Jan. 9, 1923. 1,441,651.

C. E. ANDERSON ET AL.

AUTOMATIC VACUUM PRODUCER.

FILED OCT. 25, 1920. 2 SHEETS—SHEET 1.

FIG. 2

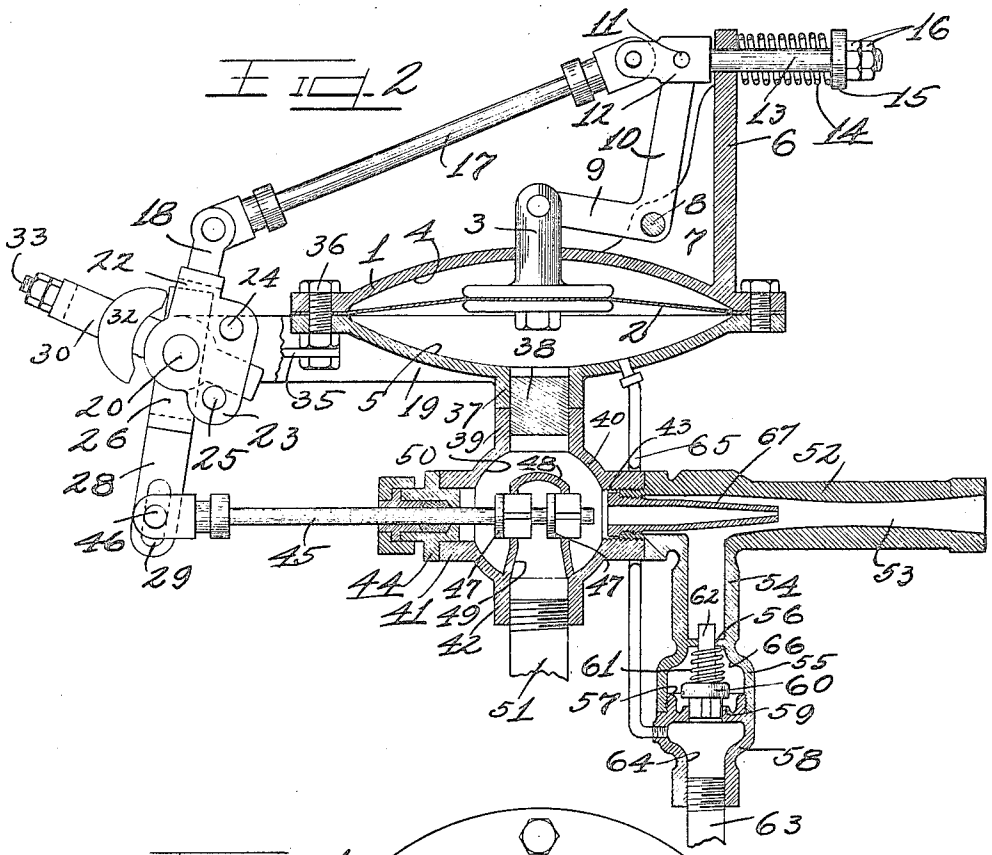
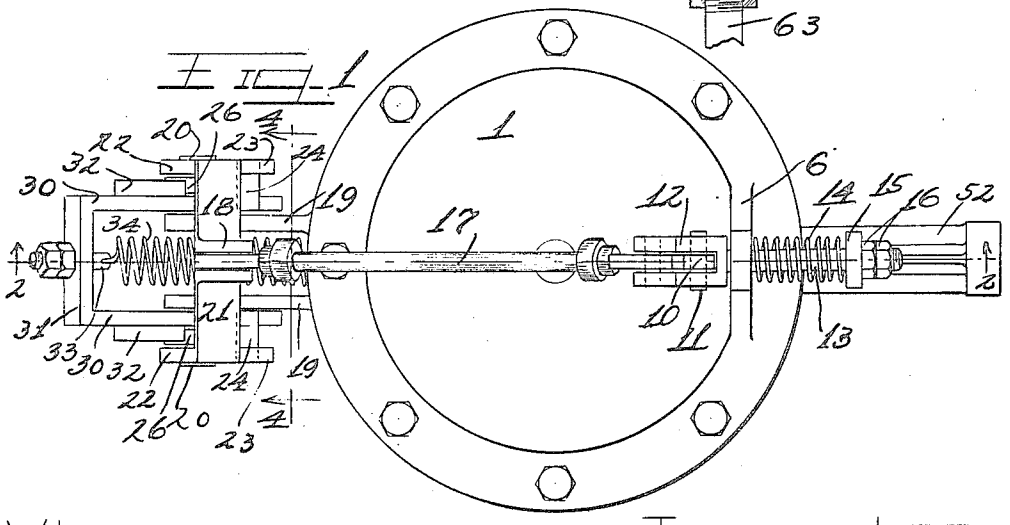


