

GFELLER LINE CONCENTRATORS

49-9-2, 49-11 + 1-2, 49-12-2

GENERAL DESCRIPTION

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2. ASSOCIATED SECTIONS	1	2.01 The associated sections for the Gfeller line concentrator are:
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 1. INTRODUCTION		067-201-401 — Schematics (49-9-2)
1.01 This section contains a general description of the Gfeller line concentrator equipment and an index of associated sections.		067-201-402 — Schematics (49-11+1-2) ←
1.02 This section is reissued to include information regarding the 49-11+1-2 and 49-12-2 models of the Gfeller line concentrator. The title has been changed to add reference to the new models. Corrections have been made to bring this section up-to-date.		067-201-403 — Schematics (49-12-2) ←
1.03 The information presented in these sections was compiled from material submitted by the manufacturer, The Gfeller Company, and the experience derived from use of the concentrator in Bell System Companies. The group of sections contains descriptive, line-up, maintenance, and power information for the Gfeller line concentrator as shown in Part 2.		067-201-501 — Power Supply (PEC-8001-A)
		067-201-502 — Power Supply (PEC-8002) ←
		067-201-701 — Apparatus Requirements and Adjusting Procedures
		067-201-801 — Piece Part Data and Replacement Procedures
1.04 This section contains photographs (Figs. 1 through 7) which show various views of the central office unit and remote unit of the Gfeller line concentrator, 49-9-2 and are typical of all models. ←		 3. GENERAL
		3.01 The Gfeller line concentrator is an electro-mechanical device which enables customers' telephones to be connected to central office line equipment efficiently, while using less outside cable facilities. It takes advantage of the fact that among any group of customers only a few will be using their telephones at the same time.

3.02 Each Gfeller line concentrator installation consists of two similar units, one located in the central office and the other located in the vicinity of the customers to be served. A unit is physically small enough, approximately two feet wide, four feet high and one foot in depth, to permit the remote unit with a weatherproof housing, to be pole mounted. It can also be installed at a suitable location within a building.

3.03 There are three models of the Gfeller line⁷ concentrator which may be used to serve a maximum of 49 customer lines. The customer lines connected may be individual, multiparty or both. The units may be used with any type of central office with line equipment having a sleeve lead. However, since the concentrators are designed to function with central office equipment that furnishes battery on the sleeve in the idle condition and ground on the sleeve when busy, some types of offices will require additional auxiliary units to convert to the proper sleeve condition. The models differ in the number of vertical bars (trunk facilities) as described below.

3.04 49-9-2: This model has a total of 9 vertical bars (trunks). It requires 11 cable pairs to connect the central office unit to the remote unit. Nine of these cable pairs are used for talking paths and two are used for circuit functions.

3.05 49-12-2: This model has a total of 12 vertical bars (trunks). It requires 14 cable pairs, twelve of the pairs are used for talking paths and two of the pairs are used for circuit functions.

3.06 49-11+1-2: This model has a total of 12 vertical bars in the central office unit and 11 vertical bars in the remote unit. It requires 13 cable pairs, eleven are used for talking paths and two are used for circuit functions. The extra vertical bar, designated BES in the central office unit, is used to return overflow tone to a terminating call in the event that all eleven trunks are busy. The vertical BES is shown in the model number by +1. ↵

4. EQUIPMENT ELEMENTS

4.01 The switching mechanism consists of two crossbar type switches, one per unit. They

are compact, measuring about 12 inches by 24 inches. The relays used to control switching functions are miniature flat-spring types and function in the same manner as other types. Resistors and capacitors are used in a conventional manner. The switching functions are accomplished with a minimum current drain due to the low current drain of switch magnets and relays. This characteristic in part enables power to be supplied to the remote unit over one cable conductor, using ground return.

4.02 The switches have 49 horizontal bars and⁷ varying amounts of vertical bars which function to connect each horizontal to any vertical by selective circuit operations. The customer lines are connected to the 49 horizontal bars at the remote unit. At the central office unit, the respective line equipments are connected to 49 horizontal bars. The interconnecting cable pairs (trunks) will be connected to the similarly numbered vertical bars, at each unit. The 49-9-2 line concentrator has in effect a 49 by 9, or 441 point switch. The 49-12-2 has a 49 by 12, or 588 point switch. The 49-11+1-2 switch differs in that the central office unit has one more vertical bar than the remote unit, thus the central office unit has a 49 by 12 or 588 point switch and the remote unit has a 49 by 11 or 539 point switch. All switches of the central office units actually have 50 horizontals, the 50th being used in circuit functions and not available for customer line equipments. ↵

