

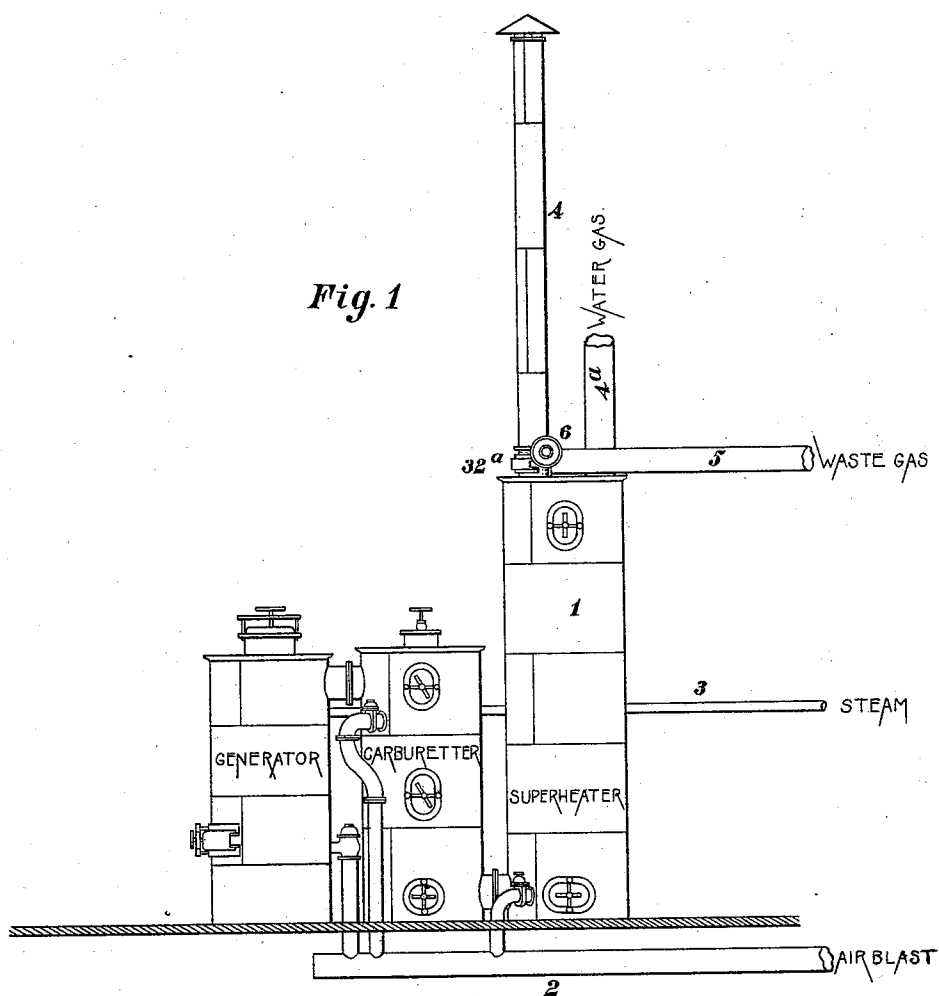
(No Model.)

3 Sheets—Sheet 1.

J. M. RUSBY.
WATER GAS APPARATUS.

No. 532,586

Patented Jan. 15, 1895.



WITNESSES:

W. Hermann Gagar.
L. M. Gilligan

INVENTOR

John M. Rusby

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(No Model.)

