

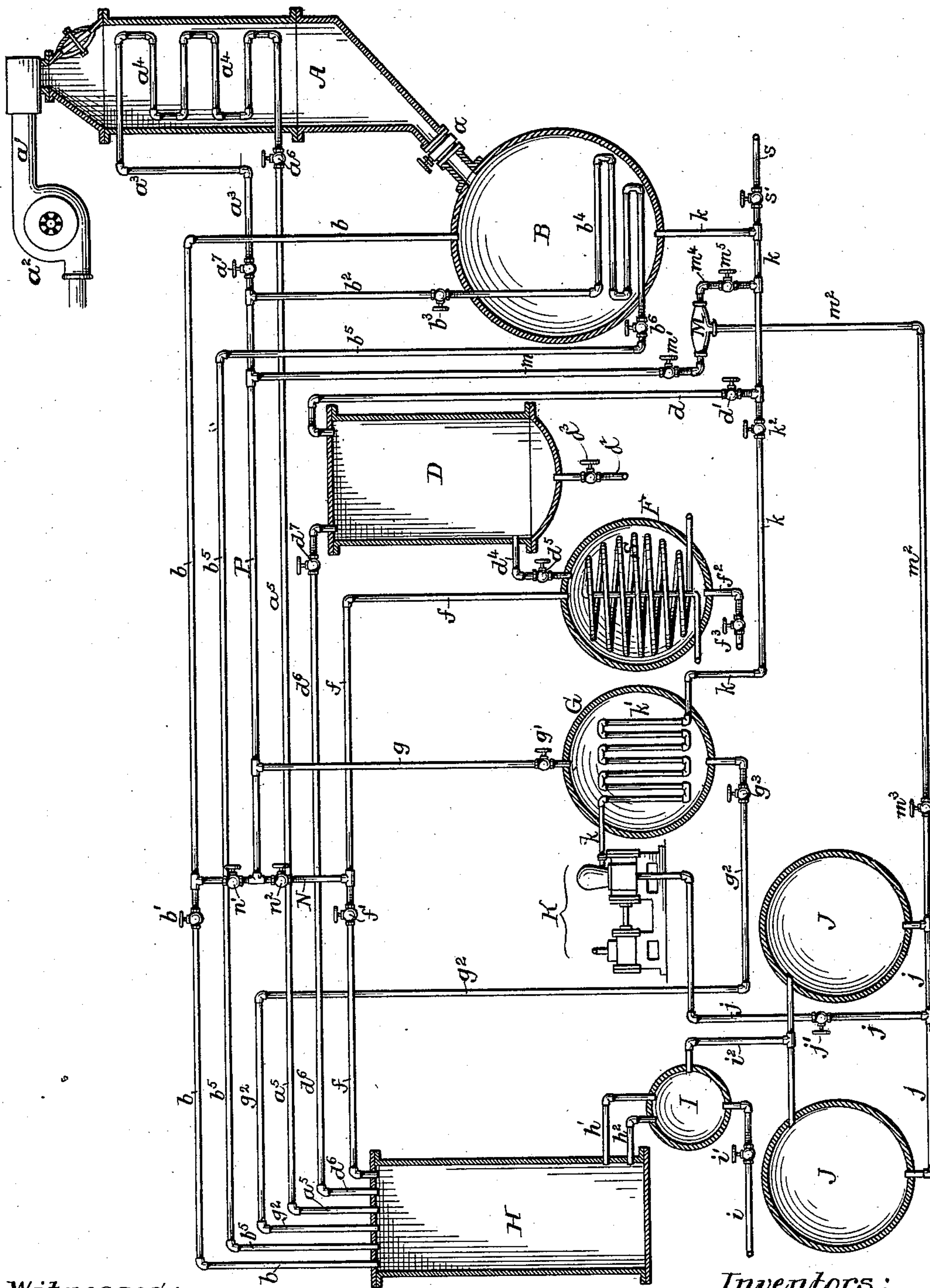
(No Model.)

