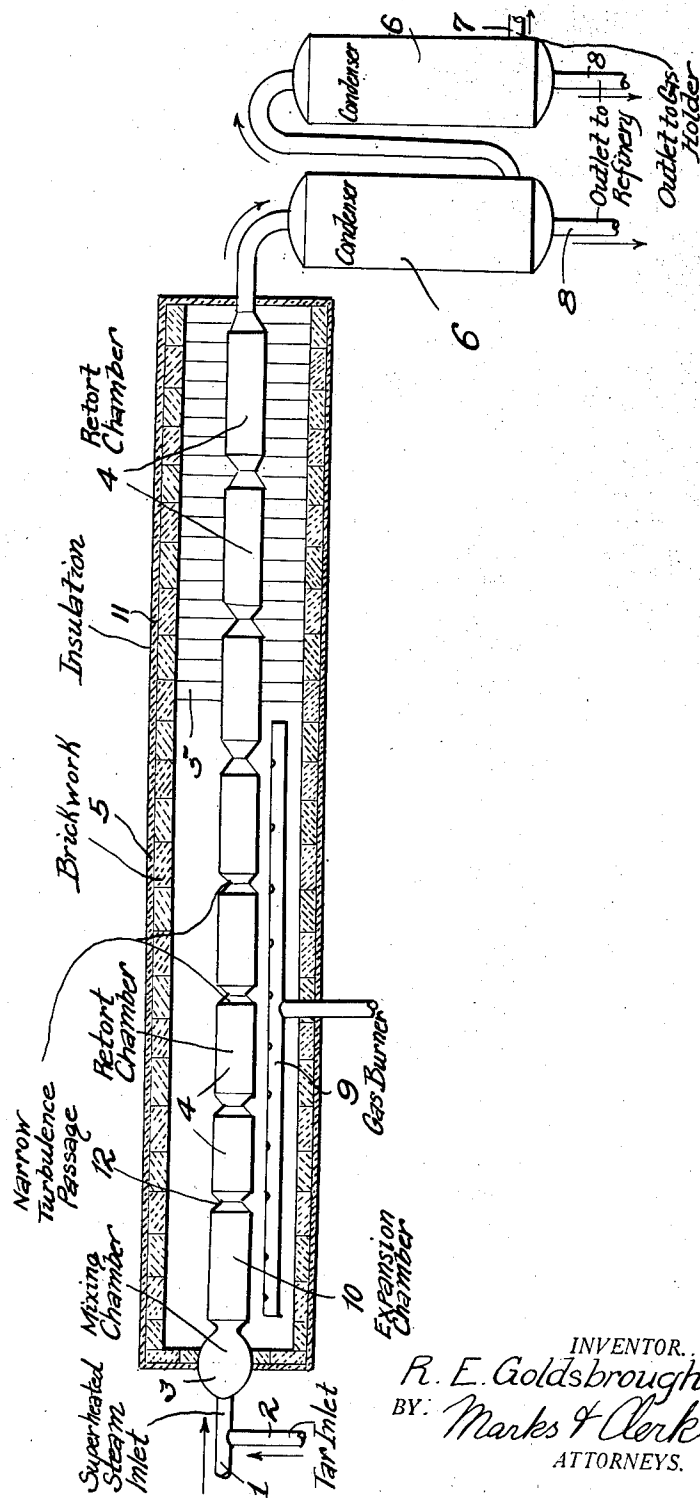


April 11, 1933.

R. E. GOLDSBROUGH
 PRODUCTION OF BENZINES, BENZENES, AND OTHER
 HYDROCARBONS FROM COAL TARS AND OILS
 Filed March 21, 1932

1,903,568



INVENTOR.
 R. E. Goldsbrough
 BY: *Marks & Clerk*
 ATTORNEYS.