4.03 The vertical bar is operated (pulled up) when its lift magnet is energized. This operation takes place on a preselection basis, that is, between the time a connection is established on a call being served and prior to serving the next call. Thus the vertical bar is operated prior to its use on the next call. The vertical bars are selected and used in rotation on successive calls; any that are busy on previously established connections will be passed over. After the vertical bar is lifted, the⁷ next idle vertical bar is preselected but remains in the idle (down) position until the operated (pulled up) vertical is used on a call. ↵

4.04 The horizontal bar is moved to the right when its coil is energized. By circuit arrangement the proper horizontal bar, associated with the call being served, is actuated in both

units. In subsequent circuit action the preselected vertical bar drops, due to gravity, when its lift magnet is de-energized. This action occurring at both units results in the mechanical connection of the customer's telephone through the switch (horizontal to vertical) over a cable pair and through the central office switch (vertical to horizontal) to the customer's line equipment.

5. PRINCIPLES OF OPERATION

5.01 The dc power required for equipment functioning at the remote unit is supplied from the central office unit over one cable conductor using ground return. This dc current charges a large capacitor at the remote unit providing the reserve power needed for the higher current demand when initially operating magnets and relays. The central office unit also feeds 60-cycle ac current over the three remaining control cable conductors to the remote unit. There are two paralleled pairs of identical relays in series with each of the ac feeders, one parallel pair of relays in the central office unit and one pair in the remote unit. These six pairs of relays, three conductors, and other components comprise a mutual code type signaling arrangement which permits selective synchronizing of the switching mechanism at both units. This so-called marking is basically the same for a call originated by a customer or terminated to a customer.

5.02 There are two types of power supplies,¹ associated with the central office unit, that may be used with the Gfeller line concentrator. The PEC-8001-A has three sections which supply the ac voltage requirements, the dc voltage requirements and, on an emergency basis, both ac and dc voltage requirements using a vibrator power supply which automatically starts to function during a commercial power failure.

5.03 The second type of power supply, PEC-8002, is a transistorized supply. This type does not require the emergency source as it functions entirely on the -48 volt dc central office battery supply. The unit supplies the same ac voltage requirements and dc voltage requirements that PEC-8001-A furnishes. ↵

5.04 A customer originating a call from a telephone connected to the concentrator operates the switchhook contacts of his telephone causing an associated line relay, one of 49 relays in the remote unit, to operate. This operates a pair of associated relays in a relay preference chain circuit in the remote unit, which will in turn initiate a coded combination of the six pairs of relays as described in 5.01. This marks the proper horizontal bar at each unit. There is a terminating-originating lock-out feature incorporated in the line concentrator which prevents a terminating call from interfering with an originating call or vice versa. The preference relay chain referred to above takes care of simultaneous originating demand by serving each one separately, depending on the position in the chain.

5.05 The vertical bar to be used at each unit has been preselected prior to this call, as discussed in 4.03, and is in the operated (lifted up) position. The same numbered horizontal bar will be moved to the right at each unit because the proper coils have been energized due to the marking operation. Subsequent circuit operations will cause the release of the preselected vertical bars. They will drop in both units. This will mechanically engage the tip and ring of the vertical bar (trunk) with the tip and ring of the horizontal bar (customer line) at the remote unit. At the central office unit the vertical bar (trunk) will engage the tip, ring, and sleeve of the horizontal bar (line equipment). A connection is now established from the station to the central office equipment line relay. The tip and ring are free from any bridged concentrator equipment and can be considered as an exchange cable pair.

5.06 The concentrator equipment now proceeds¹ to recycle itself prior to handling another call. This consists of lifting the next idle vertical bar (trunk) that was selected after the operation of the previously lifted vertical bar, as explained in 4.03. This is done by marking the particular vertical bar in both units using the six pairs of relays in an operated and released combination to indicate that vertical bar. After this marking action, the selected bar is operated (lifted up) and held operated in each unit for use on the next call. ↵

5.07 On a terminating call (incoming) the presence of ground on the sleeve, of the line

equipment associated with the called customer, will operate the particular line relay, one of 49 relays, in the central office unit. This relay will operate a pair of associated relays of a preference relay chain circuit in the central office unit which will cause an operated and released combination of the common six pairs of relays described in 5.01. This results, as in the originating call, in marking the proper horizontal bar at each unit. Circuit progress will result in the operation of the selected horizontal bar first and then the release of the pre-selected vertical bar (trunk) in both units. The tip and ring will then be closed through, over the trunk cable pair, as a result of the released (dropped) vertical bar; and ringing of the called line will take place.

5.08 Recycling of the line concentrator will now occur as on an originating call, which causes preselection of the next vertical bar (trunk) for use on the next call.

5.09 When disconnection takes place, for either originating or terminating calls, the established connections through the switches remain, with the central office line equipments normal. This condition prevails until those vertical bars

not serving a call are preselected during the re-cycle operation as explained in the originating and terminating call operation. Therefore, after the line concentrator has initially served eight customers, there will always be at least eight established connections with or without conversations.

