

# AMERICAN LOCOMOTIVE COMPANY

## SPECIFICATION

E-1540

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ONE 1000 B.H.P. DIESEL LOCOMOTIVE

AMERICAN LOCOMOTIVE COMPANY  
30 Church Street  
New York

Specification No. E-1540

1000 B.H.P. Diesel Locomotive

Type 4-0-4

General Characteristics

Track Gauge.....	4'-8-1/2"
Diesel Engine, ONE, 6 Cylinders, Supercharged.....	1000 B.H.P.
Driving Motors.....	Four
Maximum Speed Restriction.....	60 m.p.h.
Driving Wheels.....	4 Pairs
Diameter.....	40"
Weight.....	On Drivers..... 230,000 lbs.
Total Locomotive.....	230,000 lbs.
Wheel Base.....	Each Truck (Rigid)..... 8'-0"
Total Locomotive.....	30'-6"
Maximum Overall Locomotive Dimensions (Drawing)	
Height.....	14'-6"
Width.....	10'-0"
Length (Inside Knuckles).....	45'-5-3/4"
Starting Tractive Effort (at 30% Adhesion).....	69,000 lbs.
Minimum Radius Curvature (Locomotive Alone).....	50'
Supplies (Total Capacity) - Lubricating Oil.....	80 gallons
Fuel ".....	635 "
Engine Cooling Water.....	240 "
Sand.....	27 cu. ft.
General Design Shown by Drawing.....	981-N-93310

## UNDERFRAME

General	Built-up welded steel construction.
Steps	Vestibule type steps at four corners.
Floor Plates	Steel plates securely fastened to underframe. Safety tread pattern on walkway along outside of hood.
Bumpers	Front and rear of steel plates securely fastened to underframe. Push pole pockets provided.
Couplers	Swivel coupler, A.A.R. standard automatic type "E", top operated, 11" face, and with 6" x 8" semi-long shank applied at each end. Uncoupling levers provided at each end to operate independently from either side.
Draft Gear	Friction draft gear applied at each end.
Yokes	Coupler yokes of cast steel. Carrier iron integral with yoke.
Coupler Housings	Draft gear pockets of cast steel, with integral striking plates, securely fastened to underframe.

## TRUCKS

General	Two 4-wheel swivel Alco type motor trucks applied.
Frames	Three-piece type of cast steel; center member, with center plate and bolster cast integral, supported through parallel arrangement of coil and semi-elliptic springs on cast steel side frames having integral journal boxes.
Motor Mounting	Both trucks arranged for application of motors to each axle. Spring nose suspension applied with suitable wear plates. Motors are blown through the center plate and hollow bolster. Wheel and axle assembly removable with or without motors.
Center Plates	Cast steel male center plate, securely fastened to underframe. Center plates fitted with high carbon steel side and bottom liners, with horizontal liner of truck center plate removable for shimming. Center plates oil lubricated; dust guard applied.
Side Bearings	Plain sliding surfaces of steel. Truck safety lock and swivelling limit device applied at side bearings.
Axles	Two axles per truck of forged open hearth steel. Journals, diameter and length 7" x 14". Axles with collars. Axle end thrust arrangement provided in box.
Wheels	Four per truck, diameter 40", rolled steel with 2-1/2" rims.
Springs	Springs of open hearth steel tempered in oil.

CAB AND HOOD

Superstructure	Substantially built of steel plates, thoroughly braced and secured to underframe. Single end type operating Cab with low Hood covering power equipment.
Hood	Section of Hood over engine-generator set is removable. Radiators and fan at forward end of Hood; control equipment located next to Cab. Steel doors on each side, at forward end, and between Cab and Hood for inspection of all parts. Hatches located over the Diesel engine to permit removal of piston, liner or cylinder head. Radiator fan opening with suitable screen. Louvers give adequate ventilation to engine, generator, traction motor blowers, and control apparatus.
Cab	Roof, back and sides of Cab wood lined. Doors at back end and on left side leading to walkway along Hood; doors of steel plate with suitable weather seals. Back section of side windows sliding type with steel sash. Other windows fixed type with suitable rubber seals. Safety glass in all windows. Four (4) window wipers applied, located front and back on right and left sides of Cab. Cab floor of seasoned hardwood.
Control Stand	Conveniently located on right hand side of Cab. Battery ammeter, slip indicator, lubricating and fuel oil pressure gauges, engine water thermometer, air brake gauges, engine throttle lever, brake valve, and motor controller with reversing lever located on the Control Stand. Push buttons for controlling all lights including both headlights, engine starting, fuel pump, and control in boxes on Control Stand. Bell, horn, sander, fuel oil safety cut-out and engine stop control devices all located convenient to operator's position.
Seats and Locker	One cushioned swivel seat with back rest at operating position. Box type seat with hinged cushioned seat for left side of Cab. The box seat is suitable for holding small tools. Arm rests provided; seats and arm rests upholstered. Clothes locker applied, located in the Cab.
Extinguisher	Fire extinguisher located in Cab.
Heater	Motor blown Cab Heater connected with engine water system. Control convenient to operator's position.
Miscellaneous	Fuse holder, fuse tester, fuse puller, flag holder, and two inspection card holders provided in Cab.

## BRAKE EQUIPMENT

### Air Brakes

Automatic and straight air brakes on all driving wheels, with suitable train connections front and rear.  
Operating brake schedule E.L.-14, complete with operating valve and standard air gauges.

Brake cylinders --- 4 - 10 x 10".

Main reservoirs of ample capacity --- 67,800 cubic inches.

### Foundation Brake

Clasp type, with two (2) shoes per wheel.

### Hand Brake

Hand brake, connected to one (1) truck and located in the Cab.

### Brake Shoes

Flange type, cast iron with steel back, Diamond "S" type.

### Compressor

Compressor, mechanically driven by power take off from main engine, of the air cooled two-stage type, complete with unloader, pilot, and strainer for air intake located inside of Hood.

