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E. E. LITTLEFIELD
METHOD AND APPARATUS FOR CONTROLLING AND
UTILIZING MAGNETIC FIELDS OF FORCE
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2,088,604

Fig. 1.

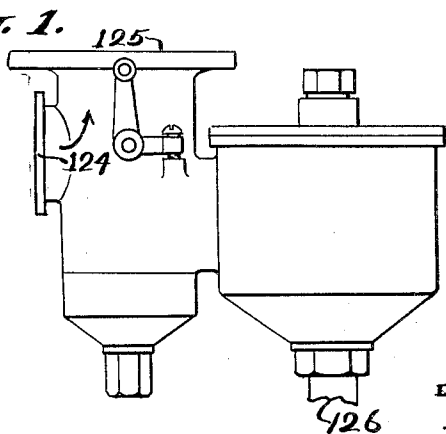


Fig. 2.

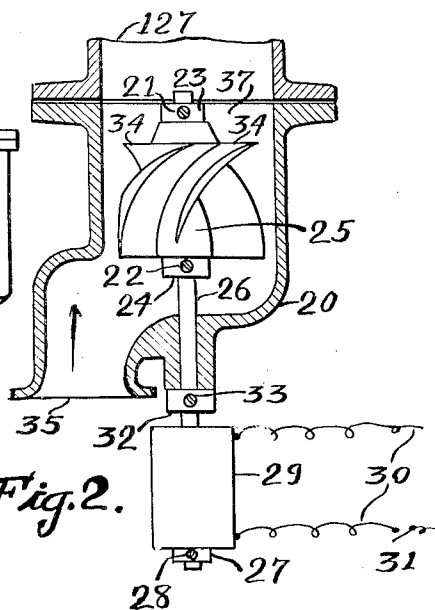


Fig. 3.

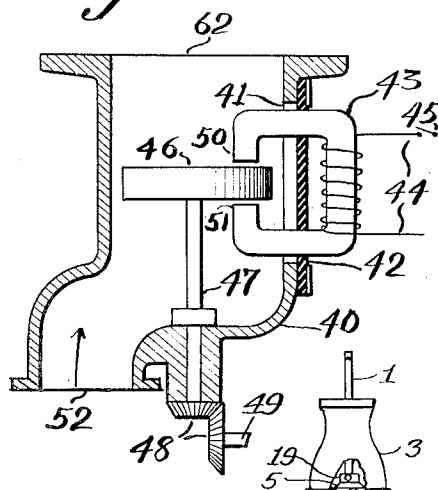


Fig. 4.

INVENTOR:

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Fig. 5.

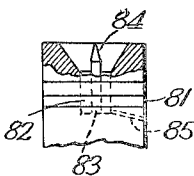
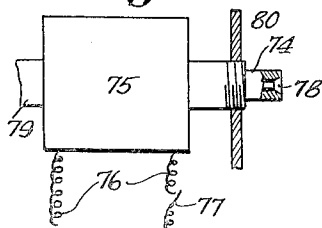


Fig. 6.

UNITED STATES PATENT OFFICE

2,088,604

METHOD AND APPARATUS FOR CONTROLLING AND UTILIZING MAGNETIC FIELDS OF FORCE

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Application May 27, 1930, Serial No. 456,131

1 Claim. (Cl. 219—38)

This application is a continuation, in part, of an application filed by me November 27, 1920, Ser. No. 426,860, for an improvement in Electrically charging and treating fluids. The present application also contains subject matter common to an application filed by me during the month of November 1929 as a continuation, in part, of application Ser. No. 549,191, filed Apr. 3, 1922.

Briefly considered this invention involves and relates to methods and apparatus for controlling and utilizing magnetic fields of force, one of the objects being to employ the heat developed by causing relative movement between particles of fluid and a magnetic field to cause dispersion or vaporization of the fluid.

Another object consists in utilizing a variation of the above and consists in causing rotation of a metallic disc in a magnetic field and applying the heat thus generated to a fluid to be treated.

Other objects and advantages will appear from what follows.

