

S. VAN SYCKEL.

Apparatus and Processes for Treating Petroleum.

No. 143,945.

Patented Oct. 21, 1873.

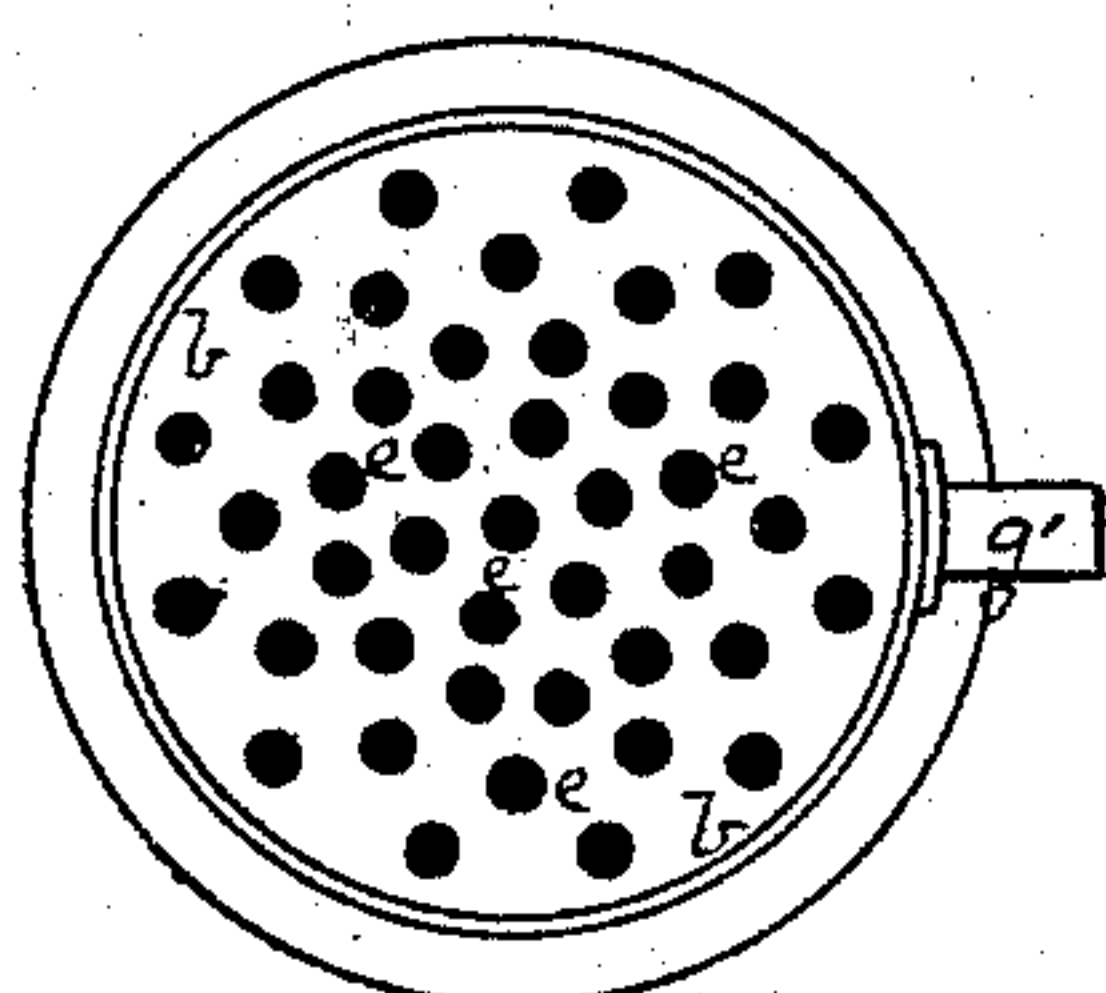


Fig. 2.

