

Aug. 8, 1933.

C. G. CURTIS

1,921,607

TRUNK PISTON FOR DIESEL ENGINES

Filed June 23, 1931

2 Sheets-Sheet 1

Fig. 1

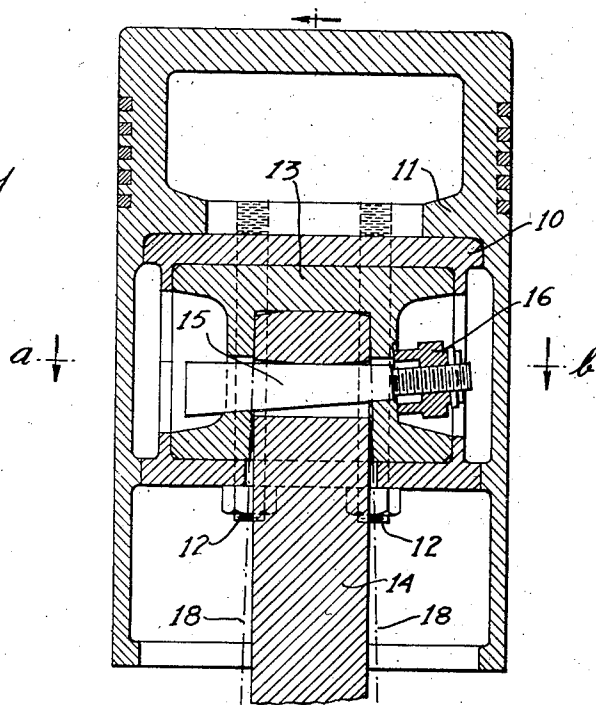


Fig. 2

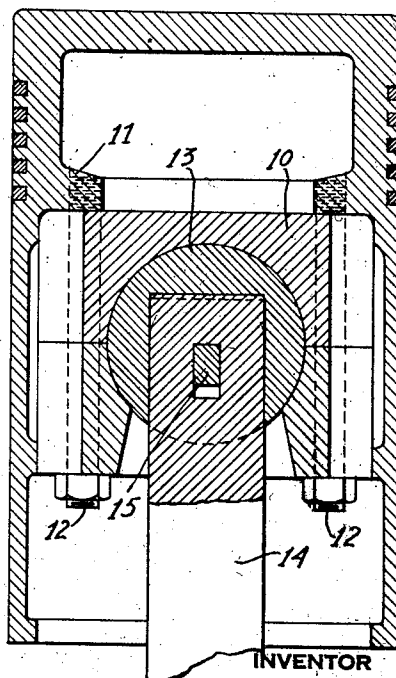
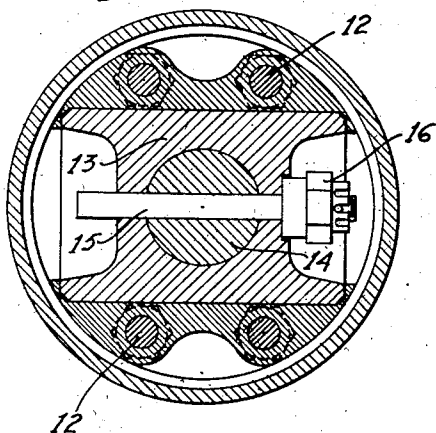


Fig. 3



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LABORATORY SWITCHBOARD SYSTEM

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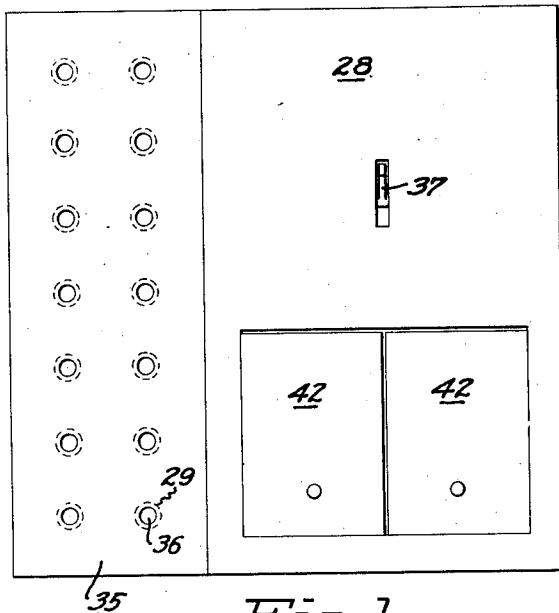


