115-22

San Francisco, August 15, 1923.

Mr. J. H. Dyer:

Yours of the 9th, proposed conversion McKeen Motor Cars:

Mr. Small advises that there are no motor cars equipped with Diesel engines in this country at present, but that there are several in Sweden, Switzerland and Germany, one of which Mr. Kruttschnitt mentions in his article on fuel conservation and the Railway Age, May 20th, 1922 issue, page 1183, also describes one. These are all electric drive and in that respect differ from the recommended design which is a simple planetary transmission and, excepting size, is the same as used by all Ford autos.

Suggest Mr. McCormick investigate the service performed by Diesel engines in tug boat service around the bay, also the planetary reverse gear used in these boats which is a modified form of the planetary reduction gear recommended. The work performed in marine service should enable him to form a conclusion as to results we can anticipate from similar installation in motor cars and will be glad to have his judgment as to the mechanical features involved at your convenience.

It is not intended that any large sum be expended for experimental purposes. If for any unforseen reason the design should not prove successful the engine can be used in the M. of W. or Steamer Dept. and our losses will be represented by the cost of the planetary transmission and alterations in truck, all of which should not exceed six thousand dollars.

I am satisfied that whatever improvements are made in Rail Cars will have to come from the Railway Companies and not the car builders and after all the expense of such developments will have to be borne by the Railways and it will be cheaper to handle the work directly. Certainly the operating economies possible thru the use of a properly designed motor rail car seem to justify the expenditure of more than the amount involved.

Paul Shoup

March 1, 1926

Mr. Paul Shoup:

Following report of November 6, 1925 your committee has continued study and investigation of various types of rail cars. The most satisfactory rail car at present on the market is manufactured by the Electro Motive Company, gasoline electric propelled.

After rejection of other types of rail cars, concentrated study has been given the Electro Motive Car and committee now recommends the purchase of one 70' 6" over all, steel car equipped with dual power plant, type 106, providing 440 h.p. From recommendations of committee Electro Motive Company agreed to make alterations in car to remove the radiators from end of car to concealed position in roof, thereby giving clear vision to engineer for either end operation which is believed to be essential in view of the grade crossing conditions in California. Car will be equipped with individual bus type seats with deep upholstering and reversible backs. It is believed maximum comfort in seats is a prime requisite. Interior arrangement of car recommended, provides for baggage and express space of 15' 5", two toilets, smoking compartment equipped with coach seats for nine passengers, passenger compartment containing thirty-four individual seats and rear vestibule containing emergency drop seats for approximately five passengers. These seats are in addition to forty-three seats in car. Car provides for double end operation. The revised arrangement is shown on attached blue print.

Price including alterations mentioned is $52,000.00, fob. St. Louis, on trial acceptance basis.

The Electro Motive Company have submitted you a proposal for purchase of small type car, 57' 10" over all, equipped with single power unit. Our present steam schedules on Sacramento--Gerber, Sacramento--

Novifax, Oakland Pier--San Jose and Watsonville Junction--Boulder Creek via Santa Cruz were included in acceptance test basis for small car. In their submission the small car is not able in all cases to meet our schedules hauling a 45 ton trailer.

The committee believes it desirable to obtain the larger car offering 38 per cent better time performance and able to shorten present steam schedules by 30 per cent hauling a 45 ton trailer. This car will be able to operate advantageously as a substitute for several midday steam trains in peninsula service and has the additional advantage of being able to turn back at San Mateo, Redwood City or Palo Alto without turning on turn table or wye. In fact, offers the opportunity for more rapid and frequent service in this territory.

Cost statistics of steam train operation for branch lines, average year 1925 shows a total cost per train mile of 82.32¢. Investigation shows the 70' 6" Electro Motive car hauling a 45 ton coach will operate at approximately 50¢ per train mile leaving a net saving of 32.32¢ per train mile. Using these figures on Sacramento--Gerber run, 250 miles per day, indicates a net saving of $80.80 per day or $29,411.20 per year. On this basis accumulated savings would equal cost of car in 1.77 years.

