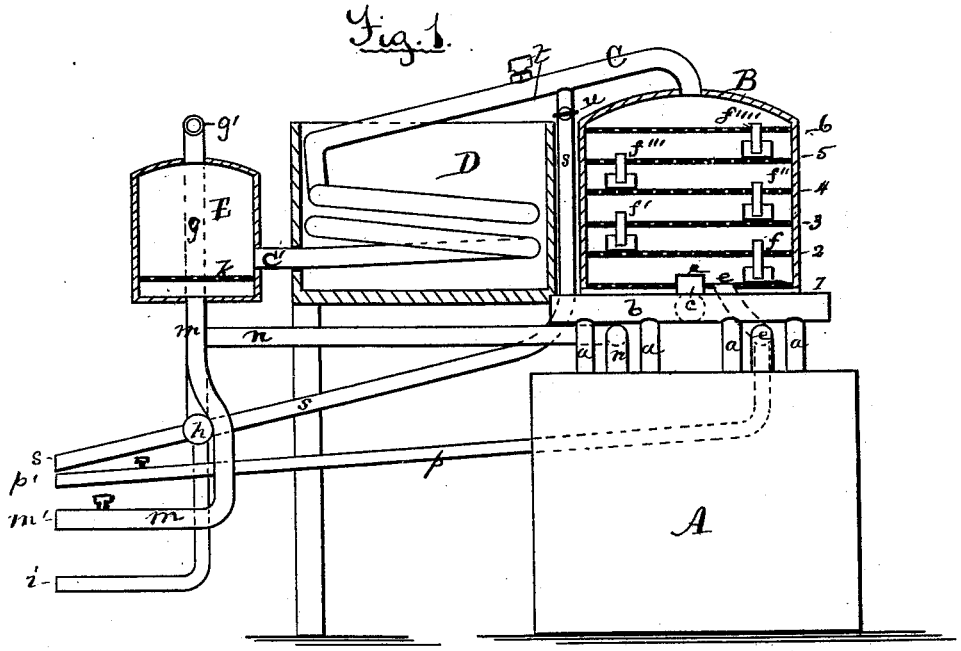
2 Sheets.—Sheet 1.

J. DAUL.

Apparatus for Rectifying Petroleum.

No. 213,395. **Patented Mar. 18, 1879.**

Fig. 1.



John Daul,
Inventor
by J. R. Drake,
Atty.

Witnesses:
T. H. Parsons.
J. R. Drake.

2 Sheets—Sheet 2.

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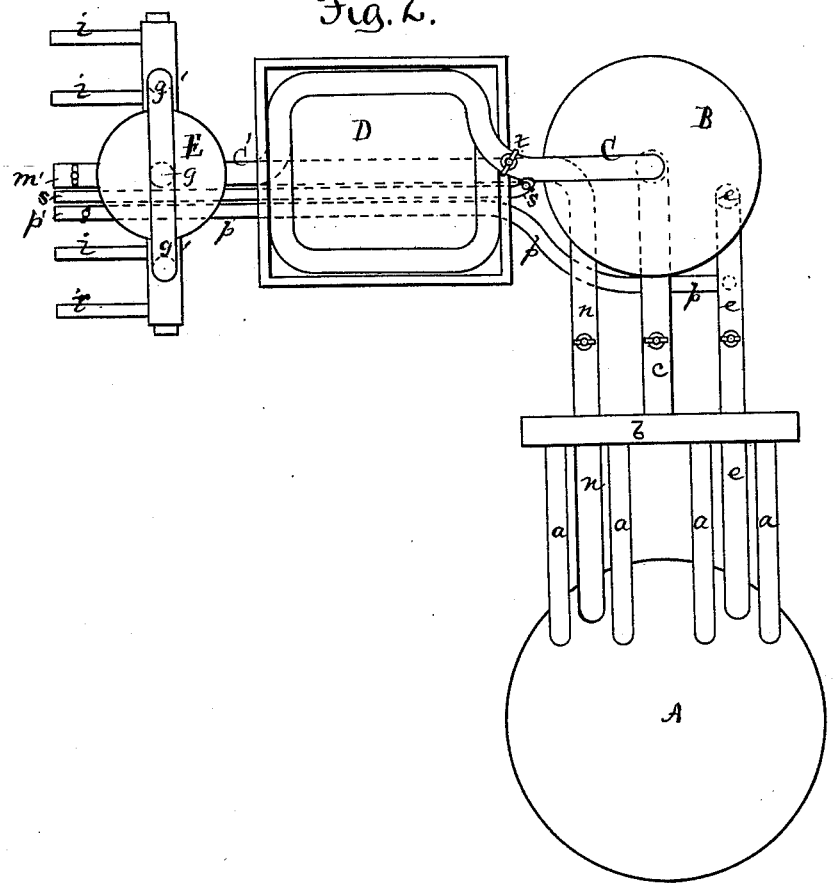
Fig. 2.