5.10 When all vertical bars (trunks) are in use,⁷ an all-trunks-busy condition will exist. This situation will cause a "no dial tone" on calls being originated. On terminating calls, audible ringing will continue until the calling customer hangs up when using either the 49-9-2 or the 49-12-2 line concentrator. When the 49-11+1-2 line concentrator is used, the calling customer is connected to vertical bar BES which returns overflow tone. Applique and auxiliary circuits can be provided for the 49-9-2 and the 49-12-2, so that the central office equipment will recognize the all-trunks-busy condition and cause a signal to be returned to the calling customer. ↵

5.11 In the central office unit provisions for connecting to an all-trunks-busy register circuit and also to the central office alarm system are provided.

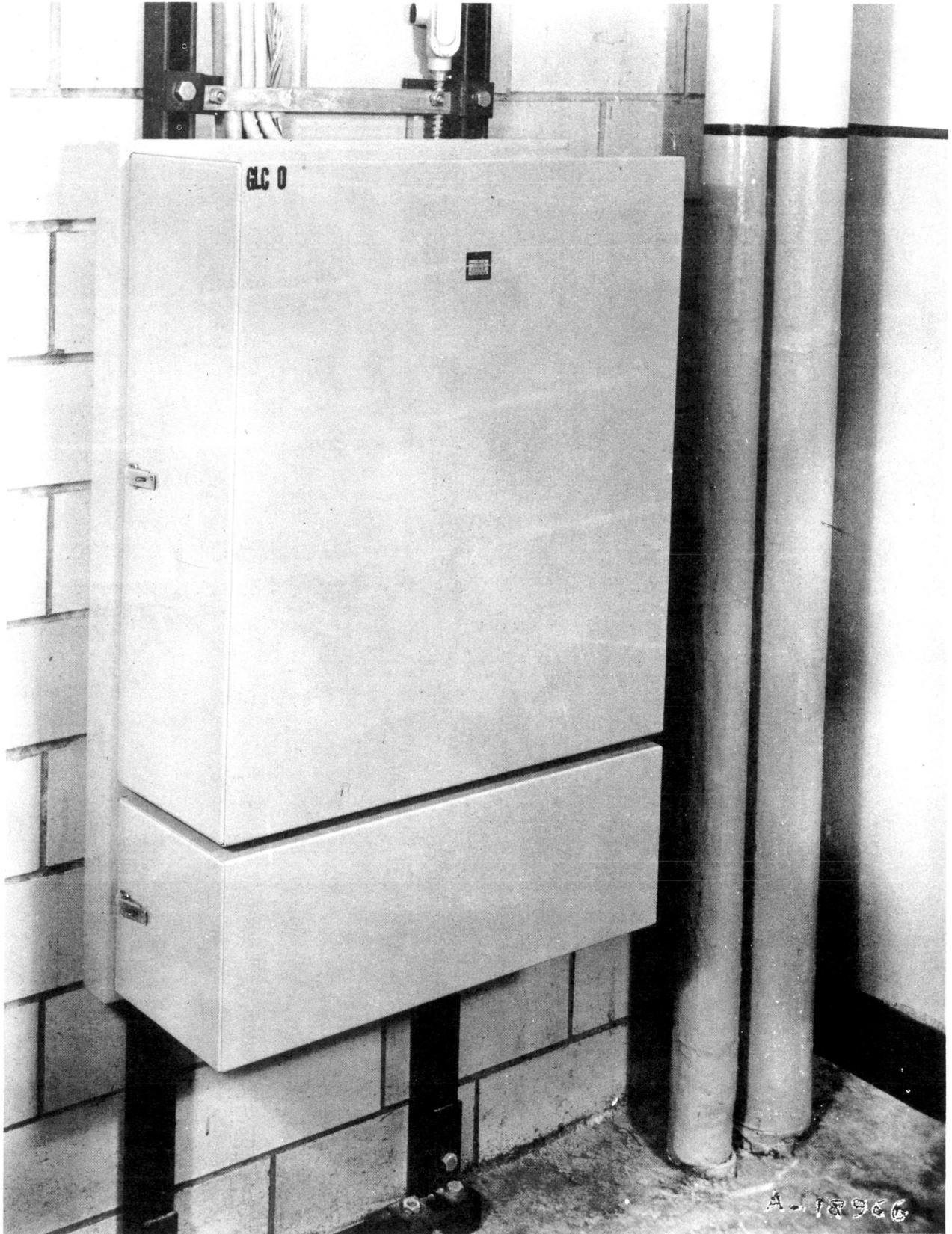


Fig. 1 — Gfeller Line Concentrator 49-9-2
Mounted Central Office Unit

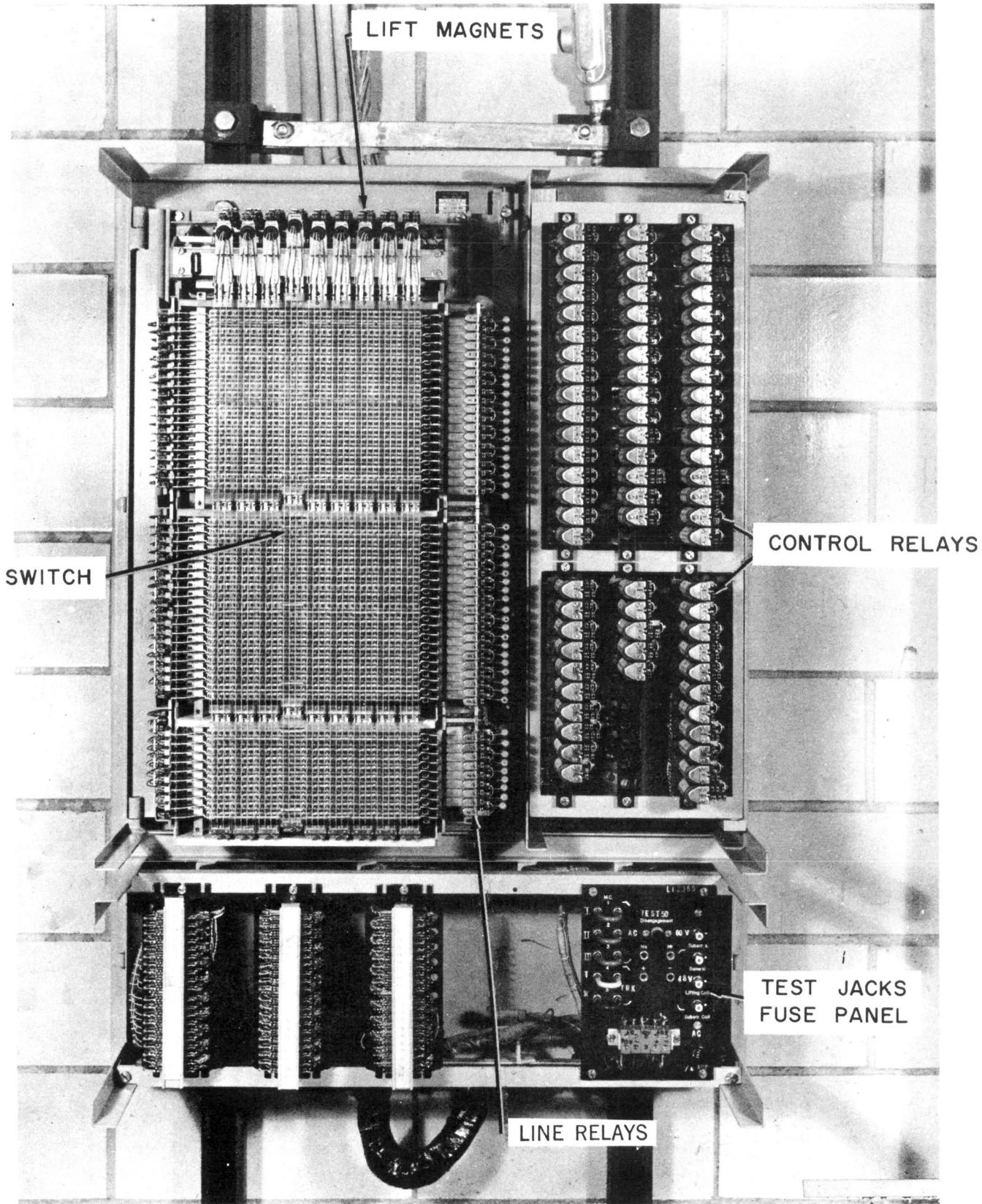


Fig. 2 — Gfeller Line Concentrator 49-9-2
Central Office Unit (Covers Removed)

