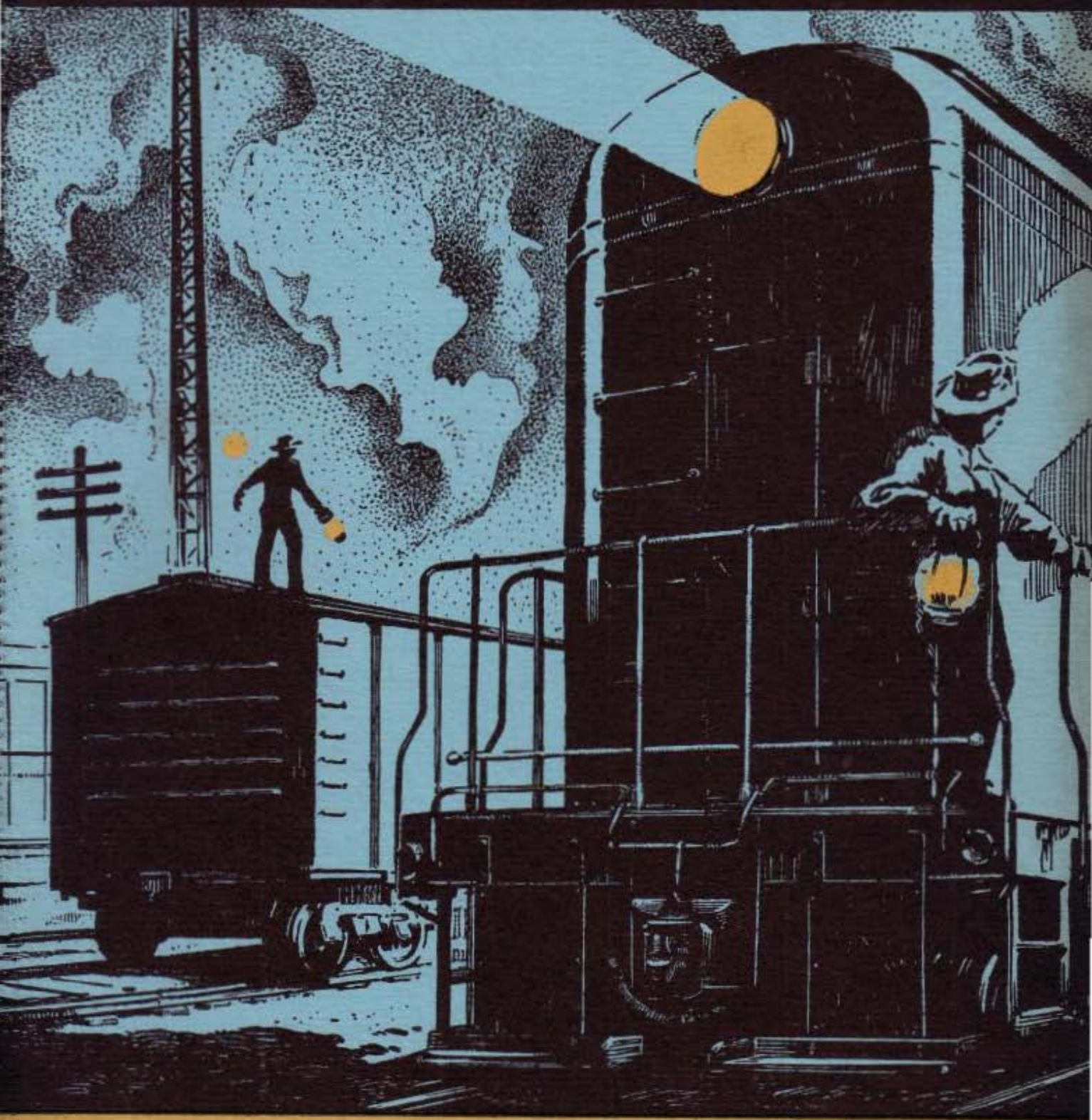
DIESEL SWITCHING LOCOMOTIVES



AMERICAN LOCOMOTIVE
— COMPANY —

· DIESEL · SWITCHING LOCOMOTIVES

AMERICAN LOCOMOTIVE
COMPANY

CATALOGUE No. 10058

· DIESEL · SWITCHING LOCOMOTIVES

Few people realize just how expensive switching service really is. On a certain prominent American road the total transportation yard expense is about 22 per cent of the total operating expenses of the Railroad.

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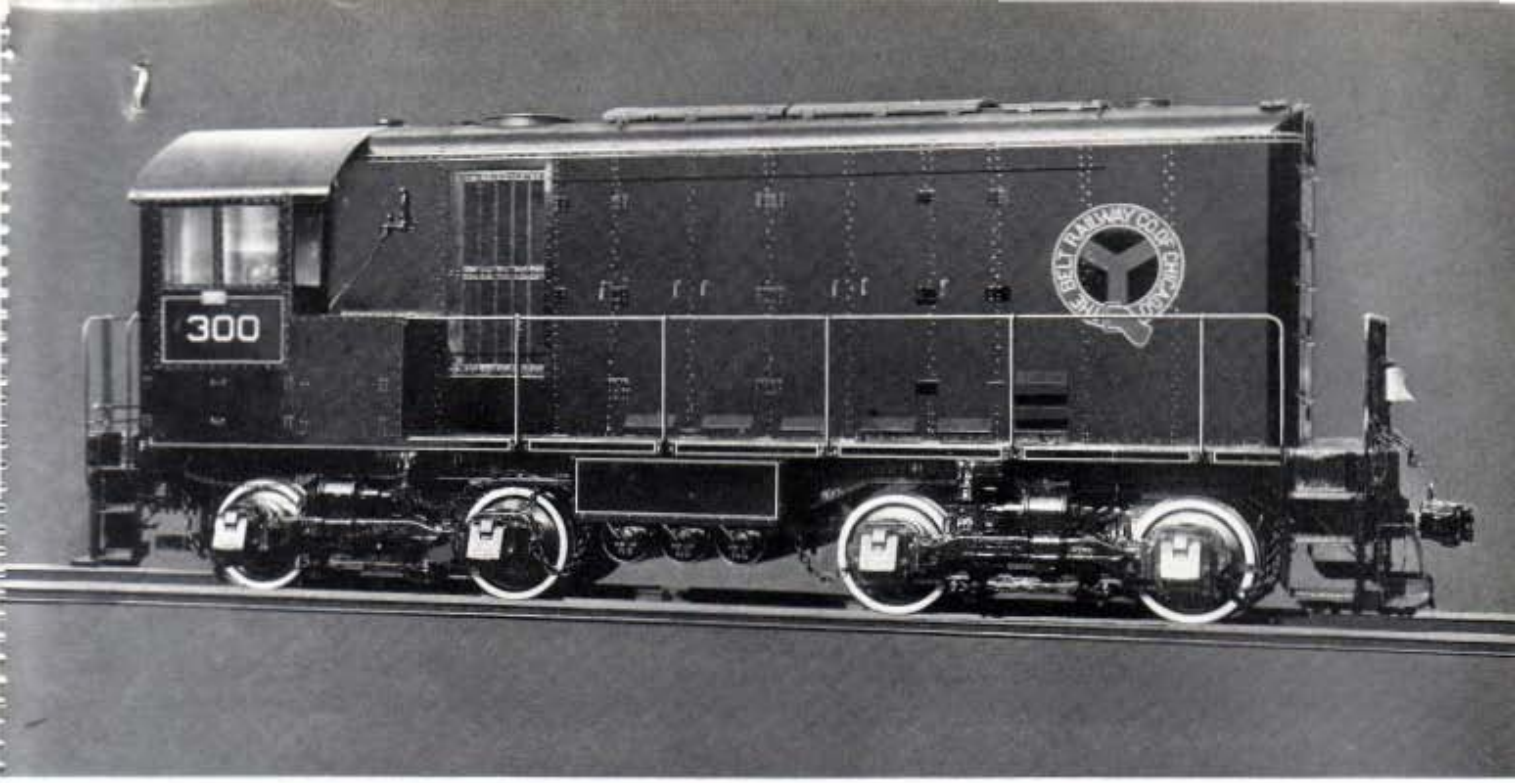


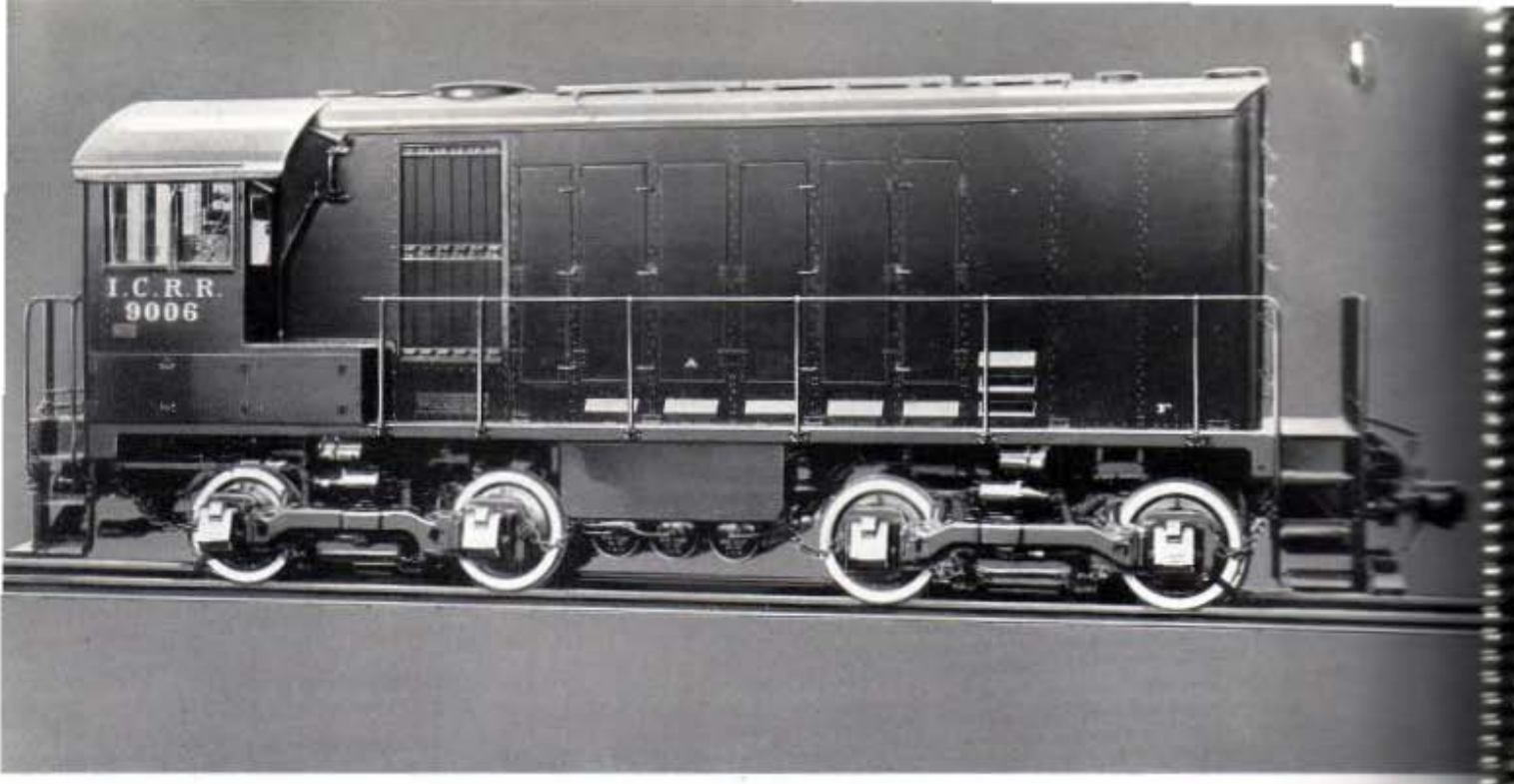
DIESEL SWITCHING LOCOMOTIVES

For practically one hundred years the American Locomotive Company and its constituent companies have been designing, developing and building motive power for railroads. During this time railroading, like most other industries, has been in a state of progressive change, not only to meet new traffic demands, but of late also to meet new and ever increasing competition. These changes in operation all are reflected in the design of the motive power that performs the service. The American Locomotive Company, therefore, at all times must endeavor to anticipate this evolution.

The margin between total railway operating revenues and expenses at best is very narrow. Any reduction at any time in railway expenses has a magnified effect on net profits. When railway traffic is at a minimum and competition is particularly keen, a reduction in operating expenses becomes of prime importance.

Switching service is a very expensive item. On one large American road the total transportation yard expense is about 22 per cent of their total operating expenses. Furthermore, the opportunity does not exist for anything like the same progress in steam switching locomotive design as has occurred in the steam road locomotive. Therefore, we have here a situation made to order for the Diesel Switching Locomotive.

The first successful Diesel switching locomotive in the United States was sold to the Central Railroad Company of New Jersey in 1925. It was rated at



300 horsepower, weighed 60 tons and was of box type construction. The American Locomotive Company furnished the mechanical equipment. A considerable number of similar Diesel locomotives were built during the following four years.

However, during this interval of time it became evident to the American Locomotive Company:

First. That the Diesel locomotive was rapidly establishing its place in switching service. Each new unit placed in service was replacing one or more steam switching locomotives.

Second. Watching the world-wide progress in the development of the Diesel engine in general, one must anticipate the time when this type of power unit might enter main line railway service. The American Locomotive Company could not afford to gamble on such a possibility with the then present set-up of the Company building only the mechanical equipment. Furthermore, during these several years of building the mechanical equipment for the Diesel switcher, some very definite ideas were formed as to just what was needed in a Diesel engine for railway service.

Therefore, in 1929, the American Locomotive Company, deciding that there was a particular need for a Diesel engine specifically designed and developed for American railway service, purchased the McIntosh & Seymour Corporation, an old and well-established concern noted for its modern heavy duty marine and stationary Diesel engines.

The McIntosh & Seymour Corporation is particularly well qualified to build Diesel engines for Railway service. They have the benefit of the extensive experience of their former Swedish Associates who have been building engines for railway service for many years, as well as the advantage of the vast knowledge of their own organization gained in building all lines of Diesel engines. Through the co-ordination of the Diesel experience of the McIntosh & Seymour Corporation with the American Locomotive Company's knowledge of general railway conditions of operation and railway facilities for maintenance and repair, a special line of Diesel engines peculiarly adapted for railway use was perfected.

Before the first of these engines was produced, many months of very exhaustive study was given to the various designs here and abroad, even to the extent of the purchase from abroad of a 600 H.P. Railway type, two-cycle, through scavenging Diesel engine, thought to be at that time the best available in Europe, and considered today as an advanced type of high speed two-cycle engine. Every detail of the ALCO Diesel engine, therefore, has a background of thorough research and experience.

In the ALCO Diesel locomotive as a whole, the 100 years' experience of the American Locomotive Company in designing and building railway motive power is reflected: first, in securing the maximum amount of availability with the least possible cost; second, in providing for ease and minimum amount of inspection and maintenance; third, in allowing the yearly recon-

ditioning with existing railway facilities. Day-in and day-out, these features save real money after the locomotive is in operation.

