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J. B. McKINLEY

2,585,337

DESTRUCTIVE HYDROGENATION OF HYDROCARBON
OILS WITH MOLYBDENUM OXIDE CATALYST

Filed Feb. 15, 1949

2 SHEETS—SHEET 1

Fig. 1.
EFFECT OF MOLYBDENA CONCENTRATION
ON CATALYST ACTIVITY

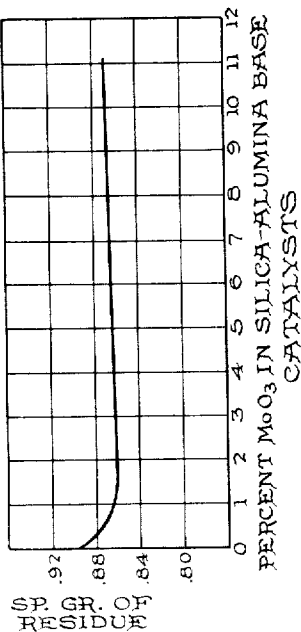


Fig. 3.

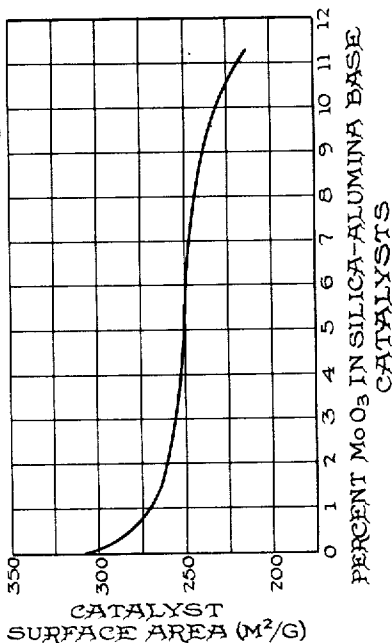


Fig. 2.

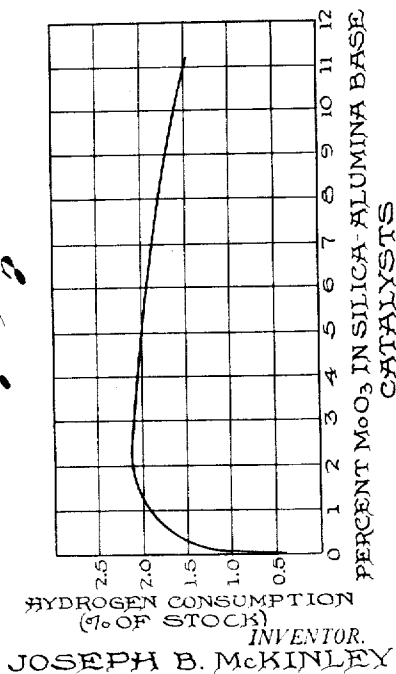
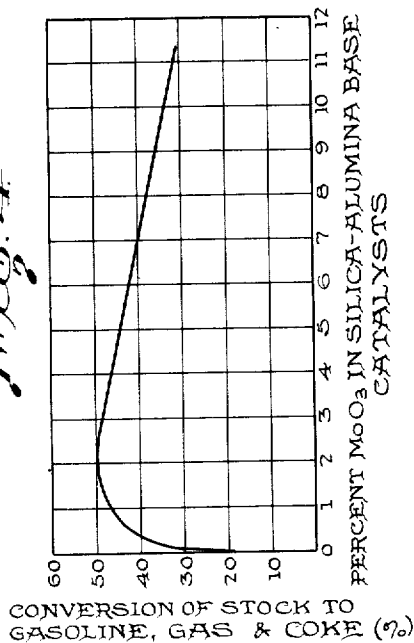


Fig. 4.



