Fred E. Kling

Luther B. Weidlein

by D. Anthony Jesina

Attorney

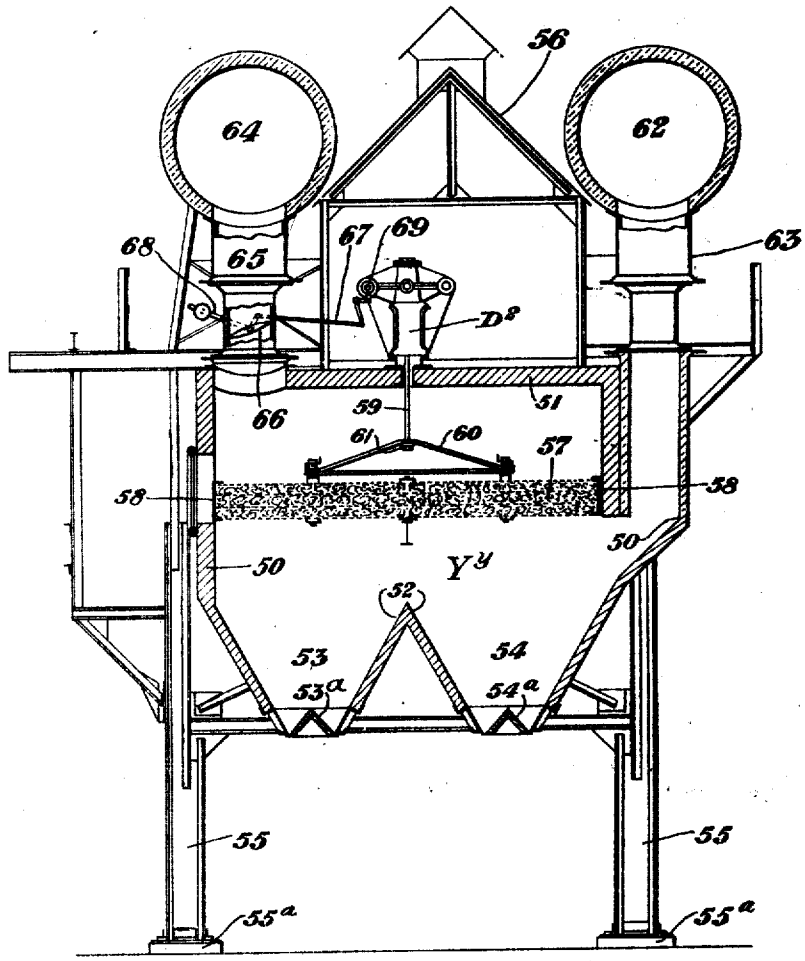
Jan. 8, 1924. 1,480,399

F. E. KLING ET AL

DRY GAS CLEANER

Filed Jan. 13 1921 8 Sheets-Sheet 8

Fig. 9.



Witnesses:

Edwin Trueb

Inventors:

Fred E. Kling
Luther B. Weidlein
by J. Anthony Dreyer
Atty.

Patented Jan. 8, 1924. 1,480,399

UNITED STATES PATENT OFFICE.

FRED E. KLING, OF YOUNGSTOWN, AND LUTHER B. WEIDLEIN, OF CLEVELAND, OHIO.

DRY GAS CLEANER.

Application filed January 13, 1921. Serial No. 436,993.

To all whom it may concern:

Be it known that we, FRED E. KLING and LUTHER B. WEIDLEIN, citizens of the United States, and residents of Youngstown, in the county of Mahoning and State of Ohio, and Cleveland, in the county of Cuyahoga and State of Ohio, respectively, have invented certain new and useful Improvements in Dry Gas Cleaners, of which the following is a specification.

This invention relates to gas cleaners, and more particularly to dry gas cleaners for use in removing particles of coke, ore, and lime dust, etc., from the gas coming from blast furnaces, and has for one of its objects the provision of such a device that will have a higher efficiency than the cleaners heretofore constructed.

Another object is to provide a cleaner that will not lower the temperature of the gases any appreciable amount.

