Sept. 4, 1951 L. J. KELLY 2,566,896

METHOD OF SEALING HYDROCARBON CONVERSION HOUSINGS

Filed Dec. 31, 1947 2 Sheets-Sheet 1

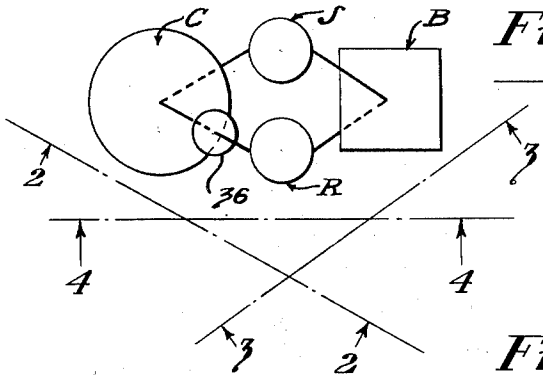


Fig. 1

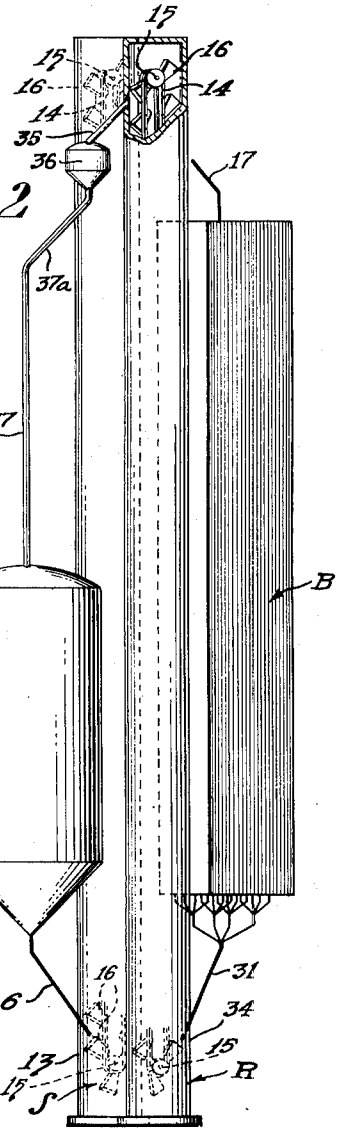


Fig. 2

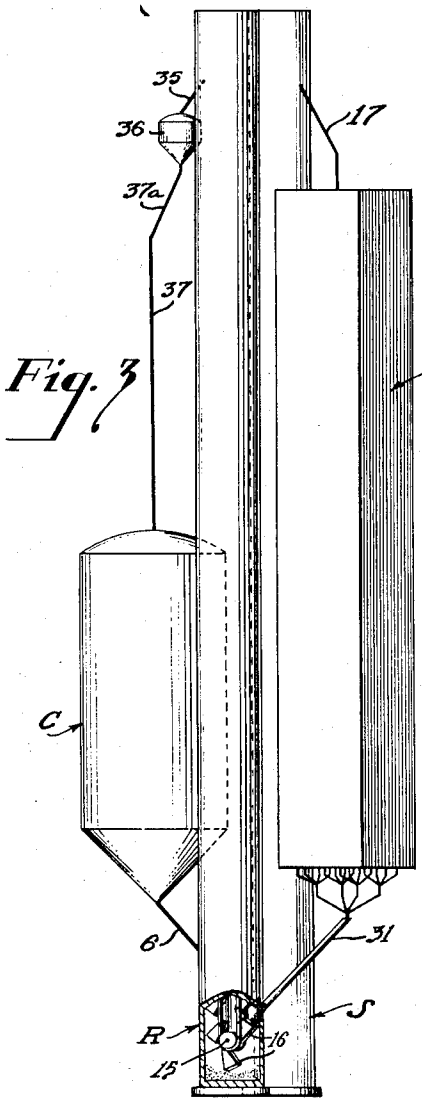


Fig. 3

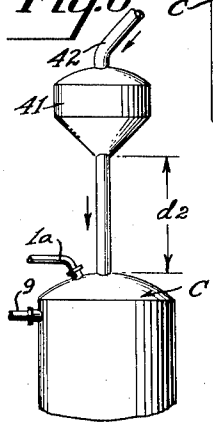


Fig. 8

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METHOD OF SEALING HYDROCARBON CONVERSION HOUSINGS

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Fig. 4

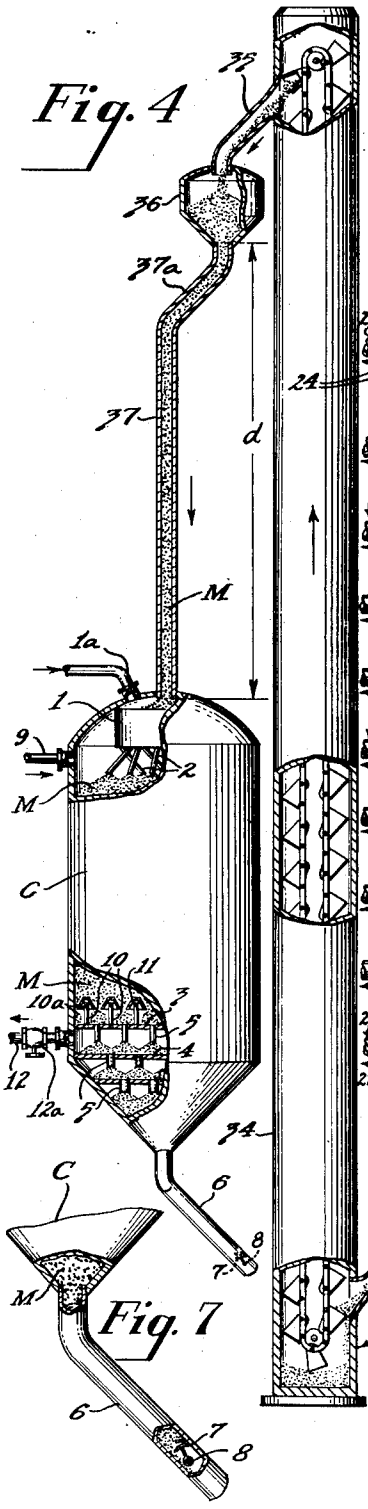


Fig. 5

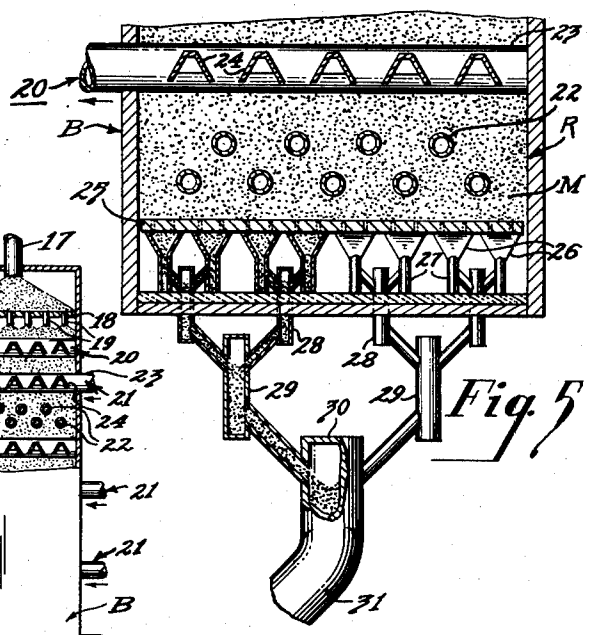


Fig. 6

