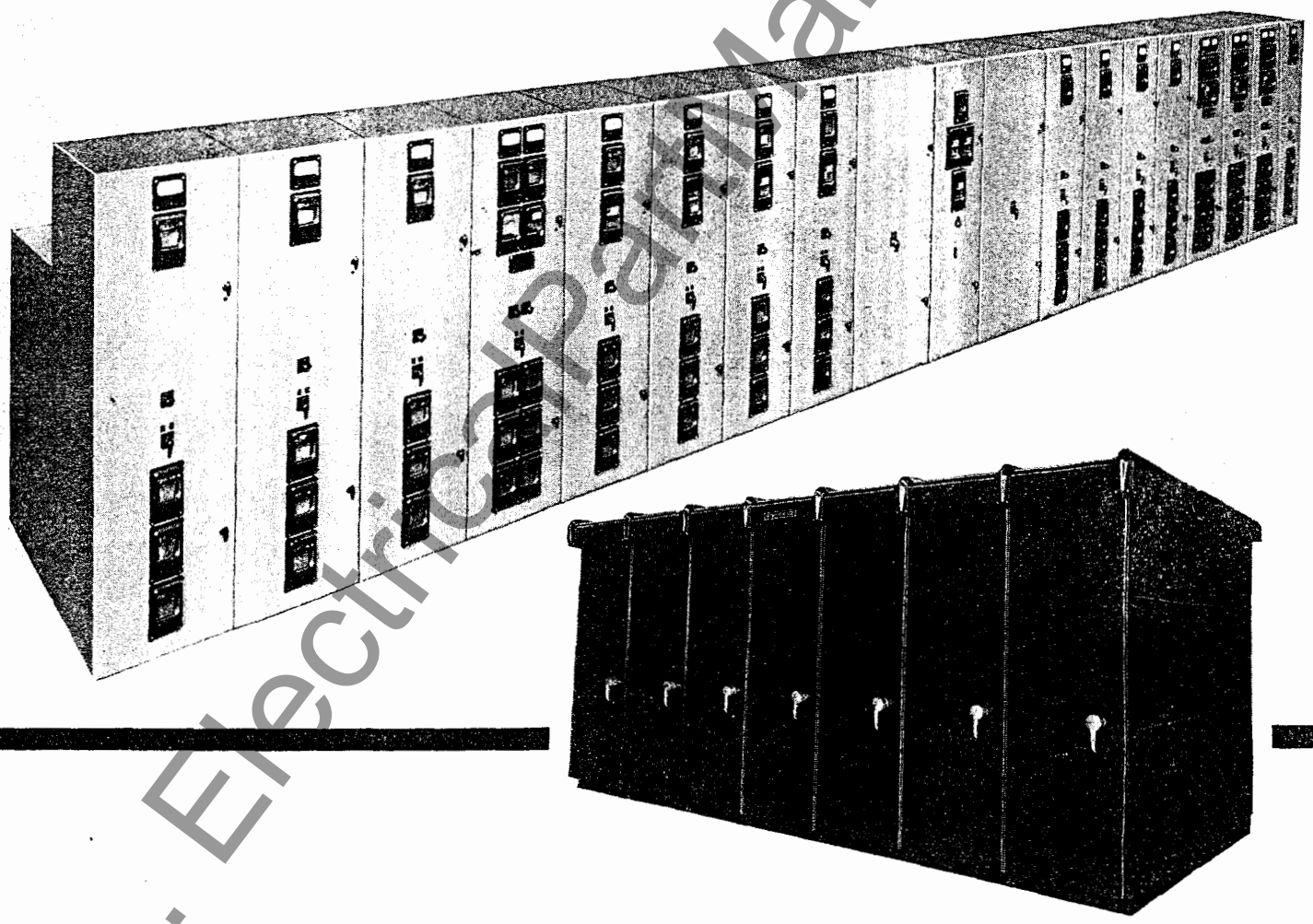
STANDARDIZE...

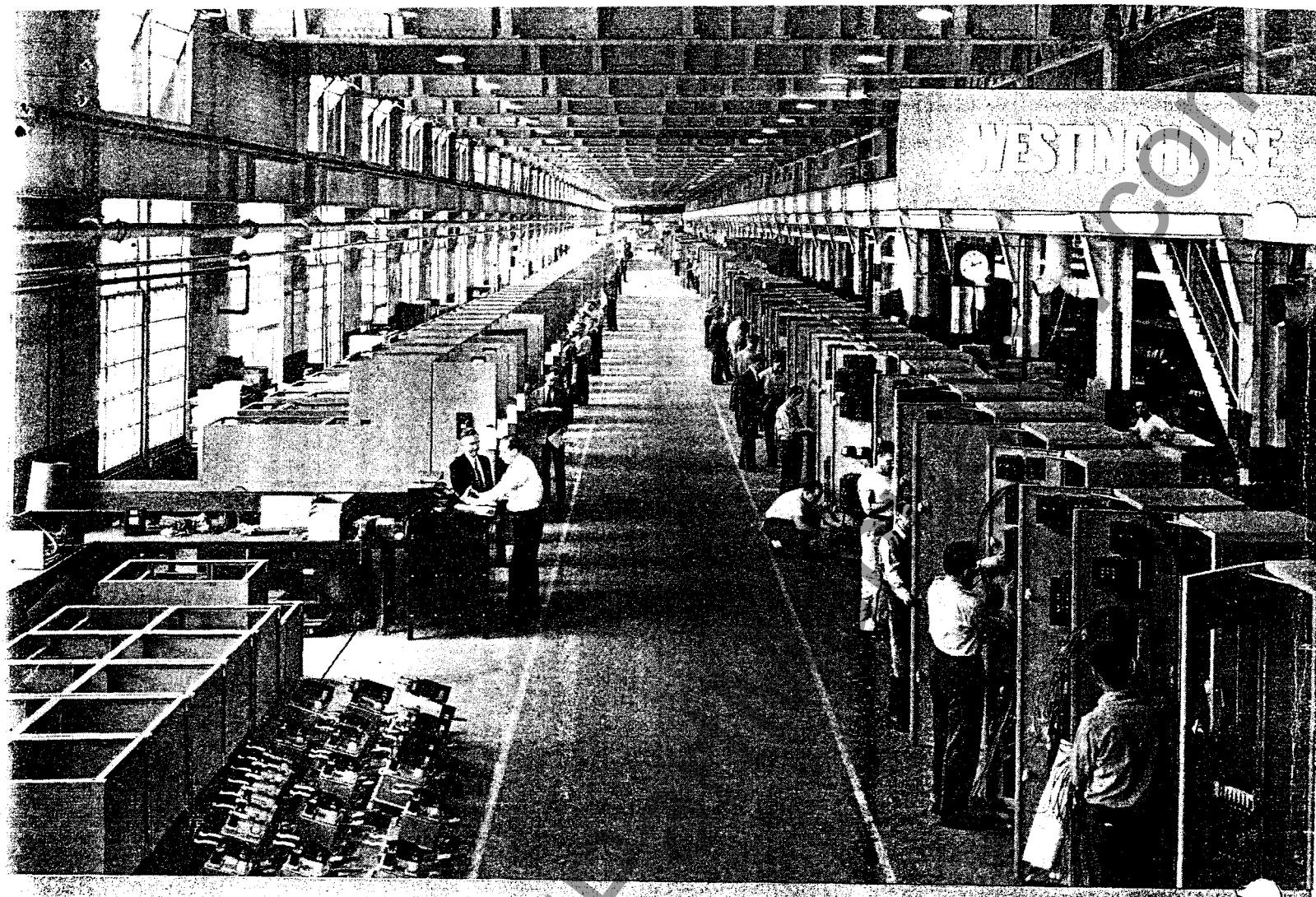
with Westinghouse heavy-duty metal-clad switchgear

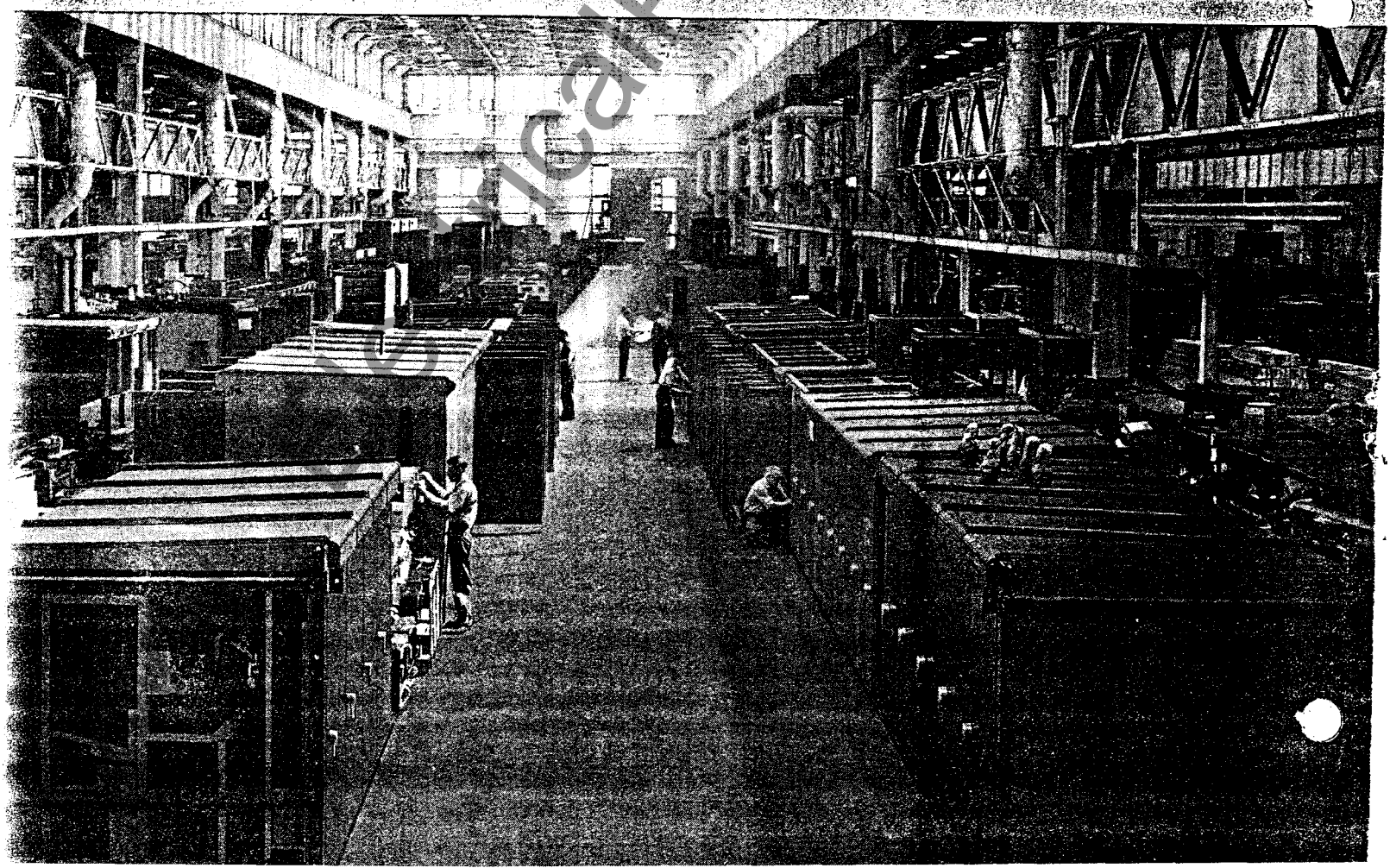


WITH TYPE DH DE-ION® AIR CIRCUIT BREAKERS

Horizontal Drawout
150 to 500 MVA Interrupting Capacity
5,000 and 15,000 Volts* • 600 to 2,000 Amperes
Indoor and Outdoor Service

*see note—page 3


WESTINGHOUSE



SWITCHGEAR . . . STANDARDIZED FOR YOU

The combination of your experience and ours—yours in operating switchgear and ours in designing and building it—has produced this ideal result . . .

A Practical, Standardized Design of Metal-Clad Switchgear that Meets All General Industrial and Electric Utility Requirements.

The Westinghouse Switchgear Division location at East Pittsburgh affords concentration of designing and manufacturing operations with ready accessibility to our High Power Laboratory testing and research facilities.

Standardized Metal-Clad Switchgear provides important customer benefits not obtainable in specially-engineered apparatus. It utilizes available stocks of standard materials . . . permits planned tooling and master precision fixtures for the fabricating, assembling, wiring and finishing processes . . . employs proved, uniform methods of workmanship. These standard materials, facilities and methods make possible repetitive manufacturing processes that produce a consistently high-quality product at reduced manufacturing time and cost . . . and thus enable us to deliver switchgear faster and at lower installed cost to you.

In short, Westinghouse Metal-Clad Switchgear offers safer and more efficient operation at low cost—through Standardized Design that adequately allows for simplified expansion or conversion. That's why . . .

It's *Standardized* for You!

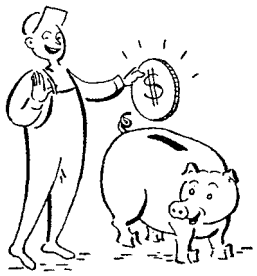
index

** The Metal-Clad voltage ratings of 5,000 and 15,000 volts, as covered in this booklet, are* **voltage classes.** *For actual voltage ratings of the power circuit breakers, see Table A on page 39.*

IT'S *STANDARDIZED* TO BRING YOU 10 MAJOR ADVANTAGES!

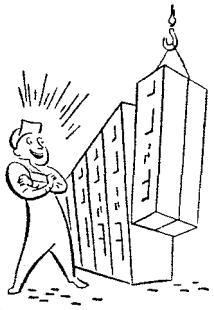
1. lower planning and ordering costs

The advantages of standardization in Westinghouse Unitized Switchgear first become apparent when you plan for and order new switchgear equipment. Costs normally attached to this phase of procurement are greatly reduced because a simplified ordering procedure eliminates the time and expense usually involved in special engineering, preparing special bills of material and specifications, ordering and receiving special stocks of material.



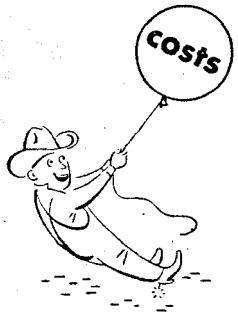
2. lower manufactured cost

Because standardization permits the use of faster, planned production methods, you get in Unitized Switchgear maximum quality at minimum cost. Savings gained by repetitive, tooled manufacturing processes, an adequate stock of standard assemblies and materials, and the elimination of special engineering, are returned to you in the form of a lower price per standard switchgear unit.



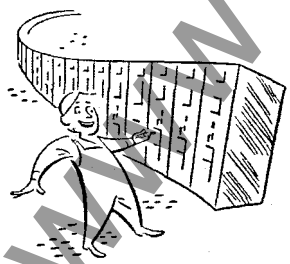
3. lower installation cost

Standardization of Unitized Switchgear permits a substantial cut in installation costs too. Its uniform construction enables you to plan conduit and foundation layouts in advance. And, because Westinghouse Switchgear is completely factory assembled, wired and tested to simulate service conditions, you need only to mount the units on their foundation and connect main and control circuits.



4. lower operation and maintenance costs

Standardization creates many features that contribute to lower operation and maintenance costs. Important among these is a design that simplifies operation by providing safe, convenient accessibility to all component parts, more circuits in less space, and disconnects combined physically to breaker elements. Maintenance is simpler because the time required in getting to and servicing the equipment is reduced to a minimum.



5. greater service continuity

Replacement of breakers is only a matter of minutes in Westinghouse Standardized Switchgear. Since breaker units are perfectly interchangeable, new units fit without time consumed in matching mounting dimensions or aligning contacts. Horizontal drawout eliminates lowering or lifting. Where multiple bus structures are required, interchangeability permits transferring breakers without interrupting service.

6. greater safety

Standardized Westinghouse Switchgear provides unusual safety through interlocking devices and full steel barriers in a completely compartmentalized design. Each compartment is accessible and provides complete isolation against live circuits in adjacent compartments. During operation, inspection or maintenance . . . maximum safety is assured.

7. greater versatility

Jig assembly of the breaker and stationary structure of Metal-Clad Switchgear provides unusual versatility. Units can be rearranged within the same structure or moved from one location to another with almost full salvage value. And because all 600 and 1200-ampere breakers in the same voltage class are physically interchangeable in stationary structures, conversion to a higher interrupting capacity can be accomplished with minimum expense.

8. longer life

Complete standardization of Unitized Switchgear permits the employment of materials, processes and manufacturing methods that produce a strong, durable switchgear structure. This steel stationary structure provides long-lasting protection against damage to breakers and other vital interior parts. The stationary structure is protected against rust by a Bonderizing treatment and other finishing processes that add years to housing life.

9. shorter manufacturing time

Planned production methods also serve to improve delivery by cutting the time between the placing of your order and final installation of switchgear equipment. Because production is based on standardized drawings and requires only standard stock assemblies and materials, no time is lost in special engineering, special manufacturing or waiting for deliveries from outside suppliers.

10. unit responsibility

Standardized Westinghouse Switchgear assures complete, undivided responsibility through complete control of design and manufacture of all component parts used in its assembly. This co-ordination of design and equipment assures the highest quality and finest performance of the equipment.

INDOOR METAL-CLAD SWITCHGEAR

The first section devoted to indoor switchgear contains facts relating to operation, standard and available arrangements, and dimensions. Similar information relating to outdoor switchgear will be found on pages 18 through 25. Type DH Air Breakers and other features common to both indoor and outdoor switchgear are covered on pages 26 through 37.

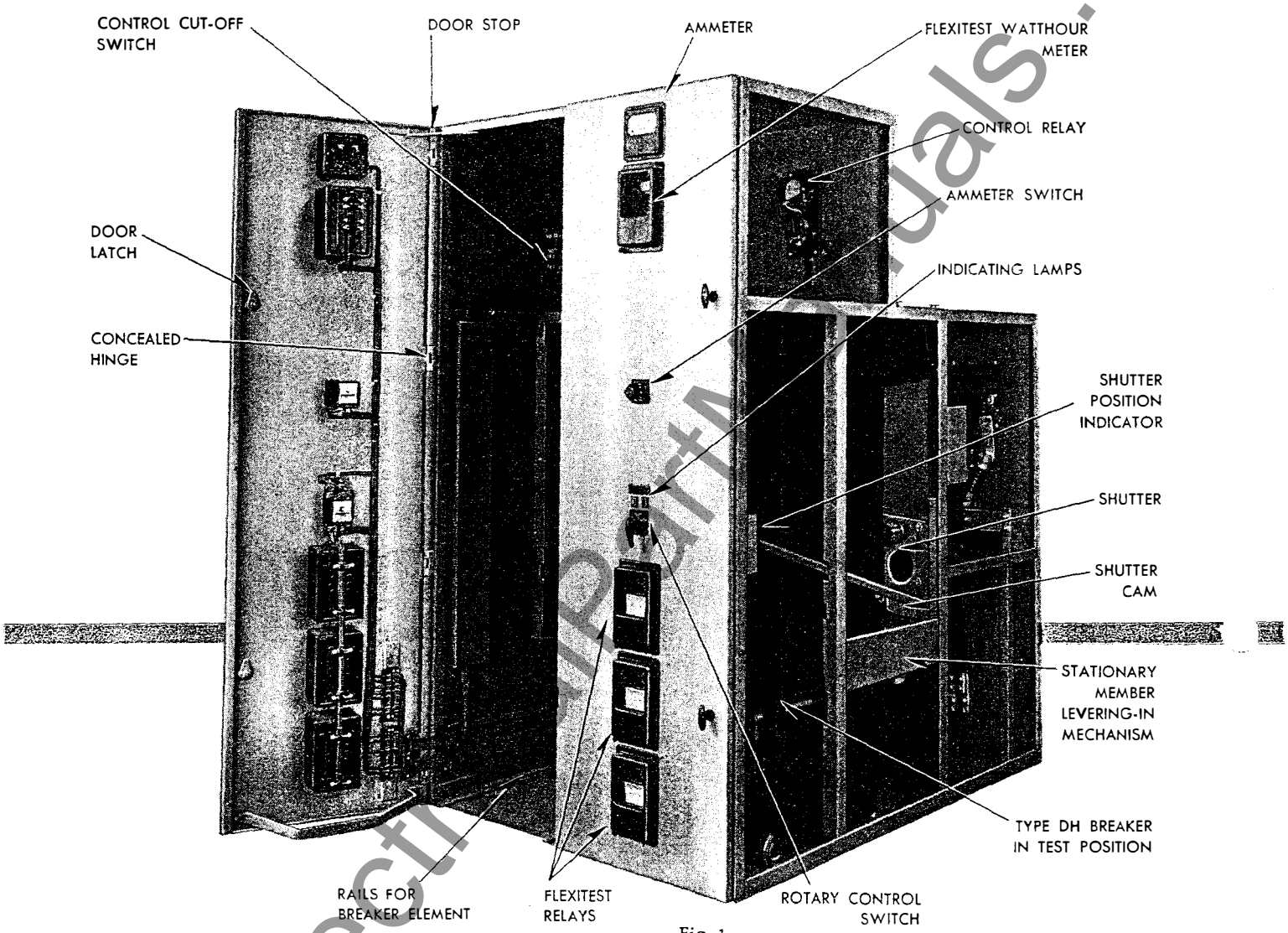


Fig. 1.

replacement of breaker elements is a simple procedure

The fast breaker replacement feature contributes to the high degree of service continuity obtainable with Westinghouse Standardized Switchgear. The interchangeable breakers eliminate time consumed in matching mounting dimensions or aligning contacts. Since breakers are drawn out horizontally, no lowering or lifting is necessary. Where multiple bus structures are required, the interchangeability feature of the apparatus permits transferring breakers without interrupting service.

Standardized units have a background of operation experience which eliminates unproved features. Full steel barriers separating compartments, fully insulated busses and automatic interlocks are features that boost reliability and minimize the possibility of service interruption.

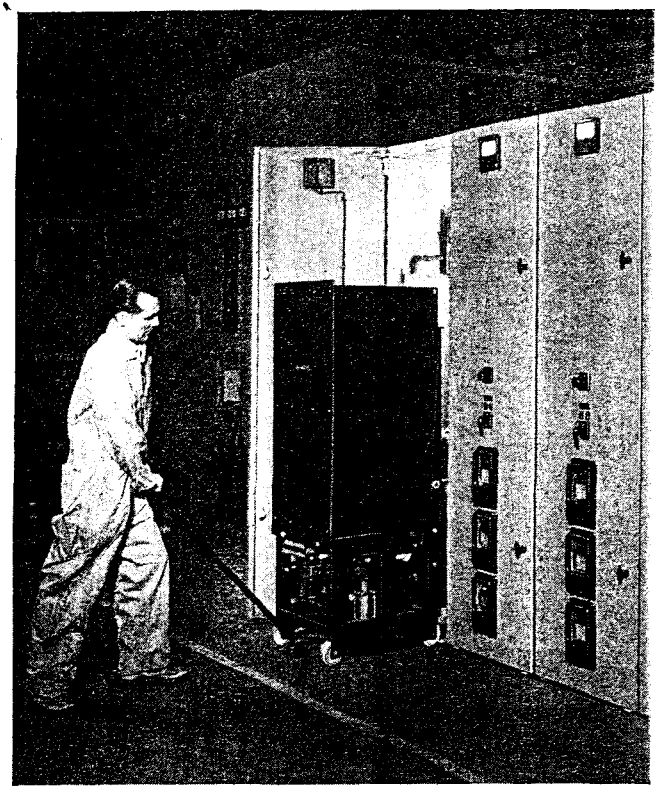


Fig. 2. Bring up replacement breaker and line up wheels on track. Wheels have two rim surfaces—one for the floor, the other, of smaller diameter, for the track which lines up breaker in the stationary structure.

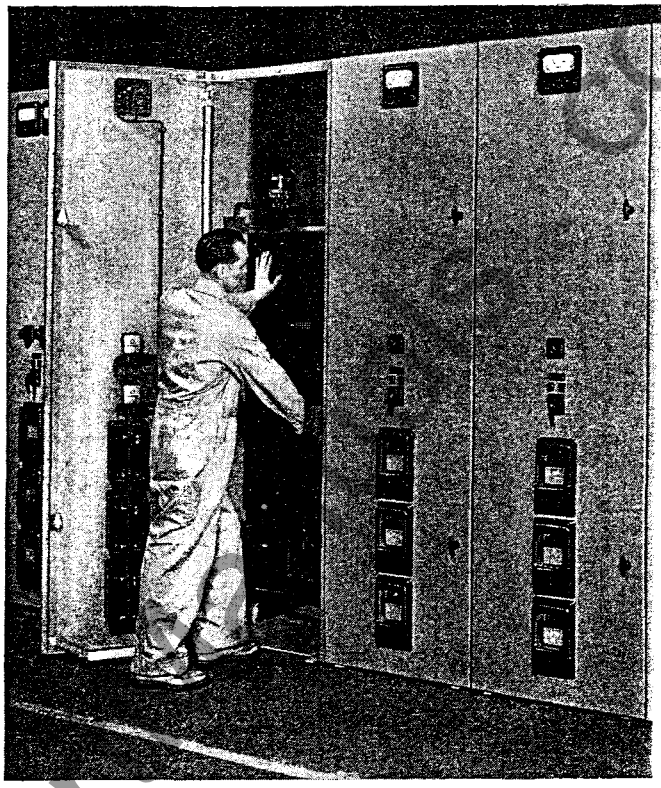


Fig. 3. Push the circuit breaker to test position. Breaker is stopped at test position by drive-in device. Metal shutter for primary disconnects remains closed.

Fig. 4. Crank to connect. Movement from test to operating position is accomplished by a few easy turns of the crank. The metal shutter opens automatically as the breaker is advanced (see page 33). An interlock prevents crank motion if breaker is in closed position (see Fig. 101, page 31).

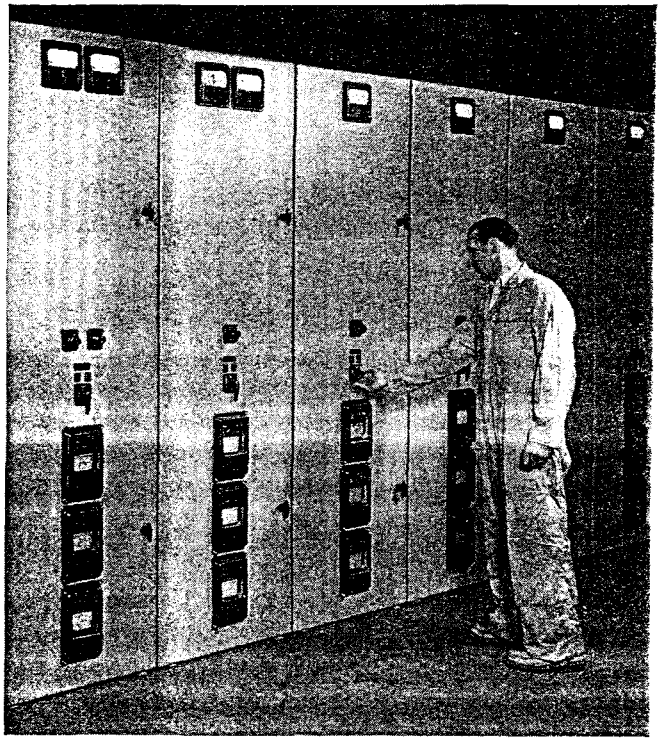


Fig. 5. Turn on power. Two metal barriers are between operator and breaker when circuit is energized, providing complete safety to operator. Control switch has modernistic design handle (see page 35).

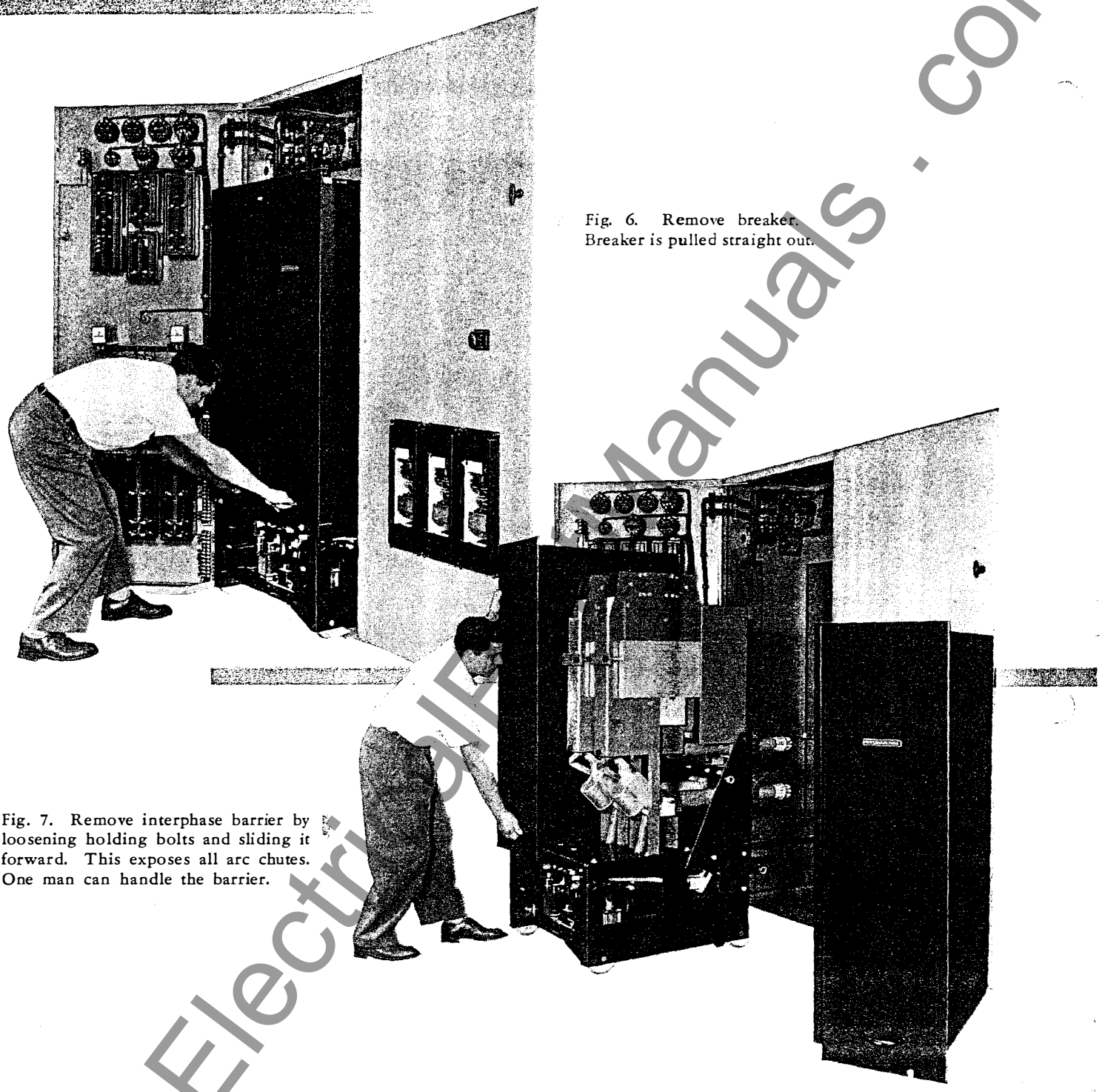


Fig. 6. Remove breaker. Breaker is pulled straight out.

