R. L. EDDY

RECORDING APPARATUS.

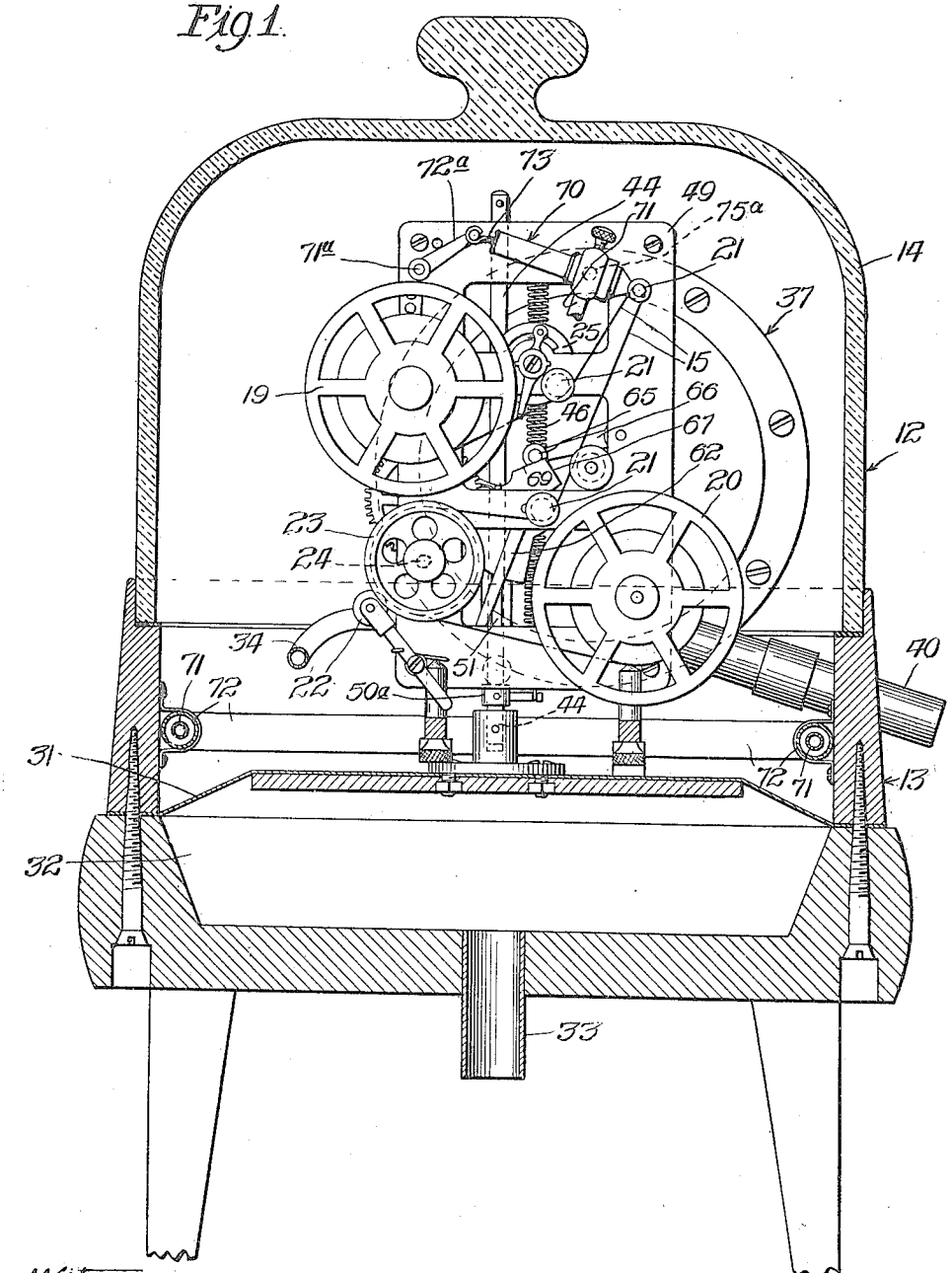
APPLICATION FILED JULY 31, 1914.

1,207,518.

Patented Dec. 5, 1916.

3 SHEETS—SHEET 1.

Fig 1.



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3 SHEETS—SHEET 2.

Fig. 3.

