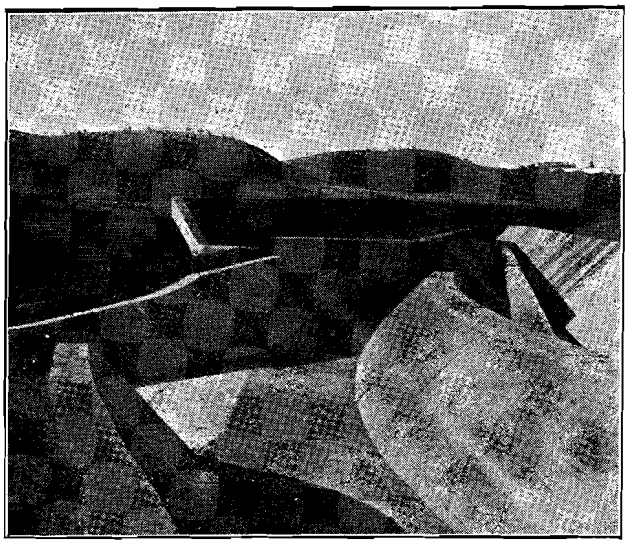
modern system of sewage disposal, it has had a contour survey made, and preliminary plans and estimates for sewering the town prepared. Owing to the high estimated cost, the matter is at present in abeyance, but it is certain that financial difficulties will shortly be overcome and this very necessary work undertaken.

In view of this probability and of the continued steady growth of the town, attention has been given to the question of supplementing the present water supply. A suitable site for a supplementary reservoir has been located on a tributary (Jones' creek) of the Little Coliban some two miles west of the present reservoir and plans for bringing in this source of additional supply are in course of preparation. When this work has been completed, the town will have a system of water supply which should be ample to meet all the demands of a sewered and growing town till such time as the expenditure incurred in carrying it out has been liquidated and Kyneton will once more possess an efficient water supply free of debt.

South Australian Water and Sewerage Schemes

The water supplies and sewerage schemes of the state of South Australia, together with the revenue department for same, and the supervision of the Glanville ironworks, are under the control of the hydraulic engineer, Mr. Herbert E. Bellamy, M.Am.Soc.C.E., M.I.E.Aust. South Australia is situated between 26 deg. and 37 deg. south latitude and 129 deg. and 141 deg. east longitude, the total area being 380,070 square miles.



Fif. 1. Diversion Weir on Bundaleer Creek, South Australia

The capital cost of waterworks to date is £10,411,310. The total length of mains laid is 5,100 miles. The area supplied with water for domestic and stock purposes is approximately 20,000 square miles and forms the largest distributing scheme in the world.

The total number of employees under the hydraulic engineer on June 30 last was 2,388, which includes 208 salaried officers. The total amount paid in wages and salaries for the past year was £443,690.

There are 24 impounding reservoirs in the state, with a total storage capacity of 16,796,906,000 gal., 45 service reservoirs, 7 pumping stations on the river Murray, 1 at the Blue Lake, Mount Gambier, 1 at Burra, 1 at Hansborough, 1 at Palmer, 1 at Kensington, 1 at Tod river, while no fewer than 106 towns are supplied with water including the metropolitan area of Adelaide. The principal country water districts are the Beetaloo, Barossa, Warren, Bundaleer, and Tod river.