Fig. 7. Remove interphase barrier by loosening holding bolts and sliding it forward. This exposes all arc chutes. One man can handle the barrier.

breaker inspection is convenient

Rather than replace breakers when it is desirable to check operation and inspect main contacts, it is only necessary to withdraw breaker and remove interphase barrier and arc chutes. Contacts are conveniently exposed at working height. Breaker can be manually closed, slowly, for check on primary contact operation. The complete inspection takes only a few minutes.

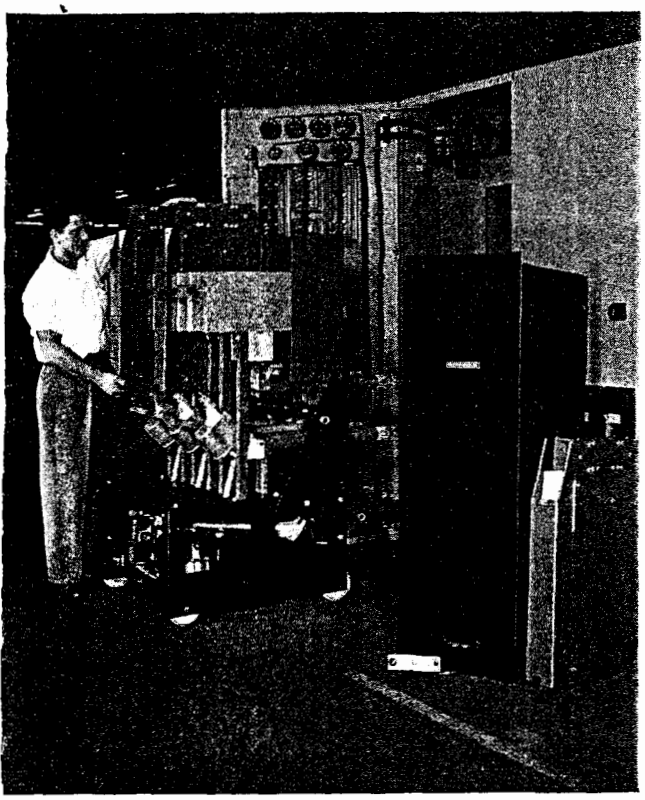


Fig. 8. Remove arc chutes by removing a few accessible bolts. Arc chutes are readily handled.

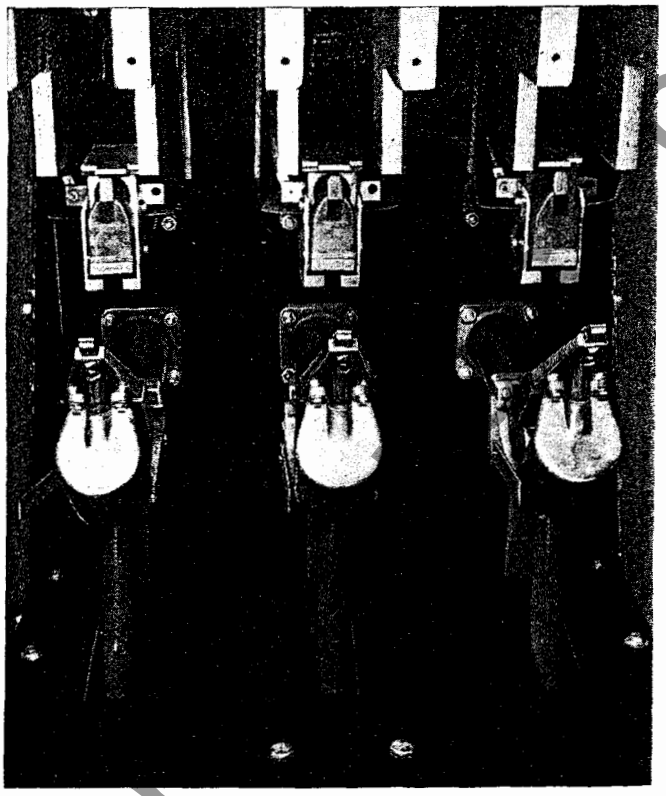


Fig. 9. Front view of breaker contacts. All three pole units are accessible.

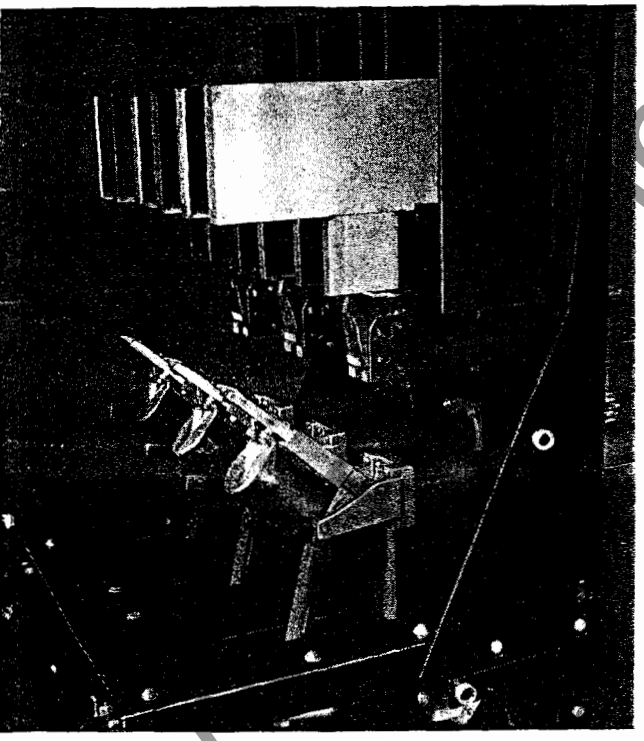


Fig. 10. CONTACTS OPEN

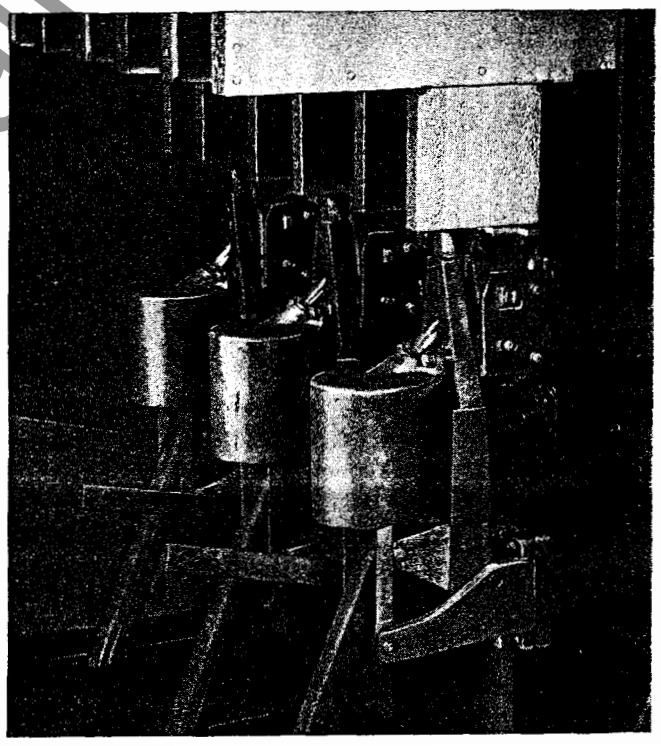


Fig. 11. CONTACTS CLOSED

Breaker contacts are accessible at a convenient working height. Close inspection is not impaired by cramped quarters. No further disassembly is necessary for inspection and minor maintenance of the contacts.

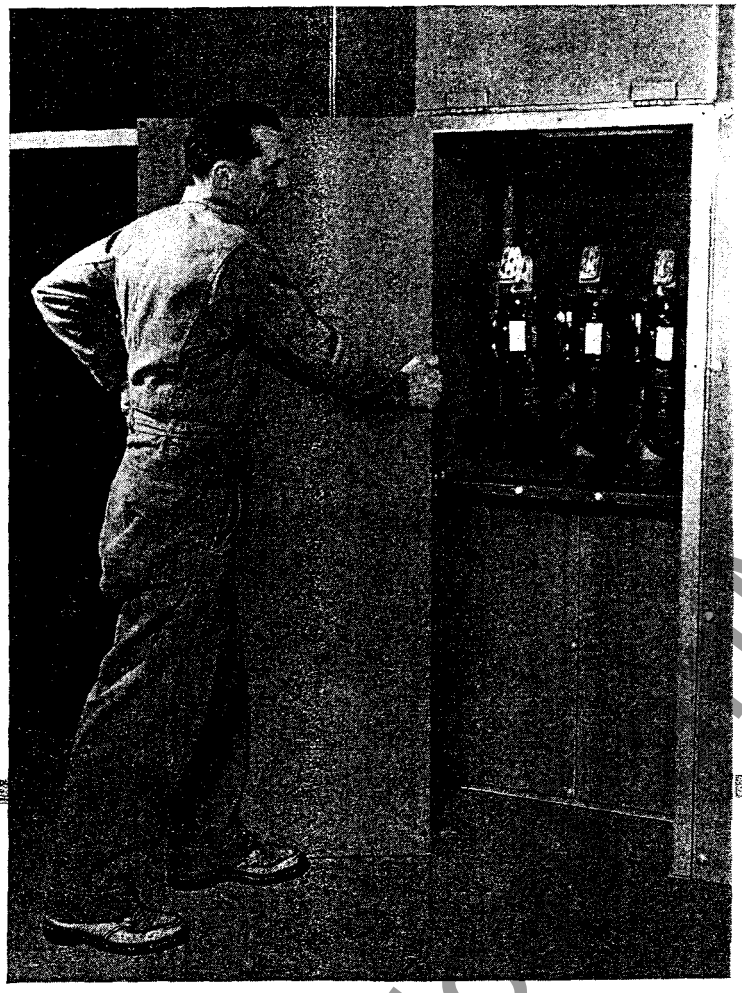


Fig. 12. Remove rear barrier for inspection of transformers and connections. Barrier is removed by unscrewing a few bolts.

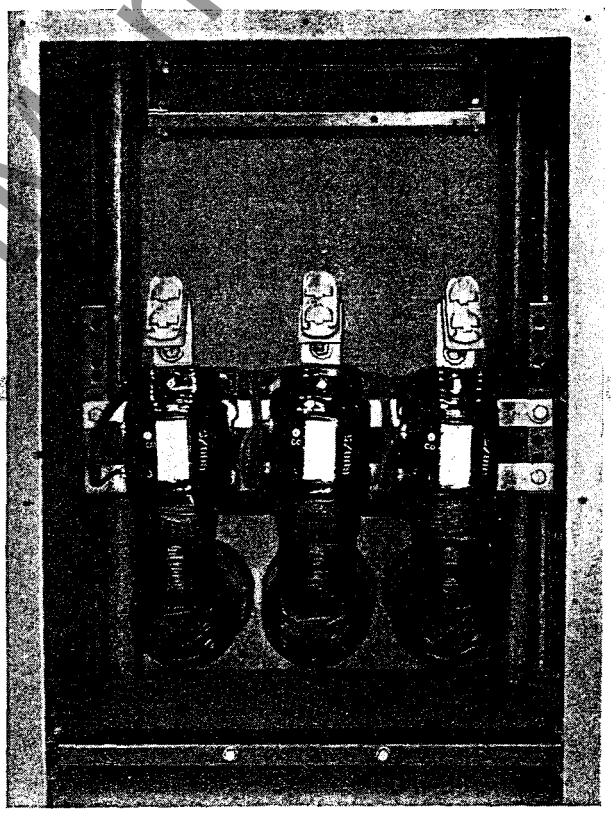


Fig. 13. Current transformers are accessible from rear. View at right shows arrangement of transformers and cable clamps.

Components are accessible for maintenance

Standardization of Westinghouse Metal-Clad Switchgear provides many features that contribute to lower maintenance costs. Removable, bolt-on covers make components in the various metal-enclosed compartments readily accessible. Inspection and maintenance of a portion of a circuit is easy and safe because that circuit can be completely de-energized and isolated from other circuits of the switchgear assembly. The disconnecting contacts are combined physically with the removable breaker element. Insulated circuits in compartmentalized structures provide more circuits in less space with greater safety and lower operating cost.

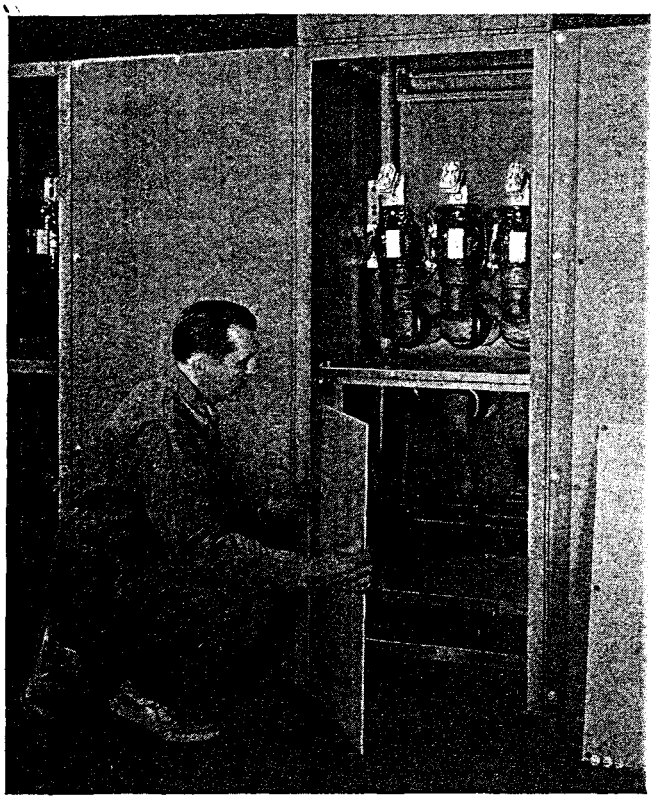


Fig. 14. Remove barriers of main bus compartment. Busses are also accessible from breaker compartment.

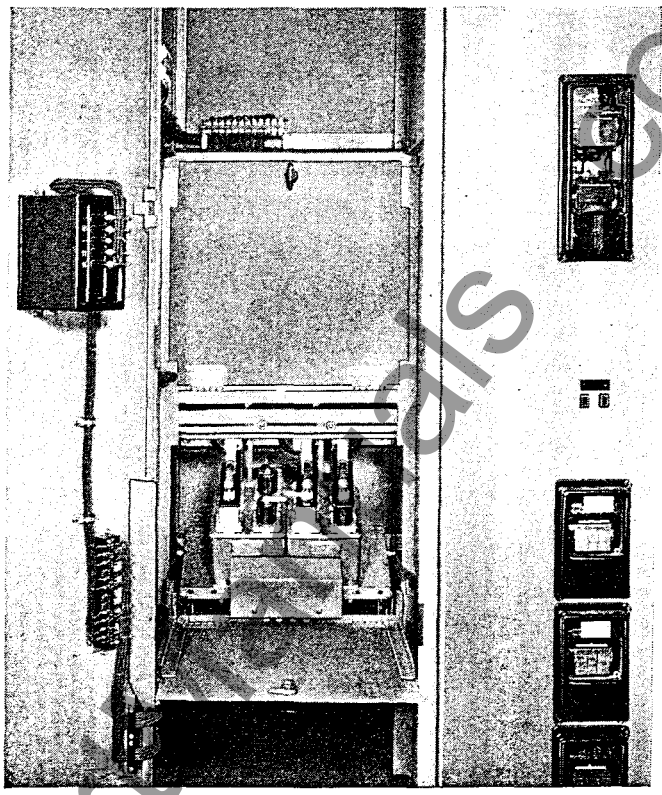


Fig. 15. Potential transformer in auxiliary compartment. Drawout arrangement automatically disconnects and grounds transformer when access to BAL fuses is necessary.

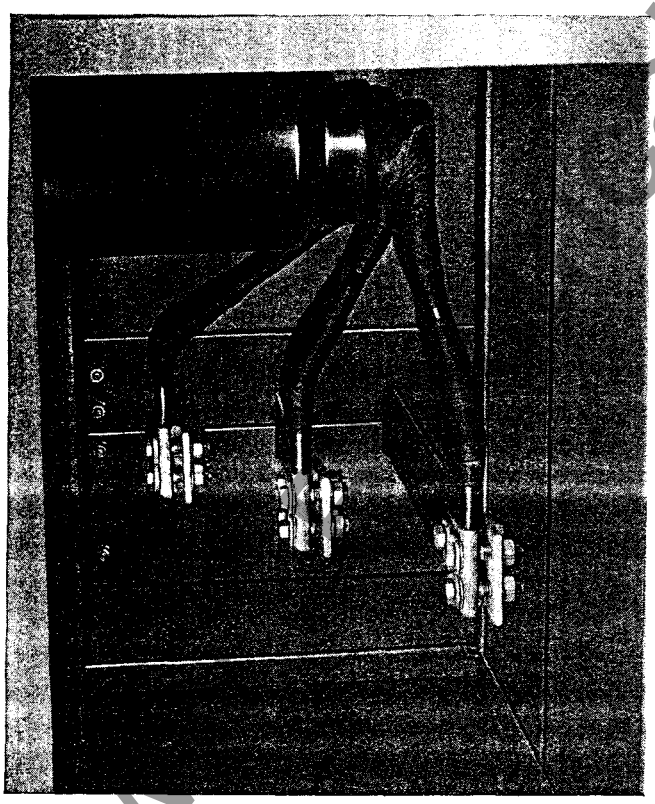


Fig. 16. Busses easily extended when adding units. Bus ends, insulation, support and cover are removed. An insulated support completes bus insulation between units.

Fig. 17. Bus taps enclosed . . . Moldarta® compound box easily installed and filled with insulating compound.

INDOOR SWITCHGEAR 5 KV
standard arrangements

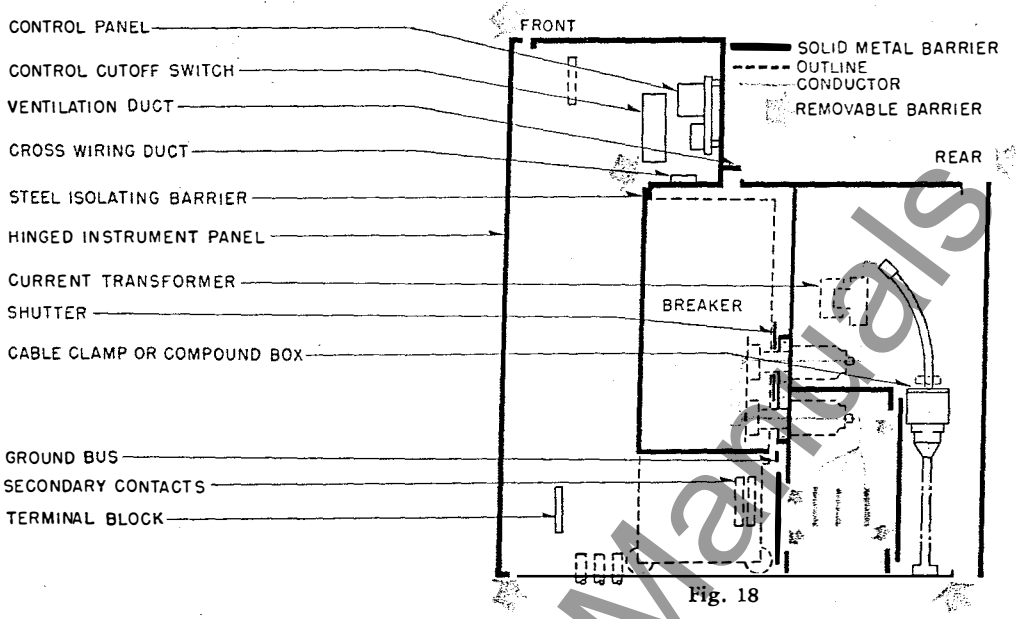


Fig. 18

steel barriers confine any possible disturbance. 1/8-inch steel forms compartments for busses, instrument transformers, etc. Isolation of compartments is aided by use of Micarta® and other insulating materials.

individual access to all compartments is provided by removable barriers at points indicated above. Operator is not exposed to live circuits in adjacent compartments.

outline dimensions

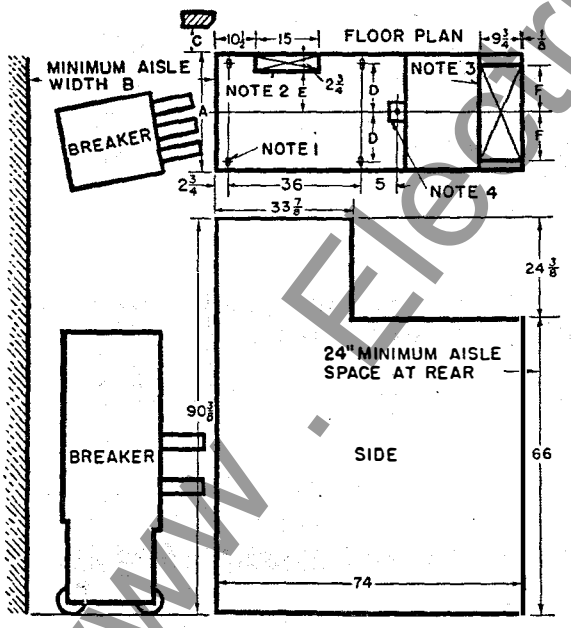


Fig. 19. Outline dimensions of Metal-Clad Units for 50-DH-150 and 50-DH-250 Switchgear.

TYPE OF UNIT	AMPS	DIMENSIONS						APPROX. WEIGHT	
		A	B	C	D	E	F	Dead Weight	*Impact Weight
50-DH-150 50-DH-250	1200	26	36	17	11 13/16	10 3/16	10 15/16	3000	3600
50-DH-150 50-DH-250	2000	36	43	23	16 13/16	15 3/16	15 15/16	3400	4000
All 75 and 150 DH Ratings	1200	See Figure 28, Page 15						4000	5000
	2000							4200	5300

NOTE: Actual weight will vary in proportion to amount and type of auxiliary equipment in the units.
* Total includes dead weight.

NOTE 1—¾″ x 1¼″ slotted holes for ⅝″ bolts or plug welding. Plug welding preferred.

NOTE 2—Maximum space for secondary conduits—1½″ maximum size—3″ maximum above floor.

NOTE 3—Maximum space for main conduits.

NOTE 4—Location for purchaser's ground connection. In groups involving six units or less, this connection is made in the second unit from the left end. In larger groups, ground connections are made in the second unit from each end.

For recommended mounting of switchgear units, see page 15.

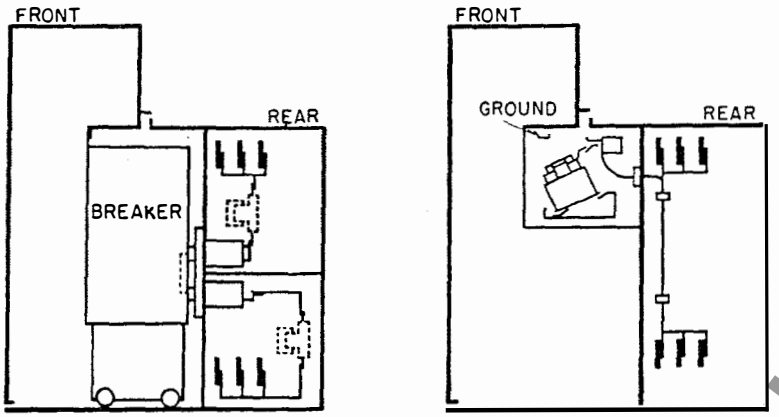


Fig. 20. Bus sectionalizing arrangement.

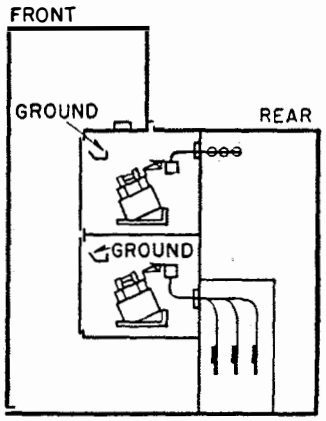


Fig. 21. Auxiliary unit housing two sets of drawout disconnecting-type potential transformers.

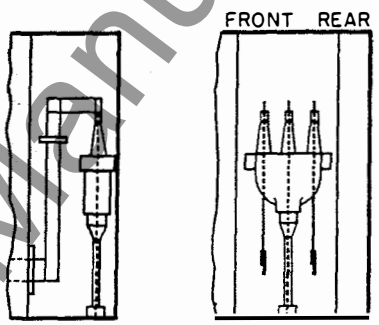


Fig. 22. End compartment for incoming lines, connected directly to bus.

maximum number of panel-mounted instruments and relays

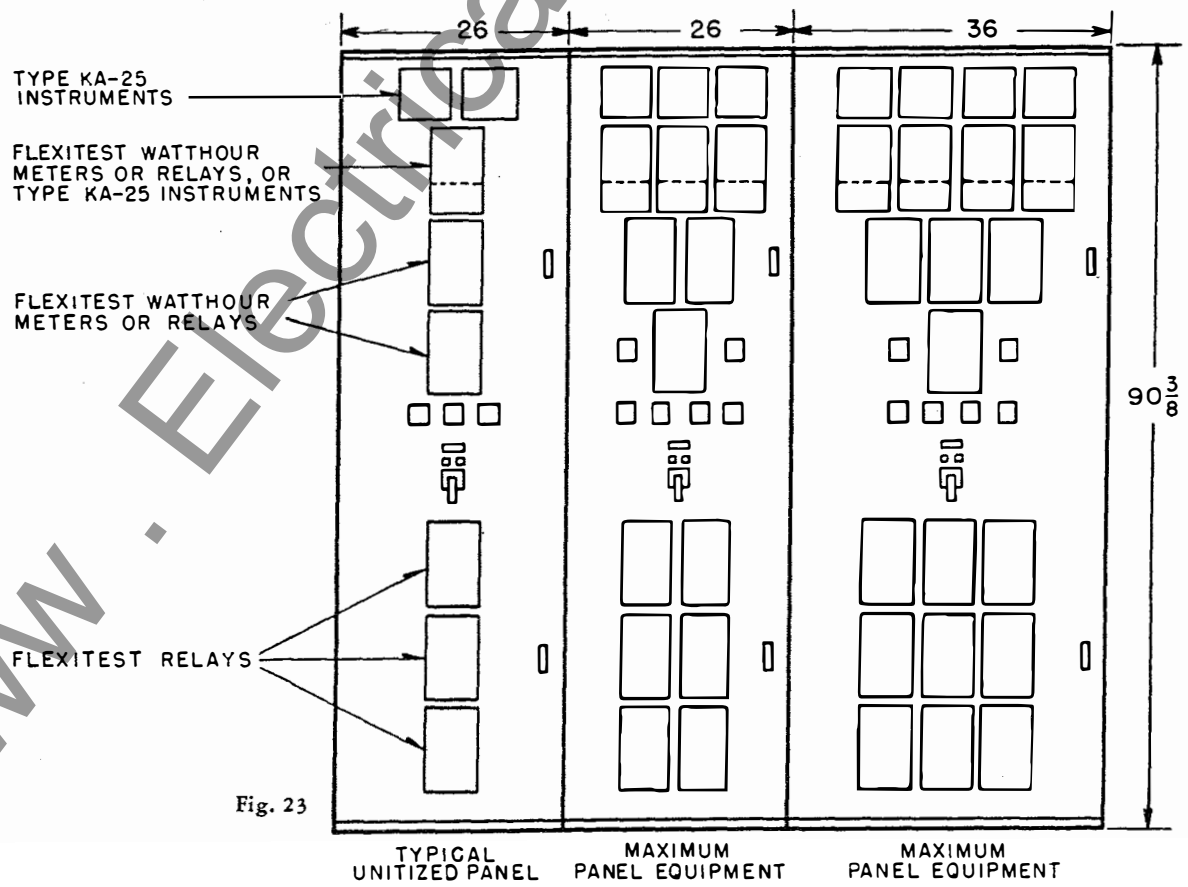


Fig. 23

INDOOR SWITCHGEAR 7.5-15 KV
standard arrangements

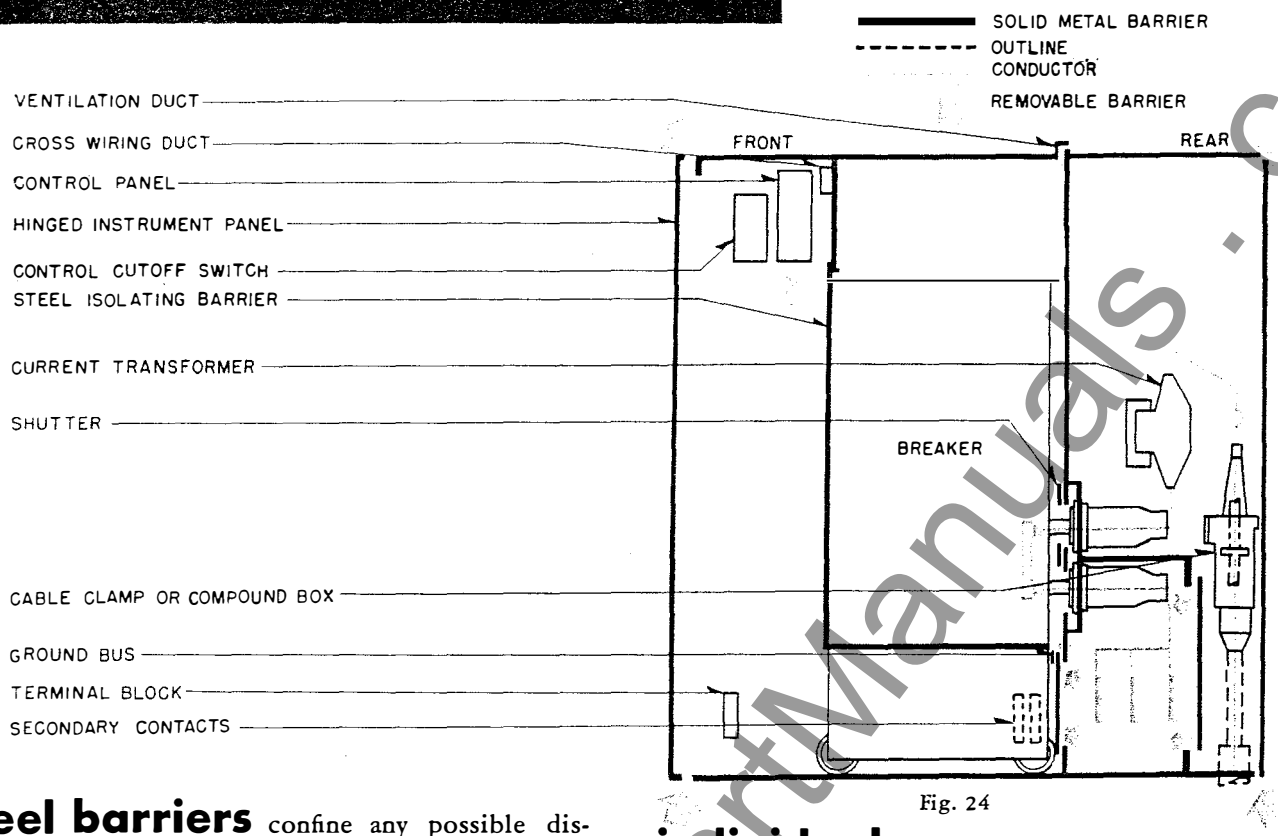
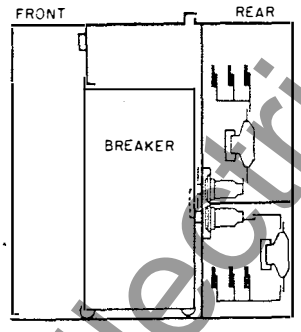


Fig. 24

steel barriers confine any possible disturbance. ⅛-inch steel forms compartments for busses, instrument transformers, etc. Isolation of compartments is aided by use of Micarta and other insulating materials.

individual access to all compartments is provided by removable steel barriers at points indicated above. Operator is not exposed to live circuits in adjacent compartments.