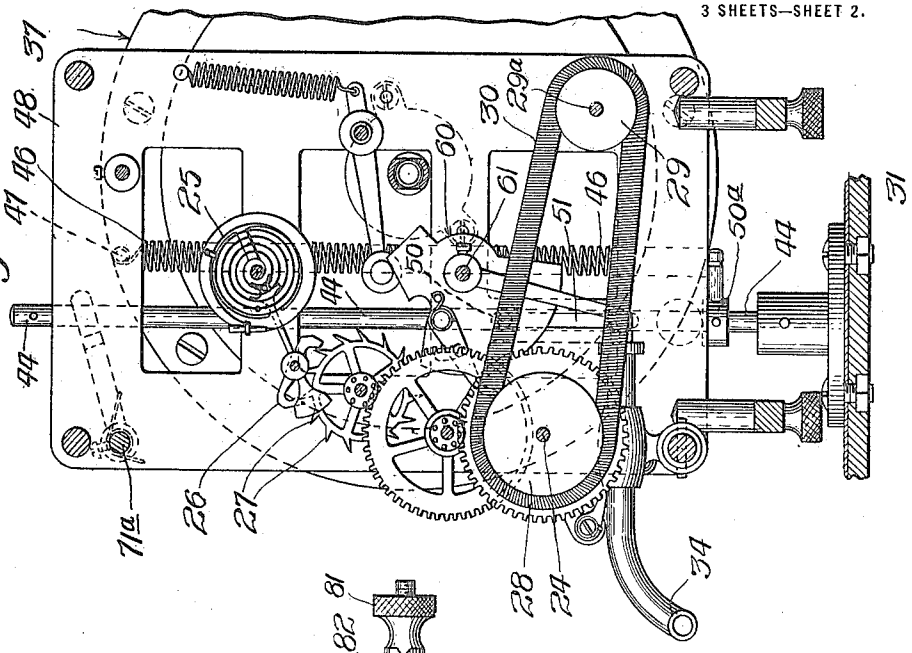
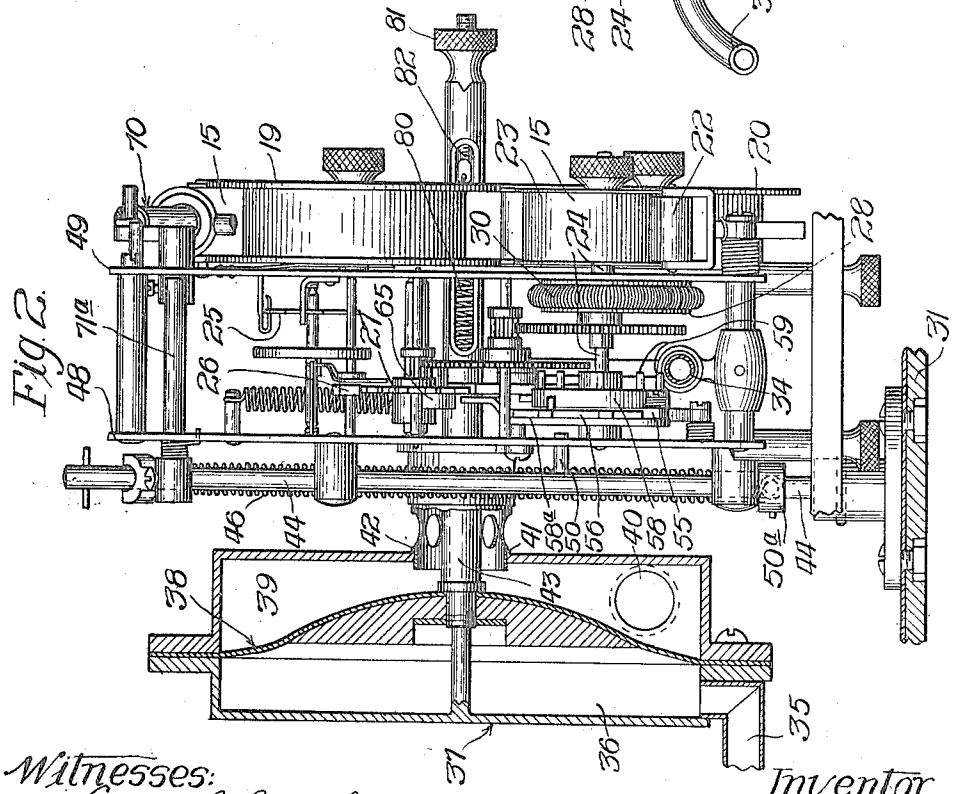


Fig. 2.



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3 SHEETS—SHEET 3.

Fig.5.

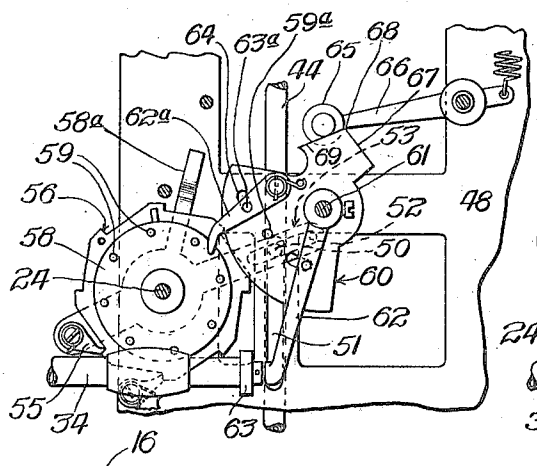
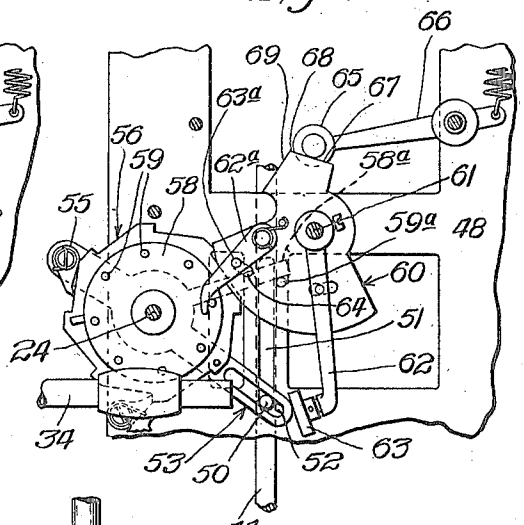


Fig.6.



