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W. M. RUST, JR., ET AL

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GRATING SPECTROGRAPH

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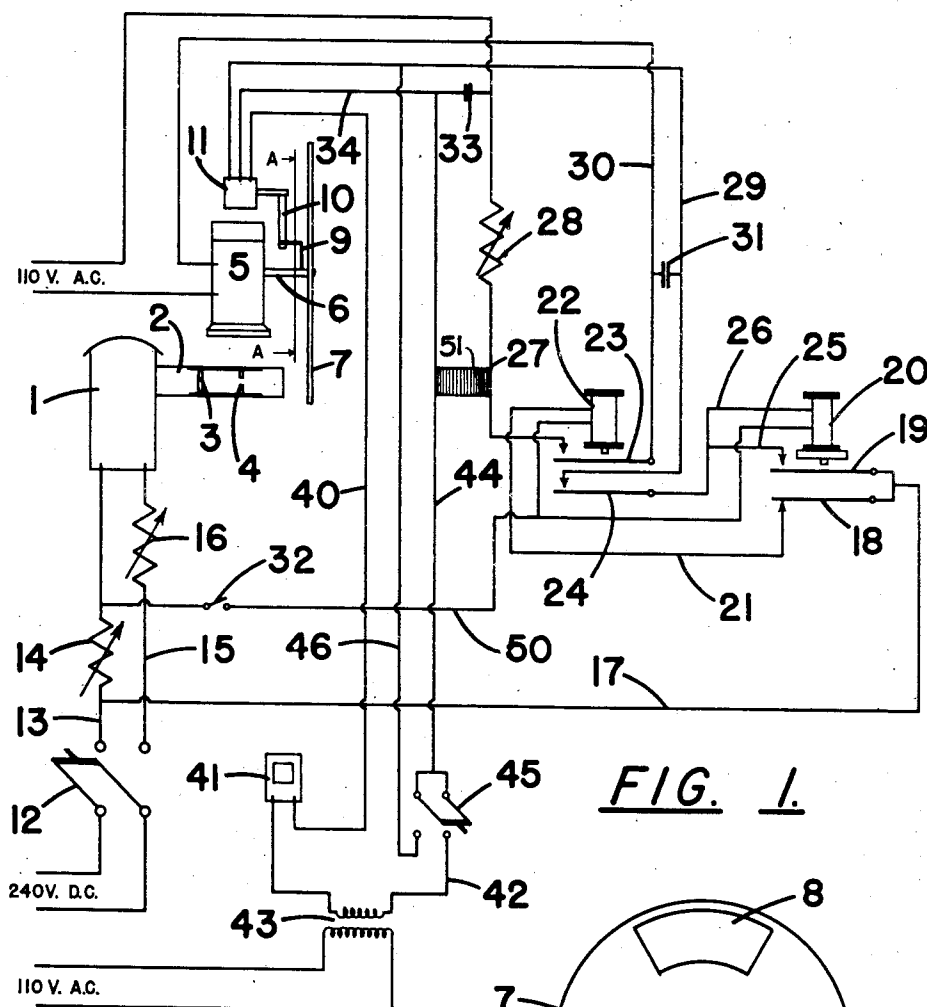


FIG. 1.

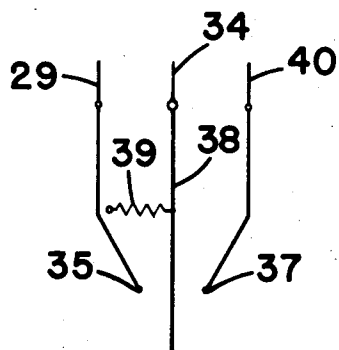


FIG. 2.

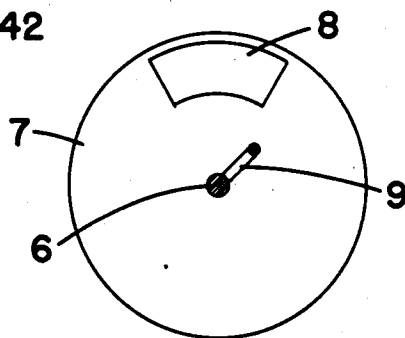


FIG. 3.

Marion A. Arthur
William M. Rust Jr.
INVENTORS
BY *P. J. Whelan*
att.

UNITED STATES PATENT OFFICE

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GRATING SPECTROGRAPH

William M. Rust, Jr., and Marion A. Arthur,
Houston, Tex., assignors to Standard Oil De-
velopment Company, a corporation of Delaware

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4 Claims. (Cl. 88—14)

The present invention is directed to an improved spectrograph of the grating type.

