May 9, 1933. G. EGLOFF 1,908,133

PROCESS FOR TREATING HYDROCARBONS

Filed Sept. 16, 1927 2 Sheets-Sheet 1

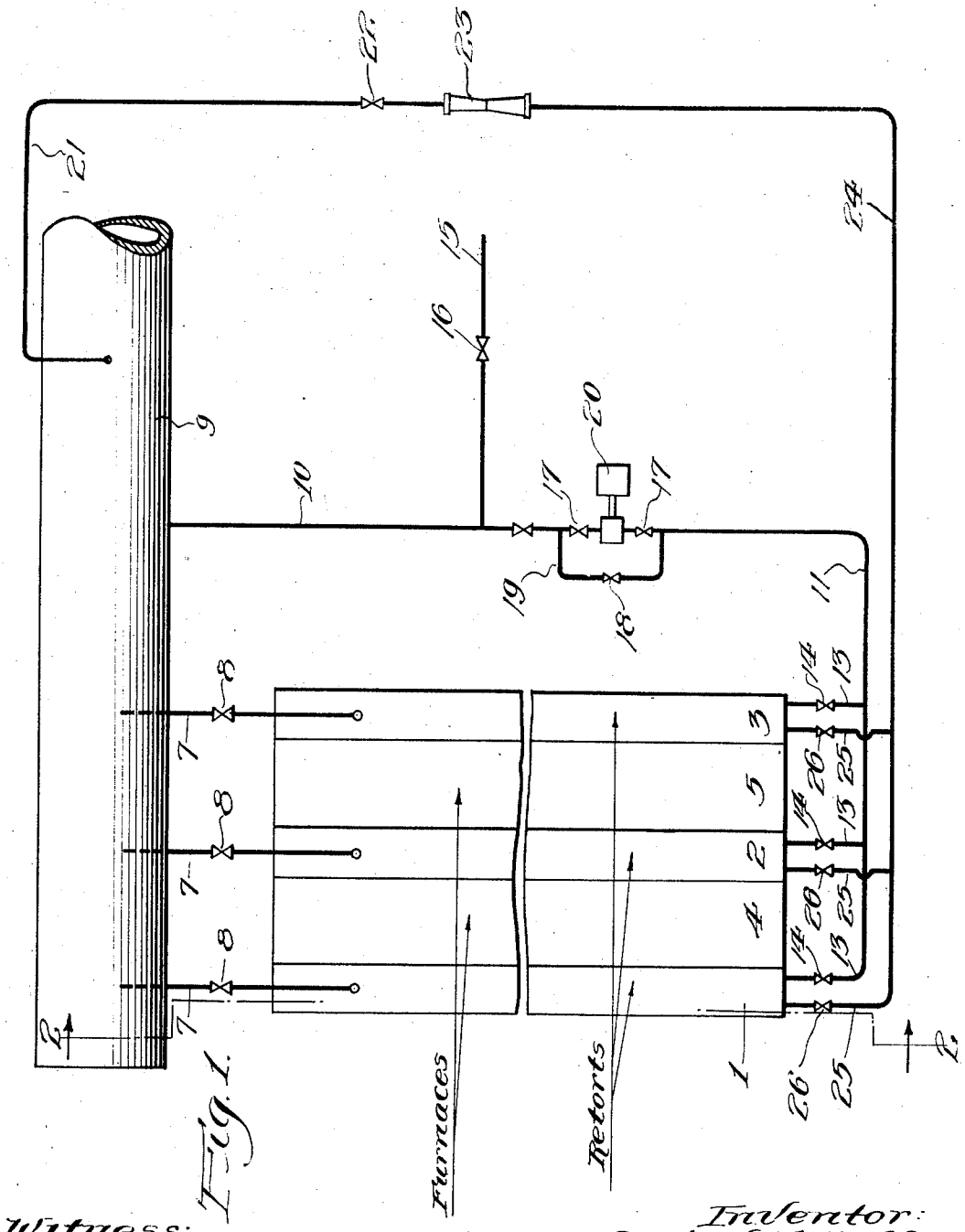

Fig. 1.

Witness:
Stephen T. Pelora

Inventor:
Gustav Egloff,
By Frank L. Belknap
Atty.