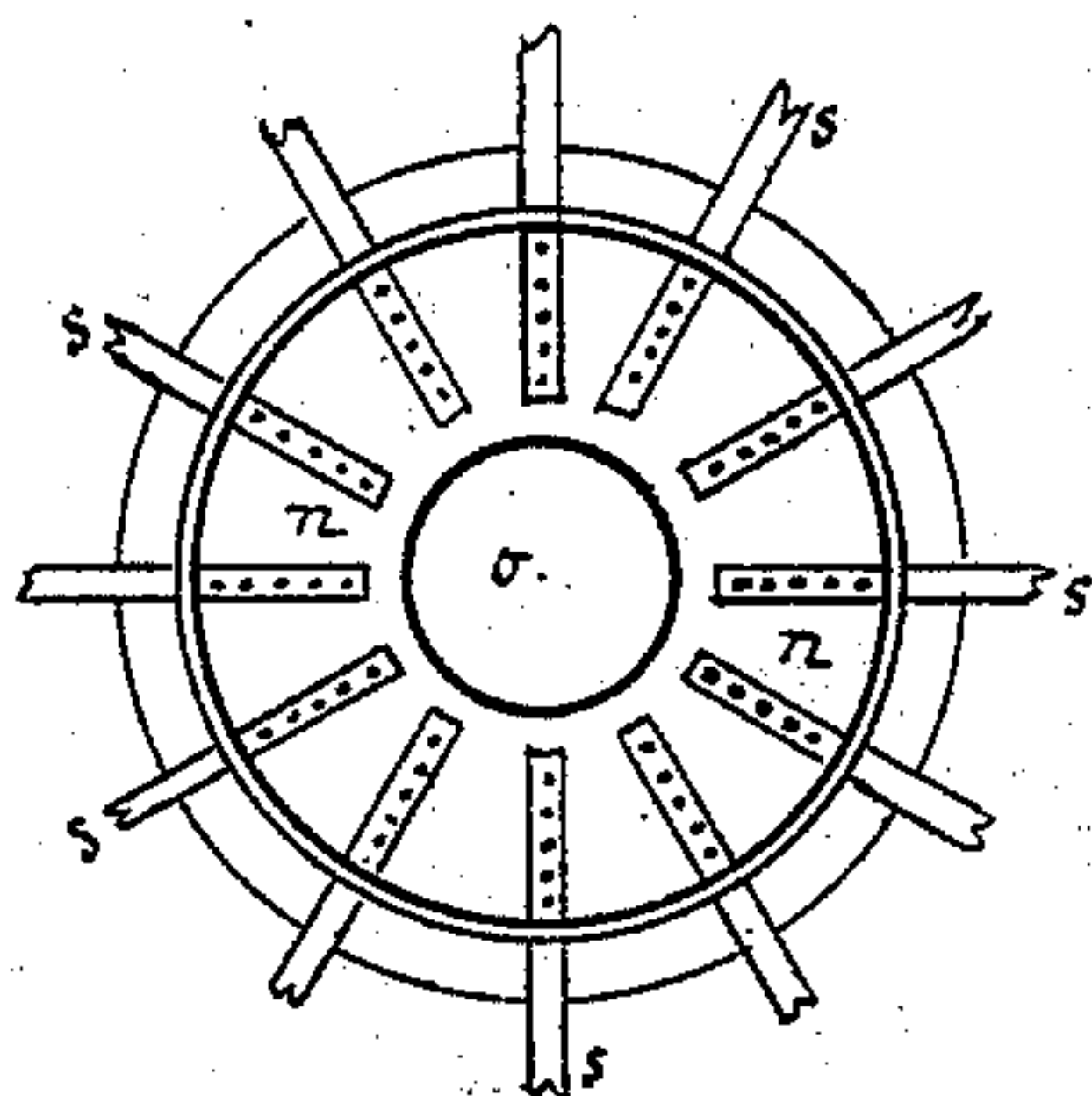


Fig. 3.

