# CALCULAGRAPHS, ELECTRICALLY DRIVEN
# MODEL 30 AND MODEL 33
# DESCRIPTION

## 1. GENERAL

1.01 This section describes electrically driven calculagraphs which are used as an alternative to spring driven calculagraphs for timing toll calls in offices where there is available a 60-cycle a-c. power source, the frequency of which is regulated for time service. A brief description is also given of the normal and emergency power supply arrangements for the drive motors.

1.02 These instruments are so arranged that, as required in the case of the majority of toll tickets, a record may be made of the time of day at which the connection is established, together with a record of the duration of the conversation and an identification of the particular calculagraph used; or, where desired, a record may be made of the time of day only. The dials of motor driven calculagraphs show elapsed time to the second, whereas, in the case of spring driven models, the finest dial markings are for each quarter of a minute.

1.03 The mechanism of either of the two calculagraph models covered herein is driven by a 2.8 watt synchronous clock motor the rotor of which is mounted upon a vertical shaft supported by a jeweled bearing. These motors are self-starting and operate satisfactorily on a single phase 60-cycle power circuit having a voltage range of 17 to 24 volts. The power for these motors is normally derived from the commercial power service and the necessary reduction in voltage is accomplished by means of one or more small transformers. Where emergency equipment is provided to keep the calculagraphs in operation throughout temporary interruptions of the commercial power service, the additional equipment consists of a KS-5481 motor-alternator set operated from the 24-volt central office battery, together with associated automatic equipment for starting the alternator and transferring the load to it.

1.04 Conversion of Spring Driven Model: The spring driven calculagraph known as Model 6 may be converted to the electrical drive and equipped with the new style stamps which give a printed record of elapsed time to the second. It is not possible, however, to change to the new stamping dials unless the drive motor is also provided since the spring mechanism is not sufficiently powerful to drive the higher speed gear train associated with the new dials.

## 2. DESCRIPTION OF EQUIPMENT

### Arrangement and Mounting

2.01 The Models 30 and 33 calculagraphs are equipped with a synchronous motor and associated reduction gearing through which are driven the clock hands and a set

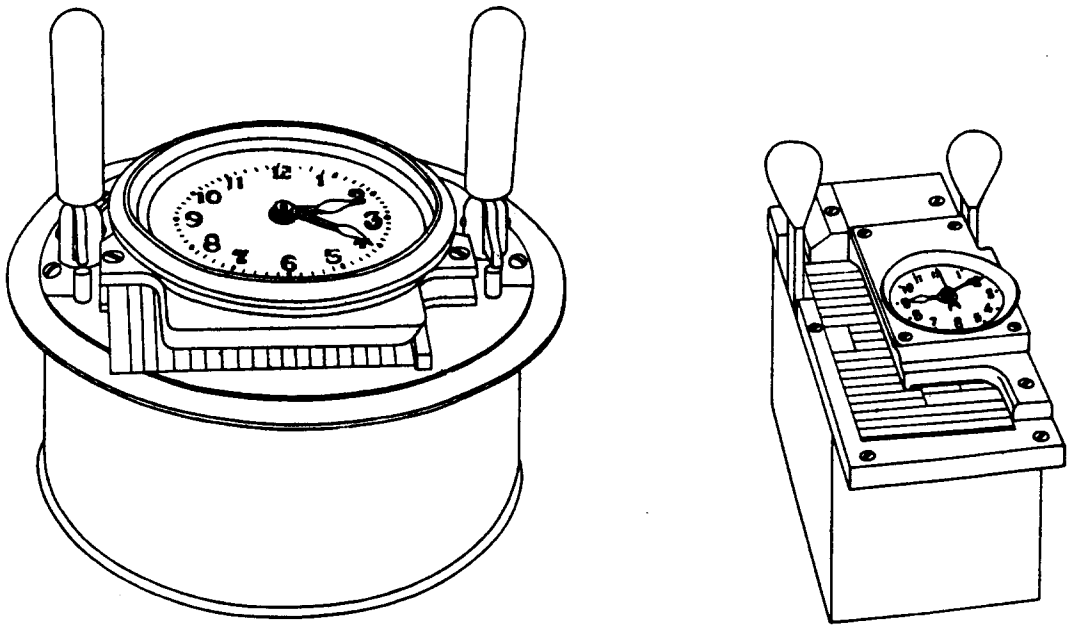


Fig. 1 - Electrically Driven Calculagraphs.

