PNEUMATIC TUBE TYPE

TICKET DISTRIBUTING SYSTEM

TOLL OFFICES

1. GENERAL

1.01 This section describes the pneumatic tube ticket distributing system which is used to distribute tickets in toll offices.

1.02 This section has been revised to cover the tube heaters for No. 51 ticket distributing desks and the use of sulphite paper tickets, to amplify the description of the signaling circuit and the blockade alarm circuit and to bring the text generally into accord with the latest accepted practice.

1.03 While at present the majority of outward calls are originated and completed at the C.L.R. positions, a delay in completing some of the calls results in the final handling of these tickets at other parts of the board and it is then necessary that the tickets be transmitted to those positions. All tickets must be transmitted from the position wherever finally handled to a ticket filing and rate quoting desk as soon as possible after the completion of the call. In many cases, the functions of both of the desks referred to are cared for by a combined desk.

1.04 As it is not feasible to provide pneumatic tubes between each section and every other point to which tickets may be sent from that section, a distributing point is provided to which uncompleted tickets may be sent and from which they may be distributed to the various switchboard sections at which they will be handled.

1.05 Briefly, tickets which originate at the C.L.R. positions and are sent to the distributing desk without the call having been completed, are then forwarded to the point-to-point sections for completion. Similarly, tickets written at inward positions are transmitted via the desk to the point-to-point sections. Tickets written at one part of the through board must sometimes be transmitted via the distributing desk to delayed positions of the through board.

1.06 In most toll offices a combined desk is provided for ticket distributing, ticket filing and rate quoting but in certain of the larger offices, a separate distributing desk is provided. A pneumatic toll ticket distributing system therefore, may consist of tubes provided as indicated below:

From	To
Inward Positions	Distributing Desk
Through Positions	Distributing Desk
C.L.R. Positions	Distributing Desk
Ticket Filing Desk	Distributing Desk
Point-to-Point Positions	Ticket Filing and Rate Quoting Desk
C.L.R. Positions	Ticket Filing and Rate Quoting Desk
Distributing Desk	Point-to-Point Positions
Distributing Desk	Delayed Through Board
Distributing Desk	Ticket Filing Desk
Distributing Desk	Test Desk

Fig. 1 shows a typical arrangement in a large office having a separate ticket distributing desk.

2. DESCRIPTION OF EQUIPMENT

General

2.01 The pneumatic tube ticket distributing system is operated on a vacuum basis and a typical installation is illustrated in Fig. 1. The exhauster unit connected to the various receiving valves through the exhaust pipe system draws air into the tube either through the open ends of sending tubes or through equalizing valves and sending valves of common return tubes. The air exhausted from the operating room is at the rate of approximately 20 cubic feet per minute per tube and tickets are carried at a speed of approximately 30 feet per second.

2.02 For the purposes of this section, the equipment involved may be classified as follows:

(A) Exhauster Equipment
(B) Exhaust Pipes
(C) Ticket Tubes
(D) Pressure Equalizer Valves
(E) Sending Valves
(F) Receiving Valves
(G) Cutoff Valves
(H) Heater for Sending Tubes

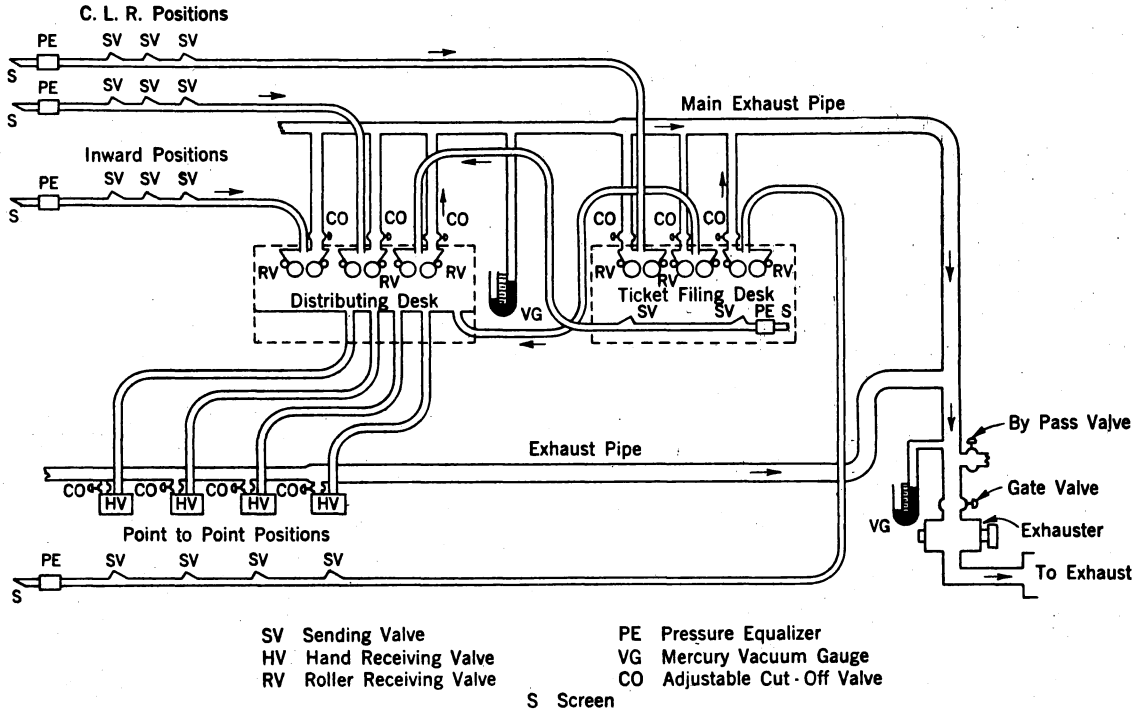


Fig. 1 - Typical Arrangement for a Large Office.