This car offers the maximum in riding comfort and eliminates the disagreeable features and unreliability of the McKeen cars. It represents the highest mechanical perfection to date in rail cars and possesses reserve speed capacity to meet a demand for faster schedules. It should receive immediate approval and patronage from the traveling public.

With dual power plant car can be operated with one engine in emergency or when without trailer, thereby preventing loss in power efficiency also eliminating possibility of complete breakdown, although re-

ports from eastern lines having had these cars in operation for several months indicate their reliability.

The larger car recommended for purchase is intended for test on several of our present schedules and later can be placed in regular service on a run requiring fast schedule with large passenger accomodation which the smaller 57' 10" car would not provide.

Mr. Frank G. Bryant, Western Representative of the Electro Motive Company cooperated closely with the committee in working out details of the large 70' 6" car to supplement proposition submitted to cover the smaller 57' 10" car and furnished authorized acceptances for the Electro Motive Company on alterations desired, also estimating prices.

If committee's recommendation is approved, suggest further handling be conducted by the Purchasing Agent in the customary official manner.

cc Mr. Dyer
Mr. McGinnis

T. B. WILSON

July 23, 1926

Memo.

A.F.E. covers Electro-Motive Company gasoline electric rail car 70'6" over all, steel car, dual power plant, 440 horse power.

Detailed constructions of car proposed is revised from their standard to conform with recommendations of rail car committee. Radiators were removed from end of car to concealed position in roof to provide clear vision, both sides, for operator. Floor plan of car is designed to meet recommendations of Mail and Express Traffic Manager, General Baggage Agent and Passenger Department. Baggage and express space of 15'5" is provided, two toilets moved from standard vestibule position into interior of car. Smoking compartment equipped with coach seats for nine people, passenger compartment equipped with 34 individual bus type seats with deep upholstering and reversible backs to provide the maximum in seating comfort. Total of 43 seats in car, plus 5 emergency drop seats in rear of vestibule. Car provides for double end operation to avoid turning on wye or turntable. The items enumerated are changes over Electro-Motive Company standard equipment.

After extensive investigation rail car committee determined the Electro-Motive Company rail car was the most proven and reliable in operation on the market. This is substantiated by operating results obtained on other lines.

Committee first undertook the adoption of single power unit car 57'10" length over all for our service, but after furnishing proposed schedules, profiles and trailer weight, it was determined that the smaller car with single power unit was unable in all cases to meet the schedules hauling a 45 ton trailer. The committee deemed it advisable to utilize

coach equipment we have available as trailers, tare 45 tons, instead of purchasing special trailer equipment.

The small single unit car would be able to fulfill some of the present steam schedules and in other cases could not do so while the dual power plant car can fulfill the steam schedules and in majority of cases improve them. The committee felt it was advisable to purchase new equipment that would be able to make faster schedules in view of the present tendency of speeding up schedules.

Average branch line steam cost for year 1925 was 82.32¢ per train mile while the dual power plant rail car hauling a 45 ton trailer will operate for approximately 50¢ per train mile leaving a net saving of 32.32¢ per mile. Using the Sacramento-Gerber run, 250 miles per day, indicates a net saving of $80.80 per day or $29,411.20 per year. On this basis accumulated savings would equal cost of car in 1.77 years.

The dual power plant car can be operated with one engine in emergency or without trailer thereby preventing loss in power efficiency and eliminating possibility of complete breakdown.

In purchasing rail cars it is anticipated they will be used on the more important branch or main line runs handling heavy traffic. The committee had in mind particularly the possible replacing of a number of the midday steam trains on the peninsula. It is felt when study is completed the adoption of motor bus on some of the smaller less important branches will better meet the traffic requirements and be more economical than application of rail cars.

Purchase provides rail car to be furnished on trial acceptance basis on 30 day test. Car will have to fulfill requirements before acceptance.

Paul 8/15 321-4

July 24, 1926

T. B. W.
JUL 31 1926

Mr. Paul Shoup: (2)

Yours July 15th in relation to clipping taken from Railway Review about motorization of branch lines by the Rock Island.

