

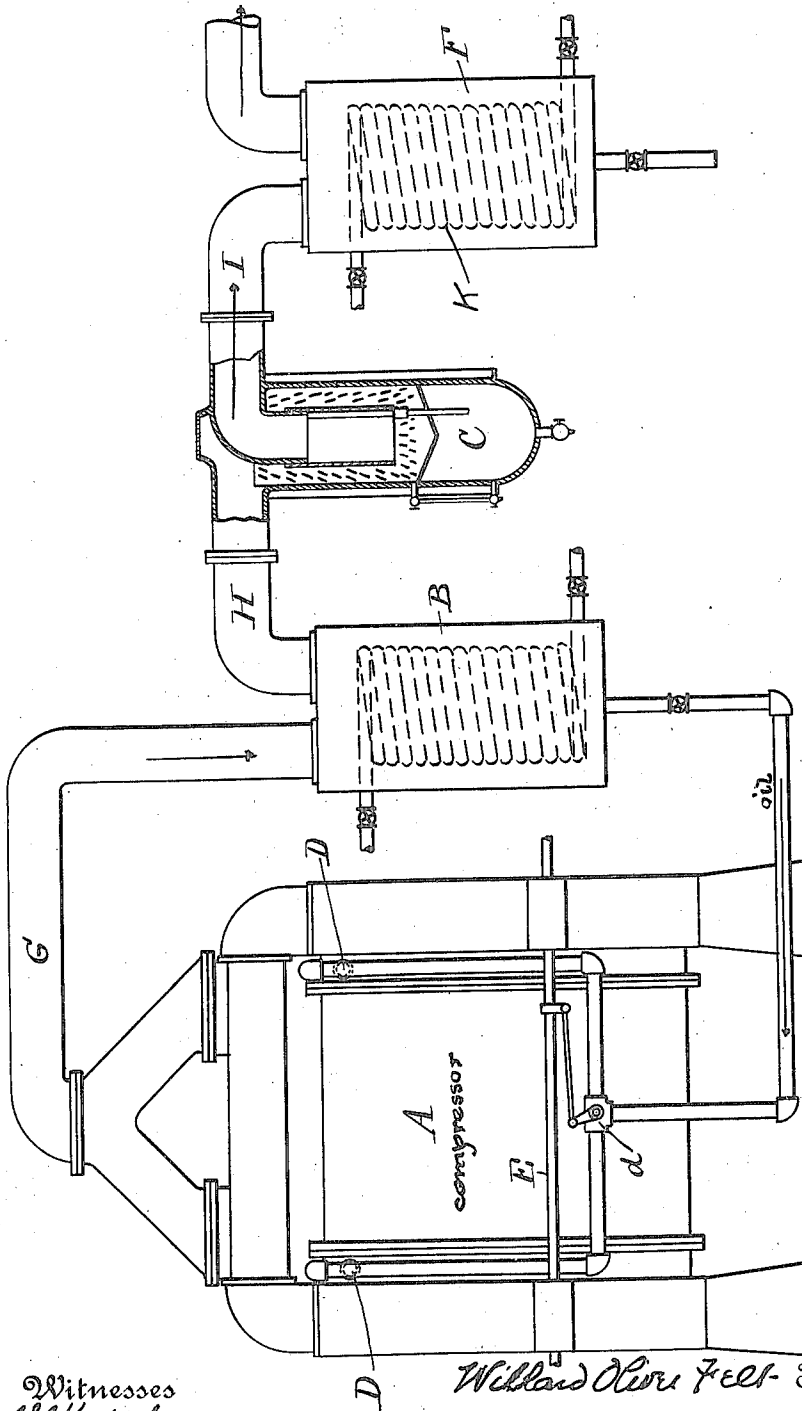
W. O. FELT.

PROCESS OF COMPRESSING, PURIFYING, DRYING, AND COOLING GASES.

APPLICATION FILED SEPT. 26, 1908. RENEWED MAY 5, 1916.

1,213,796.

Patented Jan. 23, 1917.



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UNITED STATES PATENT OFFICE.

WILLARD OLIVER FELT, OF BRADFORD, PENNSYLVANIA, ASSIGNOR TO PETROLEUM PRODUCTS COMPANY, A CORPORATION OF NEW JERSEY.