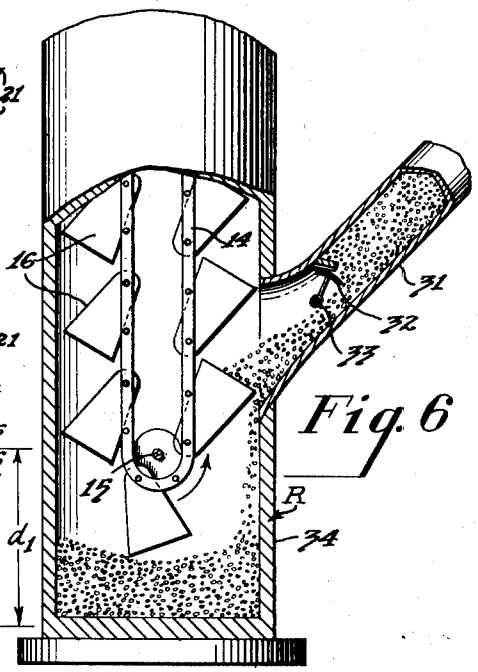


Fig. 7

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UNITED STATES PATENT OFFICE

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METHOD OF SEALING HYDROCARBON CONVERSION HOUSINGS

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Application December 31, 1947, Serial No. 794,956

3 Claims. (Cl. 196—52)

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My invention relates to a method of sealing hydrocarbon conversion housings to prevent passage of hydrocarbon vapors upwardly through the conduit which supplies regenerated contact material thereto.