This matter was discussed with Rock Island officials by our committee at Chicago..

They have a number of rather isolated branches in sparsely settled territories and have decided on adoption of rail motor cars to reduce steam operating costs. Some of the districts they have in mind have not yet developed active motor bus competition on the highway and they admit they do not believe the rail car will compete with the motor bus on the highway.

Our rail car committee considered plan similar to that outlined by the Rock Island and felt that after the one car recommended for purchase proved to be practical and met operating requirements, further consideration would follow relative installation of same propelling machinery in such car equipment we might have that would prove practical for such installation.

Investigation shows that some of the Eastern lines who early adopted the gas electric rail cars have since replaced some of them with motor bus on the highway in order to further reduce operating costs and be able to compete with bus and truck on highway.

Bus and truck committee believe we should go as far as possible in replacing branch line passenger service with motor bus on highway and resort to the rail car only for such service as the motor bus cannot accommodate.

TBW imp

(Signed) L. H. DYER

San Francisco, March 29th, 1927.

J. H. D.
MAR 29 1927

Mr. Paul Shoup:

Your memorandum, March 18th, suggesting it would be well to obtain Mr. McCormick's views on the Diesel locomotives ordered by the New York Central and Boston & Maine, and described in OIL ENGINE POWER for March. Mr. McCormick reports:

"In our Peninsula interurban service the largest locomotive operated is P-10 type, with tractive effort of 43,660-lbs. and capable of speed of 75 MPH, as compared with 42,000-lbs. tractive effort and speed of 60 MPH for passenger Diesel locomotive New York Central is building. Purchase price of Diesel locomotive is about twice that of a steam locomotive of equivalent tractive power.

"The Eastern roads now building Diesel locomotives are confronted with the problem of electrification (due to city smoke ordinances) and it is more economical to provide Diesel power, rather than go to the enormous expense of overhead or third rail electrification. Thus far we have not been confronted with this problem.

"While the Diesel locomotive is still more or less in the experimental stage, there is no question but what this type of power will ultimately come into general use. However, I look for considerable development and improvement in design within the next year or two, as result of the Diesels to be built and tried out by such roads as the New York Central and Boston & Maine; hence, for the time being I believe we can well afford to let the other fellow do the experimenting."

It would be very expensive for us to undertake experiments with Diesel locomotives at this time, and I concur in Mr. McCormick's view that we let the other fellow do the experimenting and we will keep ourselves posted of progress made.

GEC:oc
BC - Mr. Geo. McCormick
Encl. (Oil Engine Power Magazine)

416

B. A. V.
NOV 19 1927

San Francisco, November 18, 1927.

J. H. D.
NOV 18 1927

Mr. Paul Shoup:

Your letter 411-003, August 31, in further reference to oil-electric locomotives as described in advertisement "A 74% saving in Operating and Maintenance Expense".

Attach statement prepared by General Superintendent Motive Power showing comparative costs per engine hour of C.& N.W. and S.P. steam switch engines, with C.& N.W. oil-electric switch engines based on operations for month of August 1927.

Cost per engine hour for steam switching locomotives on C. & N.W. and S.P. including interest on the investment, amount to $5.49 and $4.66 respectively as compared with only $3.16 for the C.& N.W. oil-electrics.

As to the claim in the advertisement that one oil-electric switch engine does as much work as two steam engines - the following is quoted from letter received from General Superintendent Motive Power of C.& N.W. by Mr. McCormick:

> "The item you referred to in the Railway Age of Sept. 6th, 1927, that one Oil Electric Locomotive was performing the service of two steam locomotives, is somewhat misleading.
> "Our North Pier, and also our State St. Yards, where these Oil Electric Locomotives are working, are approximately five miles from the Shops and Enginehouses, and formerly our steam power, after 12 hours service, was relieved by a relay crew with another switch engine, in order to take the one which was on duty, to the enginehouse for coal and any attention that might be necessary. However, the Oil Electric Locomotive, in our North Pier Yard works from Monday until Saturday night, 24 hours a day; but in the two yards referred to, which are about a mile apart, and in each of which we have one Oil Electric Locomotive, the work could be taken care of by three steam locomotives, as the third one could cover the relief period for both yards."