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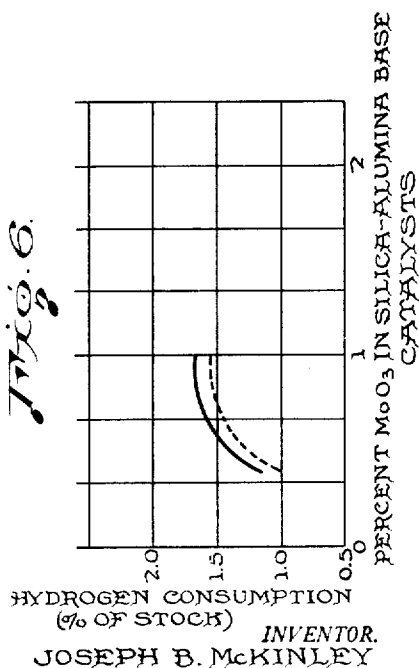
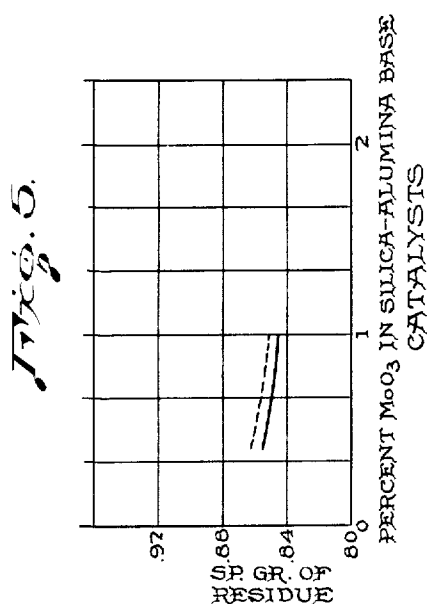
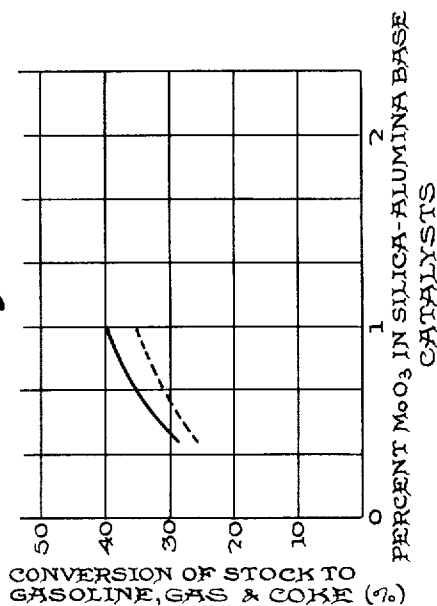
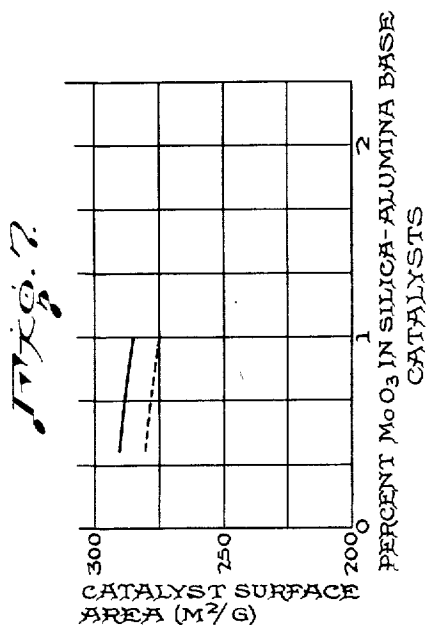
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2 SHEETS—SHEET 2



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UNITED STATES PATENT OFFICE

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DESTRUCTIVE HYDROGENATION OF HYDROCARBON OILS WITH MOLYBDENUM OXIDE CATALYST

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Application February 15, 1949, Serial No. 76,629

5 Claims. (Cl. 196—53)

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This invention relates to an improved procedure for converting hydrocarbon oils into lighter products, and more particularly to the hydrocracking or destructive hydrogenation of low grade petroleum stocks such as recycle gas oils from thermal or catalytic cracking in the presence of a molybdenum trioxide-cracking base catalyst.

It is known to subject hydrocarbon oils such as low grade petroleum stocks to hydrocracking or destructive hydrogenation under conditions which effect hydrogenation as well as cracking in order to convert the hydrocarbon oil into gasoline or lighter products. Among the catalysts which have been used in the past for promoting these reactions is molybdenum trioxide supported on a silica-alumina or other cracking catalyst base or carrier. A method commonly employed in the past in preparing this type of catalyst involves impregnating the base with an aqueous solution of ammonium paramolybdate to which has been added an excess of the amount or just the theoretical amount of ammonia necessary to convert the paramolybdate to the normal ammonium molybdate. The impregnated base is then dried and calcined in air to obtain the finished molybdenum trioxide-cracking base catalyst.