FIG. 1



Witnesses

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FIG. 3

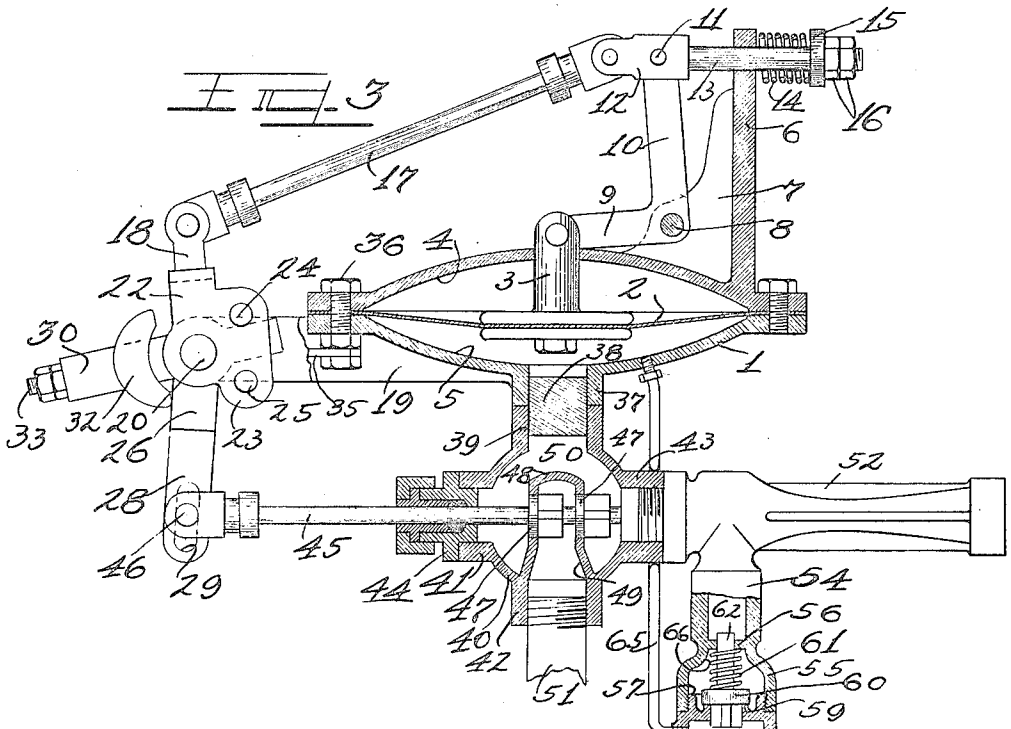


FIG. 4

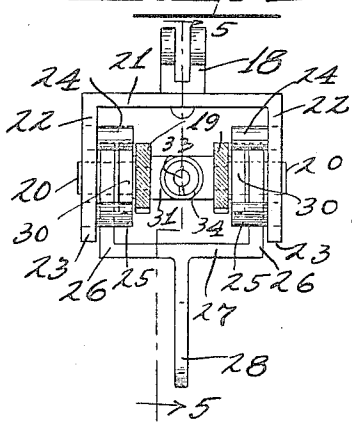
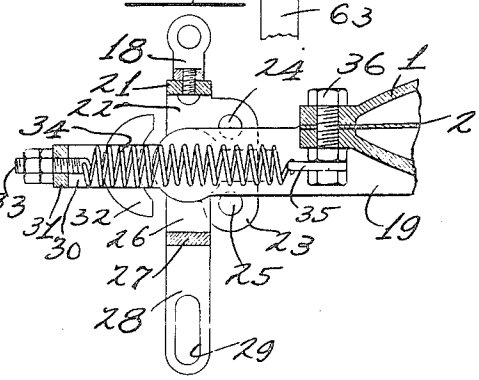


FIG. 5



WITNESSES

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UNITED STATES PATENT OFFICE.