Capacity at full engine speed --- 228 cu.ft. per min. displacement.

Capacity at idling engine speed --- 76 cu.ft. per min. displacement.

Suitable intercooler provided between compressor stages; adequate cooling pipe between compressor and reservoirs, and reservoir tanks.

## ELECTRICAL EQUIPMENT

### Main and Auxiliary Generator

Number of units \_\_\_\_\_ ONE.

Each unit consists of \_\_\_\_\_ ONE Main Generator direct connected, and a belt driven exciter - auxiliary generator set.

### Traction Motors and Equipment

Number of Traction Motors \_\_\_\_\_ FOUR Axle hung, nose supported.  
Gear Ratio - Standard, single reduction.

Motors blown by \_\_\_\_\_ TWO Belt driven blowers.  
(One blower located near each center pin and supplies air to two motors on one truck.)

### Control

Number of control positions \_\_\_\_\_ ONE.

Control Equipment \_\_\_\_\_ ONE Complete set applied.

Auxiliary generator has constant regulated voltage from idling to full engine speed, and supplies power to battery.

### Characteristics

Shown by American Locomotive Company's tractive effort-speed curve No. 115.

DIESEL ENGINE EQUIPMENT (ONE)

<b>Maker</b>	American Locomotive Co., Diesel Engine Division, Auburn, N. Y.
<b>Type</b>	Vertical, with six cylinders cast en bloc; four cycle, single acting with mechanical type fuel injection. Engine directly coupled to Railway Type generator unit.
<b>Rating</b>	Normal engine rating (at sea level) _____ - 1000 B.H.P. Normal running speed - <u>740 R.P.M.</u> Idling Speed <u>250 R.P.M.</u>
<b>Cylinders</b>	Diameter and Stroke - <u>12-1/2" x 13"</u>
<b>Cylinder Block, Heads and Valves</b>	Cylinder block of cast iron. Cylinder liners of special close grained cast iron. Cylinder heads for each cylinder cast separate, of cast iron. Two exhaust valves, two intake valves and one injection nozzle, symmetrically located in each cylinder head. All valve operating gear totally enclosed and pressure lubricated.
<b>Base</b>	Engine base of cast iron. Generator frame bolted to flange on engine base. Detachable covers provided on each side of engine base giving free access to running parts. Crankcase breather and blowout safety device provided.
<b>Crankshaft</b>	Substantial seven bearing crankshaft bedded in base.
<b>Pistons</b>	Pistons trunk type with cast iron rings.
<b>Rods</b>	Connecting rods of forged steel.
<b>Fuel Injection System</b>	Injection system includes individual injection pump unit for each cylinder mounted on engine, together with electric driven transfer pump for supplying fuel oil from tank to injection pump unit.
<b>Lubrication</b>	Full pressure system supplied by direct driven gear type pump. Lubricating oil reservoir in engine base, capacity <u>65</u> gallons. Low lubricating oil pressure trip in system.
<b>Governor</b>	Governor Woodward-Hydraulic centrifugal variable speed type. Intermediate engine speeds controlled by engineer's throttle lever which sets the governor position. Overspeed safety trip independent of governor provided.
<b>Radiation</b>	Standard sectional radiators with unit mounting, all brazed construction, for cooling engine water and lubricating oil. Radiator shutters applied operated by lever in Cab. Mechanically driven radiator fan gives positive cooling. Water circulated by centrifugal pump on one side of engine. Oil circulated to radiators by lubricating oil pressure pump.
<b>Engine Auxiliaries</b>	Engine auxiliary equipment to include: Motometer                      Lubricating oil pressure gauge. Air filters for engine air intake.
<b>Supercharging</b>	Engine equipped with turbo-charging system. (Bushi)

## ACCESSORIES

### Tanks for Fuel and Water

Tanks of steel plates, welded construction.  
Fuel tank, located under Cab, complete with vent pipe, sump, drainage provision, cleaning holes, and glass gauge.  
Filling pipe with cap at end platform of locomotive.  
Safety cut out valve at tank operative from ground and Cab.  
Fuel tank capacity --- 635 gallons.

Water tank for engine cooling system, located above engine and radiators, complete with filling connection, overflow line, vent pipe, and gauge indication to the Cab.  
Water system arranged for complete drainage at one connection.  
Cooling water tank capacity --- 50 gallons.

### Sanding Equipment

Sand boxes located inside of Hood, filled from roof.  
Total box capacity --- 27 cu. ft.  
Four (4) traps, pneumatic type, connected to leading Locomotive wheels for either direction of operation.

### Battery

Battery, 32-cell, for Lights, Diesel Engine Starting, and Control.  
Battery boxes (2) substantially built, welded construction, located underneath Cab frame between the trucks; and with insulators, drainage holes for cleaning, and properly painted.  
Battery disconnecting switch operated from the Cab.

### Lighting

Lighting circuits connected across 32-cell battery.  
Control centralized at operator's position.  
Dome light in roof of operator's Cab.  
Control stand with indirect lighting.  
Four lights in Hood over engine; one in control equipment section.  
Extension light cord provided suitable for connection to any socket.

### Headlights & Numerals

Headlight at each end, submerged type, with 12" metallic reflectors.  
Headlight bulb, 250 Watt, with suitable dimming control.  
Numeral boxes with electric lighting applied on each side of Hood.

### Warning Devices

One (1) air operated horn.  
Locomotive bell, 12" size, with pneumatic ringer.

### Auxiliaries

Auxiliaries, where consistent with proper design, mechanically driven; continuous V-belts applied with slack adjusting arrangement.  
Safety guards applied at all necessary points.

### Filters

The fuel oil filters are the standard duplex type.  
Filter for lubricating oil located near Diesel engine.

### Hardware & Fastenings

Two Cab doors with locks; all others with suitable fastenings.  
All hinges, locks, handles, and fastenings of ample strength and approved design.