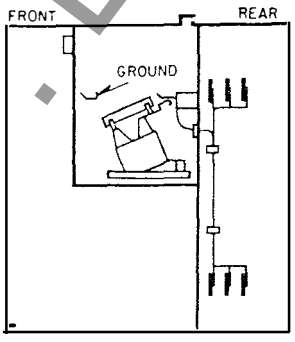


Fig. 25. Bus sectionalizing arrangement.

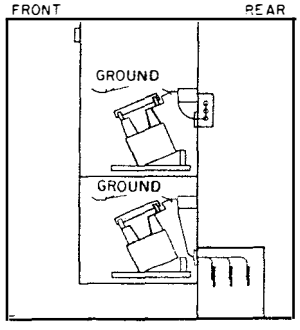


Fig. 26. Auxiliary unit housing two sets of drawout disconnecting type potential transformers.

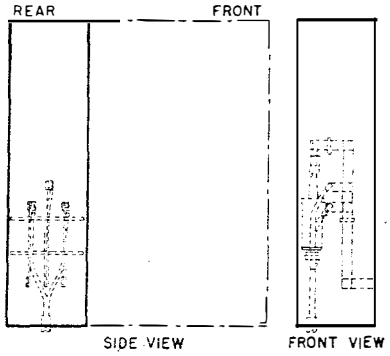
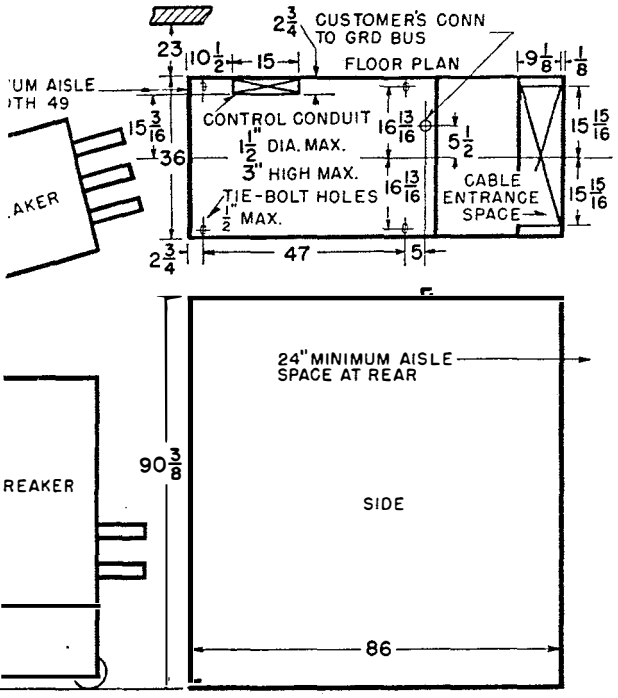


Fig. 27. End compartment (for incoming lines) connected directly to bus.

utline dimensions . . .



8. Outline dimensions for 75-DH, 150-DH units.

APPROXIMATE WEIGHTS

TYPE OF UNIT	AMPS.	DEAD WT.	*IMPACT WT.
All 75 and 150-DH Ratings	1200	4000	5000
	2000	4200	5300

* Total includes dead weight.

RECOMMENDED MOUNTING FOR 50-DH, 75-DH, AND 150-DH SWITCHGEAR UNITS

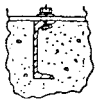


Fig. 29 ⅝"—11 tap in channel.

Fig. 30 ¾" hole in channel.

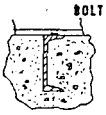


Fig. 31 Plug weld.

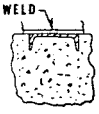


Fig. 32 For shallow floors.

mum number of panel-mounted instruments and relays

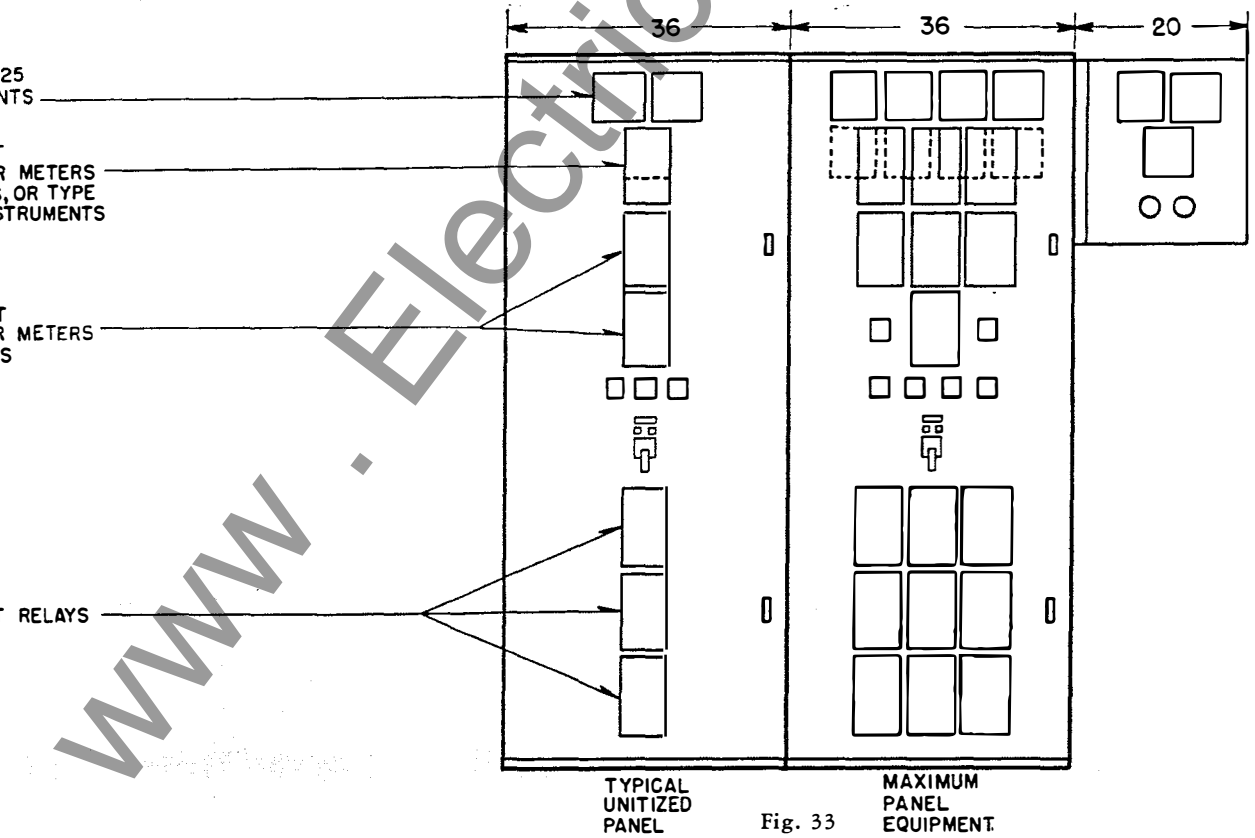


Fig. 33

INDOOR SWITCHGEAR 7.5-15 KV
available arrangements

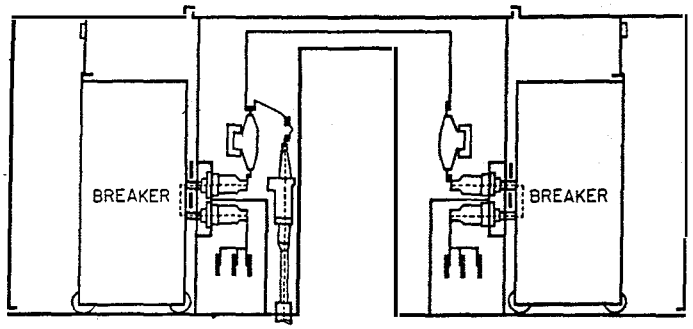


Fig. 46. Double bus—double breaker arrangement.

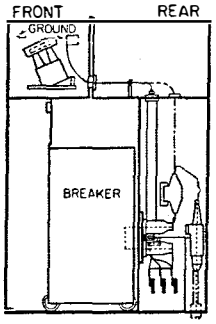


Fig. 47. Potential transformer —drawout type—in superstructure compartment.

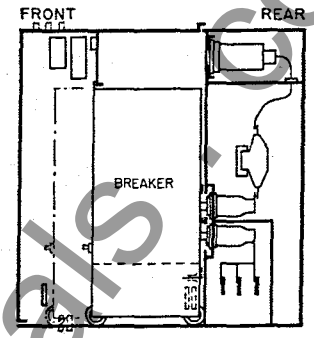


Fig. 48. Lightning arresters connected to line.

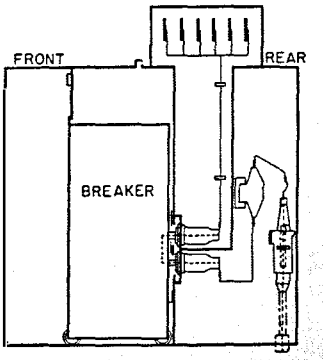


Fig. 49. 3000-ampere busses—interlaced paralleled bars in superstructure increase depth of cell 12 inches.

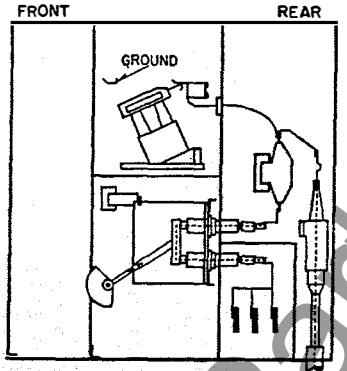


Fig. 50. Disconnecting switch unit with drawout potential transformer.

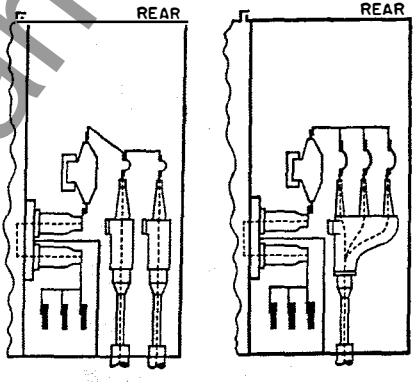


Fig. 51. Breaker unit requiring potheads for two or three parallel 3-conductor cables increases depth of standard unit 12 inches.

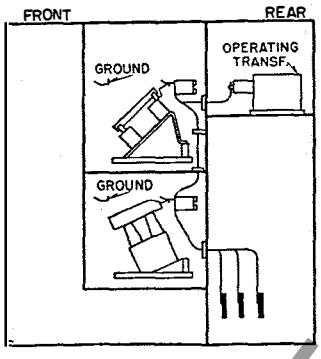


Fig. 52. Auxiliary unit for operating transformer and disconnecting fuses with disconnecting potential transformer, bus connected.

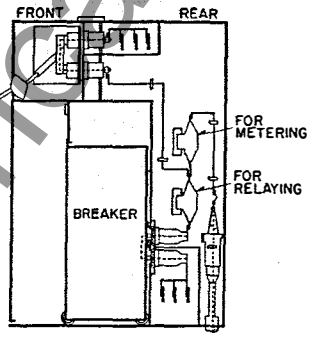


Fig. 53. Transfer bus with disconnecting switch.

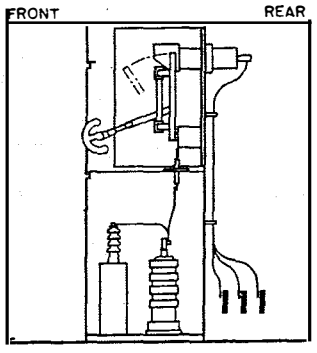


Fig. 54. Auxiliary unit for surge protective equipment.

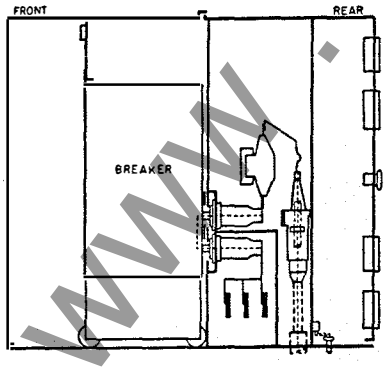


Fig. 55. Instrument panel opposite breaker side adds 16 inches to

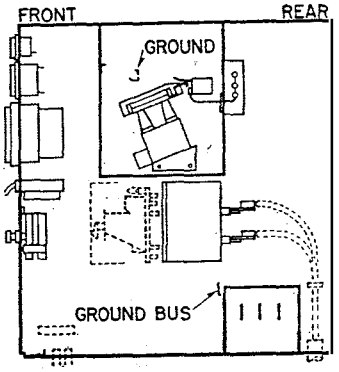


Fig. 56. Auxiliary unit for generator excitation control.

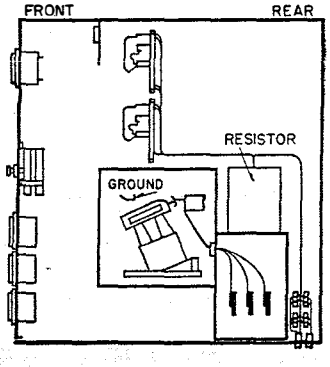


Fig. 57. Auxiliary unit for synchronous motor field control.

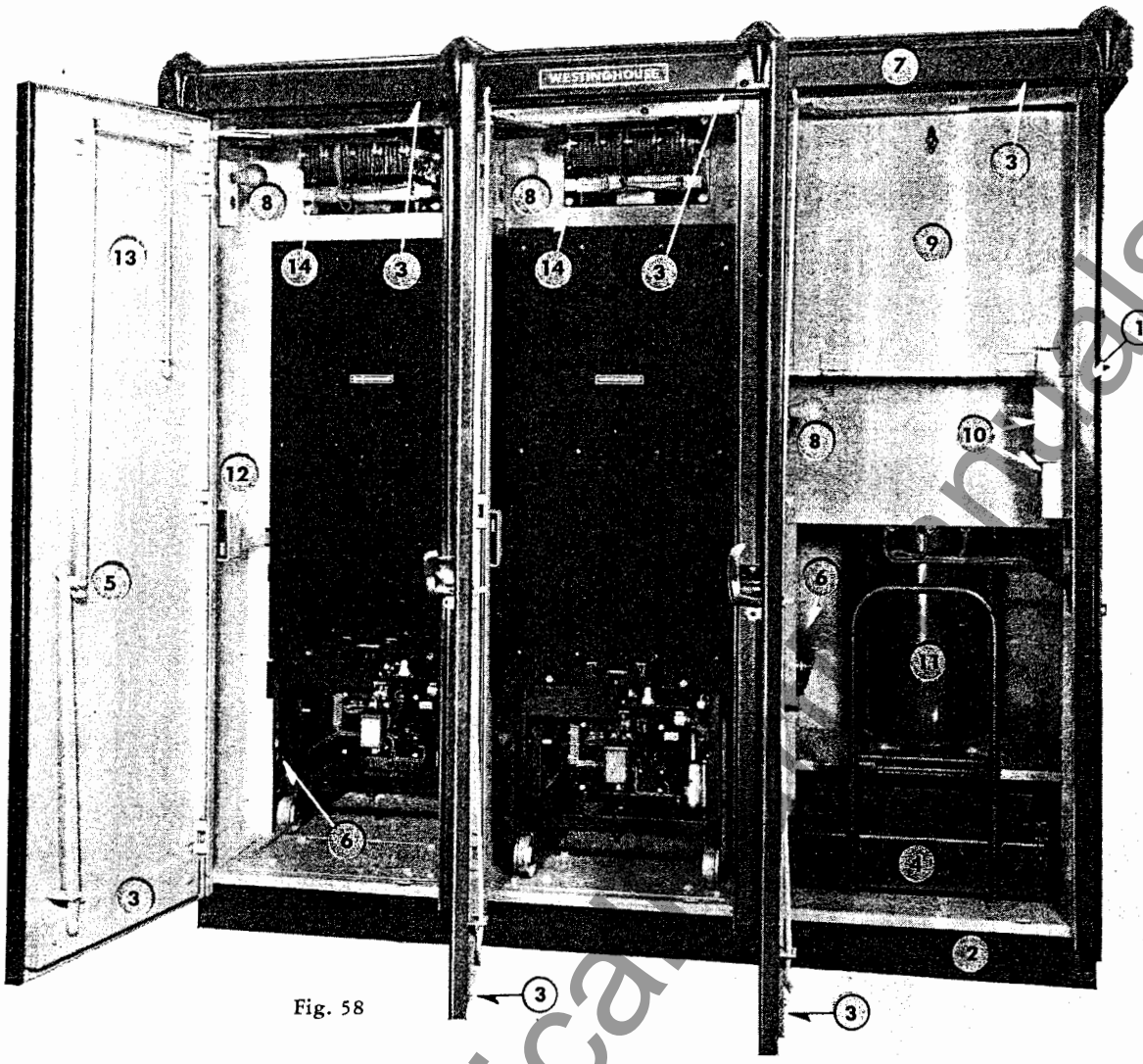


Fig. 58

Design planning has resulted in providing a distinctive Westinghouse family of outdoor metal-clad units for the complete range of air circuit breaker ratings with their associated auxiliary units.

1. Rigid, self-supporting, jig-welded unit construction.
2. Weatherproof, corrosion-resistant base construction.
3. Removable ventilating screens at top and bottom of both sides of unit.
4. Adjustable breaker transport truck in storage location (with operating transformer of 10 kva maximum capacity).
5. Latching mechanism.
6. Heater assembly (on breaker side and panel side).
7. Weather-tight, removable roof assembly.
8. Light and convenience outlet.
9. Door to disconnecting Type BAL fuse assembly.
10. AB Breaker and interlock assembly to fuse door (9) to isolate secondary load of operating transformer before breaking or making primary fuse connections.
11. Operating transformer.
12. Shutter position indicator.
13. Door stop and latching assembly.
14. Rectox rectifier for closing breaker.

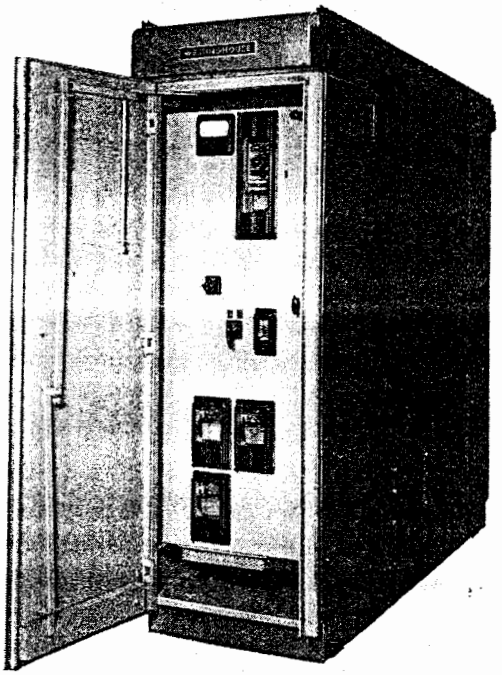


Fig. 59. Panel side of feeder breaker unit.

outdoor unit-constructed weatherproof assemblies

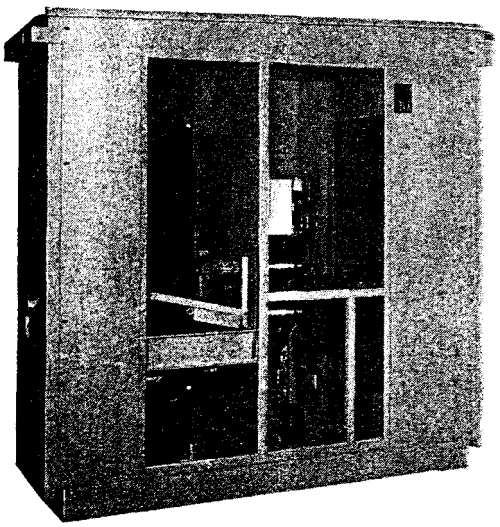


Fig. 60. Breaker unit stationary structure.

Unit construction of Westinghouse outdoor switchgear provides versatility to meet the needs of expanding electrical systems. Compartmentation is planned to provide maximum use of space, safe operating arrangements, and accessibility for inspection and maintenance. Removable bolted-on covers give access to high-voltage circuits.

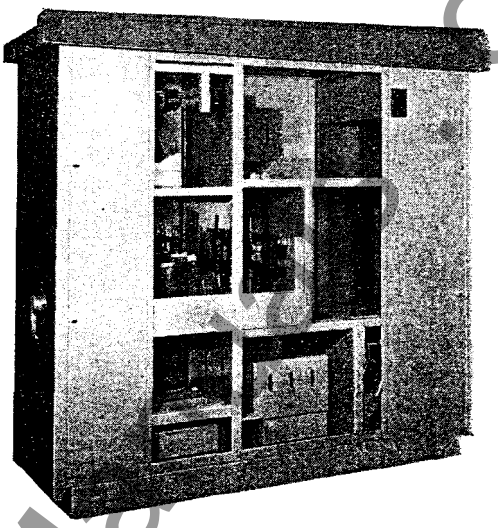


Fig. 61. Auxiliary unit stationary structure.

adjustable transport truck facilitates breaker handling

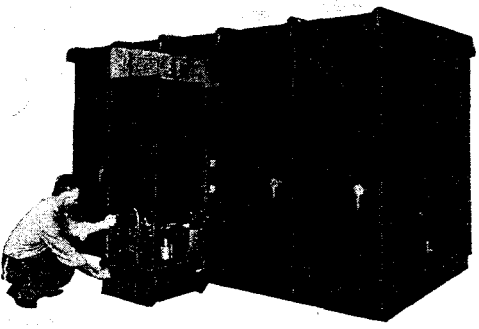


Fig. 62. Aligning adjustable transport truck with floor rails of stationary structure.

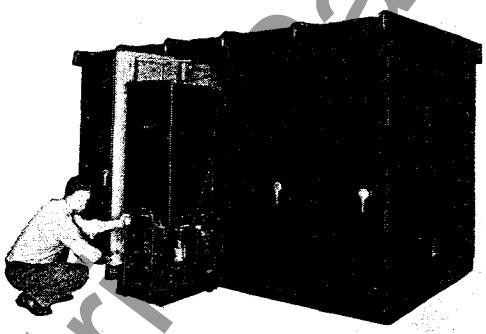


Fig. 63. Latch transport truck to stationary structure. Combination latch releases breaker unit.

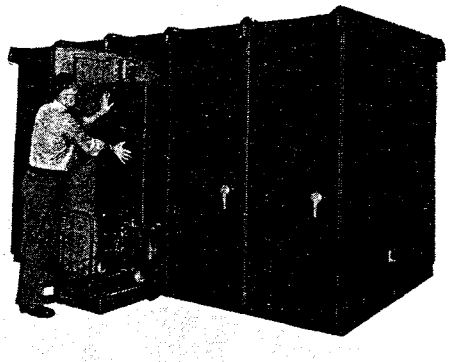


Fig. 64. Place breaker in disconnect position.

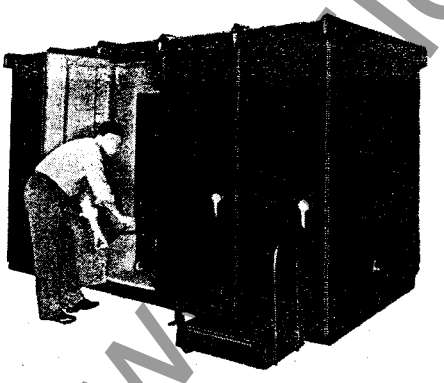


Fig. 65. Crank breaker element to operating position in stationary structure.

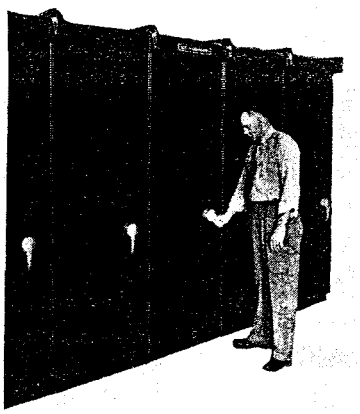


Fig. 66. Close and latch stationary structure door—breaker side.

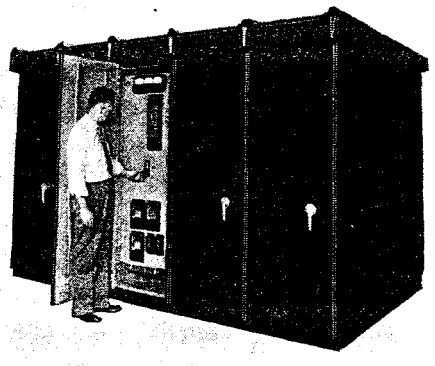


Fig. 67. Close breaker element by control switch on hinged instrument and relay panel—panel side.

accessories for outdoor metal-clad switchgear

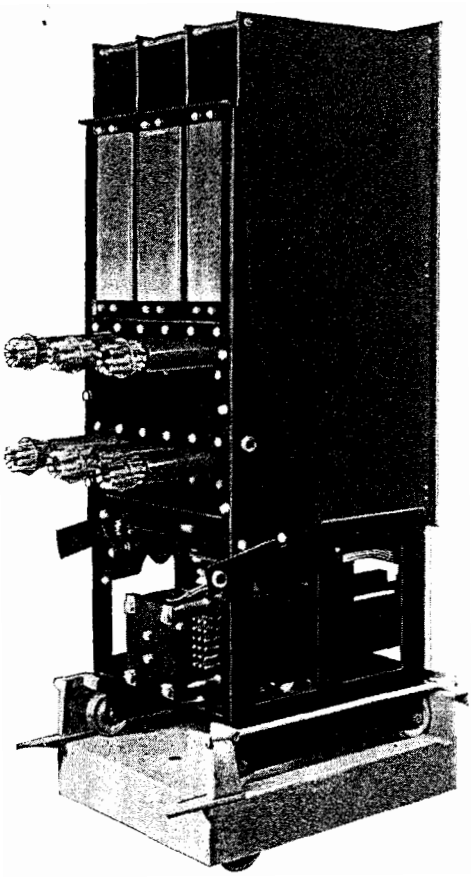


Fig. 71. Adjustable transport truck with combination latching device for breaker and stationary structure.

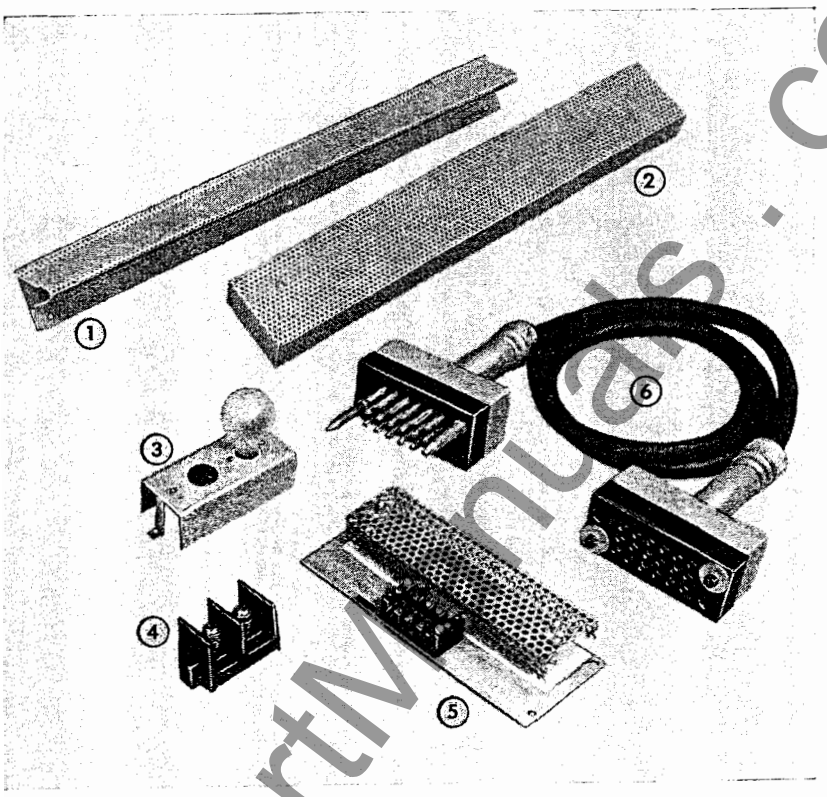


Fig. 72. Details and accessories for Outdoor Metal-Clad Switchgear: (1) Ventilator screen—top; (2) Ventilator screen—bottom; (3) Light and convenience outlet; (4) 600-volt P & N terminal block; (5) heater assembly; (6) test jumper.

all-weather undersurface coating provides lasting protection against rust and corrosion

All-weather undersurface coating for outdoor switchgear is heavy, rubberized, protective sealing material. Spray-applied to outdoor switchgear undersurfaces, it provides a thick airtight seal against corrosive elements. Note thick, rugged appearance of coating in close-up view in inset.