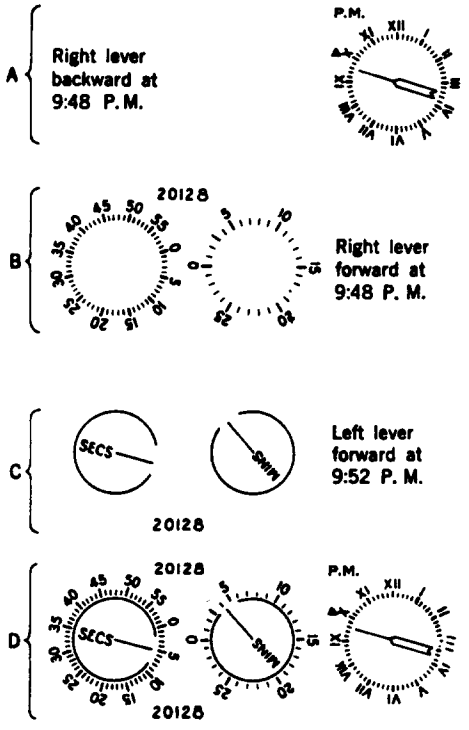
of stamping dials and pointers for recording the time of day and the elapsed time on toll tickets. Two operating levers equipped with hand grips afford means for actuating the stamping mechanism. An inked ribbon runs between two spools and across the stamping dials. The mechanism of the Model 30 calculagraph is contained within a round case approximately 8-1/2" in diameter by 4" in depth while that of the Model 33 is in a rectangular case about 3-3/8" wide, 7-1/2" long and 3-3/4" deep. Both models are arranged for mounting in the keyshelf in such a way that the face is slightly above the surface of the shelf. The Model 33 calculagraph will fit into an A-type key mounting and takes up four key spaces while the Model 30 is usually located in a space provided for it between two adjacent switchboard positions. Fig. 1 shows a view of these two models. The various details of the mechanisms are shown in figures of the sections of Division A400 which apply.

Stamping Equipment

2.02 Fig. 2 shows an example of the impressions made by the Model 30 calculagraph when the levers are operated to their various positions. Similarly Fig. 3 shows the impressions made by the Model 33 calculagraph. In these two models the arrangement of the dials differs in that, in the Model 30, the time of day is printed on the right-hand side of the ticket while, in the Model 33, the record of the time of day appears on the left side of the ticket. The relative positions of the minutes and seconds elapsed time stamps are also reversed.

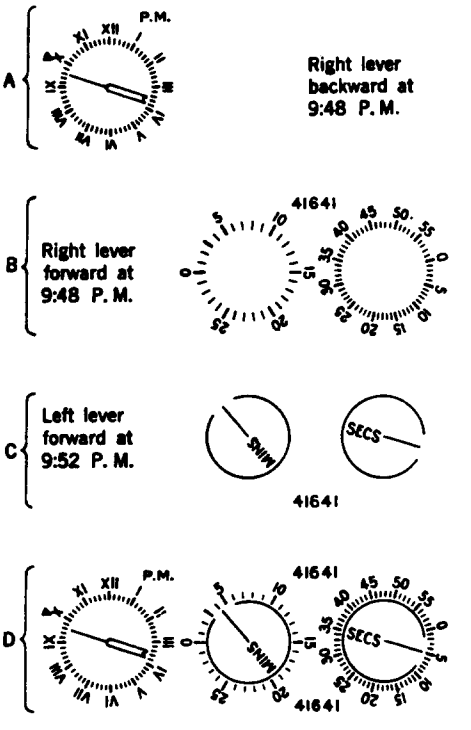
Elapsed Time Dial and Calculagraph Serial Numbers

2.03 Due to the greater power available in the motor driven mechanism as compared with the spring mechanism, the elapsed time stamps are arranged to facilitate more precise records. As shown in the above figures, these models have 30-minute and 60-second dials. Within each of the dials is a pointer, one designated MINS and the other SECS and around each pointer and designation is a circle with a small gap in it where the tip of the pointer comes. The purpose of the circle about the pointer is to make easily discernible all cases where a ticket has been improperly placed in the calculagraph either at the start or at the finish of a conversation. If at either stamping operation a ticket is improperly placed, the impression of the circle will not be concentric with that of the dial. By noting how far out of center the two im-




Note: Impressions designated by A and B are made at the start of conversation and that designated by C at the end of conversation. D shows the completed impression as it appears on the ticket to indicate the elapsed time of 4 minutes and 5 seconds starting at 9:48 P. M.

Fig. 2 - Impressions of Stamps - Model 30.




Note: Impressions designated by A and B are made at the start of conversation and that designated by C at the end of conversation. D shows the completed impression as it appears on the ticket to indicate the elapsed time of 4 minutes and 5 seconds starting at 9:48 P. M.

