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VAPOR PRESSURE DEVICE
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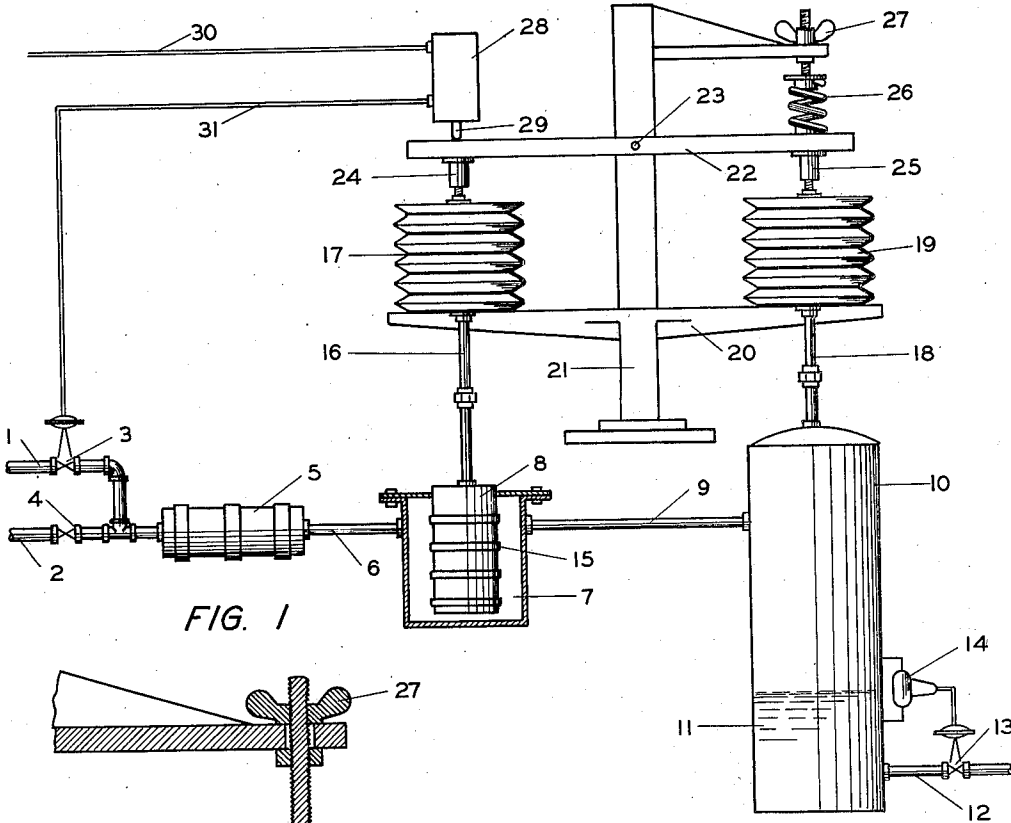


FIG. 1

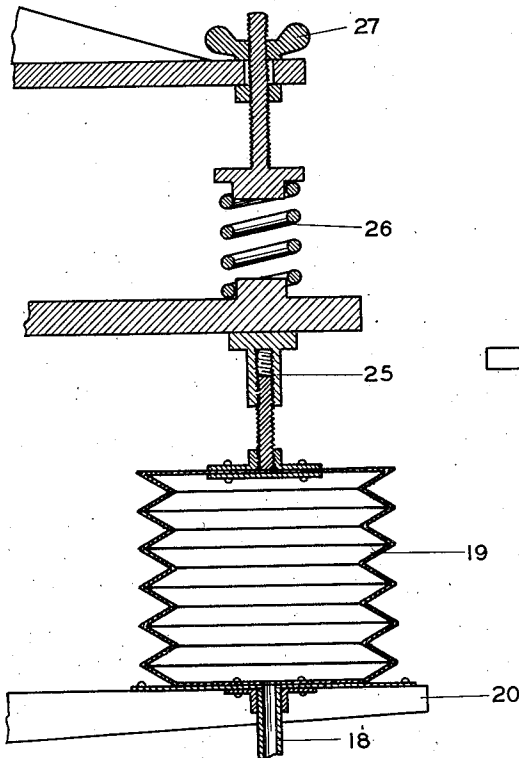


FIG. 2

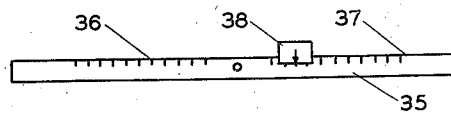


FIG. 3

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VAPOR PRESSURE DEVICE

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3 Claims. (Cl. 73—51)