Another object is the provision of a cleaner that will have less resistance than those known in the art, and one that will require very little power to operate.

A further and important object is the provision of a cleaner having an entirely automatic operation, thereby reducing the cost of operation to a minimum.

Other objects and advantages of the invention will be readily apparent to those skilled in the art, and will be disclosed in the following specification and claims.

In the drawings, Figure 1 is a transverse sectional, somewhat diagrammatic plan view of a cleaner composed of a battery of units in accordance with my invention.

Figure 2 is a sectional end elevation thereof.

Figure 3 is an enlarged sectional end elevation of one of the units, showing the detailed construction thereof.

Figure 4 is a sectional side elevation of a plurality of units.

Figure 5 is a top plan view of a battery of units showing the valve operating and shaking mechanism.

Figure 5ª is a detail view of one of the clutch levers and its operating mechanism.

Figure 6 is an enlarged side elevation of the valve and valve operating mechanism showing the details thereof.

Figure 7 is a top plan view of the mechanism shown in Figure 6.

Figure 8 is a side elevation of a modified cleaner composed of a battery of units embodying my invention.

Figure 9 is a sectional end elevation thereof.

The gas cleaner shown in Figures 1 to 7 is composed of a series or battery of units Y, all of like construction and operation, so it will suffice to describe one unit in detail.

The numeral 2 designates the side walls of each of the units which have a flat top wall 3, and converging bottom walls 4 and 5 which sustain closing bells 6, 7, and 8, thereby forming a closed main chamber A.

The main chamber or interior of each unit is divided into two sections B and C by transverse walls 9, 9ª, 10 and 10ª. The walls 9ª and 10ª terminate an appreciable distance below the top wall 3 and converge toward the top, and the walls 9 and 10 converge toward the bottom, forming a substantially diamond-shaped sub-chamber 11. The chamber 11 has an opening in its bottom closed by bell 7 for the discharge of foreign matter which is collected in the chamber, and gas exit openings 24 and 25 in its side walls.

A filter mat member 12 is arranged within the chamber 11 and supported on a flange 15 below the openings 24 and 25. A shaft or rod 13 passes through cross supports or girders 14, and has its upper end mounted in or connected with shaking or vibrating mechanism D, and its lower end is mounted for movement through an aperture in shock receiving member 13′ on the mat 12, and has a head 13ᵇ thereon. The rod 13 is adapted to move freely down through the shock receiving member 13′ and its head 13ᵇ is adapted to deliver an upward vibrating stroke or shock to said member on the upward stroke or movement of the rod.

Other filter mat members 16 and 17 are supported on flanges 18 and 19 secured on the side walls 2, and on the top of the walls 9ª and 10ª, thereby closing the top of the sections B and C of the main chamber A.

The filter mats 16 and 17 have operating shafts or rods 20 and 21, respectively, which

have their upper ends mounted in or connected with shaking or vibrating mechanism D*d*, and their lower ends mounted for movement through apertures in shock receiving members 16′ and 17′ on the respective mats. The rods 20 and 21 have heads 20′ and 21′ respectively, on their lower ends to deliver an upward vibrating stroke or shock to members 16′ and 17′ on the upward stroke or movement of the rod.

The filter mat members may be of any desired construction, but are preferably formed of metal wool held between two sheets of wire mesh or fabric with suitable supporting or stiffening members.

An inlet main 22 extends along the battery of units and has a branch pipe 23 extending into the sub-chamber 11 of each unit below the filter mat 12, and gas entering through the pipe 23 passes through the filter mat 12 and out through the outlet openings or exits 24 and 25, respectively, into sections B and C of the main chamber, then through the mats 16 and 17 arranged above the outlets 24 and 25, and into the upper portion of the main chamber A.

The main chamber A has an outlet pipe 26 extending from its upper portion above the mats 16 and 17. Pipe 26 has a valve casing 28 mounted intermediate its ends, and a gate or butterfly valve 28^a is operatively mounted within the casing so as to be normally closed by a counterweighted lever 28^b. The pipe 26 enters or communicates with a gas main 27 which carries the clean gas to suitable points of distribution.