With reference to the heating effect above referred to, an experiment devised by Faucalt and described on pages 1008 and 1009 of a volume entitled "Elementary Treatise on Physics" by Ganot, 18th edition, published William Wood & Co., New York, is referred to. As explained in this article, it has been found that by rotating a metallic disc, such as a disc of copper, between the poles of a magnet, the temperature of the disc is raised. I have found that heat thus generated may be used for the purpose of causing dispersion of fluids, such as gasoline, or the like, and for reducing various other fluids to the form of vapor or spray.

While the method described by Faucalt constitutes one method of producing heat, I have found that it is also possible to accomplish similar results by discharging, preferably under pressure, fluid vapor or spray through a magnetic field.

In the accompanying drawing, in which similar reference characters designate corresponding parts,

Figure 1 is a side elevation of a conventional form of carbureter.

Figure 2 is a side elevation, partly in cross section, of an embodiment of my invention in which a deflector is shown which is rotatable by the fluid to be treated.

Figure 3 is an elevation, partly in cross section, of an arrangement similar to the above, in which a rotatable disc is arranged to be power operated.

Figure 4 is a side elevation, showing a cut-away portion, of a device constituting one embodiment of my invention.

Figure 5 is a view, shown partly in cross section, of a conventional form of Diesel engine spray nozzle embodying my invention.

Figure 6 is the upper end of a Diesel engine piston, shown partly in cross section, slightly modified to embody my invention.

Referring to the drawing more in detail, Figure 1 is a side elevation of a conventional form of carbureter adapted for use on automobiles in which 124 and 125 represent the inlet and outlet, respectively, while 126 is a gasoline supply line.

In Figure 2 I have shown a device designed for use in imparting heat to fluid fuel in a novel manner. This device includes a tubular casing 20, preferably formed of brass or other non-magnetic material, within which is rotatably and adjustably mounted, by means of set screws 21 and 22 and rings 23 and 24, a deflector member 25 (preferably formed of brass or other non-magnetic metal) on a soft iron core piece 26. To the lower end of the core piece is detachably and adjustably mounted, by means of a supporting collar 27 and set screw 28, an energizing coil or winding 29 connected with a suitable source of direct current through circuit 30 and switch element 31. While direct current is preferable in most cases, it is also possible to employ alternating current to advantage, as when it is desired to take advantage of the increased heating effect resulting, in certain cases, from the use of the latter. The rod 26 is detachably and adjustably mounted in a bore 32 of the casing 20, by means of the set screw 33. The deflector 25 is provided with vanes or deflectors 34 adapting it to be rotated through the field of the electromagnet upon admission of fluid at inlet 35. If, now, the inlet end 35 of this tubular device is connected in the feed line of a gasoline engine, as between the outlet end 125 of a carbureter and the intake from the latter, represented by the sectional piece 127, the fuel mixture will be forced through the tubular member 20 in such manner as to cause rotation of deflector 25. Obviously, if the electromagnet is energized, the path of rotation of the deflector will be in the magnetic field provided by the former, in which case the temperature of the deflector will be increased very materially and the heat thus developed will be imparted to the fuel mixture. Should it be desired to heat the air supply instead of the fuel mixture the outlet 37 of the tubular member 20 may be connected to the inlet end 124 of the carbureter. In this case the heated air will form a part of the mixture.

I have so arranged the core piece 26 of the

electromagnet that, if desired, it may be removed and a permanent magnet substituted therefor. On the other hand, the deflector 25 may be omitted, if desired, and the fuel mixture passed through the field of either type of magnet, in which case its temperature will be raised, resulting in better vaporization. With the exception of the core piece 26, or a substitute therefor, it is preferable to form each element of the combination of non-magnetizable material.