May 9, 1933. G. EGLOFF 1,908,133

PROCESS FOR TREATING HYDROCARBONS

Filed Sept. 16, 1927. 2 Sheets-Sheet 2

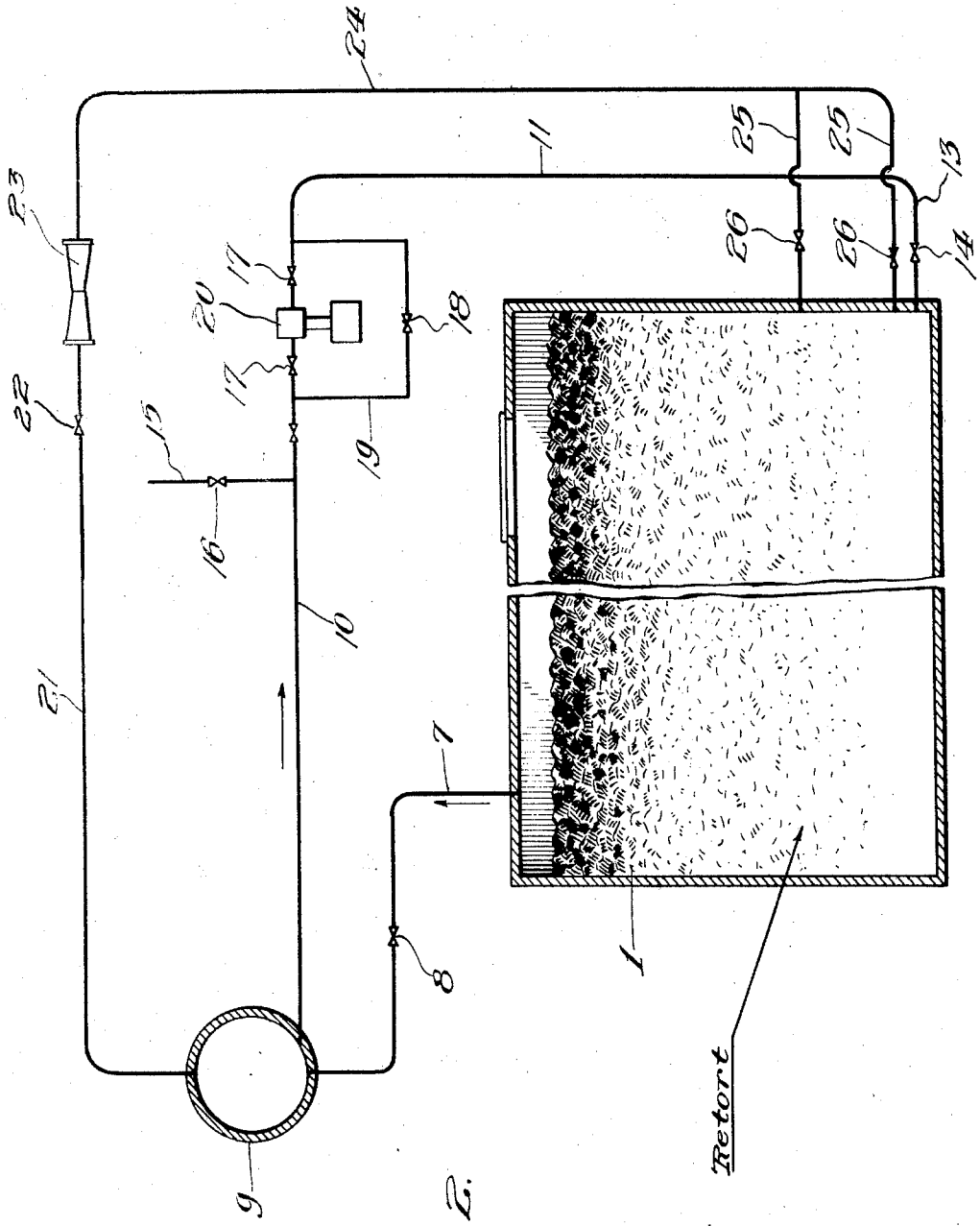

Fig. 2.

Witness:
Stephen J. Rubora

Inventor:
Gustaf Egloff,
by Frank L. Belknap
Atty.