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Inventor by
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UNITED STATES PATENT OFFICE.

JOHN DAUL, OF BUFFALO, NEW YORK, ASSIGNOR TO JAMES K. ANDERSON AND ANDREW P. W. GRASS, OF SAME PLACE.

IMPROVEMENT IN APPARATUS FOR RECTIFYING PETROLEUM.

Specification forming part of Letters Patent No. **213,395**, dated March 18, 1879; application filed November 19, 1878.

To all whom it may concern:

Be it known that I, JOHN DAUL, of Buffalo, in the county of Erie and State of New York, have invented Improvements in Devices for Rectifying and Distilling Petroleum into Gasoline and High-Test Oils, of which the following is a specification:

The object of this invention is to refine crude petroleum into a safety, high fire-test, and clear white product called "water-white oil," and also to produce the finest gasoline, from 80° to 100° gravity; and the invention combines in one apparatus distilling, rectifying, condensing, and separating.

The main object of this invention is to get a perfect circulation through the apparatus, so that the light products will be effectually separated and pass out, and the heavy be returned to the still automatically, to be redistilled by repeated passages through the apparatus until the light oils, gasoline, heavy stuff, and water are all thoroughly separated; and the invention consists in improvements in the rectifier by the peculiar arrangement therein of the main conducting-pipe and the cup-pipes; also, in the addition of a separator (having a separating perforated plate therein) to the rest of the apparatus, consisting of the usual still, rectifier, and condenser; also, in a pipe running from the separator back to the still, to conduct the oil directly back to the still without its returning back through the rectifier; also, in a water-pipe to carry off the water from the separator; also, in the return-pipe from the rectifier opening therein flush with the bottom, so as to prevent therein accumulations of stuff; and, also, in providing said pipe with an attached water-pipe, to draw off the water and prevent its return to the still, all as hereinafter fully explained.

In the drawings, Figure 1 is a cross-section through the rectifier, condenser, and separator, the still not shown. Fig. 2 is a top plan of the whole apparatus.

A is the still, of the usual kind. B is the column or rectifier, connected with still A by small pipes *a a a a*, which lead to a union-pipe, *b*, and which has a conducting-pipe, *c*, leading up through the bottom of the rectifier B in the center, and about an inch above the first perforated plate, 1. This exit above the bottom of the rectifier is important, as it allows the free passage of the vapor generated in the still to pass up through the perforated plates above and through the strata of condensed stuff that remain on them. This feeding-pipe generally opens directly at the bottom of the rectifier, and thereby gets clogged. By putting its exit-opening a sufficient distance above the bottom, and somewhat above the exit-opening of the draw-off pipe *e*, all clogging is prevented. It being above the plate (about one inch) also allows but one inch depth of surface to be covered by the liquid material suspended there by the generated vapors.