C. F. & I. M. SIMONIN.

# PROCESS OF AND APPARATUS FOR TREATING GARBAGE.

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*Witnesses :*

A.V. Groups

A. V. Groups  
Murray C. Boyer

*Inventors :*

*Charles F. Simonin & Isaac M. Simonin*

by their Attorneys

Howson Howson



# UNITED STATES PATENT OFFICE.

CHARLES F. SIMONIN AND ISAAC M. SIMONIN, OF PHILADELPHIA, PENNSYLVANIA.

## PROCESS OF AND APPARATUS FOR TREATING GARBAGE.

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### *To all whom it may concern:*

Be it known that we, CHARLES F. SIMONIN and ISAAC M. SIMONIN, both citizens of the United States, and residents of Philadelphia, Pennsylvania, have invented certain Improvements in Treating Garbage or Swill and in Apparatus for such Treatment, of which the following is a specification.

The object of our invention is to provide an economical and commercially successful process and apparatus whereby garbage or swill can be treated by a chemical reagent for the purpose of recovering from it the constituents which have a marketable value, and this object we attain in the manner hereinafter set forth, reference being had to the accompanying drawing, which represents in diagrammatic form an apparatus constructed in accordance with our invention for carrying out the process, which also forms part of said invention.

In treating garbage or swill for the recovery therefrom of those constituents which possess a market value the most rigid economy must be observed; otherwise the value of the resultant product will be less than the expense of treatment. Hence not only must great precaution be taken to prevent loss or waste of the reagent, but the expenditure of fuel required in carrying out the process must also be reduced to a minimum. The process and apparatus forming the subject of our invention have therefore been devised with these objects in view.

The reagent which we use is benzine, naphtha, or other volatile hydrocarbon which is of less specific gravity than water and which has the effect of a solvent upon grease or fats submitted to its action, especially when such action is under heat.

Water constitutes by far the greatest percentage of the garbage or swill which is to be treated, and any attempt to remove this water by drying the garbage before treatment would, because of its expense, be fatal to the commercial success of the process. A chemical reagent of the character specified, however, not only has the effect of dissolving the grease or fat which may be present in the garbage, but it also has the effect of displacing the water therein, so that it may be said to have the ef-

fect of drying the garbage in so far as that means the expulsion of the water therefrom, so that the latter will not affect the action of the reagent upon the grease or fat. The water being thus dislodged can be conveniently separated from the reagent and the grease in solution therein, so that the subsequent distillation, for the purpose of driving off the reagent from the grease in order that it may be again used in the treatment, is not hampered and rendered expensive by the presence of the water and the necessity of vaporizing the latter, as well as the reagent, in the still.

The accompanying drawing illustrates one form of apparatus which we have employed, and we will give a description of the construction and operation of the same in order that our invention may be clearly understood.

A is a vessel which may be termed a "storage-tank," in which the garbage or swill is first deposited, the lower end of this vessel communicating through a valved pipe *a* with the extractor B, and the upper portion of the vessel being, if desired, provided with a pipe *a'*, communicating with a fan *a*<sup>2</sup> for drawing off any gases or vapors which may be evolved from the mass while contained in said storage-tank.

A vessel, which we term a "settler," is represented at D, and F represents a still, G a heater for the fluid reagent, H a condenser, J J a pair of reagent-holders, and I a separator interposed between said reagent-holders and the condenser.

The upper portion of the extractor is in communication with the condenser through a pipe *b*, having a valve *b'*, and the upper portion of the still is also in communication with the condenser through a pipe *f*, having a valve *f'*, and the pipes *b* and *f* are connected by a cross-pipe N to a branch pipe P, a valve *n'* being interposed in the cross-pipe between the pipe P and the pipe *b* and a valve *n*<sup>2</sup> being interposed between the pipe P and the pipe *f*. The branch pipe P communicates through a pipe *a*<sup>3</sup> with a heating-coil *a*<sup>4</sup> in the storage-tank, this coil having a return-pipe *a*<sup>5</sup> leading to the condenser and provided with a valve *a*<sup>6</sup>, while the communication between the pipe P and the pipe *a*<sup>3</sup> is governed by a valve *a*<sup>7</sup>. The pipe P also communicates through a pipe