Fig. 3 - Impressions of Stamps - Model 33.

pressions are, it is possible to interpret correctly the length of the interval recorded.

2.04 Each elapsed time dial and the associated pointer are assembled in the calculagraph with the end of the pointer even with the zero of its dial. As the dial and its pointer rotate as a unit at the same rate, the end of the pointer remains always at the zero of the dial. Pulling the right-hand operating lever toward the operator causes an impression to be made of the elapsed time dials and the serial number of the calculagraph. Pulling the left-hand operating lever forward causes an impression to be made of the elapsed time pointers and of a second number stamp which also bears the serial number of the calculagraph. As the dials and pointers rotate continuously, the printed record, in which the dials are stamped at the beginning and the pointers at the end of the interval, shows the elapsed time.

2.05 Since the elapsed time dials and pointers are positively driven while a friction drive is provided in the gear train associated with the clock hands and time of day pointers, setting the clock has no effect upon the positions of the elapsed time dials and pointers. However, to guard against interference with the normal movement of the clock mechanism while a record is being stamped, the mechanism is so arranged that the various dials and pointers may remain stationary for an interval while an impression is being printed but will spring ahead to their proper positions when the associated operating lever is released.

2.06 The purpose of the two stamps bearing the serial number is to afford a means for checking that the initial and final stampings were both made by the same instrument as well as to determine which calculagraph was used. It is essential in measuring an elapsed time interval that only one calculagraph be used as no attempt is made to maintain a relationship between the positions of the elapsed time dials of different instruments.

Time of Day Stamps

2.07 The time of day record as shown in Figs. 2 and 3 is stamped by pushing backward the right-hand operating lever. The outer stamping dial which carries the minute markings and Roman numerals for each hour of the day does not rotate. Within this stamping dial is a pointer stamp which rotates at the same speed as does the minute hand and is driven by gearing so arranged that the position of the pointer is in constant agreement with that of the minute hand on the clock face, whether the latter is turned by the clock mechanism, as in normal operation, or manually, as when resetting is necessary. Around the outside of the stationary stamp is rotated a triangular pointer for stamping the hour. This hour pointer is driven by reduction gearing so arranged that it makes one complete revolution every twelve hours and its position is retained in proper relationship with the position of the minute pointer. The disc upon which the hour pointer is mounted also carries a pin to control the setting of the star wheel which causes either the "A.M." or the "P.M." stamp to be printed when the right-hand operating lever is pushed backward to record the time of day.

Ribbon

2.08 The ribbon which provides the necessary ink for the impression of the various dials and stamps is stretched from a ribbon spool on one side of the dials across them to another spool on the opposide side. These spools are concealed within the case but are accessible for replacement of the ribbon. Associated with each ribbon spool is a ratchet and pawl arranged to rotate the spool slightly and wind in some of the ribbon when the operating lever which is then actuating the ribbon feed returns to normal after stamping a record of elapsed time. In the Model 33 calculagraph, the return to normal of either operating lever from the forward operated position advances the ribbon. In earlier models, however, the ribbon is advanced only by the return of the operating lever which is on the side toward which the ribbon is moving at the time. The arrangement of the ribbon reverse mechanism of the Model 33 calculagraph is such that neither operating lever should be moved to its forward position unless there is a ribbon in the instrument.

2.09 The pawl of the spool from which the ribbon is being unwound is kept from engaging with its ratchet by the ribbon reversing mechanism. A properly tensioned brake upon the ribbon spool head keeps the ribbon taut. In general, calculagraphs which have been converted from the spring driven Model 6 have retained the same automatic ribbon reversing mechanism which they had before conversion. This mechanism functions when a certain amount of ribbon has been wound upon the spool which is becoming full. This is known as the "full spool" type and has been superseded by the "unwound spool" or "empty spool" type. In the case of the latter, when the ribbon is unrolled until approximately two turns remain upon the spool, the ribbon reverse mechanism functions to interchange the pawls, one or the other of which always engages the ratchet associated with each ribbon spool. This causes the direction of travel of the ribbon to be reversed.

## 3. POWER SUPPLY

Normal Supply

3.01 The 115 or 230-volt, 60-cycle single-phase, frequency regulated commercial power service is brought in through a SAFtoFUSE unit to the transformer where the line potential is reduced to 23 volts. Where a reserve source of alternating current is provided, the circuit is designed to switch the transformer equipment automatically to the emergency power source during periods of failure of the commercial service.