### Gutters

Small U-shaped gutters over side windows of Cab.

### Tools

Necessary wrenches, hammer, and chisels, together with special tools for Diesel engine and electrical equipment, to be provided; packing tools, oil cans, and hand lantern applied.

### Signal Brackets

Signal brackets to be applied in accordance with purchaser's instructions.

ELECTRICAL EQUIPMENT  
GENERAL ELECTRIC CO.

## Equipment List

1. 1 - GT-553-A Generator  
Volt-ampere Curve H-4786438  
Continuous Rating 1350 amps.
2. 1 - GMG-139-A2 Exciter-Auxiliary  
Generator Set  
Auxiliary Generator Voltage 75 volts  
Auxiliary Generator Continuous Rating 65 amps.
3. 4 - GE-731 Motors  
Characteristic Curve H-4786435  
Continuous Rating Per Motor 830 amps.  
Continuous Tractive Effort - 4 Motors 34,000 lbs.  
Ventilating Air 1200 cfm  
Gear 75 teeth  
Pinion 16 teeth  
Wheel Diameter 40 in.  
Maximum Speed Restriction 60 mph
4. 1 - Radiator Fan & Right Angle Drive  
Four Blade Aphonic Fan with  
GA-14 Gear Box.
5. 1 - Type P Control Equipment

Main  
Generator

The GT-553 Main Generator furnishes power to the traction motors. It is directly connected to the engine and is supported from it, insuring perfect alignment between the generator armature and engine crankshaft independent of any deflections caused by weaving of the locomotive frame. A single self-aligning roller bearing is used on the out-board end of the generator armature shaft. The generator is constructed so that all important parts are interchangeable.

Exciter-  
Auxiliary Set

The GMG-139 Set consists of an Exciter and an Auxiliary Generator on one shaft, belt driven from the engine. The split pole exciter, which excites the main generator, has a special magnetic circuit which maintains the generator horsepower output constant throughout the normal speed range of the locomotive. The auxiliary generator supplies power for the control circuits, the auxiliaries that are electrically operated and for charging the battery. Its voltage is constant throughout the diesel engine speed range.



## ELECTRICAL EQUIPMENT

### Traction Motors

The GE-731 Traction Motor is a four pole, direct current commutating pole type designed and insulated for operation with full or shunted field from the engine driven generator.

The Traction Motors are supported in the locomotive trucks by the axle bearings and spring nose suspension from the truck frame. The axle suspension bearings are sleeve type and are lubricated by oil fed to them by means of wool waste.

The motor armature shaft is made unusually rigid and can be removed without disturbing windings or commutator. The stiffness of the armature shaft assures accurate gear tooth alignment and long life for the gear and pinion. The completed armature is dynamically balanced before assembly in the frame.

The field coils are hot drawn, that is, mounted in place and heated by passing current through the coil, then drawn up tight, insuring tightness of the field coils.

The motor frame is an integral steel casting and is provided with large openings for inspecting brushes.

The roller bearing on the pinion end is 130-mm. in diameter and at the commutator end is 90-mm. The shaft diameter through the pinion end bearing is 5.125-in.

### Radiator Fan

A single large diameter fan driven and supported by a right angle drive gear box is located in the hood roof. The fan provides sufficient air flow at all locomotive speeds with low power input to the gear box shaft. The gear box shaft is belt-driven from the engine.

The radiator fan is 45 inches in diameter and is a four blade construction designed to deliver the air for radiator cooling at 1000-rpm for the maximum engine output. This fan is constructed of cast aluminum alloy, heat treated, with a steel insert in the hub and is carefully balanced to operate without vibration.

### Fan Gear Box

The GA-14 gear box consists of a malleable iron integral casting ribbed to insure ample rigidity. The gearing is of the spiral bevel type, case hardened, mated and lapped in pairs for quiet running. The gear ratio is unity.

Full lubrication is provided by dip and splash from the gear box. Provision is made for convenient filling and checking the oil level.

## ELECTRICAL EQUIPMENT

### Control Equipment

Type P single-end single-unit control is used with mechanically driven auxiliaries. (Connection diagram M-4725824.)

The traction motor reverser and line contactors are electro-pneumatically operated. Remaining contactors are operated magnetically.

Power supplied by the engine is regulated by the throttle lever on the control stand at engineer's position. The initial movement of the throttle closes contacts to operate the main motor and field circuit contactors.

The traction motors are arranged to operate in series and series-parallel. In the latter connection they are also operated with shunted fields. The motor connections are changed automatically from series to series-parallel and from series-parallel full field to series-parallel shunt field. The connections are controlled by a relay whereby transfers are obtained not only at rated engine speed but over the entire operating range of engine speeds. This same relay also drops out the field shunting contactors when the locomotive speed is reduced below the predetermined range for shunt field operation.

Generator protection is obtained by a current relay and an indicating light giving visible warning when the locomotive is operated below the proper speed range with the motors in the series-parallel connection.

Wheel slipping relays operate a buzzer that warns the engineer when any pair of wheels slips.

A master controller is used to select the motor combination and for controlling the direction of movement. This has an operating handle with three forward, one off and three reverse positions. The handle is normally placed in either the full forward or full reverse position before opening the throttle, so that the motor connections are then automatically changed from series to series-parallel and the field shunting contactors operated at the proper locomotive speeds without any attention on the part of the operator. The handle can be placed in the first forward or reverse position and thus maintain the series motor connection.

A multi-button switch at the operator's station controls the fuel pump, engine starting and the lighting circuits.

