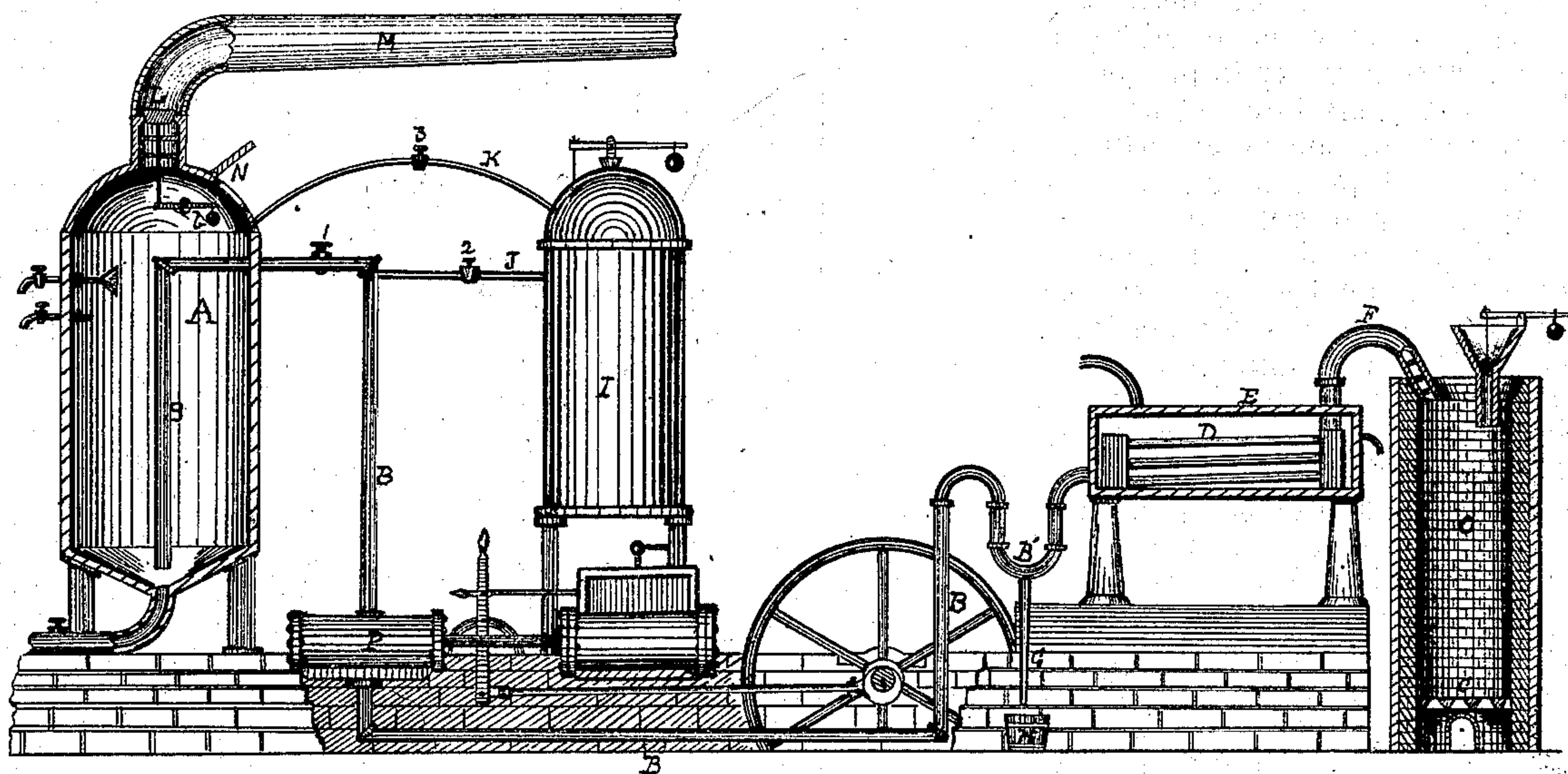


HERBERT W. C. TWEDDLE.

Improvement in Refining Hydrocarbon Oils.

No. 120,349.

Patented Oct. 24, 1871.



Witnesses:  
R. O. Ormsby  
James I. Kay

Inventor:  
Herbert W. C. Tweddle,  
by Bakewell, Christy & Herrick  
his Attys.



# UNITED STATES PATENT OFFICE.

HERBERT W. C. TWEDDLE, OF PITTSBURG, PENNSYLVANIA.

## IMPROVEMENT IN REFINING HYDROCARBON OILS.

Specification forming part of Letters Patent No. 120,349, dated October 24, 1871.

