A-C BUSY AND IDLE INDICATING LAMP SIGNALS TOLL SWITCHBOARDS

1. INTRODUCTION

1.01 This section describes the apparatus, circuit and equipment arrangements for operating the busy and idle indicating lamp signals at toll switchboards by means of low voltage alternating current supplied through transformers from commercial power mains. The advantages obtained are savings of space and in apparatus costs in the face of the switchboard, a reduction in the capacity of power plant required for the office and the utilization of a cheaper source of power for operating the signals.

2. APPARATUS

General

2.01 The equipment required for the alternating current lamp signal arrangement consists of the lamps together with a suitable mounting, and a power supply unit for reducing the commercial voltage to one that can conveniently be applied to the switchboard.

Tungsten Lamp

2.02 The lamp has a tungsten filament and is of the switchboard type. It is coded "E-1." Its nominal voltage rating is 6 volts, but it will give suitable illumination for use as a busy or idle indicating signal if a potential of about 4 volts is applied to its terminals. Its nominal current rating at 6 volts is 40 milliamperes and its estimated average life is 10,000 hours. At 4 volts it takes slightly more than 30 milliamperes and its life is substantially increased.

2.03 The filament of the lamp is concentrated near its tip. This gives it maximum illuminating efficiency and minimizes cross-illumination from one lamp to adjacent lamp locations.

Combined Lamp Socket Mounting and Designation Strip

2.04 The lamp socket mounting is coded "281-A" and will accommodate 20 lamps. It is designed for the 49-jack panel. It is the same width as a jack mounting for 49-type jacks, and it is of metal construction. Drawing 704-3824 shows its principal structural details. The face of the mounting is a metal bar drilled transversely at proper spacings to permit passage of the lamps, which may be inserted and removed from the front whenever the designation card is not in place. It is of sufficient thickness so that it acts as a shield to prevent one lamp from illuminating an adjacent lamp location.

2.05 The front edge of the face bar is milled to accommodate a designation card. When in place the card covers the holes drilled for the lamps. The cards are opaque except for transparencies spaced to correspond with the locations of the lamps. When a signal appears, the lighted lamp illuminates the transparency of the designation strip which is directly in front of it and gives the operator the proper indication. The frame of the mounting extends a short distance forward at each end, thereby forming stops to hold the designation card in approximately its proper longitudinal location.

2.06 The frame for the lamp socket is designed to hold the tip of the lamp as near the designation card as practicable. This insures maximum and uniform illumination of the transparencies and maximum use of the shielding effect of the face bar.

2.07 A ground lug has been provided at each end of the frame of the mounting for use when required. When the mountings above the No. 281-A mounting have exposed metal parts, No. 1-AK jack spaces are used to insulate them electrically and shield the signal lamp strip against reflected light or the adjacent jacks against glare from the signal lamps.

Transformers

2.08 Two 1-kv-a. 60-cycle transformers are available for stepping down the commercial line voltage to voltages suitable for operating the a-c. lamp signals. These transformers are of the insulating type and meet all of the necessary requirements for protecting the secondary circuit from the primary source. They are equipped with taps on their primary windings for use with commercial line voltages ranging from 190 to 240 volts. Their secondary windings are arranged by means of taps to give potentials ranging from 5 to 8.5 volts and from 8 to 11.5 volts, respectively, in 0.5-volt steps, the tap being used which gives the desired potential at the lamp terminals. Two fuses are provided for each 5 to 8.5-volt transformer, and the lamp load