(A) Exhauster Equipment

2.03 Roots Blower: The Roots blower, as illustrated in Fig. 2 is of the cam type and displaces a definite amount of air on each revolution. As the number of tubes in service is changed, the amount of vacuum in the system will be affected, and to maintain the same vacuum it is necessary to change the speed of the blower or adjust the by-pass valve provided for this purpose in the exhaust pipe near the blower.

2.04 Centrifugal Types: The various exhausters of centrifugal type are covered in separate sections of Division A800. Centrifugal exhausters working under normal load conditions maintain a practically constant vacuum regardless of the amount of air which is handled and in consequence are not affected by the addition or subtraction of tubes.

2.05 Gate Valves: Where two or more exhausters are connected to the same exhaust pipe system, gate valves are installed between each exhauster and the main exhaust line. The purpose of these valves is to prevent air from being drawn into the exhaust system through an idle exhauster and thereby causing the idle exhauster to rotate in the reverse direction. Where bearings have forced feed lubrication as in certain types of centrifugal exhausters, reverse rotation soon causes destruction of the bearings due to lubrication failure. To guard against such damage, automatic gate valves are provided where such equipment is installed, as manually operated valves might sometimes be inadvertently left open.

(B) Exhaust Pipes

2.06 As illustrated in Fig. 1, individual exhaust pipes connect the receiving valves to the main exhaust pipe which in turn is extended to the exhauster. These individual exhaust pipes are approximately 2 inches in diameter and are so connected to the receiving valves as to maintain a flow of air in the ticket tubes and through the valves to the exhaust pipe. The size of the main exhaust pipe between the individual exhaust pipes and the blower or exhauster is determined by the volume of air which is to be exhausted.

(C) Ticket Tubes

2.07 The tubes through which the tickets are carried are rectangular in shape having inside dimensions of 3/8" by 2-3/4". The sending ends of these tubes are either open-ended or equipped with sending valves, while the receiving ends terminate in hand or roller receiving valves. With the distributing desk taken as a reference point, ticket tubes are divided into two classes, sending tubes and return tubes. Return tubes having ticket entrances at more than one point are known as common return tubes.

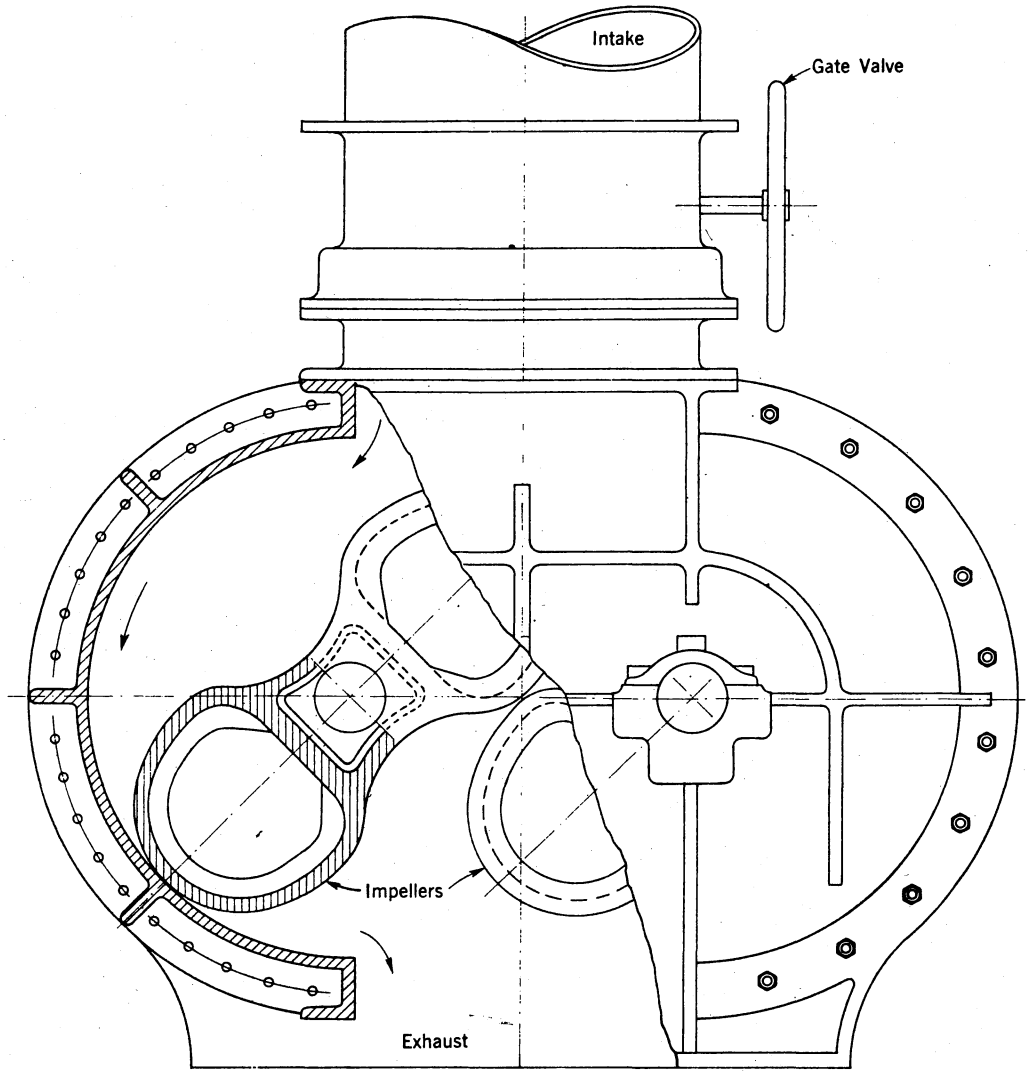


Fig. 2 - Roots Blower.