*To all whom it may concern:*

Be it known that I, HERBERT W. C. TWEDDLE, a subject of the Queen of Great Britain and Ireland, and resident of the city of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improved Mode of Agitating Hydrocarbon Oils; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawing forming part of this specification, which exhibits the apparatus which is adapted to the practical application of my improvement.

The object of my improvement is to avoid the danger attending the modes ordinarily employed by distillers of petroleum, of agitating the oil for the purpose of refining it by the mixing of acids and alkalis therewith, &c.

The most approved method adopted for securing the thorough commingling of the chemicals employed with the oil is to place the petroleum or petroleum distillate, as the case may be, in a tank or receiver, and, after introducing the acid and alkali to cause the violent and constant ebullition of the contents of the tank, by passing through the oil a current of atmospheric air, which is forced in by means of an air-pump. Petroleum, being a hydrocarbon, readily evolves hydrocarbon vapor, and when air is forced through it the oxygen of the air coming in intimate contact with the hydrocarbon vapor combines with it, forming, as is well known, a highly-explosive gaseous mixture. By some means or other, either from the intense heat frequently evolved by the rapid action of the force-pump or otherwise, this mixed gas takes fire, and the result is not only destructive to the tank and its contents, but is extremely dangerous to the lives of the persons engaged about the works. Such, at least, is my idea of the cause of the frequent explosions which occur in the agitating-tanks in oil-refineries; but, whatever may be the immediate cause of the explosion of the mixed gas and vapor thus evolved, whether it be heat, or elasticity as some suppose, the fact is undoubted that the danger would be escaped if the formation of an explosive gaseous compound could be prevented. This desirable result I effect by using, for the agitation of the oil in the tank, instead of atmospheric

air, any non-inflammable gas, or gas which will not support combustion, such as carbonic-oxide, or carbonic-acid, or nitrogen gas, or any mixture or compound thereof. These gases, or any of them, mixed with hydrocarbon vapor in any proportions, form non-explosive mixtures; and as carbonic-acid gas may be readily and cheaply generated, I prefer to make use of it. This I accomplish by forcing a stream of carbonic-acid gas, by means of a pump, through the oil in the tank, for the purpose of agitating it in presence of the acid and alkali, and also by supplying the space at the top of the tank, not occupied with the oil, with the same non-inflammable gas when the process of agitation is not being carried on, using a slight pressure so as to insure the presence of the gas and exclude the entrance of any atmospheric air.

To enable others skilled in the art to make use of my improvement, I will proceed to explain it more fully in connection with suitable apparatus for its practical application.

In the drawing, A represents the tank for holding the oil during the process of agitation. A pipe, B, enters the tank at or near the top, and extends down nearly to the bottom, for the purpose of introducing the gas by which the ebullition of the oil is to be effected. A suitable furnace, C, is provided, in which is burned coke, charcoal, anthracite coal, or other suitable fuel. The pipe B connects, as hereinafter described, with the upper part of the combustion-chamber of the furnace C. Between the furnace C and the tank A is placed a refrigerating apparatus, consisting of a series or coil of small diameter pipe, D, passing through the vessel E, which is constantly supplied with a flow of cold water. The pipe B connects with the lower end of the series of pipes D, and the pipe F, from the upper part of the combustion-chamber of the furnace, connects with the upper end of the series of pipes D. There is an elbow at B' in the pipe B, outside of the tank A and between it and the refrigerating-pipes D, from the lowest point of which a vertical pipe, G, descends to a small tub or vessel, H, containing water, into which the end of the pipe G is immersed, thus sealing it at that point. This pipe G is to carry off any water which may be formed in the pipe leading from the furnace C to the tank A.



A reservoir or gas-holder, I, is placed near the tank A, which may be supplied with the non-inflammable gas by a connecting-pipe, J, from the main gas-pipe B, by opening the cock 2, and a pipe, K, of small diameter, leads from this reservoir I to the top of the tank A, so as to supply the space in the interior of the tank not occupied with oil with the gas from the furnace C, when necessary. The gas being forced into the reservoir, is contained therein under pressure, and passes out to the agitator whenever the cock 3 is opened. On top of the tank A is a valve, L, furnished with a weighted lever, b, so as to regulate the pressure which the valve will sustain. This valve L opens upward and outward, so that when the pressure is too great the valve will open and allow the gas to escape into the pipe M, which leads it off to any desired distance or height, which may be sealed at its outer extremity so as to prevent the entrance of atmospheric air.