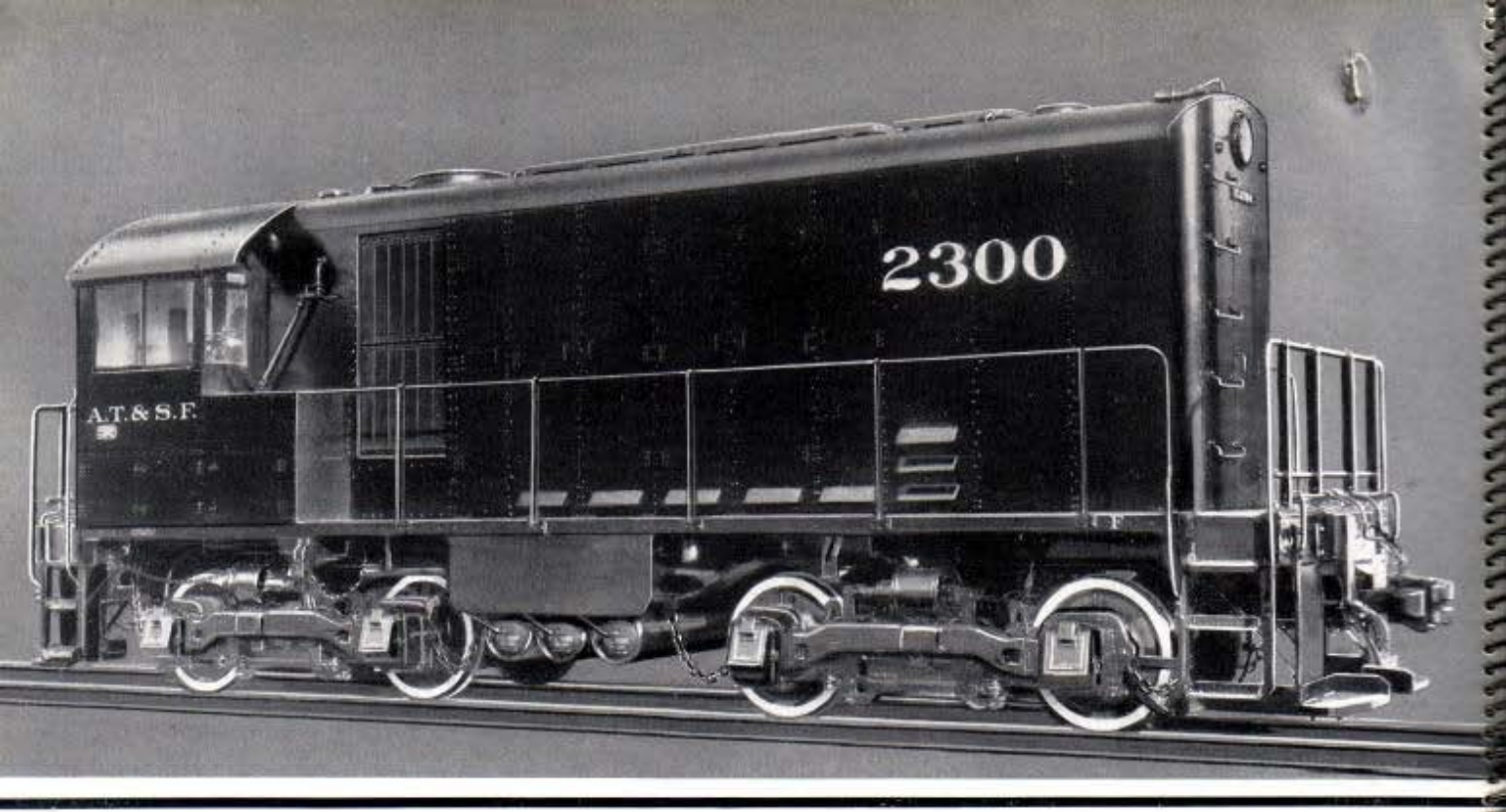
The American Locomotive Company, in christening this engine the "ALCO" type, thoroughly realizes that it has inseparately associated itself with this product. The ALCO type Diesel Railway Engine, therefore, like all ALCO products, will express the character of the builder in the delivery of quality and performance. It will reflect the aim of a personnel whose unfailing devotion to the cause of service ranks first.

There is nothing new or mysterious about the Diesel Switching Locomotive. It is no longer an experiment. It has a definite place in railroading. Having many advantages peculiarly suited for this particular service, more and more intensive use is inevitable. But as against these advantages, some consideration must be given to the higher first cost. Since there is a point past which steam operation would be the most economical, too much stress cannot be given to the recommendation that each installation deserves special analysis. And the American Locomotive Company welcomes the opportunity to make this study.

However, there are two definite distinct places where the savings to be gained through Diesel operation are readily evident. First, where the job to be done requires two or three tricks per day. There are installations of ALCO Diesel switchers operating in excess of 8000 hours per year. Here the fuel savings per hour get an opportunity to amount to real money. Second, in the outlying intermediate terminal. In recent years, railroads have been extending terminals — that is, they have been operating both freight and

passenger trains over longer distances. While this innovation gives certain economies through the increased utility of the better road locomotives, all the benefits cannot be secured until the railroads also eliminate from these former terminal points the extremely costly facilities for servicing motive power. A certain amount of switching still remains at these intermediate points. Therefore, the railroad has one of two options. The servicing facilities at these intermediate points can be retained to care for these switchers, or the switchers can be serviced from the new distant terminal — either option costs real money. Here then again is an ideal situation for the Diesel switching locomotive which requires no expensive facilities for its servicing or maintenance.

The ALCO Diesel locomotive is a self-contained power plant. The Diesel engine, burning fuel oil, drives a generator which, in turn, delivers electric power automatically to the traction motors — one traction motor geared to each axle. The Diesel engine is started similar to an automobile engine, that is, by an electric starter — and the locomotive is operated by simply opening and closing the engine throttle to obtain the desired speed. The air brake equipment is the same as applied and operated on a standard steam switching locomotive. One filling of fuel oil will last for two or more days of continuous switching. Four sand boxes are provided and the sand is delivered to the rail by means of pneumatic sanders. The operator's cab is of the single-end type with a removable and easily accessible hood covering the Diesel engine and generator. Electric cab heaters are provided. There are no stand-by losses. No coaling or water stations or ashpits are required.



The following tables give you actual and typical one year's operation of two different ALCO 600 H.P. Diesel Locomotives:

Month	Hours Operated	Fuel Oil Gallons	Lub. Oil Gallons
January	498	2014	15
February	685.5	3942	20
March	720	3640	20
April	696	4032	183
May	720	3976	15
June	688	3819	20
July	696	3752	125
August	722.5	4816	18
September	702.5	5172	10
October	707.5	4622	135
November	699	4068	45
December	547	4040	5
Total	8082	47893	611
Gallons per hour		5.93	.0757

During the year this locomotive was in the shop two weeks for its yearly inspection, which required the following man hours of work:

Diesel Engine	194	Hours
Mechanical including wheels turned	265	"
Electrical	112½	"
Total Man Hours	571½	Hours

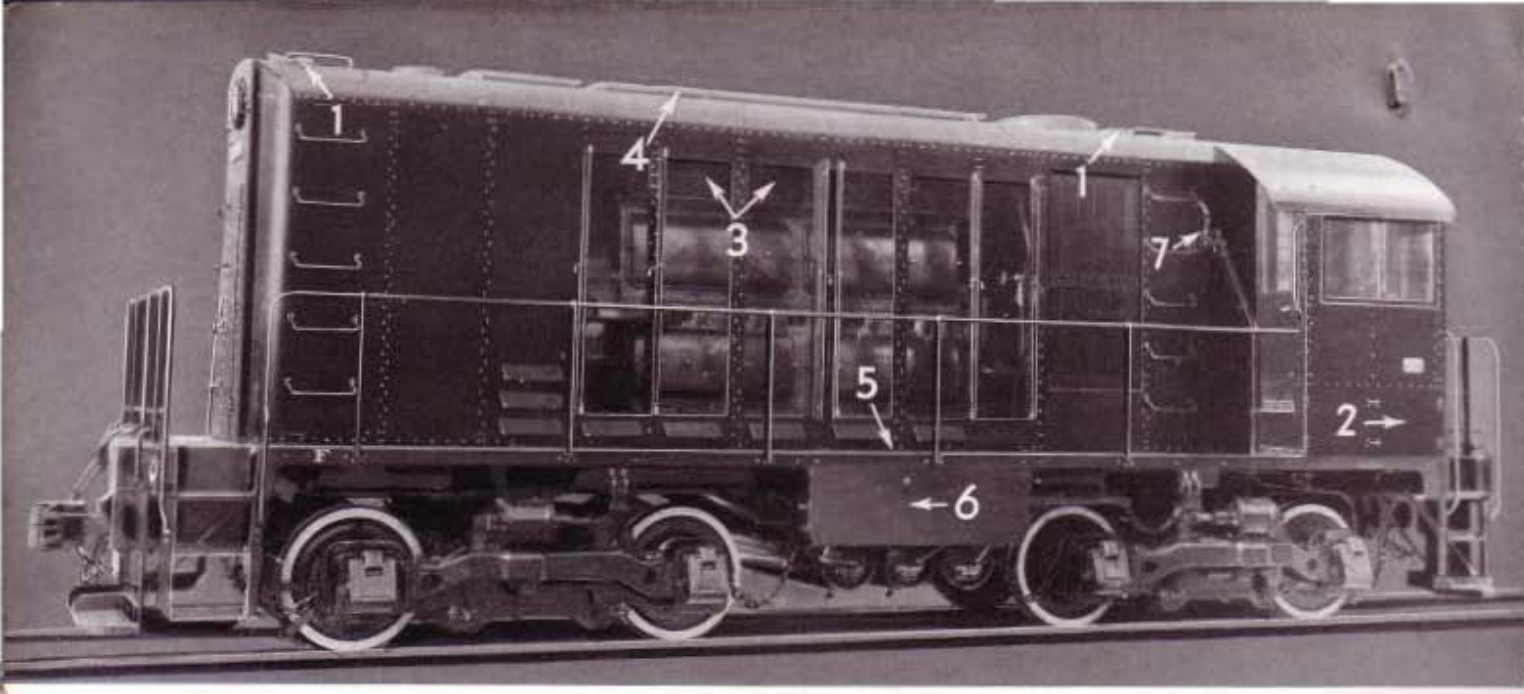
Month	Hours Operated	Fuel Oil Gallons	Lub. Oil Gallons
March	701	4390	20
April	638	3165	—
May	668	3217	130
June	684	3190	10
July	677	3449	10
August	663	3356	133.5
September	661	3205	15
October	439	2149	15
November	615	3494	135
December	673	3641	30
January	683	3673	31
February	507	2721	—
Total	7609	39750	529.5
Gallons per hour		5.22	.0696

During the year this locomotive was in the shop ten days for its yearly inspection, which required the following man hours of work:

Diesel Engine	257½	Hours
Mechanical including wheels turned	249⅔	"
Electrical	61	"
Total Man Hours	568-1/6	Hours

Operating cost of ALCO Diesel Locomotives based on three years' operating experience:

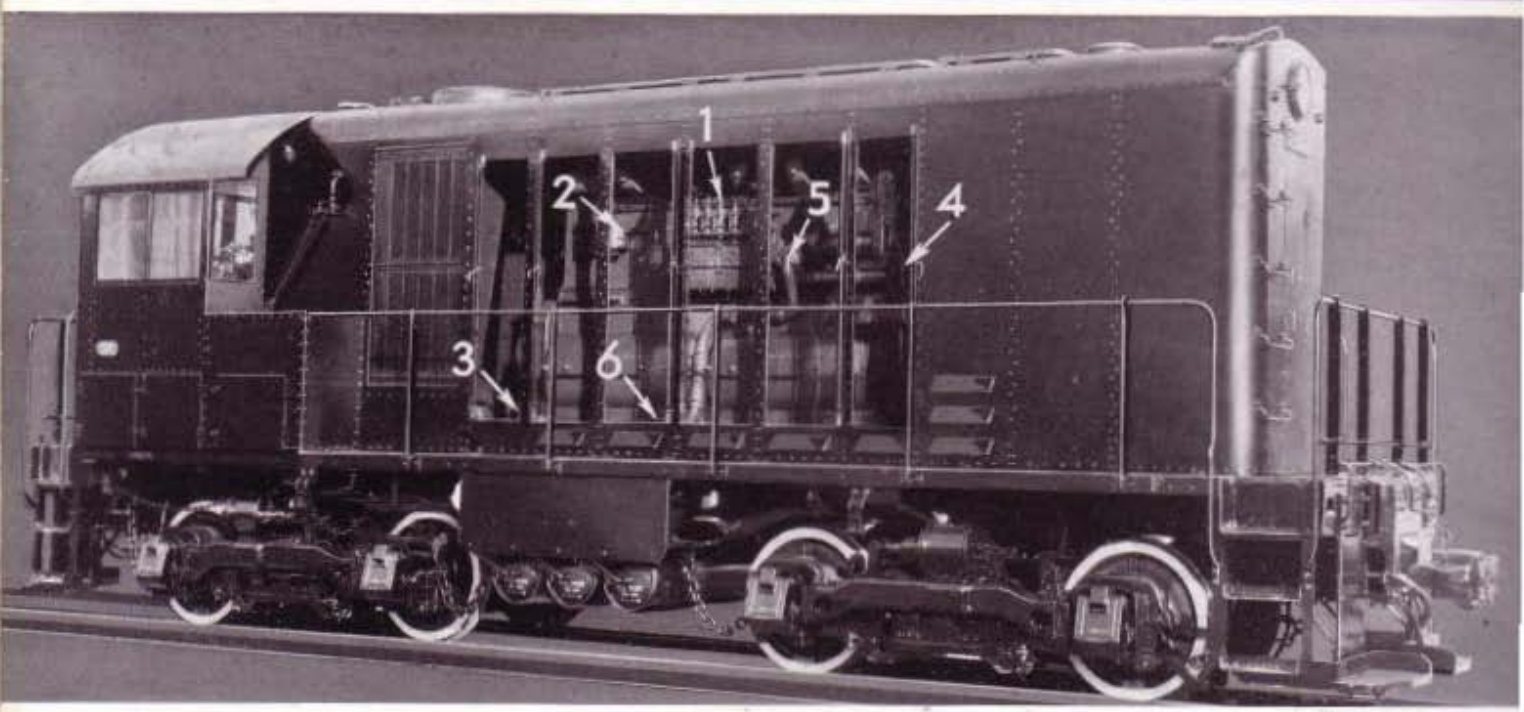
Item	Cost Per Hour	300 H.P.	600 H.P.
Repairs and running maintenance		$ .2950	$ .4920
Fuel at 4c per gal.		.1400	.2800
Lubricating oil at 50c per gal.		.0320	.0400
Other supplies		.0290	.0136
Wages of Crew		.8220	.8300
Total		$1.3180	$1.6556
Total Hours per year		7500	8000



AIR SIDE

1. Accessible sand box filling . . . . . .
2. Accessible fuel oil filling . . . . . .
3. Full-length inspection door openings for access to and removal of crank case and valve stem cover plates . . . . . .
4. Hinged hatch cover over engine. Opening around edge acts as a ventilator . . . . .
5. Trap door in running board over batteries furnishing accessible point for servicing . .
6. Side door on battery box—permitting easy removal . . . . . .
7. Sander traps exposed for ready repairs and cleaning . . . . . .