The principal object of the present invention is the provision in a device of the type mentioned of an automatic shutter operated by the energiza-
tion of the light source for regulation of the
period for which the light source shines on the
grating.

An additional object of the present invention is the provision in a device of the aforesaid character of a signal operated in conjunction with the shutter.

Further objects and advantages of the present invention will appear from the following detailed description of the accompanying drawing in which

Fig. 1 is a schematic view showing the relation between the shutter and the light source in a spectrograph and the electrical circuit for operating the light source;

Fig. 2 is a detail of the micro-switch shown in Fig. 1; and

Fig. 3 is a section taken along the line A—A of Fig. 1.

Referring to the drawing in detail, numeral 1 designates a hood which houses a light source. This light may be a sparking device, an arcing device, or an electric lamp. For different types of spectral analysis different light sources are employed. Projecting from one side of the hood 1 is a tube 2 in which is arranged a lens 3 and a slit 4. It will be understood that the slit is adjustable, but this feature is conventional in the art. The outer end of the tube is open and the axis of the tube is in line with a grating 51 which is the essential element of all grating spectrographs. The present invention does not involve the camera so this element is omitted from the drawing.

Suitably arranged in juxtaposition to the tube 2 is a synchronous motor 5 which is conveniently an electric clock. The shaft 6 of the clock carries a shutter 7. It may be mentioned here that the shaft 6 is the one which customarily carries the second hand of the clock, since, for the purpose of the present invention, it is convenient to use this sort of timing. The shutter 7 has an opening 8 in the form of a sector, the width of which is selected so as to give the desired exposure time with the disc making a complete revolution per minute.

Mounted on the shaft 6 behind the shutter is a laterally projecting arm 9 adapted to coact with a cam 10 which forms part of a micro-switch 11. This micro-switch is constructed in accordance with Patent 1,960,020 and forms no part of the present invention except in combination with the

other elements. Briefly, it is a single-pole double-throw switch so arranged with respect to the pin 9 that when the pin 9 is thrust against the cam surface 10 it holds the pole of the switch in contact with one lead and when the pin 9 passes the cam surface 10 and releases the latter, the pole is spring-pressed against another lead.

Numeral 12 designates a switch in a power line connected to the light source in hood 1. Lead 13 of this power line is provided with an adjustable resistance 14 and lead 15 is provided with an adjustable resistance 16. In ordinary practice, this power line will carry about 240 volts, which voltage, of course, will vary with different light sources. Between switch 12 and resistance 14, a branch line 17 is connected to lead 13. This line terminates in a pair of parallel arms 18 and 19, which are adapted to move as a unit and form part of a relay, the remainder of which is the solenoid 20. Arm 18 is adapted to make electrical contact with line 21 which conducts current to a solenoid 22 which is part of a second relay, the remainder of which is a pair of arms 23 and 24 which are parallel to each other and also adapted to be moved as a unit by the solenoid 22. Arm 19 is adapted to make contact with a lead 25 which, in turn, is connected to a lead 26, one end of which is connected to solenoid 20 and the other end of which is connected to arm 24. Arms 18 and 19 are so arranged that when arm 18 is in contact with lead 21 arm 19 is spaced from lead 25 and vice versa.

Arm 23 is adapted to make contact with a lead 27 which is a power line connected with a power source for operating clock work 5. Line 27 carries an adjustable resistance 28. Arm 24 is adapted to make contact with a lead 29 which is connected to one contact point of the micro-switch 11. The current for the clock is transmitted from line 27 to the clock by a line 30 connected to arm 23 and to the clock. Between lines 29 and 30 is a condenser 31. Between resistance 14 and the light source is a second branch line 50 which is connected to lead 13 and is also connected to solenoids 20 and 22. In line 50 is a switch 32.

The system thus far described operates as follows: With switch 32 closed switch 12 is closed to energize the light source. Simultaneously, arms 23 and 24 are pulled by solenoid 22 into contact with leads 27 and 29. It may be mentioned here that the relay made up of arms 23 and 24 and solenoid 22 is a quick-acting relay, while the relay made up of arms 18 and 19 and solenoid 20 is a slow-acting relay.

When the system has started, the arm 9 is resting against the cam surface 10 of the micro-switch and is holding the pole of the switch out of contact with lead 29. As soon as arm 23 makes contact with lead 27, the clock circuit is closed and the disk starts to rotate. It will be noted that the arm 9 leads the forward end of slot 8. The distance by which it leads may be adjusted so as to provide a suitable time for the light source to become stable before the light beam is allowed to pass through the slot 8.