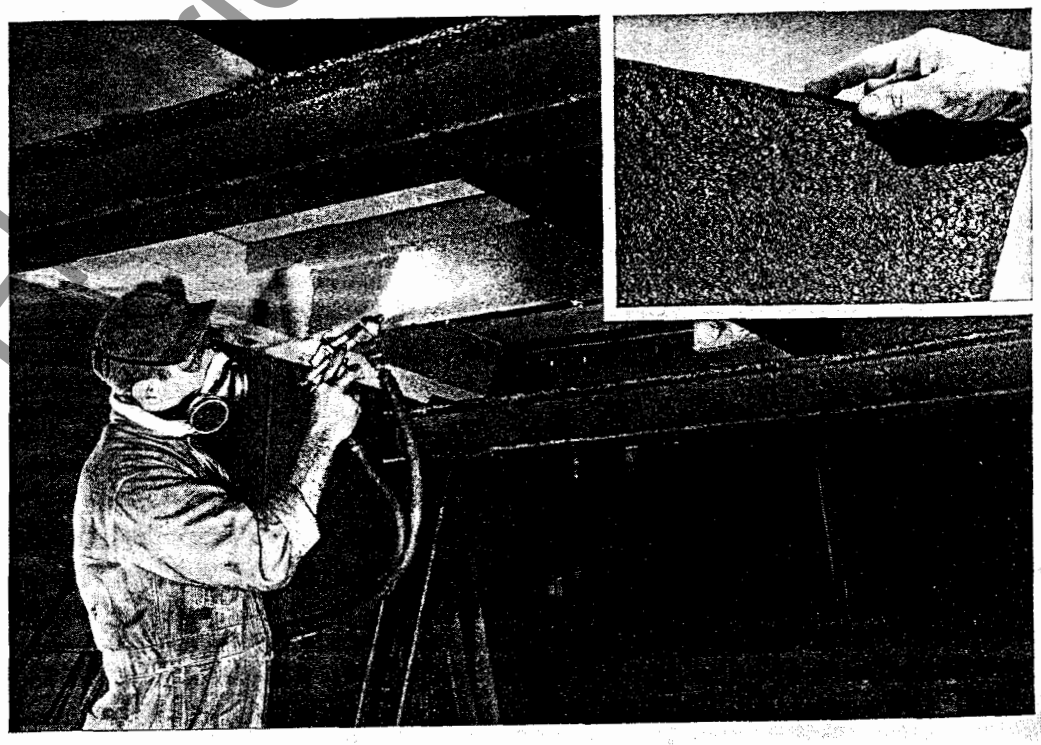


Fig. 73

dimensional data

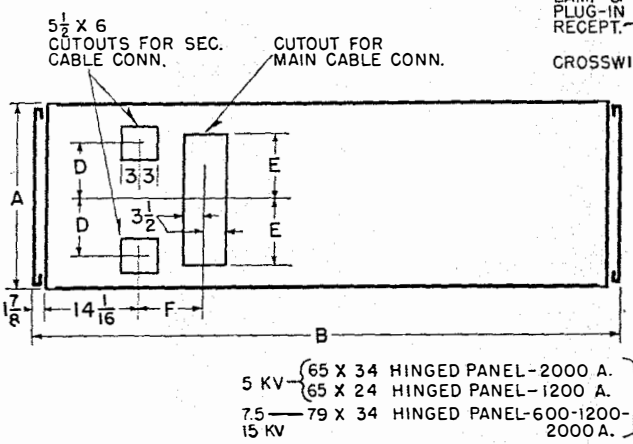


Fig. 74. Base plan dimensions for breaker units.

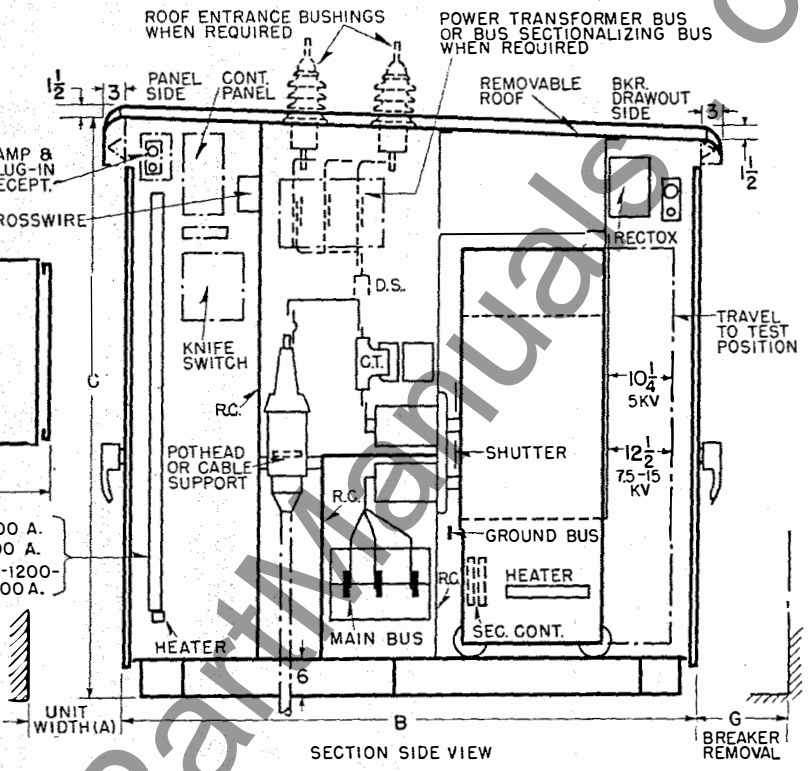


Fig. 75. Typical air circuit breaker unit.

TYPE DH AIR CIRCUIT BREAKER STATIONARY STRUCTURES

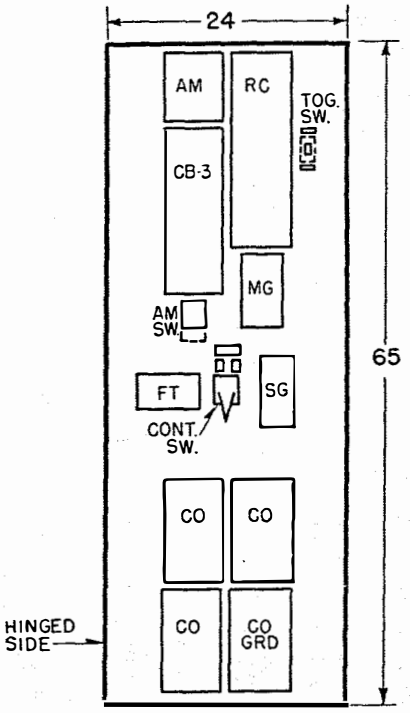
UNIT AND TYPE	CURRENT RATING AMPERES	RATED KV	UNIT DIMENSIONS							ESTIMATED APPROX.	
			A	B	C	D	E	F	G Min.	Dead Weight	Impact Weight*
50-DH-150	600-1200	4.16	28	90	90	8⅝	10¼	10	42	3900	4500
50-DH-150	2,000	4.16	38	90	90	13⅝	15¼	10	49	4300	4900
50-DH-250	1,200	4.16	28	90	90	8⅝	10¼	10	42	3900	4500
50-DH-250	2,000	4.16	38	90	90	13⅝	15¼	10	49	4300	4900
75-DH-250	1200-2000	7.2	38	102	104	13⅝	15¼	12 1/16	49	5000	6000
75-DH-500	1200-2000	7.2	38	102	104	13⅝	15¼	12 1/16	49	5200	6300
150-DH-150	600-1200	13.8	38	102	104	13⅝	15¼	12 1/16	49	5000	6000
150-DH-250	1200-2000	13.8	38	102	104	13⅝	15¼	12 1/16	49	7200	6300
150-DH-500	1200-2000	13.8	38	102	104	13⅝	15¼	12 1/16	49	5200	6300

* Total includes dead weight. Actual weight will vary in proportion to amount and type of auxiliary equipment in the unit.

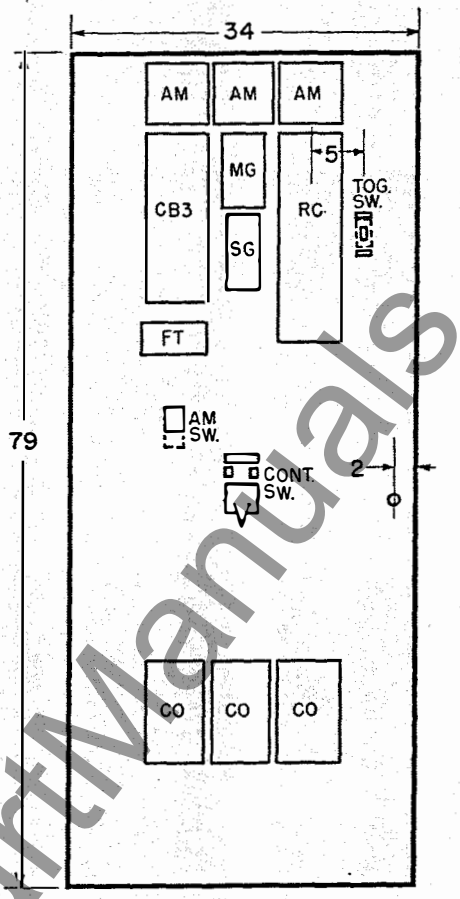
AUXILIARY UNIT STATIONARY STRUCTURES

Auxiliary	.....	4.16	30	90	90	.....	.....	.....	30	3800	.....
Auxiliary	.....	7.2	38	102	104	.....	.....	.....	38	4200	.....
Auxiliary	.....	13.8	38	102	104	.....	.....	.....	38	4200	.....

dimensional data



Typical 5-kv panel.



Typical 7.5–15-kv panel.

Fig. 76. Layouts showing number of panel mounted instruments and relays for typical outdoor switchgear.

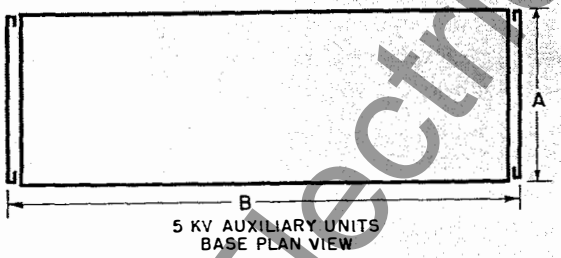


Fig. 77. Base plan dimensions for auxiliary units.

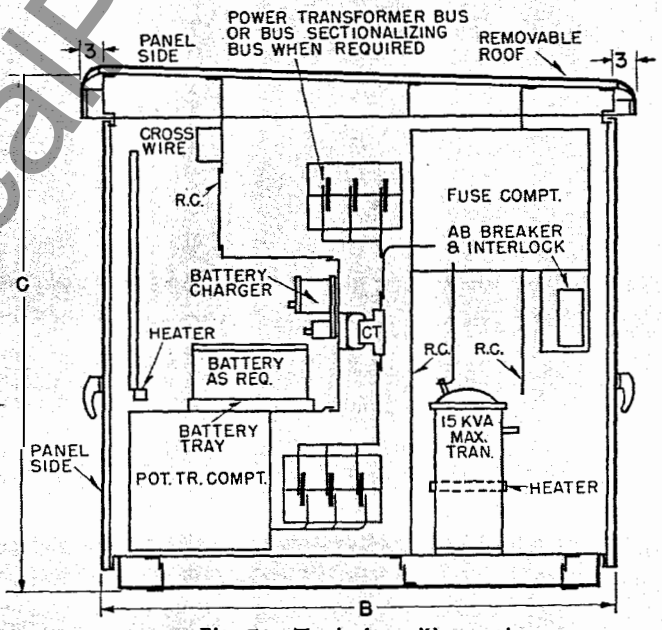


Fig. 78. Typical auxiliary unit.

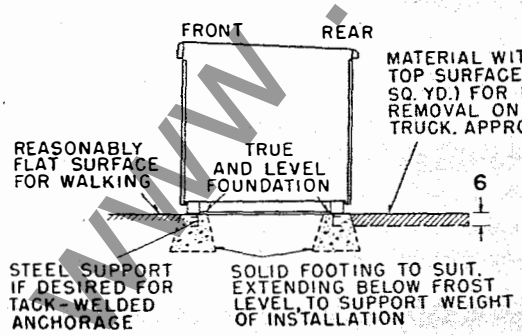


Fig. 79

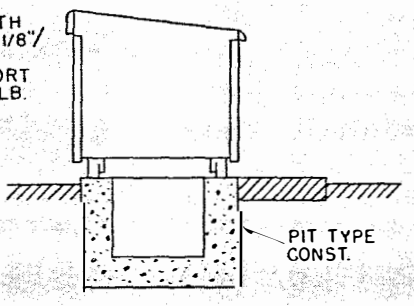


Fig. 80

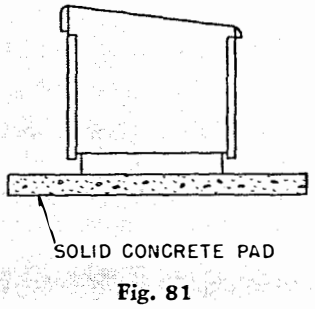


Fig. 81

field assembly data

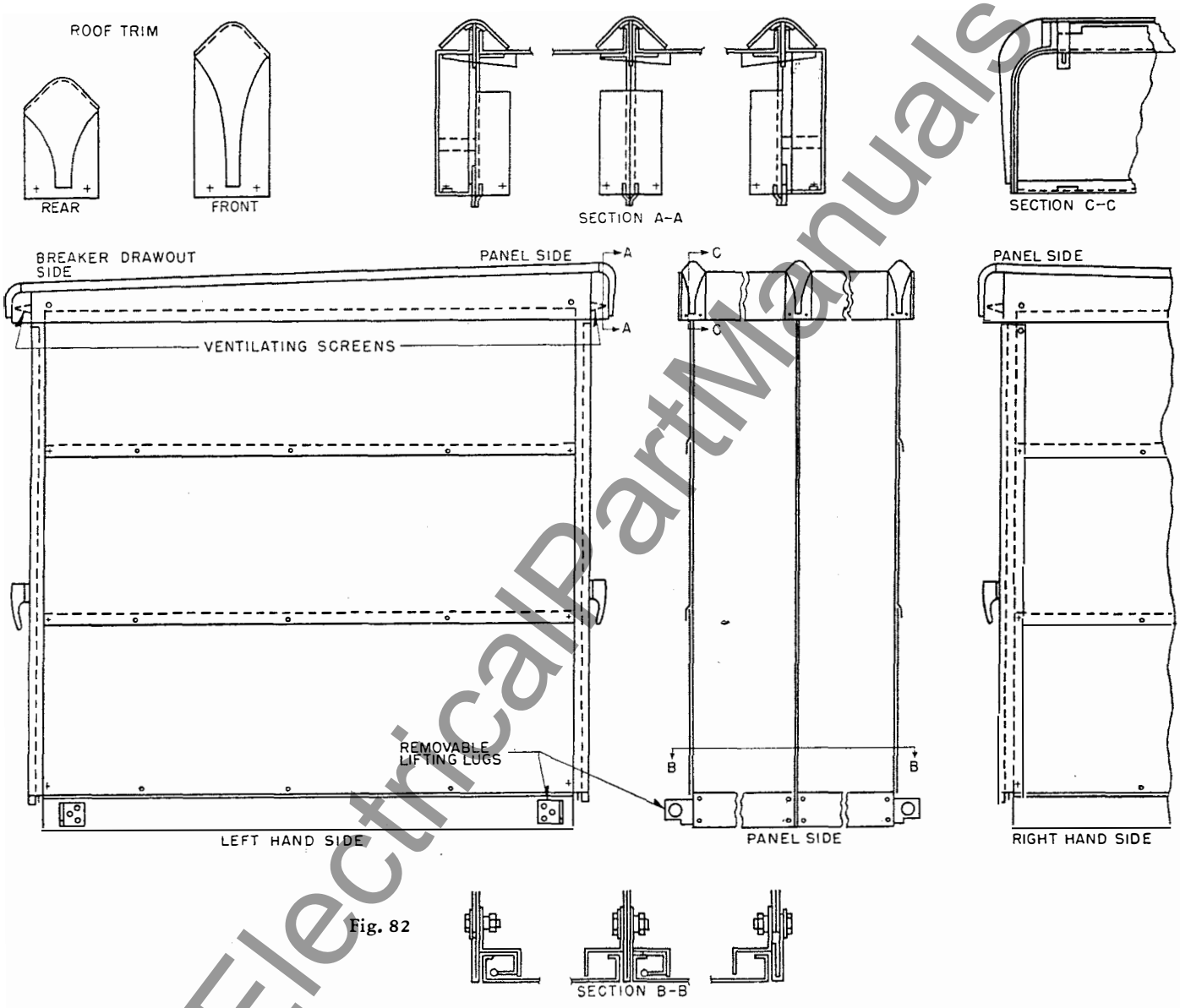


Fig. 82

1 ASSEMBLY OF GROUPS . . .

(a) Line up adjacent groups—install front, rear, and base tie bolts—draw bolts tight to get continuous close contact of all adjacent sheets.

(b) Install roof seam covers—L.H. removable side sheets and R.H. finishing trims.

2 ASSEMBLY OF NEW GROUPS TO GROUP ALREADY INSTALLED . . .

(a-1) If new group is added to L.H. end of old group, remove L.H. side sheet from old group—place new group in position and make assembly per 1 (a & b).

(b-1) Assemble side sheet & roof seam cover from (a-1) on L.H. side of new group.

(c-1) If new group is added to R.H. end of old group, remove R.H. finishing strips from old group. Place new group in position and make assembly per 1 (a & b).

(d-1) Assemble finishing strips and roof seam cover from (c-1) on R.H. side of new group.

available outdoor metal-clad switchgear arrangements

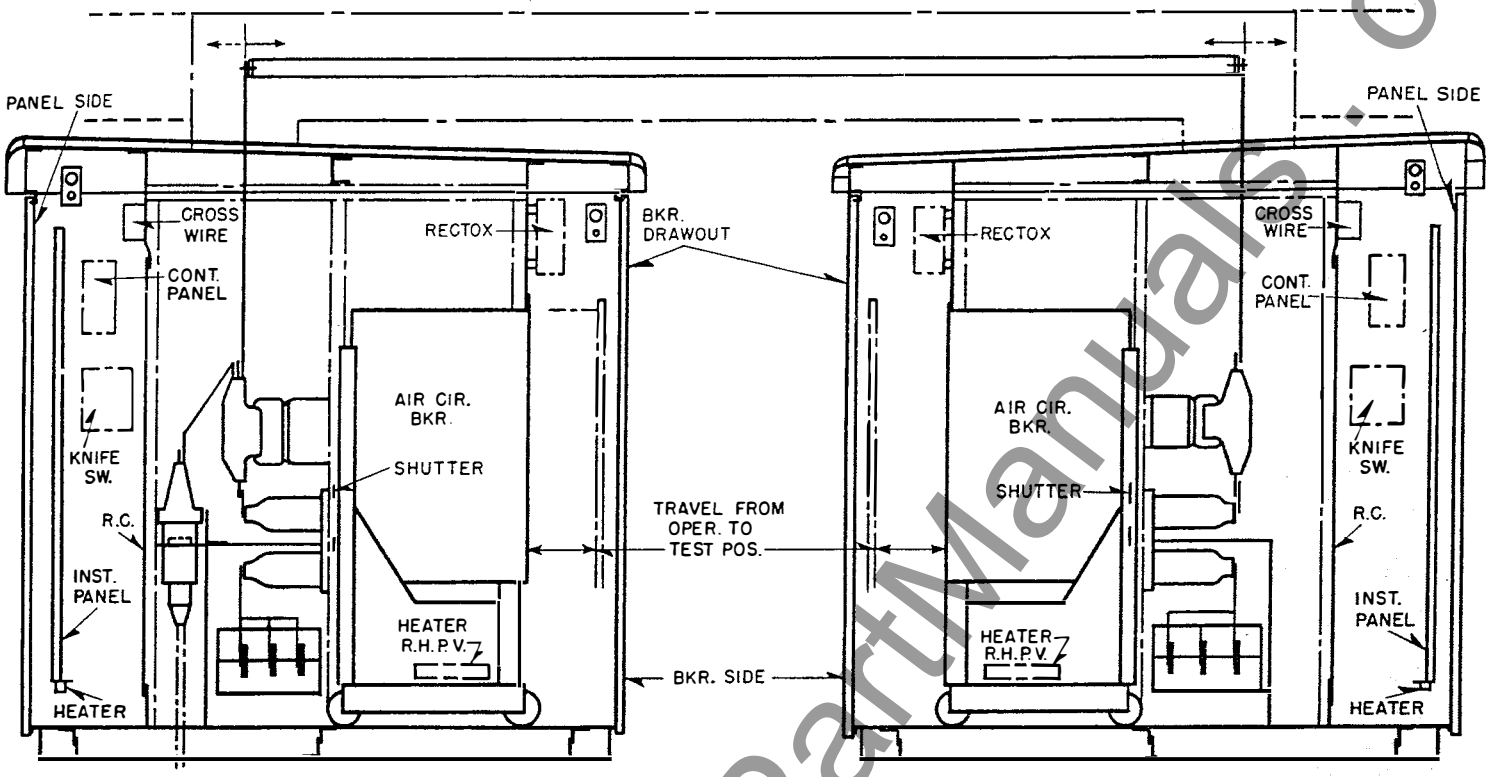


Fig. 83. Double bus—double breaker arrangement.

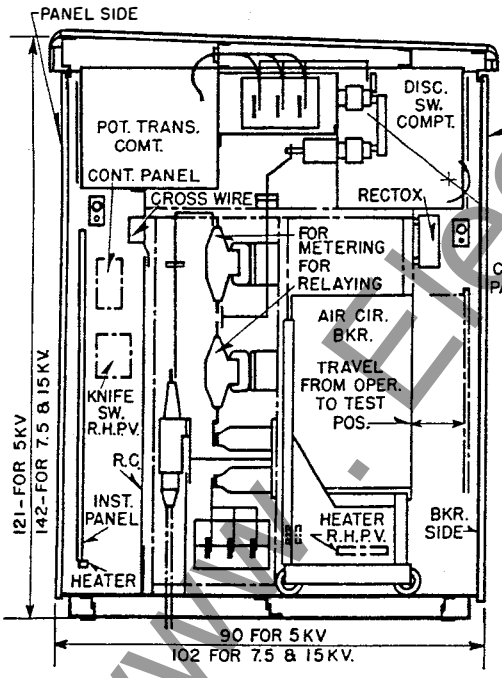


Fig. 84. Breaker unit with transfer bus in superstructure.

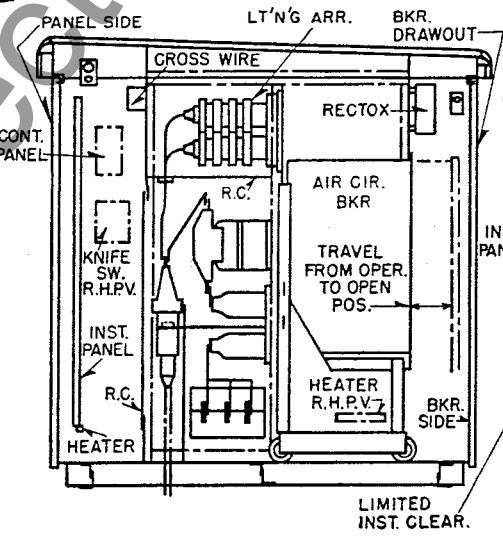


Fig. 85. Breaker unit with lightning arresters connected to line.

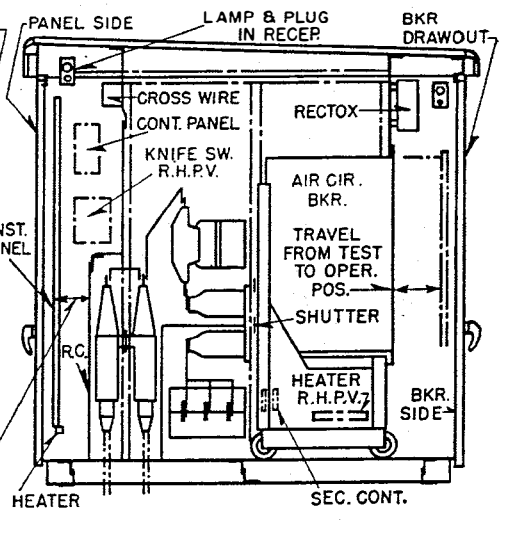


Fig. 86. Breaker unit with two three-conductor potheads.

horizontal drawout breakers

provide maximum accessibility . . .

Type DH Air Circuit Breakers are designed and built especially for standardized, drawout, Metal-Clad Switchgear. DH breaker drawout units are held to close dimensional tolerances to permit easy interchangeability in the stationary structure. Primary disconnects are full floating with high-pressure finger segments individually sprung in a single retaining ring. These segments are located on the main studs of the drawout unit which permits convenient inspection and maintenance. This is an advantage of Westinghouse design.

The "De-ion" principle utilized in DH Magnetic Air Breakers results in fast, positive arc interruption. The true ceramic material used in constructing the arc chutes provides unusually high resistance to heat shock.

5 KV

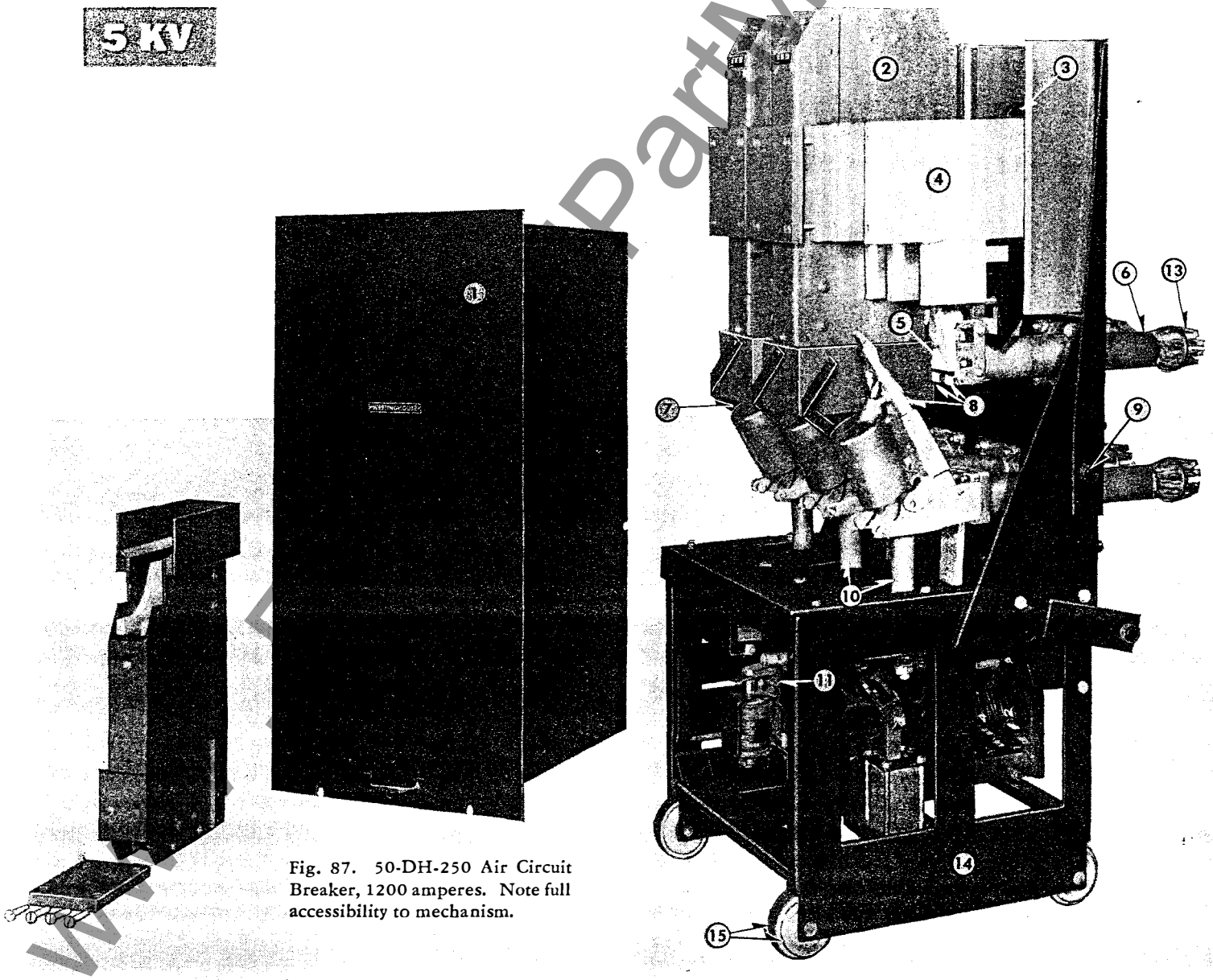


Fig. 87. 50-DH-250 Air Circuit Breaker, 1200 amperes. Note full accessibility to mechanism.

1. Interpole barrier assembly.
2. Arc chute.
3. Magnet coils.
4. Iron pole pieces.
5. Tungsten alloy secondary breaker contacts.
6. Micarta bushings.
7. Arc horn connector.
8. Silver main breaker contacts.
9. Roller for shutter.
10. Micarta operating rods.
11. Socket for hand-closing lever.
12. Secondary contacts.
13. Primary disconnect.
14. All-welded steel frame construction.
15. Two-surface wheels for mobility inside and outside structure.