While the oil-electric locomotive shows a saving of $1.50 per engine hour over our cost of operating steam locomotives, Mr. McCormick looks for considerable development and improvement in design of this class of power within the next year or two and it is his views, in

which I concur, that for the time being it would be advisable to let the other roads do the experimenting. However, by copy of this letter am requesting Mr. McCormick to keep in close touch with development of the oil-electric locomotive.

(Signed) J. H. DYER

Fncl.

cc - Mr. Geo. McCormick

bav 1

SOUTHERN PACIFIC COMPANY
(Pacific Lines)

COMPARATIVE COST PER HOUR OF OPERATION OF C&NW OIL ELECTRIC SWITCH ENGINES, C&NW STEAM SWITCH ENGINES AND SOUTHERN PACIFIC COMPANY STEAM SWITCH ENGINES.

MONTH OF AUGUST, 1927

	C&NW. Oil Electric	C&NW Steam	S.P.Co. Steam	Saving Oil Electric over C&NW Steam	Saving Oil-Electric, over S.P.Co.Steam.
Wages - Enginemen,	$ 1.50	1.89	1.56	.39	.06
Fuel,	.17	1.05	1.37	.88	1.20
Enginehouse Expense,	.01	.65	.42	.64	.41
Lubrication,	.07	.02	.02	.05	.05
Water,	--	.04	.13	.04	.13
TOTAL TRANSPORTATION,	$ 1.75	3.65	3.50	1.90	1.75
Repairs,	$ .56	1.51	.76	.95	.20
Depreciation	.42	.11	.17	.31	.25
TOTAL MAINTENANCE,	$ .98	1.62	.93	.64	.05
Interest on Investment	$ .43	.22	.23	.21	.20
GRAND TOTAL,	$ 3.16	5.49	4.66	2.33	1.50
Weight on Drivers,	130000	140500	142250		
Tractive Power,	36000	23300	28149		
Cost	$62255	$32441	$33444		

NOTE:--Above figures based on three Oil-Electric, and three Steam Switch Engines operating on C&NW, at Chicago, and average cost per hour, all switch engines on S.P.Company, Pacific Lines, - month of August.

Office of Genl.Supt.Motive Power,
San Francisco, November 10th,1927.

~~41523~~
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C O P Y

November 23, 1927

Mr. Paul Shoup,
Executive Vice President,
San Francisco.

Dear Mr. Shoup:

Return herewith Mr. Dyer's letter of November 18, relative to oil-electric locomotives, which is extremely interesting.

The characteristics of these oil-electric locomotives are similar to those of an electric locomotive, and through their use it is possible to get many of the benefits of electrification without the tremendous investment required for transmission of electric energy through overhead or third rail.

I have often thought that our peninsular suburban service from San Francisco to San Jose would be an ideal place to get the benefit of economies from oil-electric locomotives, and hope that some day there will be an opportunity to try one of them out in that service.

(Signed) C R Harding

Copies(2) made by PS 11/25 for Mr. Dyer: What are your views with respect to suggestion contained in last paragraph?

4/6

410-043-1

December 6, 1927.

Mr. Dyer:

Your memo Dec. 1st agreeing with Mr. Harding's view that our peninsular suburban service would be a good place to try out oil-electric locomotives, and expressing your intention to go into the matter further after Diesel-electric locomotive builders have succeeded in turning out an engine that will develop 2,000 horse power or better:

How far from this goal are the locomotives so far constructed? Note from statement attached to your letter Nov. 18th that the C&NW Diesel-electric switching locomotive develops 36,000 pounds tractive effort, which is greater than the tractive effort developed by the steam locomotives regularly used in our peninsular suburban service, but I presume this large tractive effort is developed at the expense of speed. It would be interesting to know what our engineers have in mind as a measure in terms of tractive effort and speed for Diesel-electric locomotives for this service.

