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PROCESS FOR INCREASED OLEFIN RECOVERY
IN A PETROLEUM REFINERY
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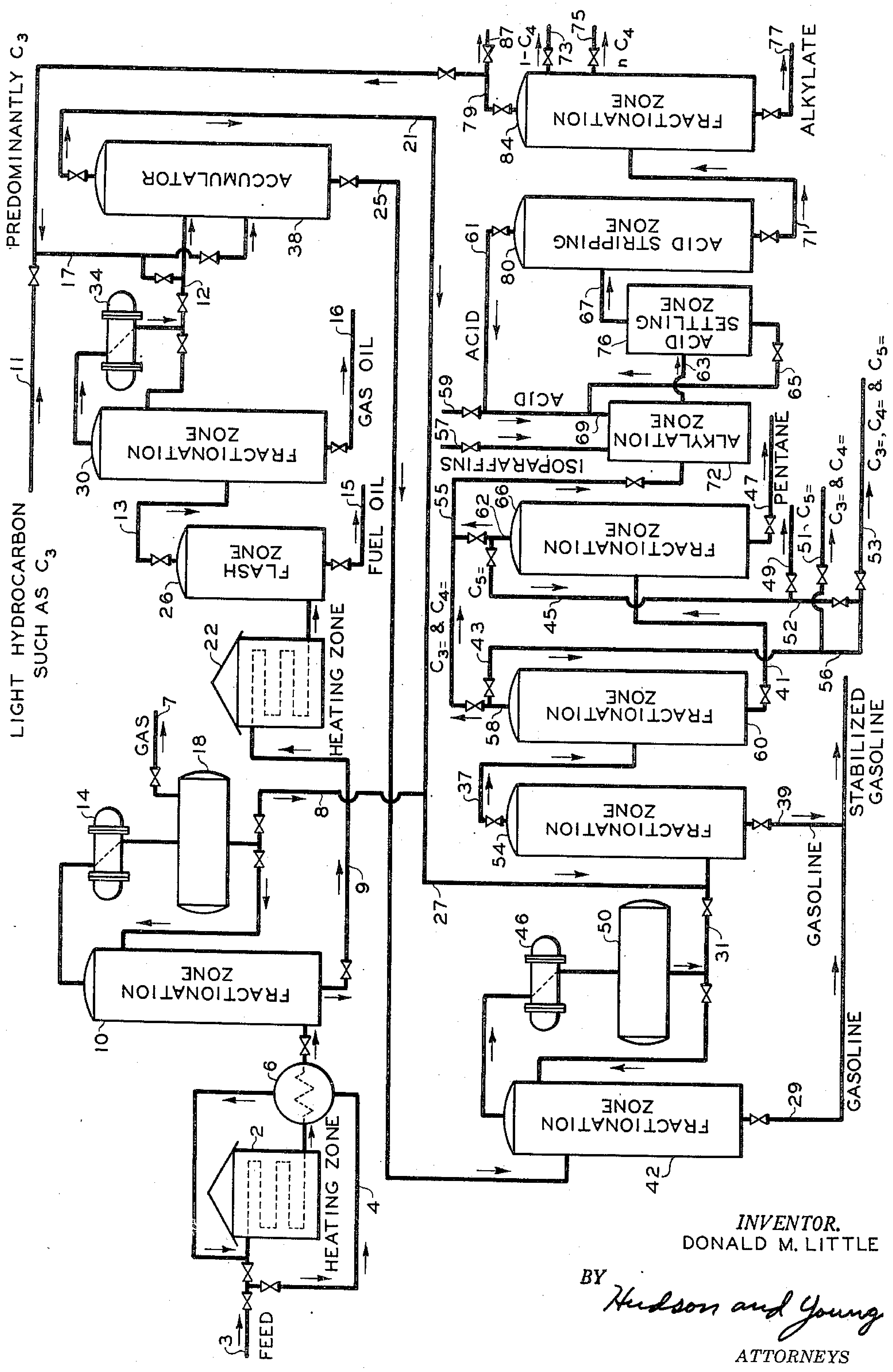

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PROCESS FOR INCREASED OLEFIN RECOVERY IN A PETROLEUM REFINERY

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6 Claims. (Cl. 260—683.4)

This invention relates to the treatment of hydrocarbons. In one of its more specific aspects it relates to the separation of C_5 and lighter hydrocarbons from a cracking furnace effluent. In still another of its more specific aspects it relates to the recovery of C_3, C_4 and C_5 olefins from a mixture of hydrocarbons containing the same. In still another of its more specific aspects it relates to an improved process for the recovery of C_3, C_4 and C_5 olefins from a cracking furnace effluent. In yet another of its more specific aspects it relates to an improved method of operating an integrated refining process comprising olefin feed preparation, alkylation and recovery of products.