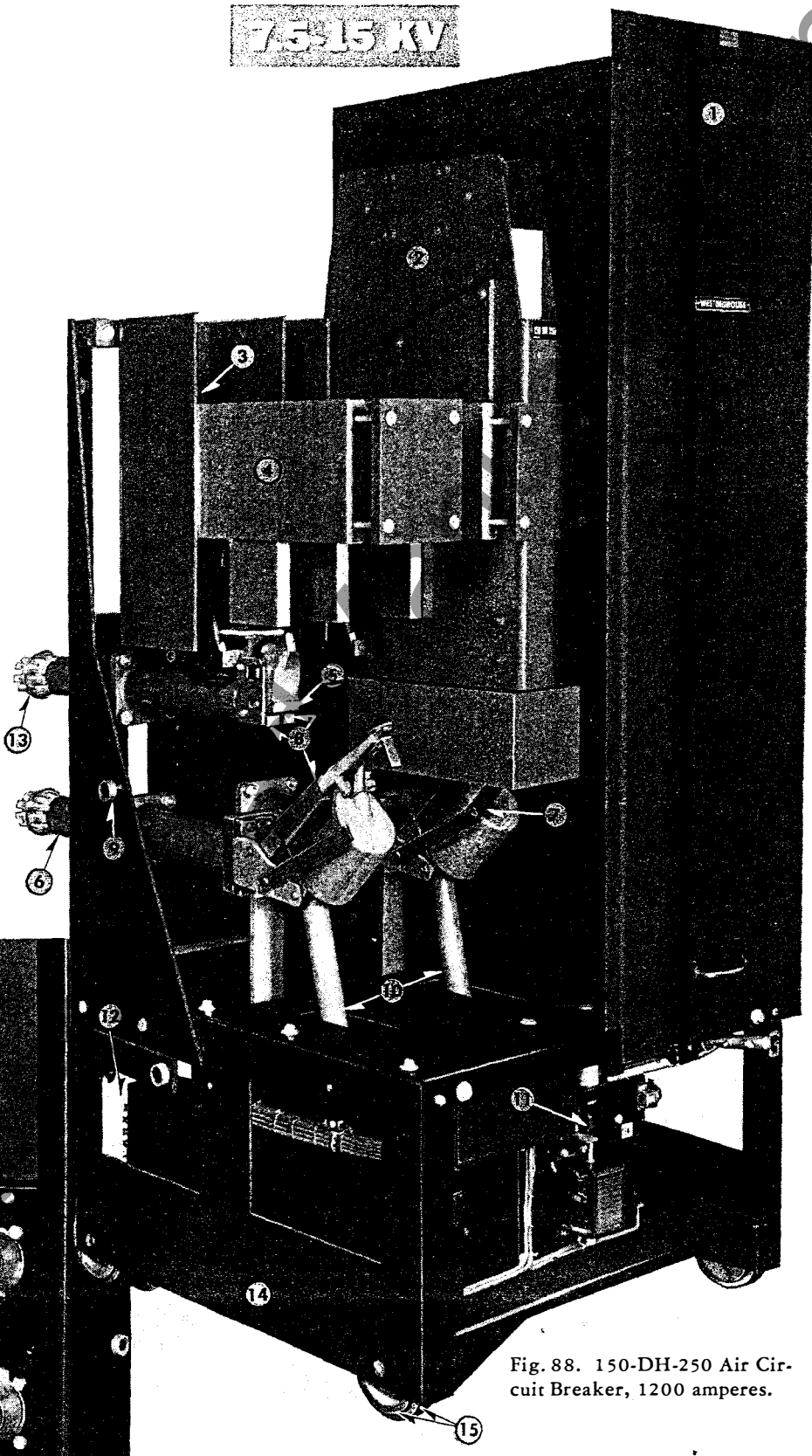


Fig. 88. 150-DH-250 Air Circuit Breaker, 1200 amperes.

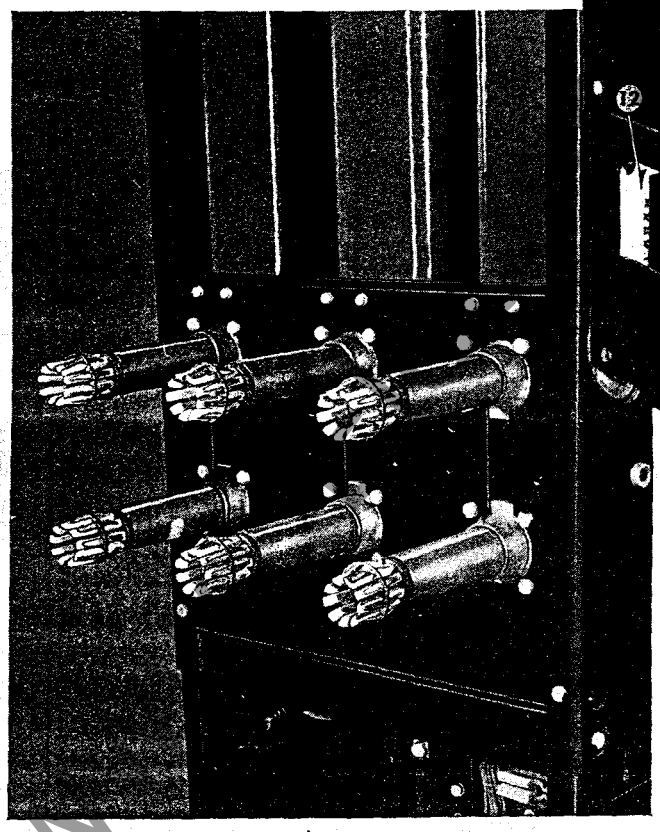
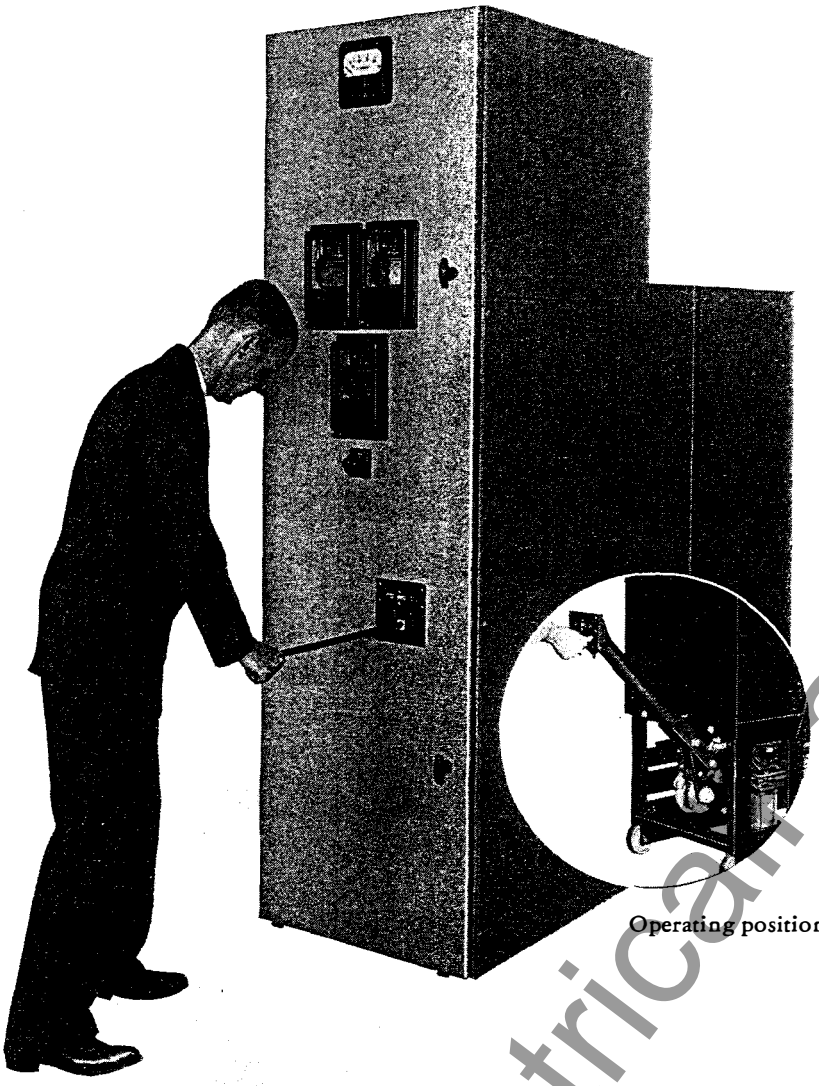


Fig. 89. Positive contact is obtained on primary disconnects by individual flat springs and heavily silvered, self-aligning, finger-like segments. Segments on breaker are easy to inspect.

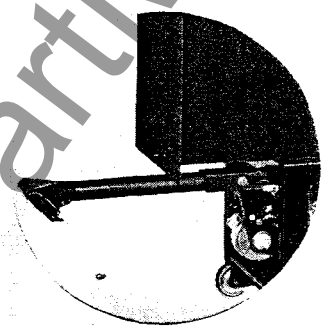
...ed-energy mechanism permits manual closing



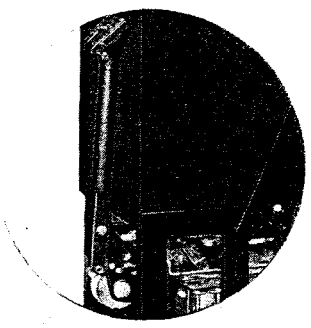
Manual closing is ideal for primary service breakers where operation is infrequent and electric closing power is not available.

The Westinghouse spring-operated mechanism for hand-closing type DH breakers makes manual operation safe. Actuated by a pushbutton, it closes the breaker with sufficient speed and force to overcome magnetic effects of short-circuit currents. The breaker can be closed and tripped with the housing door closed and the operator has a visual indication of the breaker position.

Operating position.



Control post down.



Control post up.

Fig. 90.

fast, positive De-ion arc interruption

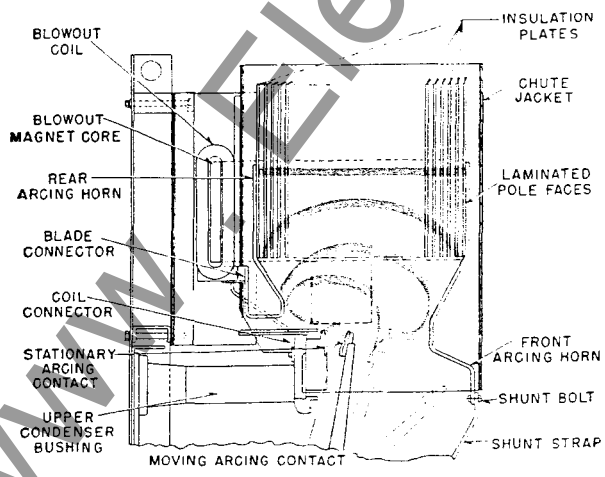


Fig. 91. Arc chute and blowout coil.

The De-ion principle of circuit interruption is an exclusive Westinghouse development.

The action of the breaker in interrupting the arc is illustrated at the left. When the arcing contacts separate, an arc is drawn between them without the blowout coil carrying current. The arc rises rapidly under the influence of the magnetic field created by the iron of the blowout magnet. This causes the arc to impringe on the arcing horns, thus inserting the blowout coil in series with the arc.

When the current starts to flow in the blowout coil, the arc is driven rapidly into the slots in the refractory plates by the magnetic field. The staggering of the slots causes the arc to lengthen as it progresses up the chute. This exposes a large part of the arc to the relatively cool surfaces of the plates and to the de-ionizing effect of the blowout magnet field. Arc extinction is rapid, due to elongation, cooling and de-ionization.

ceramic arc chute construction . . .

non-hygroscopic . . . highly resistant to heat shock

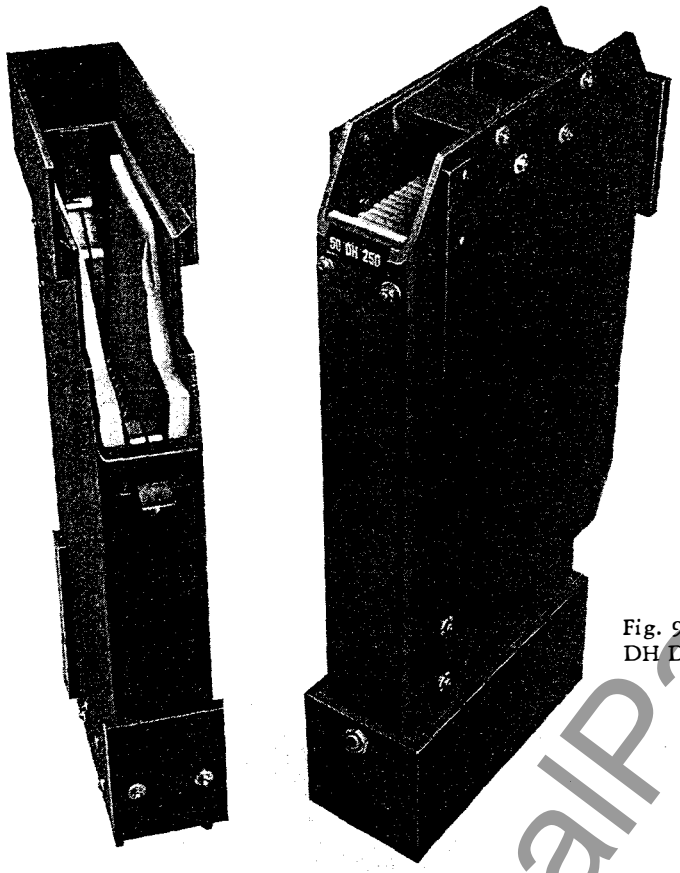


Fig. 92. Arc chutes for DH De-ion air breakers.

The arc chutes in DH breakers are so constructed that the arc is exposed only to ceramic material. This ceramic material, containing a high percentage of Zircon, has the highest melting point of any known material and great resistance to heat shock. Its dielectric and moisture absorption properties compare favorably with high-grade porcelain.

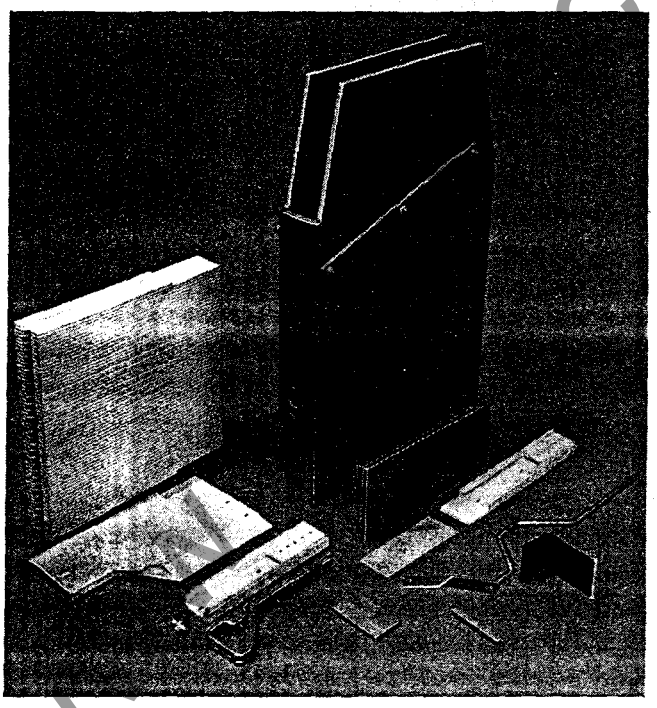


Fig. 93. Sub-assemblies of De-ion arc chute.

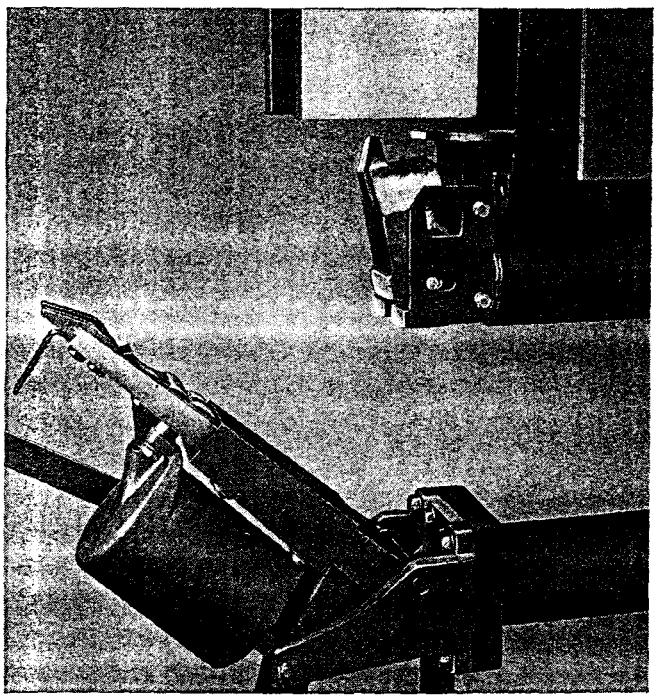


Fig. 94. Main and auxiliary contacts.

master checking fixtures assure interchangeability of breakers

A system of rigid double checking during the assembly of Westinghouse Metal-Clad Switchgear assures you of removable elements that fit into any stationary structure of like rating.

This perfect alignment is accomplished: first, by fitting all removable elements to a master stationary structure in the assembly section; second, by matching all stationary structures to a master, precision-built, removable element in assembly operations. The result is positive alignment of rails and wheels; main, auxiliary and ground contacts; shutter and main levering-in device. It eliminates the necessity for fitting on the job . . . provides simple interchangeability of breakers when the switchgear is in service.

jig welding

Jig welding assures interchangeability of standard units. Groups of units may be disassembled, rearranged and new groups added with no additional expense incurred in matching up mounting dimensions. Outline and mounting dimensions are held to close tolerances.

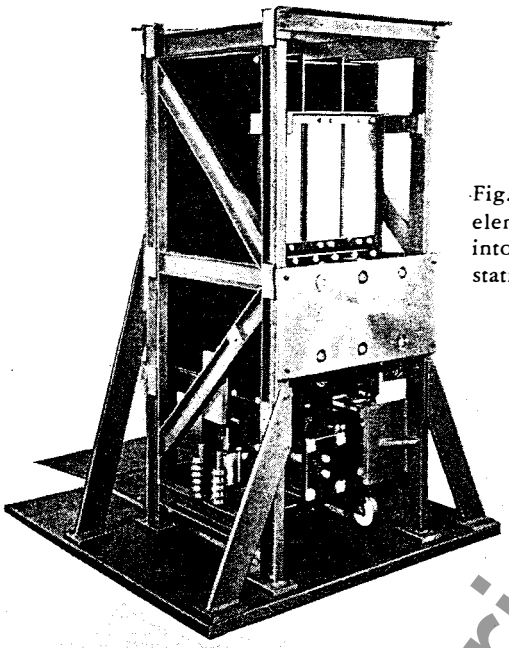


Fig. 95. Every removable element must fit exactly into a master switchgear stationary structure.

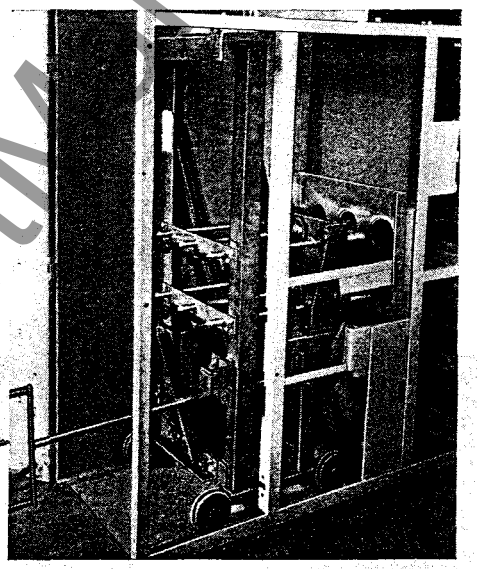


Fig. 96. Every stationary structure is checked for alignment with a master removable element.

Fig. 97. Rigid, upright welding fixtures assure uniform, plumb and square stationary structures.

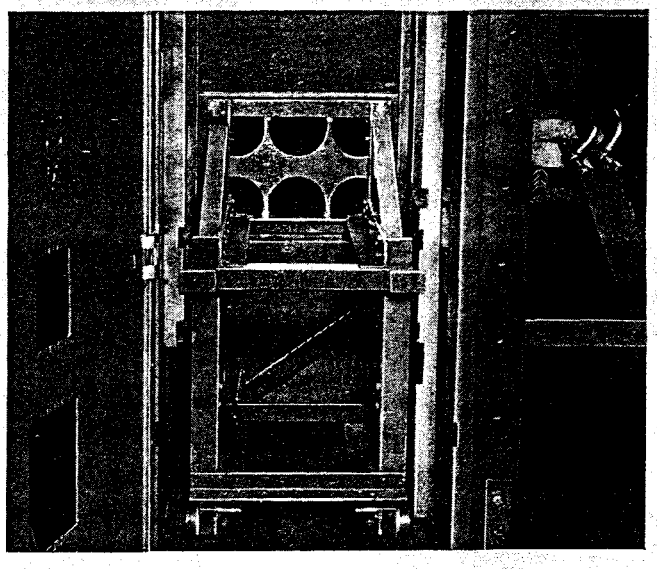


Fig. 98. Assembly jig fixture assures accurate location of breaker rails to main contacts, secondary contacts, ground contact, stops and levering-in mechanism for interchangeable breaker units.

positive interlocking devices **assure greater safety**

The Westinghouse standardized design makes full use of the interlocking devices developed and field-tested in all types of Metal-Clad installations. All interlocks are simple. A minimum of working parts assures positive trouble-free operation.

All these safety features are standard equipment in Westinghouse Metal-Clad Switchgear.

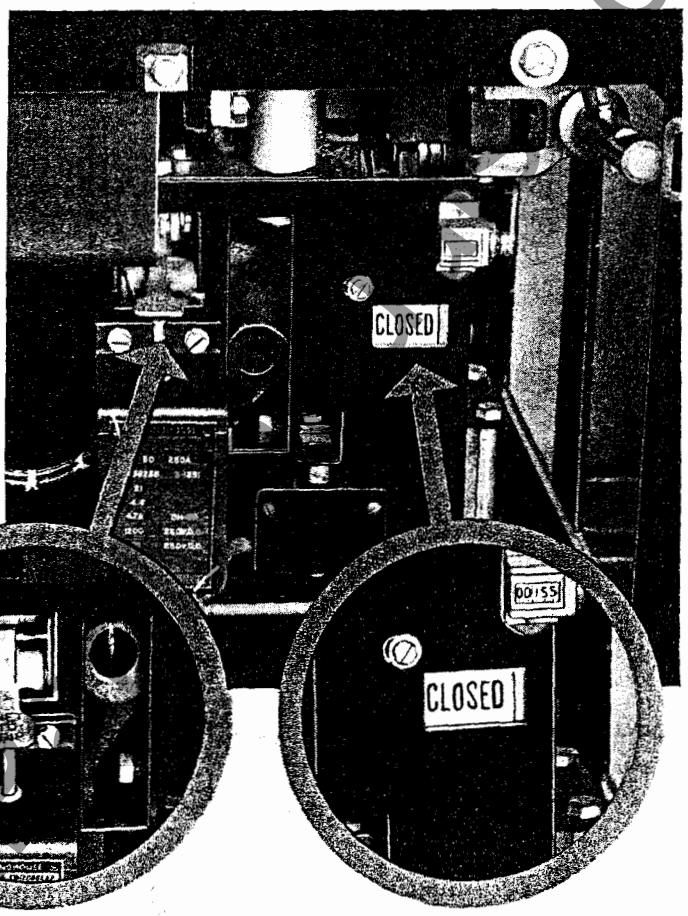


Fig. 100. Trip lever opens breaker.

Fig. 99. Positive crank motion brings breaker from test to operating position. Since breaker motion is horizontal, crank is turned quickly and easily.

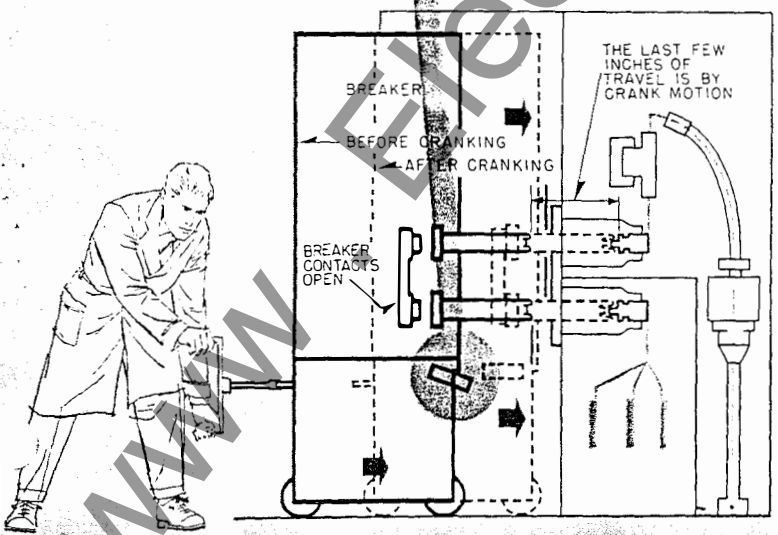
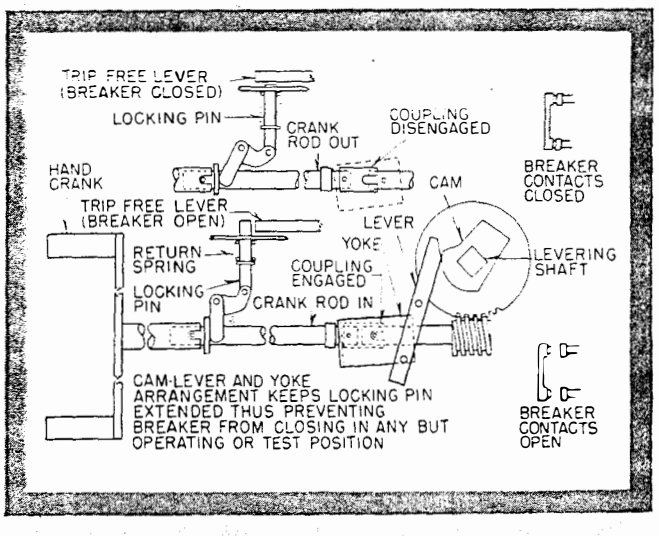


Fig. 101. Breaker must be open before it can be cranked. If breaker is closed, the trip-free linkage prevents engagement of crank linkage. When breaker is being cranked, or between test and operating positions, shear pin action with solenoid linkage prevents closing the breaker. Operation is positive.



positive grounding . . . safer testing

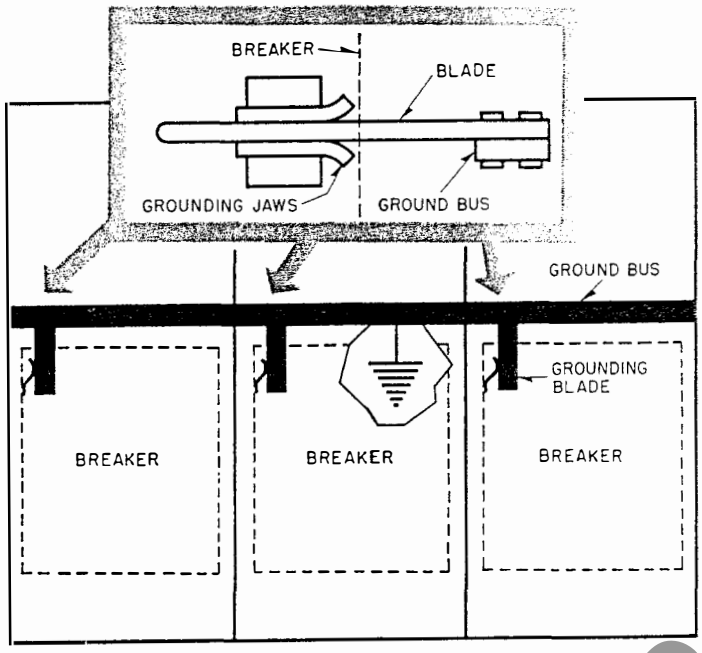


Fig. 102. Ground bus connects to all breakers and cells. This ground bus has at least 25 percent the capacity of the largest bus. It makes positive contact with all breakers through blade and jaws illustrated at the left. The breaker frame is effectively grounded before the primary contacts engage.

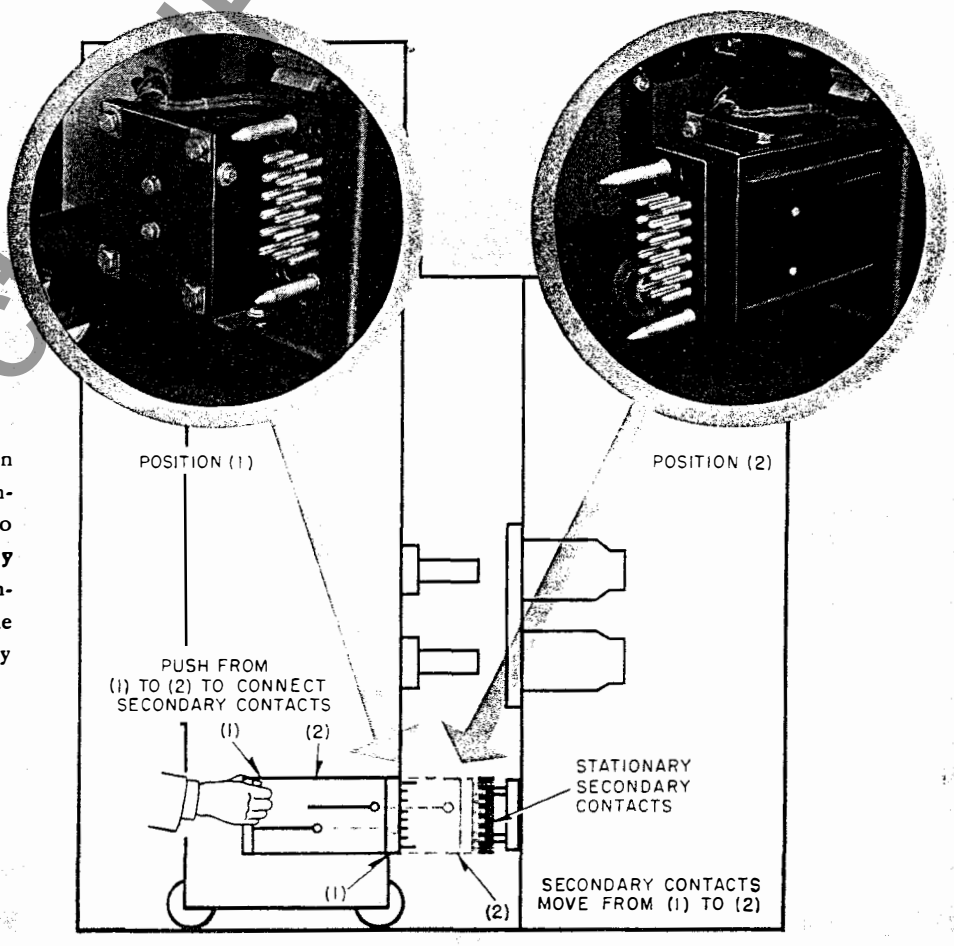
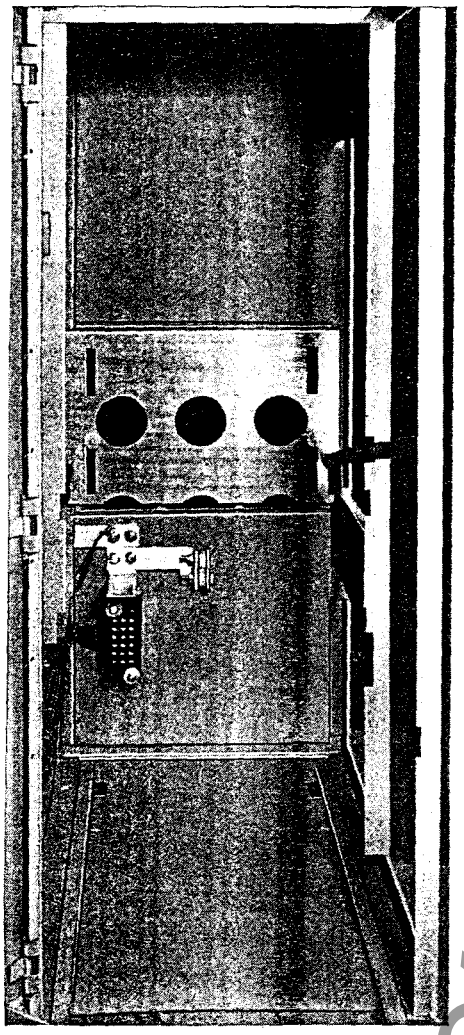


Fig. 103. Breaker in "test" position . . . by engagement of secondary contacts, breaker can be tested. No jumpers are needed. Manually operated, extendable secondary contact assembly is mounted on the breaker. This assembly is normally keyed in the operating position.

of live parts



A ⅛-inch thick metal shutter, closed by gravity, positively prevents accidental entry to live stationary contacts. The shutter drops automatically when the breaker is removed. Shutter is closed in test position and is raised automatically as the breaker advances to operating position. The shutter is a simple mechanical device requiring no maintenance.