UNITED STATES PATENT OFFICE

ROBERT EDWIN GOLDSBROUGH, OF SLOUGH, ENGLAND

PRODUCTION OF BENZINES, BENZENES, AND OTHER HYDROCARBONS FROM COAL TARS AND OILS

Application filed March 21, 1932, Serial No. 600,363, and in Great Britain October 21, 1930.

The present invention forms in part a continuation of my copending application Serial No. 513,789 filed February 5, 1931, but differs therefrom mainly in that the temperatures used in the present application are given below 700° and 500° C. respectively for the first and last reaction zones in the heating chamber, whereas in the copending application the corresponding temperature lies above said temperature. The two applications accordingly complement each other.

This invention relates to the conversion of bituminous or carbonaceous materials or products, derived therefrom, such as mineral oils, coal oils, tars and products derived from any of these, into useful products including motor spirit, kerosene, like products, lubricating oils, fuel oils, pitch and gases.

In British Patent Specification No. 266,765 there has been described a process of generating gas from liquid hydrocarbons by injecting the oil together with steam into a retort in which the mixture expands and is subjected to a gasifying temperature, the gassification being promoted by a device which produces turbulence and pressure changes. The retort and the said device are constructed of a chromium-nickel alloy in which the nickel is usually the predominant constituent.

In British Specification No. 320,619 it has been shown that in a process of this kind in which the metal surfaces in contact with the heated mixture of steam and oil vapours are coated with a catalyst comprising silica, sodium silicate, alumina and zinc oxide, a mixture of liquid hydrocarbons and water is produced by cooling the products, these hydrocarbons comprising light fractions suitable as fuel in internal combustion engines, oils similar to kerosene, a lubricating oil and substances resembling pitch.

According to the present invention the metal surfaces, or the greater part thereof, with which the heated mixture is in contact in the retort are made of nickel-chromium

alloy containing small proportions of silicon, zinc, aluminium and iron, for example an alloy of the following composition:

	Per cent
Nickel	60
Chromium	30
Silicon	1
Zinc	2
Iron	4
Aluminium	3

The presence of other metals such as molybdenum or titanium or both in proportions up to about 7 per cent. increases the catalytic efficiency of the alloy.

The use of alloys of the kind described in the preceding paragraphs makes it unnecessary to line the retort or other heating chamber with a catalyst of the kind described in said British Patent No. 320,619.

In the accompanying drawing is shown diagrammatically and partly in section a retort suitable for carrying out my process.

1 is the entry for superheated steam, 2 is the entry for tar, 3 is the mixing chamber, 9 is a gas burner for heating, 5 is a brickwork, 11 is insulation, 6, 6 are condensers, 8, 8 are outlets from condenser to refinery, 7 is the gas outlet to gas holder.

The steam and raw material are injected at 1 and 2 respectively into a mixing chamber 3 at a pressure above two atmospheres and preferably about three to four atmospheres. The mixing chamber described in British Patent No. 226,676 is found to give the best results.

The mixture of vapours and steam having expanded in the mixing chamber passes into the heating chamber or retort consisting preferably of an expansion chamber 10 and a series of retort chambers 4 connected by narrow passages 12.

This may conveniently have the form described and shown in British Patent No. 266,765.

It is impossible to prescribe the best tem-

perature for the retort because this depends upon the nature of the raw material and must be predetermined in each case. It may be said, however, that the limits of useful temperature are from 450° C. to below 700° C., and that there should be a more or less gradual fall of temperature of the mixture as it passes from the entrance to the exit of the retort; for example, the chambers 4 of the retort near the exit may be protected from directly applied heat by brickwork 5 and insulating covering 11 so that it is heated only by conduction, from 350° C. to below 500° C.

It is of advantage to remove sulphur from any raw material containing it. Any known method of doing this may be adopted; for instance the raw material may be vaporized and passed over iron oxide or the like before it is injected into the mixing chamber 3, or the liquid raw material may be heated with iron oxide, or finally, the iron oxide or like desulphurizing agent may be injected into the retort together with the mixture.