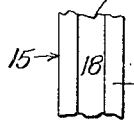


Fig.9.

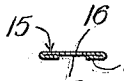


Fig10.

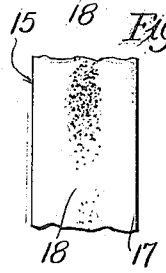


Fig11.

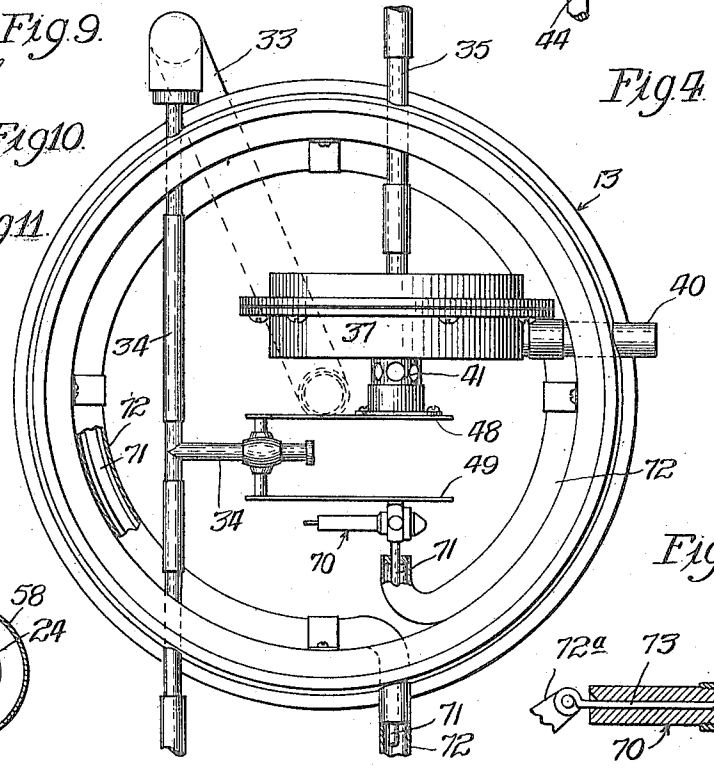


Fig.4

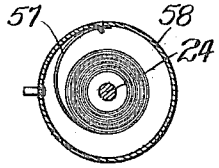


Fig.7

Fig.8.

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UNITED STATES PATENT OFFICE.

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RECORDING APPARATUS.

1,207,518. Specification of Letters Patent. Patented Dec. 5, 1916.

Application filed July 31, 1914. Serial No. 854,327.

To all whom it may concern:

Be it known that I, RAY L. EDDY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Recording Apparatus, of which the following is a specification.

The present invention relates to an apparatus for making a record showing the density of smoke, dust, or similar substance emitted from a given source.

The objects of the present invention are to provide a casing having a record sheet or chart therein, and to provide means for moving said record sheet, which means will be automatically actuated.

A further object of the invention is to so construct the means for moving the record sheet as to have the power for operating the same replenished at periodical intervals.

A further object of the invention is to provide means for scavenging or cleaning out the smoke nozzle at intervals.

A further object of the invention is to prepare the gases prior to their projection on the record sheet, by subjecting them to the action of heat.

A further object of the invention is to utilize the heat which dries the gases to maintain the interior of the casing in a dry condition, thereby preventing corrosion of the operating parts of the mechanism.

A further object of the invention is to provide means for admitting atmospheric pressure to the interior of the casing, and to provide valvular means for controlling the amount of such pressure admitted.

A further object of the invention is to provide communication between the interior of the casing and a suction pipe, and to establish a valvular means for controlling such communication.

A further object of the invention is to actuate this valvular means automatically and at periodical intervals.

The invention further consist in the features of construction and combinations of parts hereinafter described and claimed.

In the drawings: Figure 1 is a side view of the mechanism of the present invention, with the casing in section; Fig. 2 is a front view of the mechanism of the present invention, with the means which controls the flow of outside air through the interior of the casing in section; Fig. 3 is a side view of the mechanism of the present invention, looking upon the opposite side from the side shown in Fig. 1; Fig. 4 is a plan view of the casing showing the various pressure connections leading thereto as well as the conduit for the smoke, and with the record sheet feeding mechanism removed; Fig. 5 is a detail showing the valve for controlling communication between the interior of the casing and the suction pipe, with the valve in closed position; Fig. 6 is a view similar to Fig. 5 showing the valve in open position; Fig. 7 is a section showing the main spring of the record sheet feeding means operating mechanism; Fig. 8 is a section of the smoke nozzle; Fig. 9 is a face view of the record sheet; Fig. 10 is a section of such sheet; and Fig. 11 is a view showing the sheet unfolded, and showing the record thereon.

