

July 20, 1943.

3. **M. A. ARTHUR**
METHOD AND APPARATUS FOR TAKING A SERIES OF
SPECTROGRAPH MEASUREMENTS
Filed July 11, 1941

2,324,899

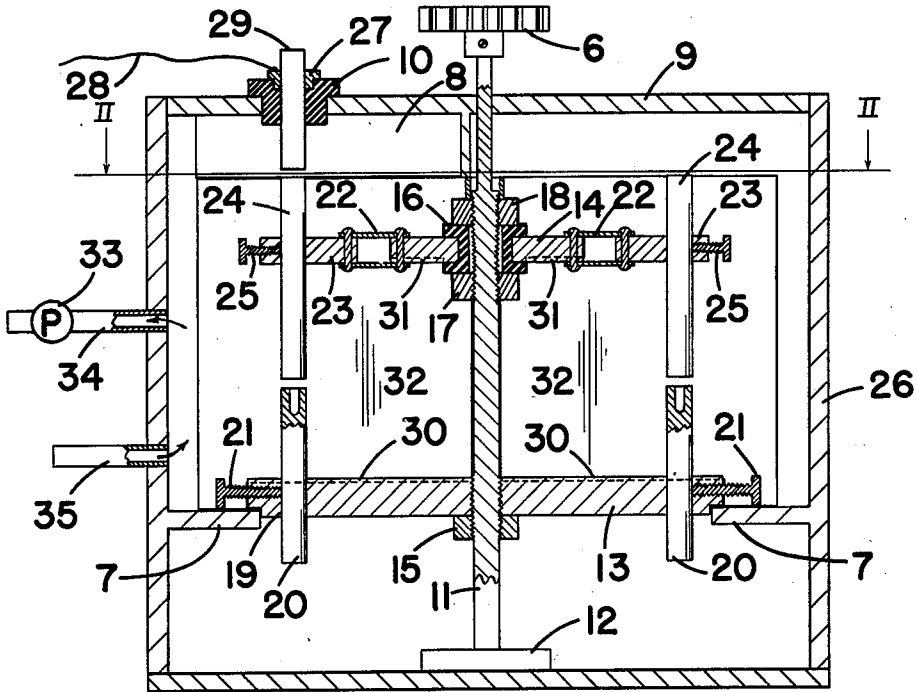
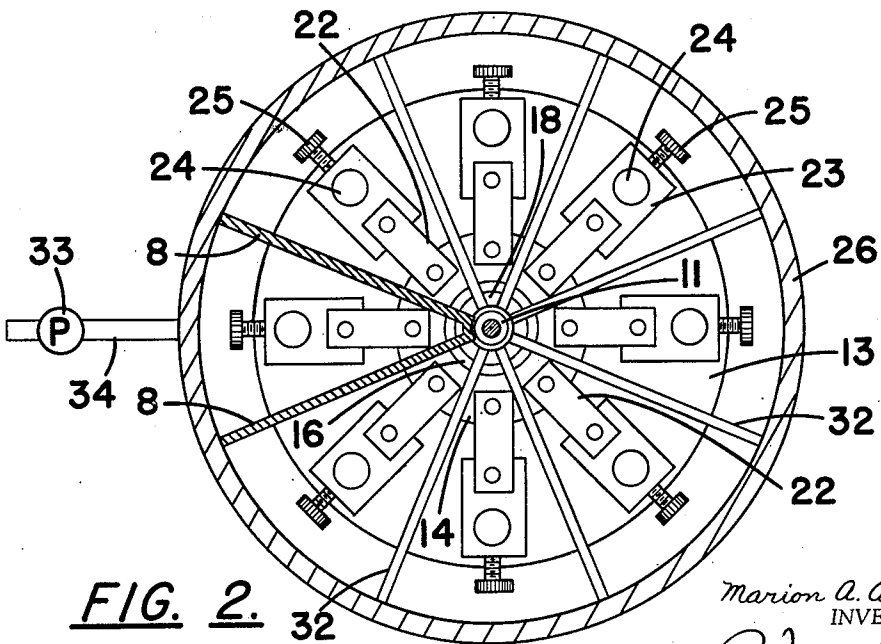


FIG. 1.



Marion A. Arthur
INVENTOR.