The processes of reforming, polyforming and thermal cracking of light oil stocks for the production of gasoline are widely used in the petroleum industry. In these processes an appreciable quantity of olefinic material is formed. C_3, C_4 and C_5 olefins are used in the well-known processes of alkylation, isomerization, chemical synthesis, etc. Many naphtha reforming and/or polyforming units were built or put into operation before it became advantageous to recover olefins formed during the reforming and/or polyforming processes. In the usual reforming or polyforming unit the furnace effluent is separated into a fuel oil fraction, a gas oil fraction, a light oil side draw fraction, a gasoline fraction and a gaseous fraction containing substantially C_5 and lighter hydrocarbons. The gasoline fraction is stabilized to provide a gasoline fraction suitable for motor fuel or for blending purposes. Many existing units were designed merely to perform the operation of stabilizing gasoline with no thought of recovering C_3, C_4 and C_5 olefins to feed an alkylation unit, with the result that many C_4 and C_5 olefins are contained in the stabilized gasoline fraction. The usual existing stabilizer will not make a good separation between the olefin-containing fraction and the C_6 and heavier hydrocarbons which predominate in gasoline because the stabilizer will not handle the liquid load necessary for sufficient fractionation. The stabilizer will not handle the reflux necessary to recover all the available C_4 and C_5 olefins. As a result, C_4 and C_5 olefins are lost for alkylation, isomerization, chemical synthesis, etc. The usual separation and recovery system, used in conjunction with a naphtha fraction reforming or polyforming operation or with a light oil cracking operation, contains a gasoline accumulation zone, usually referred to as a gasoline accumulator. The gasoline and most of the lighter hydrocarbons formed in the cracking

operation are fed into this gasoline accumulation zone. In most operations a gas comprised predominantly of C_5 and lighter hydrocarbons is taken overhead from the gasoline accumulator; however, the accumulator acts only as a flash zone and no sharp separation is made. The gasoline stabilizer is fed with the liquid in the gasoline accumulator which contains appreciable quantities of C_3, C_4 and C_5 olefins. The gasoline stabilizer is operated so as to take overhead as many of the C_3, C_4 and C_5 olefins as possible. I have found that by introducing a normally gaseous hydrocarbon fraction into a gasoline accumulator, or into the feed to an accumulator, one can recover more of the C_3, C_4 and C_5 olefins in the overhead from the gasoline stabilizer and the gasoline accumulator, thereby making more olefins available for recovery in a light hydrocarbon recovery system.

It is an object of this invention to provide an improved method of separating a mixture of hydrocarbons.

Another object of this invention is to provide an improved method of recovering C_3, C_4 and C_5 olefins from the effluent of a naphtha reformer or polyformer or from a light oil cracking furnace.

It is another object of this invention to provide an improved method of operating a gasoline recovery system so as to recover more C_3, C_4 and C_5 olefins.

Still another object of this invention is to provide an improved process of operating an integrated refining operation comprising olefin feed preparation, alkylation and recovery of unreacted hydrocarbons so as to increase the amount of C_3, C_4 and C_5 olefins available for alkylation.

Other objects of my invention will become apparent, to one skilled in the art, from this disclosure.