Fig. 1

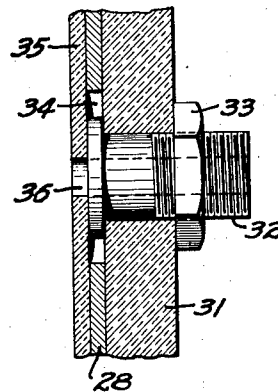


Fig. 3

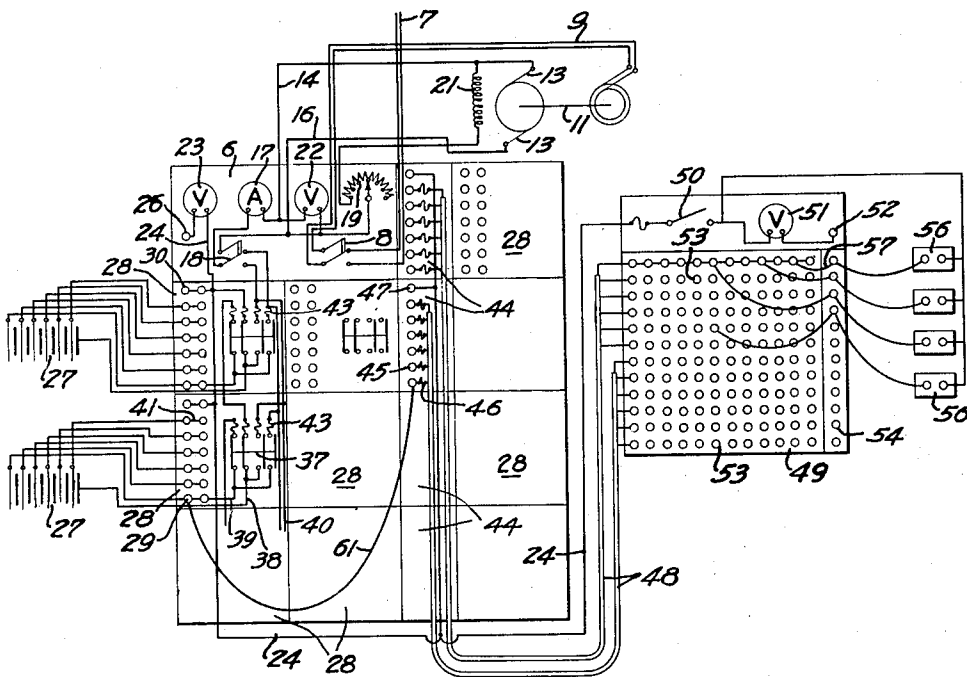


Fig. 2

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1,921,608

LABORATORY SWITCHBOARD SYSTEM

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Application June 3, 1929. Serial No. 368,176

6 Claims. (Cl. 171—314)

My invention relates to switchboards such as are used generally in school and college laboratories for controlling storage batteries; and for supplying any desired potential within the range of the battery to any of a plurality of outlet stations at which the experimental work is being conducted.

It is an object of my invention to provide a switchboard system by means of which the battery may readily be sectionalized for constant potential charging.

Another object of my invention is to provide a switchboard system of the maximum flexibility combined with minimum complexity of wiring.

Another object of my invention is to provide ready means for supplying current in excess of the normal output of the battery.

Still another object of my invention is to provide a switchboard system in which the possibility of short circuits due to erroneous connection is minimized.

A further object of my invention is to provide a switchboard system comprising a plurality of unit panels, any of which may be disconnected or removed for repair without destroying the utility of the switchboard as a whole, and which may be added to at any time to provide increased facilities.

My invention possesses other objects and valuable features, some of which will be set forth in the following description of my invention which is illustrated in the drawing forming part of the specification. It is to be understood that I do not limit myself to the showing made by the said description and drawing, as I may adopt varying forms of my invention within the scope of the claims.

Referring to the drawing:

Figure 1 is a front elevation of one of the unit control panels which are used in my system.

Figure 2 is a wiring diagram showing the connections of the system as a whole.

Figure 3 is a cross sectional, detail view showing one of the socket terminals used on the various panels.

The problem of supplying battery current for laboratory purposes is one of considerable difficulty. Whether the laboratory be for educational or for general experimental purposes, the duty upon the battery is exceptionally severe. The primary essential of the system is that it possess the utmost flexibility, and that current be obtainable of any amperage and at any potential within the range of the system, and at

any point in the laboratory. The fact that low voltages and high voltages are required from the same battery, places a heavier duty upon certain cells than upon others. Ordinary arrangements do not permit this heavier duty to be compensated for in charging the battery, and the ordinary result is that certain cells are overworked or overdischarged while other cells are overcharged, and deterioration is rapid. Added to this, is the fact that the operators of such system are frequently unskilled in battery care, and the result is that the expected life of a battery in such service is one-half, or less, of its life in ordinary commercial operation.