CHARLES E. ANDERSON, OF CHICAGO, AND FRANK P. PERKINS, OF PARK RIDGE, ILLINOIS.

AUTOMATIC VACUUM PRODUCER.

Application filed October 25, 1920. Serial No. 419,411.

To all whom it may concern:

Be it known that we, CHARLES E. ANDERSON and FRANK P. PERKINS, citizens of the United States, and residents of the city of Chicago, in the county of Cook and State of Illinois, and village of Park Ridge, in the county of Cook and State of Illinois, respectively, have invented certain new and useful Improvements in an Automatic Vacuum Producer; and we 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 numerals of reference marked thereon, which form a part of this specification.

This invention relates more particularly to an improved mechanism whereby a vacuum is automatically produced in the steam or vapor line of a heating system by controlling the operation of a balanced valve by a vacuum operated diaphragm mechanism the vacuum chamber of which is connected by a by-pass with the return line in which a vacuum is to be maintained.

It is an object of this invention to provide a device whereby a vacuum may be automatically produced in a heating system.

It is also an object of the invention to provide a vacuum in a steam heating system by automatically controlling the discharge of a liquid or steam adapted to draw air from the return line of a heating system.

Another object of the invention is the construction of a device adapted to be connected with the return line of a heating system to automatically produce a vacuum therein by permitting water or steam to be discharged through a nozzle, associated with a check valve of the return line.

It is a further object of this invention to construct a vacuum producer mechanism for a heating system whereby a vacuum may be maintained in a return line by a vacuum controlled diaphragm device the operation of which governs the opening and closing of a balanced valve which when open permits the escape of a liquid or steam whereby a suction is created to open a return line check valve thereby allowing the air to be drawn from the return line to produce a vacuum therein.

It is an important object of this invention to provide a device of simple and effective construction whereby a vacuum may be automatically produced in a heating system by opening a check valve by suction to permit air to be withdrawn from the system until a desired vacuum is created therein and in a diaphragm vacuum chamber to automatically actuate a switch device whereby a balanced valve is closed to cause discontinuance of the suction effect on the check valve thereby permitting the same to be automatically closed.

Other and further important objects of this invention will be apparent from the disclosures in the specification and drawings.

The invention (in a preferred form) is illustrated in the drawings and hereinafter more fully described.

On the drawings:

Figure 1 is a top plan view of an automatic vacuum producer embodying the principles of this invention.

Figure 2 is a sectional view thereof taken on line 2—2 of Figure 1, showing parts in elevation and with the valve mechanisms in open position.

Figure 3 is a similar section showing the valves in closed position.

Figure 4 is a view of the snap switch taken on line 4—4 of Figure 1.

Figure 5 is a sectional detail taken on line 5—5 of Figure 4.

As shown on the drawings:

The steam line vacuum producer comprises a diaphragm casing 1 having a flexible diaphragm 2 clamped between the flanges of the diaphragm casing sections. Secured to the central portion of the diaphragm 2 is a stem or arm 3, which slidably projects upwardly through an opening in the upper wall of the casing 1. The diaphragm 2 divides the casing 1 into an upper chamber 4 and a lower vacuum chamber 5. Integrally formed on the top of the casing 1 is an upright bracket or arm 6 braced by a web plate or flange 7 integral with the arm 6 and the top of the casing 1. Pivoted on the web plate 7 by means of a pin 8 is a bell-crank, the end of the shorter arm 9 of which is pivotally connected to the upper projecting end of the diaphragm arm 3. The long arm 10 of the bell-crank has the upper end thereof pivotally connected by means of a pin 11 between the arms or tines of a yoke 12. The yoke 12 is secured to one end of a rod 13, which slides through an opening in the upper por-

tion of the bracket arm 6. Engaged around the rod 13 is a coiled spring 14, one end of which bears against the arm 6 while the other end rests against a disk 15 held in place by nuts 16 threaded onto the end of the rod 13. The spring 14 normally acts to hold the rod 13 in the position shown in Figure 2, whereby the bell-crank is tilted to cause the diaphragm 2 to be deflected upwardly.