My invention is particularly applicable to a process wherein a naphtha fraction, such as a straight run naphtha fraction, is reformed or polyformed. Also, it is applicable to processes where other light oil stocks are cracked so as to form gasoline and lighter hydrocarbons. The drawing is a schematic flow sheet diagrammatically showing a preferred embodiment of my invention. The following discussion of my invention applies to reforming or polyforming a straight run naphtha fraction, as a preferred example of my invention. A straight run naphtha fraction is fed to a reformer or polyformer represented by heating zone 2 through line 3. A by-pass line 4 is provided so that part of the feed may be preheated in heat exchanger

6 by interchange with the effluent from heating zone **2**. As will be appreciated, this heat interchange is purely optional and only acts to cool the furnace effluent to the temperature desired for the first fractionation step. The furnace effluent is fed to a depropanizer represented by fractionation zone **10** which operates to carry overhead a portion of the light hydrocarbons produced in the reforming or polyforming furnace. In carrying out my invention fractionation zone **10** is operated at a top temperature of from 190° F. to 230° F., and at a pressure of from 300 to 360 pounds per square inch gauge. The vapors from the top of fractionation zone **10** are cooled and/or condensed in condenser **14** and passed to accumulator **18**. A gaseous fraction comprised predominantly of H_2 and CH_4 is vented from accumulator **18**. Part of the liquid hydrocarbon fraction in accumulator **18** is passed back to fractionation zone **10** as reflux and the remainder, which is a hydrocarbon fraction comprised predominantly of C_2, C_3 and C_4 hydrocarbons, is passed through line **8** to a light hydrocarbon recovery system tied into the system or to an extraneous light hydrocarbon stream. A hydrocarbon fraction comprised predominantly of C_4 and heavier hydrocarbons is withdrawn from the bottom portion of fractionation zone **10** as bottoms product and passed through line **9** to a flash zone **26**. This bottoms product is heated in heating zone **22** before entering flash zone **26**. The fuel oil formed in heating zone **2** and present in the effluent from heating zone **2** is withdrawn from flash zone **26** through line **15**. The hydrocarbons lighter than the fuel oil fraction are taken overhead from flash zone **26** and are passed to fractionation zone **30** through line **13**. Fractionation zone **30** is employed to separate gas oil from the gasoline formed in the cracking operation. A clay tower to polymerize diolefins and gum forming constituents and a polymer separator (tower and separator now shown) can be used in conjunction with fractionation zone **30** to separate out polymers formed in the cracking operation and in the clay tower. This, of course, is optional at this stage of the process. Fractionation zone **30** is operated with a top temperature of from 375 to 450° F., and at a pressure of from 50 to 70 pounds per square inch gauge. The gases leaving the top of fractionation zone **30** are condensed and cooled in condendenser **34**. Part of the liquified gases from the top of fractionation zone **30** are used as reflux and the remainder are passed through line **12** into a gasoline accumulation zone represented by accumulator **38**. If a clay tower and polymer separator are used to treat the overhead vapors from fractionation zone **30**, fractionation zone **30** can be refluxed with the liquid hydrocarbons in gasoline accumulator **38**, that is, accumulator **38** may serve as a reflux accumulator for fractionation zone **30**. The hydrocarbon fraction taken overhead from fractionation zone **30** and passed into gasoline accumulator **38** contains the gasoline and light hydrocarbons not taken overhead in fractionation zone **10** which were formed in the cracking operation. Substantially all of the C_4 and C_5 olefins which were formed in the cracking operation are contained in the fraction passed to accumulator **38**. A light hydrocarbon fraction, such as a hydrocarbon fraction comprised predominantly of C_3 hydrocarbons, is added either to the feed line **12** to accumulator **38** or directly to accumulator **38**. Either method of adding the light hydrocarbon fraction will give the desired results. A separation of vapor and liquid present in accumulator **38** is made. An overhead fraction comprised predominantly of C_5 and lighter hydrocarbons is passed through line **21** to a light hydrocarbon recovery system. A liquid hydrocarbon fraction is withdrawn from the bottom portion of accumulator **38** and passed through line **25** to a gasoline stabilization zone or stabilizer represented by fractionation zone **42**. Gasoline accumulator **38**, is operated at a pressure of from 8 to 16 pounds per square inch gauge and at a temperature from 80° F. to 120° F. and operates primarily as a liquid-vapor separator, or flash zone, with no attempt at fractionating. The liquid hydrocarbon fraction withdrawn as bottoms from accumulator **38** contains substantially all of the gasoline formed in the cracking operation and some C_3, C_4 and C_5 olefins along with other C_5 and lighter hydrocarbons. Stabilized gasoline is withdrawn from the bottom portion of fractionation zone **42** through line **29**. Hydrocarbon vapors containing a substantial portion of the C_5, and lighter hydrocarbons contained in the feed to fractionation zone **42** are withdrawn overhead from fractionation zone **42** and condensed in condenser **46** which discharges to reflux accumulator **50**. Part of the condensed hydrocarbons are used to reflux fractionation zone **42** and the remainder are passed through line **31** to a light hydrocarbon recovery system. The gasoline stabilizer represented by fractionation zone **42** is operated with a top temperature of from 140° F. to 180° F. and at a pressure of from 5 to 13 pounds per square inch absolute. The withdrawn overhead hydrocarbon fractions from fractionation zone **10**, separation zone or gasoline accumulator **38** and fractionation zone or gasoline stabilizer **42** are passed to a light hydrocarbon recovery zone which is represented on the diagrammatic flow sheet, by fractionation zones **54**, **60** and **66**. The light hydrocarbon recovery system just referred to is used to recover C_3, C_4 and C_5 olefins to use as reactants in an alkylation process represented by alkylation reactors **72**, acid settling zone **76** and acid stripping zone **80**. In fractionation zone **54** a cut is made between C_5 hydrocarbons and gasoline present in the feed streams to the light hydrocarbon recovery system. C_6 and heavier hydrocarbons carried over in the overhead from fractionation zone **42** and accumulator **38** are removed as bottoms product from fractionation zone **54** via line **39**. The overhead from fractionation zone **54** containing C_5 and lighter hydrocarbons is passed through line **37** to fractionation zone **60**. The overhead from fractionation zone **54** may be deethanized if desired (means to do this not shown on the flow diagram). C_3. C_4 and C_5 olefins are taken overhead from fractionation zones **60** and **66** via lines **58** and **62** respectively, and are passed through line **55** to alkylation reactors **72** which are charged with isoparaffins through line **57**, with new acid through lines **59** and **69**, and with recycle acid through lines **65** and **69** and/or **61** and **69**. If desired, C_3 and C_4 olefins may be withdrawn from the system through lines **43** and **51** and/or **43**, **56** and **53**. C_5 olefins may be withdrawn from the system via lines **45** and **49** and/or **45**, **52** and **53**, if desired. A C_5 bottoms fraction from fractionation zone **60** is passed via line **41** to fractionation zone **66**. Pentane bottoms from fractionation zone **66** is removed via line **47**. Acid settling zone **76** fed through line **63** and acid stripping zone **80** fed through line **67** are used to separate alkylate and unreacted paraffins from the reaction mixture.

