Oct. 27, 1931. H. W. GEROMANOS 1,829,001

SPECTRA DEMONSTRATOR

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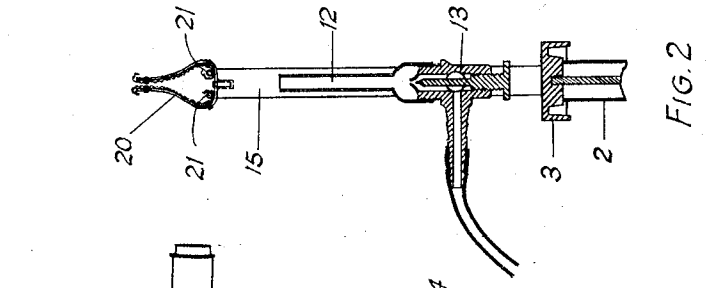


FIG. 2

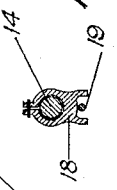


FIG 3

FIG. 1.

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SPECTRA DEMONSTRATOR

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This invention relates to apparatus designed more especially for the purpose of teaching students the more common uses of the spectroscope and some of the characteristics of spectra.

The apparatus heretofore used for this purpose has been unsatisfactory for the reason that it is difficult to exhibit spectra in the manner required to enable beginners to detect spectra lines or bands characteristic of different substances. The student naturally does not know exactly what to look for, and the instructor cannot be sure that the student sees what he should see. It is the chief object of the present invention, therefore, to improve apparatus of this character with a view to providing for the observation of actual spectra under such conditions that they can readily be compared and the characteristic lines of different spectra easily recognized.

The nature of the invention will be readily understood from the following description when read in connection with the accompanying drawings, and the novel features will be particularly pointed out in the appended claims.

In the drawings,

Figure 1 is a perspective view of an apparatus constructed in accordance with this invention;

Fig. 2 is a vertical, cross-sectional view through the burner and the holder for supporting the material whose spectra characteristics are to be observed; and

Fig. 3 is a vertical, cross-sectional view on the line 3—3, Fig. 1.

The apparatus shown comprises a stand 2 including a horizontal bar 3 which supports the operating units of the apparatus. These units include a spectroscope 4 of any suitable construction, and a socket 5 for a source of light 6 which preferably consists of a gas filled electric lamp or other form of high intensity lamp. The lamp is enclosed in a metal shield or hood 7 having a vertical slit 8 in one side thereof to direct a beam of light to the spectroscope. A lens 9 supported between the lamp 6 and spectroscope 4 serves to focus the light on the collimator slit 10.

A series of Tirrell type burners 12 is mounted on a support 13 in position to produce a long narrow flame in the field of the spectroscope and directly in line with the beam of light issuing from the slit 8, the support 13 being mounted on a rod 14 which is journaled in two upright standards 15—15 and also in the standard 16 which supports the spectroscope. This construction permits the tipping of the burners to carry the flame into or out of the field of the spectroscope, the rod 14 being provided with a handle or knob 17 to facilitate the tipping of the burners. The range of this tipping movement is limited by a clamp 18, Figs. 1 and 3, which is secured fast on the rod 14 and is provided with lugs at its lower side to engage a pin 19 which is fixed in the right-hand standard 15.

In order to support material in the flame of the burner or burners so that the spectra produced by the vaporization and burning of such material or by the incandescent vapors or gases can be observed, a gauze holder 20 is mounted on the upper ends of the standards 15—15. This holder comprises two gauze sections supported at opposite sides of the center line of the flame, these sections being properly spaced from each other at their upper margins but having lower portions which curve away from each other and then bend inwardly and upwardly to form pockets or recesses at opposite sides of the flame. The material whose characteristics are to be studied or observed is supported in these pockets. The holder should be made of some highly refractory substance, "chromel" gauze being very satisfactory.

One feature of the invention resides in a novel form of material for use in this apparatus. It will be observed that the drawings show small rods 21—21 supported in the pockets in the holder 20. Preferably these rods consist of some granular or powdered material united by a binder and molded into the form shown. They may, for example, consist of crystals of sodium chloride or a mixture of sodium salts held together by such a binder as sodium silicate, the nature of the binder being selected, of course, in accordance with the powdered material used. In some cases this material may be molded

about a central core, such as a rod or refractory gauze. Metallic salts may be used very conveniently in the manufacture of these sticks or rods and sodium silicate is an especially satisfactory binder because of its refractory characteristics.

Preferably a switch 22 is mounted on the bar 3 and controls the electric lamp 6, this switch being within convenient reach of the observer so that he can turn the lamp on and off as desired.

In using the apparatus the light emitted from the lamp 6 through the slit 8 may be focused on the collimator slit 10 and then observed through the spectroscope producing, when in proper focus, a bright continuous spectrum. The lamp next may be extinguished and the burners 12 lighted, the rods 21—21 being in place in the holder 20. In a few seconds the upper part of the chamber in the holder 20 will be filled with incandescent sodium vapor, assuming that the rods 21—21 are made of sodium chloride and sodium silicate, as above described. Viewing this vapor through the spectroscope the characteristic yellow D line of sodium may be clearly seen. With a higher resolving power in the spectroscope the D line may be divided into its component lines. If now the electric lamp 6 is lighted the D line projected on the bright continuous spectrum will appear as a dark line or lines. One of the difficulties experienced by the average student is to see these dark lines. In the apparatus shown, however, this can readily be done by turning the knob 17 and thus swinging the burners out of cooperative relationship to the holder 20 so that the dark line or lines disappear, and then swinging the burner back into its upright position again, thus bringing the dark line or lines back into the spectrum. This operation can be repeated by the observer as frequently as desired without interrupting the observation of the spectrum so that the lines can be removed from the spectrum or restored to it almost instantly, and they are therefore recognized with practically no difficulty.

