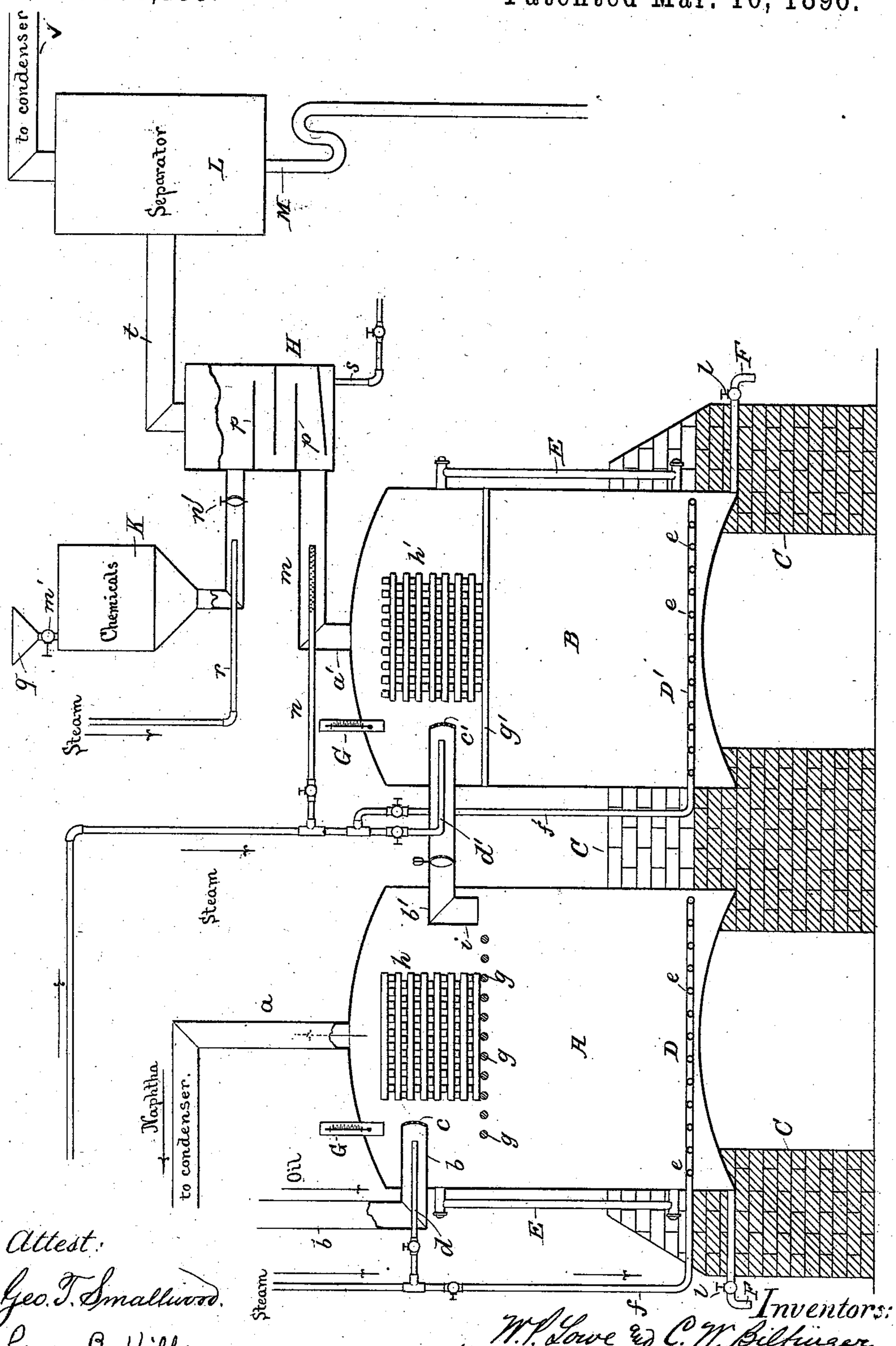
(No Model.)

# W. P. LOWE & C. W. BILFINGER.

## PROCESS OF AND APPARATUS FOR DISTILLATION OF OIL.

No. 556,155. Patented Mar. 10, 1896.