3.02 The transformer output is wired to a fuse panel for connection to the calculagraph supply circuits. These supply circuits, each of which cares for four cal-

culagraphs, are equipped with 1-1/3 ampere alarm type fuses, alternate calculagraphs being connected to one set of fuses and the intervening calculagraphs to another set. Normally one calculagraph is used for each two operators' positions. For cases where the size of the installation requires the use of two transformers, the output from one transformer is wired to alternate calculagraphs and the remainder are supplied by the other transformer.

3.03 As the power to the calculagraph motor is distributed at low voltage, regular switchboard cable is employed for the supply leads from the fuse panel to the switchboard where leads are run to each group of four alternate calculagraphs for connection to a terminal block in the calculagraph case. At the calculagraph, a plug connection is provided to facilitate the removal and replacement of the instruments.

3.04 The transformer equipment and associated SAFtoFUSE unit are located on a panel mounted on a regular 19-inch relay rack bay. This panel occupies a space of five 1-3/4 inch mounting plates for an installation served by a single transformer or ten 1-3/4 inch mounting plates where two panels are employed. In the same bay are also located the calculagraph circuit fuse panel and the fuse alarm relays and lamps. The alarm relays and a "no-voltage" alarm lamp are located on the transformer panel.

Reserve Supply

3.05 For offices which may be subject to commercial power interruptions, an auxiliary source of power consisting of a battery driven alternator may be provided to supply 60-cycle current for operating the calculagraphs on an emergency basis. This power supply unit is arranged to deliver 125 watts at approximately 115 volts and a frequency of 60 cycles when the potential of the central office battery is 25 volts. For each volt under 25, the frequency is reduced by approximately two cycles. A machine of this size will meet the requirements in a majority of cases where a reserve power supply is necessary. In offices large enough to require a greater output, two or more such units are used. The reserve power supply unit is panel-mounted and is located adjacent to the transformer panel. The battery driven motor-alternator is arranged to start automatically upon failure of the commercial service and to take over the function of supplying current to the calculagraphs. Upon resumption of the commercial power supply, the transformer equipment is automatically transferred back to the regular source and operation of the reserve unit is discontinued.

3.06 In offices where reserve power equipment is not provided, Waltham Model "L" clocks are usually used during periods when the regular power service has failed.

## 4. ALARM CIRCUITS

4.01 A no-voltage alarm circuit is provided for the 23-volt 60-cycle calculagraph power supply. In case of power failure in an office not provided with an emergency power supply, the circuit functions to light the power panel and major aisle pilot lamps and sound the major audible alarm signal. Where emergency power supply equipment is furnished, a power supply transfer alarm circuit is also provided. The operation of this circuit lights the power panel and minor aisle pilot lamps and rings the minor audible alarm signal, which may be silenced by operating a transfer key.

4.02 In either type of office, a fuse alarm which indicates the operation of a fuse is arranged to light the fuse panel pilot lamp and minor aisle pilot lamp and sound the audible alarm signal.

## 5. MAINTENANCE FEATURES

5.01 As compared with spring driven calculagraphs, less maintenance effort is required by motor driven models. Not only is it unnecessary to wind them but much work which was involved in regulating them to afford accuracy in time keeping is also dispensed with. In the case of a group of motor driven calculagraphs, all of the instruments, when once set, remain in agreement with each other and, barring an interruption of the power supply, they keep time with the accuracy afforded by the frequency regulation of the power source.

5.02 After more than a momentary interruption of the power supply, it is necessary to reset all of the calculagraphs affected, unless reserve power supply equipment is provided. Where there is such equipment, resetting of all calculagraphs is necessary only when failures of the commercial power supply have been so frequent or prolonged that the group of calculagraphs has become slow by more than the permissible amount. After every interruption, however, a check should be made for correctness of time and each instrument should be checked for agreement with the group.

5.03 Such maintenance items as cleaning the stamps, replacement of ribbons and periodic inspection and lubrication of the mechanism are essentially the same as are applicable to calculagraph models generally.

5.04 Where reserve power equipment is provided, some additional maintenance is required. In most cases the reserve equipment will be in operation only a very small part of the time but periodic tests and occasionally cleaning and adjustments are necessary to insure that the reserve equipment will function properly when it is needed.

## 6. CIRCUITS AND CIRCUIT DESCRIPTIONS

6.01 Below are listed the circuit drawings pertaining to electrically driven calculagraphs. Detailed circuit descriptions are given in the associated C.D. sheets.

| Title | Drawing No. |
|---|---|
| Power Supply Circuit for Motor Driven Calculagraphs | SD-80550-01 |
| Motor Driven Calculagraph Circuit | SD-64158-01 |
| Power Supply Alarm Circuits | SD-95001-01 |
| Distribution Fuse and Common Aisle Alarm Circuits | SD-95002-01 |