P. J. Whelan
ATTORNEY

UNITED STATES PATENT OFFICE

2,324,899

METHOD AND APPARATUS FOR TAKING A
SERIES OF SPECTROGRAPH MEASUREMENTSMarion A. Arthur, Houston, Tex., assignor to
Standard Oil Development Company, a corporation of Delaware

Application July 11, 1941, Serial No. 401,998

5 Claims. (Cl. 176—41)

The present invention is directed to a method for taking a series of spectrograph measurements and to apparatus suitable for employment in practicing this method.

When using a spectrograph for analytical purposes, it is conventional to employ an apparatus having vertically spaced electrodes. The upper end of the lowermost of the two electrodes is provided with a cavity or a crater in which the sample to be tested is placed. When a reading is to be taken, the uppermost electrode is moved downwardly to contact the lower electrode so that an arc will be struck, a suitable elastic means returning the upper electrode to a fixed position so that the arc between the electrodes is of a predetermined length. After the condition of the arc has become relatively stable, as for example, five seconds after the arc is struck, a suitable indication is obtained. At the present time this is customarily done by the exposure of a photographic film to light from the arc which has passed through a refractive grating. After one reading has been taken, the electrodes in the device must be removed and replaced by fresh electrodes, a sample placed in the cavity of the lowermost electrode, and the cycle repeated. Fresh electrodes must be placed in the machine for each reading because the vapors produced by the arcing will contaminate other electrodes to which the gases have access and the determination obtained from the contaminated electrodes would be noticeably in error.

An object of the present invention is to devise a method for analyzing a set of unknowns by means of a spectrograph without manipulating the samples until the determination for the entire set is complete, or while the determinations for the set are being obtained.

A further object of the present invention is to devise an apparatus suitable for use in practicing the above described method.

Other objects and advantages of the present invention may be seen from a reading of the following description taken with the accompanying drawing in which

Fig. 1 is a cross sectional view illustrating a preferred embodiment of apparatus suitable for practicing the present invention; and

Fig. 2 is a view taken along section II—II of Fig. 1.

Referring specifically to the drawing, a vertically arranged shaft 11 provided with a base 12 has vertically separated plates 13 and 14 secured thereto. It will be apparent that these plates are of circular shape and provided with central pas-

sages so that they may rotate in a horizontal plane with shaft 11 as the axis of rotation. Lower plate 13 may suitably be formed of metal and is secured in position by nut 15. Upper plate 14 is also suitably constructed of a metal, but is provided with an insulated bushing 16 to insulate it from the shaft and is secured against vertical movement by nuts 17 and 18 below and above the bushing.

Equally spaced around the outer edge of lower plate 13 are openings 19, each of which is arranged to hold a lower electrode 20 in a vertical position. Electrodes 20 are secured to this lower plate by thumb screws 21. Attached to upper plate 14 by springs 22 are upper electrode holders 23, each of the holders being directly above one of the sockets 19 with which the lower plate is provided. Each of upper electrodes 24 is secured to electrode holder 23 by thumb screw 25.

The apparatus which has been heretofore described is arranged within a casing 26 having a cover plate 9. Insulated bushing 10 is arranged in a suitable opening in cover plate 9 to insulate conducting bushing 27 therefrom. Bushing 27 is electrically connected by conductor 28 to a suitable source of electric current (not shown). A rod 29 having a low electrical conductivity, such as a carbon rod the same size as the electrodes previously mentioned is slidably arranged within bushing 27 so that, when an upper electrode 24 is vertically below this rod, it will be in physical contact therewith.

The upper side of plate 13 is provided with a plurality of radially extending grooves 30 which divide this plate into segments corresponding in number with the number of lower electrodes employed, each electrode being arranged in a medial portion of a segment. The lower side of upper plate 14 is provided with a plurality of radial grooves 31 corresponding in size and arrangement with the previously mentioned grooves 30. Arranged with their upper and lower edges in these grooves are vertical plates 32 constructed preferably of an insulating material, such as Transite.

Housing 26 is provided with shoulder 7 and cover plate 9 is provided with partition or fin 8 which cooperate with plates 32 to form a chamber about the pair of electrodes which are in position for striking an arc. In other words, plate 32, housing 26, lower plate 13, upper plate 14, shoulder 7 and partition 8 are arranged to partition off the vapors produced by the arc from the electrodes not actually used in producing the arc, thereby shielding the idle electrodes from contamination. After an arc has been

struck between a pair of electrodes and a reading has been taken, knob 6 allows the rotatable part of the device to be readily moved to bring a fresh pair of electrodes into position. An arc may be struck between these fresh electrodes, a reading taken, and this procedure repeated until all of the electrodes have been used.