The vibrators D and D*d* may be of any preferred construction, and are adapted to be automatically set in motion by, and to receive their power through clutches 35 on the power driven shaft 36 which extends longitudinally above the battery of units and receives its power from either the direct current motor X and its connecting gearing 36^a, or the alternating current motor W, and its connecting gearing 36^b.

Clutches 35 are automatically thrown into and withdrawn from operative engagement at predetermined intervals by clutch levers 39 which are actuated by cam members 37 on a shaft 38 which extends parallel to shaft 36, and is constantly driven through gear 38^a which is in mesh with gear 38^b on the drive shaft 36.

The valve 28^a is adapted to be operated synchronously with the shaking mechanisms D and D*d* by means of lever mechanism 29 which is operated by a cam 30 on the shaft 38, which is so positioned and shaped that it holds the lever mechanism and valve in open position for the major portion of each revolution, but will release the lever mechanism and valve to the action of the counterweighted lever 28^b to close or seat the valve for a minor portion of each revolution. The action of the cam 30 is so timed that the valve 28^a will be released to the action of the counterweighted lever 28^b and consequently seated at and during the time the shaking mechanisms D and D*d* are set in motion by the engagement of clutches 35, so as to prevent gas passing out of the units while the mats are being cleaned.

The shaking or vibrating mechanisms D and D*d* are the same for each of the several units.

The operation of the device as described is as follows—

Gas enters the inlet or main 22 from a blast furnace or other source and flows through the branch 23 into the sub-chamber 11 and passes upward through the filter mat 12, thence through the opening or exit 24 and 25 into the chambers B and C, respectively, and then upward through the filter mat members 16 and 17 into the upper portion of the main chamber A, then exits through the clean gas or outlet pipe 26, then into the main 27 for use.

At predetermined intervals the filter mats 12, 16 and 17 will be automatically shaken or vibrated by means of the rods 13, 20, and 21, and vibrating mechanism D and D*d* to remove the trapped dust and particles of foreign matter.

As has been stated, the entire operation of the device is automatic. The lever mechanism 29 is operated by a cam 30 and butterfly valve 28^a closed, and simultaneously with the closing of the valve 28^a the shaking or vibrating mechanism D is automatically set in motion and the dust and other foreign particles are released from the filter mats and falls to the bottom of the chambers. The dust is removed from the chambers B, C, and 11 by removing the bells or traps 6, 7, and 8, while the gate valve 28^a is closed.

In Figures 8 and 9 I have shown a modified construction of gas cleaner embodying the general features of my invention. This cleaner consists of a plurality of units Y*y*, of duplicate construction, each of which consists of side walls 50, curved top wall 51, and a tapering bottom portion divided by a sharp downwardly sloping wall 52 to form hoppers 53 and 54, closed by bells or traps 53^a and 54^a.

The units are supported in superstructure, composed of suitable upright supports 55 set on bases 55^a and having a suitable housing 56 arranged over the tops of the units to house the operating mechanism.

A single filter mat 57 composed of a plurality of layers, and consequently offering substantially as much cleaning surface to the gases as the plurality of mats in the preferred form, is mounted within the units Y*y*, and normally rests between the flanges 58 of a suitable channel mounted around the interior of the units. The mat is connected to

a shaker or vibrating mechanism D^2 by means of a rod 59 which has its lower end mounted for movement through apertures in shock receiving member 60 on the mat, and is provided with a head 61, to deliver an upward vibrating stroke or shock to members 60 on the upward stroke or movement of the rod.

The vibrators or shakers D^2 are adapted to be operated at predetermined intervals by suitable mechanism (not shown) to reciprocate the rods 59 and thereby shake or vibrate the mats to clean them.

A feed or supply main 62 extends along the battery on one side of the units, and has a branch 63 entering each unit below the mat 57, and an outlet main 64 extends along the other side of the battery and is connected to each unit by a branch 65 which enters or communicates with the unit above the mat 57.