2.08 Sending Tubes: At the distributing desk end of sending tubes, tickets are ordinarily inserted into the open end of the tube as a sending valve is not usually provided for a tube having but one entrance. It is the practice with these open-ended tubes to provide a number of small holes in the edge of the tubes near the sending end to reduce the vacuum at the entrance to the tubes. This is done so that if a ticket is not promptly released when placed in the tube, the bottom flap of the ticket will not be straightened by the relatively high vacuum. These sending tubes terminate at the switchboard sections in hand receiving valves and at the desks in roller valves.

2.09 Common Return Tubes: Common return tubes extending through switchboard sections or desks are equipped with as many as 18 sending valves. The originating end of each common return tube is equipped with a pressure equalizer valve. At the distributing or ticket filing desks, these tubes terminate in roller receiving valves.

2.10 Edge Sections: Removable edge sections, shown in Fig. 3, are placed along common return tubes at suitable locations to give access to bends or other parts of the tube which it may be desirable to reach in order to clear blockades or remove foreign objects and thereby avoid the necessity for disassembling tubes at the joints.

(D) Pressure Equalizer Valves

2.11 The pressure equalizer valve illustrated in Fig. 4 is an automatic valve located at the open end of each com-

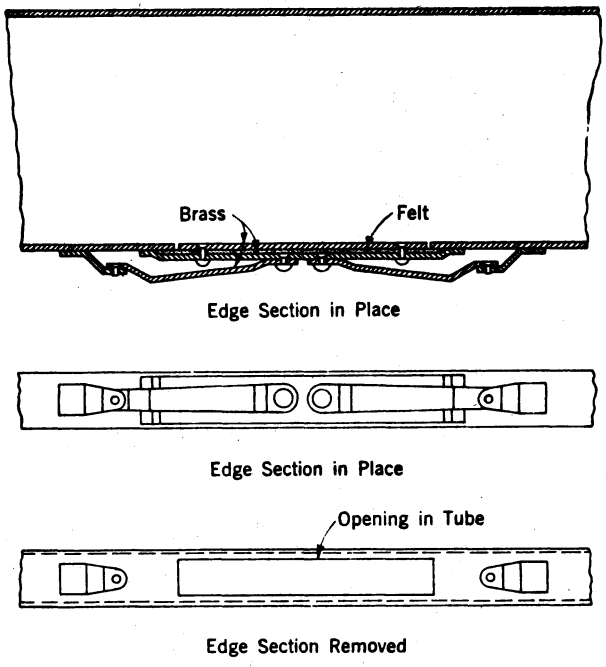


Fig. 3 - Removable Edge Section.

mon return tube. It is designed to regulate automatically the amount of air entering the open end of the tube whenever one or more of the sending valves are open.

2.12 For example, when a sending valve is open, the air supply for the operation of the tube enters the tube through the sending valve and the equalizer valve closes either partially or completely; whereas when all sending valves are closed, the air required enters the tube through the pressure equalizer. Without such a device, there would be insufficient vacuum at the sending valves to draw in a ticket.

(E) Sending Valves

2.13 Sending valves are required on common return tubes owing to the multiplicity of sending points, which may be as many as 18, each of which should be normally closed in order to maintain the proper air flow and degree of vacuum in the tube. The valve is designed to minimize the entrance of small foreign objects into the tube either by deflecting them away from the entrance by means of slanting surfaces or by permitting them to fall through openings provided to prevent such objects from entering the tubes. This valve is illustrated in Fig. 5.

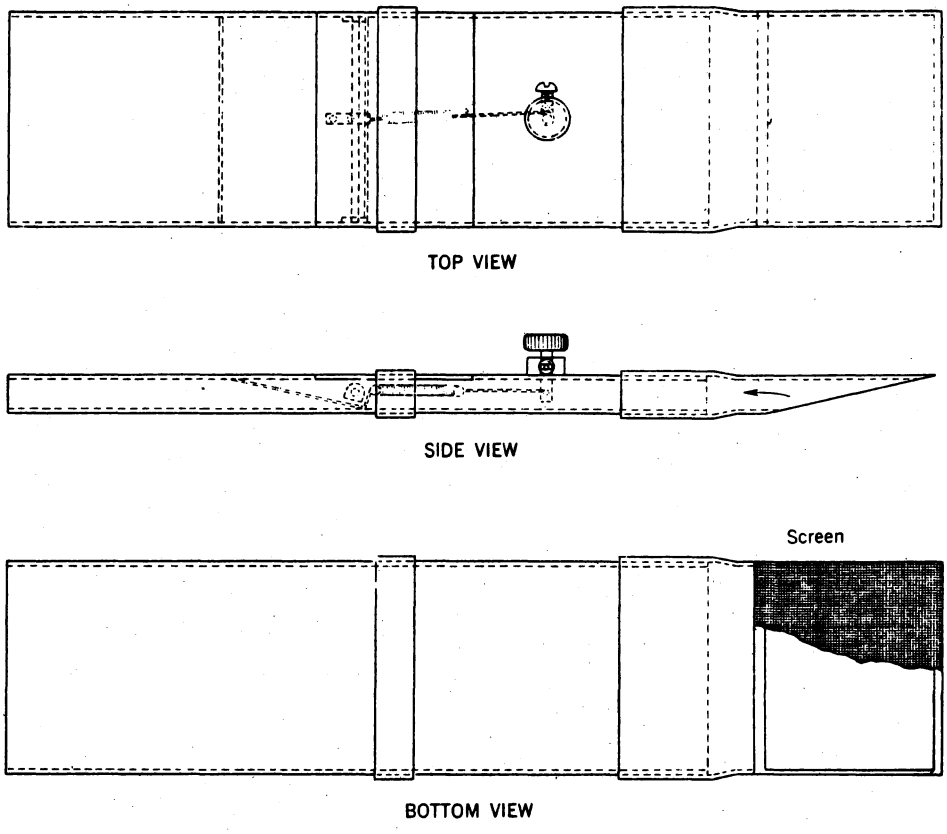


Fig. 4 - Pressure Equalizer.