$b^2$ , having a valve  $b^3$ , with a heating-coil  $b^4$  in the lower portion of the extractor B, and this coil communicates with the condenser through a pipe  $b^5$ , having a valve  $b^6$ . Communication  
 5 between the pipe P and the heater G is effected by a pipe  $g$ , having a valve  $g'$ , and the lower portion of the heater is in communication with the condenser through a pipe  $g^2$ , having a valve  $g^3$ . The lower portion of the condenser  
 10 H communicates through pipes  $h'$   $h^2$  with the separator I, which has a drain-pipe  $i$ , with valve  $i'$ , said separator being also in communication with the reagent-holders J through a pipe  $i^2$  and its branches. Each of the reagent-  
 15 holders is in communication through a pipe  $j$ , having a valve  $j'$ , with the inlet of a pump K, which discharges into a pipe  $k$ , the latter passing through the heater G and being formed therein into a series of coils or convolutions  
 20  $k'$  or being otherwise so disposed as to cause extended travel of the reagent within the heater. The pipe  $k$  communicates with the bottom of the extractor, and it is also in communication with the upper portion of the set-  
 25 tler D through a pipe  $d$ , having a valve  $d'$ , and in the pipe  $k$ , between the pipe  $d$  and the heater G, is interposed a valve  $k^2$ . The pipe  $k$  has a branch  $s$ , with valve  $s'$ , through which, when desired, the extractor B may be dis-  
 30 charged of its liquid contents or a portion of the same, and the settler D has at the bottom a discharge-pipe  $d^2$ , with valve  $d^3$ , and a pipe  $d^4$ , with valve  $d^5$ , through which it commu-  
 35 nicates with the upper portion of the still, while communication between the top of the settler and the condenser is established by means of a pipe  $d^6$  having a valve  $d^7$ . The  
 still contains a steam-coil S and has at the bottom a discharge-pipe  $f^2$ , with valve  $f^3$ . The  
 40 pipe P communicates through a pipe  $m$ , having a valve  $m'$ , with an ejector or jet-pump M, having an inlet-pipe  $m^2$ , which communicates with the reagent-holders J, and is provided with a valve  $m^3$ , the outlet-pipe  $m^4$  of said  
 45 pump M communicating with the pipe  $k$  at a point between the extractor and the branch pipe  $d$ , and said pipe  $m^4$  being provided with a valve  $m^5$ .

The storage-tank A should be provided with  
 50 a suitable opening for the admission of the garbage, and the extractor B should be provided with an opening for the removal of the solid product resulting from the treatment, such opening of course being closed during  
 55 the treatment.

When the apparatus is in full working condition, both the extractor and the still are in operation, and the vapor from these vessels escapes therefrom through the pipes  $b$  and  $f$ ,  
 60 and by manipulating the valves  $b'$  and  $f'$  and  $n'$  and  $n^2$  as much or as little of this vapor as desired may be permitted to pass directly into the condenser, the remaining volume passing into the pipe P; or the valves  $b'$  and  
 65  $f'$  may be closed and the entire volume of vapor from the extractor and still may be directed into said pipe P, from which it passes

through the pipe  $g$  into the heater G and through the pipe  $b^2$  into the heating-coil  $b^4$  in the lower portion of the extractor, a portion  
 70 of the vapor being also in some cases directed to the heating-coil  $a^4$  in the storage-tank—as, for instance, in the winter season, when the garbage or swill is received in a frozen condition, it being then desirable to thaw the mass  
 75 in the storage-tank before admitting it to the extractor.