Patented May 9, 1933 1,908,133

UNITED STATES PATENT OFFICE

GUSTAV EGLOFF, OF CHICAGO, ILLINOIS, ASSIGNOR TO UNIVERSAL OIL PRODUCTS COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF SOUTH DAKOTA

PROCESS FOR TREATING HYDROCARBONS

Application filed September 16, 1927. Serial No. 219,836.

This invention relates to improvements in a process for treatment of hydrocarbons, and refers more particularly to improvements in the treatment of carbonaceous material, such as coal undergoing carbonization, and to the cracking of the coal tar produced in the treatment of same.

One specific embodiment of the present invention contemplates that regulated amounts of the gas produced when carbonaceous material, such as coal, is subjected to thermal decomposition shall be returned and injected into the same or another body of carbonaceous material undergoing thermal decomposition in order that the volatile products of the carbonaceous material may distill more rapidly and uniformly and at a lower temperature than in the present mode of operation. At the same time regulated portions of the coal tar may be returned to the body of heated carbonaceous material from which it was derived, thus utilizing the heat being used for the distillation of the carbonaceous material as the medium for cracking the coal tar into desirable products.

In most of the by-product coke oven plants the ultimate products which it is desired to produce comprise coke and gas. The operation is such, however, that inevitably there is produced coal tar, which when produced in large quantities cannot be readily marketed, thus selling for a low price. This coal tar is viscous, frequently difficult to handle, and in cold weather is almost impossible to move without the use of steam heating systems. Hence, in the operation of by-product coke oven plants it has become the practise to convert the maximum quantity of the coal into two products, i. e. coke and gas.

As an illustration of the quantities of tar available for the operation of by-product coke oven plants, it is estimated that each ton of coal produced approximately 10 gallons of tar and 3 gallons of benzol motor fuel in the production of coke and gas. It has been estimated that the yearly production of coal tar at the present time will approximate 15,000,000 barrels. The present invention is designed to utilize this coal tar to a greater advantage than has heretofore been possible.

The coking of bituminous coal takes place at a temperature of approximately 2000° to 2100° F. and requires approximately 16 hours, more or less, for completion, depending, of course, upon the amount of charge and the size of coke oven. The products derived from this distillation of bituminous coal comprise gas, light oil, tar and coke. The vaporous and gaseous products from the highly heated coal bed pass to a gas header, in which the heavy coal tar condenses. In the usual operation of a by-product coke oven plant this heavy coal tar is removed from the gas header and collected in suitable storage tanks. This coal tar is at an elevated temperature, ranging from approximately 400° F. upward, depending upon the cooling effect in the gas header.

In the embodiment of the present invention, regulated amounts of this coal tar, instead of being withdrawn from the gas header and sent to storage are returned and injected into the highly heated coal bed in the coke oven retort, where they are subjected to a temperature of approximately 2000° F. more or less causing cracking of said coal tar and conversion of large quantities thereof into coke and gas. The conditions of operation may be so regulated that all or any regulated portions of the coal tar condensing in the gas header may be returned and injected into the highly heated coal bed, and this return to be either effected by gravity or under the impulse of a pump.

In the present invention regulated quantities of the gas passing through the gas header may be also returned to the highly heated coal bed in the coke oven retort. The heated gas passing through the highly heated body of carbonaceous material seems to exert a partial pressure therein, giving a high rate of turbulency and permitting distillation to take place at a lower temperature, due to the said partial pressure of the heated gases resulting from the distillation of the carbonaceous material. The amount of gas to be returned to the coal bed to secure the

most efficient results may be regulated so that it exerts a partial pressure therein most suitable for the results desired. The partial pressure exerted therein by the circulation of the gas may be, for example, one-half that of the total pressure therein.

For a more complete understanding of the invention, reference may be had to the attached drawings, in which

Fig. 1 is a diagrammatic top plan view of apparatus for carrying out the invention, and

Fig. 2 is a cross-sectional view taken on line 2—2 of Fig. 1.

Referring more in detail to the drawings, 1, 2 and 3 designate coke ovens separated by means of the furnaces 4 and 5, respectively. The coke ovens may take any conventional form and are constructed of material generally used for this purpose. One type of coke oven comprises a chamber approximately 16″ wide, 14′ high and 40′ long, having a capacity of 15 to 20 tons of bituminous coal. These coke ovens, of course, are sealed and no combustion takes place within the chambers.