Also pivotally connected to the yoke 12 is one end of a connecting rod or link 17, the other end of which is pivotally connected between the arms of a yoke 18. A yoke 18 forms part of a snap switch. Integrally formed on the bottom section of the diaphragm casing 1 are a pair of spaced parallel arms or brackets 19, on the outer end of each of which is supported an outwardly projecting pin or lug 20 on which the snap switch is supported. The snap switch comprises a U-shaped fork or yoke embracing a cross piece 21 and side arms 22 which are pivotally engaged on the lugs 20. Each side arm 22 has integrally formed on the edge nearest the diaphragm casing an ear or extension plate 23 having inwardly directed lugs or pins 24 and 25 supported thereon. Also pivotally mounted on the lugs 20 to the inside of the yoke arms 23 are the arms 26 of a channel yoke, the cross piece 27 having a downwardly directed handle or lever 28 integrally formed thereon at right angles. The lever 28 has a slot 29 formed therein. Pivotally engaged on the lugs 20 between the supporting arm 19 and the yoke arms 26 are the arms 30 of a channel yoke having a cross piece 31 integral with the arms 30. The ends of the yoke arms 30 project between the pins 24 and 25 of the upper yoke member. Rigidly secured on the outer side of each of the yoke arms 30 is a curved or crescent-shaped throw member or hammer 32, the ends of which are adapted to contact the yoke arms 26 to throw the lower yoke 26—27 and the lever 28 inwardly. Threaded through the yoke cross piece 31 is an adjustable screw bolt 33, the inner end of which is apertured to receive one end of a coiled spring 34 hooked therein. The other end of the coiled spring 34 is hooked in a small plate 35 engaged on a bolt 36 used to clamp the diaphragm casing sections together. The spring 34 acts to hold the intermediate yoke 30—31 swung to one side or the other of a horizontal through the yoke supporting lugs 20.

Integrally formed on the bottom of the diaphragm casing 1 is a collar 37 in which is securely engaged a plug 38. Securely attached to the plug 38 is the upper arm 39 of a four way balanced valve casing 40 having arms 41, 42 and 43 in addition to the arm 39. The valve casing arm 41 is closed by a cap 44 and suitable packing members through which a valve stem or valve rod 45 slidably projects into the valve casing 40. The outer end of the valve stem 45 is connected with the lever 28 by means of a pin 46 which projects through the slot 29 of said lever. Secured on the inner end of the valve stem 45 are two valve heads 47 which are adapted to control valve openings formed in opposite sides of a hood or dome 48 which projects into the valve casing 40 and separates the valve inlet chamber 49 from the valve outlet chamber 50. Threaded into the valve inlet arm 42 is one end of a water or steam supply pipe 51.

Threaded into the outlet arm 43 of the balanced valve casing 40 is a threaded end of a nozzle or ejector casing 52 having a restricted Venturi discharge passage 53 therein. Integrally formed on the discharge nozzle casing 52 is a downwardly directed pipe arm 54, the lower end of which is enlarged to afford a valve hood or casing section 55. Threaded into the inner end of the discharge casing 52 is a tapered nozzle or ejector 67 which projects into the Venturi discharge passage 53. An apertured partition or spider 56 is formed transversely in the pipe arm 54. Threaded into the lower end of the valve hood 55 is a threaded flange ring 57 of a check valve casing 58. The check valve casing 58 is provided with a valve seat 59 against which a valve 60 is adapted to be seated by means of a coiled spring 61 engaged around a valve stem 62. The valve stem 62 projects through the apertured partition plate 56, which serves as a guide for the valve. Threaded into the lower open end of the check valve casing 58 is one end of a return line pipe 63 forming part of a steam or vapor heating system in which a vacuum is to be maintained. Connecting the inlet chamber 64 of the check valve with the vacuum chamber 5 of the diaphragm casing 1 is an auxiliary or by-pass pipe 65. The outlet chamber 66 of the check valve is provided in the valve hood 55.