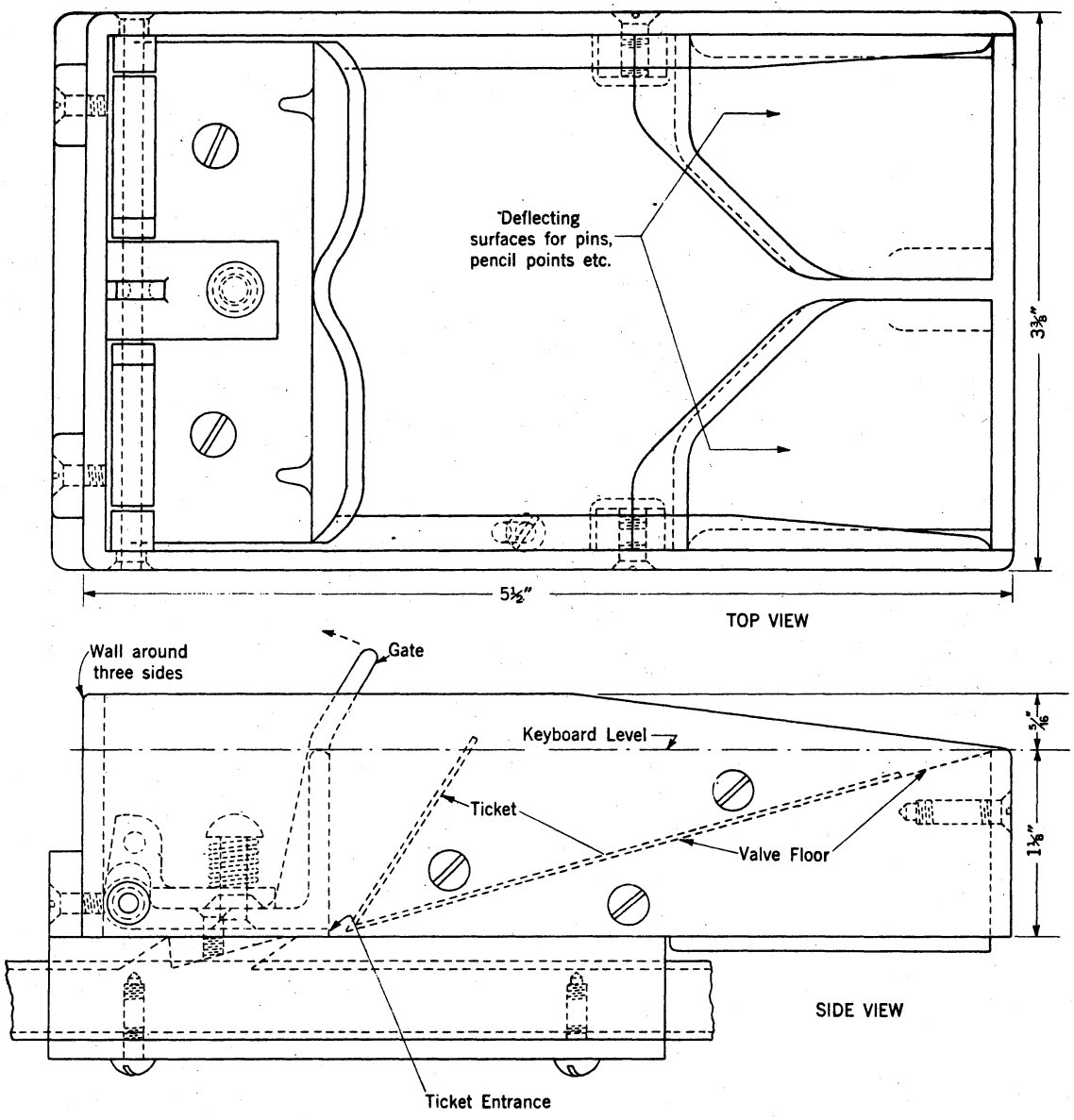


Fig. 5 - Sending Valve.

2.14 The sending of a ticket is accomplished by lifting the gate of the valve and inserting the ticket with the flaps properly folded through the opening into the tube. The valve gate is then released and returns to normal, thus closing the valve opening. As soon as the sending valve is closed, the air for the operation of the tube enters through the pressure equalizer.

(F) Receiving Valves

Hand Receiving Valves

2.15 The hand receiving valve, as illustrated in Fig. 6, is used at the switchboard sections for receiving the tickets from the distributing desk. It consists of a closed chamber connected to an exhaust pipe by an adjustable cutoff valve and is provided with a glass front so that a ticket may be seen on its arrival in the valve.

2.16 Each ticket from the distributing desk is carried by the air flowing through the ticket tube and is caught in the hand receiving valve between two contact springs and there held visible to the operator through the glass front. The separation of the two springs breaks the contacts of a signal circuit which indicates to the distributing and the receiving operators that the ticket has been received.

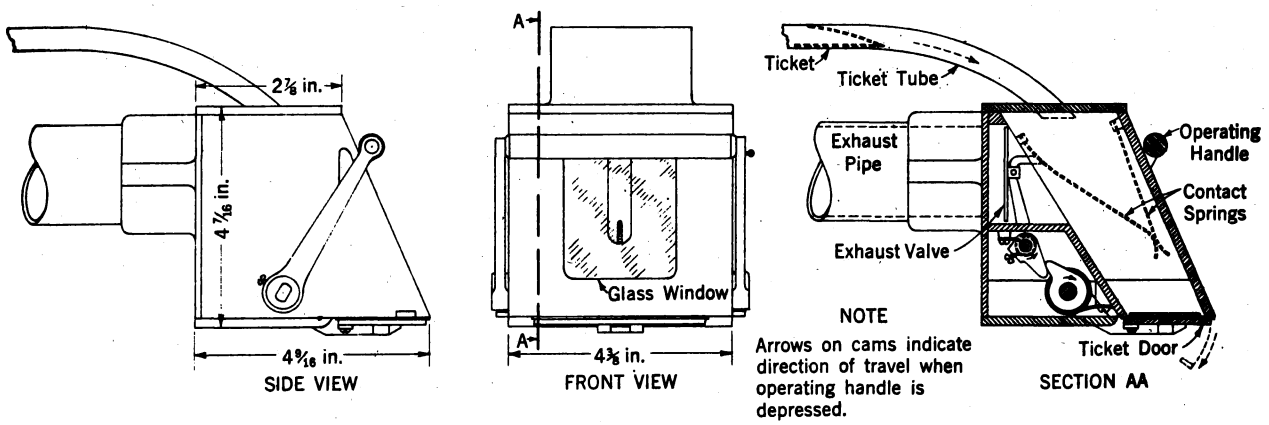


Fig. 6 - Hand Receiving Valve.