This invention relates to a vapor pressure device for use in automatically regulating the blending of two liquids, which liquids have different vapor pressure characteristics.

5 In the oil industry, the sale of the liquid hydrocarbons refined or recovered from the crude oil must meet many and varied specifications. In the processing of the crude oil and the gases liberated by the crude oil, the products obtained
10 very greatly as to their vapor pressures. Then too, the temperature of the surroundings affects the amount of vapor given off by the liquid, with the liquid hydrocarbons giving off less vapor at cold temperatures than at warm. With the tem-
15 perature varying as to seasons and localities, it is impossible to obtain a natural, topped or cracked gasoline which will meet all the varying require-
20 ments which will be placed on it for different uses and the change of seasons. The same ap-
plies to other hydrocarbon products, and while the vapor pressure device here disclosed is particularly adapted to blending gasolines, it may be used in any situation to blend liquids which are volatile.

25 In gasolines, natural gasoline has a very high vapor pressure while the topped and cracked have a much lower vapor pressure. Natural gasoline is unsuitable for use with most motor cars in view of the fact that the high volatility of the gasoline will cause vapor lock in the carburetor.
30 Topped and cracked gasolines are not volatile enough to serve as a motor fuel by themselves, so the necessity for the blending of the two becomes evident.

35 In the blending of the two products, some specification must be followed and the type of product is generally specified by the vapor pressure of the product desired. The vapor pressure of the product desired generally falls somewhere between the limits of the products being blended.
40 This presents the problems of joining or mixing the two products in such proportions as desired and to be able to produce a uniform product. The blend may begin early in the morning when the temperature is low and continue to noon when the temperature has been materially increased.
45 With the increase of temperature the vapor pressures of the products must be compensated for to provide a uniform blend.

50 An object of the present invention is to provide a vapor pressure device for use in continuously blending or mixing two liquids.

55 A further object of the present invention is to provide a vapor pressure device for use in continuously blending or mixing two liquids wherein

the blended liquids are referred to a reference standard.

A still further object of the present invention is to provide a vapor pressure device for use in continuously blending or mixing two liquids wherein the changing temperature of the surroundings is compensated for by the device and becomes a constant which in no way affects the blend.

A still further object of the present invention is to provide a vapor pressure device for use in continuously blending or mixing two different types of gasoline having different vapor pressures by referring the vapor pressures of the blended product and a reference standard to an equalizing means.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawing, forming a part of this specification, and in which like numerals are employed to designate like parts throughout the same,

Fig. 1 is a diagrammatic view, partly in section, illustrating the apparatus for carrying out the blending operations,

Fig. 2 is a detail section illustrating the adjusting means for one of the bellows,

Fig. 3 is a front view of a modified beam member which may be substituted for the beam disclosed in Fig. 1.

In the drawing, wherein for the purpose of illustration, is shown a preferred embodiment of my invention, the numeral 1 represents the source of supply of the high vapor pressure liquid while 2 represents the source of supply of the low vapor pressure liquid. Valves 3 and 4 are placed in the flow lines 1 and 2 respectively to open or close off flow in the lines. The supply pipes 1 and 2 discharge into the mixing device 5, where the two liquids are thoroughly mixed and blended together. From the mixing device 5 the liquid flows through the pipe 6 to the chamber 7, where the mixed liquid flows around the reference standard 8, and through the pipe 9 into the receiving drum 10 which may be of about fifty gallons capacity. A sufficient quantity of liquid is always left in the receiving tank as noted at 11 and flow from the tank 10 is out through the pipe 12. The pipe 12 has a valve 13 for controlling the flow there-
50 through which valve is actuated by the flow mechanism 14 connected into the side wall of the receiving drum 10, which insures that the drum at all times will have a quantity of the blended product therein.

