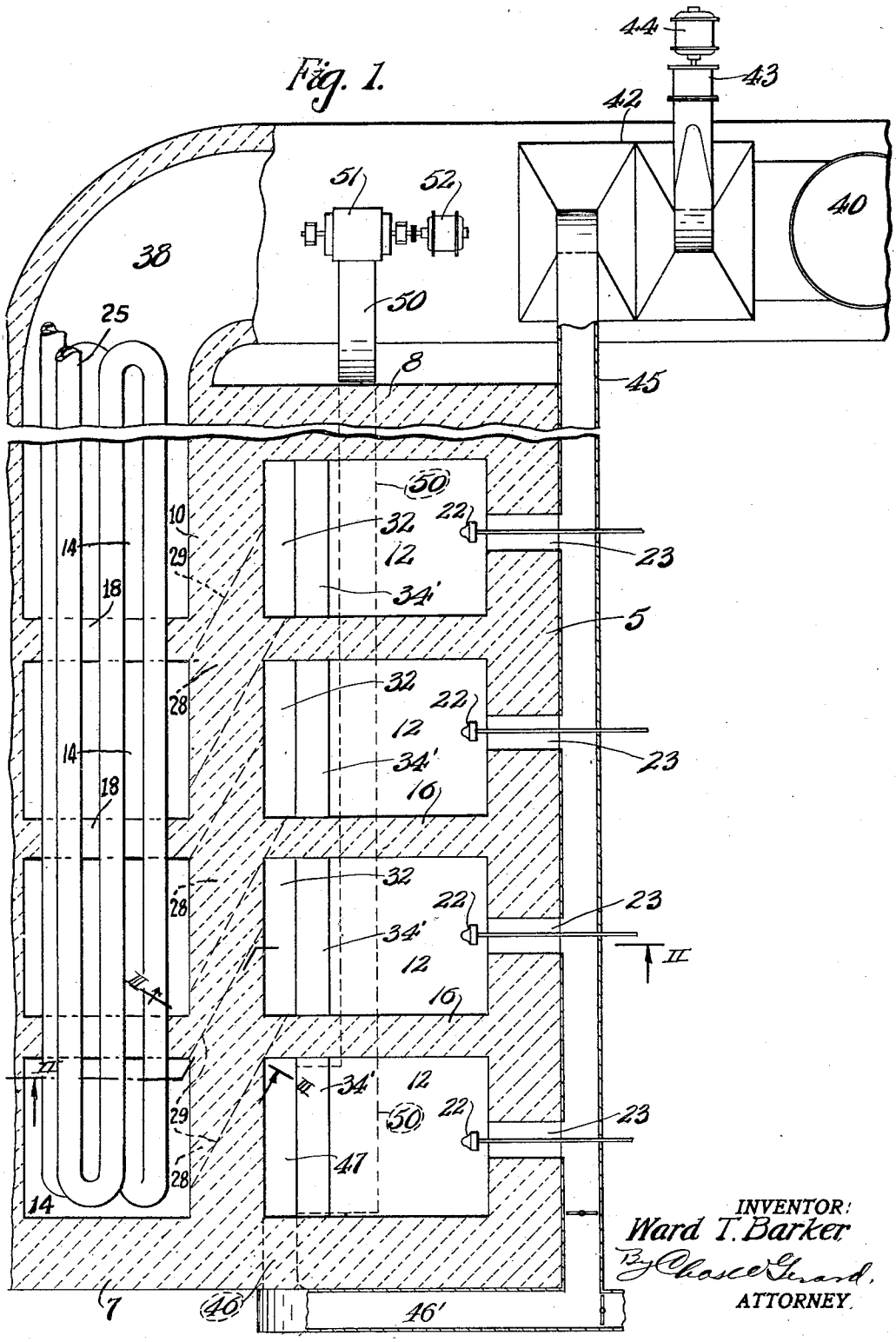
Sept. 6, 1932. W. T. BARKER 1,875,549

RECIRCULATION SYSTEM

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Fig. 1.



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Fig. 2.