When the shutter begins to rotate, the arm 9 releases the cam surface 10 and permits the pole of the micro-switch to be pulled into contact with lead 29. Current then passes from line 15 through a condenser 33 arranged in a line 34 which is connected to the pole of the micro-switch, and thus through conductor 29 to solenoid 20, energizing the latter. This causes the arm 18 to move out of contact with lead 21 and brings arm 19 into contact with lead 25. This de-energizes solenoid 22 and causes arms 23 and 24 to break contact with leads 27 and 29, respectively. The clock continues to run because the micro-switch is closed, the current flowing through line 27 through condenser 33, lead 34, lead 29, condenser 31, and lead 30 to the clock. When the shutter makes a complete revolution, the arm 9 again engages the cam surface and opens the clock circuit, stopping it.

As previously pointed out, the micro-switch employed is a well known patented switch. A schematic illustration of it is shown in Fig. 2. It is to be understood that the arrangement shown in Fig. 2 is not the actual construction of the switch, but a simplified arrangement to illustrate the manner in which the switch operates. Conductor 29 terminates in the switch housing in a contact point 35. Another conductor 40 to be referred to hereafter terminates in a contact point 37. Lead 34 is connected in the housing to a pivoted arm 38. This arm is normally spring-pulled against contact point 35 by a spring 39. It is connected for movement with the cam surface 10 whereby it may be thrust against contact point 37 by the arm 9.

Lead 40 forms part of a signal circuit. It is connected to a buzzer 41. It will be apparent that the buzzer may be replaced by a visual signal. Also connected to the buzzer is a lead 42 which includes a winding 43 of a transformer connected to a source of power. A branch line 44 is connected to line 34 and terminates in a dipolar switch 45, one pole of which is adapted to contact lead 42, and the other pole of which is adapted to contact a lead 46 which is connected to conductor 29.

When the signal is to be used, the switch 45 is closed. As soon as arm 9 passes the cam surface 10, the buzzer circuit is opened and when pin 9 again comes into contact with cam surface 10 and thrusts the pole 38 against the contact 37, the buzzer operates. Thus, it is operated each time the shutter makes a revolution. It will be apparent that this buzzer may be used to determine exposure time without the use of the shutter at all and the system will be so used when exposure times in excess of a minute are desired.

As can be seen from Fig. 1, when switch 45 is closed, the clock does not stop after each revolution for the reason that when pole 38 is pulled away from contact 35 and thrust against contact 37, the current flows through line 27, con-

denser 33, line 44, line 46, line 29, condenser 31, and line 30 to the clock.

In practice, when this system is used with a spectrograph employing an arc, for example, the buzzer is used to make possible the timing of the developing of the film. As will be understood, these operations must be carried out in total darkness. In such a spectrograph there is a pair of electrodes, one of which has a crater for holding the substance to be analyzed. Ordinarily, there is a plurality of these crater electrodes arranged circumferentially on a rotatable holder so that a new sample can be quickly moved into position below the striking electrode.

When the buzzer sounds, a new crater electrode is moved into position. At the same time, the operator immerses the picture of the preceding exposure in the developer. Then, when the buzzer sounds again, he replaces the film with the picture of the next exposure, and so on. Thus, the arrangement makes possible the continuous analysis of a large number of samples.

The nature and objects of the present invention having been thus described and illustrated, what is claimed as new and useful and is desired to be secured by Letters Patent is:

1. In a grating spectrograph, in combination, a light source adapted to cast a beam of light on a grating, means for energizing said light source and means set into operation by the energization of the light source for intercepting light from said source for a predetermined period after said light source is energized and for determining the period for which said grating is exposed to said source and capable of terminating said period while said light source is connected to its energizing means.

2. In a spectrograph, in combination, a light source arranged to cast a beam in a fixed direction, means to energize said light source, a slotted disk arranged in the path of said beam having its plane perpendicular to said path, said slot being arranged to pass the total beam emitted by the light source, means for driving said disk at a predetermined speed, and electrical means set into operation by the energization of the light source for actuating said driving means.

3. In a grating spectrograph, in combination, a light source adapted to cast a beam of light on a grating, means for energizing said light source, a movable light interceptor arranged in the path of said beam adapted, when set in motion, to intercept said beam for a predetermined period sufficient to enable the light from said source to become stable, and means actuated by the energization of said light source for setting said interceptor in motion.

4. In a grating spectrograph having means adapted to produce an arc in reflecting relation to the grating and a source of power for generating said arc, in combination, a slotted disk arranged between said means and said grating with its plane perpendicular to a line connecting them, means for driving said disk at a predetermined speed, and electrical means set into operation by the generation of said arc for actuating said driving means, the slot in the disk being so located that the imperforate portion of the disk intercepts the light beam from said arc until the arc is stabilized.

WILLIAM M. RUST JR.
MARION A. ARTHUR.