A mixture of alkylate and unconverted reactants is withdrawn from acid stripping zone **80** through line **71** and passed to fractionation zone **84**. The alkylate formed in the alkylation reactors is withdrawn from the bottom portion of fractionation zone **84** through line **77**. The unconverted paraffins are recovered as represented by side cuts taken off through lines **73** and **75**. A light hydrocarbon fraction comprised predominantly of C_3 hydrocarbons is taken overhead from fractionation zone **84**. This light hydrocarbon fraction may be recycled to the gasoline accumulation zone **38** through line **79** entering line **17**. It may also be passed directly to the overhead from fractionation zone **30** by passing it to line **12**. If desired, the overhead from fractionation zone **84** may be withdrawn from the system through line **87**. It is to be understood that the foregoing discussion of my invention is given only as a preferred method of operation and the scope of my invention is not to be unduly limited by said foregoing discussion. The drawing is only a diagrammatic flow sheet used in order to enable me to clearly point out my invention. One skilled in the art will appreciate that various modifications and arrangements of valves, pumps, auxiliary equipment, etc. can be made for any particular plant carrying out my invention.

Example

The temperatures, pressures, quantities, equipment, etc. referred to in the following example are only illustrative of my invention and are not to be deemed to unduly narrow the scope of my invention. So as to more clearly illustrate my example reference is made to the accompanying diagrammatic flow sheet.