In hydrocarbon conversion systems of known character, contact material is admitted to a conversion or reaction housing after gravitating passage through a vertical conduit which opens through the top housing wall, movement of this gravitating contact material being restricted or impeded so that it moves through said conduit in solid column fashion. After admission to the housing, the contact material gravitates therethrough in solid bed fashion and, as the conversion operation proceeds, a hydrocarbon vapor pressure is developed interiorly of the upper housing portion above said bed. In order to prevent passage of these vapors upwardly through the aforesaid vertical conduit, it is customary for a gaseous sealing medium to be admitted to said upper housing portion where, for the purpose stated, it is maintained at pressure slightly exceeding that of the hydrocarbon vapors. The gaseous sealing medium flows upwardly through the vertical conduit, counter-current as regards the descending contact material, and at some location beyond the upper end thereof is vented to the atmosphere. As a result, depending on known factors, it often is necessary for said vertical conduit to have height substantially greater than that required by other apparatus which is associated with the described conversion or reaction housing to form a complete conversion-regenerating system. This disadvantage is overcome in a novel manner as hereinafter described.

When contact material gravitates through a conversion housing in solid bed fashion as referred to above, a regenerating housing is usually disposed adjacent thereto. By a suitable elevator arrangement, spent contact material from the conversion housing is raised above the inlet level of the regenerating housing for gravitating movement therethrough, and regenerated contact material, after passage from the last named housing by way of a downwardly inclined conduit through which it moves in solid column fashion, is raised through a suitable elevator housing to a location substantially above the inlet level of the conversion housing for admission thereto by way of

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vertical conduit in the general manner described above. In accordance with the detailed aspect of my invention to which, however, the invention is not necessarily to be limited the elevator housing last named forms a sealed path including the aforesaid vertical and downwardly inclined conduits. As the operation proceeds, the described sealing medium is admitted to the lower end of said vertical conduit for passage through this sealed path in counter-current relation with respect to the contact material gravitating therethrough whereupon it is vented to the atmosphere. Further in accordance with the invention, the aforesaid sealed path is traversed by a gaseous sealing medium throughout the length thereof and, in any suitable manner, said sealing medium, in the inlet or upper end of the conversion or reaction housing, is maintained under pressure slightly exceeding that of the hydrocarbon vapors for the useful purpose described.

Various other objects and advantages of my invention will become apparent from the following detailed description.

My invention resides in the method of sealing conversion housings, arrangements and features of the character hereinafter described and claimed.

For an understanding of my invention and for an illustration of one form of apparatus utilizable for practicing the invention, reference is to be had to the accompanying drawings, in which:

Fig. 1 is a plan view diagrammatically illustrating a conversion-regenerating system of the invention;

Figs. 2 and 3 are elevational views, partly broken away, taken on the respective lines **2—2** and **3—3** of Fig. 1;

Fig. 4 is an elevational view, partly in section, taken on the line **4—4** of Fig. 1;

Fig. 5 is an enlarged, vertical sectional view, partly in elevation, showing the lower portion of the regenerating housing of Fig. 4;

Fig. 6 is an enlarged, vertical sectional view, partly in elevation, showing the lower portion of the elevator housing illustrated in Fig. 4;

Fig. 7 is an enlarged elevational view, partly broken away, showing the lower portion of the conversion housing and its outlet conduit; and

Fig. 8 is an enlarged view, partly broken away, showing a detailed feature of the invention.

Referring to Figs. 1–4 inclusive, I have shown a conversion system which, except as hereinafter described, may be such as is conventionally used for converting hydrocarbons in the presence of contact material adapted, during on-stream operation, to gravitate through a conversion zone and, during regeneration, to gravitate through a regenerating zone. Thus, as illustrated, the aforesaid system may comprise a housing C which defines the conversion zone, a housing B which defines the regenerating zone and vertical elevators S and R utilizable, respectively, for conveying spent and regenerated contact material from lower to upper levels.