This invention has for its object to provide a destructive hydrogenation or hydrocracking procedure whereby the yield of gasoline can be materially increased. Another object is to provide an improved destructive hydrogenation or hydrocracking procedure yielding a high quality gasoline product. A further object is to provide an improved destructive hydrogenation or hydrocracking process which employs a low molybdenum content catalyst which is more active in this process than prior art catalysts. A still further object is to provide an economical procedure for converting relatively heavy hydrocarbon oils into light products and especially into gasoline. Still another object is to provide an improved process for the destructive hydrogenation of petroleum stocks which employs a catalyst having high activity which is prepared in such a manner as to be particularly adapted for use in destructive hydrogenation processes. Other objects will appear hereinafter.

These and other objects are accomplished by the present invention which includes hydrocracking or destructive hydrogenation of a hydrocarbon oil by contacting it with hydrogen under conditions giving rise to hydrogenation and cracking while in the presence of an active cracking catalyst composited with molybdenum trioxide, MoO_3 , or as commonly called, molybdena, said molybdena having been deposited on the active cracking catalyst base by impregnating said

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base with a solution prepared by dissolving molybdenum pentachloride in water followed by drying and calcining.

The active cracking component of the catalyst which will be referred to as the cracking base, is preferably a synthetic or natural cracking catalyst of the well known silica-alumina type. The synthetic catalysts are preferably prepared by coprecipitation. However, other well known active cracking catalysts may be used as the cracking component. Thus, the cracking component may be any one which is known in the art to be active for catalytic cracking, as for example, a silica-zirconia, silica-titania, silica-alumina-titania, or silica-alumina-boric oxide, cracking catalyst.

To prepare the composited catalyst which is to be employed in my process, a cracking catalyst, as for example silica-alumina, is impregnated with a solution prepared by dissolving between about 0.1 and 20% molybdenum pentachloride in water. The exact nature of the hydrolysis products of molybdenum pentachloride in the solution is not known. However, it is known that during subsequent drying and calcining in air the molybdenum in solution is converted quantitatively to molybdenum trioxide or molybdena on the catalyst. The freshly prepared catalyst may also contain small amounts of other oxides than molybdena. During use of such a catalyst in destructive hydrogenation the molybdena is at least partially reduced. The impregnation may be effected by soaking the cracking catalyst base with the solution. Vacuum impregnation, which involves contacting the impregnating solution with an evacuated cracking base, gives a more thorough distribution of the solution through the cracking base and is the preferred method of impregnation. The length of time for soaking the evacuated base may be from 5 to 30 minutes, and the preferable temperature is in the range of 15° to 85° C. After impregnation the catalyst is dried in conventional manner for instance at a temperature in the range of 212° to 260° F. for 10 to 100 hours, and then calcined by heating in air at elevated temperature such as about 900° F. The concentration of the molybdenum in the solution prepared from molybdenum pentachloride may be varied so as to produce a molybdena-silica-alumina catalyst containing varying amounts of molybdenum trioxide. It is known in the prior art that the percent of molybdenum trioxide in a molybdena-cracking base catalyst can vary to a large degree and this is true in accordance with my invention. However, I have found that my invention is of unusual value in connection with catalysts which have between 0.5 and 6.0% molybdenum trioxide and preferably between 0.5

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and 4.0% molybdenum trioxide and I may therefore select a concentration for the impregnating solution which will produce the desired amount of molybdena in the molybdena-cracking base catalyst being prepared.

The method of impregnation here described, while it does not involve impregnation of the base with molybdenum pentachloride solution but rather with a solution of the hydrolysis products of molybdenum pentachloride in water, will hereinafter be referred to as the molybdenum pentachloride impregnation method and for convenience the impregnating solution will some-

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water. The samples were first evacuated and then contacted with said solutions in a closed system. Each sample was impregnated with a solution of a different concentration varying from 0.72% to 14.93% molybdenum, calculated as molybdenum trioxide, in order to deposit varying amounts of molybdenum trioxide on the catalyst samples. The five impregnated samples were oven dried and then calcined in air to convert the impregnant to the oxide. The specific temperatures and lengths of time for drying and calcining and other details of preparation for each of the impregnated catalysts are given in the following table.

