

85-159009/26 E17 H04 J04 MOBI 01.12.82  
 MOBIL OIL CORP \*US 4523-047-A  
 16.07.84-US-631684 (+US-445810) (11.06.85) C07c-01/04  
 Conversion of synthesis gas to liq. hydrocarbon(s) - with continuous or periodic removal from Fischer Tropsch conversion zone to crack and isomerise over zeolite ZSM-45

C85-069640 Intermediate priority: 26.9.83-US-536067  
 C.i.p. 4471145

Synthesis gas is converted to liq., hydrocarbons boiling in the gasoline and distillate range by

- (a) subjecting the gas to Fischer-Tropsch synthesis using a single or combined catalyst providing CO reducing characteristics slurried in a suspending liquid,
- (b) removing at least part of the suspending liquid contg. dissolved heavier hydrocarbons, after separating catalyst particles from it, and contacting it with a zeolite ZSM-45 catalyst to crack and isomerise at least part of the heavy hydrocarbons to lighter hydrocarbons,
- (c) recycling part of the product stream from (b) to the slurry reactor (a),
- (d) combining the remainder of the product stream from (b) with the product stream from (a), and
- (e) converting the combined product streams over a

E(10-J2D) H(4-B2, 4-D3, 4-E5, 4-F2) J(4-E1) N(6)

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crystalline zeolite to form the desired hydrocarbon product.

#### USE/ADVANTAGE

For prodn. of liq. hydrocarbons e.g. from coal gasification synthesis gas. Cracking of the heavy hydrocarbon product in the slurry reactor prevents increase in viscosity of the slurry which normally necessitates shutdown of the reactor for replacement of suspending liquid.

#### PROCESS CONDITIONS

The catalysts and conditions employed in steps (a) and (e) are conventional.

In step (b), the catalyst pref. comprises a Gp.VIII metal, esp. Pt or Pd, on ZSM-45 zeolite. The suspending liquid is treated at 400-800°F, 0-1000 psig and LHSV of 0.1-20.

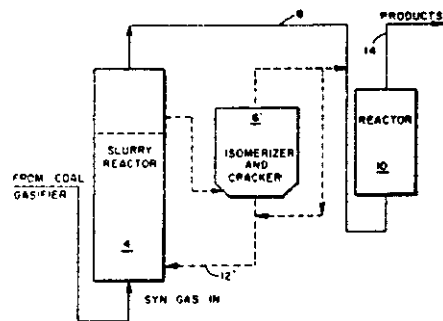
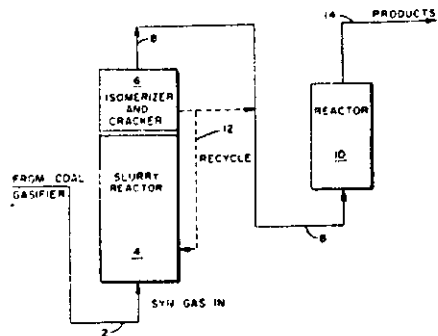
The liquid may be treated continuously or periodically.

#### APPARATUS

In one embodiment (as shown) the isomerisation/cracking zone is separate from the slurry reactor. In another arrangement, the isomeriser/cracker is arranged on top of the slurry reactor with a filter in between to prevent passage of

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catalyst particles from the reactor. (8pp909MHDwgNo1,2/2).



84-243401/39 H06 (H04) MOBI 01.12.82  
 MOBIL OIL CORP \*US 4471-145-A  
 26.09.83-US-536067 (+US-445810) (11.09.84) C07c-01/04  
 Prod'n. of gasoline and distillate from synthesis gas - in Fischer-Tropsch system where paraffin accumulations in slurry are minimised

H(4-B2, 4-D3, 4-F2B, 4-F2D) N(2-F2, 6-B)

134

carbons.

ADVANTAGE

The periodical (or continuous) removal and treatment of a portion of the Fischer-Tropsch slurry prevents the build-up of heavier (30C+) hydrocarbon waxes in the catalyst slurry and minimises the tendency of the slurry to thicken.

PREFERRED CONDITIONS

Step (c) is effected at 400-500°F and 0-1000 psig and with an LHSV of 0.1-20, (IV) esp. comprising a Gp. VIII metal (Pt or Pd) deposited on zeolite beta.

Both steps (a) and the conversion in step (e) are conventional, (V) comprising a fixed bed of ZSM-5 (see e.g. US4252736).

WIDER DISCLOSURES

According to the disclosures, (IV) pref. comprises a mixt. of a cracking component, selected from

- (i) small-pore zeolites (such as ZSM-5) and
- (ii) large-pore zeolites (such as X, Y, ZSM-45 and zeolite beta).

an isomerisation component comprising a Gp. VIII metal (Pt or Pd) deposited on alumina or a zeolite (ZSM-5 or zeolite beta). (5pp1639MHDwgNo/2).

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C84-102906

C.i.p. of 4423265 (84-017509/03)

CLAIMED HYDROCARBON SYNTHESIS PROCESS

Conversion of synthesis gas (I) to gasoline and distillate-boiling-range liq. hydrocarbons is carried out by:

- (a) subjecting (I) to Fischer-Tropsch synthesis in a reaction zone (A) contg. a slurried catalyst (II) having CO-reducing characteristics;
- (b) sepg. particles of (II) from at least part of the slurrying medium (III) contg. dissolved heavier hydrocarbons;
- (c) contacting the sepd. (III), in a contiguous or separate cracking zone (B) with a cracking/isomerisation catalyst (IV) comprising zeolite beta;
- (d) sepg. the product of step (c) into two streams; and
- (e) recycling one of the streams to step (a) and mixing the other stream with the effluent of step (a) and subjecting the mixt. to further processing by contact with a crystalline zeolite catalyst (V) to produce gasoline and distillate hydro-

84-017509/03 H04 MOBI 01.12.82  
 MOBIL OIL CORP \*US 4423-265-A  
 01.12.82-US-445810 (27 12.83) C07c-01/04  
 Gasoline and distillate prodn. from synthesis gas - with cracking and isomerisation of heavy by-products from Fischer-Tropsch reactor

H(4-D, 4-E5)

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thus preventing excessive viscosity increases and increasing the yield of useful prods.

DETAILS

Step (c) is pref. effected at 400-800 deg.F and 0-1000 psig with a LHSV of 0.1-20 using a combination of (i) a cracking catalyst comprising ZSM-5, X, Y or ZSM-beta zeolite and (ii) an isomerisation catalyst comprising a Group VIII metal (e.g. Pt or Pd) on alumina or a zeolite (pref. ZSM-5 or ZSM-beta).

Step (e) conversion is pref. effected at 400-950 deg.F and 0-800 psig with a WHSV of 0.2-5 using a ZSM-5, -11, -12, -23, -35, -39 or -48 zeolite catalyst.(6pp367APS DwgNo0/2).

C84-007512

Conversion of synthesis gas to gasoline and distillate is effected by

- (a) contacting the synthesis gas with a Fischer-Tropsch catalyst in direct contact with a liq. suspending medium;
- (b) separating at least a fraction of the liq. medium contg. dissolved heavy hydrocarbons from the catalyst;
- (c) contacting the fraction from (b) with a cracking and isomerisation catalyst to convert at least part of the heavy hydrocarbons to light hydrocarbons;
- (d) separating the prod. stream from (c) into two streams (A and B);
- (e) removing an effluent stream from (a), mixing it with stream A and contacting the mixt. with a zeolite catalyst to produce gasoline and distillate; and
- (f) recycling stream B to (a).

ADVANTAGES

The process prevents buildup of C30+ waxes in step (a).

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