Roop

My note ~~the~~ Mack's Imad's
Two-trailer cars? See
my note Mr. Bonneau's file

San Francisco, December 21st, 1927.

Mr. J. H. Dyer:-

Referring to your letter of December 7th, in reference to oil-electric locomotives:

The largest Diesel electric locomotives constructed in this country, so far, are as follows:

One - 1000 h.p. locomotive built by the Baldwin Locomotive Works for experimental purposes.
One - 960 h.p. locomotive built for the New York Central for passenger service.

In addition to the above, the Boston & Maine Railroad is having delivered to it a Diesel locomotive having a gear drive instead of the usual electric drive. This locomotive was built by the Krupps, of Essen, Germany, being about 1300 h.p., and is intended for road service.

The most powerful locomotive we have at the present time, in regular suburban service between San Francisco and San Jose, is the 4-6-0 type, class T-32, of about 2000 h.p., developing a maximum tractive effort of 38,320 lbs. This locomotive, which has 69" drivers, was designed for passenger service. Hence, the tractive effort developed at high speeds is quite high.

The Diesel electric switching locomotive used by the Chicago Northwestern Railway, which develops a maximum tractive power of 36,000 lbs., has a high tractive power at starting, considering its total weight. However, at a speed of 60 miles per hour, the tractive power drops to only 900 lbs., whereas, for the T-32 class locomotive mentioned, the tractive power at 60 miles per hour is 12,500 lbs. Hence it will be noted that the tractive power of the Diesel electric locomotive drops very rapidly as compared with the steam locomotive. Of course, it must be borne in mind that this locomotive was designed for slow speed switching service.

A Diesel electric locomotive for use on our suburban lines between San Francisco and San Jose would require a tractive power, at starting and at various speeds, at least as great as that now obtained with our T-32 class locomotives.

For ready reference, I am attaching, in duplicate, chart showing the tractive power of the Chicago Northwestern Railway Diesel electric locomotive, at starting and at various speeds, up to 60 miles per hour, and the corresponding information for our class T-32 steam locomotives.

Geo. McCandless

Enc.

San Francisco, Dec. 22, 1927.

Mr. Paul Shoup:

Your 410-043-1, December 6th, about the use of oil-electric locomotives in our peninsular suburban service:

Your queries are answered in the order asked as follows:

1. The largest Diesel electric locomotives constructed in this country, so far, are as follows:

One - 1000 h.p. locomotive built by the Baldwin Locomotive Works for experimental purposes.
One - 960 h.p. locomotive built for the New York Central for passenger service.

In addition to the above, Krupps, of Essen, Germany, is delivering a Diesel locomotive of about 1300 h.p. to the Boston & Maine Railroad. This locomotive has a gear drive instead of the usual electric drive, and is intended for road service.

The most powerful locomotive used at present in regular suburban service between San Francisco and San Jose is the 4-6-0 type, Class T-32, of about 2000 h.p. developing a maximum tractive effort of 38,320 lbs. This locomotive has 69" drivers and was designed for passenger service, hence, the tractive effort developed at high speeds is quite high.

2. The Diesel electric switching locomotive used by Chicago Northwestern Railway develops a maximum tractive power of 36,000 lbs. and has a high tractive power at starting, considering its total weight. However, at a speed of 60 miles per hour the tractive power drops to only 900 lbs., whereas for the T-32 class locomotive used in our peninsular suburban service, the tractive power at 60 miles per hour is 12,500 lbs.

Am attaching chart showing tractive power of the C.& N.W.Ry Diesel electric locomotive at starting and at various speeds up to 60 miles per hour and the corresponding information for our class T-32 steam locomotives. It will be noted that the tractive power of the Diesel electric locomotive

drops very rapidly as compared with the steam locomotive. Of course, it must be borne in mind this locomotive was designed for slow speed switching service,

3. A Diesel electric locomotive for use on our suburban lines between San Francisco and San Jose would require a tractive power, at starting and at various speeds, at least as great as that now obtained from our T-32 class locomotives.