TABLE I

Catalyst No.	Concentration of the Molybdenum Containing Solution as Per Cent MoO ₃	Oven Drying ¹		Calcining ²	
		Temp., °C.	Time, Hrs.	Temp., °F.	Time
	Per Cent				
1.....	0.72	120	60.5	900	Overnight.
2.....	1.42	120	70	900	Do.
3.....	3.78	102	20.5	900	Do.
4.....	7.36	102	20.5	900	Do.
5.....	14.93	102	20.5	900	Do.

¹ Oven drying started in hot oven.

² All calcinings started in cold furnace and calcining time includes a 4 to 5 hour heat-up period.

times be referred to as molybdenum pentachloride solution.

Vapors of the hydrocarbon stock and hydrogen are contacted with a catalyst prepared as described above at temperature and pressure usual to destructive hydrogenation procedures. The pressure should be superatmospheric, for example, from about 1000 to 5000 p. s. i. or higher, the temperature should be from about 750° to 900° F., and from about 5 to 30% hydrogen by weight as compared with the charge stock should be employed. Suitable hydrocarbon stocks for subjecting to destructive hydrogenation are thermally cracked, catalytically cracked, or virgin hydrocarbon oils, and especially highly aromatic cycle stocks from catalytic cracking. Reduced crudes, pressure still tars, and similar materials also may be treated, preferably in admixture with low-boiling material so that they are substantially in the vapor phase during ordinary conditions for destructive hydrogenation. Stocks which are substantially in the liquid phase under normal destructive hydrogenation conditions tend to be soaked up by the catalyst. This condition favors cracking rather than destructive hydrogenation for hydrogen absorption by the catalyst surface is hindered and thus it is not favorable for obtaining best results with my preferred catalysts.

In its preferred embodiment my invention involves the use of 0.5 to 4.0% molybdenum trioxide deposited on the cracking carrier. This range gives greatest activity as demonstrated by the data in Example I wherein catalysts prepared by the molybdenum pentachloride impregnation method and varying in molybdena content from 0% to 11.7% were tested.

Example I.—Five samples of co-precipitated silica-alumina catalysts of uniform quality and precalcined in air at 1000° F. were tested for their destructive hydrogenation activity with varying amounts of molybdenum trioxide deposited thereon. All were impregnated with solutions prepared by dissolving molybdenum pentachloride in

The above catalysts and an unimpregnated base (also precalcined) were tested for destructive hydrogenation activity with a light cycle stock from a Thermoform catalytic cracking operation by a standard procedure in a two liter rocking bomb. The tests were on an equal weight basis. In each test the bomb was charged with 13.6 grams of catalyst, 8.5 grams of hydrogen, and 175.0 grams of cycle stock. The bomb, containing catalyst, hydrogen and cycle stock, was heated in 132 minutes to a temperature of 835° F. That reaction temperature was maintained for 47 minutes with an average maximum reaction pressure of 2100 p. s. i. g. The bomb was then cooled in an air blast for 60 minutes to reduce the temperature to 300° F., at which time the bomb was water quenched.

The characteristics of the cycle oil, which was the charge stock in these tests, is given in Table II below.

TABLE II

Inspection of light cycle oil No. 1, from a Thermoform catalytic cracking operation

Sp. gr. at 60°/60° F.....	0.8849
Viscosity, centistokes at 100° F.....	2.98
Sulfur, wt. per cent.....	0.18
Refractive index, n_D^{20}	1.5051
Aniline point, °F.....	117.5
Bromine No.....	5.1
Mol. wt.....	208
Composition:	
Naphthenes and paraffins.....	6.0
Olefins.....	3.6
Aromatics.....	90.4
Distillation:	
Gasoline (400° F. end point), wt. per cent.....	4.7
Gas oil (above 400° F. end point), wt. per cent.....	95.3

Table III gives the results of the tests for the five molybdena-silica-alumina catalysts and the unimpregnated silica-alumina base.