The present invention, as stated, relates to a machine for recording the density of smoke, dust, or similar substance coming from a given source. The operation generally is to draw from the smoke stack or other part a portion of the smoke or dust traveling therethrough, and to project and affix such smoke or dust upon a recording sheet, whereby a record is made showing the density of the smoke or dust passing through the stack or other part at any given time.

Inasmuch as the device is, as has been stated, adaptable to record the density of smoke, dust or similar substances the term "smoke" when used hereinafter will be understood to include smoke, dust or similar substances, and with this understanding the term "smoke" will hereafter alone be used in order to eliminate prolixity in the specification.

As illustrated in the drawings, the mechanism of the present invention is contained within the casing 12 which consists of a base portion 13 and an upper dome shaped portion 14, the dome shaped portion is as shown made of glass or other transparent substances, although the form, size and material of which the casing is composed is entirely optional with the manufacturer, and the construction illustrated is merely for the purpose of showing one construction adapted for the purpose.

Inclosed within the casing is a record sheet 15 which may be of any suitable shape and material, one form is illustrated in detail in Figs. 9, 10, and 11, and in the form there

illustrated consists of a body 16 having its edges folded back, as at 17. The portion 18 between the folded portion 17 is intended to receive the record. Although this form of record sheet is not to be considered as a limitation upon the present invention, it is a very efficient form of sheet, since the smoke when discharged from the smoke nozzle will spread and blur to a greater or less degree over the surface of the sheet, producing a ragged edge or outline. The ragged portion in the form of record sheet illustrated, will come upon the folded parts 17, and when these parts are folded back, as in Fig. 11, it will leave a clear cut record down the center of the body 16, whereby a clear and sharp record is obtained. This record sheet 15 is fed from a reel 19 to a reel 20 and in traveling from one reel to the other passes around idler rollers 21. The main feed roller for the record sheet or tape is the roller designated by the numeral 23, and this roller is mounted on a shaft 24, which, in the construction shown, is driven by a tension operated mechanism in the nature of clock work mechanism. This mechanism comprises a balance wheel 25 which operates a lever 26 actuating upon an escapement wheel 27, which in turn, actuates a series of gears and pinions clearly illustrated in Fig. 3. A movable spring pressed roller 22 is placed in operative relation to the main roller 23 and serves to keep the record sheet in engagement with the periphery of the feed roller to insure movement of the tape.

Upon the shaft 24 is mounted and secured the reel 19 and a pulley 28, and upon a cross shaft 29^a is mounted and secured the reel 20 and a pulley 29, a connection between the pulleys 28 and 29 being furnished by means of a belt or cable 30. In the construction shown, this cable is in the form of a coil spring, so that the necessary slippage of the belt is allowed as the roll of record strip increases or diminishes upon the reels 19 or 20.

It is advisable, from a practical standpoint, to have the mechanism rewound automatically at periodical intervals, and to provide means for this rewinding operation which will only operate during the time when steam is up and the necessity for making a record exists. In the form illustrated in the present application, I accomplish this rewinding by means of a suctional force, and in carrying out this portion of the invention I divide off the lower part of the casing by means of a diaphragm or equivalent shiftable member 31. Thus the upper half of the casing 12 above the diaphragm 31 contains all the apparatus of the invention within the dome 14, the lower half of the chamber being a suction chamber. In that portion 32 of the chamber 12, which lies below the diaphragm 31, is entered one end of a pipe or conduit 33 (see Fig. 4). This pipe or conduit is connected to what may be termed a suction pipe 34, and this suction pipe leads to any suitable form of suction creating means, as, for instance, a steam injector. These suction creating means are so well known in mechanical arts that it is not deemed necessary to illustrate any particular means in connection with the present invention.

A suction pipe 35, which leads from the interior of the stack, enters a chamber 36 in a pressure regulator 37 (see Fig. 2); a diaphragm or equivalent member 38 divides the interior of this regulator into the chamber 36 and a chamber 39, and outside air enters the chamber 39 through a suitable conduit 40 (see Figs. 2 and 4). An outlet is provided for said outside air, consisting of a perforated sleeve 41 (see Figs. 2 and 4), and sliding inside of this sleeve is a similarly perforated tube 42 joined to a stem 43, which in turn is joined to the backing for the diaphragm 38. As this diaphragm moves in and out in accordance with the suction exerted in the chamber 36, it pulls the tube 42 in and out, with the result that the openings in the sleeve 41 are increased or decreased in area as the case may be. With the greater suction, the diaphragm is drawn toward the chamber 36, with the result that the openings in the sleeve 41 are restricted so that the volume of outside air passing in the interior of the casing is decreased. In this manner the vacuum within the casing 14 is maintained slightly below the vacuum in the stack, and the same ratio of vacuum is maintained between the interior of the stack and casing, although the vacuum within the stack varies.