As the information given above for the largest Diesel electric locomotives constructed in this country is the only data our Mechanical Department has on these locomotives, am requesting Mr. McCormick to find out their tractive power at starting and at various speeds and to also find out if the art of building Diesel electric locomotives has been developed to such an extent that it would be possible for the manufacturers to design a locomotive of this type suitable for use in our peninsular suburban service.

(Signed) J. H. DYER

bav 1

Excerpt from Report of General Conference of Executive, Operating, Traffic and Engineering Officers at San Francisco, April 16-19, 1928.

34. SUBSTITUTION OF BUS OR RAIL CAR SERVICE FOR STEAM TRAINS

After discussion engaged in by Messrs. Sproule, A. D. McDonald, McCormick, Power, Lull and Shoup, it was understood that Messrs. Lull and Shoup should, for the minutes of the meeting, present their conclusions as corollary to this discussion. They submit the following:

"It is our conclusion,

"First, we should adopt the policy of substitution of cheaper forms of transportation for steam line trains wherever the net gain to be made can be demonstrated as justifying.

"Second, such cheaper forms may be through use of motor bus highway service or service of gas or gas-electric cars on our rails. Whether rails or highways are to be used will be determined by individual study in each instance.

"Third, as to types of motor buses or rail cars, the time has not yet arrived to determine standards, as both are in what appears to be a later development stage. Bids should be called for from manufacturers who meet the specifications for any required use. There is no objection to taking on trial a single unit of any make, provided the proposed price is reasonable and provided the railroad is sole judge and can discard the equipment at end of experiment without any cost to the railroad, giving reason or not as we choose; and provided there is no obligation to purchase further cars of such make even though the experimental car be purchased. McKeen cars are not to be rebuilt but every effort is to be made to find service for them where they can be utilized to advantage, and additions and betterments may be made as in each instance is found justified.

"Fourth, the very definite and permanent effect upon our passenger revenues of motor transportation requires prompt action to meet the

situation by reductions in train expenses wherever a net gain in earnings can be accomplished. Therefore, in addition to changes made and recommendations under consideration, further studies will be kept up continuously and conclusions presented as fast as reached, with request for early action thereon."

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San Francisco, June 1st, 1928

Subject: Diesel Locomotives for Suburban Service,
San Francisco - San Jose.

Mr. J.H.Dyer:

Supplementing my letter of March 20th on above file and subject, the present status of the investigation ~~as~~ as follows:

The enclosed Speed-Tractive Effort curves show a comparison of the Diesel Locomotives upon which information has been received, with our T-32 Class Steam Locomotive which is the heaviest now in use in the San Francisco - San Jose service.

The weight of 193 tons given for this engine on the chart includes the loaded tender weight as the Diesel Locomotive weights include fuel and water.

The 1000 horsepower Baldwin Diesel Electric locomotive shown on the chart is purely an experimental machine which they do not yet consider ready for market. Its tractive effort curve is included because it is interesting to note that the curve is the only Diesel one showing a sustained starting effort similar to the steam curve.

The McIntosh & Seymour Company is carry on a further study of this ~~problem~~ problem with additional information which we have furnished at their request.

The Ingersoll-Rand Company has replied as follows to our letter to them pointing out certain shortcomings in their original proposition:

> "Yours of March 21st. You were quite right in stating that the top speed for the 600 horsepower locomotive would be 50 miles per hour. Under the original schedules as given, we

believe that these locomotives would maintain these schedules. If,however, the top speed of 60 miles per hour is essential this service could be given and the schedules met with locomotives with one 800 horsepower engine, which, at 60 miles per hour would give a wheel horsepower of 640.

The first of these experimental engines will go in service about the end of this month. We will, of course, make some revisions on the hookup after we have had a little experience with it, but in about two months time we will be in a position to give details including weight and price of such a locomotive, but for your information we estimate it will weigh about 110 tons, and should cost something in the neighborhood of $120,000 and $125,000."

We set a top speed of 60 miles per hour in an effort to cut down the required accelerating rate as much as possible, this being the requirement on which the Diesel Engine falls short.