How shutter works

Before the breaker is removed, shutter supporting frame rests on breaker frame. As breaker is withdrawn, shutter is closed. When breaker is advanced from test to operating position, rollers passing along shutter cams raise the shutter to clear the contacts.

Fig. 104. Shutter closed—live stationary contacts in the breaker cell are covered.

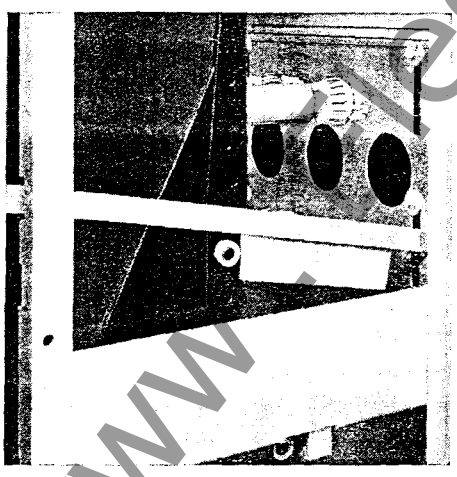


Fig. 105. Shutter still closed—breaker in test position, with cam about to raise shutter.

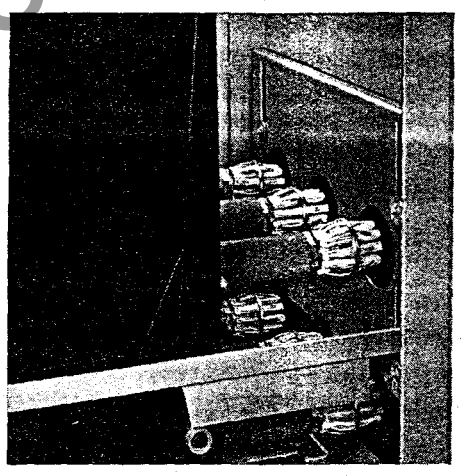


Fig. 106. Shutter open—stationary contacts cleared for entry of breaker contacts.

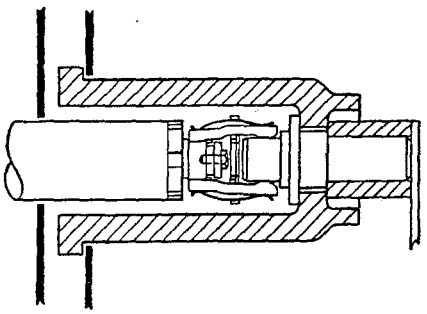


Fig. 107. Moldarta or porcelain insulators enclose primary disconnects and isolate them from each other.

adequate ventilation . . . insulation . . . standardized wiring

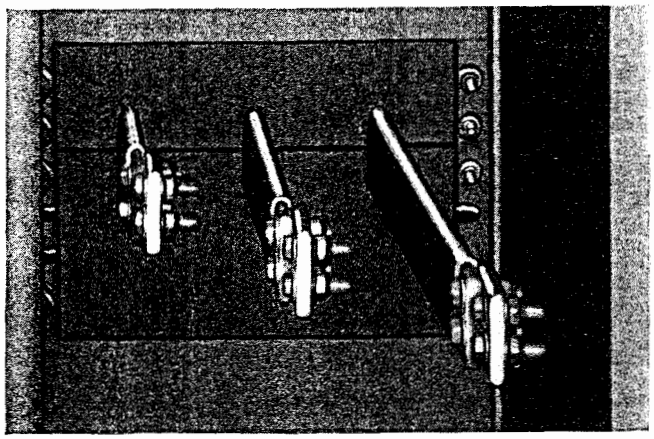


Fig. 108. Close-fitting Micarta bus supports prevent gas migration between compartments . . . another aid in localizing any possible disturbances. Busses are completely insulated.

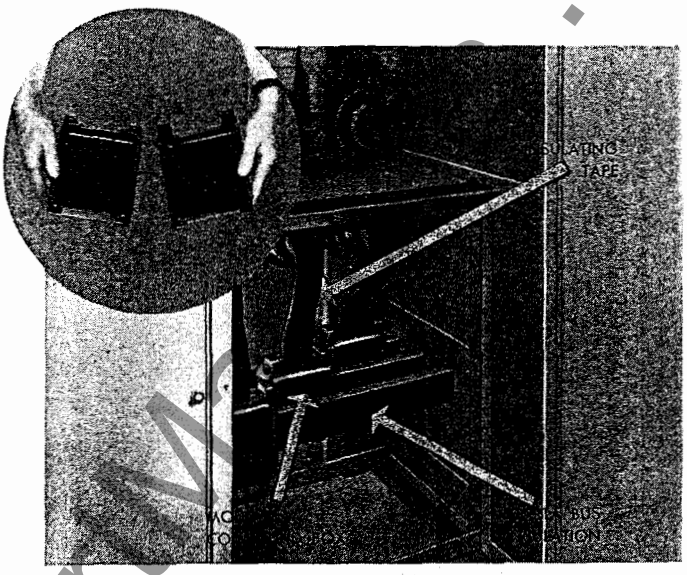


Fig. 109. Busses are completely insulated with compound-filled Moldarta boxes at joints, preformed Micarta tubes on straight portions and varnished cambric insulating tape at bends. Busses have half rounded edges to eliminate corner voltage stress. Contact surfaces are silvered and tightly bolted.

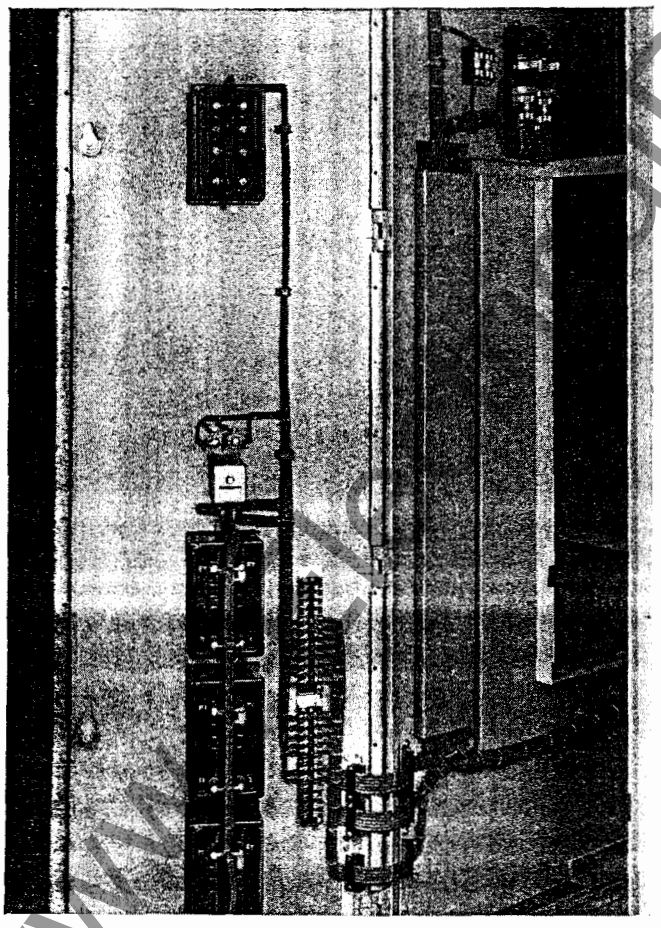


Fig. 110. Standardized wiring practice is illustrated in typical panel wiring. Form fitting hinges, loop-molded wire cleats, molded terminal blocks and rubber-lined wire cable clamp devices permit simplified, quality wiring procedures.

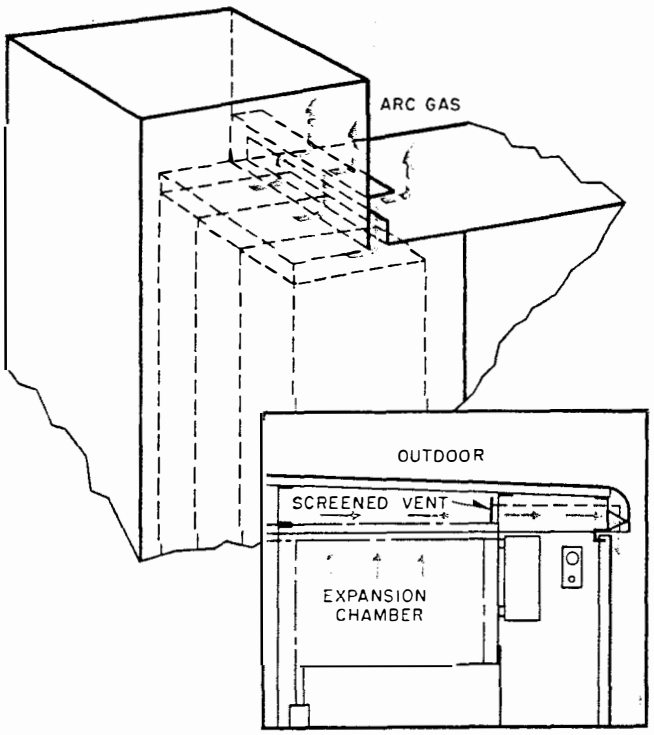


Fig. 111. Vent discharges arc gas to outside of switchgear unit.

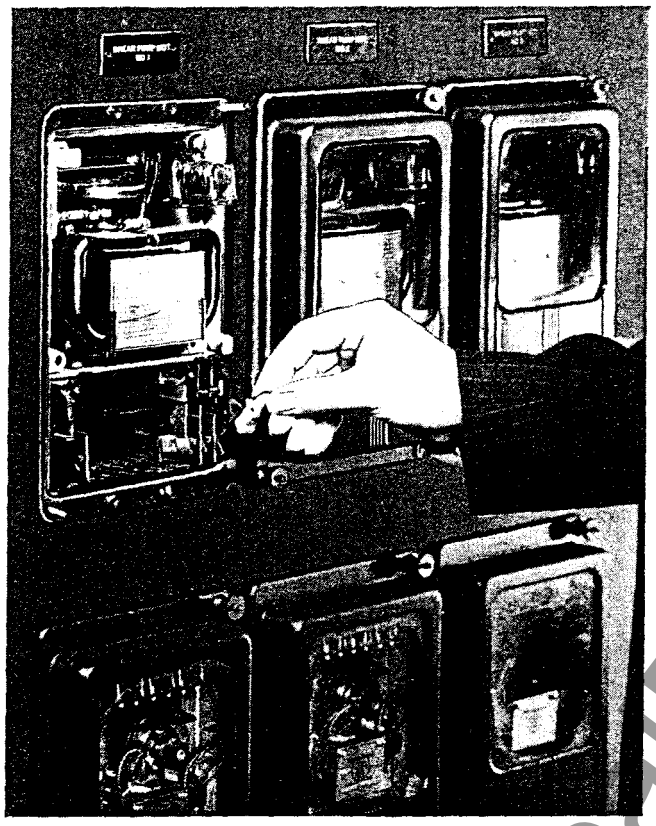


Fig. 112. Flexitest relays and watthour meters simplify testing, save space and improve appearance. Built-in test switches permit use of either test plug or spring clip leads.

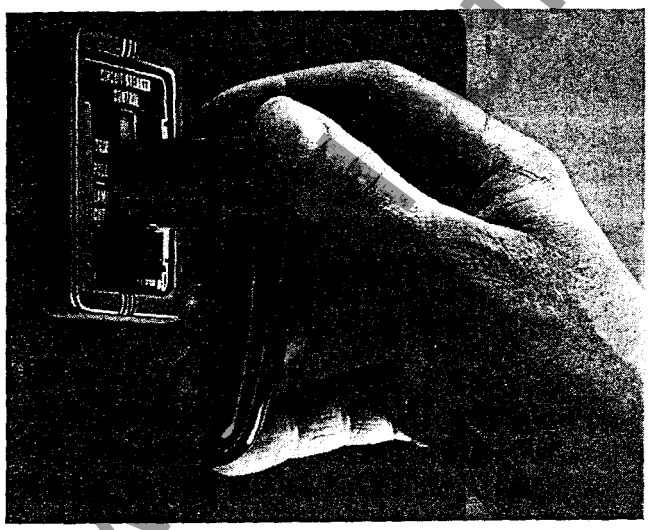


Fig. 113. Easy-to-grip control switch handle of modern design improves appearance and ease of operation.

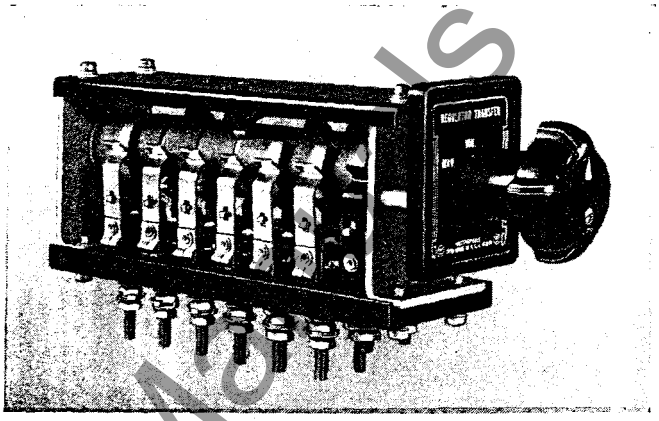


Fig. 114. Silver-plated contacts on instrument and control switches resist corrosion and give smooth, long-life rotary operation. Wiping action keeps contacts clean.

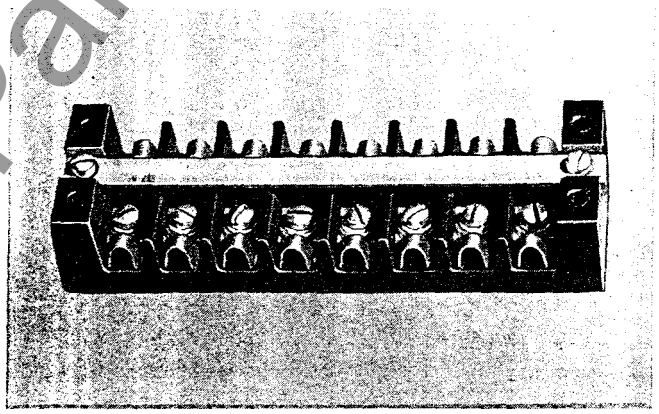


Fig. 115. Sturdy terminal block has solderless connectors with reversible marking strip.

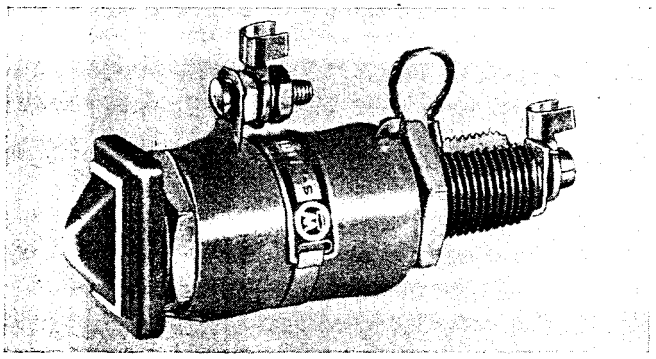


Fig. 116. Wide-angle indicating lamp is visible from all directions in front of switchgear. New low-drain bulb consumes minimum power, extends into lens for highest visibility.

coordination of surface treatments and finishes provides

BONDERIZING AND PRIME PAINTING

Bonderizing of switchgear units after complete assembly provides a tough surface coating which protects against rust and corrosion. After welding is completed, the units are immersed in a series of five tanks wherein they are cleaned, rinsed, Bonderized, rinsed and stabilized, and then air dried.

Immediately after Bonderizing, the metal structure is sprayed with a prime coat of paint to seal and preserve the full effect of the Bonderizing treatment. This provides the ideal base for final finish painting.

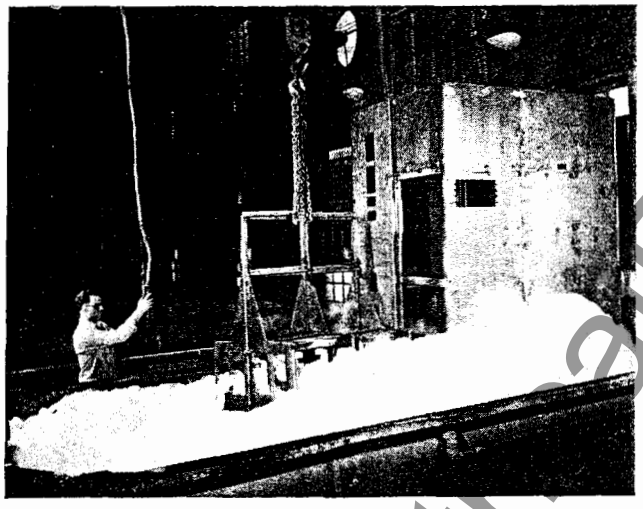


Fig. 117. Cleaning.

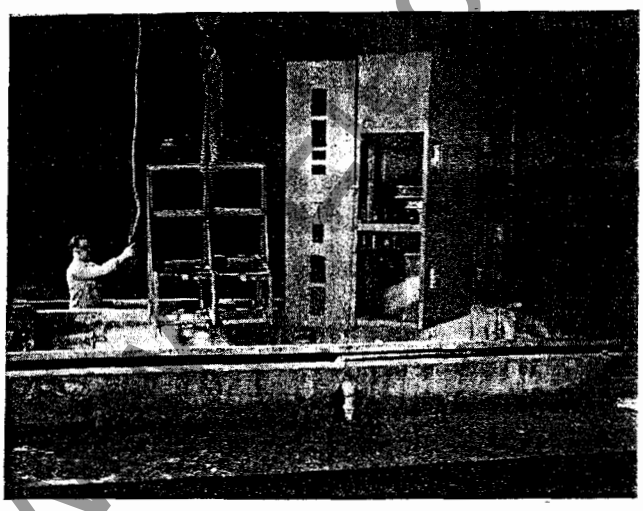


Fig. 118. Bonderizing.

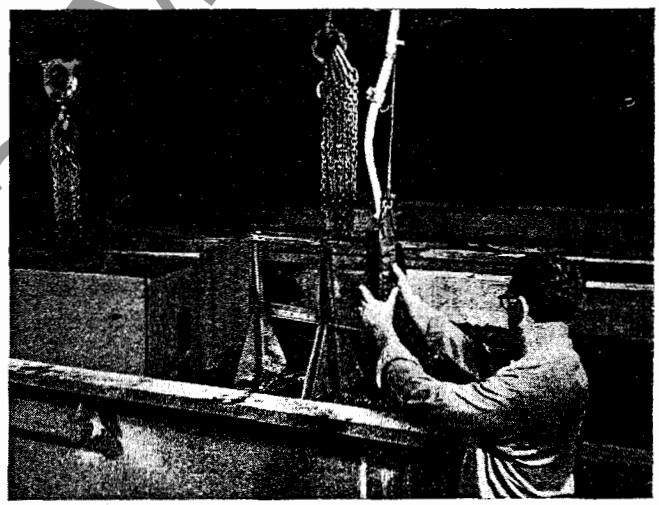


Fig. 119. Stabilizing.

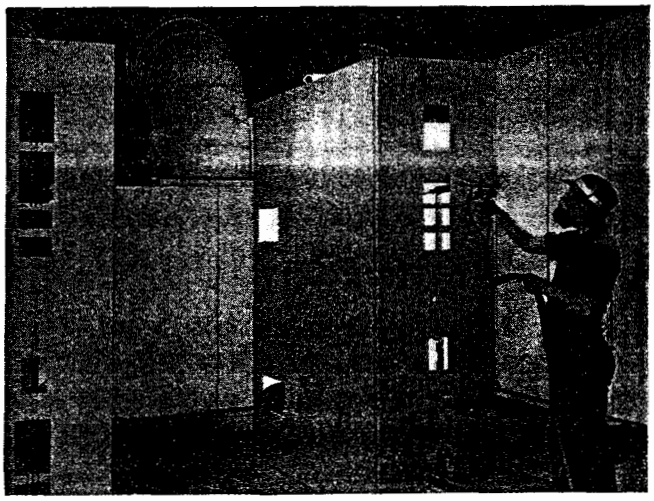


Fig. 120. Prime painting.

ttractive appearance and lasting protection

FINISH PAINTING

After prime painting and drying, the units are transferred to the assembly section for finish painting in modern, air-cleaned spray booths. This provides the final protective finish that affords attractive appearance and long life under the switchgear's operating conditions.

Standard finish for indoor switchgear is light gray ASA # 61, Munsell notation 8.3G 6.1/0.54. Outdoor switchgear is dark gray ASA # 24, Munsell notation 10B 2.4/1.18.

PLASTIC COATING

(INDOOR INSTRUMENT PANELS ONLY)

After finish painting, instrument panels of indoor Metal-Clad Switchgear receives a plastic coating which is sprayed on in liquid form. This protects the switchgear panel from dust, dirt and grease smudges during final assembly and through customer installation. After the switchgear is installed, the plastic coating is easily peeled off to reveal the clean, unmarred painted surface.

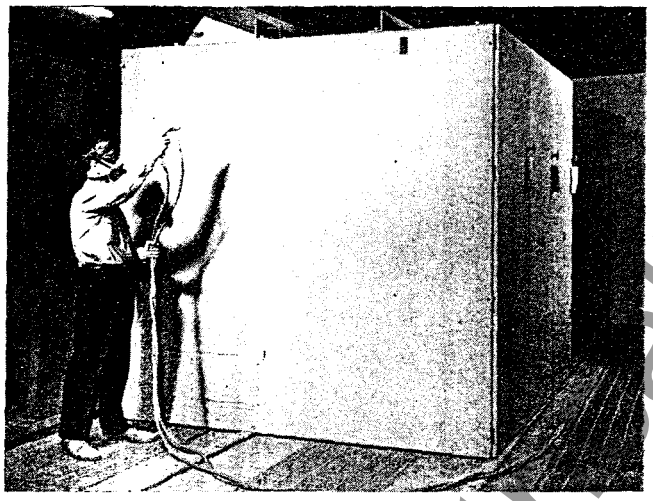


Fig. 121. Modern, air-cleaned paint booth in S aisle for Indoor Metal-Clad Switchgear.

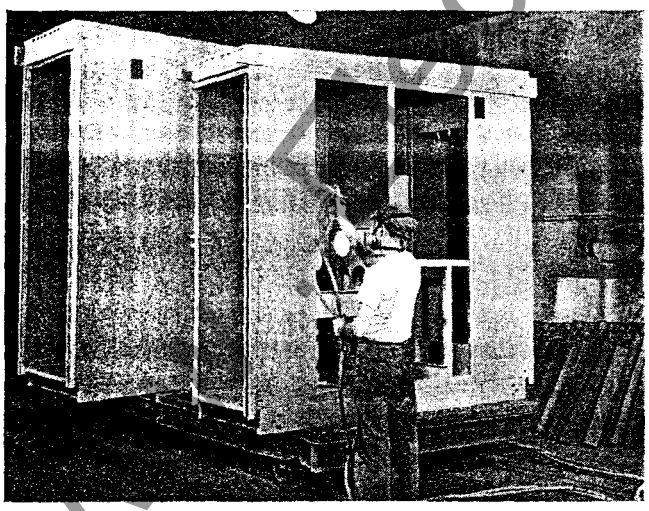


Fig. 122. Large air-cleaned paint booth in R aisle for Outdoor Metal-Clad Switchgear.

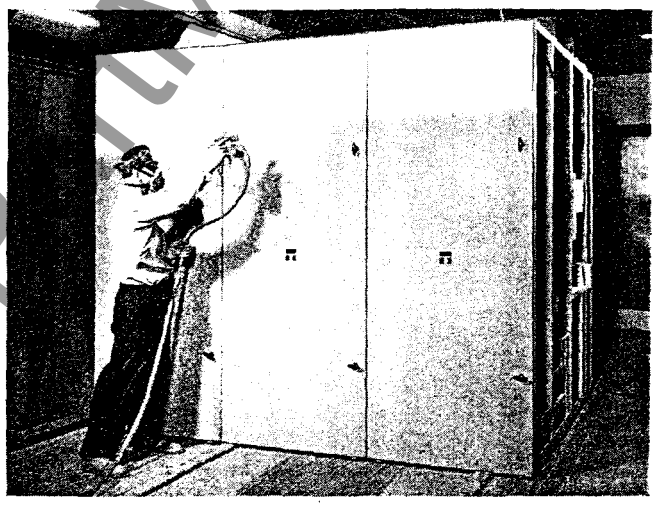


Fig. 123. Plastic coating is sprayed on finished painted surface.

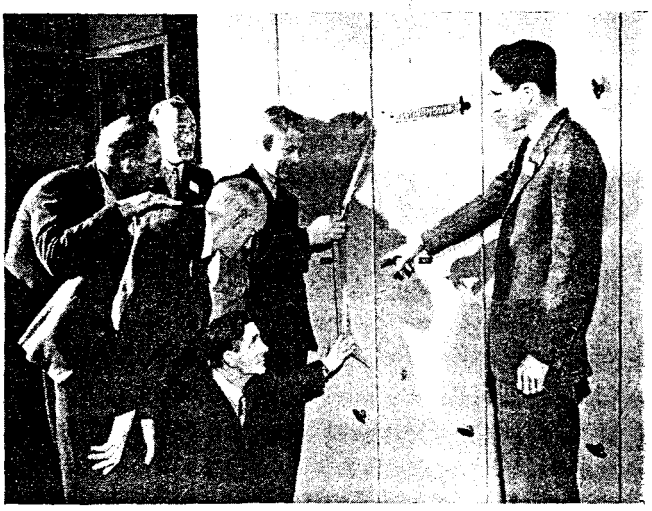
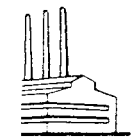


Fig. 124. After installation, plastic coating is easily peeled off the clean painted surface.