The conversion housing C and associated apparatus may be of any suitable character. As shown particularly in Fig. 4, there is supported at the top of the housing C a hopper 1 to which regenerated contact material M is admitted continuously in the manner hereinafter described. Depending from and communicating with the hopper 1 are a plurality of pipes 2 through which the contact material passes to form a gravitating bed of contact material, the lower surface of which may be defined by a tube sheet 3 horizontally supported in the lower portion of the housing C. As the conversion operation proceeds, contact material M is admitted to the housing C as described above and moves downwardly therethrough under the influence of gravity while a deposit of carbonaceous material is formed thereon.

Any suitable arrangement may be utilized for discharging the spent contact material M from the housing C. To this end, and as diagrammatically indicated, a plurality of spaced tube sheets 4 may be secured to the interior surface of the lower end portion of the housing C below the aforesaid tube sheet 3, the extreme lower end portion of said housing C, preferably, being conical as illustrated. A plurality of suitably spaced tubes or pipes 5 open through and depend from each of the tube sheets 3 and 4. As known in the art, the tubes 5 on successively lower tube sheets progressively decrease in number and the internal diameter thereof progressively increases whereby the contact material gravitates through the lower conical end portion of the housing C so as to reach and traverse a main discharge pipe or conduit 6 which should be suitably inclined as illustrated. In known manner, a valve 7 mounted on a shaft 8, Fig. 7, and controlled as hereinafter described is utilized to restrict the gravitating flow of the spent contact material through said conduit 6 for the purpose hereinafter described.

When hydrocarbon material is to be cracked in the housing C, the contact material M hereinbefore referred to should be catalytic in character and the temperature thereof, upon admission to the housing C, should range between 800° F. and 1000° F. or higher for example, about 900° F. Any suitable kind of catalytic contact material may thus be utilized such, for example, as activated clay pellets, or synthetic silica-alumina pellets or beads, etc. having suitable major dimensions such as between $\frac{1}{16}$ and $\frac{3}{4}$ of an inch. Other suitable catalysts for cracking include synthetic plural oxide composites, silicious or non-silicious in character and containing for example, zirconia, alumina, or beryllia. In lieu of a cracking operation, other types of conversion operations such, for example, as one wherein hydrocarbon material of the character referred to below is desulphurized under known conditions with catalytic contact material of the general character referred to above, or equivalent. Or, reforming or dehydrogenation of naphthas or other normally liquid hydrocarbons may be effected in the presence of the above or other desired types of catalyst, certain of which are well known in the art. In lieu of the conversion operations described above, heavy hydrocarbon material may be vaporized and viscosity-broken in the presence of inert contact material of known character.

During operation with suitable cracking contact material, vapors such, for example, as vaporized gas oil, naphtha, or lighter hydrocarbons having suitable elevated temperature, as in a range from 850° F. to 950° F., are admitted continuously by a pipe 9 to the housing C above the upper surface of the bed of contact material. In the manner hereinafter described, these hydrocarbon vapors, as the conversion operation proceeds, pass concurrently as regards the contact material gravitating through the housing C and, adjacent the lower end of said housing, any suitable arrangement may be provided for disengaging converted vapors from the contact material. To this end, as diagrammatically indicated, the aforesaid tube sheet 3 may support a plurality of tubes 10 which upstand therefrom and open therethrough, the tubes 10 supporting a plurality of suitably arranged channel members 11, or equivalent, which are disposed in inverted relation so that, in known manner, they may be utilized for disengagement of vapors from the contact material, the vapors thereafter entering the tubes 10 by way of passages 10*a* formed, respectively, therein. A pipe 12 opens through the wall of the housing C below the tube sheet 3 and communicates with the space above the adjacent conical piles of contact material. This pipe 12 has associated therewith a control valve 12*a* and is adapted to receive and conduct the converted vapors to any suitable destination, not shown. In known manner, and by suitable means, not shown, a suitable gaseous medium, such as steam or flue gases is admitted to the lower portion of the housing C, below the pipe 12 and under pressure above that existing at the level thereof, to prevent passage of hydrocarbon vapors through the conduit 6.