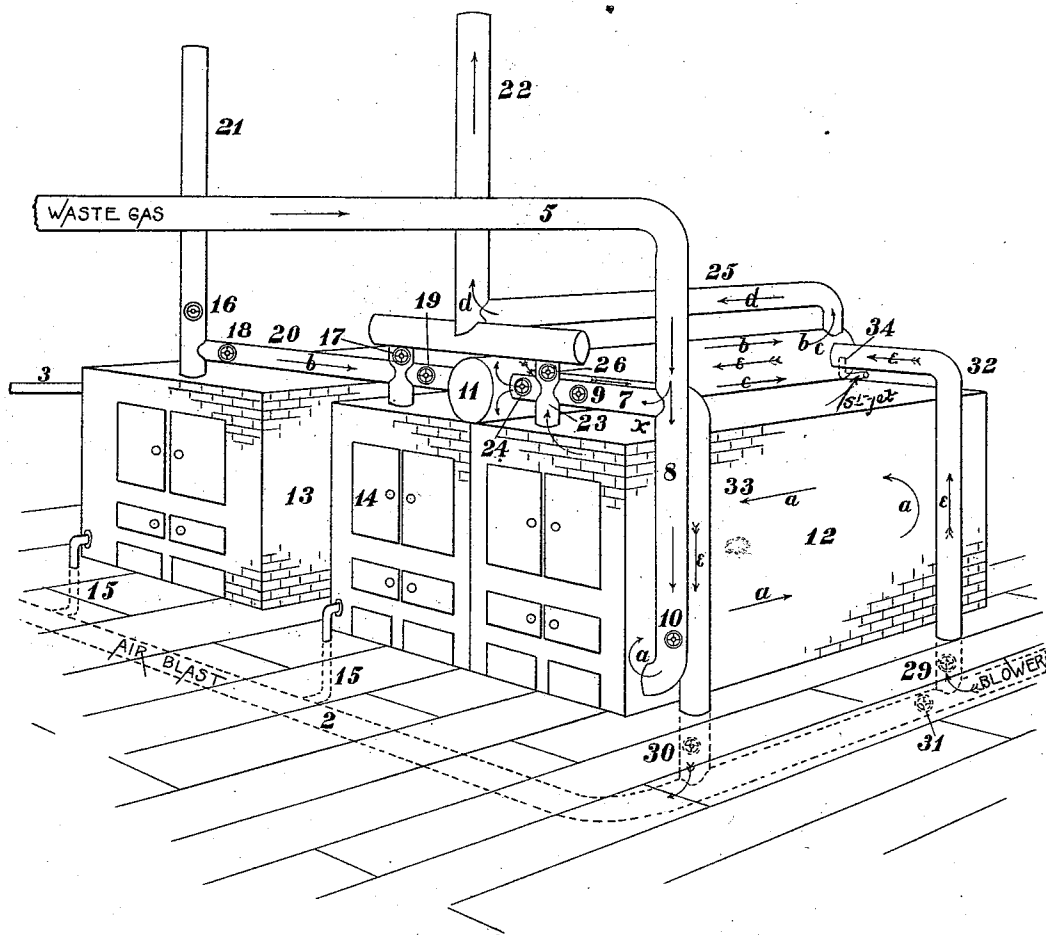
3 Sheets—Sheet 2.