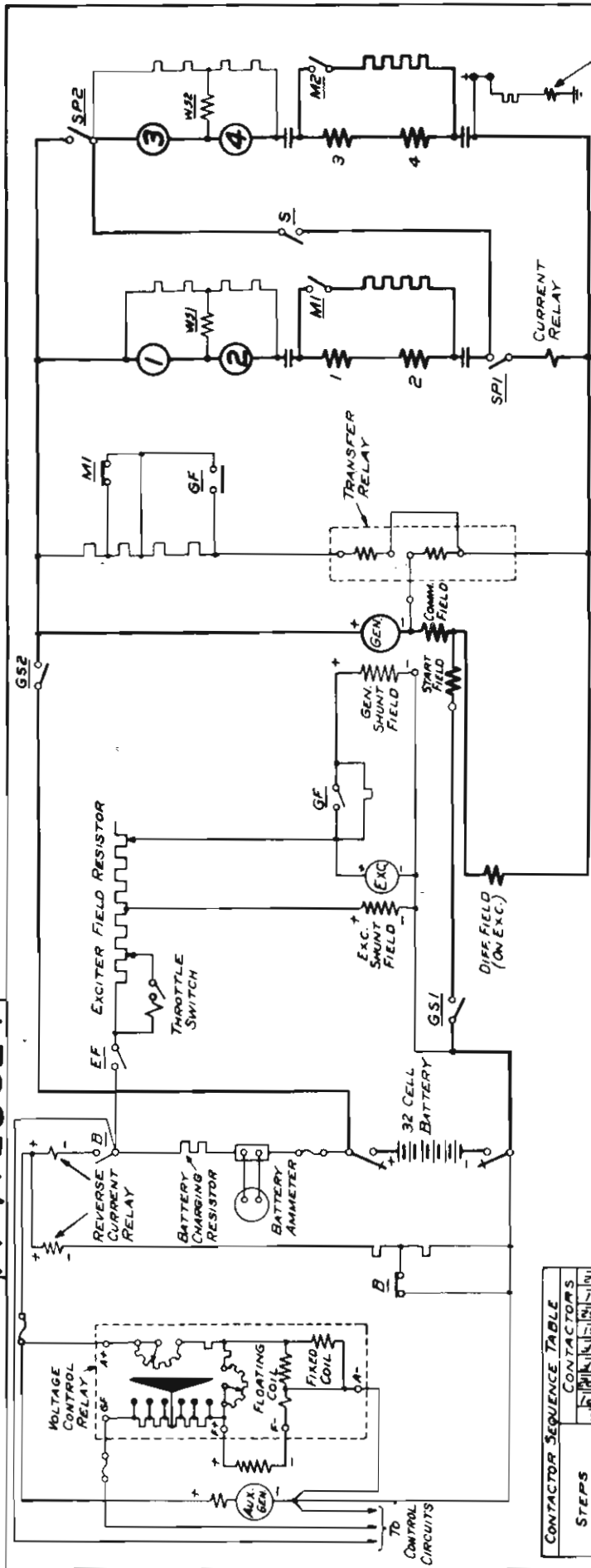
GENERAL

Painting	Duco Finish on outside of Cab, Hood, and Underframe. Balance of outside of Locomotive painted with black engine finish. Interior painted; Cab wood lining of roof and walls down to window sills to be a natural varnish finish. Lettering and Numbering as specified by Purchaser.
Safety Appliances	Steps, handrails, and safety appliances in accordance with the Interstate Commerce Commission regulations.
Patents	All patent fees not covered by this specification excepted.
Bolts & Nuts	All bolt threads U.S. Std. except where finer threads are necessary. All fittings manufactured outside Locomotive Builder's plants to have maker's standard threads.
Materials	All material to be in accordance with Locomotive Builder's and apparatus manufacturer's standard material specifications.
Testing	After complete assembly the Locomotive is to be given a running test at Locomotive Builder's works to insure the proper adjustment of all parts.

SPECIALTIES APPLIED

Foundation Brakes	American Locomotive Company
Brake Shoes	American Brake Shoe & Fdy. Co.
Hand Brake	Ajax Hand Brake Company
Compressor, Type 3-CD	Westinghouse Air Brake Company
Horn, Type A-1	" " " "
Sander Traps	Graham White
Air Push Window Wiper	Hayes
Fire Extinguisher, 1-1/2 quart	Pyrene
Pneumatic Bell Ringer	Transportation Devices Co.
Battery	Exide Ironclad 32-Cell, KT-35
Vee Belts	The Dayton Rubber Mfg. Co.
Radiators	The Young Radiator Company
Radiator Shutters	Kysor Heater Company
Headlights	Pyle National Company
Traction Motor Blower	B. F. Sturtevant Co.
Lubricating Oil Filter	Nugent

**M-4725824**



CONTACTOR SEQUENCE TABLE

STEPS	STARTING	IDLING	SERIES	T1	T2	T3	T4	T5	SER. PAR.	REDUCED FIELD
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## ABBREVIATIONS

- B BATTERY CONTACTOR  
EF EXCITER FIELD CONTACTOR  
GF GENERATOR FIELD CONTACTOR  
GS1, GS2 ENGINE CRANKING CONTACTORS  
M1, M2 FIELD SHUNTING CONTACTORS  
S SERIES MOTOR CONTACTOR  
SP1, SP2 SERIES-PARALLEL MOTOR CONTACTORS  
WS1, WS2 WHEEL SLIPPING RELAYS

## SYMBOLS

- |  |   |
|--|---|
|  | INDIVIDUALLY OPERATED CONTACTOR                                   |
|  | NORMALLY CLOSED INTERLOCK (CLOSED WHEN CONTACTOR IS DE-ENERGIZED) |
|  | NORMALLY OPEN INTERLOCK (OPEN WHEN CONTACTOR IS DE-ENERGIZED)     |
|  | AMMETER SHUNT   |
|  | KNIFE BLADE SWITCH  |
|  | ARMATURE  |
|  | OPERATING COIL OR FIELD WINDING                                   |
|  | RESISTOR  |
|  | FUSE  |
|  | REVERSER CONTACTS   |