In this rectifier B are a series of these perforated plates, 1 2 3 4 5, or more, which aid in the purification each of themselves, and also from one plate to another. These are connected by pipes and cups *f*, each pipe coming above the plate at different heights—as, for example, the first pipe, *f*, would be about one inch above plate 2; the second pipe, *f'*, a half inch above plate 3; pipe *f''*, a quarter of an inch above plate 4; pipe *f'''*, an eighth of an inch above plate 5; and pipe *f''''*, a sixteenth of an inch above plate 6. This graduation is important, as the lighter the stuff the higher it rises, and there is less heavy stuff on the perforated plate at the top than on the next one below and so on. After the stuff rises to the level of the opening of the pipe at the top *f''''*, it runs therein and down through the pipe, and overflows the cup onto the perforated plate below to just the height of the pipe *f'''*, and so on down, thereby keeping these plates comparatively clear, the cups receiving the condensed water, coloring-matter, oil, &c., and leading it back to the still by the return-pipe *e*, which opens in the bottom of the rectifier, and is thereby returned to the still, and is redistilled again and again.

The purpose of the pipe *e* opening flush with the bottom of the rectifier is to prevent accumulations on the bottom, so that all unrectified oil or heavy matter that finds its way to the bottom of said rectifier shall not remain

there, but flow out at once through pipe *e* directly back to the still, thereby keeping the bottom always clear. By these pipes of graduated height only one-sixteenth of an inch of stuff can lie on perforated plate 6, one-eighth on the next below, one-fourth on the next, one-half on the next, and so on, giving thereby better purification to each plate, and permitting the vapor, as it comes from the still through pipe *c*, easy passage through the mass on each of the plates, the greatest force of the steam or vapor being against the lower plate and the least against the upper. Therefore the depth of the stuff or mass on each plate is reduced from the bottom plate to the top.

The vapor, after being partly purified on its passage through plate 2, pushes through the next above, and is still more purified, thence to the next, and so on till it escapes through the pipe C at the top, and passes thence into the coil of pipes forming the condenser D.

In the rectifier B the naphtha and gasoline are separated and pass into the condenser to be again acted on. The oil, &c., left in the rectifier returns to the still by the pipe *e*, as before explained. The condenser is supplied with a tight case, which is filled with cold water, which condenses the vapor in the coil, the product being the uncondensed vapor of gasoline mixed with oil and water. These all pass into the separator E through the pipe C′ of the coil, the lighter part or gasoline vapor flowing through the pipe *g* in the top of the separator, the pipe or pipes *g′*, and down into the union-pipe *h* below, and out through small exit-pipes *i i i i*, which lead into closed water-boxes, where it is condensed into pure gasoline.

In the separator E is placed, a short distance from the bottom, a perforated plate, *k*, and on this settles all the oil and water, and which filters through into the bottom of the separator and down into a pipe, *m*, leading from the bottom to an exit at *m′*, where is a stop-cock to draw off the water, which, being heavier than the oil, runs down into this pipe, while the oil that comes through the pipe *m* from the separator is carried by a pipe, *n*, connected to pipe *m*, back into the still A. All the water also condensed from the rectifier B is carried off by a pipe, *p*, that taps pipe *e*, that conducts the heavy matter from the rectifier back to the still, and by a stop-cock, *p′*, is drawn off as fast as the pipe fills.

s is a pipe that taps pipe C between the rectifier B and the condenser D.

When it is desired to run off high-test or burning oils, after the gasoline has been extracted, a stop-cock, *t*, in the pipe C is closed, thereby shutting off the apparatus beyond that point, and a stop-cock, *u*, in pipe *s* is opened, the product being a highly-rectified high-test oil. This is conducted, by the pipe *s*, to exit end and into tanks or barrels.