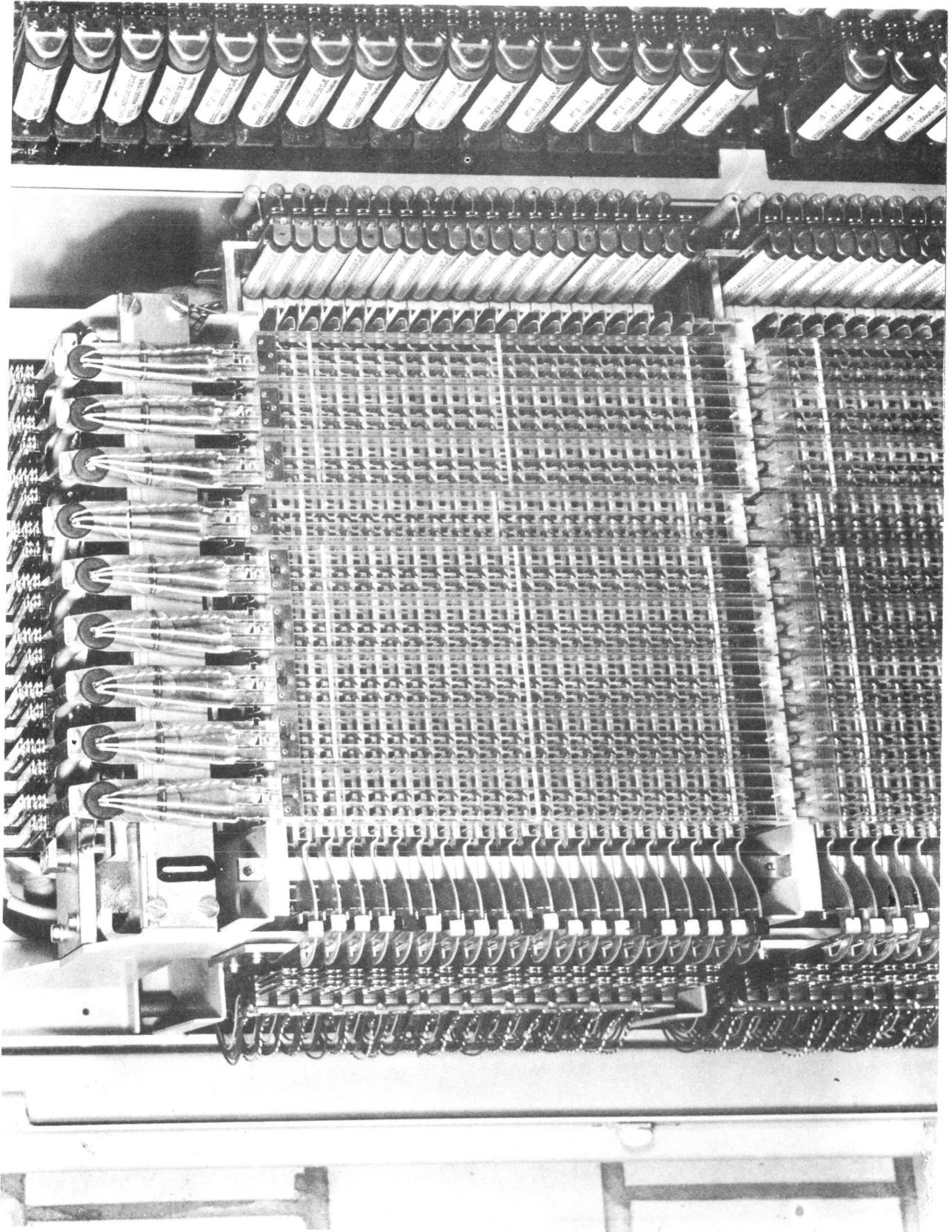


Fig. 3 — Gfeller Line Concentrator 49-9-2
Central Office Unit (Switch Close-up)