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Fig. 2



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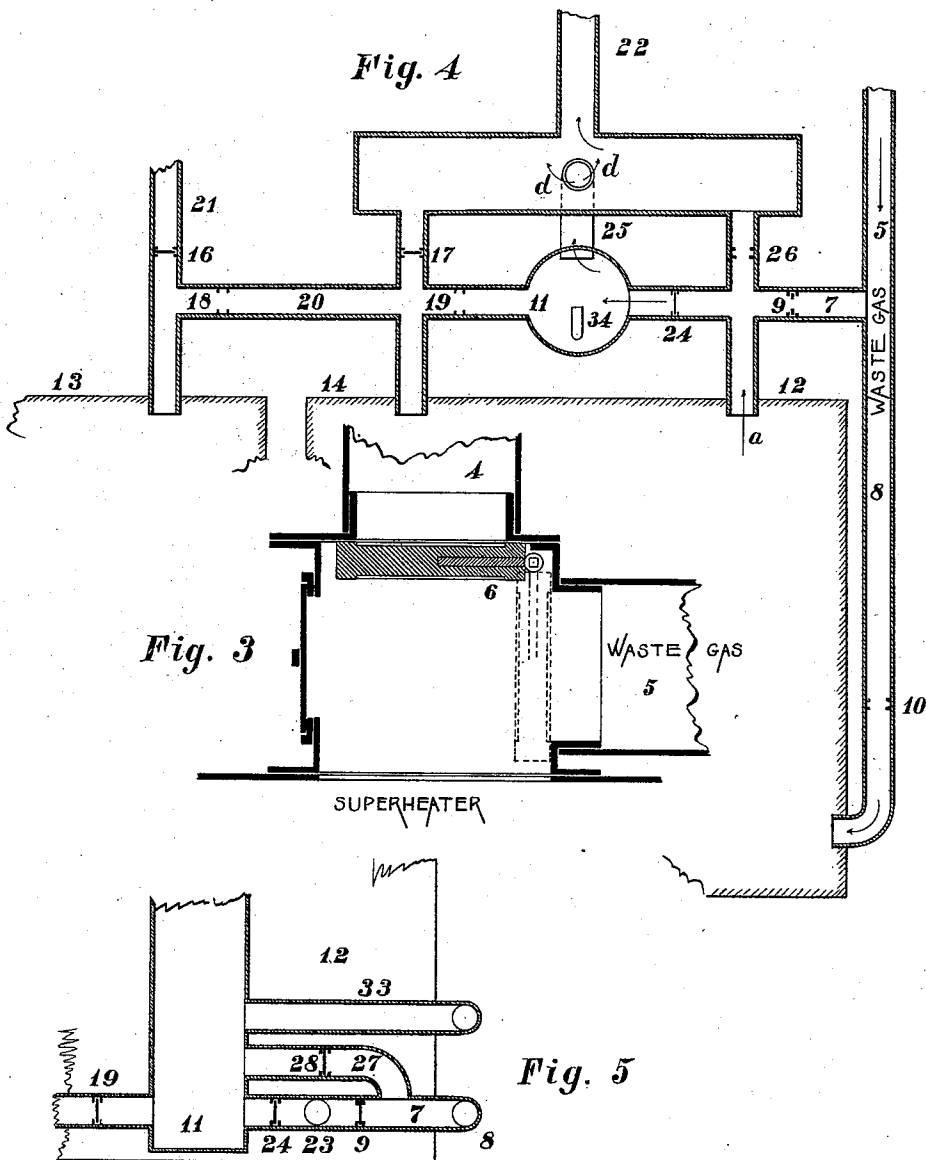
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UNITED STATES PATENT OFFICE.

JOHN M. RUSBY, OF JERSEY CITY, NEW JERSEY, ASSIGNOR TO THE UNITED GAS IMPROVEMENT COMPANY, OF PHILADELPHIA, PENNSYLVANIA.

WATER-GAS APPARATUS.

SPECIFICATION forming part of Letters Patent No. 532,586, dated January 15, 1895.

Application filed August 28, 1894. Serial No. 521,489. (No model.)

To all whom it may concern:

Be it known that I, JOHN M. RUSBY, a citizen of the United States, residing at Jersey City, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Water-Gas Apparatus, of which the following is a specification.

One object of my present invention is to effect an economy or saving and to provide for the utilization of so much of the waste heat of a water gas generating plant as is necessary under various existing conditions for heating the air-blast or blasts to any required or predetermined temperature and further to provide for the utilization of the balance or remaining portion of the waste heat for generating steam; and to this end my invention consists of the improvements hereinafter described and claimed.

The nature, characteristic features and scope of my invention will be more fully understood from the following description taken in connection with the accompanying drawings forming part hereof and illustrating one embodiment of my invention, and in which—

Figure 1, is an elevational view illustrating portions of a well-known type of water gas generating apparatus commonly designated "the Lowe apparatus," and Fig. 2, is a perspective view of boilers and an air-heater for use in connection with the portion of the apparatus shown in Fig. 1, and these two figures taken together illustrate a plant embodying features of my invention. Fig. 3, is a sectional view drawn to an enlarged scale and illustrating a flap valve shown in Fig. 1, at the junction of the stack and waste gas conduit. Fig. 4, is a vertical sectional view illustrating the by-pass shown in Fig. 2, and adapted to afford means whereby any required portion of the waste gas may be directed to an air-blast heater and whereby the balance or remaining portion of the waste gas may be directed to a boiler or boilers, and Fig. 5, is a horizontal sectional view illustrating a modified form of by-pass wherein the waste-gas is supplied to the air-heater without mingling with waste gas that has traversed the boiler and that is escaping therefrom into the boiler off-take.