ACCESSIBILITY



INJECTION SIDE

Full-length inspection doors open, making access easy to the following:

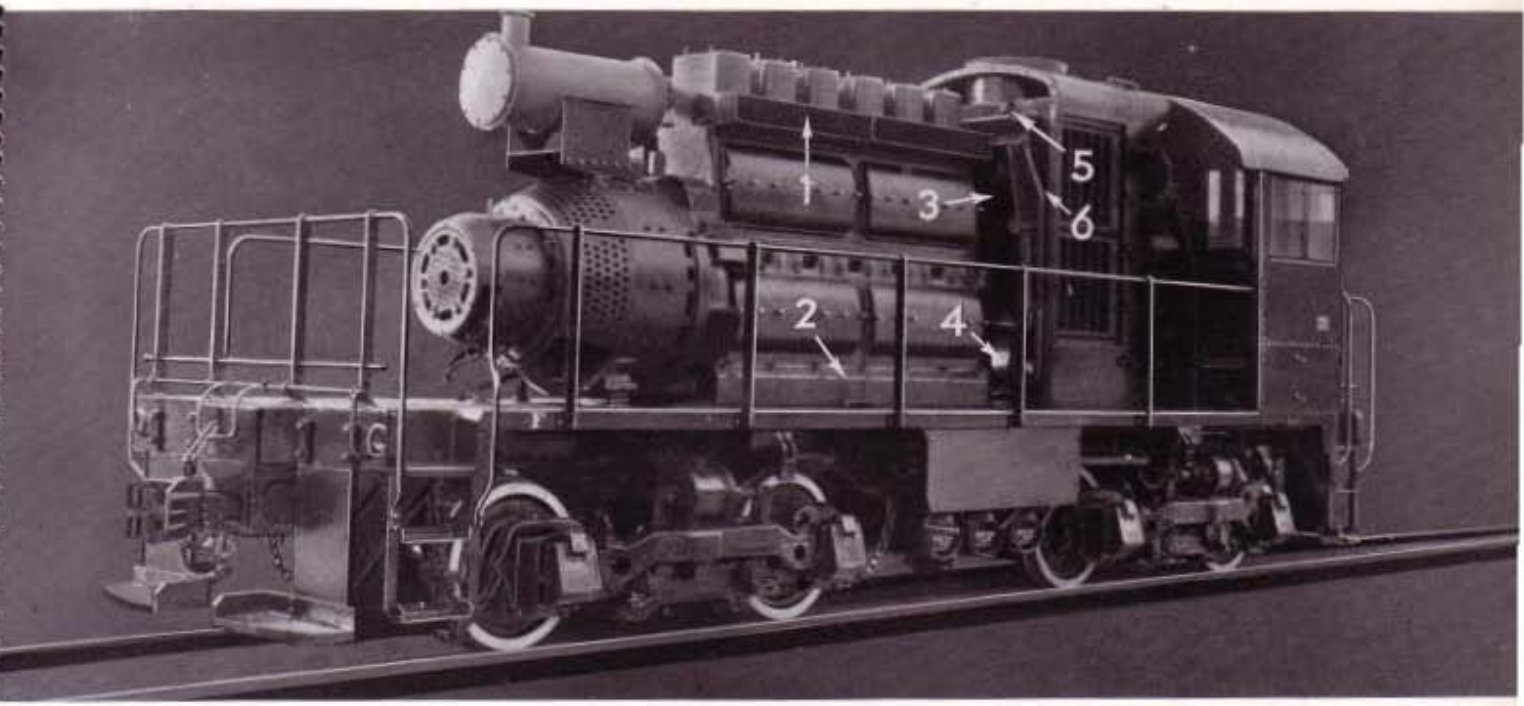
1. Fuel oil pump . . . . . .
2. Fuel oil filter . . . . . .
3. Lubricating oil circulating pump . . . . .
4. Governor and rigging . . . . . .
5. Water circulating pump . . . . . .
6. Lubricating oil height gauge . . . . . .

INJECTION SIDE

Hood removed exposing complete power plant

1. Muffler
2. Exhaust manifold
3. Fuel oil filter
4. Fuel oil circulating pumps
5. Governor
6. Water circulating pump
7. Generator—connected direct to oil engine
8. Governor control leading under floor to throttle
9. Traction motor blower
10. Battery

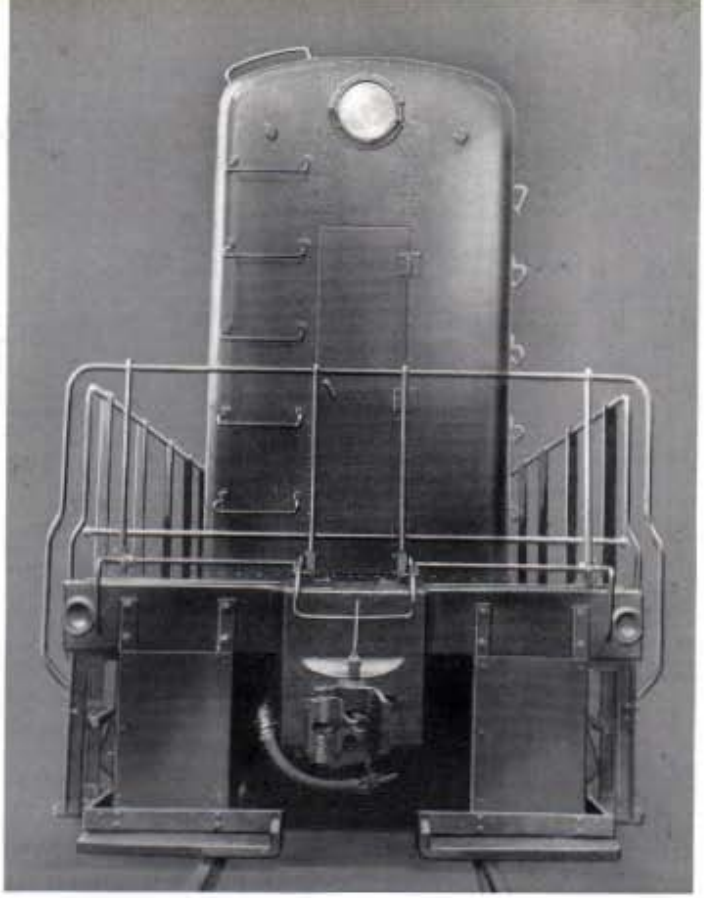
ACCESSIBILITY



AIR SIDE

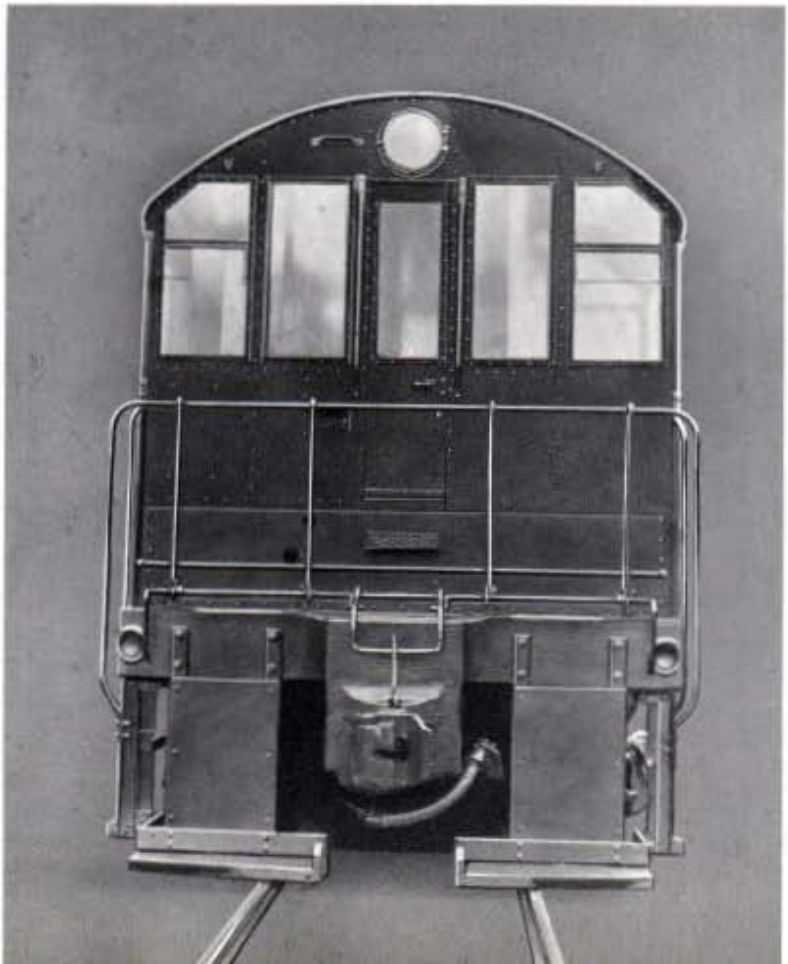
Hood removed exposing complete power plant

1. Air intake filter
2. Solid foundation bolting to frame
3. Radiator fan motor
4. Traction motor blower
5. Radiator water pipe to engine
6. Lubricator oil pipe to radiator



The hood part of the ALCO Diesel locomotive is only wide enough to cover the Diesel engine. This reduction in width tremendously increases the visibility of the operator in this direction.

VISIBILITY

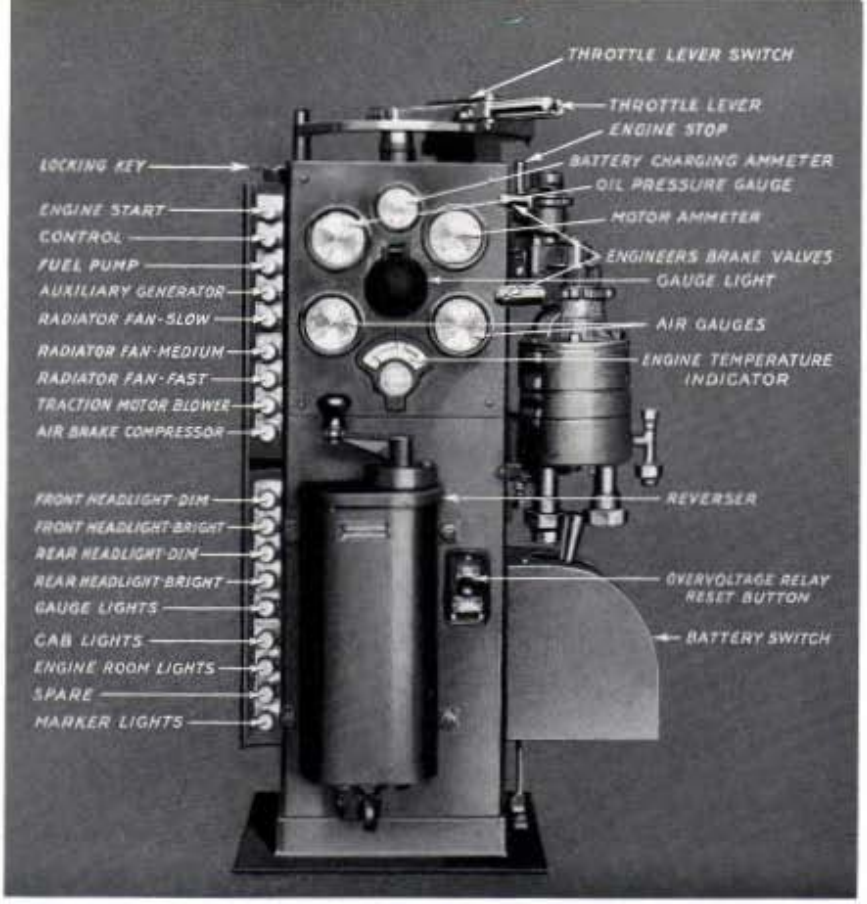


No question regarding the amount of visibility when looking through the windows at the cab end — the photograph speaks for itself.

Visibility when looking directly forward from operator's seat in cab at rear of locomotive.

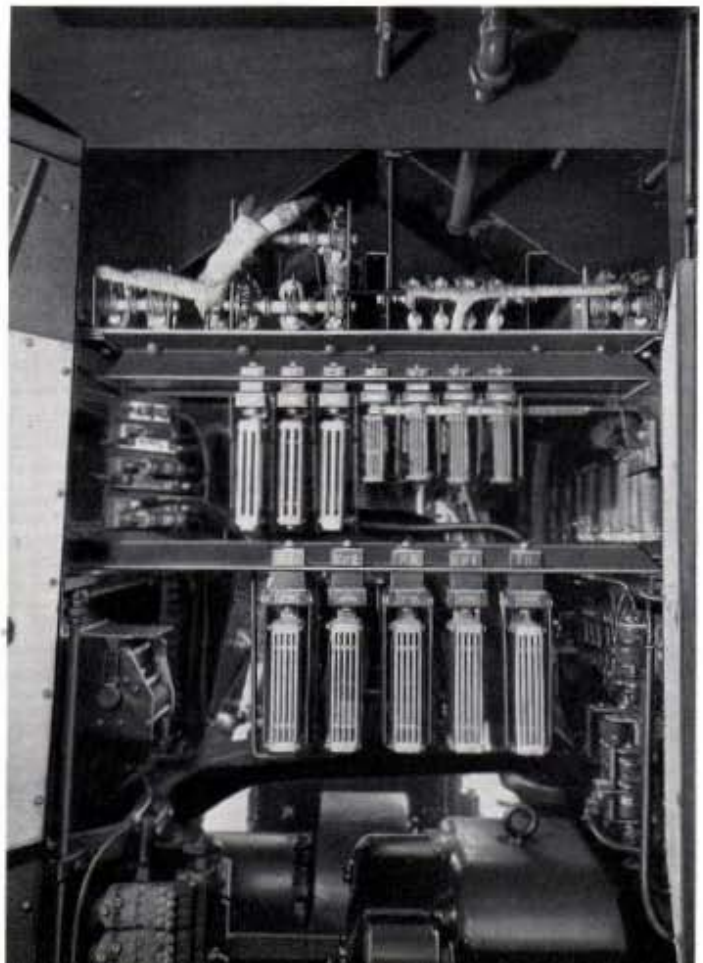
VISIBILITY

Equal visibility directly forward on the other side of the locomotive is obtained from the same operator's seat through the use of a mirror situated in the rear left corner of cab.



No attention has to be given to the ALCO Diesel engine when in operation. All the gadgets and controls that the operator has to know about are on the control stand conveniently located in the cab. This means that the operator can give his entire attention to the running of the locomotive.