In its preferred form, my invention comprises a switchboard which is built up of a plurality of individual units. One of these units is a charging panel 6 which serves the entire system, regardless of the number of units comprising it. To this panel is brought the power line 7, which connects through the charging switch 8 and the lead 9 to the motor of a constant potential motor-generator set which is indicated by the reference character 11.

From the brushes 13 on the generator side of this set connect the leads 14 and 16; the former connects through an ammeter 17 with one side of the charging switch 18. The lead 16 connects to the other side of this switch, and also, through a variable resistor 19, to one terminal of the shunt field 21 of the generator, the other terminal of the field being connected directly to the lead 14. A voltmeter 22 is also bridged across the leads 14 and 16.

The panel 6 also carries a voltmeter 23, one side of which is connected to a base-potential bus 24, and the other side to a terminal socket 26.

The storage battery from which the current supply is drawn is divided into individual sections 27; these sections may comprise any convenient number of cells, but I have found that 12 volt sections, each of six cells, is convenient; conforming to ordinary automotive battery charging practice, and at the same time giving the required flexibility to the switchboard system.

Each of the battery sections is controlled by an individual panel unit 28, such as is shown in Figure 1. This unit comprises a plurality of terminal sockets 29, a pair of these sockets preferably being provided for connection with each cell in the section, and an additional pair of sockets 30 being permanently connected to the base-potential bus 24. This bus is ordinarily

made negative, but it can equally well be the positive lead of the system if so desired.

The construction of the terminal sockets is shown in Figure 3. A slab 31 of insulating material such as asbestos board, is secured to the back of the steel panel 28. Each of the sockets themselves is a flanged conducting bushing 32, which is clamped to the slab 31 by a nut 33, the panel being cut away to provide an open space 34 around the flange. An insulating facing 35, secured over the face of the panel, covers the flanges, and is provided with holes 36, in register with the bushings to admit a contact plug.

This construction provides a dead-front board, over which a terminal plug or other conductor may be drawn without the possibility of causing short-circuits.

Adjacent the terminals 29 and 30 on the unit panel, is a quick-break, double pole, double throw switch 37. The negative lead 38 and positive lead 39 from the battery section are connected with this switch, which may be operated in one direction to throw the section in series with the lead 24 and the succeeding battery section, or across the constant potential charging line 40 which is controlled by the switch 18. The terminals 29 are connected to the lead 39 between the battery and the switch. Similar terminals may be provided for the negative lead, but this is not ordinarily necessary or desirable.

As many of the unit panels 28 as are required for the individual battery system may be supplied. In the present case, space is shown for a ten unit panel board which is sufficient to control a battery of ten sections supplying any voltage from 2 volts to 120 volts by 2-volt steps.

It will be noted that by the operation of the switches 37, the battery section corresponding to each panel may be thrown either across the charging line or in series with the base-potential lead 24 and its neighboring section. In the laboratory switchboard in which both low and high potentials are used, the duty upon the low potential section of the battery is inevitably greater than that upon the high potential section. Thus, voltages of 2, 6, 12, and 120 volts may be required simultaneously, in which case the low voltage units of the battery are called upon to supply the load at all these potentials, while the high potential units supply a much less load.

In the ordinary type of laboratory switchboard, the cells are permanently connected and charged in series, and the low potential units are customarily undercharged while the high potential units are customarily overcharged, thus leading to a short battery life. In the present system, since the charge is by individual sections and the constant potential system, this disparity is largely equalized; the low potential cells can be charged oftener than the high potential cells, and none of the sections will take more current than is required to bring it to full charge.

It is even possible to charge the low potential sections of the battery while the normally high potential sections are being used to supply low potential current. This is possible by connecting a short jumper cord from one of the terminals 29, of the section which it is desired to use, to the terminal 30 on the same panel, the switch 37 on the next lower potential panel being thrown to the "charge" position.

A similar connection makes it possible to re-

move any of the battery sections, or panels, for repair without interfering with the use of the remainder of the battery, and this without regard to the position in the series which is occupied by the section removed from service. In this case, the lowest potential terminal on the panel of next higher potential than that removed from service, is connected by a jumper cord to the highest potential terminal of the next lower potential section in service. The switches on the out-of-service sections are always thrown to the "charge" position in this case.

Maximum current may be drawn from the battery by throwing all of the switches 37 to "charge", opening the charging switch 18, and connecting the corresponding low and high potential terminals of each section together by jumper, connecting one of the low potential terminals to the bus 24, and tapping off from any convenient high potential terminal in the usual manner.

Below the switch 37 each of the unit panels may conveniently be provided with a fuse box accessible thru the doors 42. The doors interlock with the switch so that only those of the fuses 43 which are dead may be reached. This construction is not a part of this invention, and need not be described in detail here.