The lower end of the aforesaid conduit 6 opens into the lower end of the housing 13 for the elevator S which may be of conventional character or otherwise as may be desirable. As indicated in Fig. 2, the elevator S may comprise a pair of side-by-side, endless carriers 14 which are supported by suitably mounted upper and lower rotatable members 15. The carriers 14 are operated continuously by suitable mechanism, not shown, and they have elevator buckets 16 secured thereto in suitable manner. The buckets 16 receive the spent contact material from the lower end of the conduit 6 and elevate the same to the upper end of the elevator housing 13 where it is discharged into the upper end of a downwardly inclined conduit 17 which is suitably connected, in communicating relation, with said upper end of the housing 13.

The spent contact material which has been elevated as described immediately above gravitates through the conduit 17 and, in any desired manner, is admitted to the upper end of the regenerating housing B which together with its associated apparatus may be of conventional character or otherwise as may be desirable.

Thus, as shown in Figure 4, the aforesaid con-

duit 17 may extend through the top wall of the housing B at the center thereof so as to discharge the spent contact material on a tube sheet 18 horizontally secured in the top portion of said housing B. Opening through and depending from this tube sheet 18 are a plurality of tubes 19 through which the spent contact material, by action of gravity, passes into and then through the regenerating zone proper which may have disposed therein an upper disengager 20 below which is disposed an upper engager 21 having an upper set of cooling coils 22 disposed therebelow.

The disengager 20 and engager 21 may be of any suitable construction and, as herein diagrammatically shown, each may comprise a horizontal pipe 23 fixed transversely in the housing B and intersecting the longitudinal axis thereof, each pipe 23 carrying a plurality of inverted channel members 24 extending horizontally from opposite respective sides thereof.

As known in the art, the housing B, throughout the height thereof, may carry sets of disengagers 20 and engagers 21 alternately arranged with a group of cooling coils 22 disposed between each engager and the adjacent disengager as shown in Fig. 4. By each of the engager pipes 23 and the associated channel members 24, air or other suitable regenerating medium is engaged with the gravitating contact material to burn carbonaceous material therefrom with consequent elevation in temperature thereof, the resulting flue gases being disengaged from the contact material at the channel members 24 of the disengager pipes 23 and passed from the housing B by way of the pipes last named. In known manner, a suitable cooling medium, such as water, fused salts or the like is passed through the coils 22 in order to lower the temperature of the contact material after it passes each engager 21.

Any suitable draw-off arrangement may be utilized for discharging the regenerated contact material from the housing B. Preferably, however, this arrangement is of the character disclosed in pending application Serial No. 734,680, filed March 14, 1947.

As indicated in Fig. 5, the aforesaid arrangement comprises a horizontal baffle plate 25 having a plurality of symmetrically arranged funnels disposed therebelow, said baffle plate 25 comprising a plurality of symmetrically arranged vertical passages, groups of which communicate with the respective funnels 26. The funnels 26, in turn communicate with vertical pipes 27 which form groups, each of which consists of four pipes, all of these groups being symmetrically related to each other. Each pipe 27 comprises and communicates with an angular, downwardly extending pipe section, the pipe sections of each group of pipes 27 extending toward a common center where, at a common level, they communicate with a vertical pipe 28 all of which are supported by the aforesaid bottom wall of the housing B. The pipes 28 form symmetrical groups consisting of four pipes each, each pipe 28 comprising and communicating with an angular, downwardly extending pipe section, the pipe sections of each group extending toward a common center where, at a common level, they communicate with a vertical pipe 29. The pipes 29 form a single group of pipes, each of which comprises and communicates with an angular downwardly extending pipe section, all of the latter, at a common level, communicating with a single main pipe or conduit 30,

the longitudinal axis of which coincides with the longitudinal axis of the housing B.

The regenerated contact material gravitates from the regenerating zone by way of the described passages in the baffle plate 25 and thereafter gravitates through the described pipes and pipe sections and eventually reaches the main pipe 30. All of the contact material gravitates through said main pipe 30 and then through a conduit 31 which should be suitably inclined in the manner hereinafter described. A valve 32 mounted on a shaft 33, Fig. 6, and controlled as hereinafter described is utilized to restrict gravitating flow of the regenerated contact material through said conduit 31 for the purpose described below.

The lower end of the aforesaid conduit 31 opens, in sealed relation, into the lower end of the housing 34 for the aforesaid elevator R. In accordance with the invention, the housing 34 defines a passage which is sealed from the atmosphere so that, in the manner hereinafter described, pressure in excess of that of the atmosphere may be maintained therein, such excess pressure, however, being substantially the same throughout the height of said housing 34.