A straight-run naphtha fraction having a boiling range of from 250–515° F. was fed to a reformer represented by heating zone **2**. The furnace inlet pressure was 2200 pounds per square inch gauge and the inlet temperature of the straight-run naphtha was 746° F., the straight-run naphtha having been preheated by the furnace effluent in a heat exchanger represented by heat exchanger **6**. The temperature of the furnace effluent was 970° F. The furnace effluent was cooled to 490° F. and passed into a depropanizer represented by fractionation zone **10**. Said depropanizer was operated at a top pressure of 330 pounds per square inch gauge and a top temperature of 210° F. The pressure drop over the depropanizer was 5 pounds per square inch. A gaseous fraction comprised predominantly of H_2 and CH_4 was vented from accumulator **18** at a rate of 2081 M. C. F./D. The depropanizer was refluxed with a liquid hydrocarbon stream from accumulator **18** at a rate of 5,325 B./D. A hydrocarbon fraction comprised predominantly of C_2, C_3 and C_4 hydrocarbons was withdrawn from accumulator **18** through line **8** as overhead product. A hydrocarbon fraction comprised predominantly of C_4 and heavier hydrocarbons was withdrawn from the bottom of the depropanizer at a rate of 10,000 B./D. and passed through line **9** to a flash zone **26**. This bottoms product was heated from 546° F. to 692° F. in a feed heater represented by heating zone **22**. Flash zone **26** was operated at a pressure of 65 pounds per square inch gauge and at a temperature of 670° F. A fuel oil product was withdrawn from the bottom of flash zone **26** at a rate of 228 B./D. and passed through line **15** to storage. The overhead gas from flash zone **26** was passed to fractionation zone **30** through line **13**. Fractionation zone **30** was operated at a top temperature of 423° F. and at a top pressure of 61 pounds per square inch gauge. The pressure drop across the fractionator represented by fractionation zone **30** was approximately 5 pounds per square inch. A side stream consisting of hydrocarbons boiling in the kerosene range was withdrawn from fractionation zone **30** at the rate of 653 B./D. Gas oil was withdrawn from the bottom of fractionation zone **30** at the rate of 975 B./D. Gasoline and lighter hydrocarbons were withdrawn overhead from fractionation zone **30** and passed through a clay tower operated at 59 pounds per square inch gauge and then passed to a polymer separator. The clay tower and polymer separator are not shown on the diagrammatic flow sheet. The conventional clay tower converted diolefins and gum-forming constituents to polymers which were removed from the bottom of the polymer separator at a rate of 192 B./D. The polymer separator was operated at the top temperature of 353° F. and at a pressure of 43 pounds per square inch gauge. The polymer-free gasoline and light hydrocarbons were passed to a gasoline accumulator represented by accumulator **38**. Gasoline accumulator **38** was operated at a temperature of 102° F. and at a pressure of 12 pounds per square inch gauge. Fractionation zone **30** was refluxed at a rate of 5380 B./D. with liquid hydrocarbons withdrawn from accumulator **38**. A gaseous hydrocarbon fraction was withdrawn overhead from accumulator **38** at a rate of 663 B./D. and had the following composition:

Gasoline accumulator overhead

	B./D.
C_1	76.2
C_2	169.7
$C_{2'}$	22.5
C_3	137.2
$C_{3'}$	41.8
C_4	71.6
i-C_4.	13.9
n-$C_{4'}$	21.9
$C_{5'}$	21.9
C_5	39.1
C_{6+}	47.1
Total	662.9

A liquid hydrocarbon fraction was withdrawn from the bottom of gasoline accumulator **38** and passed to a gasoline stabilizer represented by fractionation zone **42** at a rate of 3790 B./D. This feed to the gasoline stabilizer had the following composition:

Bottoms from gasoline accumulator

	B./D.
C_2	29
$C_{2'}$	3
C_3	69
$C_{3'}$	19
C_4	127
i-$C_{4'}$	18
n-$C_{4'}$	37
$C_{5'}$	117
C_5	181
C_{6+}	3,190
Total	3,790

The gasoline stabilizer represented by fractionation zone **42** was operated with a top temperature of 160° F. and at a top pressure of 9 pounds per square inch absolute. An overhead product was withdrawn from fractionation zone **42** through line **31** at a rate 359 B./D. and had the following composition:

Overhead from gasoline stabilizer

	B./D.
C_2	29
$C_{2'}$	3
C_3	69
$C_{3'}$	19
C_4	79
i-$C_{4'}$	10
n-$C_{4'}$	23
$C_{5'}$	45
C_5	82
C_{6+}	0
Total	359