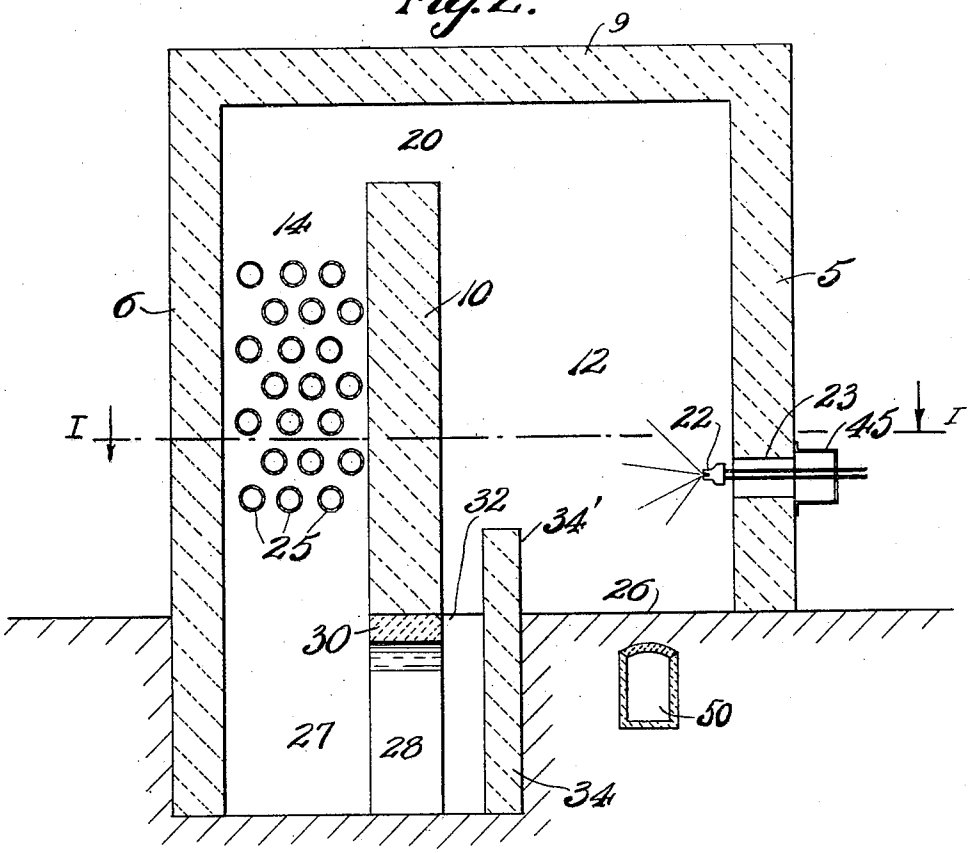
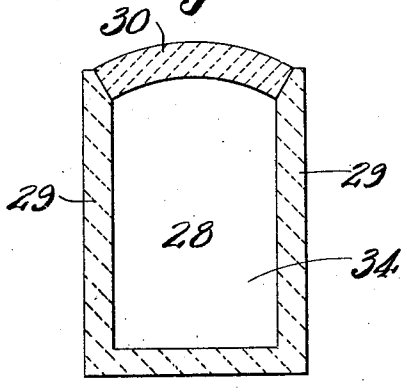


Fig. 3.



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UNITED STATES PATENT OFFICE

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RECIRCULATION SYSTEM

Application filed March 27, 1929. Serial No. 350,239.

The present invention relates to recirculation apparatus for furnace constructions, and one primary object of the invention is to provide an improved mode of recirculation of the combustion or flue gases with a view to eliminating as far as possible the necessity for utilizing forced-draft operations for maintaining the recirculating function, and thereby avoiding the mechanical disadvantages attending the use of such force-draft equipment.

It is also sought to provide a recirculating system adapted for effecting a better and more even or uniform distribution of the heating action of the recirculated gaseous products, due to the more restricted character of the passages through which the gases are conducted through the system.

With these general objects in view, as well as various minor objects as will appear in the course of the detailed description, the invention will now be described by reference to the accompanying drawings illustrating one practical form of embodiment of the proposed improvements, after which those features and the combinations deemed to be novel will be particularly set forth and claimed.

In the drawings—

Figure 1 is a horizontal sectional view illustrating a recirculating apparatus constructed in accordance with the present invention, and representing a section taken on the line I—I of Figure 2;

Figure 2 is a vertical sectional view of the same, and representing a section taken on the line II—II of Figure 1; and

Figure 3 is an enlarged sectional detail view, representing a section taken on the line III—III of Figure 1.

Referring now to the said drawings in detail, these illustrate the improved apparatus incorporated in a furnace and still or vaporizer construction such as is adapted for refinery systems, and comprising front and rear walls 5, 6, respectively, connected by end walls 7, 8, and a roof 9, all of appropriate masonry materials suitable for furnace operations. The space enclosed by these walls is sub-divided by a longitudinal vertical partition 10 to provide for a series of furnace or combustion chambers 12 between said partition and the front wall 5 and a corresponding series of vaporizing or heat-transfer chambers 14 at the rear between said partition and the rear wall 6,—the chambers 12 being separated by transverse vertical partitions 16 and the chambers 14 being separated by similar partitions 18; each combustion chamber 12 furthermore communicates with the vaporizing chamber 14 directly to the rear of it through an overhead space 20 left at the top of the partition 10 between the several transverse partitions 16—18. Each combustion chamber 12 is fired by its own individual burner unit 22 (oil or gas or other suitable type) admitted with its connections through a primary air opening 23 in the front wall 5.

Mounted within the heat-transfer or vaporizing chambers 14 are heating or vaporizing units of any suitable or preferred type, as for example, banks of longitudinally extending tubes 25, either in separate lengths corresponding to the length of each chamber, or preferably continuous tubes each extending substantially the entire length of the furnace, thereby assuring a uniformity of the vaporizing action upon the contents of the tube assembly by the practically even and uniform distribution of the heating effects throughout the same.