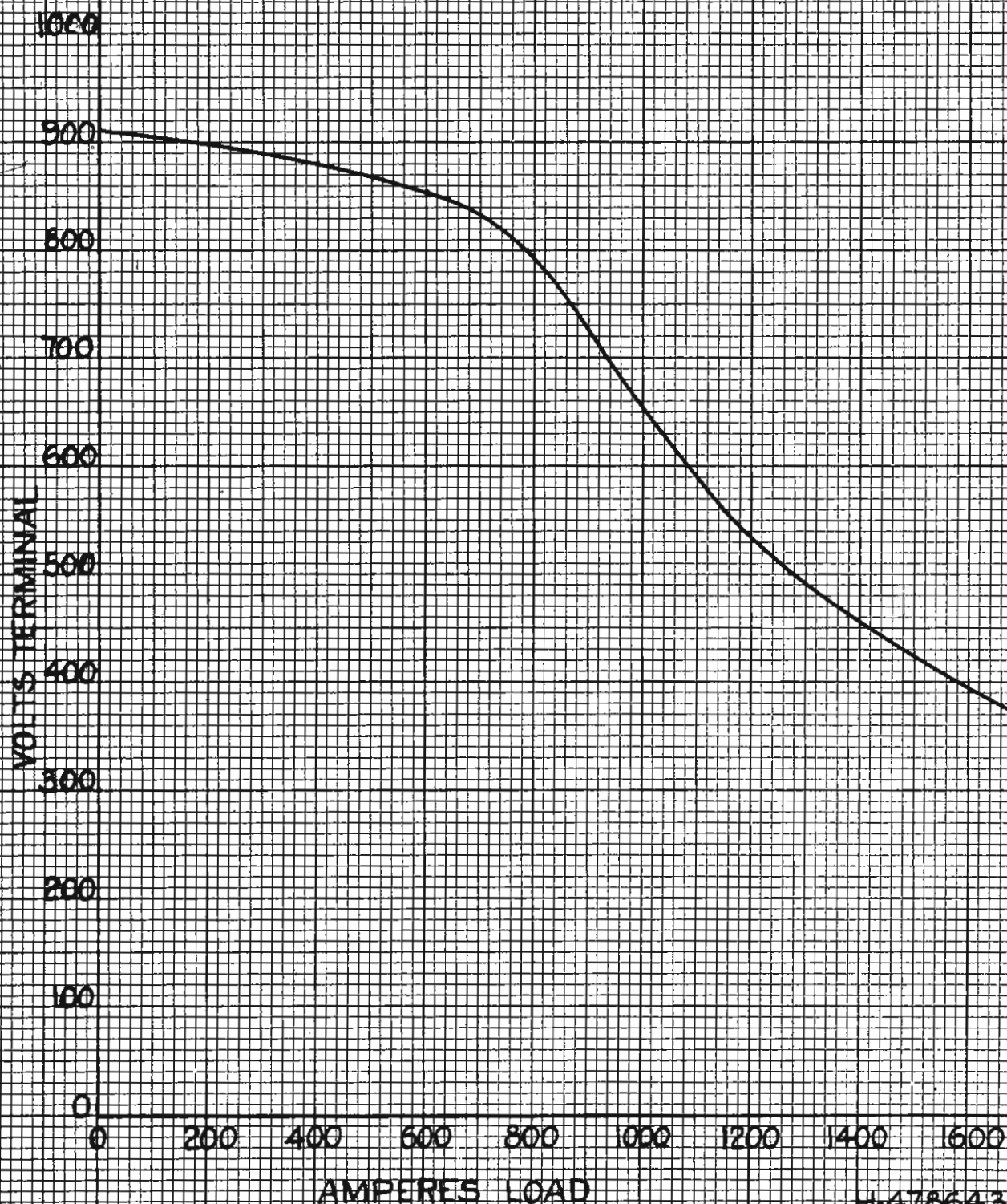
REVISIONS

**TYPE P SINGLE END SINGLE UNIT CONTROL**

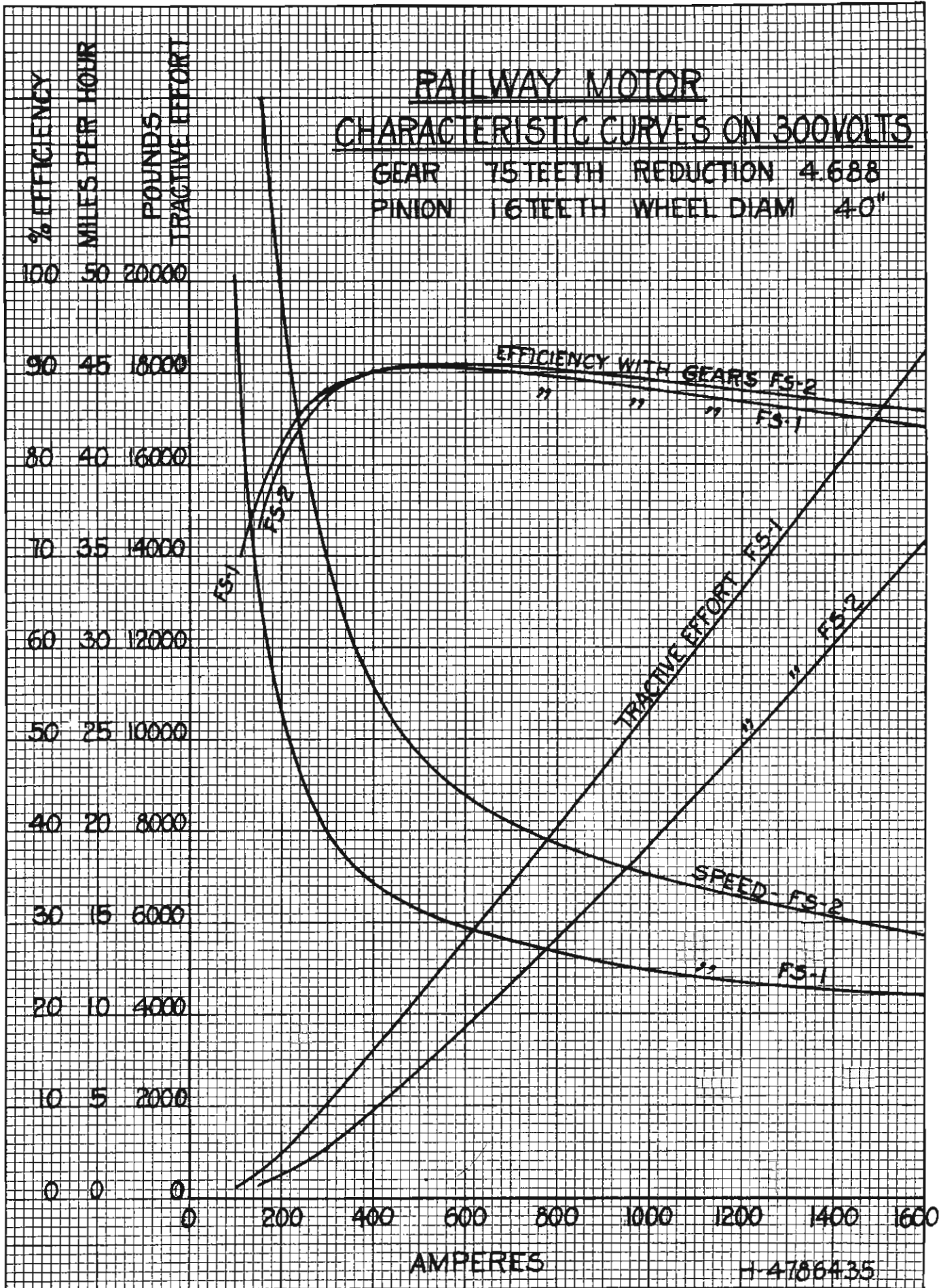
GENERAL ELECTRIC CO. ERIE WORKS	M-4725824
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PC