The operation is as follows:

The automatic vacuum producing device of this invention is adapted to be connected with a water or steam supply pipe 51 and with a return line pipe 63 forming a part of a steam or vapor heating system. As illustrated in Figure 2, the spring 14 acts to cause the rod 13 to pull the long bell-crank arm 10 toward the supporting arm 6, thereby causing the short bell-crank arm 9 to swing upwardly whereby the stem 3 acts to pull the diaphragm 2 into its upper position. The spring 14 also acts to tension the connecting rod 17 to pull the upper yoke 21—22 of the snap switch toward the diaphragm casing thereby permitting the switch spring 34 to pull the intermediate snap switch yoke 30—31 upwardly above the horizontal so that the upper ends of

the crescent members 32 contact against the upper end of the arms 26 of the lower snap switch yoke 26—27 to throw the yoke arm 26 inwardly toward the diaphragm casing and the lever 28 outwardly. Outward movement of the lever 28 exerts a pull on the valve stem 45 whereby the balanced valve heads 47 are moved into open positions.

The balanced valve is thus opened thereby permitting water or steam from the pipe 51 to flow through the balanced valve to be discharged by force through the nozzle or ejector 67 out through the Venturi passage 53 of the discharge nozzle casing 52. The flow of the water or steam through the discharge passage 53 acts to create a suction on the check valve 60 which is lifted or drawn away from the valve seat 59 against the action of the valve spring 61. With the check valve open the suction exerted by the water or steam escaping through the discharge passage 53 acts automatically to suck or draw air from the return pipe 63, thus gradually producing a vacuum in the heating system. Simultaneous with the drawing of air from the pipe 63, air is also sucked through the by-pass pipe 65 from the lower chamber 5 of the diaphragm casing 1. A vacuum is thus also produced in the chamber 5 equal to the vacuum in the pipe 63.

When the desired vacuum in the return pipe is reached the pressure of the air in the upper diaphragm casing chamber 4, as well as the suction on the bottom of the diaphragm 2, causes the diaphragm to be automatically deflected downwardly into the lowered position shown in Figure 3. This operation of the diaphragm causes the bell-crank arm 10 to swing away from the supporting arm 6, thereby pulling the rod 13 through the arm 6 compressing the spring 14. The outward swing of the bell-crank arm 10 acts to push the connecting rod 17 thereby throwing the upper snap switch yoke 21—22 outwardly into the position shown in Figure 3. This movement of the yoke 21—22 causes the pins 25 to lift the inner ends of the yoke arms 30. The intermediate or switch yoke 30—31 is thus moved downwardly to permit the switch spring 34 to act automatically to swing or snap the yoke 30—31 past dead center on its lowermost position. The throw or the switch yoke 30—31 causes the lower ends of the crescent members 32 to strike against the lower yoke arms 26 below the pivot point thereof thereby forcing or swinging the lever 28 inwardly toward the balanced valve casing 40. The lever 28 thus pushes the valve stem 45 inwardly to seat the valve heads 47 in the valve openings of the member 48 thereby closing the balanced valve and stopping the flow of water or steam from the nozzle 67 through the discharge Venturi passage 53. The suction action on the check valve 60 is thus discontinued and the spring 61 acts automatically to force the valve 60 into closed position against the valve seat 59. The pins 24 and 25 act as starters for moving the yoke 30—31 into positions wherein the spring 34 may act to swing the yoke past dead center.