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COMBINED LAMP SOCKET MOUNTING AND DESIGNATION STRIP

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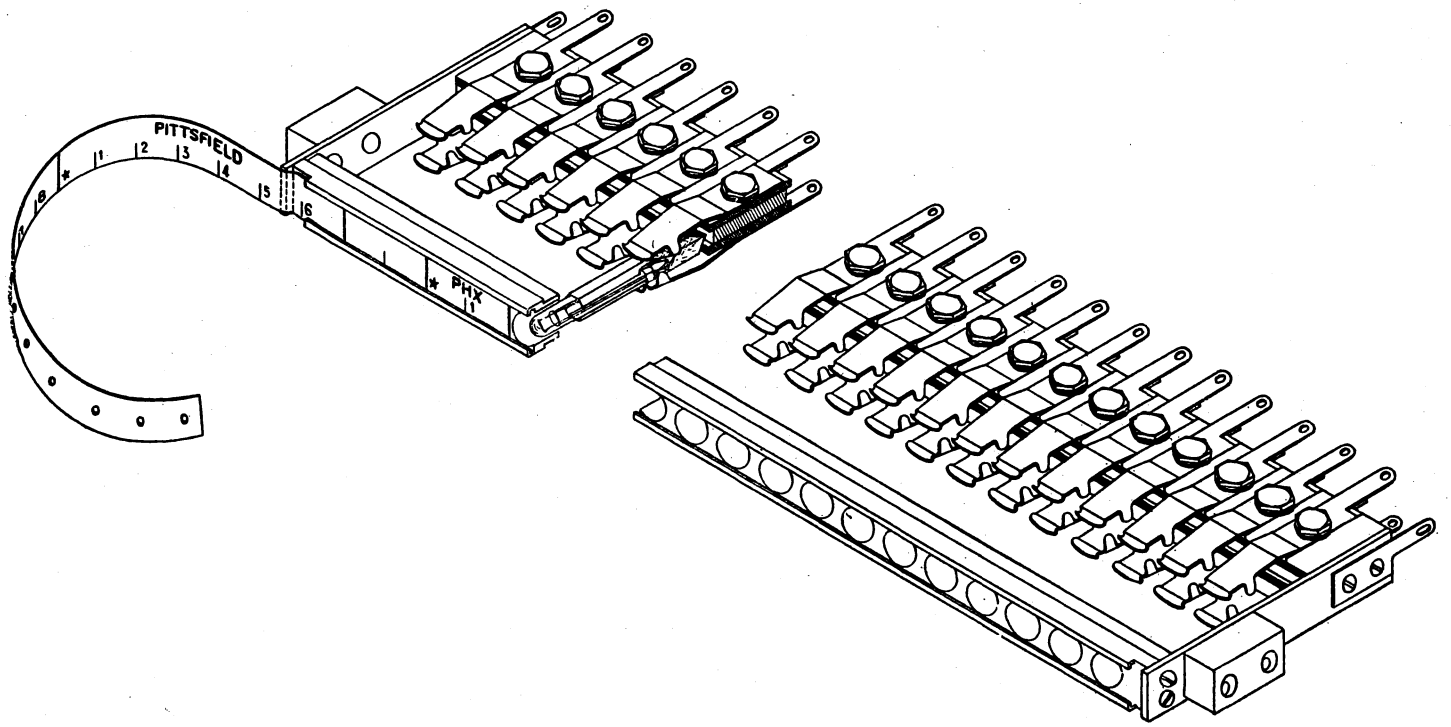
Information



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is divided approximately equally between them. If the same transformers are used for supplying two or more lines of switchboard, the two fuses may be connected to different taps if necessary. Only one fuse is provided for the 8 to 11.5-volt transformer. When a line of switchboard grows in length, the fused connections to either transformer are shifted from one tap to another to maintain the proper potential at the lamps.

2.09 Two like transformers together with their associated conduit and mounting arrangements make up what is known as a No. 501-A-type power supply unit.

2.10 The power supply unit is provided with dead front "SAFtoFUSE" units in both the primary and secondary circuits. These are used as both fuses and switches and the fuses can be changed only when the removable head is withdrawn from the circuit.

3. CIRCUIT ARRANGEMENTS

Three-Wire Lamp Circuit

3.01 A three-wire distribution system, as shown schematically on Drawing 704-3783, is employed for supplying the a-c. power to the lamp signals in the switchboard. The neutral or return lead from the lamps is connected to the midpoint of the transformer unit secondary and to the relay rack ground. This neutral lead is connected to the lamps at the end of the switchboard opposite to that at which the supply leads are connected.

3.02 The use of this three-wire arrangement for supplying current to the lamps has three principal advantages which are as follows:

(a) The voltage drop in the leads from the transformer unit to the switchboard is reduced to a minimum. Under the usual conditions of balance the return lead drop is practically eliminated.

(b) The size of the neutral lead need be only sufficient to carry the lamps on one leg of the transformer unit safely. However, since this lead serves also as a ground return for other circuits as well, it is calculated to give not more than the maximum allowable voltage drop for them when the signal lamp load is completely unbalanced.