It has been found that injection of iron oxide containing titanium oxide about 5% (a mixture known to be a good desulphurizing agent) has beneficial results upon the process which are not entirely due to desulphurization; hence the injection of such a mixture is regarded as a feature of this invention.

It is found that finely powdered material blown into the retort passes through the retort and may be separated from the elastic fluid by means of a dust catcher placed before the condenser; after appropriate cleansing and drying, if necessary, it may be reinjected into the retort with additional advantage since its good effect is enhanced by repeated use; after a time, of course, this improvement due to repeated use disappears and the efficiency of the material falls whereupon it must be purified, or exchanged for fresh material.

The process may be conducted in an atmosphere of gas which is preferably the gas formed in the process and remaining after removal of the condensable hydrocarbons by means of suitable scrubbing devices; by operating in this manner, the yield of liquid hydrocarbons may be increased.

The following is an example of the process conducted in the foregoing apparatus:

100 English gallons of a primary tar, consisting of a mixture of aliphatic hydrocarbons with a small amount of aromatic hydrocarbons and about 40 per cent. of tar acids and other accessory constituents such as bases and the like, are injected, after having been preheated to about 200° C., into the retort or retorts 4 by way of a mixing chamber 3 into which superheated steam is simultaneously injected through pipe 1. For 100 English gallons of primary tar, 150 lbs. of steam may

be used. The temperature of the retort 4 is approximately below 700° C. in the entrance and middle portions and approximately below 500° C. in the exit portion of the retort.

The vapour mixture leaving the retort 4 together with the steam is cooled in a suitable fractional separating apparatus to a temperature at which the steam and oil vapours of the light fraction separate from the higher oil fraction. The steam is condensed together with the vapours of the light fraction in a suitable condensing apparatus 6, whereas the heavy fraction, which, for example may boil above 230° C., remains in the fractional separating apparatus. This latter fraction may be used again and re-circulated for the purpose of producing a further quantity of light oil.

By operating in the manner above described, it is possible to obtain from 100 English gallons of primary tar, about 40 gallons of a light fraction which, after refining, is suitable as a first class motor spirit and about 50 gallons of heavy fraction which is either wholly or partly suitable for retreatment; the loss of about 10 per cent. is accounted for by the formation of permanent gas during the process.

If it is desired to operate in an atmosphere of gas, such as the permanent gas produced in the process, the gas may be caused to circulate through the whole plant by means of a pump working under the required pressure, the gases entering the mixing chambers of the retorts through separate inlets.

I claim:

1. In a process for the production of benzenes, benzenes and other hydrocarbons from coal-tars and oils, the steps of injecting the primary material together with steam into a heating zone, the temperature of which is from 450° C. to below 700° C. and being provided with metal surfaces made of about 90% nickel-chromium alloy containing definite small proportions of silicon, zinc, aluminium and iron, vaporizing the oil and allowing the reaction material to expand, subjecting the expanded material to turbulence and pressure changes while gradually reducing the temperature of the reaction mixture.

2. In a process for the production of benzenes, benzenes and other hydrocarbons from coal-tars and oils, the steps of injecting the primary material together with steam into a heating zone, the entering portion of which has a temperature of from 450° to below 700° C., while the exit portion thereof has a temperature of from 350° to below 500° C. and being provided with metal surfaces made of an alloy containing approximately 60% nickel, 30% chromium, 1% silicon, 2% zinc, 3% aluminium, 4% iron, and containing also smaller definite proportions of zinc oxide, iron and molybdenum, vaporizing the mate-

rial, allowing the reaction material to expand by the action of said steam, subjecting the reaction material to turbulence and pressure changes and injecting iron oxide into the heating zone, thereby desulphurizing the material.

ROBERT EDWIN GOLDSBROUGH.

10

15

20

25

30

35

40

45

50

55

60

65