When the process of agitation is being conducted the constant flow of gas into the oil in the tank will keep the valve open and allow the gas to escape freely through the valve L. The weight on the valve may be adjusted without opening the door of the man-hole N at top of the tank A, which should be tight closed so as to permit a pressure of the non-inflammable gas in the agitator. An air-pump, P, is connected with the main gas-pipe B, between the tank and the refrigerator, for the purpose of drawing the non-inflammable gas from the furnace and through the refrigerating-pipes into the tank A. This pump is so constructed that its entrance-port, instead of opening to the atmosphere, as in pumps for forcing air, connects only with the gas-pipe B, so that it is supplied exclusively from the furnace C.

The furnace C is so constructed that all the air which enters its combustion-chamber O must pass through the burning fuel, and consequently there is a rapid generation of carbonic-acid gas, mixed with nitrogen, caused by the union of the carbon of the fuel with the oxygen of the air. The gas thus produced is incapable of supporting combustion, but is equally available for the mechanical purpose of causing the agitation of the fluid contents of the tank A, so that it not only will not form an explosive mixture by combining with the hydrocarbon vapor evolved from the petroleum, but it forbids the possibility of the burning of that vapor in its presence.

When the operation of agitating the oil in the tank A is being carried on the cocks 2 and 3, which connect the reservoir I of carbonic-acid gas with the tank A, are closed, as the tank is constantly supplied with the non-inflammable gas by means of the pump P through the main gas-pipe B; but when the operation of agitation is discontinued the cock 1 is closed, shutting off the entrance of gas through the main pipe B into the tank, and the cocks 2 and 3 are opened, permitting of the forcing of carbonic-acid gas into the receiver I, and its passage through the small

pipe K into the top of the tank A. The gas, being compressed in the receiver I, will continue to supply the tank A, through the small pipe K, even when the force-pump P has ceased to work. This connection between the reservoir of carbonic-acid gas and the tank A should be maintained whenever there is any oil in the tank and the process of agitation is not being carried on, so as to prevent danger from the atmospheric air getting into the tank and mixing with the hydrocarbon vapor from the oil. In place of the employment of a coil of pipe and refrigerating-vessel, as described, the carbonic-acid gas may be cooled by passing through a shower of water in a suitable chamber or vessel, and be afterward dried before pressing into the agitating-tank. /

Instead of using the furnace C and force-pump P, carbonic-acid gas may be generated by means of sulphuric acid and carbonate of soda, or other acid and carbon alkali, in a separate vessel, the gas evolved being admitted into the tank through the pipe B connected with the gas-generating vessel. For this purpose the water, acid and waste alkali (if a carbonate) which have been used for refining the oil may be employed, or carbonic-acid gas made in any known manner.

If preferred, the carbonic-acid gas generated in any convenient manner, instead of being forced into the agitating-vessel by means of a pump, as described, may be caused to pass through the oil in the tank by means of a vacuum created in the pipe M which leads from the top of the agitating-tank. By this means the non-inflammable gas contained in a gas-holder connected with the pipe B may be drawn through it, and, after passing through and agitating the oil, may be drawn off through the pipe M. The waste non-inflammable gas (although mixed, by passing through the oil, with hydrocarbon vapor) is still non-inflammable, and may be advantageously utilized by introducing it into the tanks and other vessels containing oil in and about the works, and thereby greatly diminish or entirely prevent the danger of explosions, which so often occur in oil refineries.

The agitating-tank is furnished with suitable pipes and cocks for inserting the acids and alkalies used in the process of refining oil, and for drawing off any water and the waste acids, &c. Whether atmospheric air is used for agitating petroleum or non-inflammable or other gas, the employment of an air-tight agitator, so as to enable the air or gas to be introduced under pressure, and control the escaping gases or vapors, is a great advantage in the process of refining petroleum.

Having thus described my improvement, what I claim as my invention, and desire to secure by Letters Patent, is—

1. The method, substantially as described, of agitating petroleum by the introduction of carbonic-acid gas or other non-inflammable gas into the oil within the agitating-tank.



2. The introduction of carbonic-acid gas or other non-inflammable gas into tanks or vessels containing petroleum, for the purpose of preventing the formation of explosive mixtures of hydrocarbon vapor and oxygen, substantially as described.

3. The agitation of petroleum in an air-tight tank by means of any gas, gaseous fluid, or mix-

ture of gases under pressure, or by means of a vacuum, substantially as described.

In testimony whereof I, the said HERBERT W. C. TWEDDLE, have hereunto set my hand.

HERBERT W. C. TWEDDLE.

Witnesses:

JOSEPH CLARK,  
W. BAKEWELL.

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