In the drawings 1, designates portions of one type of water gas generating apparatus of the

"Lowe" class provided with any suitable air-blast connections 2, steam connections 3, and main 4^a, for conveying away the so-called water gas that is generated and intended for preservation and use. During the operation of heating up such an apparatus preparatory to the manufacture of so-called water gas, fuel is consumed in the generator usually under the influence of a forced draft, and the highly heated waste gas resulting from this combustion is discharged usually from the top of the superheater as shown, although in some instances, it is also discharged from other parts of the apparatus, for example, from the carburetor, and my present invention is applicable to any type of such apparatus, the point of the apparatus from which the waste gas is led off being immaterial, the apparatus shown being selected merely for purposes of illustration.

The waste gas given off or discharged from the apparatus shown in Fig. 1, while it is being heated up for the manufacture of water gas, is utilized advantageously and economically according to my invention, because the air-blast may be heated to any required temperature by a portion of it and because the balance of it is utilized for generating steam which is supplied to the apparatus, more especially during the generation of useful gas or "water gas" as it is commonly designated.

During the operation of heating up the apparatus shown in Fig. 1, the waste gas is in whole or in part, usually the former, prevented from escaping at the stack 4, and is directed into a waste gas conduit 5, by means of any suitable valve or valves for controlling the opening or passage through the stack 4, and conduit 5. For purposes of illustration, Figs. 1 and 3, a flap valve 6, is availed for this purpose and this flap valve may be caused to completely interrupt the passage of waste gas through the stack 4, as shown by full lines in Fig. 3, or through the waste gas conduit 5, as shown by dotted lines in said figure. Moreover, this flap valve may be placed in a position intermediate of those above mentioned in order to direct so much of the waste gas to the conduit 5, as is necessary or desirable for heating air and water and the remainder thereof to the stack 4, to permit of

its escape therethrough. The conduit 5, leads to a by-pass 7—8, whereby so much of the hot waste gas may be passed through the part 7, and air-heater 11, as is necessary or requisite under existing conditions for heating the blast to the temperature required under the existing conditions for attaining the most economical and beneficial results in the apparatus shown in Fig. 1. In this connection it may be remarked that the quantity or proportion of the heat of waste gas that should be imparted to the air-blast varies according to the quality and kind of fuel employed in the apparatus shown in Fig. 1, and according to other conditions that will be readily understood by gas-makers and that determine for the time being the most economical temperature at which the blast may be employed.

To provide for increasing or diminishing the quantity of the sensible heat of the waste gas utilized for heating the air-blast or in other words to provide for increasing or diminishing at will the temperature of the air-blast, use is made of a valve or valves. As shown two valves 9 and 10, are employed for this purpose, but a flap valve like that shown in Fig. 3, and hinged as at *a*, Fig. 2, might be employed in lieu thereof. For the sake of explanation it will be assumed that the valves 9 and 10, are partly open and in order to increase the temperature of the air-blast, the valve 9, is opened and the valve 10, is closed either wholly or in part according to the increase of temperature required, whereby an additional quantity of waste gas is directed from the conduit 5, to the heater 11, with the result that the air-blast is heated to a correspondingly higher temperature. Conversely the opening of the valve 10, and closing of the valve 9, causes a diminished quantity of waste gas to be delivered to the air-heater 11, whereby the temperature of the air-blast is correspondingly decreased.

In all cases, the portion of the waste gas which is not employed for heating the air-blast in the heater 11, is directed through the part 8, to the boiler 12, through which it circulates, for example, in the direction indicated by arrows *a*, in Fig. 2, in order to give up its sensible heat for the purpose of generating steam which in turn is supplied by means of the connections 3, to the apparatus illustrated in Fig. 1.