Instead of employing the type of apparatus shown in Figure 2, a power operated device such as that shown in Figure 3, may be substituted and connected, as in the above, in the feed line. To this end I have provided a casing 40, similar to that shown in Figure 2, except that at an opening 41 in the side wall thereof is mounted, by means of an insulating member 42 and its associated parts, a direct current electromagnet 43 having connection with a suitable source of current through circuit 44 and switch element 45. In this modification a metallic disc 46, preferably formed of brass or a suitable substitute therefor, is rigidly secured on the upper end of a shaft 47 mounted in a bore of the tubular casing 40 connected to be turned by means of a set of gears 48 cooperating with a suitable source of power (not shown) through the shaft 49. The disc 46 being mounted to rotate between the poles 50 and 51 of the electromagnet, it is evident that during such rotation its temperature will be increased, the amount depending upon its speed of rotation, while the fuel mixture admitted at the inlet 52, in passing through the heated zone of or in contact with the disc, will have its temperature raised. If it is desired to substitute this device in the fuel line or manifold of an internal combustion engine for the device of Figure 2 it may be accomplished by connecting the inlet end 52 to the outlet 125 of the carburetor and the outlet end 62 to the section of manifold 127, or in any other convenient manner. With the exception of the magnet, the parts are preferably made of non-magnetizable material. Obviously, the disc 46 may be made to form a deflector.

In Figure 4 I have illustrated a device which is shown and described in my previous applications above referred to, which applications, by reference, are made a part hereof. In this device a casing 18 is made up of two tubular members 3 and 4 threaded together and having a centrally disposed permanent magnet 1 adjustably and detachably secured by a set screw 7 in a bore of the part 4, while a deflector member 5, having vanes or deflectors 2, is rotatably arranged on the magnet. A removably mounted adjusting collar 19, provided with a set screw, permits free rotation of the deflector when fluid is admitted at one or both of the inlets 6 or 10. In some cases, as when the device is used in connection with a sprinkling system, the magnet 1 may be provided with a pointed rod 8, detachably mounted at 9, adapting it for insertion in the ground. Exteriously arranged threads 12 and 13 adapt the device for a variety of uses. If it is desired to use the device for the purpose of atomizing fuel, in a furnace for instance, the device may be inserted upright by the means shown and connected at 6 to a source of fluid to be atomized. By removing the screw threaded cap 10 the device may be connected to a source of gas, such as air, under pressure, for the purpose of assisting in the atomization of the fuel. While the fluid passed through the field of the magnet will have its temperature raised, resulting in better vapor-

ization, the rotation of the deflector 5 will add to this heating effect, by reason of the fact that the temperature of the deflector in rotating through the field of the magnet will be raised materially and this heat will be imparted to the fluid spray. Obviously, the deflector may be removed from the magnet, if desired, and the spray heated or electrically charged by the use of the field alone. With the exception of the magnet, the various parts of the device are preferably formed of brass or other suitable non-magnetizable material. By means of the screw threads at 6 and 12 the device may be incorporated in the fuel line of an internal combustion engine, in case it is desired to so use the device.

With reference to the above, I have found that by passing a fluid in the form of vapor or spray through a magnetic field of force in such direction that the fluid particles cut its lines of force that the particles become electrically charged and that in cutting the lines of force the fluid particles are subjected to forces tending to oppose their movement while their momentum is converted into energy in the form of electricity and heat, thereby augmenting the dispersion of the particles.

In the carrying out of the above invention it will be found possible, in certain cases, to substitute an electromagnet for the permanent magnet. For certain purposes a direct current electromagnet would be preferable, while for others an alternating current type may be employed. In the treatment of the fluid, any desirable pressure may be applied to project the same through the magnetic field and the required pressure may be also applied to the auxiliary gas when used.

It is well known that insulated objects carrying electrical charges of like sign have a tendency to repel each other when one is brought under the influence of another. I have found that by means of my invention fluid particles may be caused to disperse or scatter by reason of the mutual repulsion existing between the electrical charges of like sign carried thereby.

As indicated above with reference to the invention of Figure 4 the device may be employed to cause dispersion of fluid particles. Such a use for it exists in connection with the operation of internal combustion engines where it is necessary to atomize the liquid fuel used therewith. It may also be employed in connection with furnaces using liquid fuel. From what has been previously said it is evident that coaction between the fluid and the magnetic field will cause a certain amount of heat to be imparted to the particles and this heat will result in a certain amount of vaporization. This effect is particularly pronounced in connection with such lighter fuel oils as are used in internal combustion engines, which vaporize at comparatively low temperatures. Thus it will be seen that the invention provides means whereby dispersion may be effected in a manner both economical and novel.