Stabilized gasoline was withdrawn from the bottom of fractionation zone **42** at the rate of 3431 B./D. through the line **29**. This stabilized gasoline had the following composition:

Stabilizer gasoline

	B./D.
C_4	48
i-$C_{4'}$	8
n-$C_{4'}$	14
$C_{5'}$	72
C_5	99
C_{6+}	3,190
Total	3,431

The overhead from gasoline accumulator **38** was combined with the overhead from the gasoline stabilizer represented by fractionation zone **42** and passed to a light hydrocarbon recovery system represented by fractionation zones **54**, **60** and **66**. The combined streams gave a total of 1023 B./D. of light hydrocarbons. This light hydrocarbon feed stream had the following composition:

Gasoline accumulator overhead plus gasoline stabilizer overhead

	B./D.
C_1	76
C_2	199
$C_{2'}$	26
C_3	206
$C_{3'}$	61
C_4	151
i-$C_{4'}$	24
n-$C_{4'}$	45
$C_{5'}$	67
C_5	121
C_{6+}	47
Total	1,023

Thus 197 B./D. of C_3, C_4 and C_5 olefins were available to be recovered in the light hydrocarbon recovery system.

A similar test was then run in which a C_3 hydrocarbon stream was added to gasoline accumulator **38** through line **17** at a rate of 500 B./D. The same amount of straight run naphtha was reformed, fractionating and heating conditions remained the same and the same amount of fuel, oil, gas oil, kerosene, polymer and overhead from the de-propanizer were withdrawn from the system. All towers were refluxed at the same rate.

On overhead gas was withdrawn from the gasoline accumulator **38** at a rate 1,162 B./D. This

overhead gas stream now had the following composition:

Gasoline accumulator overhead—C_3 added

	B./D.
C_1	76.2
C_2	193.6
$C_{2'}$	25.1
C_3	466.9
$C_{3'}$	53.2
C_4	107.2
i-$C_{4'}$	20.3
n-$C_{4'}$	32.3
$C_{5'}$	35.7
C_5	62.4
C_{6+}	89.5
Total	1,162.4

A liquid hydrocarbon stream was withdrawn from the bottom of gasoline accumulator **38** and fed to a gasoline stabilizer, represented by fractionation zone **42**, through line **25** at a rate of 3,790 B./D. This gasoline stabilizer feed stream now had the following composition:

Bottoms from gasoline accumulator—C_3 added

	B./D.
C_2	19
$C_{2'}$	2
C_3	139
$C_{3'}$	15
C_4	113
i-$C_{4'}$	15
n-$C_{4'}$	33
$C_{5'}$	112
C_5	172
C_{6+}	3,170
Total	3,790

The overhead from the gasoline stabilizer now had the following composition and was withdrawn at the rate of 498 B./D.

Overhead from gasoline stabilizer—C_3 added

	B./D.
C_2	19
$C_{2'}$	2
C_3	139
$C_{3'}$	15
C_4	78
i-$C_{4'}$	10
n-$C_{4'}$	23
$C_{5'}$	52
C_5	90
C_{6+}	70
Total	498

The stabilized gasoline withdrawn from the bottom of the gasoline stabilizer now had the following composition and was withdrawn at a rate of 3292 B./D.

Stabilized gasoline—C_3 added

	B./D.
C_4	35
i-$C_{4'}$	5
n-$C_{4'}$	10
$C_{5'}$	60
C_5	82
C_{6+}	3,100
Total	3,292

The overhead from the gasoline stabilizer and the overhead from the gasoline accumulator now totaled 1660 B./D. and had the following composition.

Gasoline accumulator overhead plus gasoline stabilizer overhead—C_3 added

	B./D.
C_1	76
C_2	213
$C_{2'}$	27
C_3	606
$C_{3'}$	68
C_4	185
i-$C_{4'}$	30
n-$C_{4'}$	55
$C_{5'}$	88
C_5	152
C_{6+}	160
Total	1,660

Thus the addition of the C_3 hydrocarbon stream to gasoline accumulator **38** made available 241 B./D. of C_3, C_4 and C_5 olefins for recovery in the light hydrocarbon recovery system.