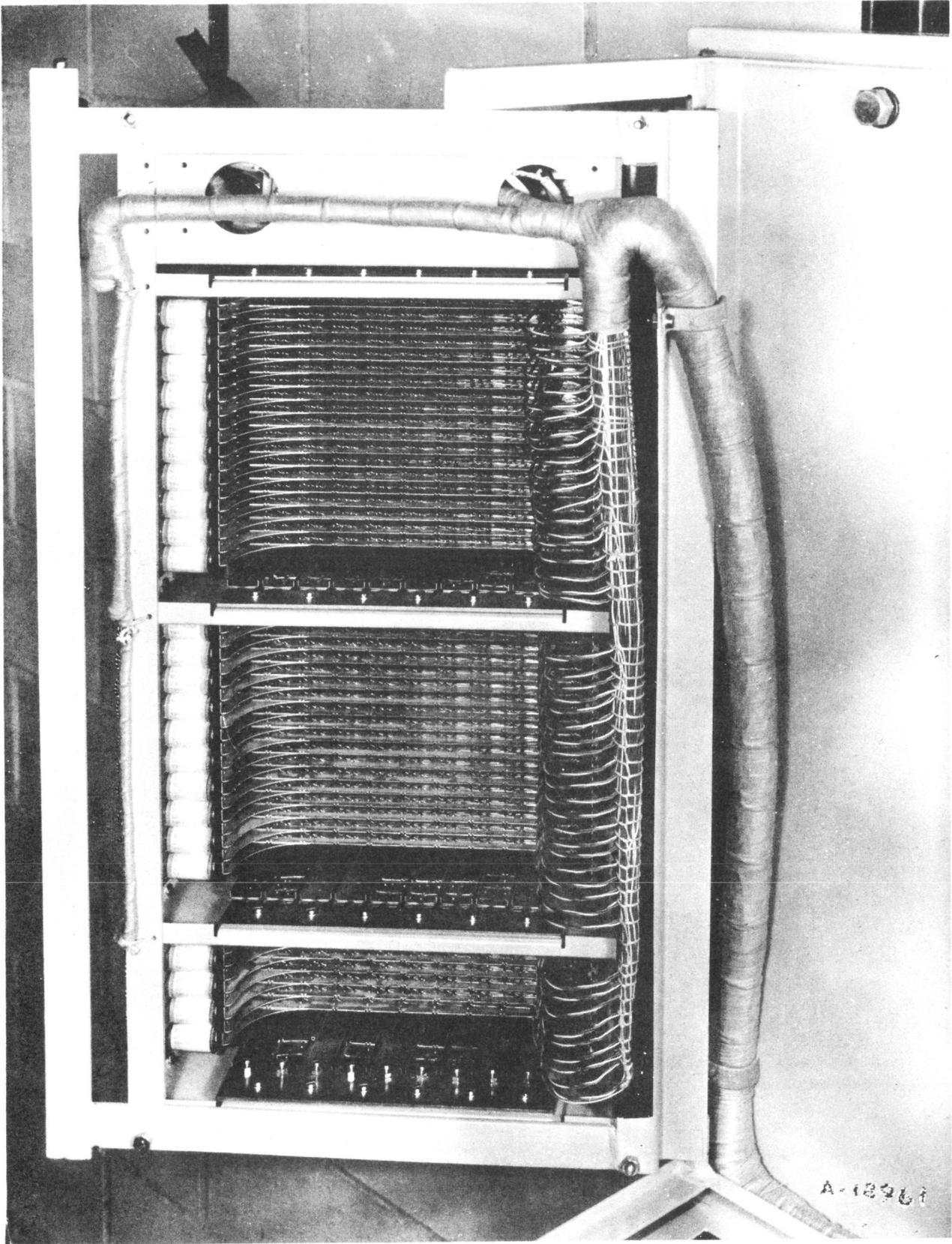


Fig. 4 — Gfeller Line Concentrator 49-9-2
Central Office Unit (Switch Rear View, Equipment Gate Open)