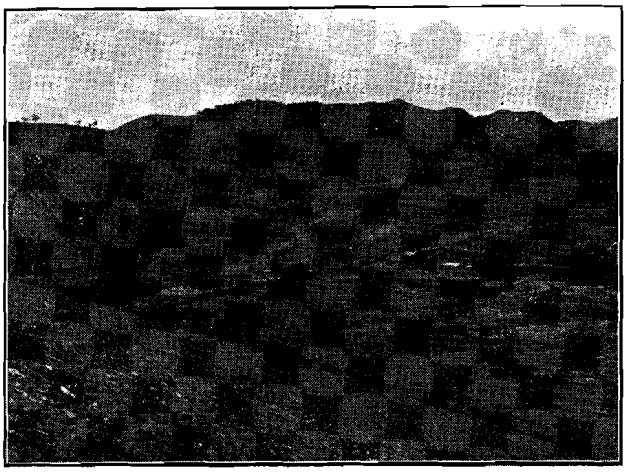


Fig. 2. Baroota Reservoir Basin

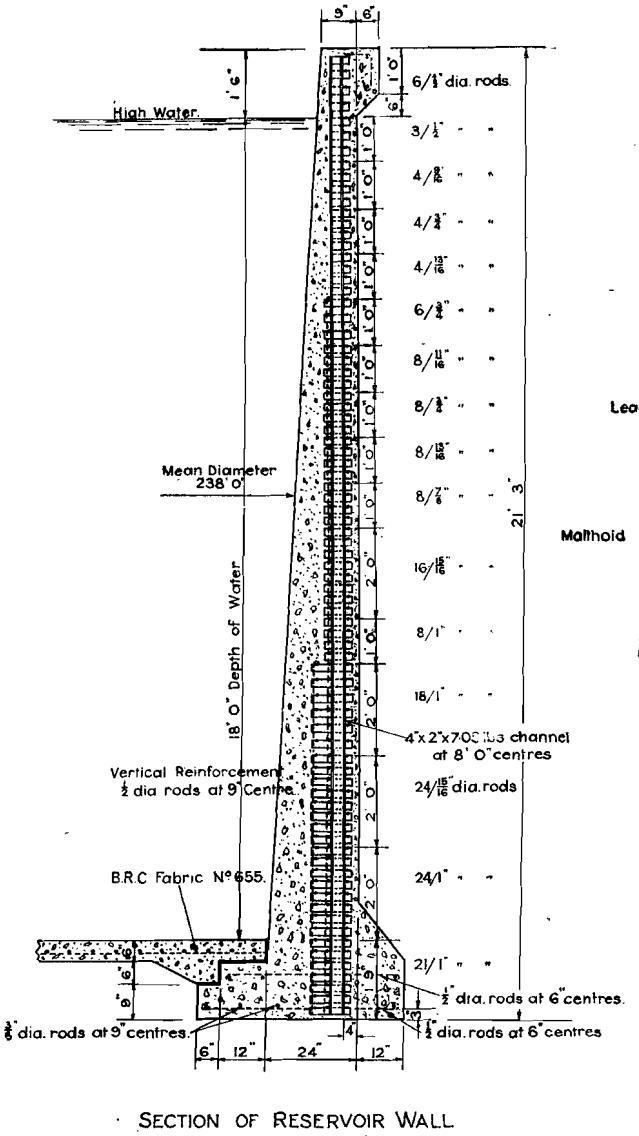
Some five miles of cast iron pipes are manufactured weekly at the Glanville ironworks, and pipe laying exceeds one mile per day in the state. 86,000 water meters are in use representing a capital of £500,000.

Reinforced concrete structures are in general use and several towers have been, and are being, constructed. The Woolpunda tower is 122 ft. high, and Loxton tower is 111 ft. high.

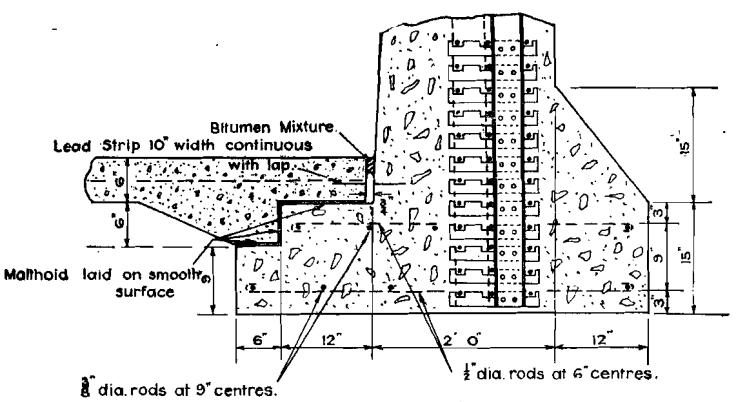
The estimated cost of works in hand and projected at the present time exceeds £5,000,000. The largest work in hand is the Tod river water scheme, the expenditure to date being £1,500,000. The length of the main trunk pipe line alone will be 240 miles. Fig. 3 shows details of one of the 5,000,000-gal. reinforced concrete reservoirs under construction at Minnipa.