TABLE III

Effect of molybdena content on the activity of molybdena-silica alumina catalysts

Catalyst Number		Unimpregnated Silica-Alumina Base	#1	#2	#3	#4	#5
Wt. Percent MoO ₃		(²)	0.5	1.0	2.7	5.5	11.7
Surface Area, m ² /g		317.7	280.3	268.4		240.2	223.4
Products (Wt. Percent of Charge Stock):							
C ₁ and Lighter	(¹)	4.1	9.2	10.6	9.8	8.8	6.6
Gasoline to 400° F.		18.7 (14.0)	37.2 (32.5)	40.4 (35.7)	43.1 (38.4)	37.5 (32.8)	30.1 (25.4)
Liquid Residue above 400° F.		75.8	52.6	48.3	46.5	52.3	63.0
Coke		1.4	1.0	0.7	0.6	0.4	0.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Conversion of Stock to Gasoline, Gas and Coke (Wt. Percent of Charge Stock) ³		19.5	42.7	47.0	48.8	42.0	32.3
Hydrogen Consumption (Wt. Percent of Charge Stock)		0.42	1.75	1.82	2.13	1.98	1.55
Ratio of Iso to n-Butane in Gaseous Products		0.7:1	1.5:1	1.4:1	1.2:1	1.1:1	0.7:1
Properties of Products—							
Gasoline:							
Sp. Gr. at 60°/60° F.		0.779	0.768	0.768	0.768	0.768	0.774
Br. No.		13.1	4.2	2.6	1.3	0.0	2.7
Residue:							
Sp. Gr. at 60°/60° F.		0.9013	0.8735		0.8623	0.8644	0.8602

¹ Charge stock.

² None.

³ Conversions are calculated as weight percent of material boiling above 400° F. in the charge minus weight percent of similarly boiling liquid materials in the product.

⁴ The figures in parentheses are the corrected gasoline yields; the actual observed weight percent yield minus the weight percent gasoline in the charge stock.

The curves presented in Figures 1 to 4 inclusive of the drawings were obtained by plotting the Table III test results for specific gravity of residue (Fig. 1), hydrogen consumption (Fig. 2), catalytic surface area (Fig. 3), and conversion of stock to gasoline, gas, and coke (Fig. 4), against the six values for percentages of molybdenum trioxide in the catalyst samples. The six points plotted in each graph were connected by a smooth curve.

The curve of Figure 1 indicates that an optimum specific gravity of residue can be obtained with a catalyst of about 2% molybdenum oxide in the molybdenum trioxide-cracking base catalyst. The low value for specific gravity of residue is considered optimum since it most probably represents a lower molecular weight and/or more saturated residue and hence is a material of better quality than higher specific gravity residues for charge to subsequent destructive hydrogenation treatments or cracking operations.

The curve of Figure 2 indicates that hydrogen consumption will be highest for a catalyst containing about 2% or slightly more molybdenum trioxide. Large hydrogen consumption is of course an indication of high catalytic activity.

The curve of Figure 3 indicates that catalytic surface area decreases as the molybdena content increases.

The curve of Figure 4 indicates that a maximum conversion of stock to gasoline, gas and coke will be effected by a catalyst having a molybdena content of about 2.0%.

Molybdenum trioxide-cracking base catalysts prepared by the molybdenum pentachloride impregnation method show the greatest superiority over the catalysts prepared by prior art methods in the molybdena content range of from about 0.5 to 6% molybdena and especially in the low molybdena content range of from about 0.5 to 4.0% molybdena. Since practically all molybdena-cracking base catalysts are most active or reach

maximum activity when they contain 0.5 to 4.0% molybdena, the molybdenum pentachloride impregnation method is most effective when impregnating the preferred amount of molybdena on cracking catalysts.

I have conducted tests to demonstrate the superiority of the destructive hydrogenation process of this invention which employs a catalyst prepared by molybdenum pentachloride impregnation method over the prior art process which employs a catalyst prepared by the ammoniacal ammonium paramolybdate method of impregnation. Example II gives the details of tests using low molybdena content catalysts (i. e., 0.5–1% molybdena) prepared by the two different methods.

Example II.—Six samples of silica-alumina cracking catalysts of uniform characteristics and precalcined at 1000° F. were selected. Three of these samples I shall designate as A, B, and C. I contacted the samples A, B, and C, after evacuating, with aqueous solutions of molybdenum pentachloride having concentrations of 0.56%, 0.97% and 1.38%, respectively of molybdenum calculated as MoO₃. Each of these samples was oven dried at a temperature and for the length of time indicated in Table IV. Following the drying period the catalyst samples were calcined in air at about 900° F. for about 16 hours in a muffle furnace to quantitatively convert all impregnant on the cracking catalyst base into molybdenum trioxide. The three remaining cracking catalyst samples which I designate as D, E, and F were prepared in an identical fashion except that the impregnation was performed with an aqueous solution of ammonium paramolybdate, (NH₄)₂Mo₇O₂₄·4H₂O, to which had been added the theoretical amount of ammonia necessary to convert the paramolybdate to the normal molybdate, (NH₄)₂MoO₄. Table IV gives the details of preparation of the six catalysts A, B, C, D, E, and F.