CONTROL

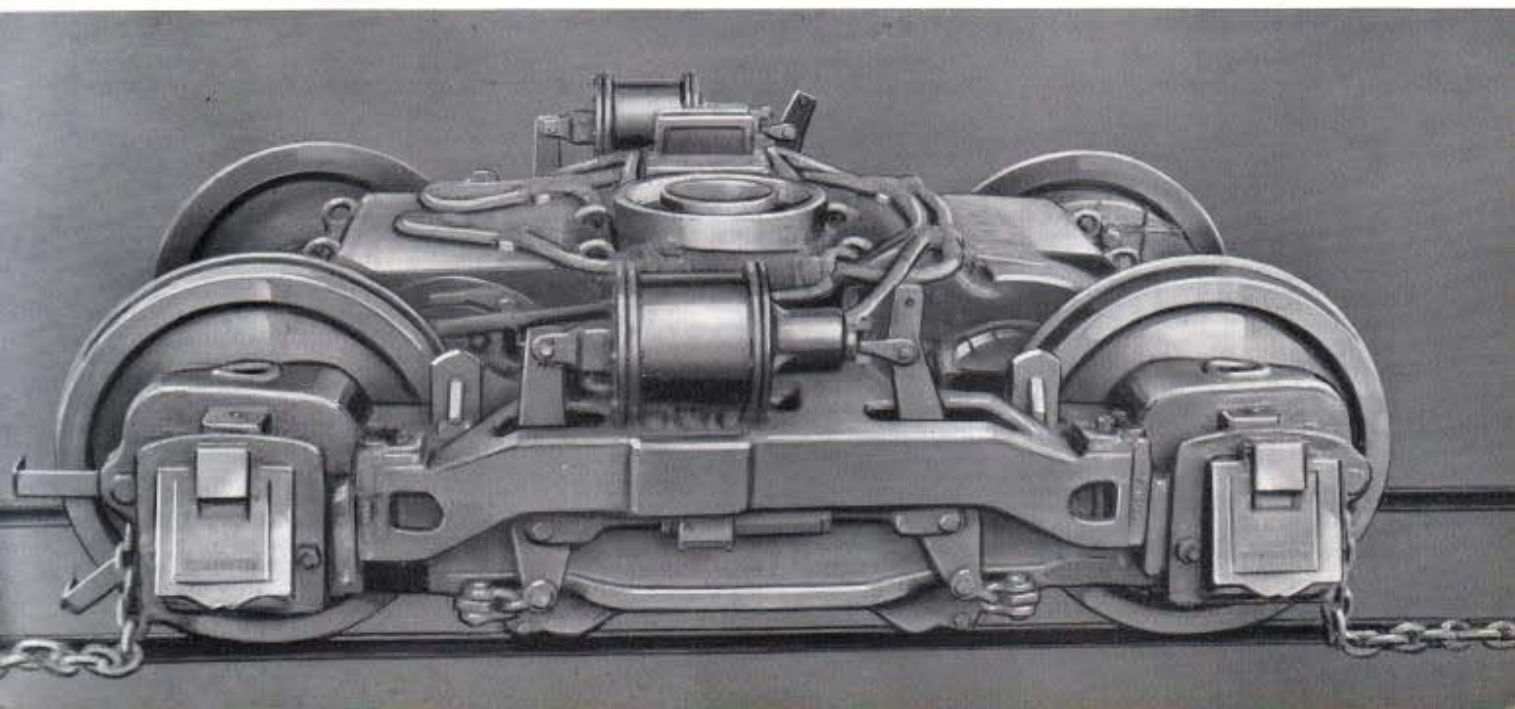


All the main operating electrical contactors and main fuses are conveniently and neatly grouped in a special compartment, readily accessible for inspection and maintenance.

T R U C K S

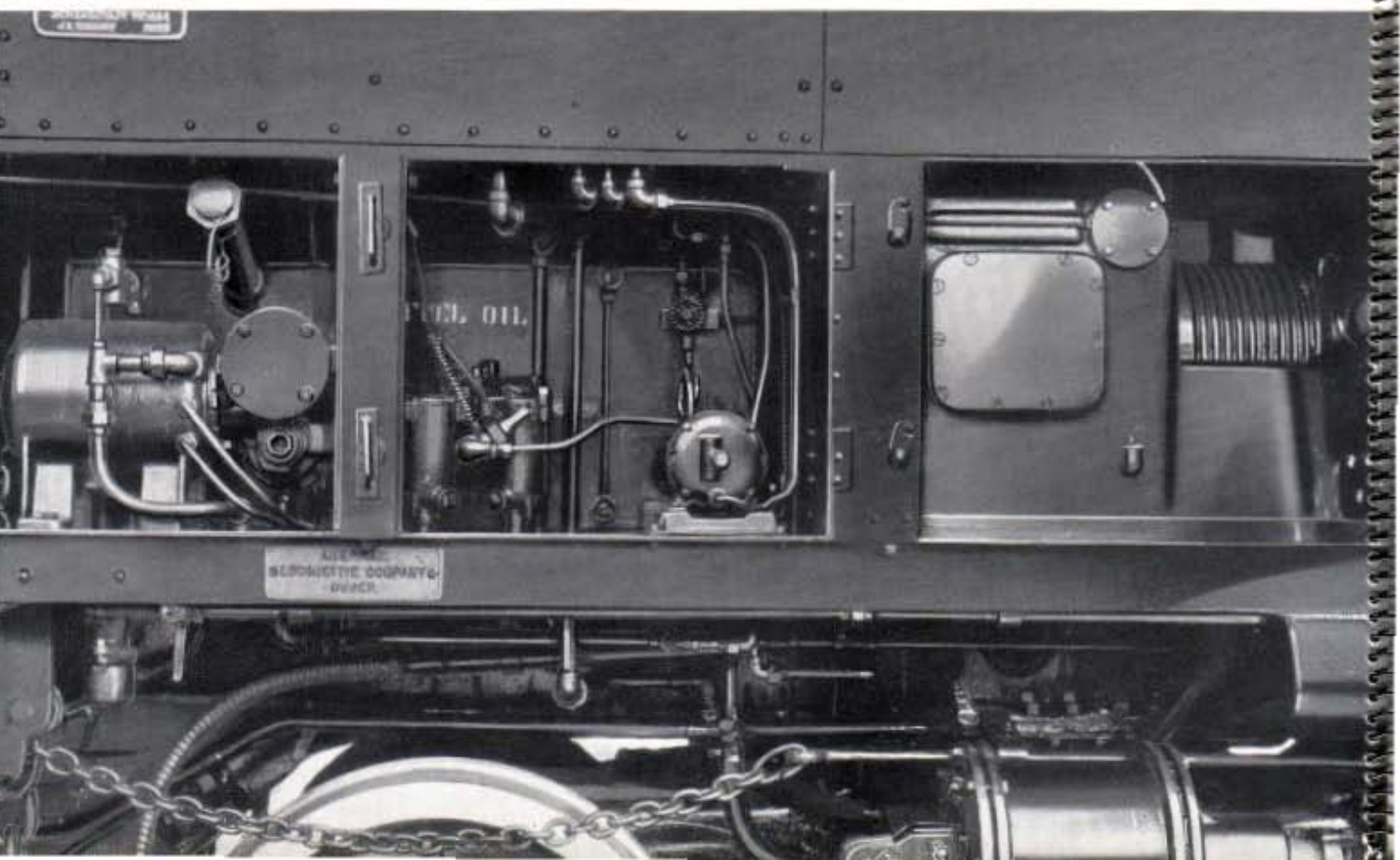
The standard power trucks are of the four-wheel center-bearing type having a specially designed cast steel bolster. The truck equalizers, more properly termed the side frames, are steel castings at each end of which is the truck-box pedestal. Single long semi-elliptic springs, one suspended by hangers in each side-frame casting, carry the load. The bolster casting is designed to form the nose mounting for the two traction motors on each truck, and two brake cylinders are mounted outside of the track line. The ends of the longitudinal side extensions of this casting have vertical wearing pads bearing against similar pads on the side frames just inside the truck boxes, thus keeping the truck square in horizontal alignment without interfering with vertical flexibility.

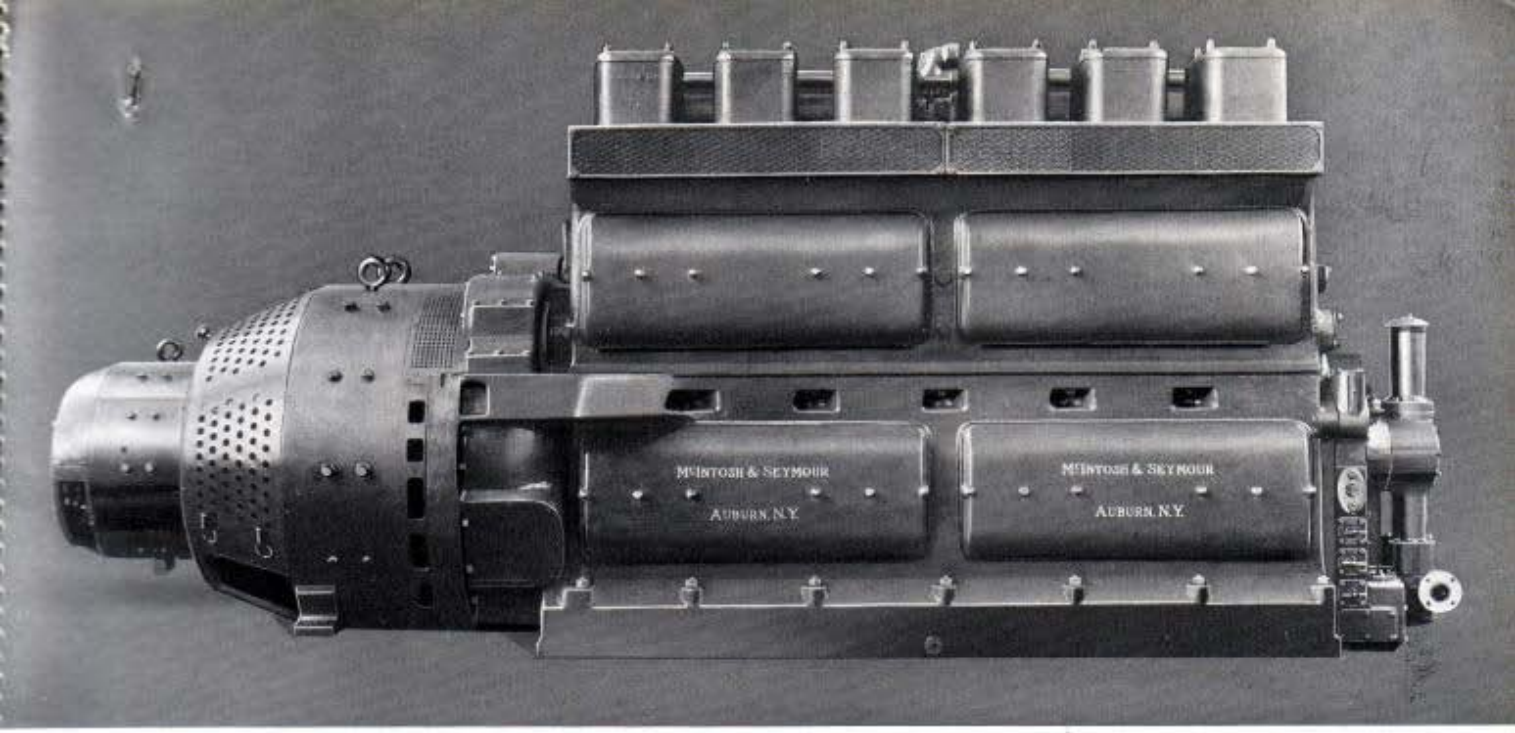
This construction provides positive equalization at all times without distortion of any truck members regardless of any uneven track condition. The low side frames and absence of end frames allow ready accessibility to inspection covers and oil reservoirs of the traction motors. The brake rigging is all placed on the outside of the truck so that brake adjustments, inspection, and brake-shoe renewals can be made with a minimum loss of time. No necessity for going over a pit.



View of radiator compartment shows convenient location of radiator fan and traction motor blower. This arrangement affords a minimum amount of piping. Both the water and oil cooling radiators, being sectional designed and removable from the outside, require no disturbing of any piping for maintenance or replacement.

View shows arrangement of fuel tank filling hole, duplex fuel strainers and fuel oil height gauge together with fuel oil booster pump.





ALCO TYPE DIESEL RAILWAY ENGINE

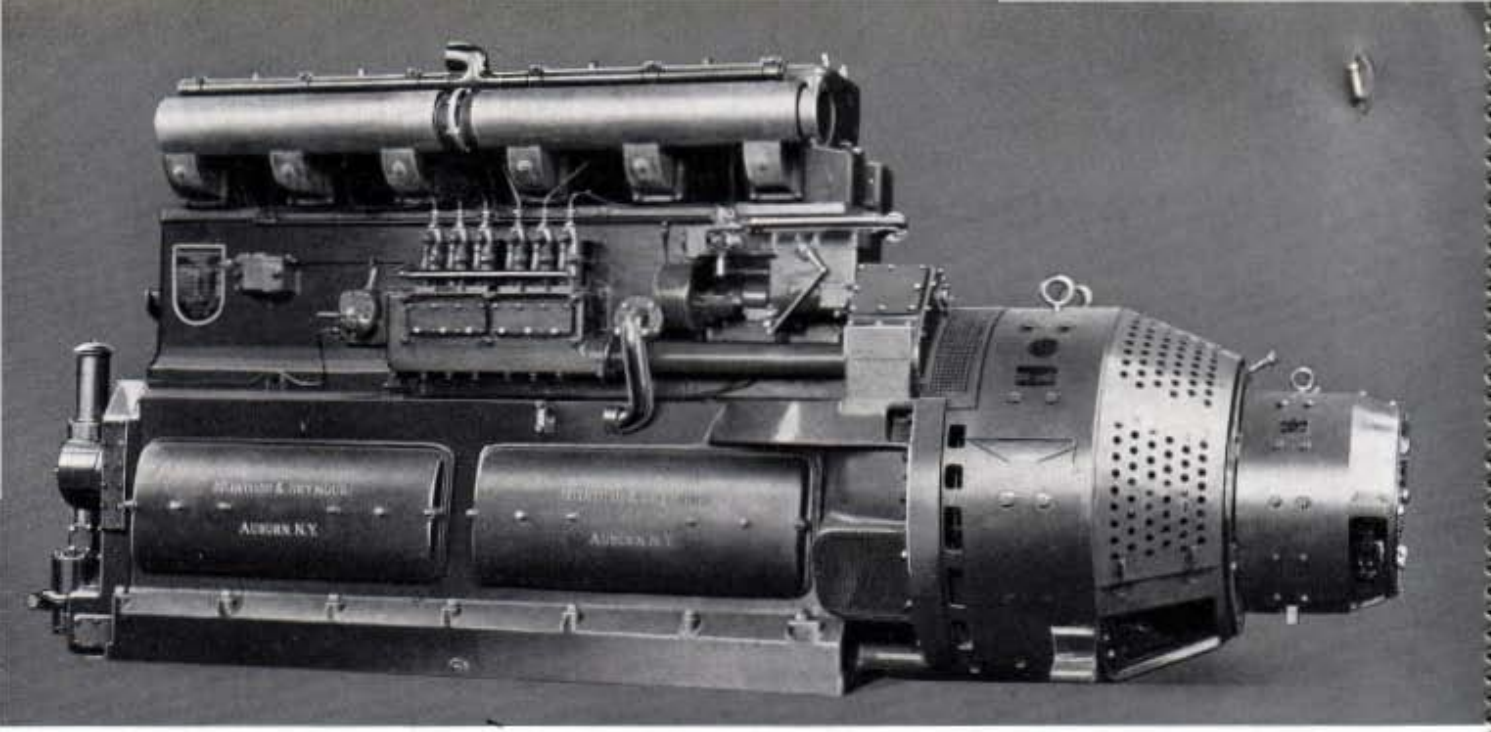
The modern Diesel engine is one of the most efficient of prime movers. It has an almost constant thermal efficiency of from 30% to 35% regardless of size. It is characterized by its simplicity of design and construction and its extreme ease of operation. It is an oil-burning internal combustion engine without carburetor or electric ignition and there is a wide latitude in the type of fuel oil that can be used.