The pump K draws the liquid reagent from the holders J and forces it through the heater and pipe  $k$  into the extractor until the ma-  
 80 terial therein is completely immersed in said heated liquid reagent, whereupon the pump is stopped and the valve  $k^2$  closed, the heating-coil  $a^4$  then maintaining the liquid reagent in the extractor in the proper heated condi-  
 85 tion. During the extracting operation the valves  $d'$ ,  $m'$ ,  $m^3$ ,  $m^5$ , and  $s'$  are also closed; but when the treatment has been continued for the proper length of time the valve  $s'$  may be  
 90 opened to permit the discharge from the extractor of the water which has been dislodged by the reagent and has accumulated in the lower portion of the extractor, after which said  
 valve  $s'$  is closed and the valve  $d'$  opened, so that the reagent, with the grease in solution  
 95 therein, will be driven into the settler D by reason of the pressure in the extractor; or, if desired, the water may also be driven from the extractor into the settler D, together with the  
 100 reagent and grease, and separated from the latter in the settler by drawing it off through the drain-pipe  $d^2$ , the reagent, with the grease in solution therein, being drawn into the still  
 as required, and the grease being removed from the still through the drain-pipe  $f^2$  after  
 105 the volatile reagent has been driven off from said grease by the heat from the steam-coil S.

In order to retreat the charge in the extractor or to treat a fresh charge therein, the  
 110 valve  $d'$  is closed, the valve  $k^2$  again opened, and the pump K started, so as to again force the liquid reagent through the heater G and into the extractor, the pump being stopped when the desired amount of reagent has been in-  
 115 troduced and the valve  $k^2$  being then closed and the reagent maintained in the heated condition in the extractor by means of the heating-coil  $b^4$ . Any vapors which enter the vessel H are therein condensed and the liquid  
 120 flows into the separator I, in the lower portion of which the water of condensation accumulates and can be drawn off from time to time through the valved pipe  $i$ , the liquid solvent passing through the pipe  $i^2$  into the  
 125 holders J.

In some cases the jet-pump M may be used in addition to or in place of the pump K as a means of forcing the liquid reagent into the  
 130 extractor and at the same time heating the same, the valves  $m'$ ,  $m^3$ , and  $m^5$  in this case being opened, so that the jet of heated vapor from the pipe  $m$  will induce a flow of the liquid reagent through the pipe  $m^2$  and out through the pipe  $m^4$ , the heated vapor being



thus brought into intimate contact with the liquid reagent, so as to be condensed or partially condensed thereby at the same time that the liquid is heated by it. This effect of condensation or partial condensation of the heated vapor likewise results from passing the same through the heating-coils in the storage-tank and extractor and through the heater G.

It will be noted that our improved apparatus not only provides for the complete saving of all of the liquid reagent used in the treatment, so as to permit of its use again and again without waste, but said apparatus also involves the use of steam only for the purpose of heating the coil in the still and for operating the pump K when the jet-pump M is not used, and in some cases, also, for heating the reagent in the extractor when the operation is first started. Hence the expenditure of fuel in carrying out the process is reduced to a minimum.

Although it is preferable to use both the heater G and the heating-coil in the extractor, either of these may be used to the exclusion of the other, and although it is also preferable to use one or more reagent-holders J the heater G itself may in some cases constitute, also, the reagent-holder. For instance, in the construction shown the coils in the vessel G would constitute such reagent-holder and would receive the reagent directly from the condenser if the latter were used, for in cases where the passage of the vapor through the heating-coils in the storage-tank and extractor and through the heater and connecting-pipes is sufficient to effect the condensation of said vapor a special condensing-vessel may be dispensed with.

Another obvious modification of our invention is one in which the pipes are so arranged that the vapor-pipe from the still supplies the heating-coil in the extractor, and the vapor-pipe from the latter supplies the heater G and the coil in the storage-tank.

The settler D provides for the deposit of foreign matters of a solid character which may be carried over into the settler from the extractor, so that these foreign matters can be withdrawn from the settler and prevented from passing into the still, where their presence would be objectionable.