A gate or butterfly valve 66 is mounted within each branch 65, and is provided with lever operating mechanism 67 and a counterweighted lever 68. The lever 68 is adapted to normally hold the valve 66 closed while the lever mechanism 67 is adapted to be operated by a cam 69 on drive shaft of the vibrating mechanism D^2, to open the valve against the action of the counterweighted lever 68 for a predetermined time, and to release the valve to the action of the counterweighted lever 68 simultaneously with the starting of the vibrating mechanism, thereby stopping the flow of gas through the unit while the mats are being cleaned.

The operation of this modified battery of units is automatic, and in general the same as that of the preferred form, with the exception that gas will only pass through the one filter mat, while in the preferred form it passes through several.

We claim:—

1. A dry gas cleaner comprising a main chamber, a sub-chamber within said main chamber, a filter mat within said sub-chamber, other filter mats arranged within said main chamber, an inlet pipe communicating with said sub-chamber, outlet ports in said sub-chamber communicating with said main chamber, an outlet pipe communicating with said main chamber, and means for imparting a vibrating movement to said filter mats at predetermined intervals.

2. A dry gas cleaner comprising a main chamber, a sub-chamber within said main chamber, a filter mat within said sub-chamber, other filter mats arranged within said main chamber, an inlet pipe communicating with said sub-chamber, outlet ports in said sub-chamber communicating with said main chamber, an outlet pipe communicating with said main chamber, a valve adapted to close said outlet pipe and means for simultaneously closing said valve and imparting a vibrating movement to said filter mats.

3. A dry gas cleaner adapted to remove the foreign particles from the gas generated in a blast furnace or the like, comprising a battery of units, each of said units comprising a main chamber, a sub-chamber within said chamber, a filter mat within said sub-chamber, other filter mats arranged within said main chamber, an inlet pipe communicating with said sub-chamber, outlet ports in said sub-chamber communicating with said main chamber, an outlet pipe communicating with said main chamber, a valve adapted to close said outlet pipe and means for simultaneously closing said valve and imparting a vibrating movement to said filter mats.

4. A dry gas cleaner adapted to remove foreign particles from the gas of a blast furnace or the like, comprising a plurality of units, each of said units comprising a main chamber, a sub-chamber formed within the said main chamber, a filter mat member within said sub-chamber other filter mats within said main chamber, an inlet pipe communicating with said sub-chamber below the filter mat therein, outlet ports in said sub-chamber above said filter mat, an outlet pipe communicating with said main chamber above said filter mats arranged therein, a valve for closing said outlet pipe, vibrating mechanism adapted to vibrate each of said filter mats, and means for simultaneously closing said valve and setting said vibrating mechanism in motion at predetermined intervals.

5. A dry gas cleaner adapted to remove foreign particles from the hot gas of a blast furnace or the like, comprising a plurality of units, each of said units comprising a main chamber, a sub-chamber formed within said main chamber, a filter mat member arranged transversely of said sub-chamber so as to form a transverse porous wall completely dividing said sub-chamber, other filter mats arranged transversely of said main chamber and above said sub-chamber, an inlet pipe communicating with said sub-chamber below the filter mat therein, outlet ports in said sub-chamber above said filter mat, an outlet pipe communicating with said main chamber above said filter mats arranged therein, a valve for closing said outlet pipe, vibrating mechanism adapted to vibrate each of said filter mats, and automatic means for simultaneously closing said valve and setting said vibrating mechanism in motion at predetermined intervals.

6. A dry gas cleaner for hot blast furnace gas comprising a plurality of units, each unit having a cleaning chamber, a metal wool filter mat arranged transversely within said chamber so as to form a porous wall completely dividing said chamber, flanges

on the walls of said chamber for supporting said mat, a vibrating mechanism supported above said chamber and connected by a vertical shaft to said mat, an inlet pipe communicating with said chamber below said mat, an outlet pipe arranged above said mat, a butterfly valve adapted to close said outlet pipe, and means for automatically, simultaneously, closing said valve and setting said vibrating mechanism in motion to vibrate said mat.

In testimony whereof we have hereunto set our hands.

FRED E. KLING.
LUTHER B. WEIDLEIN.