The controlling element in the blending organization is the reference standard 8. This reference standard contains about one quart of the grade or vapor pressure that it is desired to produce. This reference standard may be one of the commercial grades that has been made for the locality or may have been accurately blended to fulfill the specifications of the product desired. This standard sample of the grade desired will exert the pressure characteristic of that grade for any of the atmospheric temperatures encountered. Pipes 15 run through the interior of the reference standard which allow for a better heat transfer of the heat from the blended product to the reference sample in order to insure that the blended product and the reference sample are both at the same temperature. The device is so designed as to be sensitive to changes in vapor pressure resulting from changes in composition while remaining insensitive to changes caused by changes in temperature.

The reference sample 8 has a pipe 16 connected in the top thereof which leads into the bottom of a Sylphon bellows 17, which pipe will conduct the vapor from the reference standard to the Sylphon bellows. Connected into the top of the receiving drum 10 is a pipe 18 which conducts the vapor from the blended product in the drum 10 into the Sylphon bellows 19. The Sylphon bellows 17 and 19 are mounted on the arm 20 which is rigidly mounted on the standard 21. Mounted on the standard 21 and above the bellows 17 and 19 is an exactly balanced beam 22 which pivots about the point 23 on the standard. The vapor pressure of the reference standard 8 will exert its pressure on the upper end of the Sylphon bellows 17 and through the member 24 will be transmitted to the left side of the balanced beam. The vapor pressure of the blended product 11 will exert its pressure on the upper end of the Sylphon bellows 19 and through the member 25 will be transmitted to the right side of the balanced beam. Since these two bellows are under opposite ends of an exactly balanced beam, a temperature change, which must equally affect both, will be cancelled out. But a change for example, in butane content, can only affect the blended product, which in turn will cause a movement of the balanced beam. The thumb screws 24 and 25 at the top of each bellows are provided and are adjustable, either to lengthen or shorten the Sylphon bellows when a standard reference of another grade is placed in the system. The spring 26 and wing nut 27 above bellows 19 may be adjusted either in tension or compression to cause the blend to be of a little lower or a little higher vapor pressure than the standard sample, thus permitting correction for instrument factors or other need for minor adjustment.

Mounted on the other end of the balanced beam 22 is a pilot valve mechanism 28 having a portion 29 contacting the balanced beam 22 and movable therewith. The pilot valve 28 connects with a flow line 30 which is attached to a compressed air source. An outlet line 31 connects to the pilot valve 28, and the amount of compressed air flowing through the line 31 is controlled by the pilot valve 28. The outlet line 31 connects with the motor valve 3 in the flow line 1 of the high vapor pressure fluid and controls the amount of high vapor pressure fluid flowing into the blend.

The operation of the device is as follows: The high vapor pressure liquid flows through the line 1, through the valve 3 into the blending chamber