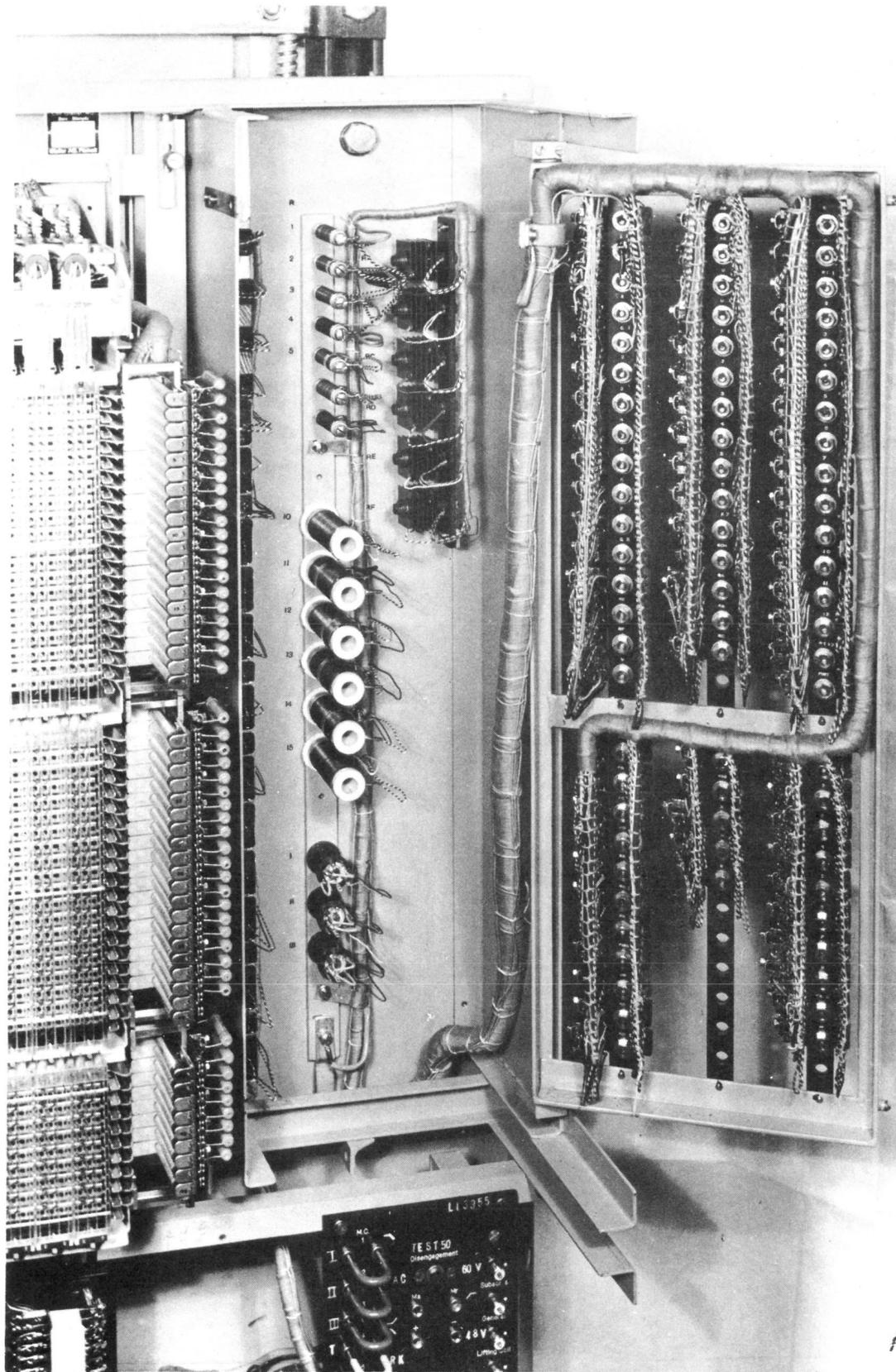


Fig. 5 — Gfeller Line Concentrator 49-9-2
Central Office Unit (Interior View, Relay Rack Gate Open)