The addition of C_3 hydrocarbons to the gasoline accumulator increased the recovery of C_3, C_4 and C_5 olefins by 44 B./D., and by 22 per cent.

As will be evident to those skilled in the art, various modifications of this invention can be made, or followed, in the light of the foregoing disclosure and discussion, without departing from the spirit or scope of the disclosure or from the scope of the claims.

I claim:

1. An improved process for recovering C_3, C_4 and C_5 olefins from a mixture of hydrocarbons containing the same in admixture with other hydrocarbons, said mixture being a thermally cracked straight run naphtha fraction, which comprises passing said mixture to a first fractionation zone operating under a pressure of from 300 to 360 pounds per square inch gauge with a top temperature of from 190° F. to 230° F., withdrawing overhead from said first fractionation zone a hydrocarbon fraction comprised predominantly of C_2, C_3 and C_4 hydrocarbons, withdrawing a hydrocarbon fraction as bottoms from said first fractionation zone, passing said withdrawn bottoms to a second fractionation zone operating under a pressure of from 50 to 70 pounds per square inch gauge and with a top temperature of from 375° F. to 450° F., withdrawing overhead from said second fractionation zone a gaseous hydrocarbon fraction, at least partially condensing same and introducing into a portion of same a hydrocarbon fraction comprised predominantly of C_3 hydrocarbons, passing a resulting hydrocarbon mixture into an accumulation zone operating under a pressure of from 8 to 16 pounds per square inch gauge and at a temperature of from 80° F. to 120° F., withdrawing a gaseous hydrocarbon fraction overhead from said accumulation zone, withdrawing a liquid hydrocarbon fraction from the bottom portion of said accumulation zone and passing same to a third fractionation zone operating under a pressure of from 5 to 13 pounds per square inch absolute and at a top temperature of from 140° F. to 180° F., withdrawing a hydrocarbon fraction overhead from said third fractionation zone, passing said hydrocarbon fractions, withdrawn overhead from said first fractionation zone, said accumulation zone and said third fractionation zone, to a fourth fractionation zone and recovering therefrom C_3, C_4 and C_5 olefins.

2. An improved process for recovering C_3, C_4 and C_5 olefins from a mixture of hydrocarbons constituting effluent from a light oil cracking furnace, which comprises passing said mixture to a first fractionation zone, withdrawing overhead from said first fractionation zone a hydrocarbon fraction comprised predominantly of C_2, C_3 and C_4 hydrocarbons, withdrawing a hydrocarbon fraction from the bottom portion of said first fractionation zone comprised predominantly of C_4 and heavier hydrocarbons, passing said hydrocarbon fraction withdrawn from the bottom portion of said first fractionation zone to a second fractionation zone, withdrawing overhead from said second fractionation zone a gaseous hydrocarbon fraction containing gasoline and lighter hydrocarbons not taken overhead in said first fractionation zone, at least partially condensing same and passing a portion of said hydrocarbon fraction withdrawn overhead from said second fractionation zone to an accumulation zone, introducing into said accumulation zone a light hydrocarbon fraction containing C_3 hydrocarbons and minor amounts of other light hydrocarbons, withdrawing a gaseous hydrocarbon fraction overhead from said accumulation zone comprised predominantly of C_5 and lighter hydrocarbons, withdrawing a liquid hydrocarbon fraction from the bottom portion of said accumulation zone containing C_6 and heavier hydrocarbons and containing appreciable quantities of C_5 and lighter hydrocarbons, passing said liquid hydrocarbon fraction withdrawn from the bottom portion of said accumulation zone to a third fractionation zone, withdrawing overhead from said third fractionation zone a hydrocarbon fraction containing a substantial portion of the C_5 and lighter hydrocarbons contained in the above mentioned hydrocarbon fraction passed to said third fractionation zone, passing said hydrocarbon fractions, withdrawn overhead from said first fractionation zone, said accumulation zone and said third fractionation zone, to a fourth fractionation zone and recovering therefrom C_3, C_4 and C_5 olefins.