When the suction exerted in the chamber 32 is sufficient to cause a flexing of the diaphragm 31, said diaphragm is pulled downward, with the result that a rod 44 is pulled downward, and a spring 46 is provided (see Figs. 2 and 3), attached at its upper end to a pin 47 in a plate 48, which plate forms a portion of a support, that consists of the plate 48 and a plate 49 (see Fig. 2). The spring 46 at its other end is attached to a pin extending from a collar 50^a attached to the rod 44. The function of the spring is to assist the rod and diaphragm in returning to normal or raised position. The diaphragm rises very shortly after it has descended, and it does not remain in its collapsed or down position for any material length of time.

To revert again to the movements of the diaphragm 31, as previously stated, when a sufficient suction is exerted below this diaphragm, or in other words, when a sufficient vacuum is created in the chamber 32, the diaphragm is pulled downward, with the resultant pulling down of the rod 44. This rod 44 has connected to it a pin 50 traveling

within a slot 51 of the plate 48 (see Figs. 5 and 6), and this pin extends beyond the plate and enters a slot 52 in a pivoted member 53, said member being pivoted upon the main or cross shaft 24. Attached to one extremity of this member 53 is a spring pressed dog 55, and when the rod 44 is pulled downward it raises this dog 55 into the position shown in Fig. 6; then when the rod descends it lowers that end of the member 53 carrying the pawl 55, with the result that said pawl engages with a tooth of a ratchet member 56 and revolves this ratchet member a step. This ratchet member, as shown in Fig. 7, carries the main end of a spring 57, the other end of which is attached to a spring barrel 58, which barrel has projecting therefrom a series of pins 59. The shaft 24 is affixed to the disk 58 and is driven by a spring 57; and this spring, therefore, constitutes the main spring of the clock work mechanism, so that the periodical rewinding of this spring regenerates power to operate the clock work.

The member 53 has an arm 58ª extending therefrom, and when the rod 44 is pulled down, this arm engages with a pin 59ª on a plate 60, which plate is pivoted upon a cross shaft 61. As this plate is pulled downward, it rocks the cross shaft 61, with the result that the arm 62, carrying the valve 63 which controls communication between the suction pipe 34 and the interior of the casing, is thrown to open position as shown in Fig. 6. It is desirable to maintain this valve in open position for a period of time, first, in order to suck the smoke out of the casing, and, second, to change the atmospheric pressure above the diaphragm, so as to allow the spring 46 to act to pull the diaphragm back to raised position; and to maintain this valve open, I attach a finger 62ª to a plate 60, which finger carries a pin 63ª traveling within a slot 64 in said plate, and this finger is spring pressed, so that it is normally maintained in the position shown in Fig. 5. When the plate is pulled downward, as in Fig. 6, the end of the finger 62ª is lying above one of the pins 59 on the disk 58, and as this disk revolves it forces this finger upward, so that, when the pin 63ª on the finger has reached the end of the slot 64, it commences to rock said plate upward, with the result that a spring pressed roller 65 carried by a pivoted arm 66 assumes a position where it forces the plate 60 up into position shown in Fig. 5, rocking the shaft 61 and again closing the valve as in Fig. 5.

The action of the pivoted arm 66 is as follows: When the plate is thrown downward, as in Fig. 6, the roller 65 rests upon a flat edge 67 on said plate, and as the plate is turned, the roller passes from this portion 67 over the corners 68 and onto another flat portion 69 of the said plate, with the result that when it reaches the latter flat portion a pressure is exerted by the tension on the arm 66 which tends to swing the plate upwardly, as will be readily understood by referring to Figs. 5 and 6. By this means, the valve 63 is open when the diaphragm 31 is lowered and remains open for a period of time. The effect of opening the valve is to establish communication between the interior of the casing and the interior of a suction pipe 34, whereby the suction or vacuum below the diaphragm is broken and the spring 46 acts to pull the diaphragm upward. This upward movement of the diaphragm takes place directly after the downward movement, since the vacuum below the diaphragm is immediately reduced when the valve is opened.

If there is a small vacuum existing in the stack, it is obvious that a considerable amount of outside air can be admitted to the interior of the casing and still have a lower vacuum in the casing than in the stack, and should the vacuum increase in the stack less outside air would be admitted to the casing to maintain the same relative degree of vacuum between the stack and casing. The vacuum in the chamber is, of course, lower than in the stack, whereby the smoke is drawn from the stack.

A smoke nozzle 70 is provided, which nozzle is mounted, as shown in Fig. 1, in position to deliver smoke from the mouth thereof against the record sheet, and the smoke is conveyed to the nozzle by means of a pipe or tube 71, and surrounding this pipe or tube is a jacket 72, and steam or other heat is applied to this jacket, so that the smoke in traveling through the tube 71 is properly prepared, it being desirable to prepare the gas prior to passage through the nozzle to avoid clogging of the same. Various means heretofore have been used for preparing these gases, such as passing them through or over a filter of cotton, sulfurite acid, calcium chlorid, or similar substances. By the heated jacket which I employ, the holders, etc., necessary for drying the gases by chemicals is eliminated, and, moreover, by using this jacket, the interior of the casing is maintained in a dried condition, which tends to eliminate corrosion of the working portions of the mechanism.