The operation of this apparatus is as follows: The vapor generated in the still A passes, by the pipes *a a b c*, into the rectifier B. Here the pressure of the steam and vapor forces it up through the perforated plates 2 3 4, &c., the heavier substances remaining on the plates only to the depth allowed by each pipe *f* (which are graduated in height above each plate, as before explained) until it overflows into said pipes *f*, and falls down into the cup of the pipe below and overflows onto that plate, and so on until reaching the bottom of the rectifier, where it passes into the pipe *e*, opening directly on the bottom thereof, and is carried back into the still A, to be again vaporized and returned to the rectifier again and again. The water in this stuff separates itself from the rest, and is conducted off by the pipe *p* as fast as it fills, a stop-cock regulating it. The vapor in the rectifier, successively purified by the perforated plates therein, now passes out through the top pipe, C, directly into the condenser D, the pipe C forming part of the coil. This is filled with cold water, and the vapor in the pipes is thereby partly condensed, and passes through pipe C′ into the separator E in the form of uncondensed vapor, oil, and water. Here the heavy parts, consisting of oil and water, pass through the perforated plate *k* therein. The water (being the heaviest) drops into the pipe *m*, leading from the bottom of the separator, and the oil, &c., is conducted back, by the pipe *n*, directly to the still A, where it is again vaporized, to return again through the apparatus. The product now remaining in the top of the separator is pure gasoline in vapor, and passes through the pipes *g g′* into the union-pipe *h*, and through the small pipes *i i i* into close water-boxes, where it is condensed and conducted into separate tanks, running from 80° to 100° gravity.

The great advantages of this construction are, not sending back through the rectifier the heavier stuff, &c., that has passed once through it; but by the return-pipe *n* from the separator it is carried back independently to the still to be worked over again. This is the vapor or condensations of illuminating-oil that runs back direct to the still. If it were allowed, as has been usual, to run back through the rectifier, it would clog it, so that it would work only a short time before having to be cleaned out.

Another advantage is, that no water runs back into the rectifier, condenser, or still, as it is carried off by the pipes *m* and *p*, thereby preventing a revolution in the still. All the water is separated from the oil and carried off and all the oil separated from the heavier stuff; and when gasoline is produced it is absolutely free from oil, and of from 80° to 100° gravity.

After the gasoline has been made, the light oil is separated from the heavy by rectification as follows: The cock *t* in pipe C is shut and cock *n* in pipe *s* is opened. This shuts off the condenser and gasoline-making parts from the rest, and burning-oil is then produced of

any test desired. This gives three products—viz., gasoline of the highest gravity, light oil of any test desired, and heavy oil of from 110° to 175° test—and without being tested or acted on by acids, soda, or any chemicals whatever.

All coloring and tarry matter is eliminated in the rectifier by my improved construction of the pipes *f f'*, &c., in connection with the perforated plates, the feeding-pipe *c*, arranged above the first perforated plate, and the water-pipe *p*, preventing the water returning to the still, as before explained.

By this apparatus the various oils of petroleum are produced in a most perfect manner, and gasoline at from 80° to 100° gravity is obtained—a result never before accomplished to my knowledge, 80° to 90° being the highest heretofore produced. I also claim that twenty-five per cent. more of better and purer gasoline is obtained from crude gasoline and ten per cent. more of purer burning-oil from the same amount of crude petroleum than by any other distillation.

I do not claim any improvements in the still or in the use of a rectifier or condenser, for such are old, but only my improvements in the rectifier, the arrangement of pipes, and the employment of new ones, and the combination, with the other devices, of the improved separator, all as fully set forth and claimed.

I claim—

1. In combination with the still A, rectifier B, and condenser D, the separator E, with the pipe *n*, for conducting the oil directly back to the still A, and the attached pipe *m*, for drawing off the water, all substantially as specified.

2. In combination with the still A and rectifier B, the conducting-pipe *c*, having its induction-opening in the rectifier above the level of the opening of the draw-off or exit pipe *e* therein, substantially as and for the purpose specified.

3. In combination with the perforated plates of the rectifier B, the cup-pipes *f f'*, &c., with the top openings at gradually-increasing heights from the surface of said plates from the upper one, 6, to the lower, substantially as specified.

4. In a petroleum-rectifying apparatus, in combination with the still A, rectifier B, and condenser D, the separator E, provided with the perforated plate *k* and pipes *m* and *n* leading therefrom, all substantially as specified.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

JOHN DAUL.

Witnesses:
J. R. DRAKE,
LOUIS DAUL.