In the Diesel engine, oil is injected into the engine cylinders in an atomized condition just before the piston reaches the top of its compression stroke. The heat of compression in the cylinder is used to ignite the mixture of oil and air which burns without explosive violence, and expansion of the gases continuing during the downward power stroke supplies the necessary energy for running the engine.

Every Diesel engine employs the heat of compression for ignition. When a volume of air is compressed in a confined space, its temperature rises as the compression is increased. In the Diesel engine this compression has to be sufficient to generate a temperature higher than the ignition temperature of the fuel. And this high compression is the reason for the heavy construction of the Diesel engine of the past. Of late, however, through refinement of design and the use of new and better materials, the weight per horsepower of the Diesel engine has been reduced again and again. But as we continue to reduce this weight per horsepower we reach a point where any further reduction must affect the life of the engine.

The success of the ALCO Diesel engine in railway switching service is due primarily to the importance and full consideration given by the designers to two pertinent fundamental conditions peculiar to this particular service. First—a switching locomotive does all of its work at very low speeds. And, since the full horsepower of the Diesel locomotive is available at starting, it is not necessary to go into the higher horsepowers. Second—a certain amount of weight is necessary in any locomotive for traction. If the weight of the Diesel engine is reduced past a certain point, weight would have to be added to the base or frame structure in order to have sufficient adhesive weight on the traction wheels. Therefore, the low horsepower range coupled with a certain desired weight has allowed the ALCO Diesel engine to be built heavy enough to give it the required ruggedness so necessary for assured long life and low maintenance—two outstanding characteristics of the ALCO design.

The ALCO Diesel engine operates on the four-cycle, single-acting principle with mechanical fuel injection. The cylinders are cast en bloc of semi-steel with special close-grained cast-iron liners, and the cylinder heads are separate castings of semi-steel, one for each cylinder.



ALCO TYPE DIESEL RAILWAY ENGINE

Each head contains two intake and two exhaust valves and the fuel injection nozzle, all arranged symmetrically. The valve operating gear is entirely enclosed and pressure lubricated.

All crank shafts for ALCO Diesel engines are heavy forgings of heat-treated steel, hollow bored to reduce revolving mass and for pressure lubrication. The engine base is extended to provide a support to which the generator frame is bolted, and detachable covers on the side provide access to the running parts in the crank case and base.

Fuel is raised from the fuel-oil reservoirs by a single pump to an injection-pump unit containing individual pumps for each cylinder. The injection unit is so located on the side of the cylinder casting as to assure minimum fuel-line lengths.

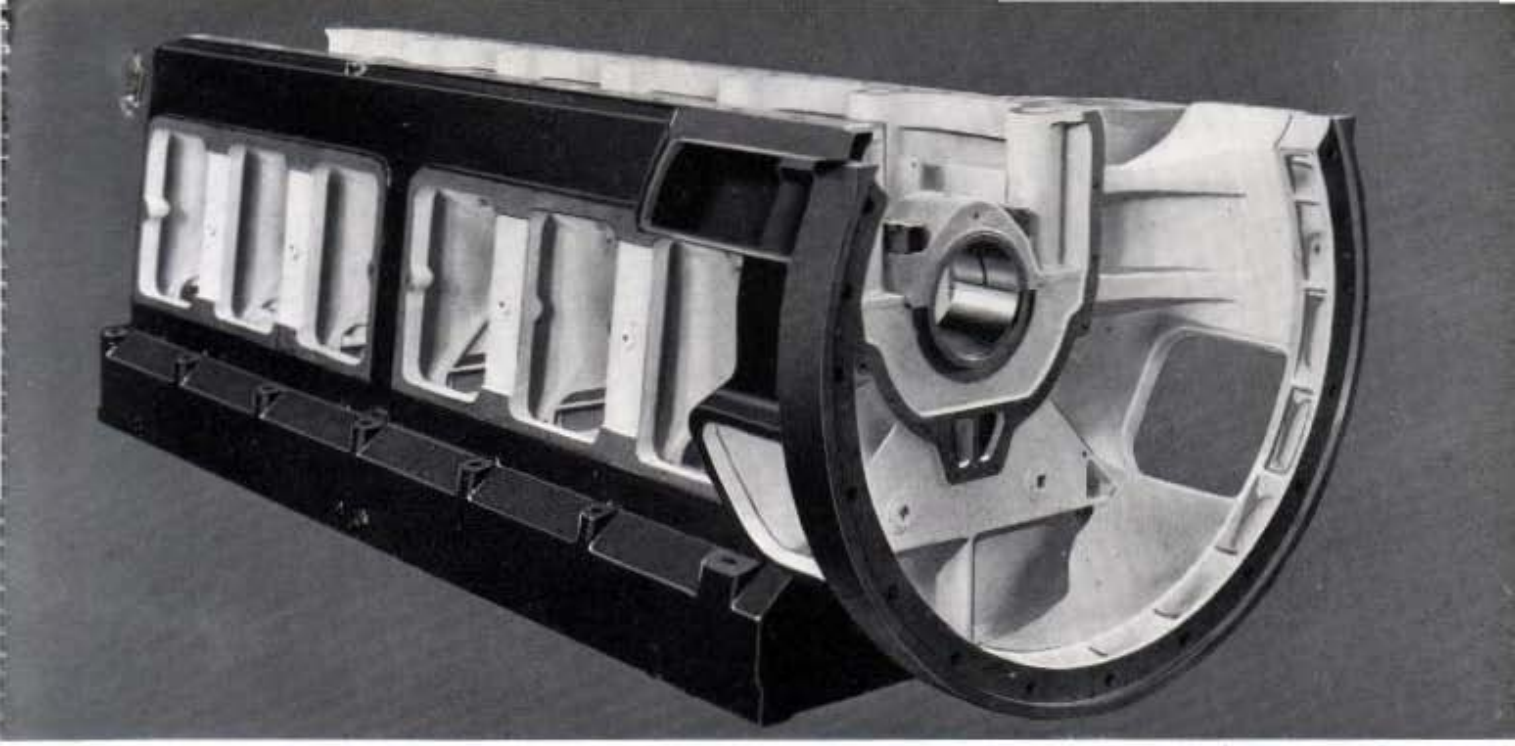
All wearing parts are pressure-lubricated from a high capacity pump and oil reservoir, both located in the engine base. Manual lubrication of any kind has been entirely eliminated.

Radiators of ample capacity for the circulating water and lubricating oil are mounted in a compartment between the engine and cab. The water is circulated by a centrifugal water pump and the air is forced through the radiators by a motor-driven fan.

ELECTRICAL EQUIPMENT. The electrical equipment consists primarily of the main and auxiliary generators and the traction motors. The main and auxiliary generators are overhung from the engine frame and driven by the main engine shaft. The main generator has characteristics especially suited to switching service. The auxiliary generator is of the constant voltage type (125 V.) maintaining this voltage regardless of engine speed. This generator furnishes current for charging the 56-cell heavy-duty storage battery for starting the engine as well as power to such auxiliaries as the air compressor, radiator-fan motor and traction motor blower.

To assure gear and pinion alignment, the four single-geared commutating-pole type traction motors are partially supported on the truck axles. They are also partially supported on the truck bolster by means of motor nose supports. Especially designed for switching service, the motor losses, particularly at high tractive forces, are relatively low.

The entire control of the power of the locomotive is embodied in the operator's throttle, which simply regulates the speed of the Diesel engine. Reversal is effected by a master controller. The motors operate in series at low speeds and are automatically changed by a voltage relay to series-parallel.



A one-piece cast iron frame, designed for heavy-duty service, supports the engine bearings and the generator. On each side detachable covers give free access to the main and connecting rod bearings. The base of the frame forms the lubricating oil reservoir.

ENGINE FRAME

DIESEL PARTS

The crank shaft illustrated is for the six-cylinder engine. All crank shafts for ALCO Diesel engines are of heat-treated steel and are hollow bored to reduce revolving mass and for pressure lubrication.

CRANK SHAFT

CYLINDER BLOCK

The cylinder block is of semi-steel and is arranged to include water jackets of ample capacity with free circulation.

CYLINDER LINERS

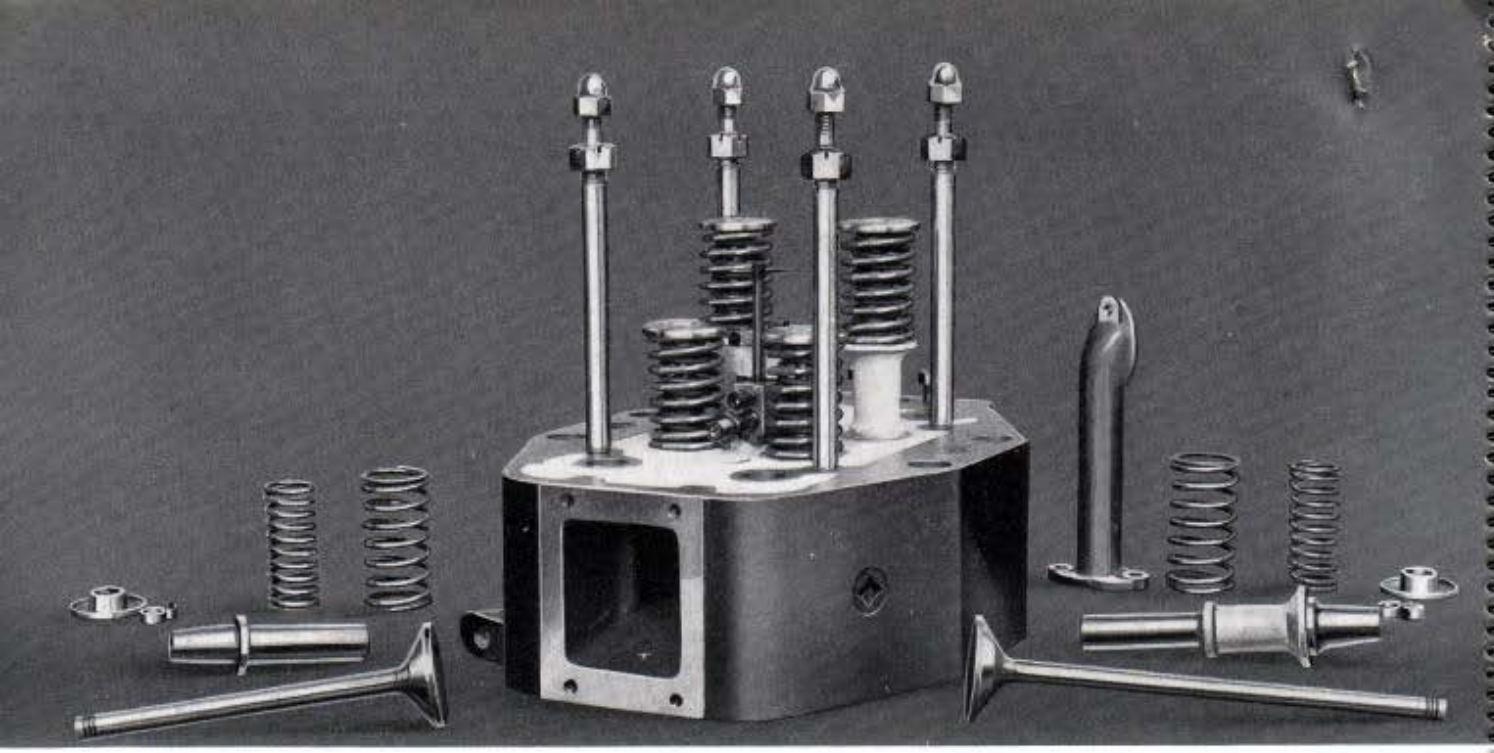
Removable cylinder liners are used in order to protect the cylinder block. The cylinder liners take the wear and may easily be replaced when necessary.

CONNECTING RODS

Connecting rods are of forged steel. The crank pin bearing shells of bronze are lined with babbitt metal. Bearing caps of forged steel are accurately fitted to each rod. The rods are rifle-drilled to carry lubricating oil from the connecting-rod bearing to the wrist-pin bearing.

PISTONS

The trunk type pistons are of cast iron and ground to size. Piston rings are of cast iron. There are five compression rings and two lubricating oil wiper rings. This number of rings not only maintains high compression but also keeps lubricating oil consumption down to a minimum. The wrist-pin, being of the full floating type, requires no adjustment and is easily applied and maintained.