Attest:
Geo. T. Smallwood.
Percy B. Hills.

Inventors:
W. P. Lowe & C. W. Bilfinger
by Pennie & Goldsborough, Attys

# UNITED STATES PATENT OFFICE.

WALTER P. LOWE, OF CLEVELAND, AND CHARLES W. BILFINGER, OF LIMA, ASSIGNORS TO THE MANHATTAN OIL COMPANY, OF TOLEDO, OHIO.

## PROCESS OF AND APPARATUS FOR DISTILLATION OF OIL.

SPECIFICATION forming part of Letters Patent No. 556,155, dated March 10, 1896.

Application filed December 16, 1890. Serial No. 374,863. (No model.)

*To all whom it may concern:*

Be it known that we, WALTER P. LOWE, residing at Cleveland, county of Cuyahoga, and CHARLES W. BILFINGER, residing at Lima, county of Allen, State of Ohio, citizens of the United States, have invented certain new and useful Improvements in Processes of and Apparatus for the Distillation of Oil; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to the distillation of oil, and more particularly to the distillation of crude petroleum for the purpose of obtaining purified, refined, and deodorized products of different gravities therefrom.

The invention is based upon the discovery that superheated steam may be successfully employed for the continuous introduction of the oil under treatment into the distilling-vessels in the form of a spray and for distributing such spray upon an extended surface of refractory material, so as to assist in its rapid distillation; that superheated steam passed upwardly through the heavy oils within the still will more effectually and quickly drive off the imprisoned lighter oils and vapors therefrom, and will produce a tar residuum free from coke and devoid of water, and that superheated steam introduced into the current of vapors on their way to the condensers and separators is particularly efficacious in breaking up and destroying the obnoxious sulphur compounds which impart a disagreeable odor to many crude petroleums.

The invention consists in an improved process and apparatus for practically realizing the advantages of these discoveries without danger to the operator and at a moderate cost of construction and manipulation.

In the accompanying drawing, forming a part of this specification, we have illustrated the preferred form of apparatus for the practice of our invention.

Referring to the drawing, A and B indicate two distilling vessels or stills of ordinary construction suitably set or mounted within the brickwork of a furnace C in such manner as to receive the impact and heating effect of the hot products of combustion upon their bottom portions.

From the summit of the still A extends the pipe *a*, serving, as will be hereinafter more fully set forth, for the exit of the vapors of naphtha and benzine of light gravity produced in the first stage or period of the general operation and leading to a condenser for the liquefaction and recovery of said vapors.

Near the top of the still A enters the pipe *b* leading from any suitable source of oil supply and terminated at its end by a covering *c* of wire-gauze, perforated metal or similar substance which will insure the breaking up of the coil passing through it into fine streams, sprays or jets. The pipe *b* has preferably a bend, as shown, through which enters the open-ended pipe *d* for the admission of steam superheated to about 600° Fahrenheit, said pipe *d* terminating somewhat in advance of the covering *c*, so as to permit the oil to flow past its open end and to be forced by the steam through perforations of the covering *c*.

At the bottom of the still A is located a pipe-coil D, said coil being provided with perforations *e* throughout its length, and being connected to a pipe *f* furnishing steam superheated to about 600° Fahrenheit. Rods *g* extend across the still A at a point below the pipe *b*, and upon these supporting-rods is built up a series *h* of refractory bars, preferably of iron, piled in alternate courses one upon the other and spaced apart so as to leave intervening spaces, the entire body forming an open-work structure located immediately in front of the oil-spraying device, and presenting an extended highly-heated surface upon which the oil is sprayed and from which the heavier oils drip down into the lower portion of the still, while the naphtha and benzine vapors pass upward through the pipe *a*.