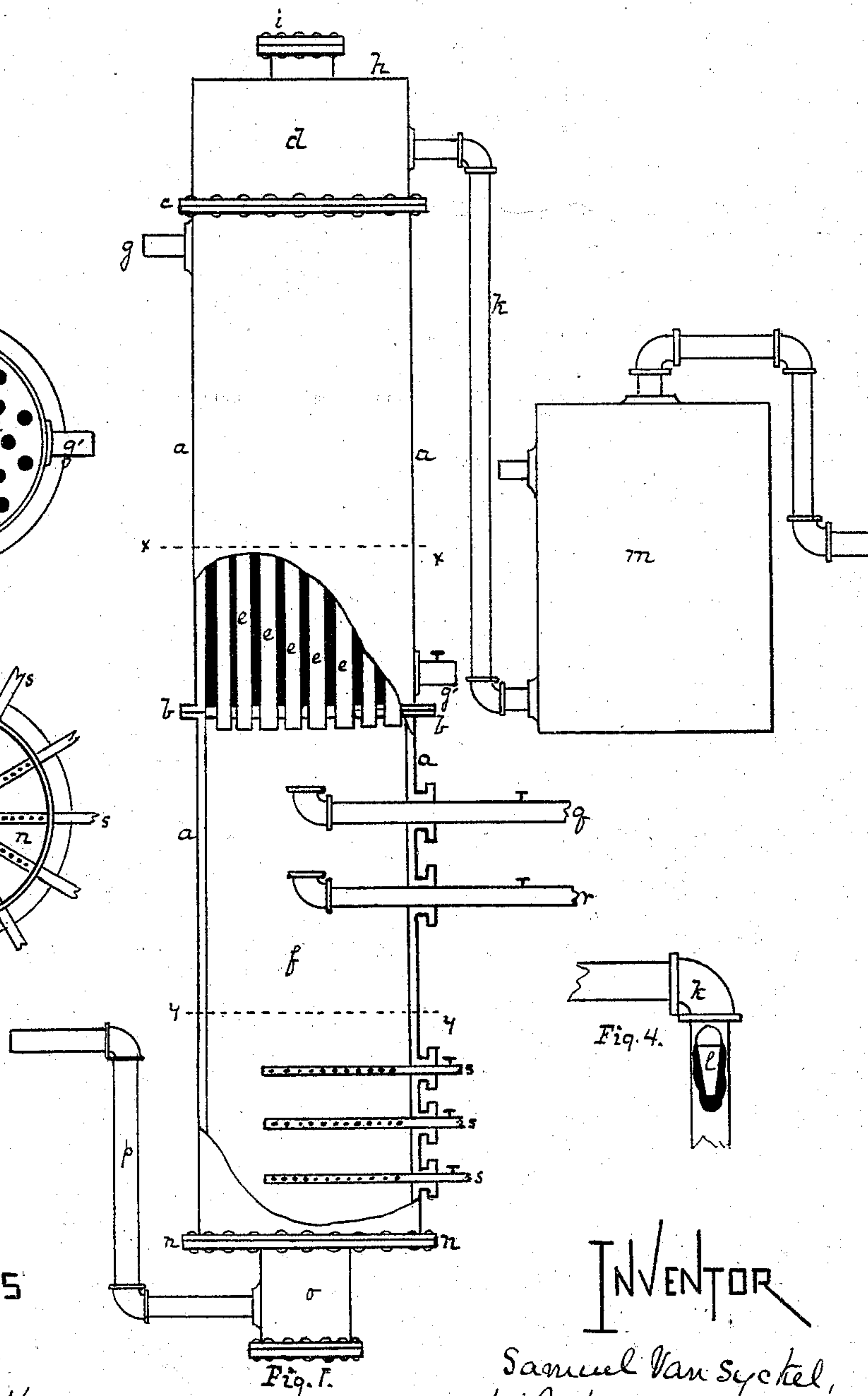


Fig. 1.

Fig. 4.

WITNESSES

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# UNITED STATES PATENT OFFICE.

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## IMPROVEMENT IN APPARATUS AND PROCESSES FOR TREATING PETROLEUM.

Specification forming part of Letters Patent No. **143,945**, dated October 21, 1873; application filed July 8, 1873.

*To all whom it may concern:*

Be it known that I, SAMUEL VAN SYCKEL, of Titusville, in the county of Crawford and State of Pennsylvania, have invented a new and useful Improvement in Apparatus and Process for Treatment of Petroleum; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to the treatment of crude petroleum, for the purpose of removing by separation, and without destructive distillation of, the non-condensable or permanent gas, so as to bring the oil under treatment to a high fire-test, without the production during the said process of benzine, rhigoline, gasoline, or other light condensable liquids usually produced during the first stages of the distillation of petroleum; or, if desired, the process can be used for the separation of those lighter products at such gravity or gravities as may be required.

To enable others skilled in the art to make and use my improvement, I will proceed to describe its construction and mode of operation, referring for that purpose to the drawing hereunto annexed, in which—

Figure 1 is a side elevation, partly in section, of my improved apparatus. Fig. 2 is a cross-section through *xx* of Fig. 1. Fig. 3 is a like section through *yy* of Fig. 1; and Fig. 4 shows the ejector in the gas-pipe.

Like letters of reference indicate like parts in each.