The ovens are heated through the furnace walls and the distillation of the volatile matter from the coal may take place at the rate of approximately one inch of coal per hour. The far end of each oven may be provided with a vapor line 7 in which is interposed valve 8, the vapor line 7 communicating with the enlarged gas header 9. The gas header 9 may be from, say 4 to 6 feet in diameter, and cooling or condensing of the tarry material in the gas takes place in the header. The condensed tarry material settles to the bottom of the header and may be withdrawn therefrom through draw-off line 10, which communicates with a return manifold 11. Said manifold communicates through the medium of branches 13, controlled by valves 14, with each of the coke ovens 1, 2 and 3. It is to be understood, of course, that the coal tar may be introduced into the coal bed at any point in the height of the retort, the most desirable point for injecting said coal tar being dependent upon temperature conditions, amount of coal tar being returned for retreatment and the products desired.

Thus, it will be apparent that instead of withdrawing the coal tar from the gas header and passing same to storage, as is the usual practise, said coal tar is returned and injected into the highly heated coal bed in the coke oven.

Due to the high temperature conditions maintained in the coal bed, approximately between 2000 and 2100° F., more or less, the coal tar will be cracked and converted into the products which are most desirable in the operation of by-product coke oven plants, i. e. coke and gas. It is apparent, of course, that all or any regulated amount of the coal tar condensing in the gas header 9, the balance may be removed through the outlet line 15, in which may be interposed a valve 16, which outlet line may discharge into any suitable storage.

As a feature of the invention, that portion of the coal tar which has been returned to the highly heated coal beds for retreatment may be returned by gravity or may be returned under the impulse of a hot oil pump. Where it is desired to force the return of the coal tar under the influence of a hot tar pump, the valves 17 in the line 10 may be opened and the valve 18 in the by-pass 19 may be closed. This permits the coal tar to pass through a conventional type of hot tar pump, illustrated diagrammatically at 20. Where it is desired to return the coal tar by gravity, valves 17 may be closed and valve 18 in by-pass line 19 opened, thus cutting out the pump 20.

The gas in the header 9 may be withdrawn therefrom in regulated quantities through the line 21, which communicates with a return manifold 24.

Said manifold 24 communicates through the medium of branches 25, controlled by valves 26, with each of the coke ovens 1, 2 and 3. If desired, the gas may be passed through a conventional type of gas blower, illustrated diagrammatically at 23. It is understood, of course, that this gas blower may or may not be used. Several branches 25 may communicate with each retort, as is more apparent in Fig. 2, which branches may be spaced at any point along the height of the retort so that a good distribution of the gas may take place in the body of carbonaceous material.

It is to be clearly understood that the showing in the drawings is highly diagrammatic. There may be any number of coke ovens separated by means of furnaces and coal tar and gas may be returned to any one or more alternately, simultaneously or intermittently. It may be found desirable between the point at which the coal tar is removed from the gas header and the point at which it is injected into the highly heated coal bed to strip said coal tar of lighter hydrocarbon fractions which may possess high utility as compounds to be mixed with motor fuel to impart anti-detonating qualities thereto. The conditions of operation in the distillation retorts may be so regulated as to produce more or less of such compounds.

I claim as my invention:

1. A process which comprises destructively distilling a body of bituminous coal by external heating thereof under non-burning conditions at a temperature adequate to produce incondensible gas and coal tar vapors, separating the coal tar from the gas, introducing to the lower portion of said body at

least a portion of the separated coal tar and a portion of said incondensible gas and forcing the same upwardly through the body, and collecting the remaining incondensible gas.

2. A process which comprises destructively distilling a body of bituminous coal by external heating thereof under non-burning conditions at a temperature adequate to produce incondensible gas and coal tar vapors, separating the coal tar from the gas, introducing to the lower portion of said body at least a portion of the separated coal tar and a portion of said incondensible gas and forcing the same upwardly through the body, maintaining said body at a temperature sufficiently high to decompose the returned coal tar substantially completely into coke and gas, and collecting the remaining incondensible gas.

In testimony whereof I affix my signature.

GUSTAV EGLOFF.