# MAIN GENERATOR CHARACTERISTIC CURVE



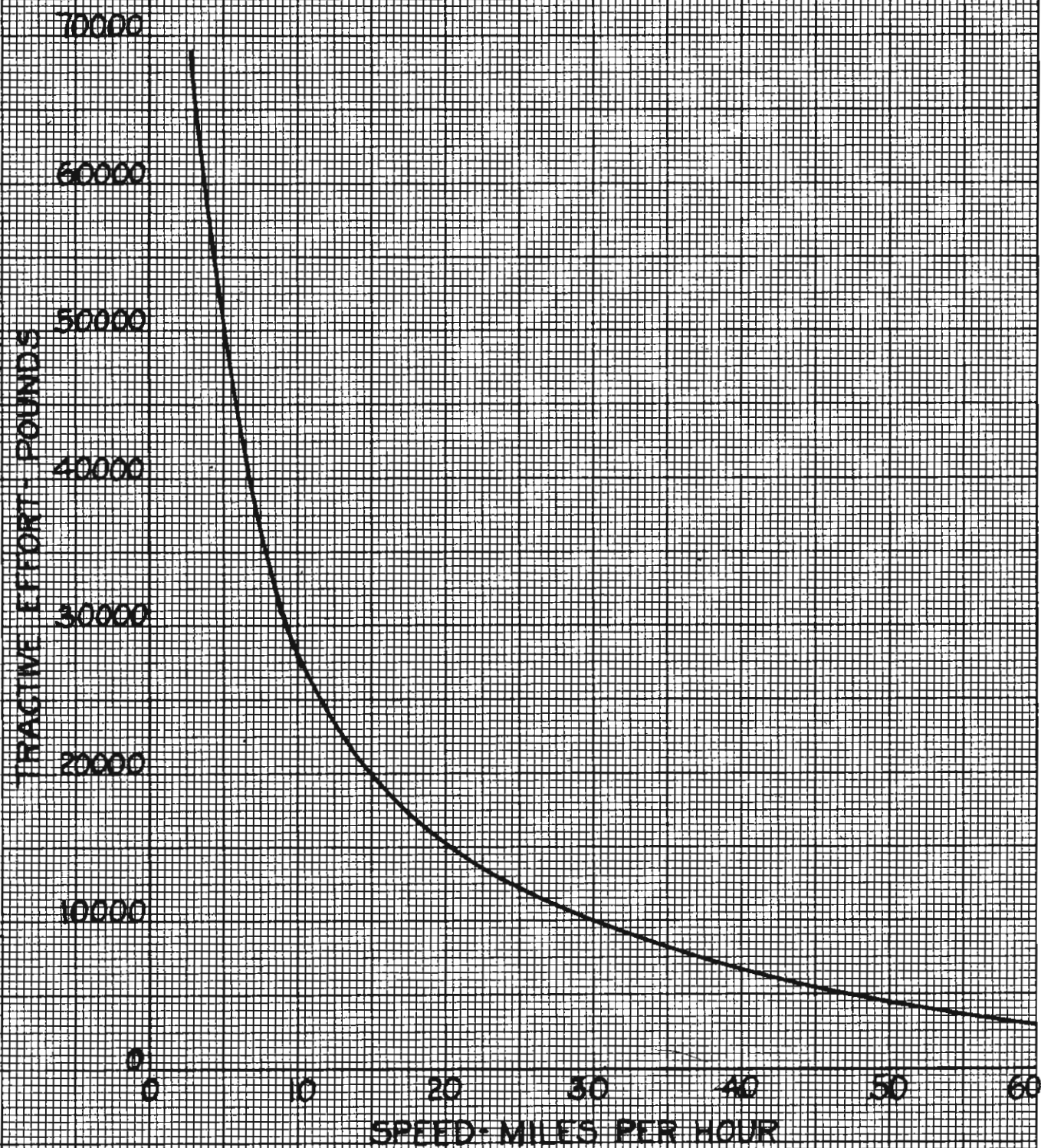
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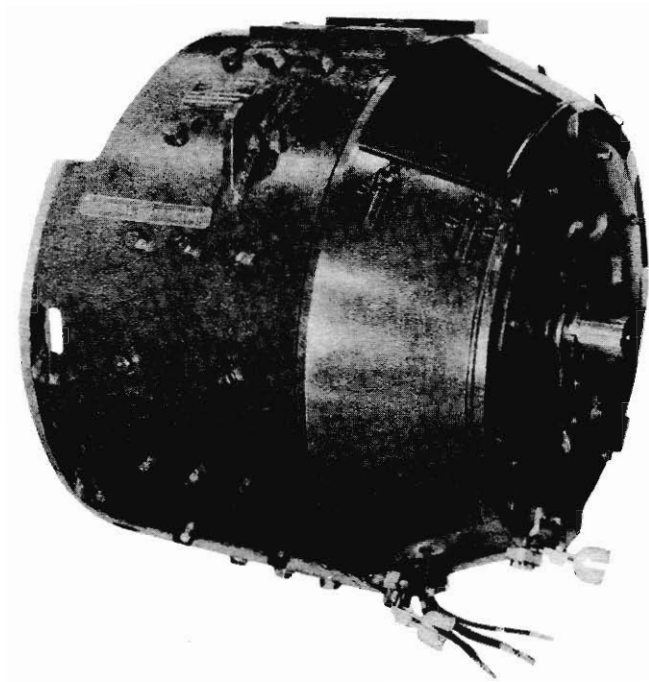