If desired, the elevator R, the same as the hereinbefore described elevator S, may comprise a pair of side-by-side, endless carriers 14 supported by suitably mounted upper and lower rotatable members 15, the carriers being continuously operated by suitable mechanism, not shown, and having elevator buckets 16 secured thereto. The buckets 16 of the elevator R receive the regenerated contact material from the lower end of the conduit 31 and elevate the same to the upper end of the sealed elevator housing 34 where it is discharged into the upper end of a downwardly inclined conduit 35 which is suitably connected in communicating, sealed relation with the upper end of the housing 34.

The regenerated contact material which has been elevated as described immediately above gravitates through the conduit 35 from which it enters a receptacle 36 which, preferably and in accordance with the invention, is positioned at the highest practical level while permitting the conduit 35 to have sufficient slope to obtain proper gravitational movement of the contact material therethrough. After admission to the receptacle 36, the contact material gravitates continuously therethrough after which it enters and gravitates through a conduit portion 37a and then through a conduit 37 which communicates with the hereinbefore described hopper 1 at the top of the housing C.

During operation of the disclosed system, the position of the valve 7 may be controlled automatically in known manner, for example, as disclosed in application Serial No. 719,730, filed January 2, 1947, now Patent No. 2,528,537, in response to change in level of the upper surface of the contact material in the receptacle 36. By the valve 7, gravitational movement of the contact material along a path extending from the level thereof in the receptacle 36, through the conduit 37, the housing C and the portion of the pipe 6 above said valve 7 is restricted or impeded so that, throughout the length of said path, the contact material moves in solid column fashion.

As will be understood, the hydrocarbon vapors admitted to the housing C, Fig. 4, by way of the pipe 9 are subjected to a definite pressure drop while traversing said housing, the tubes 10, the pipe 12 and such equipment as is connected in

circuit therewith. In order to produce the desired concurrent flow of the hydrocarbon vapors with respect to the gravitating contact material in the housing C, it necessarily follows, then, that said hydrocarbon vapors should be admitted to the housing C at a pressure sufficient to overcome the aforesaid pressure drop to suitable degree. At the same time, the operation should be conducted under conditions such that the hydrocarbon vapors do not pass upwardly through the pipe **37**.

To this end, a suitable gaseous sealing medium, such as flue gases, steam, or equivalent, is admitted continuously to the top of the housing C above the hopper **1** by way of a pipe *1a*, Fig. 4, at a pressure exceeding that at which the hydrocarbon vapors are admitted to the housing C by way of the pipe **9**. Due to this operation, the hydrocarbon vapors are prevented from passing upwardly through the vertical conduit **37** and the major portion, usually, of the sealing medium passes along the above described sealed path and then to the atmosphere in the manner hereinafter described. Also, by the described operation, the hydrocarbon vapors are caused to flow in desired concurrent relation as regards the gravitating contact material in the housing C.

Initially, the aforesaid major portion of the sealing medium passes, counter-current to the descending contact material, upwardly along that part of the sealed path defined by the vertical conduit **37**, the receptacle **36** and the pipe **35**. By reason of the described restricted or impeded flow of the contact material traversing the vertical conduit **37** (which defines and is an example of one downwardly extending path portion as set forth in claim language) a pressure gradient is effective throughout a vertical distance *d*, Fig. 4.

In connection with the foregoing, the pressure gradient through the receptacle **36** is insignificant by reason of the substantially larger diameter thereof compared with that of the pipe **37**. Moreover, the contact material traversing the pipe **35** falls freely under the influence of gravity except for frictional retardation on the interior surface thereof and, accordingly, the pressure gradient therethrough is nil or substantially so.

After passage of the aforesaid major portion of the sealing medium along that part of the sealed path described above, said sealing medium, at reduced pressure, enters and, at substantially constant pressure, passes downwardly through the housing **34** of the elevator R which, as stated, is sealed from the atmosphere. Thereupon, as described below, the sealing medium leaves the bottom of said elevator housing and traverses the remaining part of the sealed path.

During operation of the disclosed system, the valve **32**, Figs. 4 and 6, restricts or impedes gravitational movement of the contact material along a path extending from the level thereof at the top of the housing B, through the draw-off system illustrated in Fig. 5 and then through that portion of the pipe **31** above said valve **32**. Should it become necessary, the position of this valve may be changed manually in order to vary the rate of movement of the gravitating contact material last named. Due to the described action of the valve **32**, the contact material moves in solid column fashion throughout the length of the path described immediately above.