3. An improved process for recovering C_3, C_4 and C_5 olefins from a mixture of hydrocarbons constituting effluent from a naphtha fraction cracking furnace, which comprises passing said mixture to a first fractionation zone, withdrawing overhead from said first fractionation zone a hydrocarbon fraction comprised predominantly of C_2, C_3 and C_4 hydrocarbons, withdrawing a hydrocarbon fraction from the bottom portion of said first fractionation zone comprised predominantly of C_4 and heavier hydrocarbons, passing said hydrocarbon fraction withdrawn from the bottom portion of said first fractionation zone to a second fractionation zone, withdrawing overhead from said second fractionation zone a gaseous hydrocarbon fraction containing gasoline and lighter hydrocarbons not taken overhead in said first fractionation zone, at least partially condensing same and passing a portion of said hydrocarbon fraction withdrawn overhead from said second fractionation zone to an accumulation zone, introducing into said accumulation zone a light hydrocarbon fraction containing C_3 hydrocarbons and minor amounts of other light hydrocarbons, withdrawing a gaseous hydrocarbon fraction overhead from said accumulation zone comprised predominantly of C_5 and lighter hydrocarbons, withdrawing a liquid hydrocarbon fraction from the bottom portion of said accumulation zone containing C_6 and heavier hydrocarbons and containing appre-

ciable quantities of C_5 and lighter hydrocarbons, passing said liquid hydrocarbon fraction withdrawn from the bottom portion of said accumulation zone to a third fractionation zone, withdrawing overhead from said third fractionation zone a hydrocarbon fraction containing a substantial portion of the C_5 and lighter hydrocarbons contained in the above mentioned hydrocarbon fraction passed to said third fractionation zone, passing said hydrocarbon fractions, withdrawn overhead from said first fractionation zone, said accumulation zone and said third fractionation zone, to a fourth fractionation zone and recovering therefrom C_3, C_4 and C_5 olefins, alkylating said C_3, C_4 and C_5 olefins recovered from the above mentioned three hydrocarbon fractions, passing a resulting alkylation reaction product to a fifth fractionation zone, withdrawing overhead from said fifth fractionation zone a hydrocarbon fraction containing C_3 hydrocarbons and minor amounts of other light hydrocarbons, and recycling said hydrocarbon fraction withdrawn overhead from said fifth fractionation zone to said accumulation zone.

4. The improved process of claim 2 wherein said light-oil is a naphtha fraction.

5. An improved process for recovering C_3, C_4 and C_5 olefins from a mixture of hydrocarbons constituting effluent from a light-oil cracking furnace, which comprises passing said mixture to a first fractionation zone, withdrawing overhead from said first fractionation zone a hydrocarbon fraction comprised predominantly of C_2, C_3 and C_4 hydrocarbons, withdrawing a hydrocarbon fraction from the bottom portion of said first fractionation zone comprised predominantly of C_4 and heavier hydrocarbons, passing said hydrocarbon fraction withdrawn from the bottom portion of said first fractionation zone to a second fractionation zone, withdrawing overhead from said second fractionation zone a gaseous hydrocarbon fraction containing gasoline and lighter hydrocarbons not taken overhead in said

first fractionation zone, removing polymer forming constituents from same, at least partially condensing said resulting gasoline and lighter hydrocarbons and passing resulting hydrocarbons into an accumulation zone, introducing into said accumulation zone a light hydrocarbon fraction containing C_3 hydrocarbons and minor amounts of other light hydrocarbons, withdrawing a gaseous hydrocarbon fraction overhead from said accumulation zone comprised predominantly of C_5 and lighter hydrocarbons, withdrawing a liquid hydrocarbon fraction from the bottom portion of said accumulation zone containing C_6 and heavier hydrocarbons and containing appreciable quantities of C_5 and lighter hydrocarbons, passing said liquid hydrocarbon fraction withdrawn from the bottom portion of said accumulation zone to a third fractionation zone, withdrawing overhead from said third fractionation zone a hydrocarbon fraction containing a substantial portion of the C_5 and lighter hydrocarbons contained in the above-mentioned hydrocarbon fraction passed to said third fractionation zone, passing said hydrocarbon fractions, withdrawn overhead from said first fractionation zone, said accumulation zone and said third fractionation zone, to a fourth fractionation zone and recovering therefrom C_3, C_4 and C_5 olefins.

6. The improved process of claim 5 wherein said light-oil is a naphtha fraction.

DONALD M. LITTLE.

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