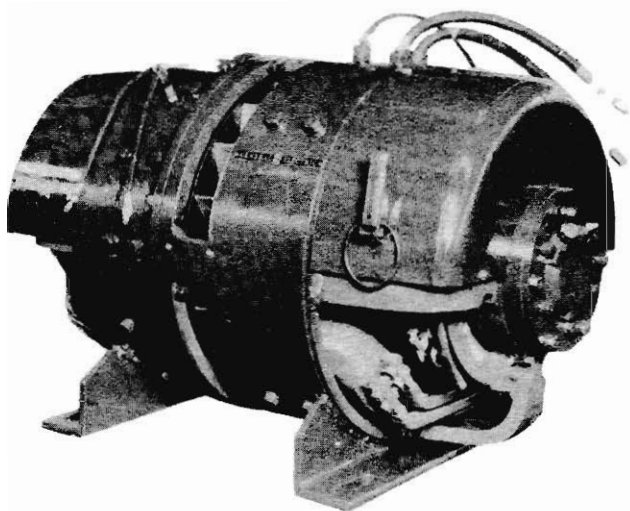
# DIESEL LOCOMOTIVE

## SPEED-TRACTIVE EFFORT CURVE

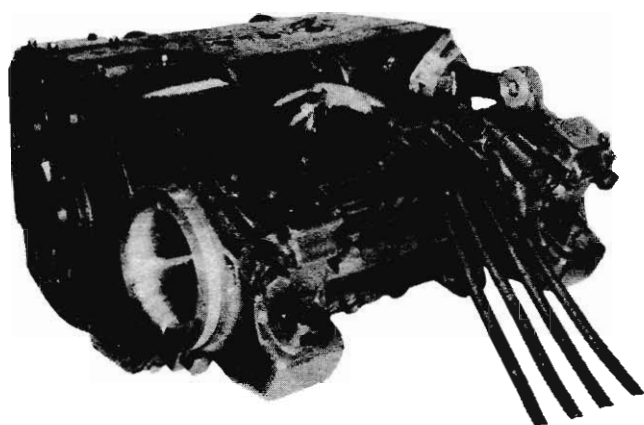




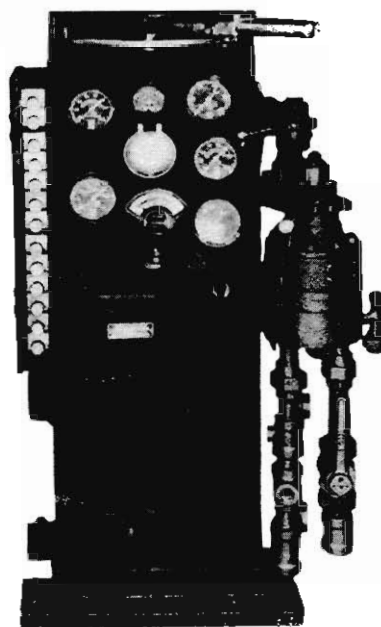
816172 G-E DIRECT-CURRENT TRACTION GENERATOR,  
TYPE GT-553-A.