While conditions under which catalysts may be prepared by the molybdenum pentachloride impregnation method can vary widely without much effect upon the final catalyst activity, care was taken in this and the following example to make conditions of all preparations, regardless of method, as nearly identical as possible in order that the superiority to be shown for the molybdenum pentachloride impregnation method should be unambiguous.

Each of the six catalysts before testing was reduced in a 6000 STP space velocity hydrogen stream at 900° F. overnight, cooled to room temperature and contacted with oil and hydrogen, in such a manner as to prevent reoxidation before and during testing. For testing each of the six catalysts, a two liter rocking bomb was charged with 23 cc. of the reduced catalyst, 8.5 grams of hydrogen, and 175.0 grams of cycle stock. The bomb, containing catalyst, hydrogen,

TABLE IV

Catalyst	Impregnating Solution		Oven Drying ¹		Calcining ¹	
	Type Employed	Molybdenum Concentration MoO ₃	Temp., °C.	Time, Hrs.	Temp., °F.	Time
		Per cent				
A.....	MoCl ₅	0.56	125	21	900	overnight.
B.....	MoCl ₅	0.97	126	21	900	Do.
C.....	MoCl ₅	1.38	126	21	900	Do.
D.....	A.P.M.+NH ₃ ²	0.56	123	20	900	Do.
E.....	A.P.M.+NH ₃	0.98	126	19	900	Do.
F.....	A.P.M.+NH ₃	1.40	126	19	900	Do.

¹ See footnote 1, Table I.

² See footnote 2, Table I.

³ Ammonium paramolybdate (A.P.M.) solution plus enough added ammonia to form the normal molybdate, (NH₄)₂MoO₄.

The six catalysts A, B, C, D, E, and F, were then subjected to comparative destructive hydrogenation tests under conditions similar to those set forth in Example I. The charge stock was a Thermoform catalytic cracking cycle oil having the following characteristics.

and cycle stock, was heated in 125 minutes to a temperature of 790° F., maintained at 790° F. for 50 minutes, and then cooled in an air blast for 60 minutes to reduce the temperature to 300° F. at which time the bomb was water quenched. Table VI gives the results of these tests.

TABLE VI

Comparison of activity of low molybdena content catalysts made by different impregnation methods

Catalyst		A	B	C	D	E	F
Prepared by Impregnating Cracking Base with.....		(¹)	(¹)	(¹)	(²)	(²)	(²)
Per cent MoO ₃		0.4	0.7	1.0	0.4	0.7	1.0
Surface Area, m ² /g.....		289.5	289.5	283.6	279.4	277.4	273.8
Products (Wt. Per Cent of Cycle Stock):	(³)						
C ₄ and Lighter.....		4.4	5.7	6.1	3.8	5.4	5.5
Gasoline to 400° F.....		26.4(23.0)	32.5(29.1)	36.7(33.3)	24.7(21.3)	29.4(26.0)	32.4(29.0)
Residue above 400° F.....		68.7	61.3	56.7	71.0	64.7	61.6
Coke (Approx.).....		0.5	0.5	0.5	0.5	0.5	0.5
Total.....	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Conversion of Stock to Gasoline, Gas and Coke (Wt. Per Cent of Cycle Stock) ⁴		27.9	35.3	39.9	25.6	31.9	35.0
Hydrogen Consumption (Wt. Per Cent of Cycle Stock).....		1.13	1.60	1.66	1.00	1.48	1.52
Properties of Products—							
Gasoline:							
Sp. Gr. at 60°/60° F.....		0.768	0.766	0.764	0.776	0.761	0.766
Br. No.....		0.9	0.4	0.2	1.7	0.7	0.4
Residue:							
Sp. Gr. at 60°/60° F.....		0.8565	0.8476	0.8448	0.8618	0.8576	0.8473

¹ M. P. C.—Molybdenum Pentachloride Solution.

² A. P. M.—Ammonium Paramolybdate in Ammoniacal Solution.

³ Charge.

⁴ See footnote 4, Table III.

⁵ See footnote 3, Table III.