In Fig. 1, *a* is a cylindrical vessel, made of boiler-iron or other suitable material, of a height of from thirty to fifty feet, and a diameter from one to four feet. These and other dimensions given in this specification are merely for the purpose of illustration, and may be varied according to the desired capacity of the apparatus and the condensing power which may be desired. This cylinder is placed in a vertical position. From a point about one-third in height from the bottom of the cylinder is placed the horizontal diaphragm *b*, and near the top of the cylinder is a similar horizontal diaphragm, *c*. These diaphragms are perforated by a series of apertures, in which are placed vertical pipes or flues *e*, from one to two inches in diameter, which open through these diaphragms, forming a free communica-

tion between the chamber *d* at the top of the cylinder and the space *f* at the lower end. This series of flues *e* between the diaphragms *b* and *c* forms a condensing-chamber, and the space between the diaphragm and outside the pipes is to be filled with cold water, which flows in at a pipe, *g*, near the top of the condensing-space, below the diaphragm *c*, and flows out at a pipe, *g'*, near the bottom of the condensing-space, and above the diaphragm *b*, which pipe *g'* may be extended up outside of the cylinder *a* to a point a little below the inflow water-pipe *g*, so as to preserve the water in the condensing-chamber to a level a few inches only below the upper diaphragm *c*; or the same end may be attained by the use of a suitable cock, as shown. The cylinder *a* is covered at the top by a head, *h*, in the center of which is a man-hole, covered by a cap, *i*. The chamber *d* above the upper diaphragm *c* forms a gas-chamber, from which extends a pipe, *k*, for the outflow of gas, which is extended down to or near the level of the lower diaphragm *b*, outside the cylinder. At a suitable point in the outflow of gas-pipe *k* is introduced a steam-jet, *l*, Fig. 4, for the purpose of aiding the outflow of gas and drawing it off from the gas-chamber *d*. The pipe *k* is extended horizontally or otherwise, so as to conduct the permanent gas to a gas-receiver, or, if desired, directly to some point where it is desired to be utilized as fuel or otherwise. In place of the steam-jet in the pipe *k*, a vacuum-pump may be used, if desired. Near the bottom of the cylinder *a* a man-head may be made, for the purpose of entering the cylinder for cleaning or repairs. The lower end of the cylinder *a* is closed by a head, *n*, of cast-iron or boiler-plate, bolted to the cylinder, in the center of which is introduced a vertical pipe, *o*, of sufficient diameter to carry off the oil after having been treated in the apparatus, and this vertical pipe *o* communicates, near its lower end, with a pipe, *p*, which rises up outside of the cylinder *a* to a height of from two to four feet above the lower plate *n* of the cylinder *a*, so as to preserve at all times, during the operation of the apparatus, a quantity of oil of from two to four feet in depth in the cylinder. The oil to be treated is introduced into the cylinder below the lower diaphragm *b* of the condensing-chamber through one or more



supply-pipes, *q*, which lead from the tank or other vessel containing oil to be treated. Below the supply-pipe *q*, and above the highest point of the outflow-pipe *p*, is introduced an air-pipe, *r*, for the purpose of admitting atmospheric air outside into the cylinder *a*. At about or below the level of the top of the outflow-pipe *p*, which will be about the level of the surface of the oil in the cylinder *a*, are introduced one or more steam-pipes, *s*. That portion of the pipe or pipes *s* which is within the cylinder *a* is perforated with a number of fine holes for the purpose of allowing the escape of naked steam into the oil under treatment.

The operation of the apparatus which I have described is as follows: The condensing-chamber between the diaphragms *b* and *c*, and around the flues *e*, is supplied with a current of cold water through the pipe *g*, which, as it becomes heated, continually flows out at the pipe *g'*. Crude oil is allowed to flow in continuously through the supply-pipe *q*, and stands in the lower part of the cylinder *a* at or about the height of the top of the outflow-pipe *p*. Steam at the ordinary temperature is introduced from a steam-boiler or other steam-generator to the pipe or pipes *s*, and escapes freely into the body of the oil under treatment, the effect of which is that permanent gas is evolved, which, rising up, passes through the flues *e* into the gas-chamber *d*, and thence is drawn off by means of the steam-jet or vacuum-pump through the pipe *k*. The oil thus relieved of its permanent gas flows off through the pipes *o* and *p*. The length of time during which it is subjected to this treatment will depend, of course, upon the rapidity with which the oil is supplied through the pipe *q*.