(c) The connection of the neutral lead to the lamps at the end of the switchboard opposite that of the entrance of the supply leads reduces the variation in the voltage furnished to the lamps on the circuit.

3.03 As a parallel arrangement of the lamps is used a lamp failure affects only the jack with which that particular lamp is associated.

Lamp Relay Circuit

3.04 In order to minimize differences in voltages in the current supply to the lamps, due to variations in the lengths of cabling and of cross connections, which might otherwise occur in the larger toll offices, the current is supplied to the lamps in the switchboard directly through contacts of a relay. This relay is definitely associated with the toll line or trunk multiple and, in general, a separate one is supplied per line of board for each circuit. The winding of the relay is cross-connected to and is under the control of the line or trunk or associated relay equipment.

3.05 Each lamp circuit is supplied from the contact of a relay known as the lamp relay and a single lead is required from the contact of this relay to the multiple. This lead is run direct from the relay to the switchboard.

3.06 The lamps are wired in parallel through the switchboard. The alternating current is connected to the top terminal of the first lamp in a line of switchboard and ground is connected through the stile strips to the bottom terminal of the last lamp. The intermediate lamps are connected together and to the end lamps by a two-wire circuit in a short multiple cable so that all lamps associated with a particular circuit have as nearly as possible the same impressed voltage. A ground return is provided between the switchboard and the transformers.

A-C. Lamp Supply Panels

3.07 The lamp relays, together with the transformer units, the fuse panels and the no voltage alarm and fuse alarm circuits associated with them, are mounted on bays in the terminal room. Two sizes of bays are available, one having a capacity for 480 lamp relays, and the other having a capacity for 600 lamp relays.

3.08 The bay having the smaller capacity is normally equipped with two transformer units of two transformers each, and is usually employed where the lamps are used as busy lamps. The transformer units are located at the bottom of the bay with the miscellaneous fuse panel next, the fuse panels for the lamp leads next, and the lamp relays themselves at the top.

3.09 The bay having the larger capacity is arranged for only a single transformer unit consisting of two transformers and is usu-

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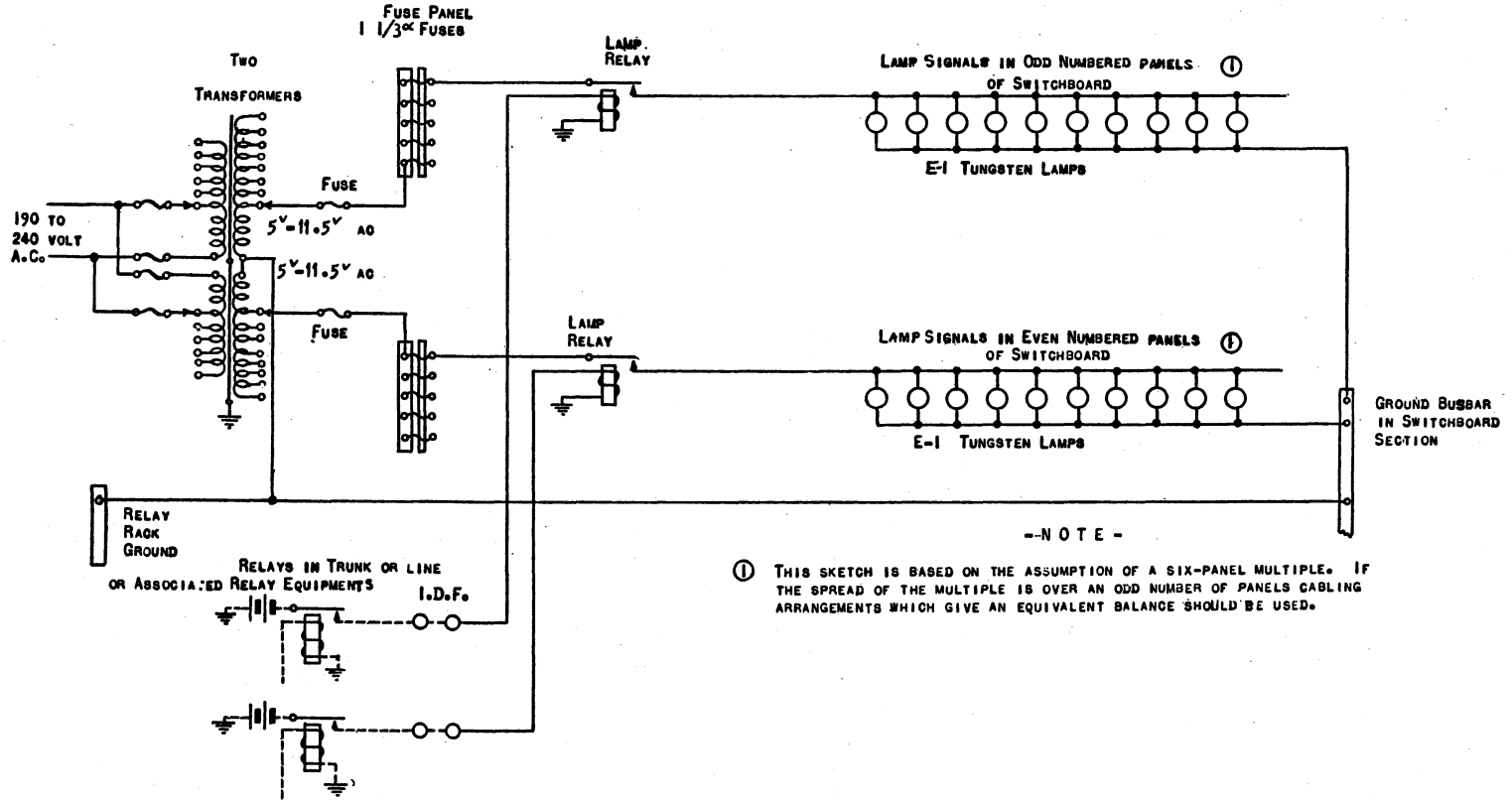
THREE-WIRE LAMP CIRCUIT