TABLE V

Inspection of light cycle oil No. 2, from a Thermoform catalytic cracking operation

Sp. gr. at 60°/60° F.....	0.8713	60
Viscosity, centistokes at 100° F.....	3.05	
Sulfur, wt. per cent.....	0.20	
Refractive index, n _D ²⁰	1.4938	
Aniline point, °F.....	122.7	
Bromine No.....	4.4	65
Mol. wt.....	209.0	
Composition:		
Naphthenes and paraffins.....	13.7	
Olefins.....	3.1	
Aromatics.....	83.2	70
Distillation:		
Gasoline (400° F. end point), wt. per cent.....	3.4	
Gas oil (above 400° F. end point), wt. per cent.....	96.6	75

The data of Table VI are plotted in Figures 5 to 8 inclusive where it is readily seen that catalysts in the low molybdena content range are most suitable for destructive hydrogenation where they have been prepared by the molybdenum pentachloride impregnation method. The dotted line curves represent the values obtained for the catalysts prepared by the prior art method of ammoniacal ammonium paramolybdate impregnation and the solid line curves represent the values obtained for the catalysts prepared by the molybdenum pentachloride impregnation method.

Thus, Figure 5 shows that destructive hydrogenation, using a catalyst prepared by the molybdenum pentachloride impregnation method, results in a lower specific gravity of the residue than in the process employing a catalyst pre-

pared by the ammoniacal ammonium paramolybdate impregnation method.

Figure 6 shows that hydrogen consumption is greater when the catalyst prepared by the molybdenum pentachloride impregnation method is employed.

Figure 7 shows that the surface area of the catalyst prepared by the molybdenum pentachloride impregnation method is greater.

In Figure 8 it is seen that the destructive hydrogenation process of this invention employing a catalyst prepared by the molybdenum pentachloride impregnation method has the important result of converting more stock to gasoline, gas, and coke and particularly to gasoline and gas since coke formation is small, than the prior art method employing the catalyst prepared by the ammoniacal ammonium paramolybdate impregnation.

I have made additional tests to determine the advantages of destructive hydrogenation with catalysts prepared by the molybdenum penta-

II were selected for preparation of five molybdena-cracking base catalysts which I designate as G, H, I, J, and K. Three of these samples were impregnated with aqueous solutions of molybdenum pentachloride, dried, and calcined in the manner explained in Example II to form catalysts G, H, and I. In these preparations however, the concentration of the impregnating solutions were such as to prepare samples containing 1%, 3%, and 6% by weight of molybdenum trioxide, respectively. The two remaining cracking catalyst samples were impregnated with ammoniacal ammonium paramolybdate solution, dried, and calcined as in Example II to form catalysts J and K. The impregnating solutions were more concentrated than those in Example II so that catalysts containing higher percentages of molybdenum trioxide, namely 3% and 6% by weight were obtained. The specific details of preparation of the five catalysts of this example are listed in Table VII.

TABLE VII

Catalyst	Impregnating Solution		Oven Drying ¹		Calcining ²	
	Type Employed	Molybdenum Concentration as MoO ₃ percent	Temp., °C.	Time, Hrs.	Temp., °F.	Time
G.....	MoCl ₅	1.36	120	20	900	overnight.
H.....	MoCl ₅	4.02	120	20	900	Do.
I.....	MoCl ₅	7.92	120	21	900	Do.
J.....	A. P. M. +NH ₃ ³	4.11	122	22	900	Do.
K.....	A. P. M. +NH ₃	8.23	121	22	900	Do.

1, 2, 3 See footnotes to Table IV.

chloride impregnation method having a relatively high molybdena content as explained in Example III.

Example III.—Five silica-alumina cracking catalyst samples having a higher surface area than the cracking catalyst samples in Example

These five catalysts were subjected to destructive hydrogenation tests under conditions identical with those of Example II and employing portions of the same cycle stock that was charged in the Example II tests. The results of the tests are given in Table VIII.