2.17 The removal of the ticket is accomplished by operating the handle on the front of the valve. This operation closes an auxiliary valve in the exhaust pipe, thus stopping the flow of air through the valve; it also separates the contact springs holding the ticket and opens a door at the bottom of the valve, thus allowing the ticket to fall upon the keyshelf.

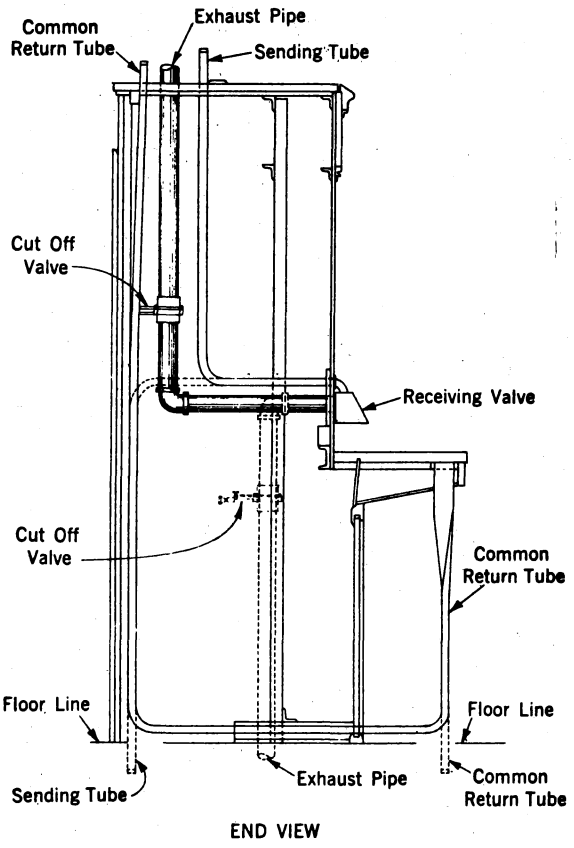
2.18 Upon release of the operating handle, the valve returns to normal and reestablishes the flow of air. Restoration of the valve also closes the contact springs so that, where a signal circuit has been provided, the distributing operator is afforded a means to determine that the ticket has been taken from the valve (see 3.07).

2.19 The hand receiving valves are generally located on the face of the switchboard above the piling rail as illustrated in Fig. 7.

Roller Valves

2.20 The roller receiving valve illustrated in Fig. 8, is a continuous delivery belt-driven valve used to receive tickets at ticket filing and distributing desks where there is an inflow of a large number of tickets. It is mounted above the desk and is so designed that tickets upon their arrival in the valve are caught between two rubber rollers and dropped upon a tray provided on the desk in front of the operator.

2.21 The roller receiving valve, as illustrated, has a closed chamber in which the ticket tubes and the exhaust pipe terminate. This chamber is closed at the bottom by two rubber rollers between which the tickets are delivered without affecting the vacuum. The sides of the chamber adjacent to rubber rollers are closed by small steel rollers resting upon each rubber roller. These steel sealing rollers have such close clearance with the side walls of the chamber that the air entering at these points is negligible in amount.



Note: Dotted lines show arrangement of tubes and pipes where these pass downward through the floor.

Fig. 7 - Location of Receiving Valves at the Switchboard.

2.22 The exhaust pipe is connected to the top of the chamber and is provided with an adjustable cutoff valve to regulate the degree of vacuum within the valve and the flow of air through the ticket tubes.