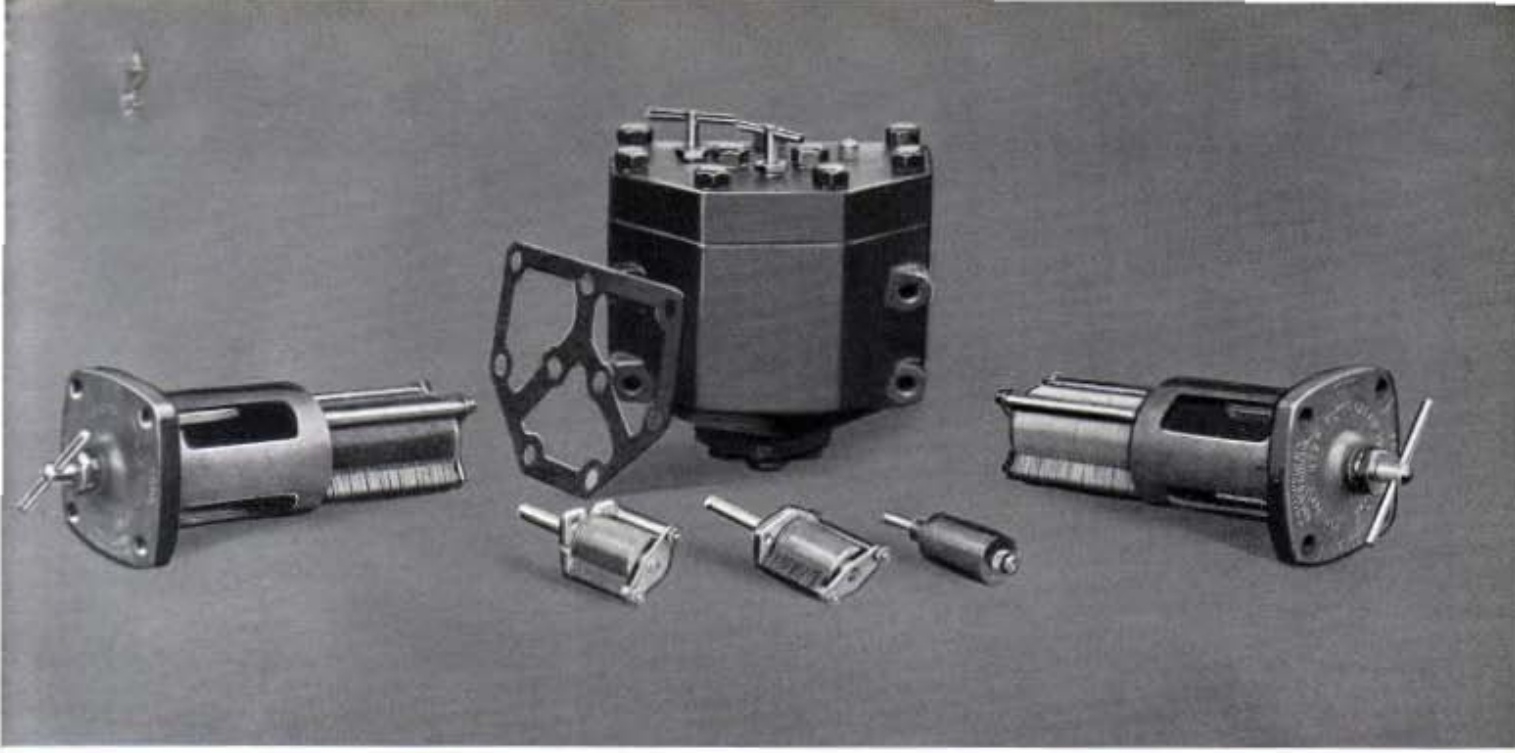


CYLINDER HEADS

Individual cylinder heads are used. They are of uniform section semi-steel; are water jacketed and are secured to the cylinder block by heavy studs. Two exhaust valves, two intake valves and one injection nozzle are symmetrically located in each cylinder head. The injection nozzle is located in the center of the cylinder head and is designed to give proper fuel atomization. The valve gear is of the rocker type, and is totally enclosed and pressure lubricated. The valve springs are suitable for heavy-duty operation.

VALVE LEVER CASE

The valve lever case is secured to the top of the cylinder head by four extension studs. This case carries all the valve actuating mechanism from the push rods to the valves. It is a self contained unit which can be removed as a whole, thereby giving access to the cylinder head without disconnecting the individual parts.



FUEL OIL AND LUBRICATING OIL STRAINERS

These strainers are self cleaning and are of an indestructible type which require no maintenance. Their efficiency is not impaired with age.

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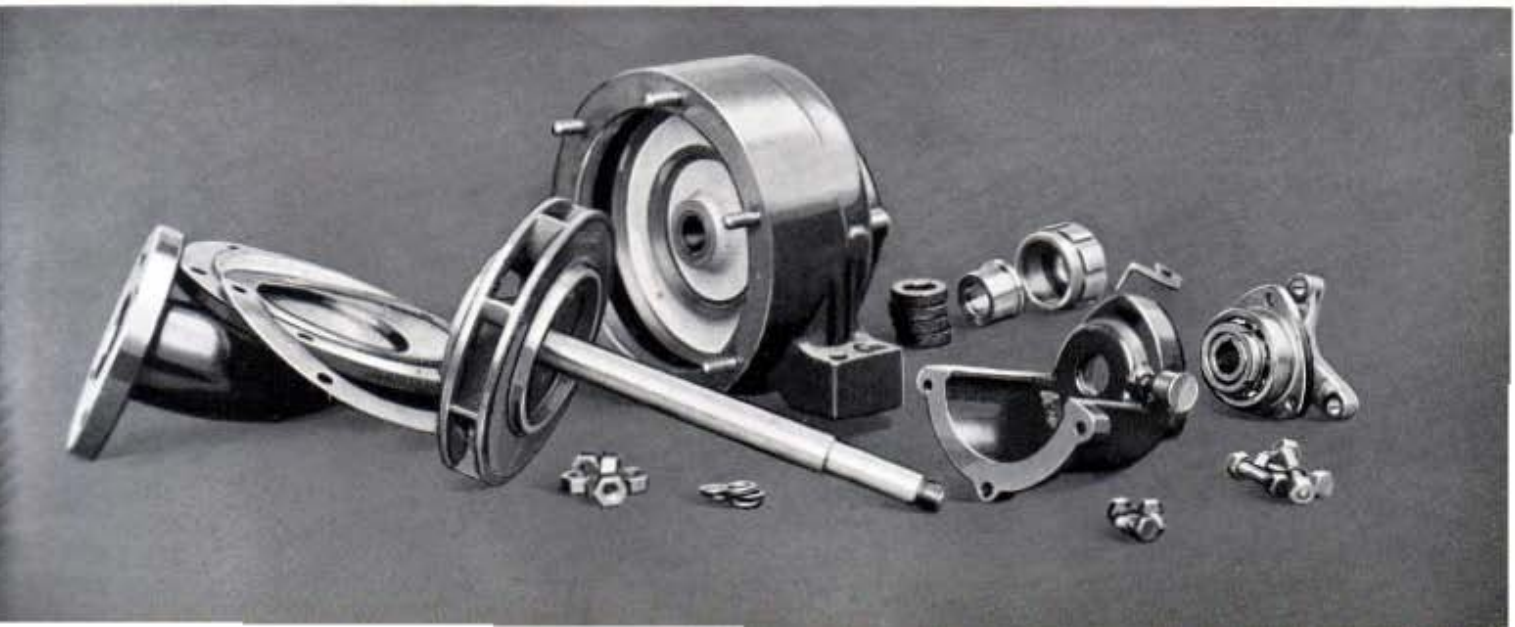
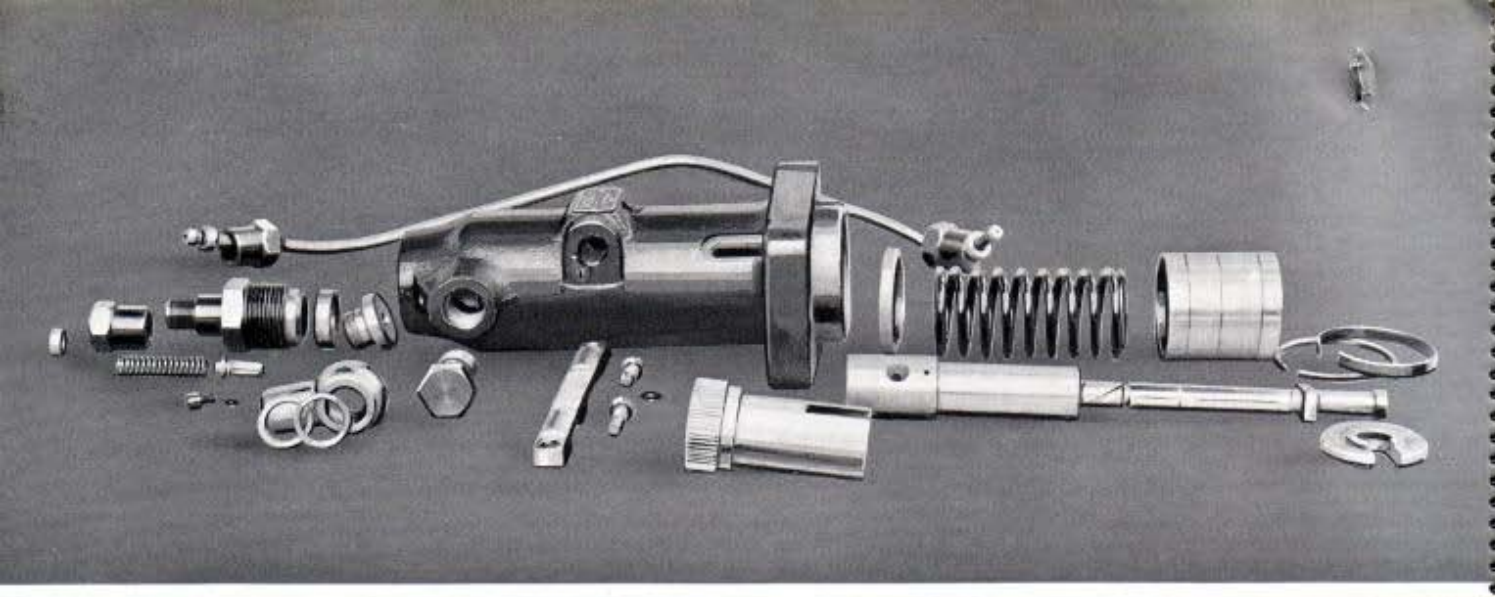
WATER PUMP

The centrifugal type water pump is mounted on the side of the engine. It forces the water through the cylinder jacket—out through the top of the cylinder head to the top of the radiator—and back to the water pump from the bottom of the radiator.





FUEL PUMP PARTS

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NOTE:

Except where specifically noted, all parts as illustrated and described apply to the entire line of ALCO type Diesel engines as built for switching service.

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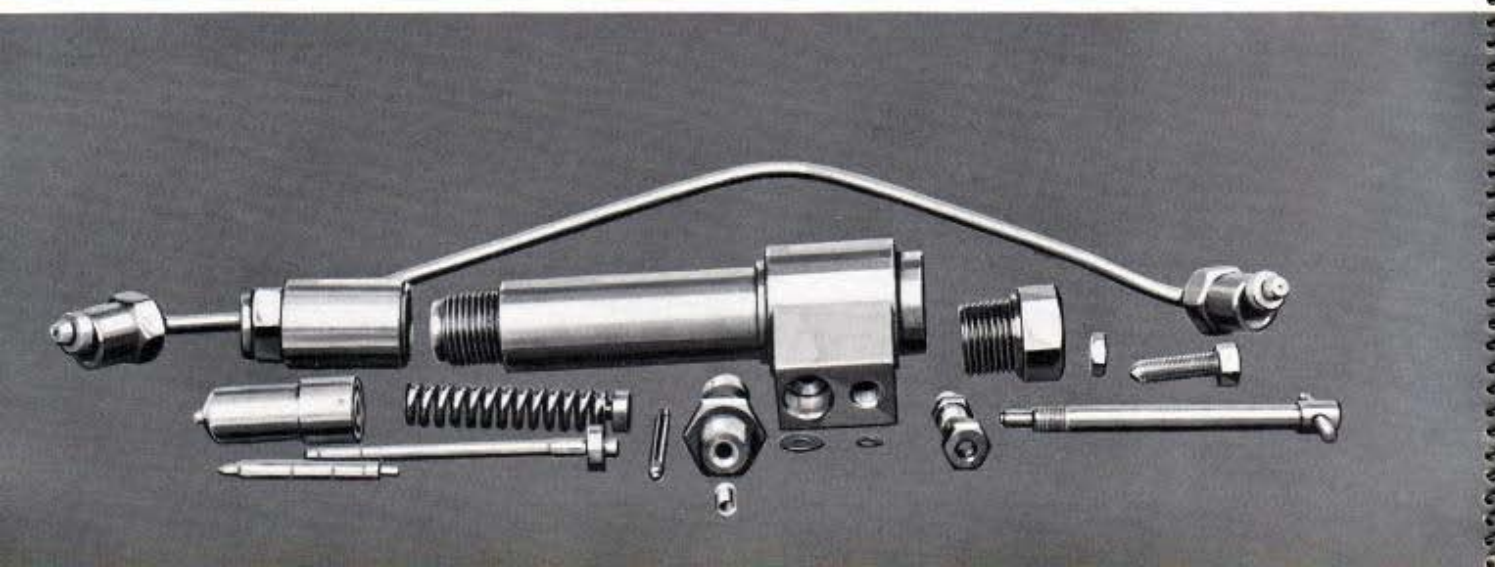
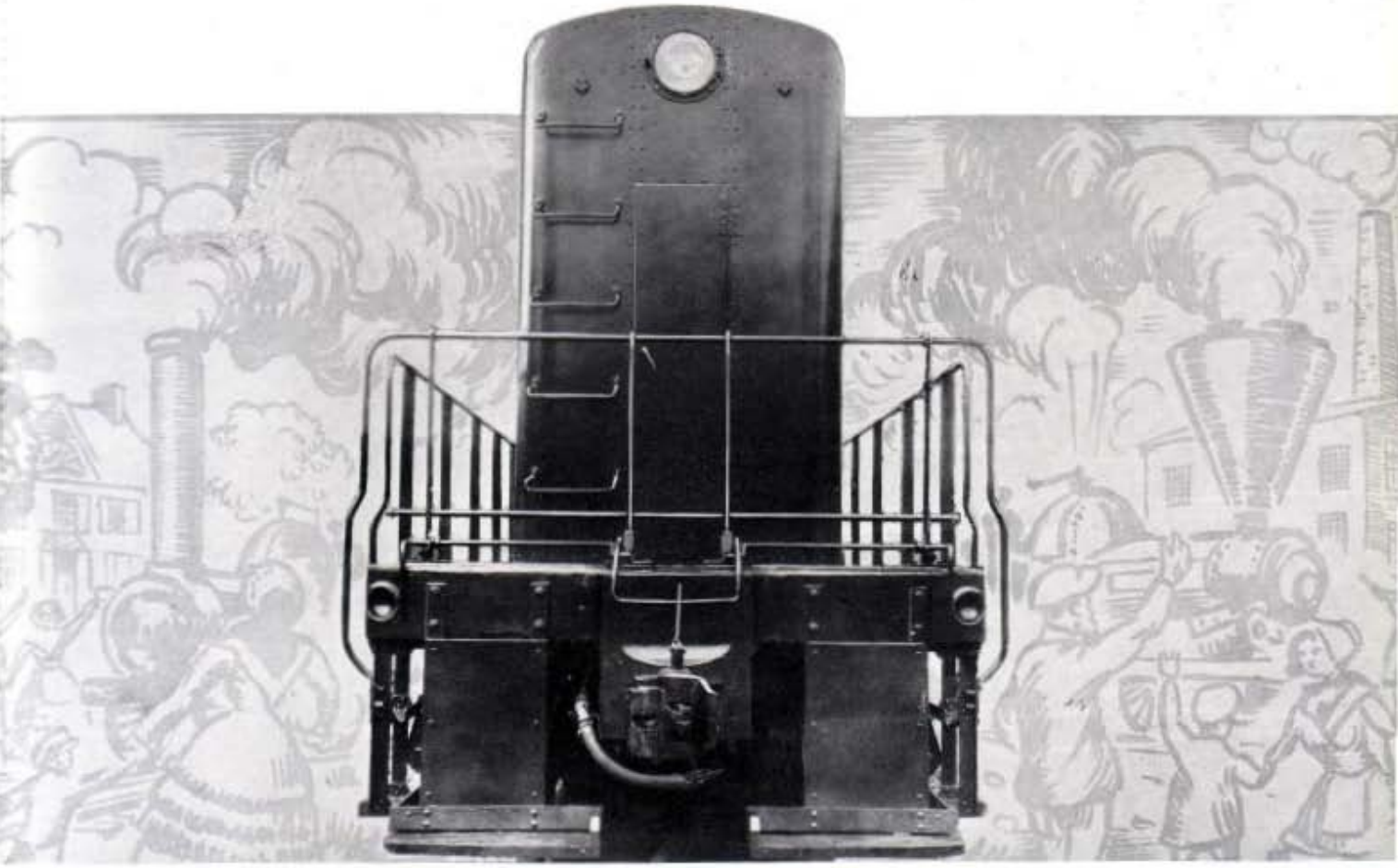
INJECTION NOZZLE PARTS