TABLE VIII

Comparison of activity of high molybdena content catalysts made by different impregnation methods

Catalyst	G	H	I	J	K
Prepared by Impregnating Cracking Base with.....	(¹)	(¹)	(¹)	(²)	(²)
Percent MoO ₃	1.0	3.0	6.0	3.0	6.0
Surface Area, m ² /g.....	310.1	298.9	279.0	293.1	254.7
Products (Wt. Percent of Cycle Stock).....	(³)				
Gas and Lighter.....	7.1	7.4	8.7	7.5	7.8
Gasoline to 400° F.....	41.9 (38.5)	40.9 (37.5)	36.9 (33.5)	39.4 (36.0)	39.8 (36.4)
Residue above 400° F.....	50.5	51.2	53.9	52.5	51.9
Coke (Approx.).....	0.5	0.5	0.5	0.5	0.5
Total.....	100.0	100.0	100.0	100.0	100.0
Conversion of Stock to Gasoline, Gas and Coke (Wt. Percent of Cycle Stock) ⁴	46.1	45.4	42.7	44.0	44.7
Hydrogen Consumption (Wt. Percent of Cycle Stock).....	1.97	1.97	1.99	1.89	1.95
Properties of Products—					
Gasoline:					
Sp. Gr. at 60°/60° F.....	0.762	0.760	0.766	0.758	0.759
Br. No.....	0.5	0.3	0.2	0.2	0.6
Residue:					
Sp. Gr. at 60°/60° F.....	0.8393	0.8378	0.8393	0.8403	0.8408

¹ See footnote to Table VI.

² See footnote to Table VI.

³ Charge.

⁴ See footnote 4 to Table III.

⁵ See footnote 3 to Table III.

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The Example III results indicate that even for these higher molybdena content catalysts, the catalysts prepared by the molybdenum pentachloride impregnation method for each of the tested percentage compositions gives superior results for specific gravity of the residue, hydrogen consumption, and surface area. Also the conversion of stock to gasoline, gas, and coke is greater for the molybdenum pentachloride prepared catalysts throughout much of the composition range tested.

What I claim is:

1. The process of destructively hydrogenating a hydrocarbon oil which comprises contacting said oil with hydrogen at an elevated temperature and superatmospheric pressure in the presence of a catalyst which is prepared by impregnating a silica-alumina cracking catalyst base with an aqueous solution of molybdenum pentachloride and drying and calcining the resulting mass to convert the impregnant into molybdenum trioxide, said molybdenum pentachloride being deposited in an amount sufficient to result in a calcined catalyst containing between about 0.5 and about 4% molybdenum trioxide, said molybdenum trioxide being deposited in an amount sufficient to result in a calcined catalyst containing between about .05 to about 4% molybdenum trioxide.

2. A process for destructive hydrogenation of a hydrocarbon oil which comprises contacting the vapors of such oil with hydrogen at an elevated temperature and superatmospheric pressure while in the presence of a catalyst which is prepared by compositing a silica-alumina cracking catalyst base with between about 0.5 and 4% by weight molybdenum trioxide said compositing being effected by impregnating said base with an aqueous solution of molybdenum pentachloride and drying and calcining the impregnated base to form molybdenum trioxide on said base.

3. The process of destructive hydrogenation which comprises contacting the vapors of a heavy hydrocarbon oil with hydrogen at a temperature above about 750° F. and a pressure above about 1000 p. s. i. while in the presence of a catalyst which is obtained by impregnating a silica-

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alumina base with an aqueous solution of molybdenum pentachloride and drying and calcining to form molybdenum trioxide on the silica-alumina base, the amount and concentration of said solution of molybdenum pentachloride being sufficient to form between about 0.5 and 4% molybdenum trioxide on said base.

4. The process which comprises subjecting the vapors of a heavy hydrocarbon oil to a temperature of between about 750° F. and 900° F. and a pressure of between about 1000 and 5000 p. s. i. while in the presence of hydrogen and a catalyst which is obtained by impregnating a silica-alumina base with an aqueous solution of molybdenum pentachloride and drying and calcining the impregnated base to convert the impregnant into molybdenum trioxide, the amount and concentration of said solution being sufficient to form between about 0.5 and 4% by weight molybdenum trioxide on said base.

5. The process of destructive hydrogenation which comprises subjecting the vapors of a highly aromatic cycle stock from a catalytic cracking operation to a temperature of between about 750° F. and 900° F. and a pressure of between about 1000 and 5000 p. s. i. while in the presence of hydrogen and a catalyst which is obtained by impregnating a silica-alumina base with an aqueous solution of molybdenum pentachloride and drying and calcining the impregnated base to convert the impregnant into molybdenum trioxide, the amount and concentration of said solution being sufficient to form between about 0.5 and 4% by weight molybdenum trioxide on said base.

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