As stated above, the major portion of the sealing medium leaves the bottom of the sealed elevator housing **34**. Thereafter, this sealing medium passes upwardly through the pipe **31** and, above the valve **32**, traverses the remaining part of the sealed path, namely, that portion of the pipe **31** above said valve **32**, the draw-off system shown in Fig. 5 and the bed of contact material in the housing B below the lowermost disengager **20**, said gaseous medium, as the operation proceeds, passing to the atmosphere by way of the channel members **24** and the pipe **23** of said last named disengager. By reason of the described restricted or impeded flow of the contact material along the sealed path last noted (which is an example of another downwardly extending path portion as set forth in claim language), a pressure gradient is effective through a vertical distance d_1, Fig. 4.

In prior practice, as regards a conversion-regenerating system of the general character herein disclosed, it is customary for the regenerated contact material to pass from the upper end of its elevator by way of an inclined pipe which communicates with a surge hopper communicating, in turn, with a vertical pipe which extends into the upper end of the conversion housing. This pipe has vertical height below the surge hopper sufficient for the intended purpose. With this prior art arrangement, the vertical height of the aforesaid pipe together with that of the surge hopper and the inclined pipe admitting contact material thereto determines the height of the elevator which supplies regenerated contact material to said last named inclined pipe. Aside from this, the over-all height of the system, ordinarily, is dependent on the height of that portion of the elevator which extends above the regenerating housing so that spent contact material may be passed thereto by way of the sloping pipe provided for this purpose. Often, in prior art practice, the required vertical height of the aforesaid pipe causes the height of the elevator for the regenerated contact material to be substantially greater, for example, twenty-five to fifty feet greater than is required by any other part of the system.

In accordance with my invention and by utilization of the path portion indicated at d_1, Fig. 4, the necessary height of the elevator for the regenerated contact material may be substantially reduced compared with prior practice as referred to above. Thus, for example and as shown on the drawing, the height of the elevator last named may be the same or substantially the same or even less than that of the elevator which supplies spent contact material to the regenerating housing.

Obviously, substantial reduction in height of the elevator for the regenerated contact material as referred to above is desirable because reducing the expense of installation and maintenance. Again, decreased elevator height renders the prospect of continuous operation more favorable and this, of course, is highly desirable. By my invention, the over-all height of the conversion-regenerating system is reduced to substantial extent and this is desirable because reducing the expense, simplifying the construction and operation, and lessening the hazard of air travel particularly when the system is located in the immediate vicinity of an airport.

As indicated in Fig. 4, a part of the sealed path indicated by the distance d_1 extends upwardly through the described draw-off arrangement and includes the lower portion of the regenerating housing B. However, the invention is not to be thus limited. Thus, for example, should it be de-

sirable to shorten the length of the path indicated by the distance d_1, the pipe **31**, in a suitable location, may be provided with a suitable vent to the atmosphere.

From one of its broader aspects, the invention relates to utilization of the sealed elevator housing **34** or equivalent which extends between and communicates with separate portions of said paths. These portions may be of suitable character as desired and not necessarily as herein illustrated. However, ordinarily and as disclosed, it is desirable for one of these path portions to be defined by a vertical conduit **37** through which regenerated contact material gravitates into a conversion housing while flowing in a restricted or impeded manner. Again, in accordance with another broad aspect of the invention, this vertical conduit **37** may be omitted and, if so, the contact material from the upper end of the sealed elevator housing **34** may be admitted to the conversion housing C (or a suitable surge hopper) in suitable manner, for example by way of a downwardly inclined pipe through which said contact material falls freely under the influence of gravity except for frictional retardation on the interior surface thereof. With an arrangement of this character, the lower end of said elevator housing may communicate in sealed relation with the lower end of the part portion above the valve **32** which may have proper length for the intended purpose. Or the lower end of said elevator housing may communicate with one or more downwardly extending path portions through which the contact material gravitates in solid column fashion.