SPECIFICATIONS

SPECIFICATIONS

Weight, Total Locomotive	114,000 lb.
Starting Tractive Effort (30% adhesion)	34,200 lb.
Minimum Radius Curvature (locomotive alone)	50 ft.
Maximum allowable speed (for motors)	35 m.p.h.
Number of motors (one geared to each axle)	4
Fuel tank capacity (gallons)	200

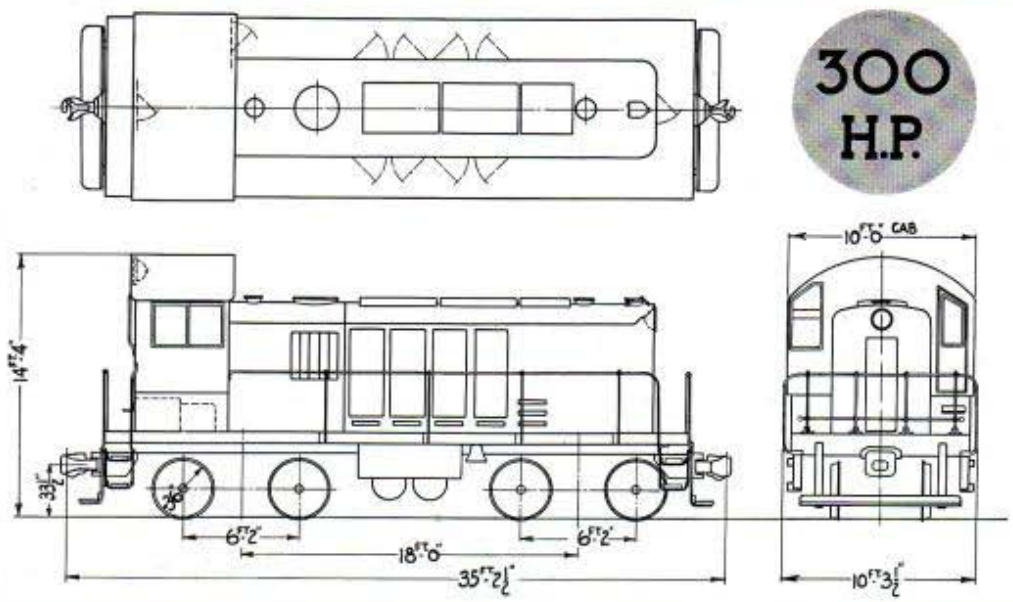
One generator—Railway Type—Direct Connected to Engine

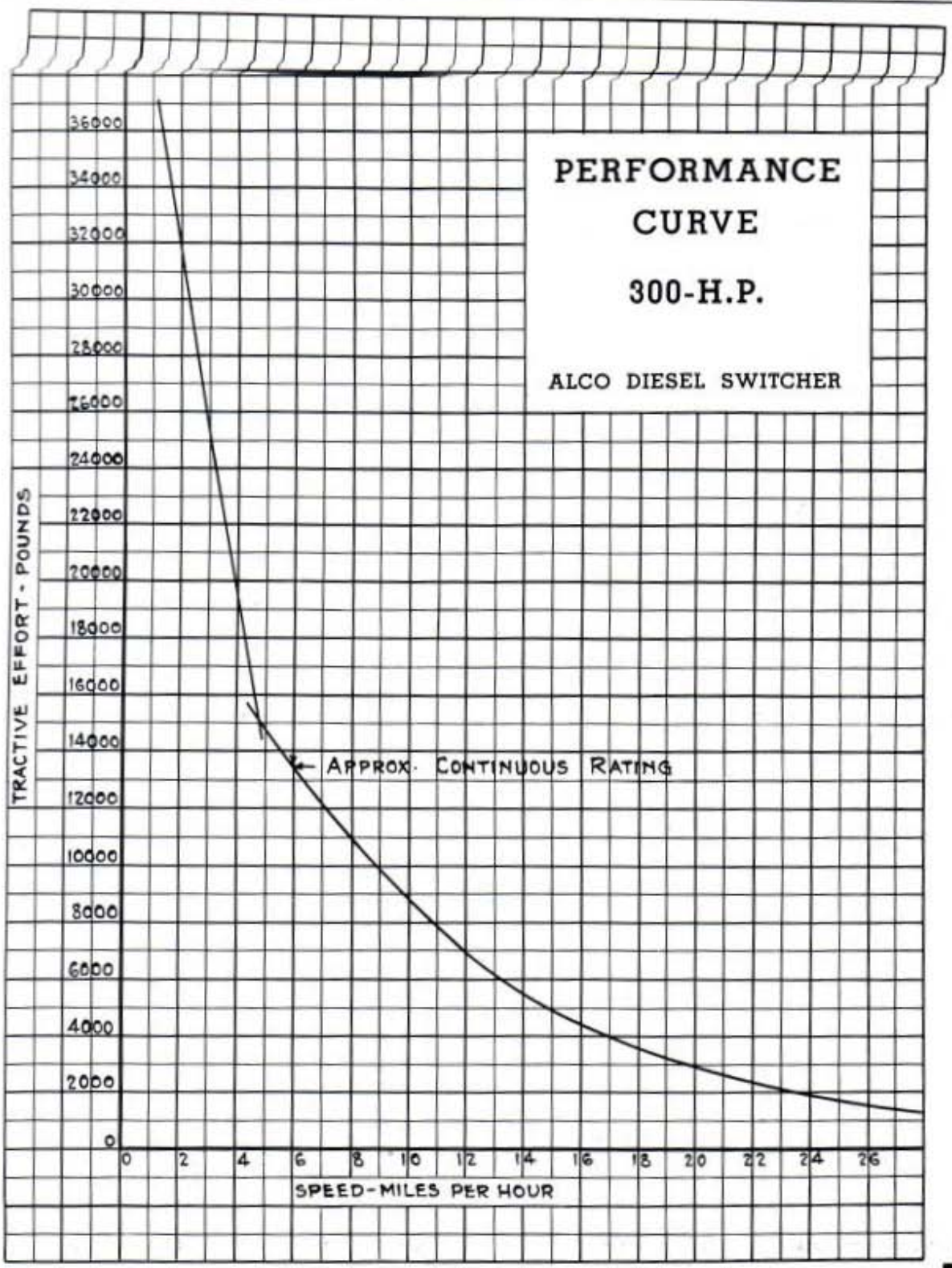
●

One Diesel Engine—Alco Railway Type	4 Cycle
Rated Brake Horsepower	300
R.P.M.	700
Number of Cylinders	6
Bore and Stroke (inches)	9½ x 10½

Air Brake Compressor built into Engine

Standard Air Brake Equipment




PERFORMANCE
CURVE
300-H.P.
ALCO DIESEL SWITCHER
TRACTIVE EFFORT - POUNDS
36000
34000
32000
30000
28000
26000
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
← APPROX. CONTINUOUS RATING
0
2
4
6
8
10
12
14
16
18
20
22
24
26
SPEED-MILES PER HOUR

SPECIFICATIONS

Weight, Total Locomotive	130,000 lb.
Starting Tractive Effort (30% adhesion)	39,000 lb.
Minimum Radius Curvature (locomotive alone)	50 ft.
Maximum allowable speed (for motors)	35 m.p.h.
Number of motors (one geared to each axle)	4
Fuel tank capacity (gallons)	250

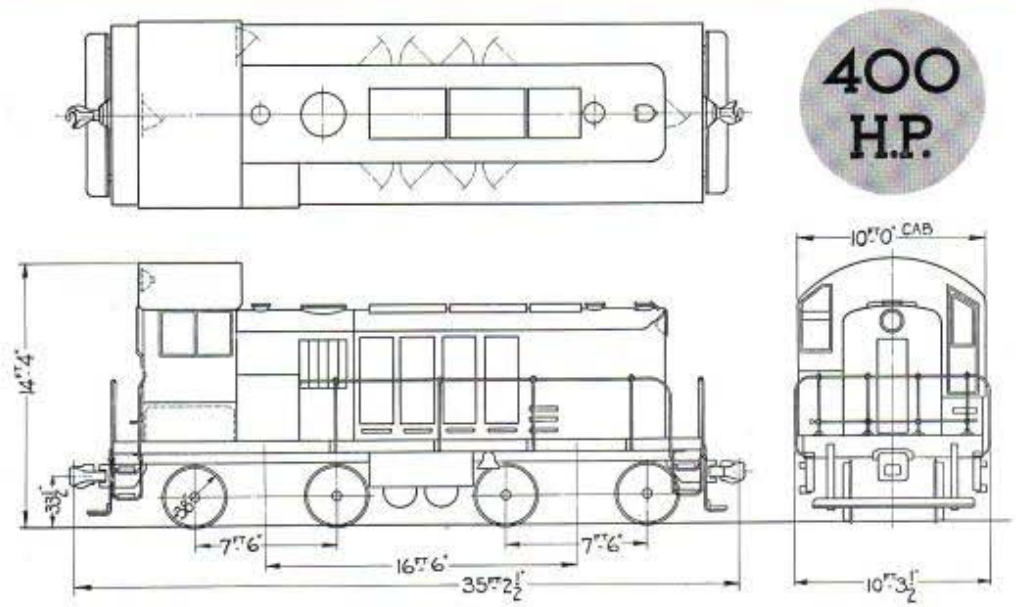
One generator—Railway Type—Direct Connected to Engine

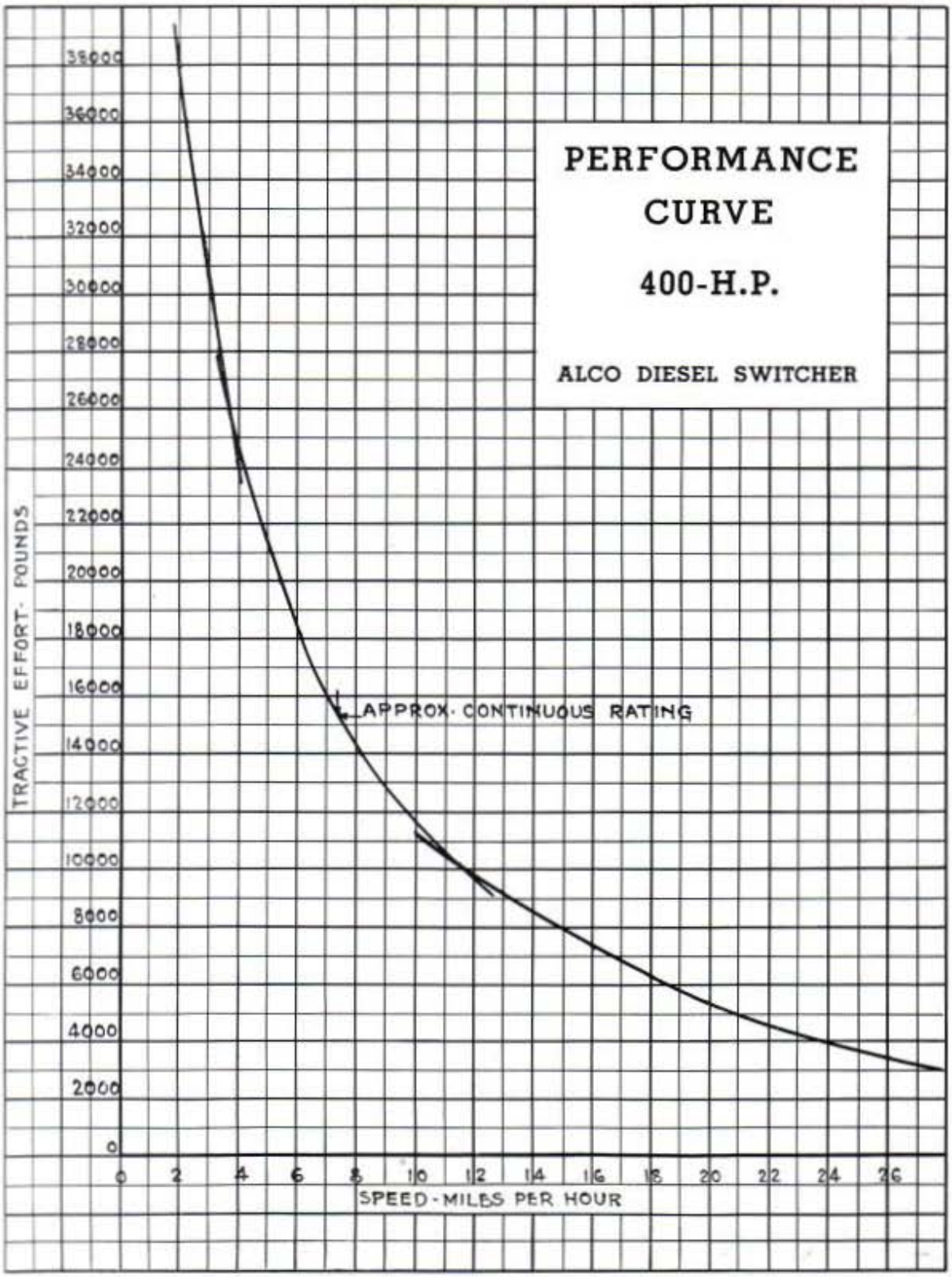
•

One Diesel Engine—Alco Railway Type	4 Cycle
Rated Brake Horsepower	400
R.P.M.	875
Number of Cylinders	6
Bore and Stroke (inches)	9½ x 10½

Air Brake Compressor—Electrically Driven

Standard Air Brake Equipment




PERFORMANCE
CURVE
400-H.P.
ALCO DIESEL SWITCHER
TRACTIVE EFFORT - POUNDS
38000
36000
34000
32000
30000
28000
26000
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
APPROX. CONTINUOUS RATING
0
2
4
6
8
10
12
14
16
18
20
22
24
26
SPEED - MILES PER HOUR

SPECIFICATIONS

Weight, Total Locomotive	200,000 lb.
Starting Tractive Effort (30% adhesion)	60,000 lb.
Minimum Radius Curvature (locomotive alone)	50 ft.
Maximum allowable speed (for motors)	40 m.p.h.
Number of motors (one geared to each axle)	4
Fuel tank capacity (gallons)	400