The balanced valve and the check valve remain closed until the vacuum produced in the heating system is reduced to such an extent that the pressure of the control spring 14 overcomes the suction effect which holds the diaphragm in its depressed lower position. When this occurs the spring 14 acts automatically to operate the bell-crank 9—10 thereby simultaneously pulling the diaphragm upwardly and operating the snap switch to automatically cause opening of the balanced water or steam control valve. The operation is thus repeated and a desired vacuum is automatically maintained in the heating system.

The vacuum to be produced in the heating system is controlled by the spring 14, which may be adjusted for different vacuums by adjusting the nuts 16 on the rod 13. Attention is called to the fact that different types of balanced valves and check valves may be used in place of the particular types illustrated and described. The snap switch mechanism may if desired also be replaced by any other suitable switch mechanism.

We are aware that numerous details of construction may be varied through a wide range without departing from the principles of this invention, and we therefore do not purpose limiting the patent granted otherwise than necessitated by the prior art.

We claim as our invention:

1. A heating system vacuum producer comprising a diaphragm mechanism, a switch connected therewith, a valve connected with the switch and with a supply pipe, a discharge nozzle connected with the valve, a check valve connected with the discharge nozzle and with a pipe line of the heating system, and a by-pass pipe connecting said check valve and said diaphragm mechanism.

2. An automatic vacuum producer comprising the combination with a diaphragm mechanism, of a switch connected therewith to be operated thereby, a spring control for said diaphragm mechanism, a supply line, a valve connected therewith having the valve stem connected with said switch, a discharge nozzle connected with said valve, a second valve connected to said nozzle and with a pipe line of a heating system in which a vacuum is to be produced, and a pipe connecting said second valve with the diaphragm mechanism to permit the diaphragm to be controlled by a vacuum produced in the pipe line by suction created by the discharge of a suction producing medium through the

nozzle when the first mentioned valve is open.

3. The combination with a heating system return line pipe, of an automatic vacuum producer connected therewith and embracing a diaphragm casing, a diaphragm therein, a stem connected therewith and projecting out of said casing, a bell-crank pivoted on said casing and connected to said diaphragm stem, a rod slidably mounted on said casing and connected with said bell-crank, a control spring on said rod for normally holding the diaphragm in an elevated position in said casing, a snap switch supported on said casing, a connecting rod connecting said switch with said bell-crank, a balanced valve supported on said casing, a valve stem for said balanced valve connected with the switch, a discharge nozzle connected with said balanced valve, a water supply pipe connected with the balanced valve, a check valve connecting the discharge nozzle with the heating system, and a by-pass pipe connecting the lower chamber of the diaphragm casing with the heating system return line pipe to permit the diaphragm to be controlled by a vacuum produced in the heating system return line pipe by the suction of water discharged through the discharge nozzle when the balanced valve is open.

4. The combination with a heating system return line pipe, of suction producing means connected therewith for drawing air from the heating system return line pipe to produce a vacuum therein, a switch for governing the operation of said suction producing means, a vacuum controlled mechanism connected with the heating system return line pipe, and an adjustable device connecting the vacuum controlled mechanism with said switch to permit automatic operation of said switch and said suction producing means when a predetermined vacuum is reached.

5. The combination with a heating system return line pipe, of suction producing means for drawing air from said pipe, a switch controlling the operation of said suction producing means, a vacuum controlled mechanism connected with said pipe and with said switch for automatically operating the switch, and means for adjusting the switch and said vacuum controlled mechanism.

6. The combination with a heating system return line pipe, of an automatic vacuum producer connected therewith and embracing a diaphragm casing, a diaphragm therein, a stem connected therewith and projecting out of said casing, a bell-crank pivoted on said casing and connected to said diaphragm stem, a rod slidably mounted on said casing and connected with said bell-crank, a control spring on said rod for normally holding the diaphragm in an elevated position in said casing, a snap switch supported on said casing, a connecting rod connecting said switch with said bell-crank, a valve supported on said casing, and a valve stem for said valve connected with said switch.

In testimony whereof, we have hereunto subscribed our names in the presence of two subscribing witnesses.

CHARLES E. ANDERSON.
FRANK P. PERKINS.

Witnesses:
FRED E. PAESLER,
EARL M. HARDINE.