·ial plants

ghting circuits—radial
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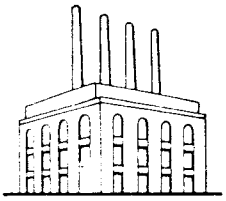
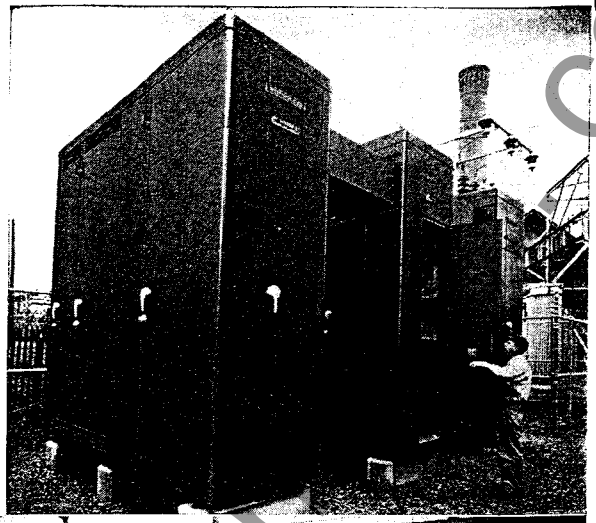
·ation and auxiliaries
·s for industrial proc-

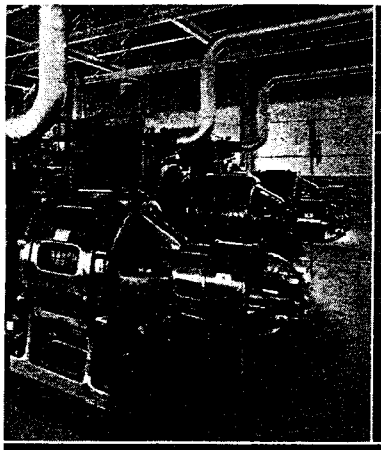
transformers

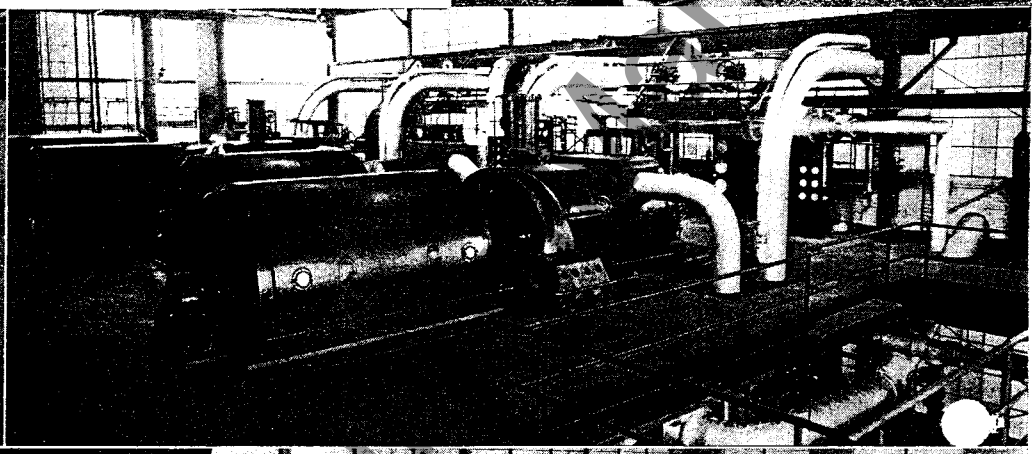


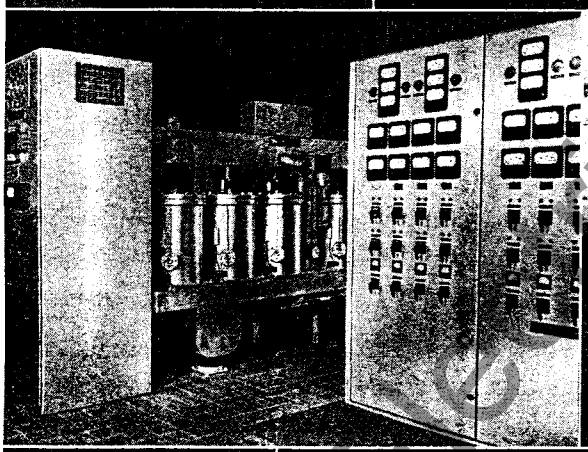
electric utilities

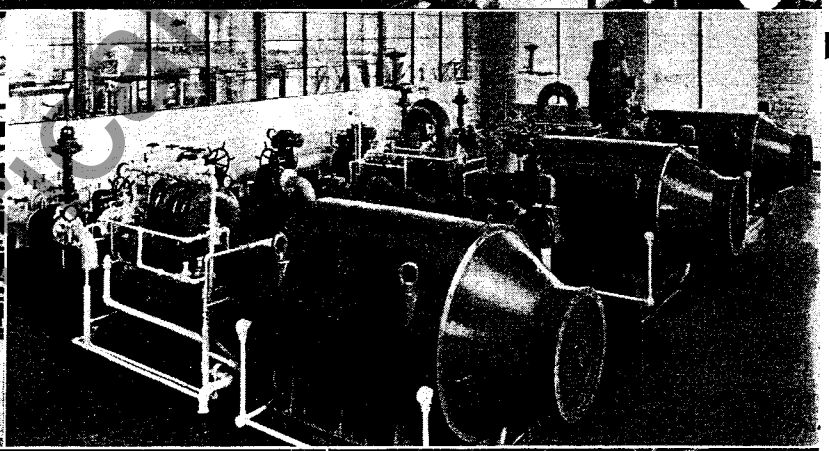
Power generation
Power conversion
Transformation and distribution
Station auxiliaries
Capacitor circuits

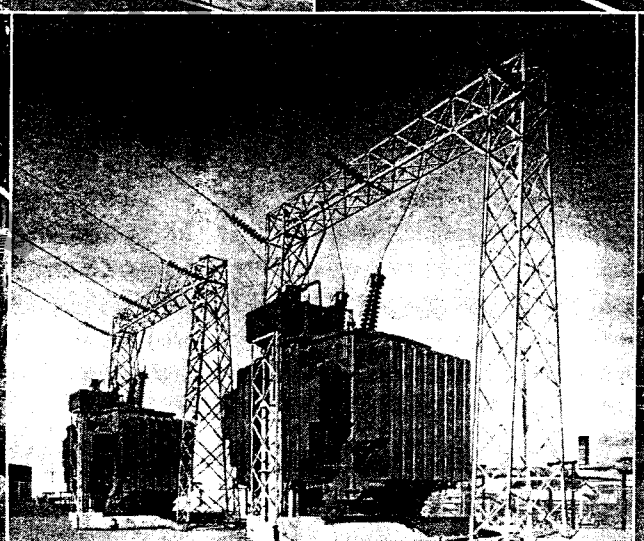


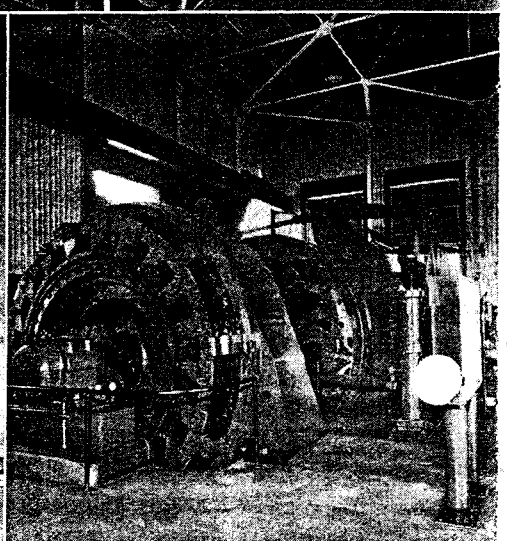












INDOO
standa

Fig. 2

maxi

TYPE KA-
INSTRUME

FLEXITES
WATTHOU
OR RELAY
KA-25 IN

FLEXITES
WATTHOU
OR RELA

FLEXITES

application table "A"

AVAILABLE BREAKER TYPES

AIR CIRCUIT BREAKER TYPE	3-PHASE INTERRUPTING RATING MVA.	VOLTAGE RATINGS			CURRENT RATINGS IN AMPERES			INTERRUPTING RATINGS—AMPERES		60 CYCLES TEST FOR ONE MINUTE KV.	IMPULSE RATING OPEN OR CLOSED GAP KV.
		Rated KV.*	Max. Design KV.	Min. KV. for Rated INT. MVA.	Continuous 60 Cy.	Short Time Momentary	4 Second	At Rated Voltage	Max. Amperes		
50-DH-150-D	150	4.16	4.76	3.5	600	40,000	25,000	21,000	25,000	19	60
50-DH-150-D	150	4.16	4.76	3.5	1200	40,000	25,000	21,000	25,000	19	60
50-DH-150-D	150	4.16	4.76	3.5	2000	40,000	25,000	21,000	25,000	19	60
50-DH-250-D	250	4.16	4.76	3.85	1200	60,000	37,500	35,000	37,500	19	60
50-DH-250-D	250	4.16	4.76	3.85	2000	60,000	37,500	35,000	37,500	19	60
75-DH-250-A	250	7.2	8.25	4.6	1200	51,000	32,000	20,000	32,000	36	95
75-DH-250-A	250	7.2	8.25	4.6	2000	51,000	32,000	20,000	32,000	36	95
75-DH-500-A	500	7.2	8.25	6.6	1200	70,000	44,000	40,000	44,000	36	95
75-DH-500-A	500	7.2	8.25	6.6	2000	70,000	44,000	40,000	44,000	36	95
150-DH-150-A	150	13.8	15.0	6.6	600	20,000	13,000	6,300	13,000	36	95
150-DH-150-A	150	13.8	15.0	6.6	1200	20,000	13,000	6,300	13,000	36	95
150-DH-250-A	250	13.8	15.0	6.6	1200	35,000	22,000	10,600	22,000	36	95
150-DH-250-A	250	13.8	15.0	6.6	2000	35,000	22,000	10,600	22,000	36	95
150-DH-500-A	500	13.8	15.0	11.5	1200	40,000	25,000	21,000	25,000	36	95
150-DH-500-A	500	13.8	15.0	11.5	2000	40,000	25,000	21,000	25,000	36	95

* For Application Data concerning power circuit breakers, see A. D. 33-115.

application table "B"

Type PT POTENTIAL TRANSFORMERS

Accuracy Classifications—Mounting Limitations

Potential transformers are Type PT mounted on drawout disconnect drawer assemblies which disconnect both the primary and secondary connections and ground the high-voltage winding when the door is opened. Available ratings and number of transformers per drawout drawer are indicated below.

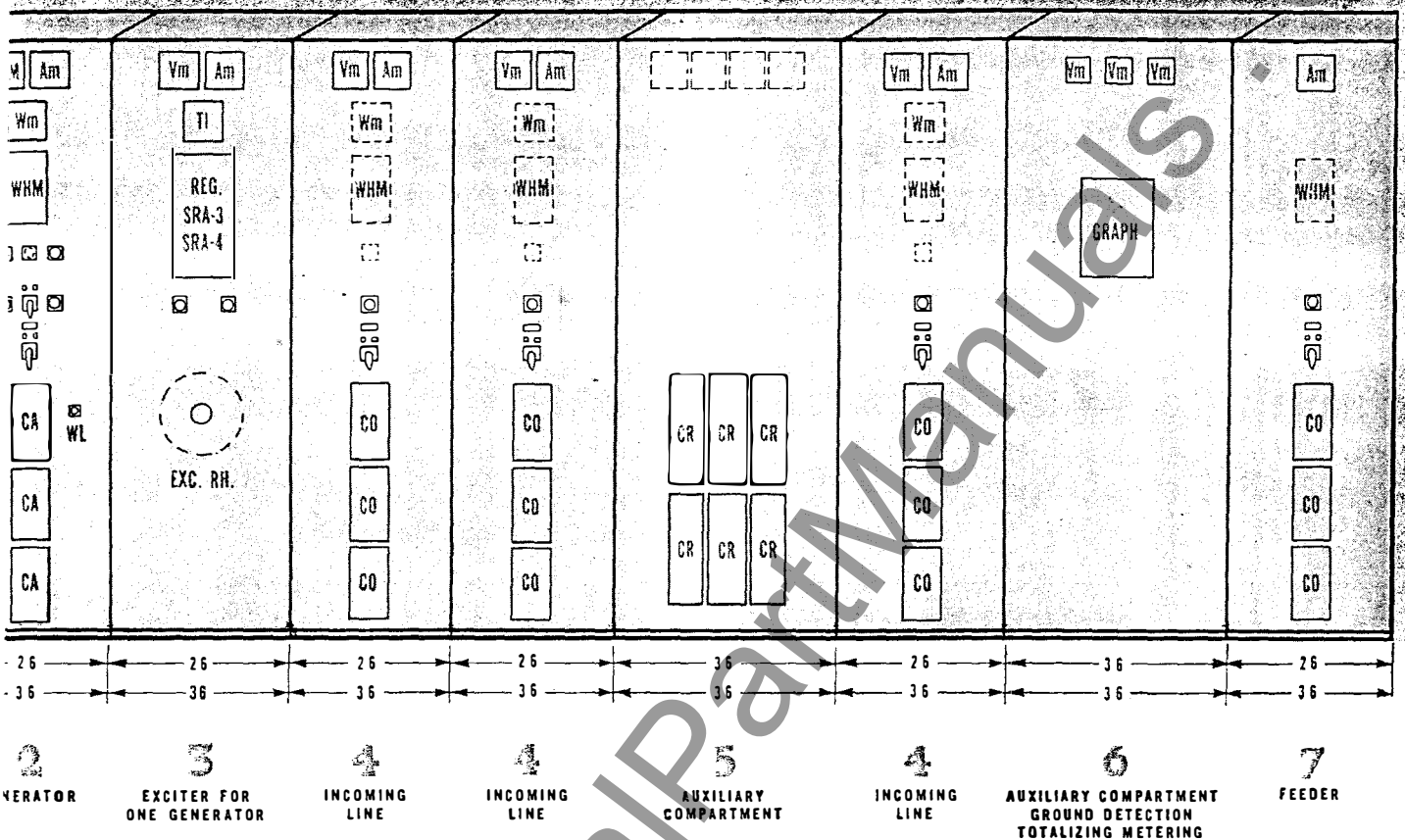
PRIMARY VOLTAGE RATINGS	50/60 CYCLE DATA								MAX. TRANS. PER DRAWOUT DRAWER							
									INDOOR				OUTDOOR			
									60 CYCLE		25 CYCLE		60 CYCLE		25 CYCLE	
	STYLE NO.	CONNECTIONS	IMPULSE RATING KV.	55°C. Ambient Volt-Amperes Thermal	ACCURACY CLASSIFICATION				UNIT WIDTH		UNIT WIDTH		UNIT WIDTH		UNIT WIDTH	
					W	X	Y	Z	26	36	26	36	28 30	38	28 30	38
2400	1629 985	Ø to Ø	60	400	0.3	0.3	0.3	0.6	3	3	2	3	3	..	2	..
4200	1483 798	Ø to Grd.	60	600	0.3	0.3	0.3	0.6	2	3	2	3	2	..	2	..
4800	1483 799		60	600	0.3	0.3	0.3	0.6	..	3	..	3	..	3	..	3
2400	1483 803	Ø to Ø	95	600	0.3	0.3	0.3	0.6	..	3	..	2	..	3	..	2
4200	1483 804	Ø to Ø	95	600	0.3	0.3	0.3	0.6	..	3	..	2	..	3	..	2
4800	1483 805	Ø to Ø	95	600	0.3	0.3	0.3	0.6	..	3	..	2	..	3	..	2
7200	1483 800	Ø to Ø	95	600	0.3	0.3	0.3	0.6	..	3	..	2	..	3	..	2
12000	1483 801	Ø to Ø	95	750	0.3	0.3	0.3	0.3	..	3	..	2	..	3	..	2
14400	1483 802	Ø to Ø	95	750	0.3	0.3	0.3	0.3	..	3	..	2	..	3	..	2
2400	1483 794	Ø to Grd.	95	600	0.3	0.3	0.3	0.6	..	3	..	2	..	3	..	2
4200	1483 795	Ø to Grd.	95	600	0.3	0.3	0.3	0.6	..	3	..	2	..	3	..	2
4800	1483 796	Ø to Grd.	95	600	0.3	0.3	0.3	0.6	..	3	..	2	..	3	..	2
7200	1483 791	Ø to Grd.	95	600	0.3	0.3	0.3	0.6	..	3	..	2	..	3	..	2
*6928	1483 792	Ø to Grd.	95	450	0.3	0.3	0.3	1.2	..	3	..	2	..	3	..	2
*8314	1483 793	Ø to Grd.	95	450	0.3	0.3	0.3	1.2	..	3	..	2	..	3	..	2

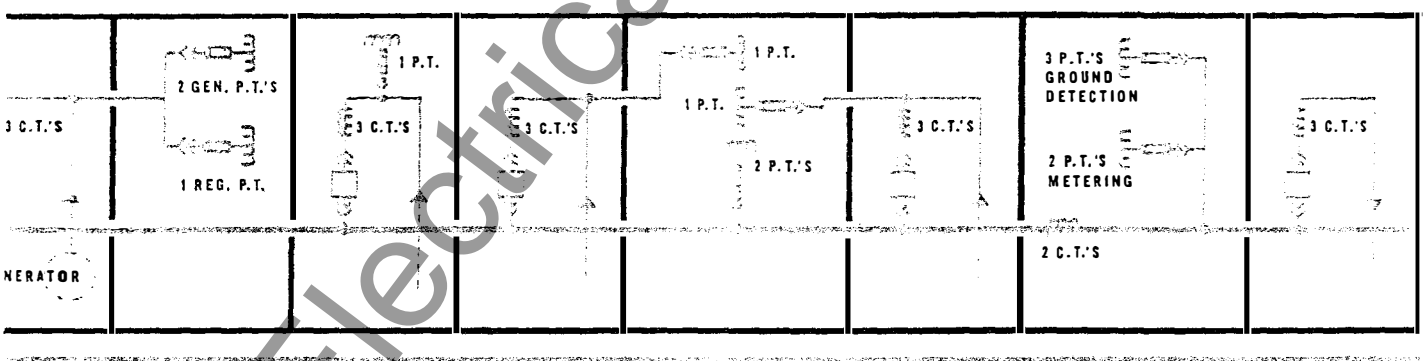
* Line-to-neutral transformers are fluxed to corresponding line-to-line voltage for grounded wye connection to provide ground detection and relay protection.

NOTES:

1. Listed Style Numbered Potential Transformers are for Metal-Clad Switchgear Applications.
2. When Circuit Breakers are Type 50-DH-150 or 50-DH-250 Auxiliary Units are—{Indoor—26" or 36" wide only. Outdoor—30" wide only.
3. When Circuit Breakers are 75-DH or 150-DH; Auxiliary Units are—{Indoor—36" wide only. Outdoor—38" wide only.
4. Disconnecting Type Potential Transformer Assemblies can be mounted in Outdoor Circuit Breaker Units *only* when Transfer Bus Type Assemblies are required. See Fig. 84, Page 25.
5. When three transformers are connected in WYE, the neutral is grounded.
6. For Technical Data on potential transformers, see publication T. D. 45-910.

ANDARD UNITS MEET NORMAL





REQUIRED: UNITIZED switchgear for control of a single generator with exciter, synchronizing equipment, and three feeder circuits.

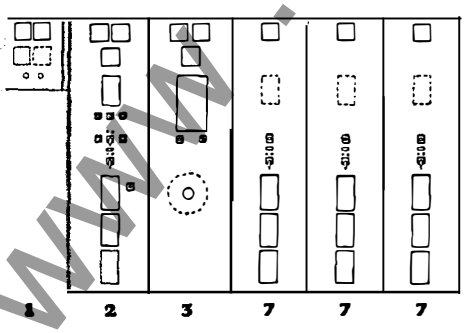


Fig. 126.

REQUIRED: UNITIZED switchgear for control of parallel generators, with exciters, ground detectors, synchronizing equipment, one incoming line, and four feeders. This becomes a group made up of the following basic units:

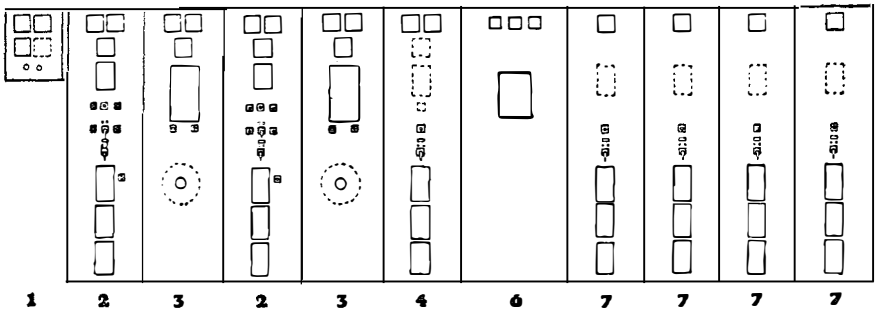
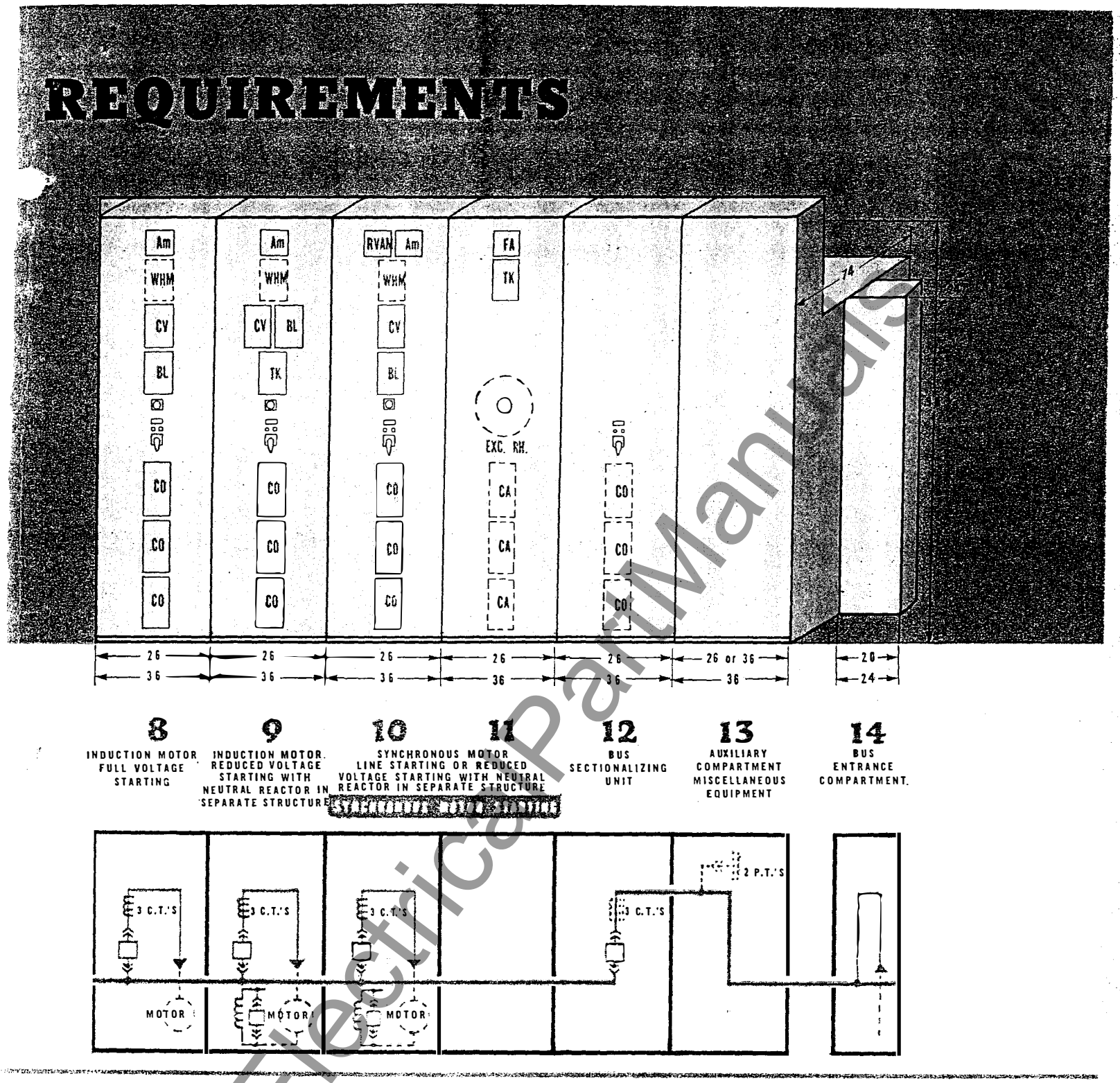


Fig. 127.

REQUIREMENTS



3. **REQUIRED:** UNITIZED switchgear for starting a synchronous motor, for control of two incoming lines with directional protection, and two feeders.

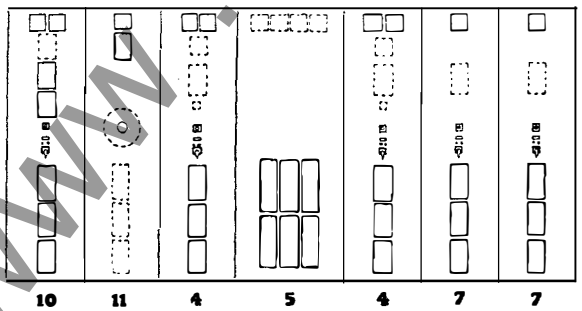


Fig. 128

4. **REQUIRED:** UNITIZED switchgear for a substation with two incoming lines, two induction motor circuits, two feeders and bus sectionalizing equipment.

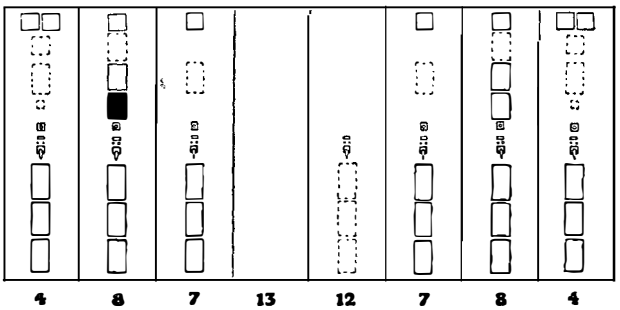


Fig. 129

HOW TO ORDER

Heavy-Duty DH Metal-Clad Switchgear Indoor and Outdoor

information to be furnished with orders:

1. Single-line diagram showing main connections and sketch showing desired order of assembly of units.
2. Name of manufacturer and complete name plate rating of all equipment to be controlled by the switchgear. Generator information should include the field rheostat, field discharge resistor, governor motor information and exciter rating. Synchronous motor information should include exciter rating.
3. The control voltage, such as 125-250 volts d-c, for operating the solenoid closing mechanism and shunt trip coil.
4. Type of cable, number and size of conductors and diameter over lead or braid for each power circuit and where they are to enter (top or bottom).
5. How power cables are to terminate (clamp terminals or potheads).
6. Where control cables are to enter (top or bottom).
7. Maximum over-all dimensions of shipping section which can be handled and installed at destination.
8. Complete name plate wording for each circuit identification name plate.

standard specifications

BASIS OF SPECIFICATIONS

The following specifications are based on 3-phase service, with ungrounded or solidly grounded neutral. The panel equipment specified is the minimum essential for the various circuits. Additional instruments and relays may be specified within the space limitations of the panel. See Figs. 23, 33, and 76.

The arrangements which are covered by these specifications are the most common for this class of switchgear. Other arrangements are also available, such as the double bus, double circuit breaker arrangement (Figs. 34, 46 and 83), and the main and transfer bus arrangement (Figs. 40, 53, and 84). All other bus arrangements or special requirements should be referred to a Westinghouse Sales Office for recommendations.

The following specifications are based on units that will accommodate 1200 or 2000-ampere bus capacities. Busses in excess of 2000 amperes will require increase in depth, as shown in Figs. 36 and 49.

NOTE: The specification is based on d-c, solenoid-operated breakers, as this is the most common and desirable arrangement. A-c operation can be obtained by use of Rectox® solenoid closing and capacitor tripping device or low-voltage, d-c, battery trip coil. This requires the addition of operating transformers connected to the incoming circuits and bus for operating and control source. Manually operated air circuit breakers are not to be specified in any case.

GENERAL: Type DH Metal-Clad Switchgear will consist of a stationary housing and a horizontal drawout air circuit breaker, equipped with a solenoid operating mechanism and primary and secondary disconnecting devices, assembled on a frame to form a self-contained and self-supporting mobile unit. The switchgear will be suitable for service up to (5000) (7500) (15,000) volts, as indicated in application table "A" (see page 39), and will receive dielectric tests in accordance with NEMA standards. The switchgear will be designed, manufactured, and tested in accordance with the latest standards of the AIEE and the NEMA.

STATIONARY STRUCTURE: Unit-type construction will be used in the formation of the housing to provide a rigid, self-supporting and self-contained enclosure for each circuit breaker unit. Each stationary structure will be built of ⅛-inch thick, formed, stretcher-leveled steel sheets, and structural members, electrically welded, and will have a hinged steel panel suitable for mounting of instruments, meters, relays, and control devices. The circuit breaker unit, busses, instrument transformers, and outgoing cables will be isolated within separate compartments formed by sheet steel barriers. Heavy Micarta bus supports will be mounted over the bus openings between units.

These close-fitting supports form a barrier which will isolate each unit from adjacent units. Each compartment will have a separate cover for individual servicing without exposing circuits in adjacent compartments.

A metal shutter will automatically close the opening to the insulators for the primary disconnecting devices when the circuit breaker unit reaches the "Disconnect" position. The shutter will be a simple, one-piece unit closed by gravity and raised automatically upon insertion of the air circuit breaker.

The cable compartment in the rear of each housing will be provided with wiping sleeves or Micarta supports for the primary cables, and is adaptable for pothead entrance. Compartment will be arranged for the cables to enter from above or below the housings, as required.

Terminal blocks will be conveniently located for external connections.

The stationary structure and circuit breaker units will be constructed so that each unit is interchangeable with every other unit of similar rating.

The steel work will be *Bonderized as a unit* after all welding is completed, and painted with a rust-resisting primer coat, followed by a light grey interior and exterior finishing coat. The Outdoor Metal-Clad Switchgear will receive a light grey interior coat and a dark grey weather-resistant external finish coat.

The circuit identification name plates will be engraved Anodized aluminum, 1 inch high and 3 inches wide.

BUSSES AND CONNECTIONS: The busses will be made of high-conductivity, flat copper bar having round edges and will be completely insulated with preformed Micarta tubes, two-piece compound-filled Moldarta boxes and varnish cambric taping. The copper at each main bus joint and each tap joint will be silver-plated and tightly bolted to insure maximum conductivity.

A ground bus with a cross section equal to at least 25 percent of the capacity of the largest circuit will extend throughout the length of the Metal-Clad assembly. Each housing will be grounded directly to this bus. The frame of each circuit breaker unit will be grounded through a rugged ground contact shoe at all times, except when the primary disconnecting devices are separated a safe distance.

DISCONNECTING DEVICES: The primary disconnecting device for each high-voltage circuit will consist of a fixed terminal clamped within a Moldarta or porcelain tube, and a moving contact mounted on the circuit breaker stud. All live parts will be enclosed by the Moldarta tube for 5-kv and porcelain tube for 15-kv insulation class of equipment.

The moving contact will consist of a flexibly mounted, self-aligned assembly of bridging segments, formed so that each segment will make a high-pressure, two-point contact with the fixed terminal at one end and with the circuit breaker terminal at the other end. All contact surfaces will be heavily silver-plated to prevent reduction in current carrying capacity due to oxidation.

The bridging segment assembly will be a part of the removable circuit breaker unit for easy accessibility and inspection.

The secondary disconnecting device will provide connections for the control circuits between the circuit breaker unit and the housing and will consist of multiple plug and socket contacts of the train-line coupler type. The secondary disconnect will automatically engage when the circuit breaker is placed in the "Operating" position and can be re-engaged manually when the unit is in the "Test" position, without using a test jumper.

REMOVABLE ELEMENT: The circuit breaker element will be the Westinghouse Type DH Air Circuit Breaker complete with solenoid operating mechanism, auxiliary switches, and interlocks mounted on a mobile frame. The frame will be fabricated from formed steel plates electrically welded to form a rugged support for the equipment. A horizontal steel barrier will separate the high-voltage parts of the circuit breaker from the operating mechanism and control devices. The frame will have four wheels with needle bearings and a special flange construction which will engage with the rail as the unit is rolled into the housing.

The breaker unit is moved between the "Test" position and "Operating" position by means of a worm gear levering device that is operated by a removable hand crank. The worm gear levering device is so mechanically interlocked with the breaker closing mechanism, that a closed breaker cannot be removed from the "Operating" position or inserted from the "Test" position. The breaker mechanism cannot be closed when the worm gear levering device is between the "Operating" position or the "Test" position of the levering device.