The 750 horsepower Ingersoll-Rand locomotive will handle 3 loaded cars at 60 miles per hour, but has only the required acceleration to make our present schedule with 2 loaded cars. It is possible that the 800 horsepower locomotive mentioned in their letter will make our schedule with 3 loaded cars. This meets the mid-day service requirements but falls short of the 8 car rush hour service even with double heading

The 1500 horsepower Ingersoll-Rand engine will just make our schedule with 6 cars under the most favorable conditions. With a five car train there appears to be suitable reserve power. This unit will handle 11 loaded cars at 60 miles per hour, but cannot accelerate such a train with sufficient rapidity.

The American Brown Boveri Electric Corporation has replied to our letter as follows:

"From the necessarily hurried study which the short time interval between the arrival of your service data and the

departure of our Mr.Bardo permitted, it would appear that the 148 ton 1600/2000 H.P. Diesel Electric locomotive described below, would amply take care of all but your heaviest rush hour service. This locomotive has the largest output of those fully developed by us up to this time and is ready for immediate manufacture. The other types fully developed are of 400 and 800 H.P. rating. The arrangement of the latter is very similar to that of the largest type except that its Diesel engine consists of twin 4-cylinder units instead of four 3-cylinder units and that its wheel arrangement is of the 2-6-2 instead of the 2-4-4-2 type. The tractive effort rating of the 800 horsepower locomotive would be exactly half of that of the 1600 horsepower locomotive.

These locomotives are readily equipped with multiple unit control, allowing double or even triple heading of these locomotives under one crew, which naturally would allow of a very flexible operation for adaptation to both regular day service and rush hour service.

These locomotives represent the combined experience of the four firms given below:

(a) The American Brown Boveri Electric Corporation which is responsible for the general design and the adaptation to American railroad standards.

(b) Brown,Boveri & Co.Ltd., of Baden, Switzerland for the main electrical features.

(c) The M.A.N.Company of Augsburg,Germany, of which we are licensees for the Diesel engine equipment.

(d) Swiss Locomotive Works of Winterthur,Switzerland, of which Mr.Buchli, is the Chief Engineer, and who has worked out the Mechanical features.

We would be prepared to guarantee that the Diesel engine if properly maintained and normally adjusted will have a fuel consumption at full load not exceeding .45 lbs per brake horsepower per hour of a good grade of Diesel engine fuel oil having a specific gravity of not less than 20° to 25° Baume'and 18,000 B.T.U.'s per lb.

By combining as we have done the accumulated results of the best American and European practices represented by the combined engineering forces of the above companies, we feel confident that what we are offering you represents a distinct advance in the art of Diesel electric traction.

We draw your particular attention to the relatively low

weight of the locomotive in proportion to its horsepower capacity. The weight on the drivers per continuous B.H.P. developed is about 185 lbs, and for the complete locomotive about 238 lbs., thereby approaching the weight efficiency of the modern steam locomotive."

They also include a description of the 1600 horsepower locomotive and drawings covering general details.

This locomotive is claimed to be capable of operating at a maximum horsepower of 1850 for one hour with supercharger. At its continuous horsepower rating of 1600, it will haul 11 loaded cars 60 miles per hour or 9 loaded cars 65 miles per hour. By using the reserve power of the supercharger in starting it appears to have sufficient power to accelerate up to schedule with 7 cars.

Our rush hour service calls for trains of from 6 to 8 cars and 10 car trains have been run on occasions. While 3 car trains are average mid-day traffic, it may be desirable to use 4 cars in this service.

Average cost of operating the present steam equipment on the San Francisco - San Jose run is 38.19 cents per mile. Ingersoll-Rand estimates an operating cost of 15.6 cents per mile for their 600 horsepower Diesel Electric unit which is now in service. A Diesel locomotive such as proposed by Brown Boveri could operate continuously at full power for 12 hours without refueling. Our present service uses an average of 22 engines per day. The average miles run per engine per month in this service is 1199. When further information is available on this subject, we will advise you.