It was hereinbefore stated that the receptacle **36** is located, preferably, at the highest practical level while permitting the conduit **35** to have sufficient slope to obtain proper gravitational movement of the contact material therethrough. The invention, however, is not to be so limited. Thus, as indicated in Fig. 8, the conversion housing C may have associated therewith a vertical pipe **40** which communicates with a surge hopper **41** from which an inclined pipe **42** extends upwardly to the top of the elevator R. With this arrangement, regenerated contact material traversing the pipe **42** falls freely under the influence of gravity except for frictional retardation on the interior surface thereof. Thereafter, this contact material gravitates in solid column fashion through the surge hopper **41** and the vertical pipe **40**. This arrangement, except as regards the height of the vertical pipe **40**, corresponds with the prior art arrangement previously described and, as will be understood, a pressure gradient is effective throughout a vertical distance d_2 which is less than as disclosed in Fig. 4.

When contact material gravitates in an impeded or restricted manner through an inclined pipe, it is necessary for this pipe to be related to a horizontal plane by an angle of at least approximately 45 degrees. As regards the disclosed system, the foregoing applies to the pipes **6**, **31** and the inclined portion **37***a* of the pipe **37**. This relation is shown in Figs. 3 and 4 with respect to the pipes **6**, **31** and in Fig. 2 with respect to the pipe portion **37***a*. When contact material traversing an inclined pipe falls freely under the influence of gravity except for frictional retardation on the interior surface thereof, the angle of inclination may be somewhat less than as stated above. This applies to the described pipes **17**, **35** and **42**.

It will be understood that the invention is not to be limited to the disclosed conversion operation which involves admission of hydrocarbon vapors to the top of the housing C for passage therethrough in concurrent relation as regards the gravitating contact material. Obviously, the invention is applicable to conversion operations of other types such, for example, as one wherein hydrocarbon vapors pass counter-current as regards the gravitating contact material or wherein the charge, partly in liquid phase, is admitted into the upper portion of the conversion housing for downward passage therethrough along with hydrocarbon vapors.

It shall be understood that, except as set forth in claim language, there is to be no limitation of the invention to the disclosed arrangement involving admission of the gaseous sealing medium to the housing C by way of the conduit *1a*. Thus, within a broader aspect of the invention, the gaseous sealing medium may be admitted to the described sealed path at any desired location provided, first, that said gaseous medium is present throughout the length thereof so as to be maintained, in the upper part of the housing C, at pressure slightly greater than that of the hydrocarbon vapors and, second, that it passes through the solid column contact material gravitating through one or more of the described path portions having sufficient length for the intended purpose.

Each of the appended claims includes a reference to a sealed path arrangement such, for example, as "said path portions and the part of said path connecting them together being sealed from the atmosphere throughout the length thereof." It shall be understood that such references are intended to be descriptive of sealed path arrangements wherein the pressure of the gases therein is maintained in excess of that of the atmosphere even though some of the gases may pass to the atmosphere, for example, through a throttled vent.

Obviously many modifications and variations of the invention as hereinbefore set forth may be made without departing from the spirit and scope thereof and therefore only such limitations should be imposed as are indicated in the appended claims.

I claim as my invention:

1. In a hydrocarbon conversion system in which solid contact material is passed cyclically through separate zones wherein said material is contacted with different gases under different gaseous pressures, the method of transferring said contact material between said zones while maintaining a substantial gas seal therebetween which comprises the steps of passing said contact material from the zone of lower gaseous pressure downwardly in a confined path as a compact moving column, elevating said contact material from the lower end of said column through an elongated confined path wherein the gaseous pressure is substantially uniform throughout, passing all said elevated contact material downwardly in a confined path from the upper end of said elongated confined path as a second compact moving column, introducing said contact material at the lower end of said second column into the contact zone of higher pressure, and introducing a gaseous sealing medium at a low point in said second column to provide a pressure thereat greater than the pressure in said contact zone of higher pressure, said confined paths and said elongated confined path providing a single continuous passage for

countercurrent flow of said material and said sealing medium between said zones.

2. A method as defined in claim 1 wherein said zone of higher pressure constitutes a reaction zone for the conversion of said hydrocarbons and the zone of lower pressure constitutes a regeneration zone for reactivating said contact material, and wherein said gaseous sealing medium is discharged to the atmosphere from the lower region of said regeneration zone.

3. A method as defined in claim 1 wherein said elongated confined path is of sufficient cross-section area to permit the elevation of said contact material therethrough in separated mass

formation and to provide a continuous, unobstructed flow path with substantially no pressure drop therethrough for said gaseous sealing medium.

LOUIS J. KELLY.

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The following references are of record in the file of this patent:

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