PROCESS OF COMPRESSING, PURIFYING, DRYING, AND COOLING GASES.

1,213,796.

Specification of Letters Patent.

Patented Jan. 23, 1917.

Application filed September 26, 1908, Serial No. 454,925. Renewed May 5, 1916. Serial No. 95,673.

To all whom it may concern:

Be it known that I, WILLARD OLIVER FELT, a citizen of the United States, and a resident of the city of Bradford, in the county of McKean and State of Pennsylvania, have invented certain new and useful Improvements in the Processes of Compressing, Purifying, Drying, and Cooling Air and other Gases, of which the following is a specification.

The objects of my invention are to remove the tarry vapors, the ammonia, the carbonic acid, the sulfur compounds, the sulfureted hydrogen, the aqueous vapor, and the heat of compression from natural gas, or illuminating gas, or from air or other gases, during the process of compression or after, whether the treated air or other gas is used under pressure or otherwise.

Other objects will appear from the hereinafter description.

I have illustrated one type of apparatus for carrying out my invention, during compression, but the process may be worked afterward at any stage so long as the gas remains under pressure, or on natural gas under its original pressure.

Referring to the drawing, the figure is a view of a compressor cylinder, showing the valve gear for injecting oil into the cylinder while compressing, a supply tank under pressure, which is also a cooler and condenser, a separator, connecting pipes, and valves.

The part marked A on the drawing represents a compression cylinder driven in the usual way, by power not shown, in which the gas may be compressed up to 1500 pounds to the square inch, or to any convenient lower pressure not less than about 150 pounds, in one stage without the use of water-jackets or inter-coolers.

B is the supply tank under pressure, containing Turkey-red oil under pressure, to which is piped the compressed gas above the liquid, and from which is piped the Turkey-red oil to the compression cylinder, and it is provided with a cooling coil.

C is a separator, of any form, in which by means of baffle plates, for example, or centrifugal force or otherwise, the Turkey-red oil is separated from the compressed gas.

D and D are injection nozzles for the introduction of the Turkey-red oil in a spray,

controlled by a three-way cock *d* moved by an eccentric rod E, adjusted to open the injection ports alternately on the compression side of the stroke, each valve opening as soon as the piston begins to compress, and remaining open during compression or some part of it.

G is a pipe connection between the compressed gas main and the supply tank, maintaining a constant pressure of the gas above the surface of the Turkey-red oil to work the injection of the Turkey-red oil into the cylinder, which pressure is always greater than that in the cylinder at any point of the compression stroke except at the end of the stroke.

H is a pipe from the compression cylinder to the separator, through which is conveyed the gas and the Turkey-red oil associated with all the tarry vapors and all other impurities and with the moisture, and carrying nearly all the heat of compression.

For simplicity I have shown this apparatus in diagrammatic form, without encumbering the drawing with the inlet ports for the gas to be compressed, the outlet valves, the stop-cocks and other details, all of which are well-known to those conversant with the art, and all of which may be varied according to the preference of those working the process.

The operation of the apparatus and the working of the process will be well understood by the illustration, wherein natural gas, as an example, is to be compressed for the purpose of liquefying the gas or for conveying it through mains for long or short distances, and the liquid employed in this illustration is the ordinary Turkey-red oil of commerce, the best of which is made from castor oil with sulfuric acid in a well-known manner, but I may use Turkey-red oil formed from olive oil, cottonseed oil and arachis oil, or otherwise. For example, I charge the supply tank with about 2,000 pounds of the ordinary Turkey-red oil of commerce, filling the tank about a quarter full, if it is 10 feet high and 4 feet in diameter, and start the compression cylinder, to the inlet ports of which are led the supply pipe from a well of natural gas, such, for example, as is found in the Bradford fields in Pennsylvania. As soon as the pressure rises in the pressure main, that