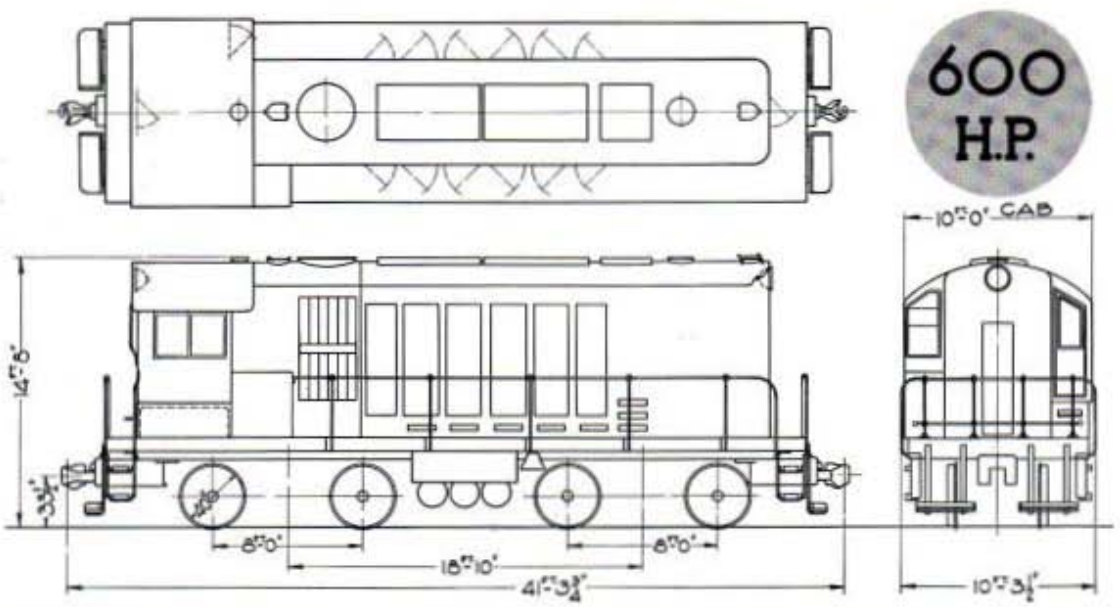
One generator—Railway Type—Direct Connected to Engine

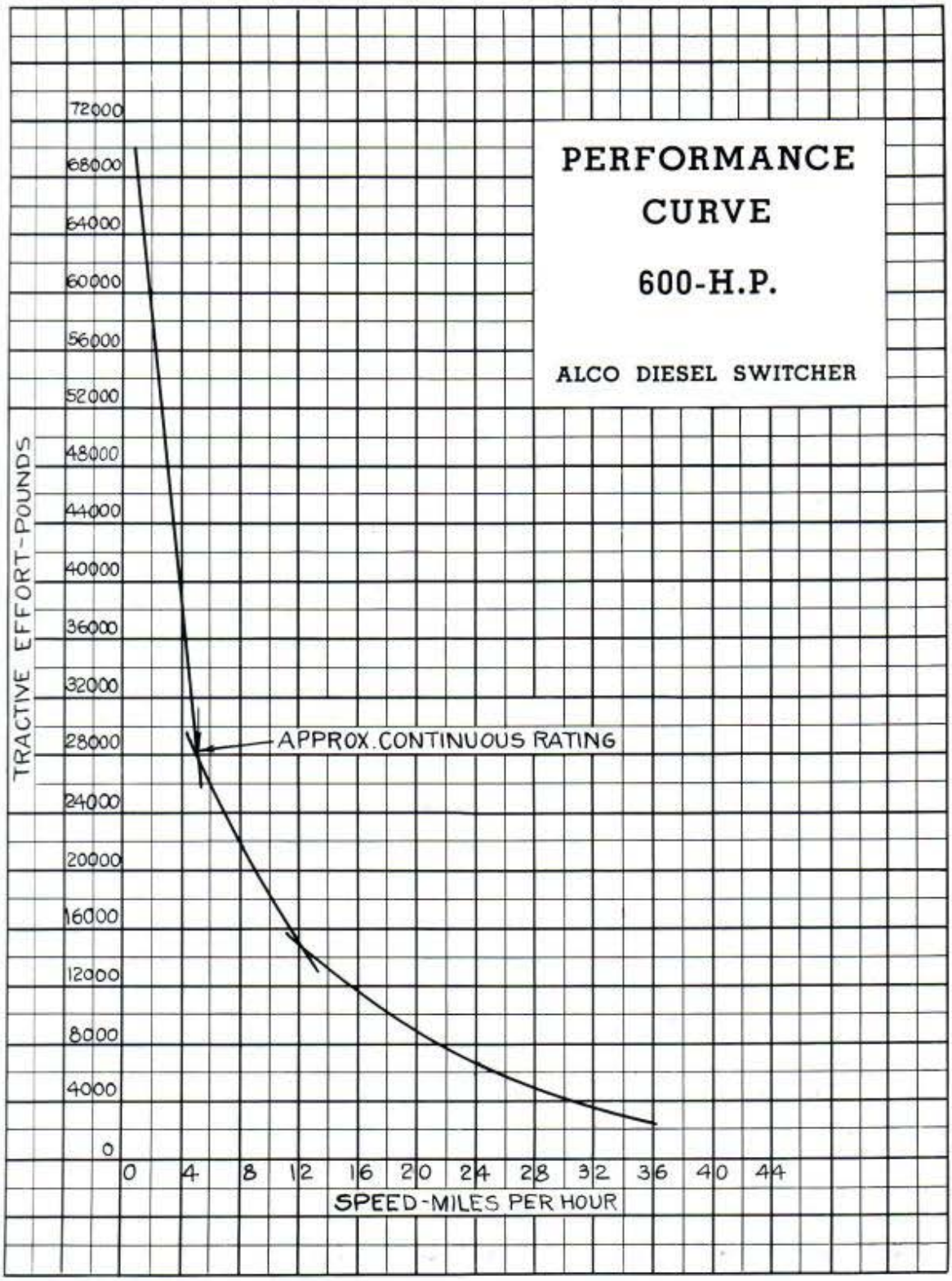
•

One Diesel Engine—Alco Railway Type	4 Cycle
Rated Brake Horsepower	600
R.P.M.	700
Number of Cylinders	6
Bore and Stroke (inches)	12½ x 13

Air Brake Compressor—Electrically Driven

Standard Air Brake Equipment




PERFORMANCE
CURVE
600-H.P.
ALCO DIESEL SWITCHER
TRACTIVE EFFORT-POUNDS
72000
68000
64000
60000
56000
52000
48000
44000
40000
36000
32000
28000
24000
20000
16000
12000
8000
4000
0
APPROX. CONTINUOUS RATING
0
4
8
12
16
20
24
28
32
36
40
44
SPEED-MILES PER HOUR

SPECIFICATIONS

Weight, Total Locomotive	212,000 lb.
Starting Tractive Effort (30% adhesion)	63,600 lb.
Minimum Radius Curvature (locomotive alone)	50 ft.
Maximum allowable speed (for motors)	40 m.p.h.
Number of motors (one geared to each axle)	4
Fuel tank capacity (gallons)	500

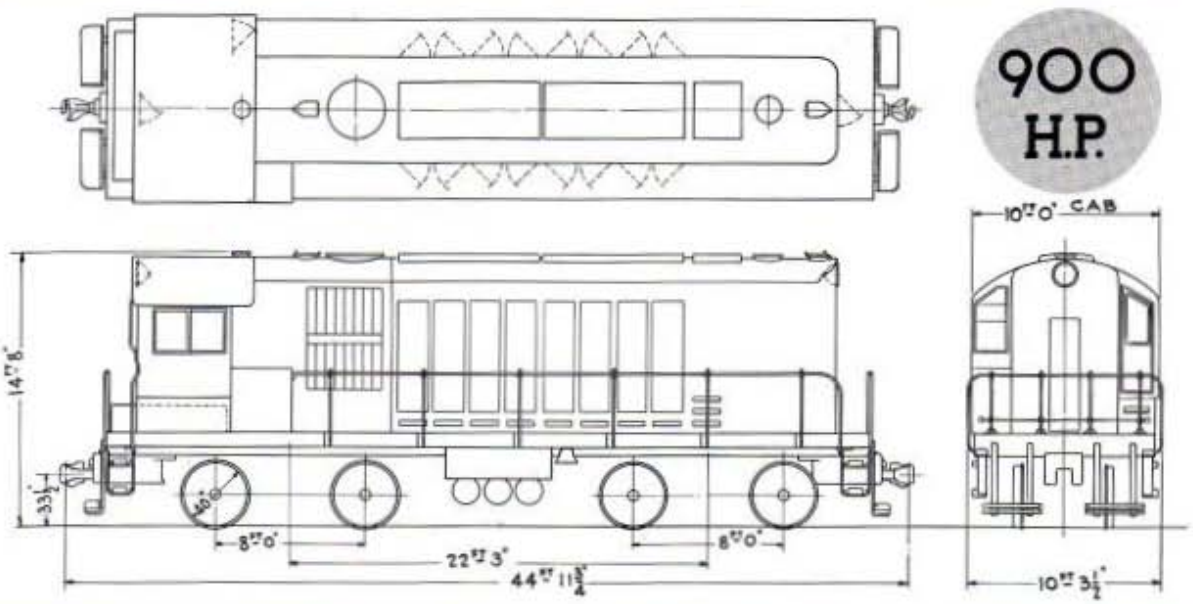
One generator—Railway Type—Direct Connected to Engine

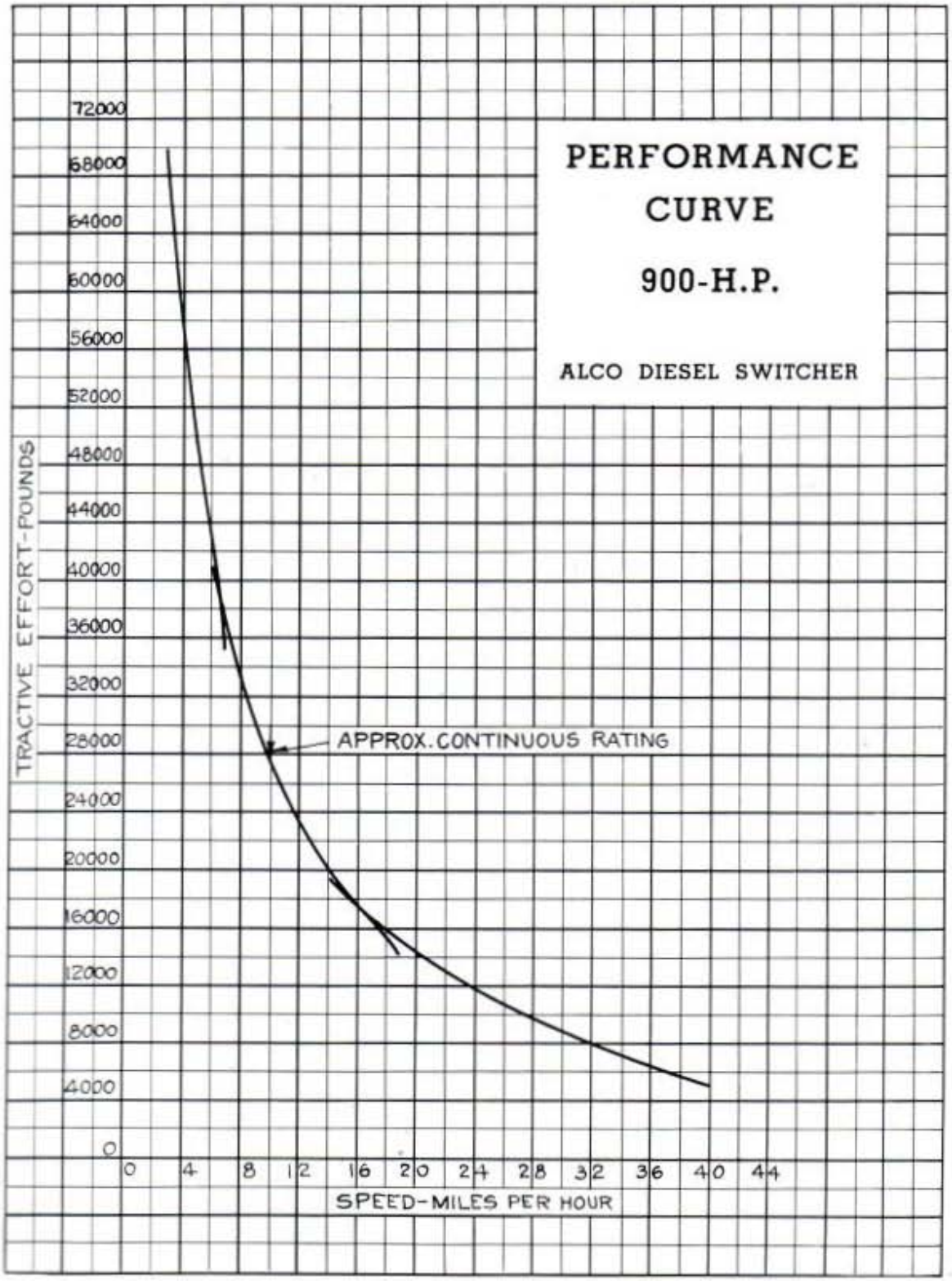
●

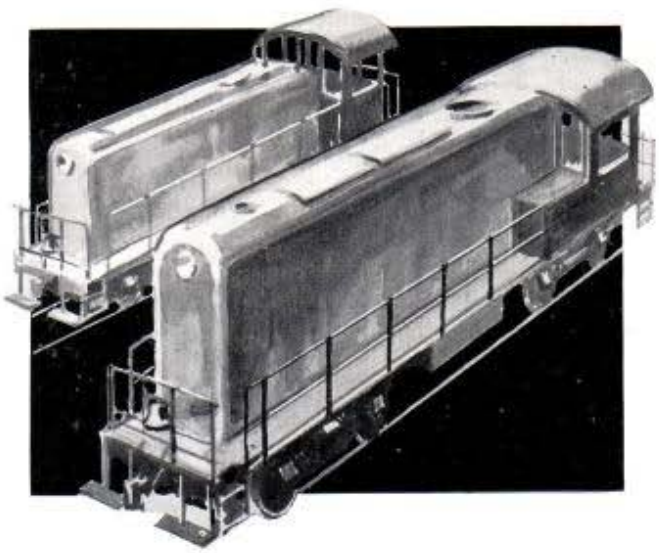
One Diesel Engine—Alco Railway Type	4 Cycle
Rated Brake Horsepower	900
R.P.M.	750
Number of Cylinders	8
Bore and Stroke (inches)	12½ x 13

Air Brake Compressor—Electrically Driven

Standard Air Brake Equipment




PERFORMANCE
CURVE
900-H.P.
ALCO DIESEL SWITCHER
TRACTIVE EFFORT-POUNDS
72000
68000
64000
60000
56000
52000
48000
44000
40000
36000
32000
28000
24000
20000
16000
12000
8000
4000
0
APPROX. CONTINUOUS RATING
0 4 8 12 16 20 24 28 32 36 40 44
SPEED-MILES PER HOUR



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