FACTORY ASSEMBLY AND TESTS: The switchgear will be completely assembled, wired, adjusted, and tested at the factory. After complete assembly, each standard unit will be tested for operation under simulated service conditions by impressing primary current on the current transformers. Properly phased voltage from the same source will be impressed on the potential circuits. This assures accuracy of the wiring, correctness of the control scheme and functioning of the equipment.

SPECIFICATIONS FOR STANDARDIZED UNITS INDOOR AND OUTDOOR

unit 1

SWINGING INSTRUMENT PANEL

A swinging steel instrument panel will be mounted on the (right) (left) hand end of the structure for synchronizing instruments. The panel will be 21½ inches wide and 24 inches high and will be equipped with the following:

2—Type KA-25 voltmeters, 0- ..... volt scale, 150-volt coils.
1—Type KI-25 synchroscope with two lamps.
1—(*Optional*) Type KY-25 frequency indicator, 58-62 cycle scale, 115-volt.

standard units nos. 2 and 3

FOR CONTROL OF ONE GENERATOR

unit 2

The Metal-Clad Switchgear for the control of one generator and one exciter will consist of two housings which will provide switching, instrumentation, voltage regulation and excitation control.

The Metal-Clad Unit for the control of one 3-phase, 60-cycle generator will be ..... inches wide, ... inches deep, 90⅜ inches high, and will be equipped with the following:

1—Type DH air circuit breaker, ... ampere, 3-pole, single-throw, d-c, solenoid operated.
1—Set of ..... ampere insulated busses.
3—Current transformers, .../5/5 ratio, double secondary (5 kv) (15 kv).
3—Current transformers, .../5 single secondary (5 kv) (15 kv) for generator neutral unmounted.

Mounted on the hinged instrument panel:

1—Type KY-25 power-factor meter, 50-100-50 scale.
1—Type KA-25 a-c ammeter, 0- ..... scale, 5-ampere coil.
1—Type KY-25 polyphase indicating wattmeter, 0- ..... scale, 5-ampere, 115-volt.
1—Type CB-2F Flexitest polyphase watthour meter, 2-element, 5-ampere, 120-volt, with built-in test switches.
3—Type CA Flexitest generator differential relays, with built-in test switches.
1—Type WL auxiliary tripping relay.
1—Type W 3-phase voltmeter switch.
1—Type W 3-phase ammeter switch.
1—Type W synchronizing switch.
1—Type W rheostat control switch.
1—Type W field breaker control switch with red and green indicating lights.
1—Type W governor motor control switch.
1—Type W circuit breaker control switch with red and green indicating lamps for generator air circuit breaker.
1—Name plate for circuit identification.

unit 3

The auxiliary compartment for the control of the exciter will be ..... inches wide, ... inches deep and 90⅜ inches high, and will be equipped with the following:

NOTE: The 26-inch auxiliary compartment is suitable for a total of two sets of three each, of 2400/120 volt potential transformers or two sets of two each, of 4200/120 volt potential transformers.

1—Set of ..... ampere insulated busses.
1—Electrically operated disconnecting Type DB field breaker.
2—Disconnecting Type PT potential transformers ...../120 volt ratio, 60-cycle, with fuse mountings, and one set of current limiting fuses. (To be connected to the generator circuit for metering.)
1—Disconnecting Type PT potential transformer, .../120 volt ratio, 60-cycle, with fuse mountings, and one set of current limiting fuses. (To be connected to the generator circuit for voltage regulator.)

Mounted on the hinged instrument panel:

1—Type KX-25 d-c voltmeter, 0- ..... scale.
1—Type KX-25 d-c ammeter, complete with 50 mv shunt, 0- ..... scale.
1—Type KX-25 temperature indicator, 0-150 degrees C scale, complete with Rectox unit.
1—Type SRA-(1) (2) (3) (4), direct, quick-acting (Silverstat®) generator voltage regulator with voltage adjusting rheostat, damping transformer, and provision for cross current compensation.
1—Type W temperature indicator switch.
1—Type W regulator transfer switch.
1—Type W exciter rheostat control switch, *or*
1—Manual mechanism for operation of exciter field rheostat and drilling only for mounting of rheostats. (2—15-inch diameter plates maximum.)

FOR CONTROL OF ONE INCOMING LINE

unit 4

The Metal-Clad Switchgear for the control of one incoming line will consist of one housing which will provide switching, instrumentation and relaying.

NOTE: This unit provides indicating ammeters and voltmeter. Optional equipment may include watthour meter, indicating wattmeter, synchronizing switch to synchronize between the incoming line and bus and the necessary reverse power relay protection, when required.

The Metal-Clad Unit for the control of a 3-phase, 60-cycle incoming line will be ..... inches wide, ... inches deep, and 90⅜ inches high, and will be equipped with the following:

1—Type DH air circuit breaker, ... ampere capacity, 3-pole, single-throw, d-c, solenoid operated.

1—Set of ..... ampere capacity insulated busses.

3—Current transformers, .../5 ratio, single secondary (5 kv) (15 kv).

1 or 2—(*Optional—mounted in superstructure*) Disconnecting Type PT potential transformers ...../120 volt ratio, 60-cycle, with fuse mountings and one set current limiting fuses. (To be connected to the line).

Mounted on the hinged instrument panel:

1—Type KA-25 voltmeter, 0-..... scale, 150-volt coil.

1—Type KA-25 a-c ammeter, 0-..... scale, 5-ampere coil.

1—Type W 3-phase voltmeter switch.

1—Type W 3-phase ammeter switch.

1—Type W circuit breaker control switch with red and green indicating lamps for incoming line air circuit breaker.

3—Type CO Flexitest overcurrent induction relays, 4-15 ampere range, with built-in test switches.

1—Name plate for circuit identification.

1—(*Optional*) Type KY-25 wattmeter, suitable scale.

1—(*Optional*) Type CB-2F Flexitest polyphase watthour meter, 2-element, 5-ampere, 120-volt, with built-in test switches.

1—(*Optional*) Type W synchronizing switch.

standard units nos. 4, 5, 4

FOR CONTROL OF TWO INCOMING LINES WITH DIRECTIONAL PROTECTION

unit 5

The Metal-Clad Unit for the control of two incoming lines will consist of three housings which will provide switchgear, instrumentation, overcurrent and directional protection.

STANDARD UNIT No. 4—For specifications, see above.

The Metal-Clad auxiliary compartment for the two incoming lines will be 36 inches wide, ... inches deep, and 90⅜ inches high, and will contain the following equipment:

1—Set of ..... ampere insulated busses.

2—Disconnecting Type PT potential transformers, .../120 volt ratio, 60-cycle, with fuse mountings and current limiting fuses. (Each potential transformer will be mounted on a separate disconnect type truck connected to the incoming line side of the breaker to give potential indication and synchronizing potential for each of the two incoming lines.)

2—(*Optional*) Disconnecting Type PT potential transformers, .../120 volt ratio, 60-cycle, with fuse mountings and one set current limiting fuses. (To be connected to the bus for metering and voltage indication purposes.)

Mounted on the hinged instrument panel:

6—Type CR Flexitest reverse current relays, 4-15 ampere range, with built-in test switches. (Three of which will be connected to each incoming line circuit.)

STANDARD UNIT No. 4—For specifications, see above.

AUXILIARY COMPARTMENT

unit 6

The auxiliary compartment for the totalizing equipment will be 36 inches wide, ... inches deep, and 90⅜ inches high, with provision for the following equipment:

1—Set of ..... ampere insulated busses and connections.

2—Current transformers, .../5 ratio, single secondary, (5 kv) (15 kv).

2—Disconnecting Type PT potential transformers, .../120 volt ratio, 60-cycle, with fuse mountings and one set of current limiting fuses. (To be connected to the bus.)

3—Disconnecting Type PT potential transformers, .../120 volt ratio, 60-cycle, with fuse mountings and one set of current limiting fuses. (To be connected to the bus y-y for ground detector voltmeters.)

Mounted on the hinged instrument panel:

3—Type RA-37 voltmeters, 0- ..... scale. (To be connected for ground indication.)

1—Type R-2 recording demand watthour meter, 2-element, 5-ampere, 120-volt, complete with Type FT test switches.

Space only for mounting other indicating or recording meters or instruments, within the limitations of the panel as shown in Figs. 23, 33, and 76.

FOR CONTROL OF ONE FEEDER

unit 7

The Metal-Clad Switchgear for the control of one feeder circuit will consist of one housing which will provide switching, instrumentation, and relaying.

The Metal-Clad Unit for the control of a 3-phase, 60-cycle feeder circuit will be ..... inches wide, ... inches deep, 90⅜ inches high, and will be equipped with the following:

1—Type DH air circuit breaker, ... ampere, 3-pole, single-throw, d-c, solenoid operated.

1—Set of ..... ampere insulated busses.

3—Current transformers, .../5 ampere ratio, single secondary (5 kv) (15 kv).

2—(*Optional—mounted in superstructure*) Disconnect Type PT potential transformers, .../120 volt ratio, 60-cycle, with fuse mountings, and one set current limiting fuses.

Mounted on the hinged instrument panel:

1—Type KA-25 ammeter, 0- ..... scale, 5-ampere coil.

3—Type CO Flexitest overcurrent induction relays, 4-15 ampere range, with built-in test switches and 20-80 ampere instantaneous trip attachment.

1—Type W 3-phase ammeter switch.

1—Type W circuit breaker control switch with red and green indicating lamps.

1—Name plate for circuit identification.

1—(*Optional*) Type CB-2F Flexitest polyphase watthour meter, 2-element, 5-ampere, 120-volt, with built-in test switches.

FOR CONTROL OF INDUCTION MOTOR
(Full Voltage Starting)

unit 8

The Metal-Clad Switchgear for the control of one across-the-line starting circuit will consist of one housing which will provide switching, instrumentation and relaying.

The Metal-Clad Unit for the control of a 3-phase, 60-cycle induction motor circuit will be ..... inches wide, ... inches deep and 90⅜ inches high, and will be equipped with the following:

1—Type DH air circuit breaker, ... ampere, 3-pole, single-throw, d-c, solenoid operated.

1—Set of ..... ampere insulated busses.

3—Current transformers, .../5 ampere ratio, single secondary (5 kv) (15 kv).

2—(*Optional—mounted in superstructure*) Disconnecting Type PT potential transformers, .../120 volt ratio, 60-cycle, with fuse mountings, and one set current limiting fuses.

Mounted on the hinged instrument panel:

1—Type KA-25 a-c ammeter, 0-..... scale, 5-ampere coil.

1—Type CV Flexitest a-c undervoltage relay, with built-in test switches.

2—Type BL Flexitest thermal relays, with instantaneous trip attachments, and built-in test switches. (Two Type BL thermal elements mounted in one flush mounted relay case.)

3—Type CO Flexitest overcurrent induction relays, 4-15 ampere range, long time, with built-in test switches and 20-80 ampere instantaneous trip attachment.

1—Type W 3-phase ammeter switch.

1—Type W circuit breaker control switch with red and green indicating lamps.

1—Name plate for circuit identification.

1—(*Optional*) Type CB-2F polyphase watthour meter, 2-element, 5-ampere, 120-volt, complete with test switches.

FOR CONTROL OF INDUCTION MOTOR

(Reduced Voltage Starting)

unit 9

The Metal-Clad Switchgear, for the control of one induction motor reduced voltage starting unit, will consist of one housing which will provide switching, instrumentation, and relaying.

The Metal-Clad Unit for the control of a 3-phase, reduced voltage starting unit will be ..... inches wide, ... inches deep, and 90⅜ inches high and will be equipped with the following:

1—Type DH air circuit breaker, ... ampere, 3-pole, single-throw, d-c, solenoid operated.

1—Set of ..... ampere insulated busses.

3—Current transformers, .../5 ampere ratio, single secondary (5 kv) (15 kv).

2—(*Optional—mounted in superstructure*) Disconnecting Type PT potential transformers, .../120 volt ratio, 60-cycle, with fuse mountings, and one set current limiting fuses.

Mounted on the hinged instrument panel:

1—Type KA-25 a-c ammeter, 0-..... scale, 5-ampere coil.

1—Type CV Flexitest undervoltage relay, with built-in test switches.

2—Type BL Flexitest thermal relays, with instantaneous trip attachments, and built-in test switches. (Two BL thermal relay elements mounted in one flush mounted relay case.)

1—Type TK Flexitest timing relay, with built-in test switches, for automatic operation of the shunting breaker for the starting reactors.

3—Type CO Flexitest overcurrent induction relays, 4-15 ampere range, long time, with built-in test switches and 20-80 ampere instantaneous trip attachment.

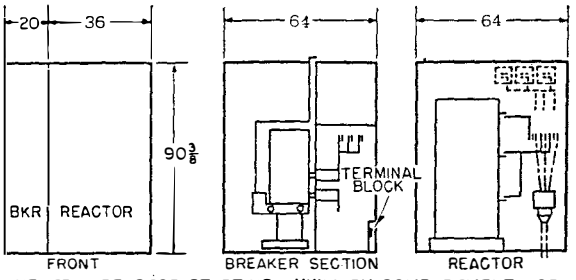
1—Type W 3-phase ammeter switch.

1—Type W circuit breaker control switch with red and green indicating lamps.

1—Name plate for circuit identification.

1—(*Optional*) Type CB-2F Flexitest polyphase watthour meter, 2-element, 5-ampere, 120-volt, with built-in test switches.

unit no. 9-A



NEUTRAL REACTOR STARTING AUXILIARY COMPARTMENT FOR SHIELDED AIR CORE REACTOR. SPACE SHOWN SUITABLE UP TO APPROXIMATELY 2500 H.P. MOTOR

Fig. 130.

The auxiliary structure for the starting reactor and starting reactor shunting breaker will be ..... inches wide, ... inches deep, 90⅜ inches high, and will be equipped with the following:

1—Type DH air circuit breaker, ... ampere, 2-pole, single-throw, d-c, solenoid operated.

1—Space for starting reactor, 3-phase, ... ampere, ... kv.

1—Set of ..... ampere insulated connections.

1—Set of cable clamps and terminals.

FOR CONTROL OF SYNCHRONOUS MOTOR

unit 10

The Metal-Clad Switchgear for full voltage or reduced voltage starting of one synchronous motor will consist of two housings which will provide switching, automatic field application, instrumentation, and shutdown upon occurrence of overcurrent, thermal overload, undervoltage, synchronous speed pullout, field failure, and incomplete starting sequence.

The Metal-Clad Unit containing the circuit breaker for the control of a 3-phase, 60-cycle, full voltage or reduced voltage starting synchronous motor will be ..... inches wide, ... inches deep, and 90⅜ inches high, and will be equipped with the following:

1—Type DH air circuit breaker, ... ampere, 3-pole, single-throw, d-c, solenoid operated.
1—Set of ..... ampere insulated busses.
3—Current transformers, .../5 ratio, single secondary (5 kv) (15 kv).
2—(*Optional—mounted in superstructure*) Disconnecting Type PT potential transformers ...../120 volt ratio, 60-cycle, with fuse mountings and one set current limiting fuses.

Mounted on the hinged instrument panel:

1—Type KY-25 polyphase, reactive volt-ampere indicator, 0-..... scale, 5-ampere, 120-volt.
1—Type KA-25 a-c ammeter, 0-..... scale, 5-ampere coil.
1—Type CV Flexitest undervoltage induction relay, 120 volts, with built-in test switches.
2—Type BL Flexitest thermal overload relays, with instantaneous trip attachments, and built-in test switches. (Two BL overload thermal elements mounted in one flush relay case.)
3—Type CO Flexitest overcurrent, long time, induction relays, 4–15 ampere range, with built-in test switches and 20-80 ampere instantaneous trip attachment.
1—Type W 3-phase ammeter switch.
1—Type W circuit breaker control switch, with red and green indicating lamps.
1—Name plate for circuit identification.
1—(*Optional*) Type CB-2F Flexitest polyphase watthour meter, 2-element, 5-ampere, 120-volt, with built-in test switches.
1—(*Optional*) Type W rheostat control switch.

unit 11

This compartment can be located in the main structure lineup as shown, or arranged for separate mounting adjacent to the motor.

When supplied for remote mounting for reduced voltage starting application, the field equipment will be mounted on the reduced voltage starting structure, Unit 11-A. When compartment is removed from main structure, field rheostat, when required, must be electrically operated and rheostat control switch added to main panel Unit No. 10.

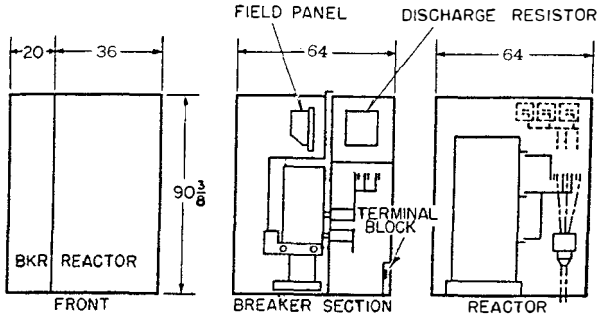
The auxiliary compartment for the control of the motor field circuit will be ..... inches wide, ... inches deep, and 90⅜ inches high and will be equipped with the following:

1—Set of ..... ampere insulated busses.
1—Synchronous motor field panel, consisting of the following:
  1—Type HI field failure relay.
  1—Shunt for field ammeter.
  1—Type DN field contactor, for field currents of 125 amperes or less.

or 1—Electrically operated disconnecting Type DB field breaker for field currents greater than 125 amperes.
  1—Field discharge and starting resistor.
  1—Field application relay.
  2—(*Optional*) Disconnecting Type PT potential transformers, .../120 volt ratio, 60-cycle, with fuse mountings and one set of current limiting fuses.

Mounted on the hinged instrument panel:

1—Type KX-25 ammeter, 0-..... scale for motor field.
1—Type TK Flexitest timing relay, with built-in test switches, for field application over-all sequence checking.
1—Manual mechanism for operation of exciter field rheostat and drilling only for mounting of rheostats, maximum size, 2—15-inch diameter plates, or one type W switch for electrically operated rheostats when size exceeds two 15-inch diameter plates.
3—(*Optional*) Type "CA" Flexitest ratio differential relays, with built-in test switches.



NEUTRAL REACTOR STARTING AUXILIARY COMPARTMENT FOR SHIELDED AIR CORE REACTOR. SPACE SHOWN SUITABLE UP TO APPROXIMATELY 2500 H.P. MOTOR

Fig. 131.

The auxiliary structure for the starting reactor and starting reactor shunting breaker will be ..... inches wide, ... inches deep, 90⅜ inches high, and will be equipped with the following:

1—Type DH air circuit breaker, ... ampere, 2-pole, single-throw, d-c, solenoid operated.

1—Space for shielded air core starting reactor, 3-phase, ... ampere, ... kv.

1—Set of ..... ampere insulated connections.

1—Set of cable clamps and terminals.

1—Type TK Flexitest timing relay, with built-in test switches, for closing running breaker.

3—(*Optional*) Type CA Flexitest ratio differential relays, with built-in test switches.

CONTROL FOR BUS SECTIONALIZING

unit 12

The Metal-Clad Unit for the control of the bus sectionalizing circuits will be ..... inches wide, ... inches deep, and 90⅜ inches high, and will be equipped with the following:

1—Type DH air circuit breaker, ... ampere, 3-pole, single-throw, d-c, solenoid operated.

1—Set of ..... ampere insulated busses and transition bus connections.

3—(*Optional*) Current transformers, .../5 ratio, single secondary (5 kv) (15 kv).

2—(*Optional—mounted in superstructure*) Disconnecting Type PT potential transformers, .../120 volt ratio, 60-cycle, with fuse mountings and one set current limiting fuses.

Mounted on the hinged instrument panel:

1—Type W circuit breaker control switch, with red and green indicating lamps.

1—Name plate for circuit identification.

3—(*Optional*) Type CO Flexitest overcurrent induction relays, 4-15 ampere range with built-in test switches.

1—(*Optional*) Type W synchronizing switch.

NOTE: An auxiliary unit is required for the bus transition connectors of the bus sectionalizing unit. When an auxiliary unit is not included in the switchgear assembly that can be used for bus transition connections, auxiliary unit No. 13 must be added.

AUXILIARY COMPARTMENT

unit 13

The auxiliary compartment will enclose one set of insulated primary transition bus connections associated with the bus sectionalizing breaker unit and one set of insulated main bus and connections. Space will be available when required for mounting current transformers in the transition connections, a disconnecting type potential transformer assembly or an operating transformer for control power with its associated disconnecting type "BAL" fuse assembly, surge protective equipment or other equipment associated with the Metal-Clad Switchgear.

The housing for an auxiliary compartment will be ..... inches wide, ... inches deep, and 90⅜ inches high.

BUS ENTRANCE COMPARTMENT

unit 14

The bus entrance compartment will be mounted on the (right) (left) hand end of the switchgear structure and will provide an enclosure for incoming cables which are to connect directly to the main bus.

accessories—INDOOR AND OUTDOOR

One set of accessories for the operation, test and inspection of the circuit breakers, which will include the following:

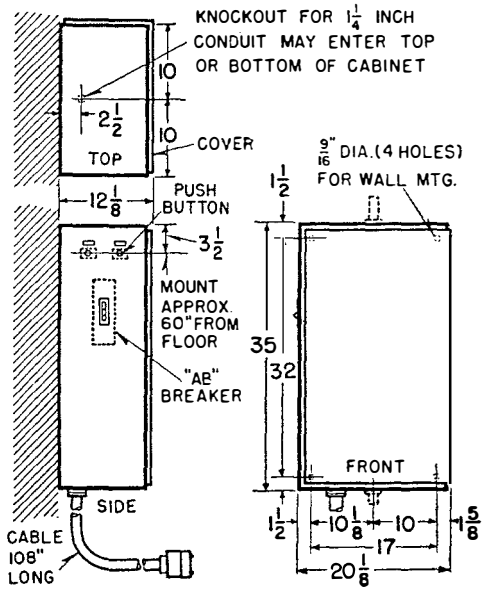


Fig. 132.

1—Test cabinet, complete with secondary contacts, control relay and pushbuttons for electrically-operated breakers (see Fig. 132).
1—Closing lever for manually closing the circuit breaker.
1—Removable hand crank for operation of the levering-in device.
1—Set of special wrenches, for the primary disconnecting devices.
1—Set test plugs for Flexitest meters and relays.
1—Adjustable transport truck for Outdoor Metal-Clad Switchgear installations only, or
1—Transport dolly for indoor installations.

NOTE: For outdoor installations, a 10-foot test jumper is usually substituted for the test cabinet.

125-VOLT CONTROL BATTERY

The control battery will provide power for operation of electrical operating mechanism and may be used for all indicating lamps and any alarm circuits.

1—60-cell storage battery, acid type with pasted plate assembly in sealed glass jars. Discharge rate will not be less than . . . amperes for one minute or . . . amperes for 8 hours to 1.75 volts per cell. There will also be furnished electrolyte, inter-connectors, two-step rack, cell numbers, portable hydrometer and vent hole thermometer.

24-VOLT TRIPPING BATTERY

The tripping battery will provide power for operation of the shunt trip coils of Metal-Clad Switchgear installations when a-c Rectox solenoid operating mechanisms are supplied.

1—12-cell storage battery, acid-type, with pasted plate assembly in sealed glass jars. The discharge rate will not be less than . . . amperes for one minute or . . . amperes for 8 hours to 1.75 volts per cell. There will also be furnished the electrolyte and inter-connectors.

A-C TRIPPING

A 24-volt tripping battery is recommended as the most reliable method for Rectox operated breakers. Where local conditions make the tripping battery undesirable, specify a capacitor trip device for each breaker. In addition, a potential transformer or operating transformer must be available on the line side of each incoming line and generator unit, and on each bus section, to insure a-c supply to the capacitor trip device before its respective breaker is closed.

BATTERY CHARGER FOR 125-VOLT CONTROL BATTERY

Nonautomatic Chargers

1—Rectox battery charger, 115-volt, 60-cycle, a-c and 0.1 to 3.0-ampere, d-c, complete with dial, switch and ammeter suitable for wall mounting S# 708909, or
1—Rectox battery charger, 115-volt, 60-cycle, a-c and 0.2 to 6.0-ampere, d-c, complete with dial, switch, ammeter, voltmeter and suitable for floor mounting. S# 897720.

RECTOMATIC SELF-REGULATING BATTERY CHARGER

1—Rectomatic battery charger 115-volt, 60-cycle, a-c and 0.3 to 3.0-ampere, d-c, complete with indicating and control devices. Floor mounting S# 1549708, or
1—Rectomatic battery charger 115-volt, 60-cycle, a-c and 0.6 to 6.0-ampere, d-c, complete with indicating and control devices. Floor mounting S# 1549726.

A-C CLOSING

A full-wave Rectox rectifier for each breaker will provide the necessary d-c power for operating the solenoid closing mechanism. One 2,400/250/120 volt, operating transformer is required for each incoming line and generator unit and each bus section.

BATTERY CHARGER FOR 24-VOLT TRIPPING BATTERY

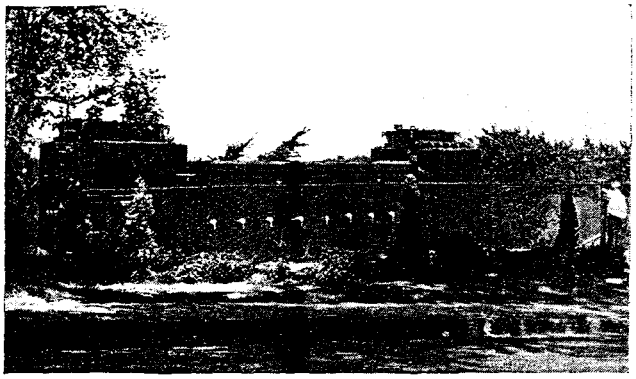
1—Rectox battery charger, 115-volt, 60-cycle, a-c and 0.1 to 1.0-ampere, d-c, complete with ammeter, voltmeter, rheostat and suitable for wall mounting. S# 1551650.

SURGE AND LIGHTING PROTECTION

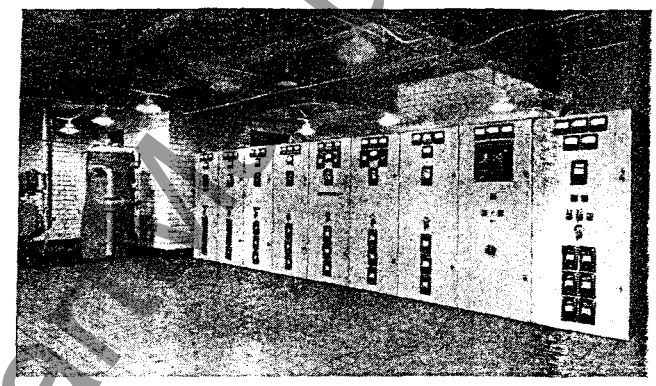
Where there are exposed lines, it is recommended that the purchaser provide adequate surge and lightning protection. If desired, this protective equipment can be supplied in the Metal-Clad Gear.

These installations are typical of hundreds of Westinghouse Metal-Clad Switchgear units—wherever large blocks of power are handled and controlled.

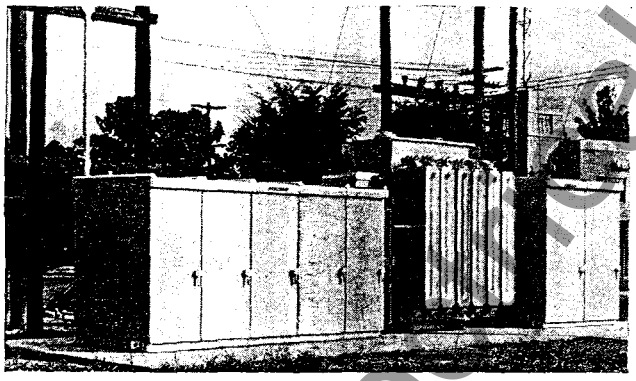
STEEL MILLS



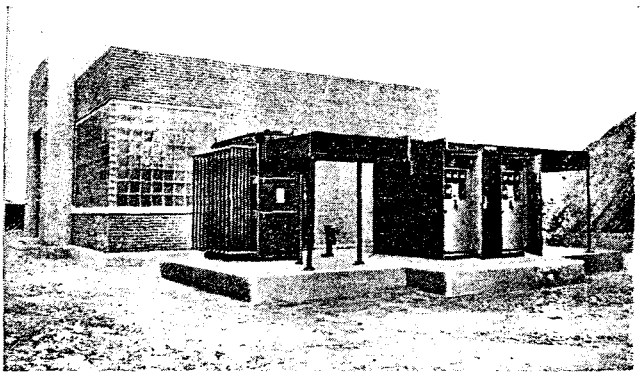
UTILITIES



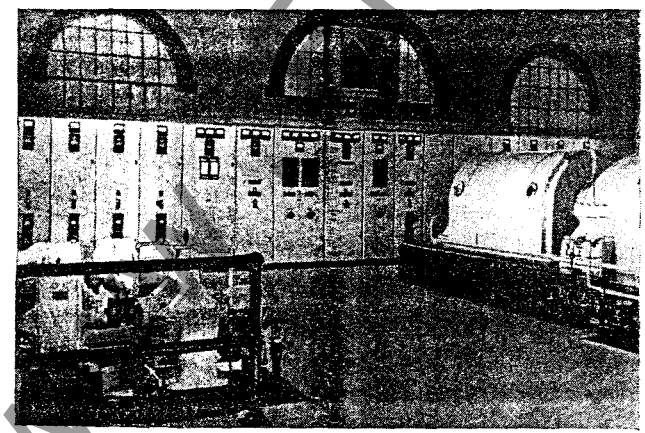
PAPER MILLS



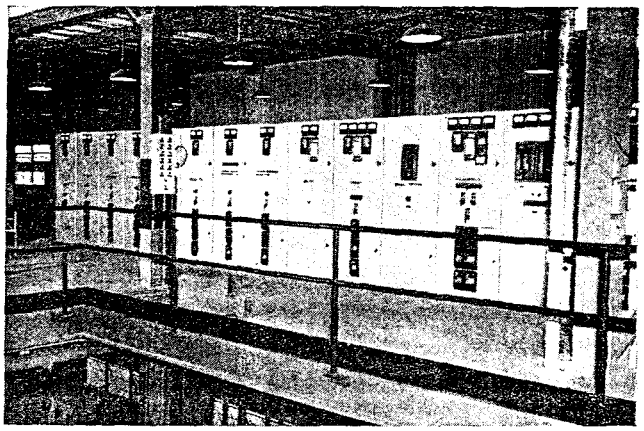
UTILITIES



METAL MINING



POWER PLANTS



LUMBER MILLS