The other conventional portions of a spectrograph, such as the grating and indicating and recording means, have not been illustrated since these portions are familiar to the art and do not in themselves form a part of the present invention.

With the device as above described it has been found that a set of samples may be arranged in the cavities of the lower electrodes, the electrodes arranged in the apparatus and a series of measurements taken without contamination of subsequently determined samples by the arc of the samples preceding them. As a further refinement it has been discovered, however, that more satisfactory results may be obtained by the attachment of a pump 33 by means of conduit 34 to the portion of the device in which the arc is produced. A suitable opening or orifice 35 is arranged in casing 26 some distance below the entrance of conduit 34 to allow outside air to be drawn into the compartment in which the arc is produced and to be withdrawn from the compartment by pump 33. Such a stream of air not only rapidly removes vapors from the casing to eliminate any possible contamination of the adjacent electrodes through the joints separating plates 13 and 14 and 32, and partition 8, shoulder 7 and housing 26, but, in addition, produces more uniform results by removing products of combustion from the arc and maintaining more constant conditions therein. It has been found that the maintenance of a pressure drop of 3" of water adjacent to the entrance to conduit 34 maintains the flow of air at a suitable rate through the compartment in which the arc is being operated.

In running a set of samples a plurality of prepared lower electrodes are arranged in the device. These electrodes are prepared in a manner known to the art so that they will be free from extraneous material, the last step in preparing the electrodes involving the production of an arc. A sample which is to be analyzed is then placed in each cavity. Prepared upper electrodes are then arranged in the apparatus. By rotating knob 6 an electrode 24 is brought into position immediately below conducting rod 29. An arc is then struck in the usual manner and a reading taken. When this determination has been completed, the arc is extinguished, the plates revolved to bring the next pair of electrodes in position, an arc again struck, and another determination made. This procedure is repeated until an arc has been produced between each pair of electrodes and a determination for each sample made. As the determinations are being made, pump 33 may be operated in order to produce uniform conditions in the arc and eliminate any possibility that the samples and the unused lower electrodes will be contaminated by the arc. It will be apparent that in carrying out the procedure as described as many

pairs of electrodes may be used in making a set of runs as there are holders in the apparatus. In the specific embodiment illustrated eight pairs of electrodes may be loaded into the machine at one time, a sample arranged in the cavity of each lower electrode, and then the determinations of the eight samples completed without the operator touching either the electrodes or the samples, the only manipulation required being the rotation of the electrode holders to bring the samples serially in position and contacting upper conducting rod 29 with the upper electrode of each pair of electrodes.

While a specific embodiment of the present invention has been illustrated, it will be obvious that changes in the size, shape and arrangement of parts may be made by a skilled worker without departing from the scope of the invention and it is my intention to embrace such changes by the hereto appended claims.

I claim:

1. In a device for obtaining a series of determinations by a spectrograph, in combination, means for mounting a plurality of electrodes in pairs with each pair in spaced relation, means for serially bringing each of said spaced pairs to a predetermined point, and means arranged to enclose the pair of electrodes at said predetermined point in a substantially gas-tight chamber to shield them from the remainder of the electrodes.

2. In a device for obtaining a series of determinations by a spectrograph, means arranged for mounting a plurality of electrodes in pairs in spaced relation with an elastic member supporting at least one electrode of each pair whereby the electrodes may be brought in momentary contact for striking an arc and returned to their spaced relationship, means arranged for selectively moving each pair of spaced electrodes to a predetermined point, and means for connecting said electrodes with a source of electric current at said point.

3. In a device for obtaining a series of determinations by a spectrograph, means arranged for mounting a plurality of electrodes in pairs in spaced relation with an elastic member supporting at least one electrode in each pair, whereby the electrodes may be brought in momentary contact for striking an arc and returned to their spaced relationship, means arranged for selectively moving each pair of spaced electrodes to a predetermined point, means arranged to enclose the pair of electrodes at said predetermined point in a substantially gas-tight chamber to shield them from the remainder of the electrodes, and means for connecting said electrodes with a source of electric current when at said predetermined point.

4. A device in accordance with claim 1, in which a means is arranged for reducing the pressure in said substantially gas-tight chamber to a value less than atmospheric.

5. A device in accordance with claim 3, in which a means is arranged for reducing the pressure in said substantially gas-tight chamber to a value less than atmospheric.

MARION A. ARTHUR.