An overflow-pipe *b'*, having a bend *i* for the purpose of preventing the entrance of any portion of the oil-spray from the opposite pipe *b*, passes from the still A into the still B. It is located at a lower level than the pipe *b*, and serves to conduct into the still B the heavy oils resulting from the distillation in still A. It terminates in a covering *c'* in all respects

similar to the covering *c*, and within it is the superheated-steam pipe *d'*, furnishing steam at a temperature of about 1,000° Fahrenheit and similarly located to the steam-pipe *d* and having like functions. The still B is furthermore provided with a perforated pipe-coil D' receiving its supply of superheated steam of 1,000° Fahrenheit from the pipe *d'*, and with rods *g'* and superposed bars *h'* and vapor-pipe *a'*, all corresponding in construction and function to the similar parts in still A.

Each still is provided with an oil-level gage E for observing the oil-level, and with a draw-off pipe F having a twin plug or valve *l* for drawing off the tar from the stills from time to time, as required. Thermometers G may also be provided so as to observe the prevailing temperatures within the stills.

The vapor-pipe *a'* from the still B has an extended prolongation *m* into which projects the superheated-steam pipe *n*, perforated at its inner end, as shown, so that the issuing superheated steam which is at the temperature of about 1,000° Fahrenheit shall intimately mix with and permeate the oil-vapors in the pipe *m* and shall come in contact with and destroy or break up as far as possible the sulphur compounds therein. This action may be assisted in the chamber H by the passage of the vapors back and forth in zigzag course over and between the inclined partitions or shelves *p* supporting solid desulphurizing agents, or over which liquid desulphurizing agents may be caused to flow from the receptacle K, having a hopper *q*, stop-cocks *m' n'*, and steam-injector pipe *r*. A drawing-off pipe *s* is provided for the chamber H. Good results may, however, be attained without the employment of any chemicals whatever, and we do not therefore intend to restrict ourselves to their employment.

From the chamber H a pipe *t* leads to a separator L, in which some of the heavy oils are recovered and trapped off by the trap M, the remaining vapors escaping by the pipe *v* to the condenser, where the final condensable products are recovered, the residual gas escaping into the atmosphere or otherwise.

It will be understood that the various pipes will be provided with suitable regulating-valves, as required.

The operation of the invention will be apparent. The crude Lima or other oil entering the pipe *b* at a temperature of 110° to 125° Fahrenheit is forced by the jet *d* of superheated steam of 600° Fahrenheit in a fine spray upon the bars *h*, over whose extended surface it spreads in a thin film or layer, constantly exposed to the continuing action of the injecting device. The bars *h* being interposed directly in the path of the injected oil and superheated steam soon attain a temperature very nearly approximating that of the spray, and thus serve as reservoirs of heat, which heat is continuously imparted to the oil upon them, thereby assisting in its volatilization. The result of the operation in the still A is that the naphtha and benzine vapors pass upward through the pipe *a* to their condenser, while the heavy oils drip from the bars *h* into the lower portion of the still, in which they collect, submerging the coil D. During the injecting operation steam superheated to 600° Fahrenheit is admitted through the perforations of the coil D, and passing upward through the heavy oil carries off any light naphtha vapors or oils that may still be contained therein. The constant agitation produced by the passage of the steam through the heavy oils prevents any charring or coking of the tar that collects at the bottom of the still, and the high temperature of the steam insures against the admixture of water with the tar, which is accordingly, when drawn off from time to time through the pipe F, free from coke and dry. As the operation continues the quantity of heavy oil in the still A constantly increases until it reaches the level of the pipe *b'*, whereupon it begins to flow into the said pipe. When this heavy oil attains a sufficient level in the pipe *b'*, the steam-jet *d'* of 1,000° Fahrenheit is turned on, whereupon the oil is injected in the form of jets or spray upon the refractory bars *h'*, which, being brought by the steam-jet to a higher heat than the bars *h*, serve to volatilize the heavy oil to a very large extent, the portions that are not volatilized dripping down into the main body of the still B and submerging the perforated steam-coil D'. Thereupon superheated steam at about 1,000° Fahrenheit is admitted through the pipe *f'* into the said coil D', and escaping through the perforations therein passes upward through the oil above, agitating it and driving off in the form of vapor any imprisoned oils and vapors capable of volatilization at 1,000° Fahrenheit. This vapor, together with the vapor produced by the spraying device and bars *h'*, passes upward through the pipe *a'* into the prolongation *m*, where it meets the steam, superheated to about 1,000° Fahrenheit, which enters through the pipe *m*. This superheated steam thoroughly mixes with and permeates the vapors on their way to the separator L and abstracts practically all of the sulphur they contain. Should a product of extraordinary purity be desired, liquid chemicals of appropriate character may be introduced into the chamber H by means of the steam-jet *r*, said liquid chemicals flowing over the shelves *p* and being tapped off, as desired, through the pipe *s*, or the shelves *p* may receive merely a charge of solid chemicals, which may from time to time be removed and a fresh charge substituted. In many instances, however, we will dispense entirely with the chamber H and its adjuncts. Through the pipe *t* the oil-vapor and superheated steam enter the separator L, of relatively large capacity, in which a large portion of the oil-vapor is recovered and trapped off by the trap M. The remainder of the oil-vapor and the steam passes to