--NOTE--

① THIS SKETCH IS BASED ON THE ASSUMPTION OF A SIX-PANEL MULTIPLE. IF THE SPREAD OF THE MULTIPLE IS OVER AN ODD NUMBER OF PANELS CABLING ARRANGEMENTS WHICH GIVE AN EQUIVALENT BALANCE SHOULD BE USED.

ally employed where the lamps are used as idle indicating lamps. Above the transformer unit are located the regular fuse panels and above them, the lamp relays. The miscellaneous fuse panel is located in some nearby bay. If there is an adjacent bay for additional lamp relays, it is mounted in part of the space corresponding to that occupied by the transformer unit in the first bay.

3.10 In both of the arrangements mentioned above, the bottom mounting plate in the relay space is used for mounting the apparatus included in the no-voltage and fuse alarm circuits.

3.11 The equipment bays are universal and the apparatus provided on them may be used, within limits, for either busy or idle indicating lamps, for either toll lines or trunks or partly for each of these classes of circuits. Also, one bay may sometimes be used to supply signal power to more than one line of switchboard where engineering considerations permit. The lamp relay windings are wired to the I.D.F. where they are cross-connected to the various trunk and line circuits.

4. MAINTENANCE FEATURES

4.01 The nature of the lamps and the use made of them as busy and idle indicating signals requires that troubles affecting their operation be promptly detected and that circuits in trouble be removed from service as quickly as possible.

4.02 The busy signal testing circuit which has heretofore been used at No. 3 toll switchboards in testing magnetic busy signals is used at this type of board for making tests on the a-c. lamps when installed as busy signals.

4.03 When the a-c. lamp signals are used as idle indicating signals, the non-operation of a single lamp may hold up traffic over a whole group of circuits in so far as certain operators are concerned. Unlike magnetic signals which have an indefinite life and may ordinarily be used so long as they can be kept in adjustment, the lamp signals have a definite life span and are no longer useful after it has expired. These facts not only increase the importance of the routine tests but require the replacement of the lamps that are dim or burned out.

5. CIRCUITS AND CIRCUIT DESCRIPTIONS

5.01 The following table is a list of the circuit drawings pertaining to a-c. busy and idle indicating lamp signals for toll switchboards. Detailed circuit descriptions will be found in the associated CD sheets.

Title	Drawing
Lamp Relay Circuit	SD-62848-01
Transformer Circuit	SD-80324-01
Fuse and No-Voltage Alarm Circuits	SD-63108-01
Busy Signal Testing Circuit (No. 3 Toll Boards)	SD-62289-01

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