Adjacent the unit panel 28, a plurality of line panels 44 are provided. These are preferably small vertical panels, and upon them are disposed line terminals 45 which are equal in number to the outlet stations which it is desired to use with the board. Each of the terminals is provided with a fuse 46. It is also desirable that each of these panels carries a terminal 47 which is connected with the base potential bus. The leads from the terminals 45 are carried through the cable 48 to a distribution panel 49, which is arranged to be conveniently accessible from the outlet stations. If these stations are distributed through various rooms, a separate distribution panel is preferably provided for each room.

The distribution panel preferably comprises a portion which carries a fused switch 50, which may be used to open the neutral or base-potential lead, and a voltmeter 51, which is connected to this lead beyond the switch, and to a terminal socket 52.

The remainder of the distribution panel is devoted to socket terminals 53 for the outlet stations, these terminals being preferably arranged in horizontal and vertical rows, the rows in one direction being designated as ranks and the rows in the other direction as files each being equal in number to the outlet stations. Each terminal in any file is connected to a different lead of the cable 48, while all of the terminals in each rank are connected together. Adjacent this arrangement, is a single file of terminals 54 which are permanently wired to their corresponding outlet station 56. The terminals 54 may be connected with any of the terminals 53 by the jumper cords 57, and it will be seen that by the arrangement shown, any of the outlet stations can be connected to any of the lines of the cable 48, or each may be connected to a different line.

Jumper cords 61 are also used to connect the line terminals 45 with the battery section terminals 29, thus making any potential within the range of the battery available at the distribution board.

The arrangement described has certain very

definite advantages over the ones ordinarily used. The use of the continuous "negative" or base potential bus, connected with each of the unit and line panels and with the various outlet stations, gives maximum convenience of connection, and greatly reduces the number of terminal sockets and connection cords. Opening this bus by means of the switch 50 positively kills all of the outlet stations when this is desired.

Since only one cord is used in connecting any of the outlet stations at the distribution panel, the dangers of short-circuiting are eliminated. Each of the lines is fused on the main switch board, and individual fuses at the outlet stations are unnecessary. For heavy currents at low potentials, as many sections of the battery as desired may be connected to the low potential bus.

The fact that no terminals are provided for the low potential end of the battery sections, has been found advantageous as tending to prevent mis-connections and short circuits. When emergency connections are made, only 10 volts are available from the sections so connected, but it is obvious from a glance at the board that a "positive" lead is connected to the base-potential bus, and this calls attention to the fact that care must be exercised in making further tie-ins.

While the system is primarily designed for experimental use, there are certain industrial applications where extreme flexibility is required, in which it is also useful, and the term "laboratory" as here used includes all such applications.

I claim:

1. A laboratory battery switchboard system comprising a plurality of battery sections, a plurality of panel units corresponding to said battery sections, terminals on each panel unit connecting with taps on the battery section, a constant potential charging line, and a switch on each panel unit for connecting its battery sections optionally in series with a succeeding section or across the charging line.

2. A laboratory battery switchboard system comprising a plurality of battery sections, a plurality of panel units corresponding to said battery sections, terminals on each panel unit con-

necting with taps on the battery section, a plurality of outlet stations, a base-potential bus permanently connecting all of said distribution stations, and a terminal on each panel unit connecting with said bus.

3. A laboratory battery switchboard system comprising a plurality of battery sections, a plurality of panel units corresponding to said battery sections, terminals on each panel unit connecting with taps on the battery section, a plurality of outlet stations, a panel arranged adjacent the section units and provided with a line terminal for each of said outlet stations, and means for connecting any of said line terminals with any of said section terminals.

4. A laboratory switchboard system comprising a plurality of battery sections, a plurality of panel units corresponding to said battery sections, terminals on each panel unit connecting with taps on the corresponding battery section, a plurality of outlet stations, a panel provided with a line terminal for each of said outlet stations and mounted adjacent said section panel units to permit interconnection therewith by jumper-cord, a cord for making said interconnection, a distribution panel having ranks and files of terminals, each corresponding in number to the outlet stations and each rank of terminals being connected with one of said line terminals, and means for connecting any of said outlet stations with any of said ranks of terminals.

5. A laboratory battery switchboard system comprising a plurality of battery sections, a plurality of panel units corresponding to said battery sections, an outlet station, a base-potential bus connecting to said outlet station, a series-parallel switch on each panel unit for connecting said sections, and additional means for connecting any of said sections to the bus.

6. A laboratory switchboard system comprising a plurality of battery sections, a plurality of panel units corresponding to said battery sections, socket terminals on each panel unit connecting with taps on the battery section, a line panel adjacent said unit panels and having socket terminals arranged thereon, and means for shielding said socket terminals from accidental contact.

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