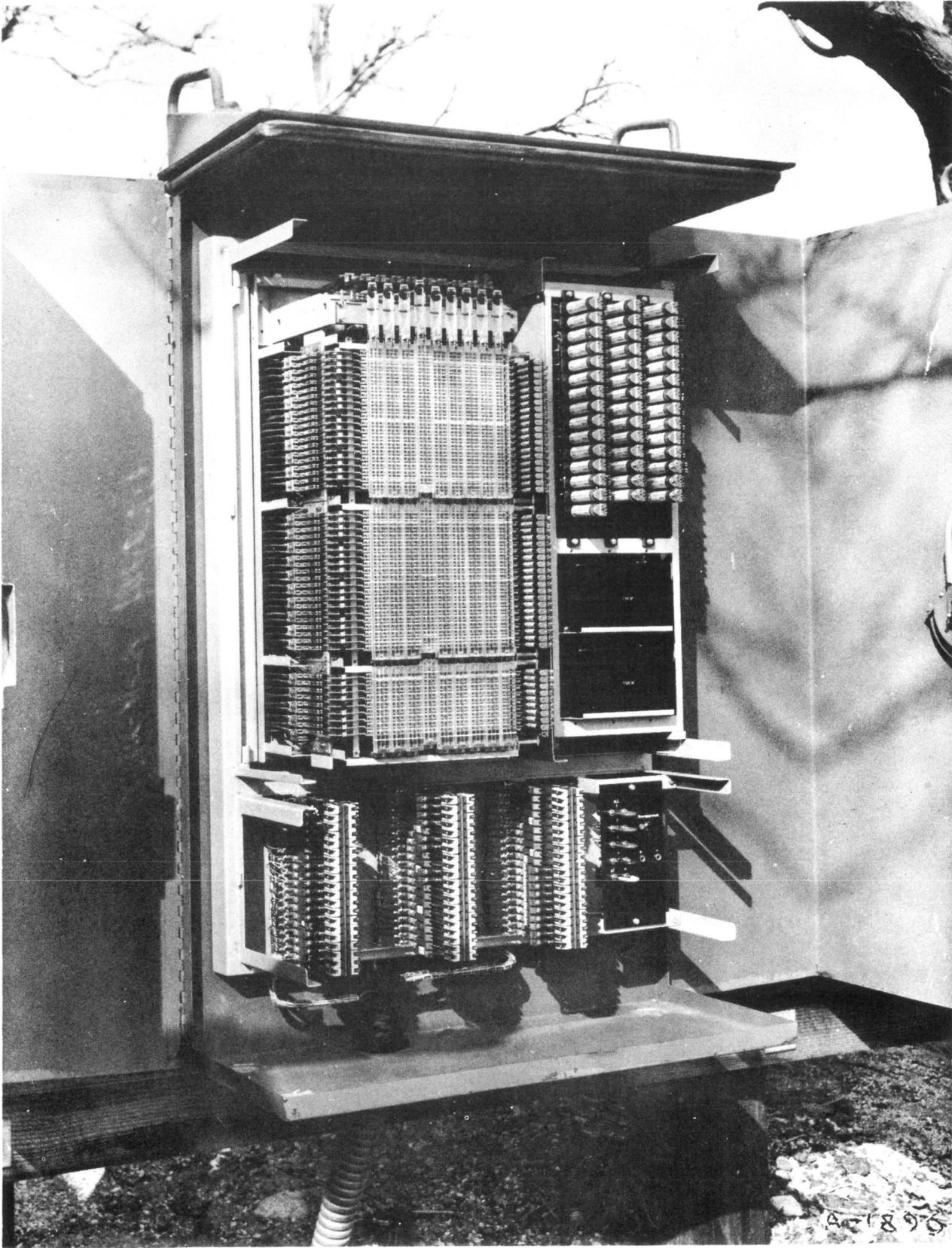


Fig. 6—Gfeller Line Concentrator 49-9-2
Remote Unit (Housing Doors Open, Covers Removed)

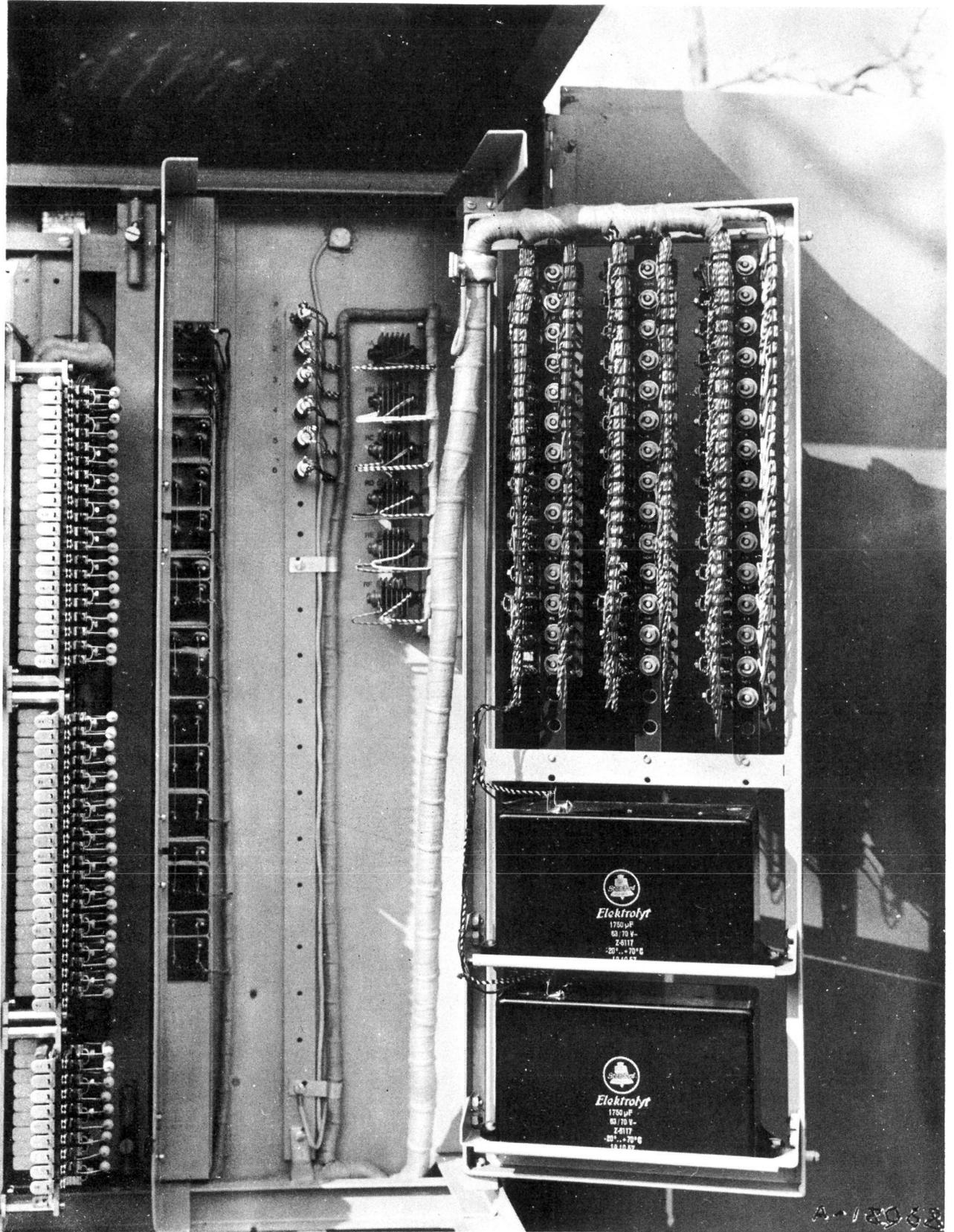


Fig. 7 — Gfeller Line Concentrator 49-9-2
Remote Unit (Interior View, Relay Rack Gate Open)