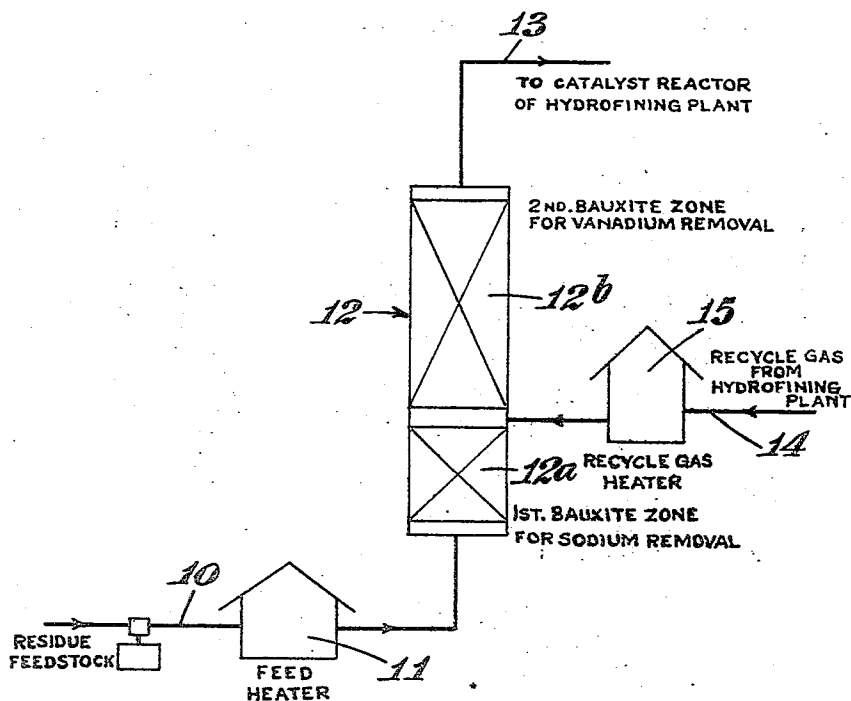


Aug. 31, 1954

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REMOVAL OF VANADIUM AND SODIUM
FROM PETROLEUM HYDROCARBONS
Filed Jan. 22, 1953

2,687,985



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UNITED STATES PATENT OFFICE

2,687,985

REMOVAL OF VANADIUM AND SODIUM
FROM PETROLEUM HYDROCARBONS

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Application January 22, 1953, Serial No. 332,662

Claims priority, application Great Britain
January 31, 1952

5 Claims. (Cl. 196—44)

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This invention relates to the removal of vanadium and sodium from petroleum hydrocarbons in particular crude petroleum and petroleum residues.

In the specification of the co-pending applica-
tion of Porter and Hyde No. 263,956, filed Dec-
ember 28, 1951, there is described a process for
the removal of vanadium and sodium from pe-
troleum hydrocarbons wherein the hydrocarbons
are contacted with bauxite in the presence or
absence of hydrogen and under conditions of
temperature and pressure such that the sodium
and vanadium are deposited on or incorporated
with the bauxite. The removal of sodium and
vanadium from a petroleum feedstock prior to
hydrofining the feedstock is of particular advan-
tage since it avoids contamination of the cobalt
molybdate type catalyst commonly used in the
hydrofining process, and such a two-stage process
forms the subject of co-pending application of
Porter and Hyde, No. 276,256 filed December 13,
1952. It has now been discovered that the con-
ditions which are most favourable for the removal
of vanadium from petroleum feedstocks are not
the most favourable for the removal of sodium
and vice versa. For example, on treating a Ku-
wait residue over bauxite at 780° F., 1000 p. s. i.
ga., 1.0 v./v./hr. and 4000 SCF/B recycle rate,
the vanadium removal over 100 hours was ap-
proximately 50% and the sodium removal 30%.
On treating the same feedstock over bauxite at
780° F., 1000 p. s. i. ga. and 1.0 v./v./hr. but with-
out hydrogen recycle, vanadium removal was
only approximately 10%, whereas sodium removal
was over 90%. The feedstock employed con-
tained 35 p. p. m. vanadium and 35 p. p. m. so-
dium, the bulk of the sodium being of extraneous
origin introduced during distillation of the crude.