In order to secure a correct record, it is necessary to maintain the smoke nozzle and especially the discharge orifice in a clean condition, and to accomplish this end, in addition to preparing the gases, I provide an added preventative in the form of mechanical means, and this consists of a shaft 71ª to which is connected an arm 72ª carrying a stem 73 which extends within the nozzle, as shown in Fig. 8. This shaft 71ª is connected to the rod 44, so that every time

this rod moves up or down the shaft will rock. As the rod moves down, it swings the arm 72^a downwardly, with the result that the stem 73 is forced inward, causing the end 74 of said stem to project through the discharge orifice 75 of the nozzle and maintain the same in a clean and proper condition. As the arm 72^a swings downward, it tips the whole nozzle about a suitable pivot 75^a, with the result that the discharge end of the nozzle is tilted upward and out of alinement with the record sheet during the cleansing operation, whereby no matter which may have accumulated in the nozzle is projected thereon.

The operation briefly is as follows: When sufficient vacuum is created within the chamber 32, the diaphragm 31 is sucked downward, lowering the rod 44, swinging the member 53, causing the pawl 55 to operate on the ratchet 56 and wind the spring 57, and at the same time the plate 60 is swung downward by the arm 58^a, rocking the shaft 61 and opening the valve 62. This establishes communication between the interior of the casing and the interior of the pipe 34, with the result that a suction is created within the chamber and the atmospheric pressure in the chamber 12 reduced so as to allow the spring 46 to act to return the diaphragm to raised position, this raising movement occurs almost immediately after the downward movement. The spring 57 having been wound through the action of the rod 44, as previously described, the mechanism continues to operate for a predetermined period of time. As soon as the plate 60 has been swung upward a sufficient distance by means of the pins 59 acting on the finger 62^a, the spring pressed arm 66 acts to swing the plate upward into the position shown in Fig. 5, rocking the shaft 61 and closing the valve 63, cutting off communication between the pipe 34 and the interior of the casing above the diaphragm, and allowing the suction to be again exerted within the chamber 32 below the diaphragm. Through the medium of the clock work mechanism, the recording sheet advancing means is operated and the record sheet drawn past the smoke nozzle, the smoke being projected thereon and the record made. At each movement of the rod 44 the shaft 71^a is rocked, tipping the nozzle 70 to carry the projecting end out of alinement with the record sheet, and the rod 73 is moved to scavenge the nozzle.

A spring 80 is connected to the stem 43 of the diaphragm 38, so that, when the diaphragm is moved into the chamber 36, it is moved against the tension of this spring, and any adjustment of the tension can be obtained by manipulating a finger piece 81 which moves a stem 82 and expands or contracts the spring.

The foregoing description has been confined almost entirely to the mechanical parts of the device, together with their arrangement and operation, and to fully understand the invention it is deemed expedient to include a description of the action of the various pressures and their influence on the proper recording of the gases. First, it must be understood that there is intended to be a continuous flow of gas from the discharge nozzle 70 against the record sheet, and a passage of this gas out from the interior of the casing 12. In order to have this flow continuous, the degree of vacuum within the interior of the casing must be somewhat greater than the degree of vacuum within the smoke stack or other place from which the samples of gas are being extracted. Otherwise, obviously a flow through the gas pipe 71 into the interior of the casing would not take place. Moreover, it is not desirable to have a very marked difference in the degree of vacuum within the casing and the place from which the sample of smoke or gas is being taken, since this would cause too violent a flow of the smoke and would not make a clear record. A smooth continuous and gentle flow of the gases is the most desirable. The flow should be continuous or practically so, as otherwise the gas would be drawn out in wads or chunks, so that an accurate registration would not be made of the flow through the stack. It is to accomplish these results that the means for regulating the pressure within the casing has been provided.

Assume for the purpose of illustration that a vacuum equal to seven inches in water is present in the stack from which the samples of smoke are being extracted, and assume that it is desirable to maintain a vacuum of eight inches in water within the casing. A pipe 35 which leads from the stack will exert an influence on the diaphragm 38 equal to a vacuum pressure of seven inches in water. This will position the sliding perforated tube 42 so that a registration will be effected between the perforations in this tube 42 and the perforations in the sleeve 41 to permit a certain amount of outside air to the inside of the casing.

Now assume that a continuous vacuum of seventeen inches in water is being exerted through the pipes 33 and 34 from the steam injector or other vacuum creating means. When the valve 63 is thrown open so as to establish communication between the pipe 34 and the interior of the casing, the vacuum being exerted in the pipe 34 which, as stated, is seventeen inches in water, will be exerted within the casing, and this vacuum will be reduced by the outside air coming in through the alined openings in the sleeve 41 and tube 42, so that there will be a vacuum of eight inches in water produced within the casing.