13 and 14, represent additional boilers of the same tubular type as boiler 12, and which may or may not be employed. Within the boilers 13 and 14, when present, there is maintained a combustion of suitable fuel and this combustion is controlled by air-blasts supplied from the air-blast pipe 2, through branch pipes 15, that may be provided with automatic damper regulators that control the passage of air through them and that are governed automatically to maintain the required pressure of steam. The heated products of combustion from the boilers 13 and 14, may, by closing the valves 16 and 17, and opening

valves 18 and 19, be caused to traverse the conduit 20, and air-heater 11, in the direction indicated by the arrows *b*, in order to impart their sensible heat to the air-blast. In this connection it may be remarked that the air-heater may resemble in construction a tubular boiler and that the products of combustion from the boilers 13 and 14, may be caused to traverse one set of tubes in the heater 11, while the waste gases issuing from the part 7, are caused to traverse another set of tubes in the heater 11, although the employment of one or two sets of tubes in the heater 11, is a matter of construction. By closing the valves 18 and 19, and opening the valves 16 and 17, the products of combustion from the boilers 13 and 14, may be permitted to escape through the off-takes 21 and 22, without entering the air heater 11. The waste gases, after traversing the boiler 12, and after having been deprived of at least a portion of their sensible heat for the generation of steam, escape through the pipe 23, and as shown in Fig. 2, mingled with the waste gas traversing the part 7, and the resultant mixture passes the valve 24, which is open for this purpose, and escapes through the air-heater 11, as is indicated by the arrows *c*. From the air-heater 11, the comparatively cool gases escape, in the present instance, through a pipe 25, into the off-take 22, as shown by the arrows *d*. However, if the temperature of the gases traversing the pipe 25, will warrant it, this pipe may be replaced by an additional air heater. By closing the valve 24, and opening the valve 26, Fig. 4, none of the waste gas is passed through the heater 11, although either all or a part of it according to the position of the valves 9 and 10, passes through the boiler. In such case, the air-heater 11, may be heated wholly by means of the products of combustion from the boilers 13 and 14.

Although horizontal tubular boilers are illustrated in the drawings, still my invention is obviously applicable to boilers of a vertical type and in such case, the air-heater may also be disposed vertically and made to stand upon its end on the boiler.

It will be observed that as shown in Fig. 2, and above described, the waste gas passing through the pipe 23, after having been deprived of at least a part of its sensible heat in the boiler 12, unites and commingles with hot waste gas traversing the part 7, on its way to the air-heater 11. In Fig. 5, I have illustrated a separate connection 27, and valve 28, whereby this commingling of hot and partially cooled waste gas before entering the air heater, is obviated.

Referring to Fig. 5, when the valve 28, is open and the valve 9, closed, the hot waste gas traverses the part 27, and enters the air-heater 11, and in this construction the waste gas which issues from the boiler 12, through the pipe 23, may be directed to the off-take 22, by closing the valve 24, so that under these circumstances, the waste gas which has been

cooled by traversing the boiler 12, does not enter the air-heater 11, although it may be caused so to do by closing the valve 26, Fig. 1, and opening the valve 24, Fig. 5. Air is forced into air-conduit 2, by means of a blower or other suitable device not shown, and by closing the valves 29 and 30, and opening the valve 31, this air would be caused to pass directly through the conduit 2. However, this is not done, but the valve 31, is closed and the valves 29 and 30, are opened so that the incoming air is caused to traverse the pipes 32 and 33, and space between the tubes of the air-heater 11, in the direction indicated by the arrows *e*, and in a direction opposed to the direction of travel of the hot-gas through the tubes of the air-heater. From the air-heater, hot blasts of air are supplied through the conduit 2, to the apparatus illustrated in Fig. 1, in any well-known manner.

32^a, is a door provided at the base of the stack 4, and adapted to be opened periodically by the gas-maker in order that he may examine the condition of the out-going or waste gas. Moreover the door 32^a, may be opened in order to admit air to the waste gas so that the latter may be burned before entering the boiler 12. If there is not sufficient draft when the door 32^a, is open, the natural draft of the boiler off-take 22, may be aided by a small steam jet injector 34.

Various modifications in the manner of constructing and working the above described apparatus have been referred to. However, a description will now be given of its usual mode of operation.