Beneath the vaporizing or heat-transfer chambers 14 is constructed a series of outlet passages, as by means of a tunnel structure below the ground line or level corresponding to the floor 26 of the combustion chambers, and to this end the rear wall 6 and partition walls 18 are all extended below said level to provide a separate gas outlet passage 27 from each of the chambers 14. From each of these passages 27 a bypass or recirculating passage leads through a tunnel or conduit 28 extending at an angle or diagonally between vertical side walls 29, topped by an arch 30 (see Figure 3), to a discharge orifice 32 through the floor of the combustion chamber 12 corresponding to the next vaporizing unit of the series. A vertical intermediate wall 34 beneath the floor of each combustion

chamber is extended upward to provide a baffle projection 34′ to shield the corresponding orifice 32 somewhat from the primary combustion zone around the burner in that chamber, as shown in Figure 2.

The series of combustion chambers and vaporizing units may be extended to any desired practical number, according to the requirements of the installation, and the final vaporizing chamber 14 of the series communicates with a flue-gas tunnel or conduit 38 leading to the stack 40.

In the flue gas passage 38 is installed any suitable form of air preheater construction 42, illustrated conventionally in Figure 1, for the preheating of air as supplied by a fan 43 driven by a motor 44, this primary air supply being thus heated by the waste flue gases and conducted by a conduit 45 to each of the air openings 23 leading into the several combustion chambers 12.

For the supply of secondary air, as required, an air conduit may be provided in the end wall 7 for an air inlet passage 46 beneath the floor 26 of the first combustion chamber 12 and communicating with an intake orifice 47 in said chamber, as represented in Figure 1 of the drawings.

In the operation of the construction as above described, the products of the combustion in the first combustion chamber of the series pass into the vaporizing chamber 14 by way of the overhead passage 20 communicating therewith and thence through the outlet space 27 and bypass conduit 28 and orifice 32 into the next combustion chamber 12 of the series. Here the gases from the first combustion chamber are combined with the products of combustion of the second combustion chamber 12 and with them recirculated through the corresponding vaporizing chamber 14, whereupon the recirculating operation is repeated by the passage of the combined gaseous product through the second set of passages 27, 28, to the orifice 32 of the third combustion chamber. Thereafter the same operation is simply repeated for each of the succeeding units of the series.

A recirculation process of the combustion or heating gases is thus provided in which a better and more efficient distribution of the heat to the vaporizing units is effected by virtue of the fact that the stream of the gaseous products is confined to a more limited space, resulting in a more even and uniform distribution of the hot gases to the heat transfer surfaces of the vaporizing apparatus. By recirculating the gases over and over again through the successive combustion chambers and vaporizing chambers, the temperatures therein are maintained at an efficient point with as little loss of heat as is practicable, and without any undue dampening effect of the flue gases on the combustion zones, since the recirculated gases are admitted at the opposite ends of the combustion chambers from the burners.

This recycling of the combustion gases repeatedly through a succession of the furnace units enables the recirculation principle to be carried out by means of the natural furnace draft, and eliminates the necessity of using a forced draft for the operation of a plurality of such units. For example, if each of the units possessed a capacity of 15000 cu. ft., making a combined capacity of 60000 cu. ft. for four complete units illustrated, then the combined circulation would comprise the 15000 cu. ft. originating in the first unit of the series, together with 45000 cu. ft. for the remaining units, of which the greater portion would be represented by the recirculated gases entering them from the preceding units. By the elimination of the use of a fan mechanism for maintaining a forced recirculating draft, a serious mechanical difficulty is avoided, as the high temperatures encountered in the recirculation of such hot gaseous products have rendered it almost impossible to operate a fan efficiently for any great length of time.

If under some conditions it should seem advisable to recirculate some of the flue gases after they have left the last vaporizing unit of the series, as where the number of units is too great to rely solely on the natural draft of the entire battery, a return conduit 50 may be provided, communicating with the flue passage 38 and operating with a fan 51 and motor 52 for returning a part of the waste gases to the orifice 47 provided in the floor of the first combustion chamber 12; although such supplementary forced recirculation will not ordinarily be necessary in a comparatively small assembly of the type illustrated.

While I have illustrated and described what I now regard as a practical and the preferred form of embodiment of my improvements, I desire to be understood as expressly reserving the right to make all such changes or modifications as may fairly fall within the scope of the appended claim.

What I claim is:

A recirculating apparatus comprising, in combination with a plurality of separate furnace units each having a combustion chamber communicating with a vaporizing chamber, means providing a conduit passage for conducting the heating gases from the vaporizing chamber of one of said units to the combustion chamber of the next succeeding unit, and a vaporizing assembly comprising a plurality of tubes each extending continuously through the vaporizing chambers of all said furnace units.

In witness whereof I hereunto affix my signature.

WARD T. BARKER.