Encl.

Geo. W. Emerick

C O P Y

418

San Francisco, December 5th, 1929.

SUBJECT: Deisel Locomotives:

Mr. F. L. Burckhalter:

Referring to Mr. Dyer's mailgram C-5 of December 3rd, to you:

With return of attached papers would advise as follows:

The Diesel locomotive subject is not a new one, and the best manufacturers in the United States and elsewhere have been endeavoring for a number of years to perfect an economical Diesel locomotive that will satisfy our present day transportation requirements. While there have been units of small power developed that have given reasonably good results, so far there has been no satisfactory locomotive of heavy power developed.

The Baldwin Locomotive Works endeavored to develop and build for this Company a Diesel locomotive in 1925, with the result that they did build and place in service early in 1926, a locomotive of 1000 horsepower. After numerous trials and alterations they satisfied themselves that the locomotive would not be a success and it was never sold. It is still in use by them for switching purposes around their works. At the time this locomotive was first placed in service newspapers were furnished with some glowing accounts of the great economy of this machine, and it was visualized as hauling large passenger trains across the continent at high speeds without stopping.

Our Company, together with other American Railroads, has been watching with interest claims and developments of this class of motive power. Recently the American Railway Association Committee on Locomotive Design and Construction had an opportunity to inspect and ride on the

C O P Y

Canadian National's Diesel locomotive number 9000.

Referring particularly to the editorial in the Los Angeles Examiner, we note the following points:

1. "A gallon saved is a gallon gained, and saving of millions of gallons means a gain of Millions of Dollars". A Dollar a gallon is rather an extreme valuation for water.

2. While "Canada is not troubled with a water supply problem", the fuel problem is rather acute, as most of the coal being used in Canada has to be imported.

3. The Canadian National's Diesel locomotive develops 2660 horsepower, and on its test run hauled a train of 7 cars weighing 663 tons as compared to our passenger locomotives developing from 2965 to 3800 indicated horsepower and regularly handling trains out of Los Angeles consisting of from 12 to 14 cars weighing from 900 to 1050 tons.

4. In regard to the "full train recently drawn from Montreal to Toronto at 70 miles an hour", this statement is in error. This train made an average speed of 43.6 miles per hour including stops which is the same schedule speed maintained by steam locomotives. Speeds of from 60 to 65 miles per hour were maintained for considerable periods on comparatively level track, and in one place over 70 miles per hour was made for a short distance. The train hauled on this run consisted of 7 cars weighing 663 tons, which is considerably lighter than the majority of our through passenger trains.

5. In the comparison made as to the cost of fuel on the steam as against the Diesel locomotive, "$25.00 worth of oil as against $80.00 worth of coal", no mention is made of the comparatively large expenditure

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for lubricating oil on the Diesel engine, which was as great or greater than the cost of fuel oil; neither is there any mention made of the cost of repairs.

We know as a matter of fact that the lubrication problem has not been solved on this Canadian National Diesel locomotive, with the result that it has been out of service a considerable part of the time. As conclusive proof that this Diesel locomotive is still to be considered as an experiment, we note that the Canadian National have recently placed orders for 20 4-8-4 type steam passenger and fast freight locomotives, and for 20 0-8-0 type steam switching locomotives, and have purchased no additional Diesel locomotives.

As you know we have conducted a study of Diesel locomotives since 1925 with a view to using them on our San Francisco-San Jose suburban trains. Although we have followed all recent developments on the subject we have not, up to the present time, been offered Diesel locomotives of sufficient power to handle these suburban trains without an impractical amount of double heading. The 3 most objectionable features of the Diesel locomotives as built up to the present are as follows:

1. The excessive weight per horsepower, caused not only by the weight of the Diesel engine itself, but by the heavy electrical transmission.

2. The relatively small horsepower of the units as compared to modern steam locomotives

3. The high cost per horsepower, which is at least three times that of steam locomotives.

At present the Diesel locomotives produced commercially in this country are only suitable for switching and other slow speed service.

(signed) Geo. McCormick

Encl.