While the apparatus is being heated up preparatory to the generation of water gas, the conduit 4^a, is closed, the flap valve 6, is turned into the position indicated by full lines in Fig. 3, for directing waste gas from the apparatus shown in Fig. 1, through the conduit 5, and in this connection it may be remarked that when water gas is being generated, the stack 4, is open and the flap valve 6, is in the position indicated by dotted lines in Fig. 3, for closing the conduit 5, so that any water gas that may leak from the superheater, will pass through the stack 4, into the air. Moreover the valve 6, when in this position prevents the ingress of cold air by way of the stack 4, to the boiler 12. From the conduit 5, so much of the waste gas as is necessary for heating the blast to the temperature necessary or desirable for producing the best results in the apparatus shown in Fig. 1, is passed through the by-pass 7, directly to the heater 11, where its sensible heat is given up to the current or blast of air traversing the pipes 32, 33, and 2. The remaining portion of the waste gas is led by the pipe 8, into and through the boiler 12, in which it imparts at least a part of its sensible heat for the generation of steam, which, together with the steam generated by the boilers 13 and 14, is supplied to the apparatus shown in Fig. 1. Moreover the gas-maker may raise or lower

the temperature of the air-blast at will and in the proper manner for securing the most economical and beneficial results under the existing conditions such as quality of fuel, condition of fire, and the like, by the simple operation of changing the apportionment of waste gases between the air-heater and boiler through the intervention of the by-pass 7—8, and its complemental valve or valves. The hot gaseous products from one or all the boilers including the partially cooled waste gas from the boiler 12, may be passed through the air-heater 11, as has been already described or, if preferred these last mentioned gaseous products from one or all of the boilers may be permitted to escape through the off-takes 21 and 22, without traversing the air-heater 11. In such case, the air-heater is heated wholly by means of hot waste gas traversing the part 7.

It will be obvious to those skilled in the art to which my invention relates that modifications may be made in details without departing from the spirit thereof. Hence I do not limit myself to the precise construction and arrangement of parts hereinabove set forth and illustrated in the accompanying drawings, but,

Having thus described the nature and objects of my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In combination, a water gas apparatus alternately cooled by the production of water gas and re-heated giving rise to waste gas, air and water heaters appertaining to and co-operating with said water gas apparatus, and a by-pass for distributing waste gas from said water gas apparatus among its air and water heaters, substantially as described.

2. In combination, a water gas apparatus alternately cooled by the production of water gas and re-heated giving rise to waste gas, air and water heaters co-operating with and appertaining to said water gas apparatus, and a by-pass and valve connections for apportioning waste gas from the water gas apparatus among its air and water heaters, substantially as described.

3. In combination, a water gas apparatus, an air heater, water heaters whereof some are fired, connections for conveying hot products of combustion from the last mentioned water heaters to the air heater, and a by-pass for distributing heated gas from the water gas apparatus among the air heater and remaining water heaters, substantially as described.

4. In combination, a water gas apparatus, an air heater, a water heater, a by-pass for apportioning heated gas from the water gas apparatus among the air and water heaters, and separate pipe connections from the water and air heaters to the boiler off-take, substantially as described.

5. In a gas apparatus the combination of, a furnace, air and water heaters and their pipe-connections for alternately supplying heated air and steam to said furnace, and a

by-pass for apportioning waste gas from the furnace among the separate air and water heaters, substantially as described.

6. The combination in a water gas apparatus of, a fixing chamber provided with a water gas off-take and with a discharge stack, a conduit and by-pass for conveying waste gas from said stack and apportioning the same among the water and air heaters that appertain to and co-operate with the water gas apparatus, and valve connections for opening communication with the stack and closing communication with the conduit during the production of water gas whereby leakage of the latter is prevented from entering the heaters and escapes into the stack, substantially as described.

7. In combination, a water gas apparatus, a

conduit and by-pass for conveying waste gas from the stack thereof and apportioning the same among water and air heaters, and a door in the stack, substantially as described.

8. In combination, a water gas apparatus, a conduit and by-pass for conveying waste gas from the stack thereof and apportioning the same among water and air heaters, a door in the stack, and an injector or steam jet exhauster discharging steam or air through the air heater, substantially as described.

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

J. M. RUSBY.

Witnesses:

WEST BISSELL,
HENRY MARTIN.