It is considered that vanadium removal is pri-
marily a hydrogenation process which is depen-
dent, among other things, upon the hydrogen
partial pressure, while the removal of extraneous
or uncombined sodium is primarily a physical
process, the efficiency of which is not improved
by the presence of hydrogen which competes with
the sodium for the adsorbing surface of the baux-
ite. Whether this explanation is correct or not,
it has been discovered that improved removal of
vanadium and sodium may be effected by a two-
stage treatment over bauxite, only one stage be-
ing carried out in the presence of hydrogen.

According to the invention therefore, a petro-
leum feedstock containing vanadium and uncom-
bined sodium is passed first over bauxite at ele-
vated temperature and pressure and in the ab-

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sence of hydrogen, whereby substantially all the
sodium is removed from the feedstock, and then
over bauxite at elevated temperature and pres-
sure and in the presence of hydrogen, whereby a
considerable proportion of the vanadium is re-
moved from the feedstock.

Both stages of the process are advantageously
operated at a temperature of approximately 780°
F. and a pressure of approximately 1000 lb./sq. in.
The invention may advantageously be carried
into effect in a tower containing a single bed of
bauxite, hydrogen being admitted to the tower at
an intermediate point calculated to afford the
optimum space velocities for both sodium and
vanadium removal.

The invention also includes a continuous proc-
ess wherein a petroleum feedstock containing
vanadium and sodium is passed first to a two-
stage bauxite treating process as above described
and is then passed to a hydrofining zone wherein
it is treated for the removal of organically com-
bined sulphur.

One embodiment of the process according to the
invention is diagrammatically illustrated in the
accompanying drawing.

A petroleum feedstock containing sodium and
vanadium, such as crude oil or crude oil residue,
is passed via line 10 and heater 11 into a tower
12. The treated feedstock leaving the tower 12
is passed via line 13 to a hydrofining zone oper-
ated in known manner. The tower 12 is divided
into a lower part 12a and an upper part 12b,
both parts being filled with bauxite, and recycle
gas from the hydrofining zone is introduced into
the tower between the two parts thereof via line
14 and heater 15.

We claim:

1. A process for the removal of vanadium and
sodium from petroleum hydrocarbons, which
comprises passing the hydrocarbons over bauxite
at elevated temperature and pressure and in the
absence of hydrogen, whereby substantially all
the sodium is removed from the hydrocarbons,
and then passing the hydrocarbons over bauxite
at elevated temperature and pressure and in the
presence of hydrogen, whereby a considerable
proportion of the vanadium is removed from the
hydrocarbons.

2. A process according to claim 1, wherein both
stages of the process are operated at a tempera-
ture of approximately 780° F. and a pressure of
approximately 1000 lb./sq. in.

3. A process for the removal of vanadium and
sodium from petroleum hydrocarbons, which
comprises passing the hydrocarbons through a

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bed of bauxite at elevated temperature and pressure, and admitting hydrogen to said bed at an intermediate point calculated to afford optimum space velocities for both sodium and vanadium removal.

4. A process according to claim 3, wherein the bed of bauxite is maintained at a temperature of approximately 780° F. and a pressure of approximately 1000 lb./sq. in.

5. A process for the treatment of petroleum hydrocarbons containing vanadium, sodium and organically combined sulphur, which comprises passing the hydrocarbons over bauxite at elevated temperature and pressure and in the absence of

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hydrogen, then over bauxite at elevated temperature and pressure and in the presence of hydrogen, and finally to a hydrofining zone operated in known manner for the removal of organically combined sulphur.

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