pressure is communicated through the pipe G to the gas above the surface of the Turkey-red oil in the supply tank B and furnishes the means for injecting a small quantity of the Turkey-red oil into the compression side of the compressor at each stroke and during that part of the stroke wherein the cylinder pressure is lower than the supply tank pressure. If the compressor is of the capacity, say, of 600 cubic feet of free air per minute, the injection of oil would be about 1000 grains per stroke, the compression cylinder being about 12 inches in diameter and 24-inch stroke, running about sixty revolutions a minute. The Turkey-red oil by means of a spray is diffused through the gas during the compression stroke, and I have discovered that it has the property of taking up nearly all the heat of compression, nearly all the aqueous vapor, the ammonia, the tarry vapors, and all the other impurities of natural gas, when both the gas and the oil are under pressure, preferably of not less than 150 pounds per square inch or upward, provided the gas is cool all the time. Before the end of the compression stroke and about the time the pressure in the cylinder equals the pressure in the supply tank, the inlet port for the Turkey-red oil is closed by the three-way cock *d*, operated by an eccentric on the main shaft, not shown, of the driving engine, or otherwise. The compressed gas, intimately commingled with the oil, associated with the aqueous vapor and the impurities, and carrying the heat of compression, is led to the top of the separating tank, where by passing over the baffle plates, if the separator is of that construction, the oil, associated vapor and impurities warmed by the heat of compression drips down to the bottom, and the purified, cooled, compressed gas is drawn off higher up and conveyed to the outgoing main and the operation is complete.

I have described but one stroke, but whether double acting or single the operation is substantially identical with each stroke, and I have found that all the foregoing objects are thus attained. The operation would be substantially similar in the case of the compression of air, whether for refrigeration, liquefaction or metallurgical operations, such as for the blast of furnaces or converters, and for compression systems for power. It would be similar for illuminating gas, producer gas, and the like.

I have found that no water-jackets or inter-coolers are necessary even for high pressures conducted in one stage compressors.

The oil after compression is led back through a cooler or through condensing pipes, or other device for abstracting the heat on its return to the supply tank, and is used over and over again, and is not dissi-

pated by the treatment, although some is consumed in lubricating the compressor piston, but thereby dispenses with all other lubrication. It is readily separated from the impurities by gravity, or in other well-known ways, or by concentration in a vacuum.

While I prefer to inject the oil into the compression cylinder during the first of the compression stroke, I do not confine myself to this point of introduction, but may introduce the oil into the air or gas to be compressed in any manner and at any stage, so that the oil and gas or air may be intimately mixed, either concurrently with the compression or while the gas is under pressure; and if during compression the operation of absorbing the heat, vapors, and impurities takes place at each stroke almost instantaneously.

If the natural gas, for example, is treated while under its original pressure, it may be forced up through a body of Turkey-red oil in a tank inserted in the gas main which contains the body of the Turkey-red oil in the bottom of the tank, into which the gas is introduced by a section of the gas main leading nearly to the bottom of the tank, the upper part of which tank is filled with coke or staggered plates supported on a screen on which the treated gas, oil, impurities, and vapor impinge, and from which they drip back into the bottom of the tank. The dried, purified and cooled air is led off from the top of the tank to the main.

When air is treated by my process it is likely to be for the removal of moisture, and in that case the treatment should be conducted in the compressor cylinder, in order to escape the expansion of the air in the cylinder due to the heat of compression, and the consequent lessening of the volumetric capacity of the compressor. The example given is by way of illustration only and not as a limitation.

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

1. The process of purifying gases which consists in compressing them in the presence of Turkey-red oil.

2. The process of purifying gases which consists in compressing them in the presence of Turkey-red oil in the form of a mist or fine spray.

3. The process of purifying gases which consists in compressing them in the presence of Turkey-red oil which has been reduced in temperature considerably below that of the gas to be treated.

4. The process of purifying gases which consists in compressing them in the presence of Turkey-red oil in the form of a mist or fine spray, and subsequently recovering the Turkey-red oil for reuse.

5. The process of purifying gases which consists in refrigerating Turkey-red oil to a temperature below that of the gas to be treated, commingling the said oil and gas and then compressing the mixture.

5 In testimony whereof, I have hereunto set my hand and affixed my seal, at the city,

county and State of New York, this 15th day of September, 1908.

WILLARD OLIVER FELT. [L. s.]

In presence of—

JOHN J. RANAGAN,
I. R. RICHARDS.