In an apparatus of the size which I have described, the oil may be flowed in through the pipe *q* at the rate of about a barrel a minute. But no specific time can be stated during which the oil ought to be treated, as the result will depend upon the length of treatment and the heat of the steam used, which will have to be varied according to the result desired to be attained, and the size of the apparatus used.

By increasing the size of the machine, the rapidity with which the oil can be treated may be increased; and if the supply is kept up constantly through the pipe *q*, the operation will be continuous.

In case it is desired to use my apparatus so as not only to remove the permanent gas, but also to produce benzine, gasoline, or other light liquid products from the oil, the apparatus used is the same as I have already described, with the exception that an additional condensing apparatus, *m*, is employed outside of the apparatus already described, for the purpose of condensing the lighter condensable vapors, and the process which I have described is varied in this case by keeping the condensing-chamber between the diaphragms *b* and *c* in the apparatus I have described at a higher

temperature, by allowing water to flow less rapidly through the pipes *g g'*. By this means the condensing power is reduced, and condensable vapors are allowed to pass off through the flues *e* and the pipe *k*, together with the non-condensable gas. Then by passing these vapors, which pass through the pipe *k*, through a separate condensing apparatus, of any usual description, surrounded by a refrigerating mixture, these condensable vapors are condensed. Thus by regulating the temperature of the condensing-chamber between the diaphragms *b* and *c* in my apparatus, I am enabled to obtain lighter products of petroleum, such as benzine, gasoline, &c., at any gravity which may be required, and in greater quantity than can be obtained by any other known process; or, if preferred, as I have already stated, the process may be carried on so as to produce no condensable vapors, but permanent gas only, the result in either case on the crude petroleum being to deprive it of its lighter ingredients, and bring it down to a high fire test.

One of the advantages of my process is that the requisite amount of gas to supply fuel for the boilers and stills of a distillery may be at all times produced by treating crude oil at such times and in such quantities as the demand for fuel may indicate; as I have ascertained to be a fact, that the quantity of permanent gas producible by my process from crude petroleum, and which ought to be removed therefrom in order to bring it to the requisite fire test, is, in ordinary cases, amply sufficient to supply all the fuel required for the conducting the process of distillation, and the generation of the amount of steam required for carrying on an oil-refinery.

In that part of the operation in which only oil and fixed gas are produced, the condenser is of such height that practically all oily vapors will be condensed and fall back into the space *f*. To this end the oil in the chamber *f* should, by the steam which is admitted, be kept at a temperature of about 180° Fahrenheit, and the condenser should be such that the vapors and gas will, on entering the chamber *d*, be brought down to say 60° or 80° Fahrenheit, at which temperature they will contain little or no oil.

By this process none of the oily matter is wasted in the form of gasoline or benzine, a larger quantity and better quality of oil is secured, the operation is carried on continuously and more rapidly, and the fixed gases are utilized as fuel.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The process hereinbefore described of treating crude petroleum with the resultant product of only oil and gas, by effecting the condensation of the oleaginous vapors, and the immediate return of the condensed product to the body of oil in the treating-chamber, and carrying over only the uncondensable gases, substantially as set forth.



2. The arrangement of the condensing apparatus described above, the treating-chamber, with a direct communication from the latter through the former, and in suitable position for the direct reflow of the condensed product, substantially as set forth.

3. The combination of a vertical chamber, *f*, for treating crude oil, furnished at or near its lower end with a pipe or pipes for the admission of steam, and a condensing-chamber arranged above, with condensing-pipes for condensing the oily vapors, and a gas-pipe from the dome or chamber above for carrying off the uncondensed gases, substantially as set forth.

4. The combination of the treating-chamber, the condensing apparatus above, the gas-pipe

and steam-jet or vacuum apparatus, arranged and combined substantially as set forth.

5. The combination of the treating-chamber *f*, condensing-flues *e*, pipe *k*, condenser *m*, and jet-pipe *l*, arranged substantially as set forth.

6. In combination with the oil-treating and condensing-column *a*, the supply-pipe *g*, the delivery-pipe *p*, and one or more steam-pipes *s*, substantially as described.

In testimony whereof I, the said SAMUEL VAN SYCKEL, have hereunto set my hand.

SAMUEL VAN SYCKEL.

Witnesses:

T. B. KERR,

G. H. CHRISTY.