Having thus described our invention, we wish it to be understood that we do not desire to claim, broadly, the extraction of fats or fatty matters by means of benzine, naphtha, or other volatile reagent of low specific gravity, as this has long been known and practiced; but

We claim as our invention and desire to secure by Letters Patent—

1. The within-described method of treating swill or garbage containing water, said method consisting in immersing the garbage while in a suitable vessel in a heated liquid reagent which is a solvent of grease and is of less specific gravity than water, so as to displace

the water in the garbage and take up the grease, separating the water from the reagent with the grease in solution therein, distilling the reagent from the grease, and subjecting the fresh supplies of liquid reagent to the action of the vaporized reagent given off in the treatment, whereby the liquid reagent is heated and the vaporized reagent is at the same time condensed or partially condensed, substantially as specified.

2. The combination, in apparatus for treating garbage with a heated liquid reagent, of the following elements, namely: an extractor, means for conducting liquid reagent thereto, a still, a communication through which liquid can be conveyed from the extractor to the still, means for separating the water from the reagent and grease before the latter enters the still, a heater for the liquid reagent, vapor-pipes leading from the extractor and still, and a vapor-conducting pipe leading to the heater, substantially as specified.

3. The combination, in apparatus for treating garbage with a heated liquid reagent, of the following elements, namely: an extractor, a still, a settler interposed between the extractor and still, means for conducting liquid reagent to the extractor, a heater for the liquid reagent, vapor-pipes leading from the extractor and still, and a vapor-conducting pipe leading to the heater, substantially as specified.

4. The combination, in apparatus for treating garbage with a heated liquid reagent, of the following elements, namely: an extractor, a still, a settler interposed between the extractor and still, means for conducting liquid reagent to the extractor, a heater independent of the extractor and adapted to heat the liquid reagent before the latter enters the extractor, vapor-pipes leading from the extractor and still, and a vapor-conducting pipe leading to the heater, substantially as specified.

5. The combination, in apparatus for treating garbage with a heated liquid reagent, of the following elements, namely: an extractor, a still, a settler interposed between the extractor and still, means for conducting liquid reagent to the extractor, a heater for the liquid reagent contained within the extractor, a second heater for said reagent independent of the extractor, vapor-pipes leading from the extractor and still, and pipes for conveying vapor to both of said heaters, substantially as specified.

6. The combination, in apparatus for treating garbage with a heated liquid reagent, of the following elements, namely: an extractor, a still, a settler interposed between the extractor and still, means for conducting liquid reagent to the extractor, a condenser, a heater for the liquid reagent, vapor-pipes leading from the extractor and still, and pipes for conveying vapor first to the heater and then to the condenser, substantially as specified.

7. The combination, in apparatus for treat-



ing garbage with a heated liquid reagent, of the following elements, namely: an extractor, a still, a settler interposed between the extractor and still, means for conducting liquid reagent to the extractor, a condenser, a heater for the liquid reagent, vapor-pipes leading from the extractor and still to the condenser, and pipes for conveying vapor first to the heater and then to the condenser, substantially as specified.

8. The combination, in apparatus for treating garbage with a heated liquid reagent, of the following elements, namely: a storage-tank having a heater therein, an extractor communicating with said storage-tank, a still, a settler interposed between the extractor and still, means for conducting liquid reagent to the extractor, a condenser, vapor-pipes leading from the extractor and still to the condenser, and a pipe for conveying vapor from

said pipes to the heater in the storage-tank, substantially as specified.

9. The combination, in apparatus for treating garbage with a heated liquid reagent, of the following elements, namely: an extractor, a still, a settler interposed between the extractor and still, means for conducting liquid reagent to the extractor, a holder for the liquid reagent, vapor-pipes leading from the extractor and still, a jet-pump communicating with the reagent-holder and with the extractor, and a pipe for conveying the vapor to said jet-pump for the purpose of operating the same, substantially as specified.

CHARLES F. SIMONIN.  
ISAAC M. SIMONIN.

Witnesses:

A. P. JENNINGS,  
JOHN A. WIEDERSHEIM.