This will be a greater vacuum than the seven inches in water vacuum within the stack, and will cause the smoke to pass out of the discharge nozzle on to the record, from whence it will be drawn through the pipe 34 out of the casing. Of course, when the valve 63 is open, it will immediately cause a decrease in the vacuum within the chamber 32 with a resultant uplifting of the diaphragm 31 as previously explained.

In certain forms of apparatus, especially locomotives, the degree of vacum within the stack will vary from zero to fifteen inches in water, and in order to maintain a proper correlation between the vacuum in the stack and the vacuum within the casing, means must be provided for regulating the vacuum within the casing in accordance with the fluctuations of the vacuum within the stack, and this is where the diaphragm 38 comes into use. Assume that the vacuum in the stack should change from seven inches in water to twelve inches in water. Obviously, such increased vacuum force will pull the diaphragm 38 toward the chamber 36. This will result in a decrease in the size of the registered opening in the sleeve 41 and tube 42 permitting an entrance of outside air into the casing, so that, when communication is established between the pipe 34 and the interior of the casing, the vacuum released into the interior of the casing through the pipe 34 which, as stated, is seventeen inches in water, will be less reduced by the amount of air admitted to the casing than was the case where seven inches in water existed in the stack and more outside air was admitted to the interior of the casing. Thus with twelve inches in water vacuum in the stack, the vacuum finally created in the casing will be, say, thirteen inches in water, or thereabout. By this arrangement the vacuum passing through the pipe 34, which is constant, is reduced, when admitted to the interior of the casing, by an admission of outside air to the interior of the casing, which air is admitted in direct proportion to the degree of vacuum within the stack, and thus a final vacuum is created within the casing which is at all times of a predetermined greater degree than the vacuum within the stack, thus causing a continuous and even flow of the smoke into and out of the casing, which gives an efficient record.

I claim:

1. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, for projecting thereon gas under test means operatively connected for moving said record sheet past said nozzle, said moving mechanism being actuated when certain relative air conditions are brought about between the inside of the casing and a chamber outside of said casing, the air conditions in the latter being furnished from a source separate from the source of gas under test, substantially as described.

2. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet for projecting thereon gas under test, and means operatively connected for moving said record sheet past said nozzle, said operating mechanism being actuated when certain relative air conditions are brought about between the inside of the casing and a chamber outside of said casing, the air conditions in the latter being furnished from a source separate from the source of gas under test, substantially as described.

3. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet for projecting a gas under test onto said sheet, means operatively connected for moving said record sheet past said nozzle, a shiftable member for actuating said means, said shiftable member being moved by a creation of air conditions supplied from a source other than the source of gas under test, substantially as described.

4. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, means operatively connected for moving said record sheet past said nozzle, and a shiftable member operatively connected to said operating means, said shiftable member being operated by air conditions above and below the same, the air conditions on one side thereof being supplied from a source other than the source of gas under test, substantially as described.

5. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, means operatively connected for moving said record sheet past the nozzle, a shiftable division wall within the casing, means for shifting said wall controlled by air conditions supplied from a source other than the source of gas under test, and an operative connection between said record sheet moving means and said shiftable wall, substantially as described.

6. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, means for moving the record sheet past the nozzle, a diaphragm, an operative connection between the diaphragm and record sheet moving mechanism, and means for raising and lowering the diaphragm at periodical intervals

controlled by air conditions supplied from a source other than the source of gas under test, substantially as described.

7. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, means for moving the record sheet past the nozzle, a diaphragm, a connection between the diaphragm and record sheet operating means, means for creating a suction below the diaphragm to draw the same downward, and tension means for restoring the diaphragm to normal position, substantially as described.

8. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relative to the record sheet, means for moving the record sheet past the nozzle, a diaphragm, a connection between the diaphragm and said record sheet moving means, means for periodically creating a suction to actuate said diaphragm downwardly, and tension means for restoring the diaphragm to normal position, substantially as described.

9. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, a spring actuated mechanism for moving the record sheet past the nozzle, and means for automatically rewinding the spring of the record sheet moving mechanism, substantially as described.

10. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, spring actuated mechanism for moving the record sheet past the nozzle, and means for automatically and periodically rewinding the spring of the record sheet advancing mechanism, substantially as described.

11. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, clockwork mechanism for moving said record sheet past the nozzle embodying clock-work mechanism, and means for periodically regenerating the actuating power for said clockwork mechanism, substantially as described.

12. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, clockwork mechanism for moving the record sheet past the nozzle embodying clock-work mechanism, and suction actuated means for regenerating power to actuate said clockwork mechanism, substantially as described.

13. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, clockwork mechanism for moving the record sheet past the nozzle comprising a diaphragm and clock-work mechanism, means for actuating the diaphragm at intervals, and a connection between the diaphragm and clock-work mechanism, whereby at each actuation of the diaphragm a regeneration of actuated power is given to the clock-work mechanism, substantially as described.

14. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, clockwork mechanism for advancing the record sheet past the nozzle comprising a shiftable member and clock-work mechanism, and a connection between the shiftable member and clock-work mechanism, whereby at each operation of the shiftable member power is regenerated for actuating the clock-work mechanism, substantially as described.

15. In a device of the class described, the combination of a casing, a record sheet within the casing, a nozzle in operative relation to the record sheet, means for moving the record sheet past the nozzle, a shiftable member, a connection between the shiftable member and record sheet moving mechanism, means for creating a suction on one side of the shiftable member, means for admitting atmospheric pressure to the other side of the shiftable member, and tension means for restoring the diaphragm to normal position, substantially as described.

16. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, means for moving the record sheet past the nozzle, a diaphragm, a connection between the diaphragm and record sheet moving means, means for creating a suction on one side of the diaphragm, means for admitting atmospheric pressure to the other side of the diaphragm, and means for controlling the flow of atmospheric pressure in accordance with the degree of suction in the stack, substantially as described.

17. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, means for moving the record sheet past the nozzle, a shiftable member, means for creating a suction on one side of the shiftable member, and valvular means for admitting atmospheric pressure to the other side of the shiftable member, said valvular means being actuated by suction from the stack, substantially as described.

18. In a device of the class described, the combination of a casing, a record sheet

within the casing, a projecting nozzle in operative relation to the record sheet, means for moving the record sheet past the nozzle, a vacuum suction pipe, and means for automatically and periodically establishing communication between the suction pipe and the interior of the casing, substantially as described.

19. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, means for moving the record sheet past the nozzle, a shiftable member, a suction tube leading to one side of the shiftable member, and means for controlling communication between said suction tube and the interior of the casing, said means operating at periodical intervals and in accordance with the downward movement of the shiftable member, substantially as described.

20. In a device of the class described, the combination of a casing, a record sheet within the casing, a nozzle in operative relation to the record sheet, a shiftable member, a suction pipe leading to one side of the shiftable member, and a valve controlled means of communication between the interior of the casing and the suction pipe, said valve being actuated in accordance with the movements of the shiftable member, substantially as described.

21. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, means for moving the record sheet past the nozzle, means for regenerating power to actuate said record sheet moving means, a suction pipe a valved communication between said suction pipe and the interior of the casing, a connection between said valvular means and record sheet moving means, whereby said valve is opened at periodical intervals and is held open for a predetermined length of time, and means for closing said valve, substantially as described.

22. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, means for moving the record sheet past the projecting nozzle, and means for subjecting the gases to the action of heat prior to their projection from the nozzle, substantially as described.

23. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, means for moving the record sheet past the nozzle, a conduit for conducting the gases to the nozzle, and means for heating said conduit, substantially as described.

24. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, means for moving the record sheet past the nozzle, a tube for conducting gases to the nozzle, a jacket surrounding said tube, and means for heating said jacket, substantially as described.

25. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, means for moving the record sheet past the nozzle, a conduit for conducting the gases to the nozzle, and a steam jacket surrounding the conduit, substantially as described.

26. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, means for moving the record sheet past the nozzle, a conduit for gases leading to the nozzle, a jacket about said conduit, and means for heating said jacket, said heated jacket serving to dry the gases and to heat the interior of the casing, substantially as described.

27. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, means for moving the record sheet past the nozzle, means for conducting gases to the nozzle, and means for periodically scavenging the discharge orifice of the nozzle, substantially as described.

28. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, means for moving the record sheet past the nozzle, means for conducting gases to the nozzle, and means for scavenging the discharge end of the nozzle, substantially as described.

29. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, means for moving the record sheet past the nozzle, and means operated by said record sheet moving means for automatically scavenging the discharge orifice of the nozzle, substantially as described.

30. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, means for conducting gases to the discharge nozzle, a plunger for scavenging the discharge orifice of the nozzle, and means for periodically and automatically operating said plunger, substantially as described.

31. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, means for

moving the record sheet past the nozzle, means for conducting gases to the nozzle, means for periodically scavenging the discharge orifice of the nozzle, and means for bringing the discharge end of the nozzle and the record sheet out of alinement during the scavenging operation, substantially as described.

32. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, means for moving the record sheet past the nozzle, means for conducting gases to the nozzle, means for scavenging the nozzle, and means for bringing the discharge end of the nozzle and the record sheet out of alinement during the scavenging operation, substantially as described.

33. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, means for moving the record sheet past the nozzle, means operated by said record sheet moving means for automatically scavenging the nozzle, and means for bringing the discharge end of the nozzle and the record sheet out of alinement during the scavenging operation, substantially as described.

34. In a device of the class described, the combination of a casing, a record sheet within the casing, a projecting nozzle in operative relation to the record sheet, means for moving the record sheet past the nozzle, means for conducting gases to the nozzle, a plunger for scavenging the nozzle, means for periodically operating said plunger, and means for bringing the record sheet and discharge end of the nozzle out of alinement during the scavenging operation, substantially as described.

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