Theoretically considered the velocity of the particles, in passing through a magnetic field, determines, in a measure, the rate of energization as well as other factors, including the potential of the charge. On the other hand the velocity will depend upon two factors consisting of a force tending to stop the particles and a force acting in opposition. In the present instance the particles in cutting the lines of force are subjected to forces tending to oppose their movement while their momentum is converted into energy in the form of electricity and heat. By applying air un-

der pressure to the particles, not only their velocity through the field but their velocity of rotation may be governed. In other words, by utilizing the pressure of any suitable gas the force acting in opposition to the force tending to stop the particles may be made anything desired.

Thus, it has been found that a gas, such as air, may be utilized not only for effecting a more complete vaporization of fluids but for causing particles of solid matter, such as pulverized fuel in the form of coal, or the like, to define a path through the field. In connection with shower baths the invention may be employed to govern the degree of vaporization as well as the velocity and movement of the particles. It may also be used in connection with certain drying processes including that of milk dehydration. Obviously, the particles in passing through the field will be subjected to the heating effect of the force tending to oppose their movement. In fact this heating effect, in the case of combustible fuel, may be utilized to cause ignition of the fuel.

In the foregoing I have discussed moving particles in their relation to magnetic fields. Evidently, the field produced by an uninterrupted direct current electromagnet is, in form, the equivalent of the field produced by a permanent magnet. Whether the described results are produced by a movement of the particles or a movement of the field, is for the artisan to decide, since either method may be employed. It is also possible to employ fluids of other types in the treatment. From the foregoing it follows that the pressure of any suitable gas may be utilized in carrying out the method. It is also apparent that instead of being limited to one type of field, various types may be used, depending on the particular function of the apparatus.

Moreover, the method may be employed for the purpose of electrically charging, or electrically treating, or heating, either relatively pure or chemically charged fluids. It may also be employed for electrically charging, treating, or heating particles of solid matter, or a combination of solid and fluid matter.

In Figure 5 is shown a form of device adapted to be employed in connection with a Diesel engine. In this modification I have provided a conventional form of spray nozzle 74, preferably formed of a suitable quality of iron or steel, with an energizing winding 75, connected with a suitable source of current, preferably direct (not shown) by means of circuit 76 having a switch 77. A valve 78 of a conventional type is con-

nected for operation in the usual manner, the valve and its stem preferably being formed of non-magnetizable material such as bronze or hard brass, otherwise upon the tube 74 being energized or magnetized the valve would have a tendency to stick. The threaded supporting collar 79 permits insertion of the spray device in an appropriate place in the end of the cylinder wall 80 of the engine. Obviously, instead of employing an electromagnet arrangement, the part 74 may consist of a strong permanent magnet, in which case the winding 75 may be omitted. Or, the valve and its stem may constitute a permanent magnet, in which case it would be preferable to form the remainder of the device of other than magnetizable material. In any case the spray in passing through the field of the magnet will have its temperature raised, as a result of which better vaporization follows, and, if the speed of the particles is sufficient, ignition will take place.

In Figure 6 I have shown, partly in cross sectional elevation, the upper end of a conventional form of piston commonly employed in Diesel engines, in a recess of which piston 81 a recess 82 is provided in which I have threaded, as at 83, a strong cylindrical permanent magnet 84 having a pointed end, the purpose of which will be understood later. A drain passage 85 permits escape of oil etc., from the recess. With the exception of the magnet itself the device is preferably formed of any of the well known non-magnetizable metals of which pistons are now made. Obviously, when the piston is in its proper place in the engine cylinder, if we consider the usual practice, the spray is discharged directly above the piston. In the present case the spray will pass through the field provided by the magnet, resulting in an increased temperature and, if conditions are right, ignition of the fuel.

While in the above description I have illustrated and explained improvements embodying my invention, it will be apparent that many modifications in the structure of the apparatus used and in the application thereof may be made without departing from the scope of the appended claim.

I claim:

The method of heating particles of fluid by causing the particles to overcome the tendency of a steady uni-directional magnetic field to resist the movement of an electrical conductor therein and utilizing the heat thus generated to heat the particles.

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