816248 G-E DIRECT-CURRENT EXCITER AUXILIARY  
GENERATOR SET, TYPE GMG-139



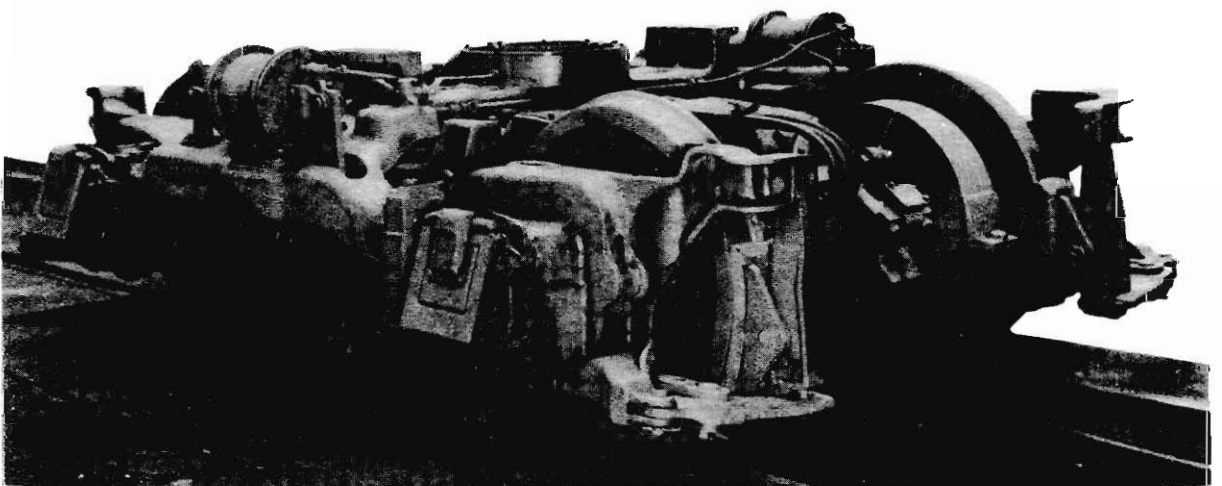
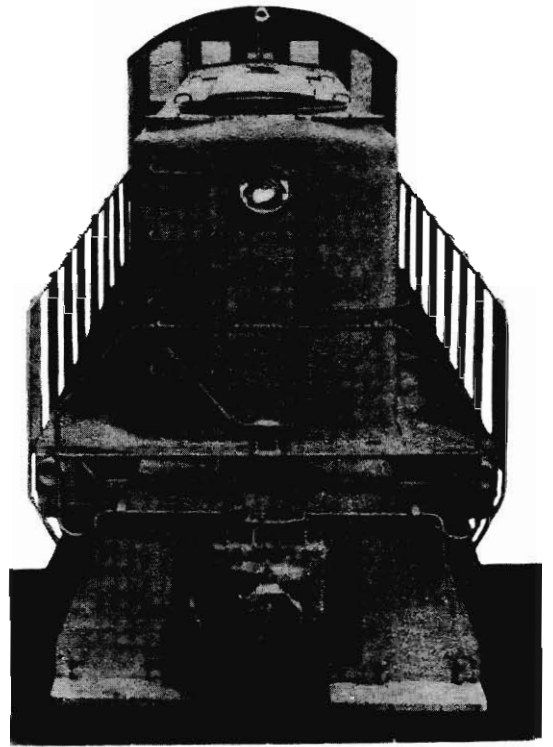
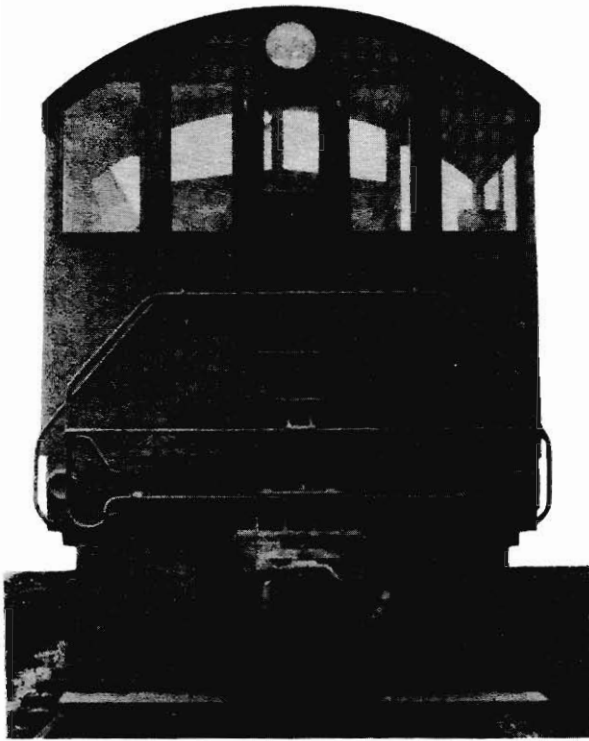
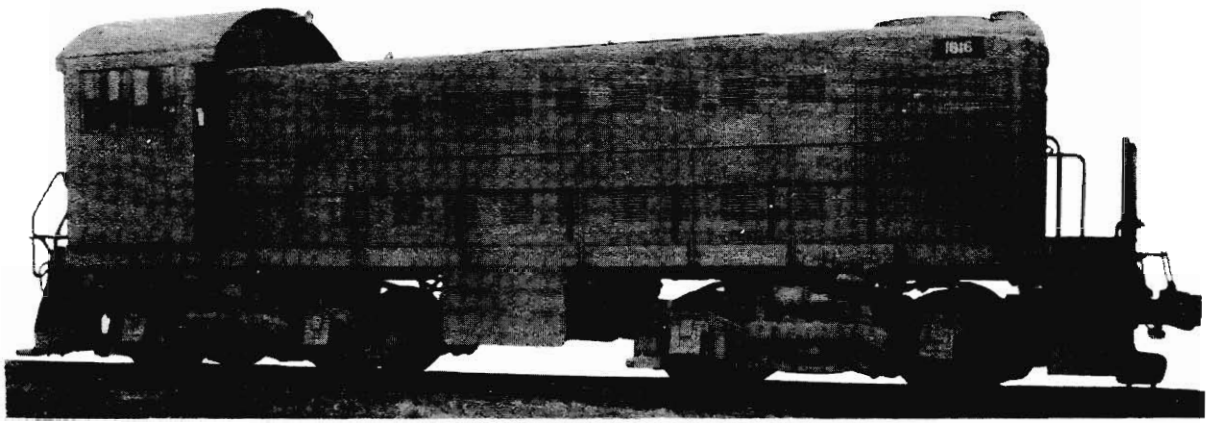
816174 G-E DIRECT-CURRENT MOTOR, TYPE GE-731.



816473 G-E MASTER CONTROLLER, TYPE C-173-L.  
INSTRUMENT PANEL AND AUXILIARY SWITCHES  
AS INSTALLED.

816482 PRINCIPAL ELEMENTS OF G-E ELECTRIC DRIVE FOR 1000 HP  
DIESEL-ELECTRIC SWITCHING LOCOMOTIVE.





# AMERICAN LOCOMOTIVE COMPANY

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