the condenser by the pipe *v*, in which condenser they are reduced to a liquid condition and recovered, any uncondensable portions passing out finally into the air.

The tar formed in the still B and other heavy residuums which are the final products in said still may be drawn off by the pipe F and will be found to be devoid of coke or water.

The process as an entirety is a continuous one, and to insure its continuance requires merely that the crude oil be fed in through the pipe *b* in regulated quantity, while the other parts of the apparatus maintain their operation, the by-products being removed from time to time, and the temperatures and oil-levels being kept constant by observance of the thermometers and gages. It will of course be understood that during the entire operation the heat of the furnace C maintains the stills A and B at an appropriate temperature.

Having thus described our invention, what we claim, and desire to secure by Letters Patent, is—

1. An oil-still provided at its top portion with a heat-storing and heat-absorbing structure sustained therein, the lower portion of the still forming a receptacle for the collection of drippings from said structure, an oil-admission pipe, a steam-injector pipe therefor both of said pipes being located in front of said structure, and a vapor-exit pipe; substantially as described.

2. Oil-distilling apparatus consisting of two stills, each provided with an oil-admission pipe, a steam-injector pipe therefor, an open-work body of refractory material in front of said pipes, and a vapor-exit pipe, the oil-admission pipe of the second still extending into the interior of the first still; substantially as described.

3. Oil-distilling apparatus consisting of two stills, each provided with an oil-admission pipe, a steam-injector pipe therefor, an open-work body of refractory material in front of said pipes, and a vapor-exit pipe, the oil-admission pipe of the second still extending into the interior of the first still; in combination with a steam-pipe extending into the vapor-exit pipe of the second still; substantially as described.

4. Oil-distilling apparatus consisting of two stills, each provided with an oil-admission pipe, a steam-injector pipe therefor, an open-work body of refractory material in front of said pipes, and a vapor-exit pipe, the oil-admission pipe of the second still extending into the interior of the first still; in combination with a steam-pipe extending into the vapor-exit pipe of the second still; and a purifying-chamber adapted to receive a charge of liquid or solid chemicals and communicating with said second vapor-exit pipe; substantially as described.

5. Oil-distilling apparatus consisting of two stills, each provided with an oil-admission pipe, a steam-injector pipe therefor, an open-work body of refractory material in front of said pipes, and a vapor-exit pipe, the oil-admission pipe of the second still extending into the interior of the first still; in combination with a steam-pipe extending into the vapor-exit pipe of the second still; and a purifying-chamber adapted to receive a charge of liquid or solid chemicals; said purifying-chamber being provided with an auxiliary feeding-receptacle opening thereinto and having a steam-injector pipe and communicating with said second vapor-exit pipe; substantially as described.

6. Oil-distilling apparatus consisting of two stills, each provided with an oil-admission pipe, a steam-injector pipe therefor, an open-work body of refractory material in front of said pipes, and a vapor-exit pipe, the oil-admission pipe of the second still extending into the interior of the first still; in combination with a steam-pipe extending into the vapor-exit pipe of the second still; a separator, and a pipe leading to a condenser; substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

WALTER P. LOWE.
CHARLES W. BILFINGER.

Witnesses:
THOS. MCDONALD,
JOHN PFAUNSTIEL.