2.23 Drive Shafts and Belting: The roller valves are driven by means of 5/16-inch round leather belts from drive shaft-

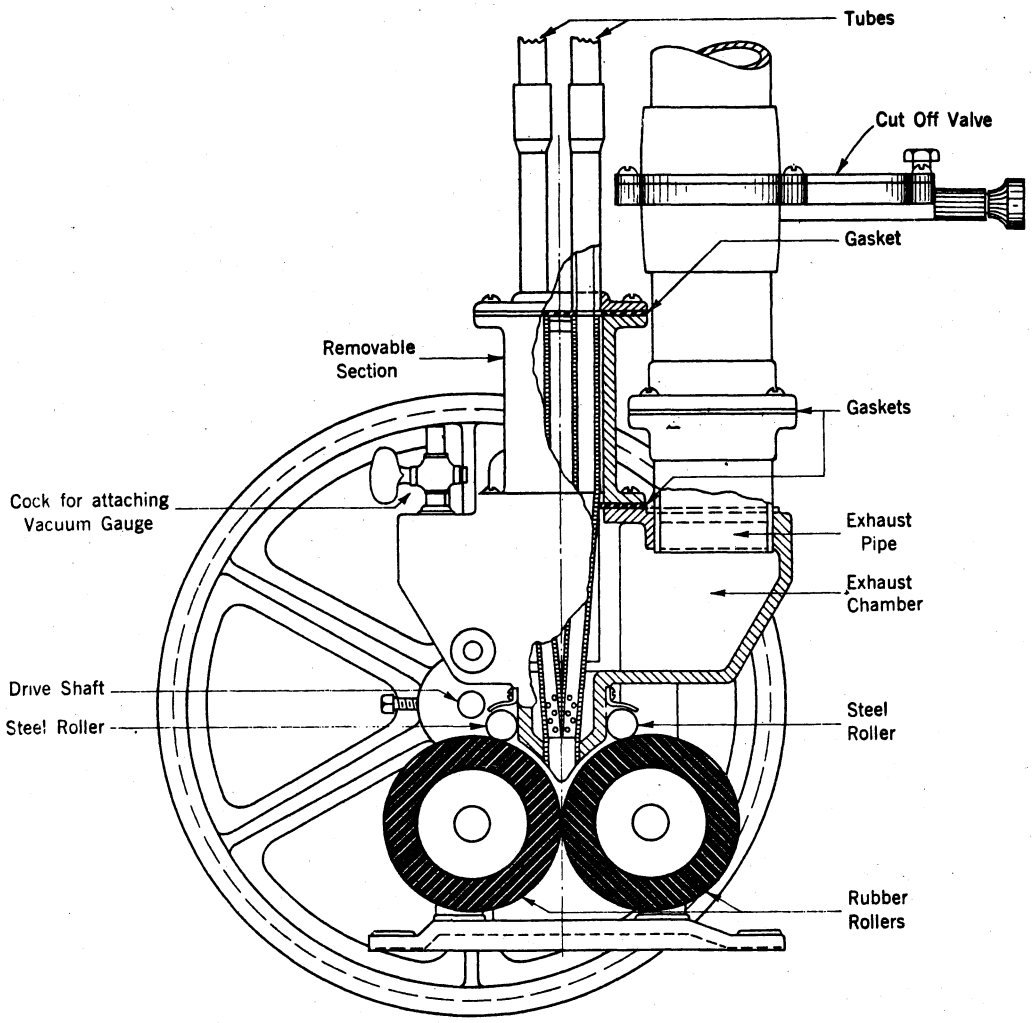


Fig. 8 - Roller Receiving Valve and Cutoff Valve.

ing and this in turn is driven by an electric motor operated from the building power supply. A flat leather belt is used between the drive motor and the shafting. The shafting and pulleys are supported by pillow blocks equipped with Fafnir ball bearings.

(G) Cutoff Valves

2.24 From Fig. 1 it will be noted that there is an adjustable cutoff valve in the exhaust lead between each receiving valve and the exhaust pipe. This valve is provided to afford means for stopping the flow of air through tubes, when required, and for adjusting the vacuum in the receiving valve to a value which will cause the tickets to travel at the rate of approximately 30 feet per second in the associated tube or tubes.

2.25 For the longest ticket tube in the office, the cutoff valve is usually wide open and the exhauster is adjusted to give the necessary degree of vacuum in this tube. For the remaining tubes, which are shorter, the proper speed of ticket travel is obtained with less vacuum at the receiving valve by adjusting the cutoff valves associated with these shorter tubes.

(H) Heater for Sending Tubes at the No. 51 Ticket Distributing Desk

2.26 Since in No. 51 Ticket Distributing Desks there are usually three bends in close succession near the open end of the tube where the ticket is inserted, this is the part of the tube system where the possibility of tickets becoming stuck is likely to be greatest. In some cases, particularly where high humidity conditions are prevalent, tube heaters are provided for this part of the system.

2.27 These heaters consist of an enclosure about the tubes of heat insulating materials. Within this enclosure and below the tubes are a number of electrical resist-

ances fed from the commercial power source. A thermostat switch within the enclosure controls the temperature which is held at about 120° F. A switch is provided to shut off the current when it is not necessary to keep the heater in operation. Adjacent to the switch is a pilot lamp which is lighted while the heater is turned on. Fig. 9 shows the arrangement of these tube heaters.

3. CIRCUIT FEATURES

Signaling System

Description and Use

3.01 In order that the distributing operators will not send tickets to vacant sections, it is necessary that the distributing operator know when the sections to which she distributes tickets are occupied.

3.02 For installations which are relatively small but which are large enough to require more than one tube for sending tickets to the switchboard, it is practicable to set up a routine among the operators whereby the sending end of the tubes at the distributing desk will be capped when the sections at which these tubes terminate are vacated.

3.03 For larger offices, where it is not practicable to set up a routine to cap the tubes at the distributing desk when sections are vacated, signaling circuits, as shown in Fig. 10, are provided. One such circuit is associated with each sending tube at the distributing desk and each receiving valve at the switchboard.

3.04 At the switchboard section, a key (A) and two lamps with green caps are mounted in the piling rail associated with the hand receiving valve. In the older installations, two additional keys (B) and (C) are mounted in the piling rail and two additional lamps equipped with green caps