5. The low vapor pressure liquid enters through the line 2, valve 4 and into the blending device 5. In the blending device 5 the two liquids are thoroughly mixed and flow out through the line 6, into the chamber 7, around the reference standard 8, where both the reference standard liquid and the blend acquire the same temperature. The liquid then leaves the chamber 7 by way of pipe 9, goes to receiving drum 10 where a quantity of liquid 11 always remains, before the overflow 10 passes out through pipe 12. The vapor of the reference standard 8 passes into the bellows 17 and its pressure is exerted on the left hand side of the balanced beam 22. The vapor of the blended product passes into the bellows 19 and its pressure is exerted on the right hand side of the beam 22. Since a temperature change must equally affect both the liquid of the reference standard and the blended product, there will be no movement of the beam due to a temperature change, but an increase or decrease in the high vapor pressure liquid of the blend will affect the beam. For example, say the blended product is coming through high in butane content. This will increase the vapor pressure of the blended product over the reference standard, and in turn cause a greater pressure to be exerted on the bellows 19 than on the bellows 17. This will cause a movement of the beam 22, with the right end moving upwardly and the left end downwardly. The downward movement of the left side of the beam will allow the member 29 of the pilot valve 28 to come open and allow a greater amount of compressed air to pass to the motor valve 3 to close the same somewhat, thus cutting off some of the supply of high vapor pressure liquid and gradually bringing the blended product into balance again with the reference standard. As the high vapor pressure liquid is cut down, the pressure on the bellows 19 will be diminished, thus bringing the blend into conformity with the reference standard again. As can be readily seen, the beam will act at all times to keep the vapor pressure of the blended product the same pressure as the reference standard. The reverse of the situation just explained takes place if the blended product becomes low in butane content. In this case, the reference standard liquid will exert a greater pressure on the beam, thus moving the left side of the beam upward, which in turn tends to close the pilot valve 28, cutting off some of the compressed air from the motor valve 3, which in turn allows more high vapor pressure liquid to flow into the mixing chamber, until the products again come into equilibrium as to their vapor pressures.

The device has been described so far with chief attention to maximum theoretical accuracy. This requires that there be prepared at each plant a set of "reference standards," one for each commercial grade as made in that plant and having the local peculiarities of pentane-butane ratio. While the preparation of such a set of samples is a matter of no great expense nor difficulty and would clearly result in a large reduction in the tolerance allowed in vapor pressure of shipments, Fig. 3 shows another means which may be employed to effect a blended product.

If the balanced beam 35 as shown in Fig. 3 be extended equally at both ends and graduated as at 36 and 37, a sliding weight 38 can be used on one end or the other, and by this means it is possible to use but one reference sample in the instrument for making all grades. If the reference sample were, for example, of 18# grade, 75

by suitably weighing the beam on either side of the center thereof, 12# grade could be made in one case while 24# could be made in another. The beam could be very easily graduated, with 5 the graduations on the left side of the beam being for blends less than the vapor pressure of the reference standard and those on the right hand side being for a blend having a greater vapor pressure than the reference standard. The 10 weight 38 may be placed on the graduation on the beam for the product desired. Choice between the two devices is largely one of temperament as both have been used and have been found to give very excellent results, well within 15 the present tolerance for accuracy. A medium standard would, to a great extent, account for local peculiarities in ratios of components and to care for variations in slope of the vapor pressure curve with temperature, the pound marks 20 on the beam would be suitably curved for temperature. The blending temperature on any given day would vary but little, but might be 50° F. in winter, 90° F. in summer, thus requiring, if but one sample were used, that the weight for a given 25 grade be in a different position at different temperatures.

It is to be understood that the form of my invention, herewith shown and described, is to be taken as a preferred example of the same, and 30 that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of my invention, or the scope of the subjoined claims.

Having thus described my invention, I claim:

1. In a vapor pressure device, a reference standard containing liquid of the vapor pressure desired, a receiving drum for the blended liquid, a pair of Sylphon bellows, one connected with the 5 reference standard and the other with the receiving drum and affected by the vapor pressure of the liquids, a balance beam, and said bellows being attached to opposite ends of said balance beam. 10

2. In a vapor pressure device, a reference standard containing liquid of the vapor pressure desired, a receiving drum for the blended liquid, a pair of Sylphon bellows, one connected with the reference standard and the other with the 15 receiving drum and affected by the vapor pressure of the liquids, a balance beam, said bellows being attached to opposite ends of said balance beam and means located between the bellows and beam for adjusting the pressure on the bellows. 20

3. In a vapor pressure device, a reference standard containing liquid of the vapor pressure desired, a receiving drum for the blended liquid, a pair of Sylphon bellows, one connected with the reference standard and the other with 25 the receiving drum and affected by the vapor pressure of the liquids, a balance beam, said bellows being attached to opposite ends of said balance beam and said balance beam being graduated and having a weight which slides along the 30 beam.

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