It will be observed that the use of a gas filled electric lamp gives a light of very high temperature which forms a very satisfactory source of the continuous spectrum. The burners and gauze holder for the material whese spectra characteristics are to be studied are used as a source of bright line spectra, and the projection of the latter upon the former produces the dark line spectra. By mounting the burner in the manner described the flame may be swung into or out of the field of the spectroscope but always maintains exactly the same conditions as to height, blue cone, temperature, etc. when brought back into line with the spectroscope, thus reproducing practically identical conditions in the flame chamber upon the return of the flame as existed before its removal. This is valuable in facilitating the quick comparison of the spectra and detection of the characteristic lines produced by the presence of different substances in the flame.

While I have herein shown and described a preferred embodiment of the invention, it will be understood that the invention may be embodied in other forms without departing from the spirit or scope thereof.

Having thus described my invention, what I desire to claim as new is:

1. In a spectra demonstrator, the combination of a spectroscope, a source of light in line with said spectroscope, a burner mounted in operative relationship to said spectroscope to produce a flame in the field of said spectroscope, a holder for supporting material in said flame to modify the character of the flame, and supporting means for said holder and burner, said holder and burner being mounted in said means for relative tipping movement into and out of cooperative relationship to each other to enable the observer to change the character of the spectrum during his observation of the spectrum.

2. In a spectra demonstrator, the combination of a spectroscope, a source of light in line with said spectroscope, a burner mounted in operative relationship to said spectroscope and said source of light, a holder for supporting material in said flame to modify the character of the flame, and supporting means for said parts, said parts being mounted in said means for movement relative to each other whereby the effect of said material in the flame may be moved in and out of the spectrum at the will of the observer during his observation of the spectrum.

3. In a spectra demonstrator, the combination of a spectroscope, a source of light in line with said spectroscope, a burner mounted in operative relationship to said spectroscope to produce a flame in the line between said spectroscope and said source of light, a holder for supporting material in said flame to modify the character of the flame, a stand on which said spectroscope, said source of light, said burner and said holder are mounted, and means carried by said stand for supporting said burner for movement by the observer into and out of a definite operative relationship to said spectroscope during his observation of the spectrum.

4. In a spectra demonstrator, the combination of a spectroscope, a source of light in line with said spectroscope, a burner mounted in operative relationship to said spectroscope to produce a flame in the field of said spectroscope, a holder for supporting material in said flame to modify the character of the flame, a stand on which said spectroscope, burner and holder are mounted, and means carried by said stand for supporting said burner for tipping movement relative to said

spectroscope and holder whereby the observer may shift said flame into and out of the field of the spectroscope at will and during his observation of the spectrum.

5. In a spectra demonstrator, the combination of a spectroscope, a source of light in line with said spectroscope, a burner mounted in operative relationship to said spectroscope for producing a flame to be observed, a holder having portions at opposite sides of said flame and between which the flame is confined, said holder being constructed to afford a clear view of the flame between said portions and having parts for holding material designed to modify the character of the flame, a stand on which said burner and holder are mounted, and means carried by said stand for supporting said burner for swinging movement relative to said spectroscope and holder whereby the observer may move the burner into and out of cooperative relationship to said holder at will.

6. In a spectra demonstrator, the combination of a spectroscope, a source of light in line with said spectroscope, a burner mounted between said spectroscope and said source of light and arranged to produce a flame in the line between said spectroscope and said source of light, and means including a device located in proximity to the observer's position and operable at the will of the observer to remove the effect of said flame in the spectrum and restore it again while the observer continues his observation of the spectrum.

7. In a spectra demonstrator, the combination of a spectroscope, a source of light in line with said spectroscope, a burner mounted in operative relationship to said spectroscope to produce a flame in the field of said spectroscope, a holder for supporting material in said flame to modify the character of the flame, and means for supporting said holder and said burner for relative movement in a fixed path into and out of cooperative relationship to each other to enable the observer to remove the effect of said material in the flame and to restore it again during his observation of the spectrum.

8. In a spectra demonstrator, the combination of a spectroscope, a source of light in line with said spectroscope, a burner for producing a flame in the field of said spectroscope and between it and said source of light, a gauze holder for supporting material in position to be vaporized by said flame to cause said vapors to modify the flame, and a stand on which said spectroscope, said source of light, said burner and said holder are mounted, said burner being mounted for movement relative to said spectroscope and holder to enable the observer to shift said burner and thereby move the flame into and out of the field of the spectroscope during his observation of the spectrum.

9. In a spectra demonstrator, the combination of a spectroscope, a source of light in line with said spectroscope, burners arranged to produce a relatively long flame in line with the spectroscope and between said spectroscope and said source of light, a gauze holder including portions at opposite sides of said flame and between which the flame is confined, said holder having pockets in the lower part thereof and at opposite sides of the flame to hold material designed to modify the flame, and supporting means for said burners and holder, said burners and holders being mounted in said means for relative movement to enable the observer to swing the burners into and out of cooperative relationship to the holder at will during his observation of the spectrum.

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