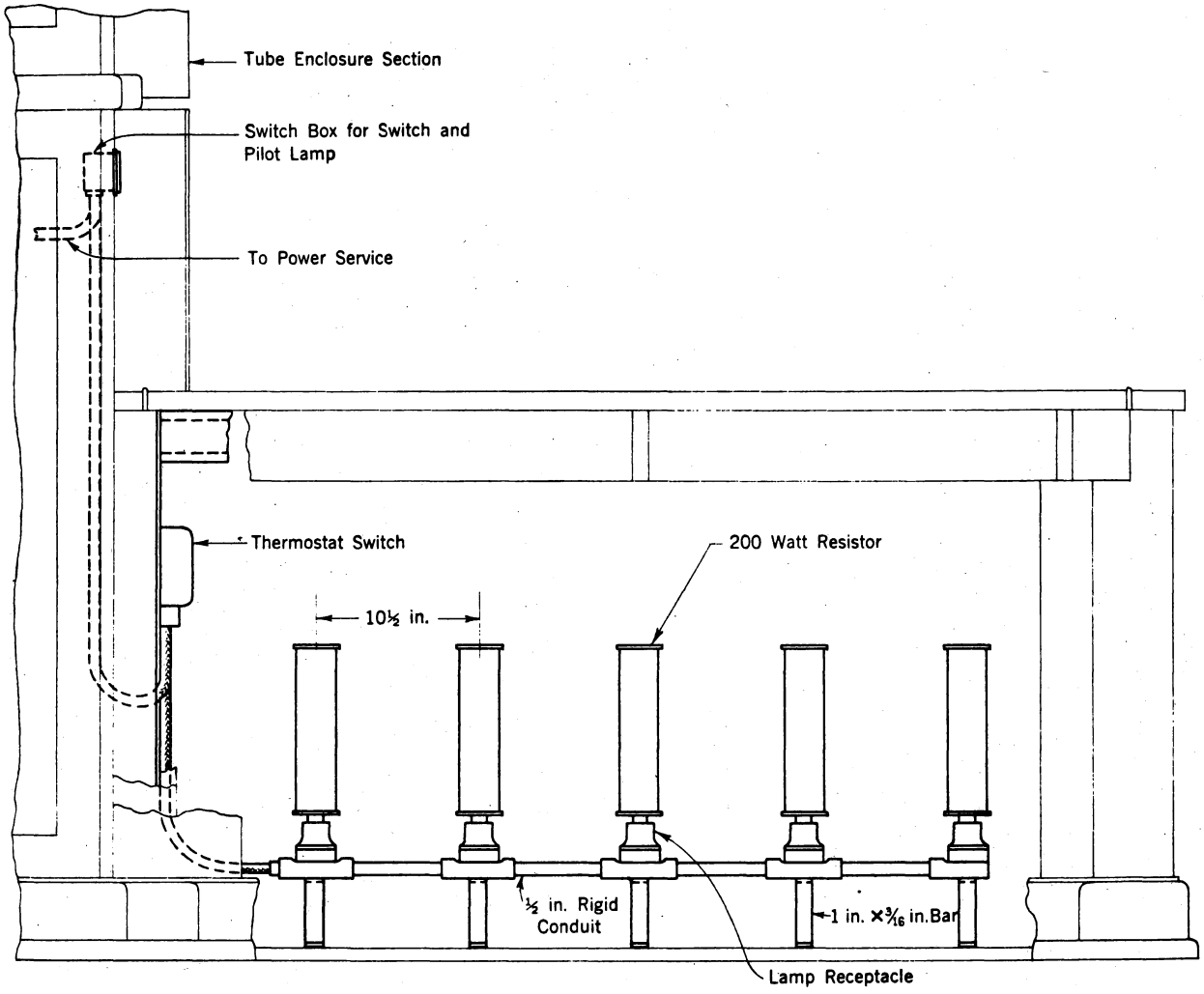
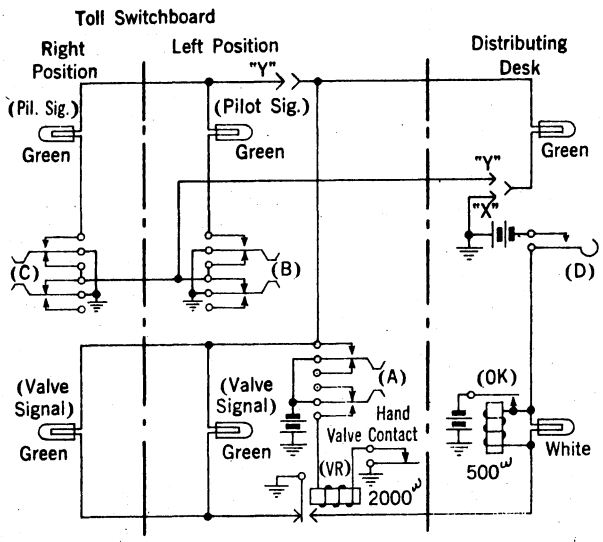


Fig. 9 - Tube Heater for No. 51 Ticket Distributing Desk.



NOTE: Pilot signals and "Y" wiring are provided only in the older installations.

Fig. 10 - Signaling System.

are mounted in the crown moulding of the switchboard section. At the distributing desk there is a key (D) and two lamps, one of which is equipped with a green cap and one with a white cap.

Circuit Operation

3.05 When any of the positions served by a sending tube are occupied, key (A) is operated, which should light the green lamp at the distributing desk, indicating to the distributing operator that the position is occupied and prepared to receive tickets.

3.06 The distributing operator, before sending a ticket, operates key (D) which completes the circuit and should light the white lamp at the distributing desk. If the white lamp lights, it is an indication that there is no ticket in the hand receiving valve and a ticket may be sent.

3.07 When the ticket arrives in the hand receiving valve at the toll position, the valve contacts open and should extinguish the white lamp at the distributing desk, indicating to the distributing operator that the ticket has arrived at the hand receiving valve.

3.08 The opening of the valve contacts should also light the two green valve signal lamps to indicate to the operators that a ticket is in the hand receiving valve. When the ticket is removed from the valve, the closure of the valve contacts should extinguish the valve signal lamps and set up the circuit condition under which the white lamp at the distributing desk is under the control of key (D) preparatory to sending another ticket.

3.09 Where keys (B) and (C) are provided together with lamps in the crown moulding and either toll position associated with a tube is overloaded or unoccupied, key (B) or (C) is operated, thus lighting the green pilot lamp signal in the crown moulding at the position associated with the operated key. This signal is an indication to the toll supervisor that the position is overloaded so that she may, if necessary, arrange to have the excess tickets handled at other positions.

3.10 Should both positions become busy and keys (B) and (C) be operated at the same time, the green lamp at the distributing desk will be extinguished, thus indicating to the distributing operator that no more tickets should be sent to that section.

Blockade Alarm System

Description and Use

3.11 Tickets occasionally stick in a tube, especially during periods of high humidity. This sometimes results in a blockade by causing other tickets to collect at the same point. Usually blockades are not serious if discovered and cleared at once so that they do not assume large proportions. Due to the possibility, however, that in a common return tube, a blockade might relatively quickly involve a considerable number of tickets, an alarm circuit is provided for these tubes to ensure prompt detection of stuck tickets and thus avoid serious delays likely to result in lost and canceled calls.

3.12 The blockade alarm equipment consists of pneumatic relays which function thermal relays, in order to introduce a delay feature, and the latter in turn set up the necessary condition to give audible and visual indications at suitable points. A lamp associated with this alarm is provided at the roller receiving valve end of each common return tube. At the sending end, red pilot lamps and associated buzzers are provided in desks or supervisor's divisions at the switchboard. Located near the buzzers are non-locking release keys by means of which the buzzers may be silenced. The alarm is also connected into the central office annunciator circuit. A cutoff key is provided at the receiving valve end of the tubes so that the battery supply can be cut off from the alarm system when the tubes are not in use. The pneumatic and thermal relays are covered in separate sections of the Bell System Practices.

Circuit Operation

3.13 The pneumatic relay is actuated by the difference in pressure which arises between two return tubes entering a roller receiving valve when the free flow of air in either of these tubes is impeded, as by a stuck ticket. When the contacts of

the pneumatic relay close, current flows through one of the resistance windings of the associated thermal relay and causes it to operate if the circuit remains closed for a sufficient period.

3.14 When the contacts of the thermal relay close, a controlled relay is operated. This relay locks up to the operated pneumatic relay and closes circuits to operate the various associated audible and visual signals and also to function the central office annunciator system.

3.15 When it is desired to silence the buzzer, or buzzers, pending clearance of the trouble, the non-locking release key is momentarily depressed. This operates a relay which cuts off the buzzer in immediate proximity to the key but has no effect upon other signals or upon the annunciator alarm system. The relay locks up through the closed contacts of the pneumatic relay and thus remains operated until the pneumatic relay is released by clearance of the trouble. Release of the pneumatic relay thus restores the circuit to its normal condition.

4. TICKETS

4.01 The tickets used in the pneumatic ticket distributing system are about two and a half inches wide, five inches long and approximately .005 inch thick. They are made of a good quality of sulphite paper with a ledger finish and are arranged to be folded as shown in Fig. 11.

4.02 In the case of installations of the pneumatic ticket distributing system where short-radius bends are used, care should be taken to see that tickets are inserted into the tubes with the flaps toward the proper side of the tube, that is, with the flaps up at the sending valves of common return tubes and with the flaps as indicated by the designation cards at the distributing desks where such cards are provided.

4.03 In damp weather, tickets should not be left on unoccupied positions over night or for any great length of time, but should be removed for use at other positions or for storage in a warm dry place.

5. CIRCUITS AND CIRCUIT DESCRIPTIONS

5.01 Table 1 lists the circuit drawings pertaining to the pneumatic tube ticket distributing system. Detailed circuit descriptions are given in the associated CD sheets.

TABLE 1

Title	Drawing No.
Signal Circuit for Indicating Blockade in Pneumatic Tubes	SD-60948-01
Toll Operating Room Desks Signal Circuit - Pneumatic Tube System For Use with Tubes Incoming from Ticket Distributing Desk	SD-63464-01
Power Service Circuit for Exhausters per KS-5265-02 and KS-5405	SD-80254-01
Power Service Circuit 115-Volt, 60-Cycle, Single Phase. Heating Unit for Use with Distributing Desk No. 51.	SD-80479-01

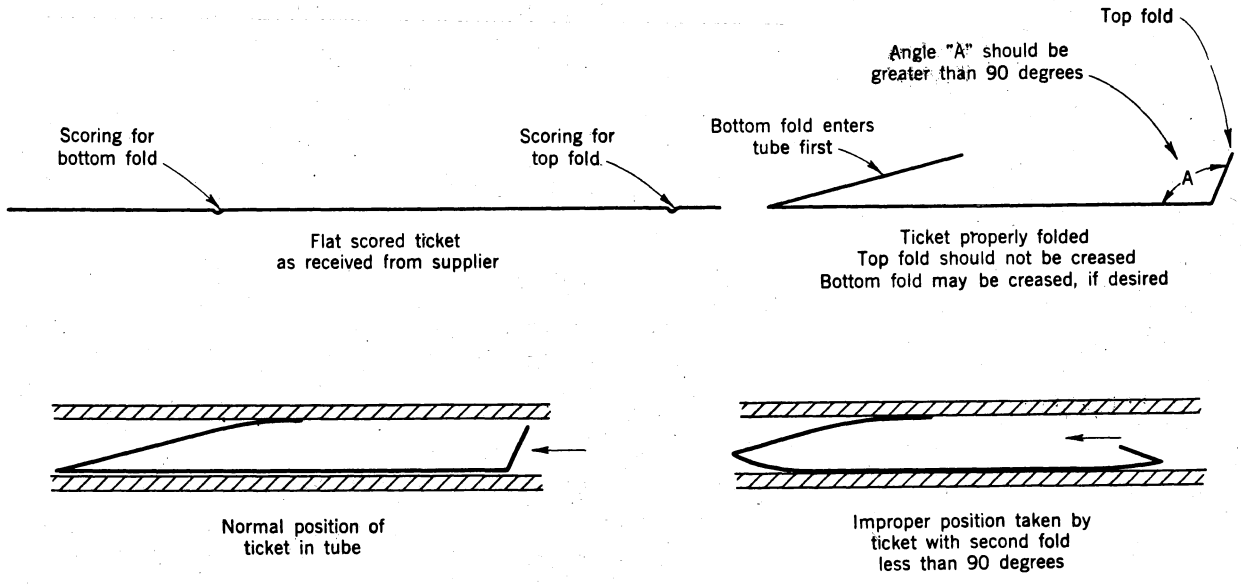


Fig. 11 - Folding of Toll Tickets.