Statement by the Commissioner

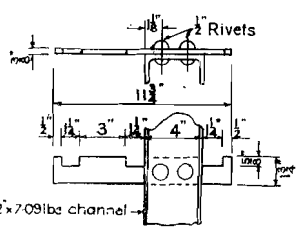
The commissioner of public works (Hon. L. L. Hill), speaking on the address in reply in the South Australian assembly early last month, outlined the new works which had been approved by the government. He said that when the government assumed office, the reorganisation of the waterworks department had to be under-



SECTION OF RESERVOIR WALL



SECTION SHOWING JOINT BETWEEN RESERVOIR FLOOR AND WALL.



DETAIL OF REINFORCEMENT SPACER

Fig. 3. Details of 5,000,000-gal. Service Reservoir, South Australia

The Hume Steel Co. are supplying 57 miles of 16-in. steel cement-lined pipes manufactured at Thevenard, and the same company have supplied 15 miles of 8-in. similar class of pipe.

The capital expenditure on sewerage works to date is £1,669,876. In March last the government approved of a comprehensive scheme for the Adelaide area designed by Mr. H. E. Bellamy, estimated to cost £1,400,000, and construction work is being actively pushed forward.

taken. The death of Messrs. C. A. Bayer (hydraulic engineer), and R. Gunner (waterworks superintendent), and the resignation of the deputy hydraulic engineer (Mr. T. A. Hicks) added to the many difficulties which had to be surmounted. With the appointment of Mr. H. E. Bellamy, as hydraulic engineer, the working of the department had had close attention. The state had been divided into three districts, and a district engineer appointed for each. Previous

speakers had lent a word of praise in connection with the admirable work performed by Mr. Bellamy, and he desired to reiterate that approbation. The government were exceedingly pleased with Mr. Bellamy's capabilities in the many activities to which he had applied himself.

The Tod river reservoir was commenced in 1918, and completed in 1922. When the government took office in April, 1924, they found that the whole thing was in a hopeless bungle. Only 26 miles of trunk main had been laid, the main reservoir was leaking at the rate of over 1,000,000 gal. per day, the Knott's Hill service reservoir was leaking, and no provision had been made for reticulation. No pipes were available at the Glanville workshops, and no surveys had been made of any of the lands adjoining the trunk main. The water leaking from Knott's Hill had to be pumped from the Tod river reservoir at a cost of 5d. per 1,000 gal.

The government completed the balance of the contract (43½ miles), carried the trunk main another 60 miles to Minnipa, and had now let a contract to Hume Steel Ltd. amounting to £189,000 for a further 57 miles of trunk main from Minnipa to Pimbaacla. Works were now established at Thevenard by that company, and later about 100 men would be employed in the manufacture of pipes. During last financial year the government undertook seven schemes of reticulation involving 90 miles of pipes. Approval had been given for the reticulation of Port Lincoln, and a service tank was in course of construction for that town. A service tank of 5,000,000 gal. capacity was also being constructed at Minnipa. The government had approved of the lining with concrete of the Knott's Hill reservoir up to a capacity of 5,000,000 gal., the total capacity of that reservoir being 10,000,000 gal. Cresco Fertilisers Ltd. had, on the assurance of the government that water was to be reticulated to Port Lincoln, decided to establish fertiliser works at that port. That would mean a great benefit to settlers on the peninsula, resulting in the saving of freight and the quick delivery of orders for super.

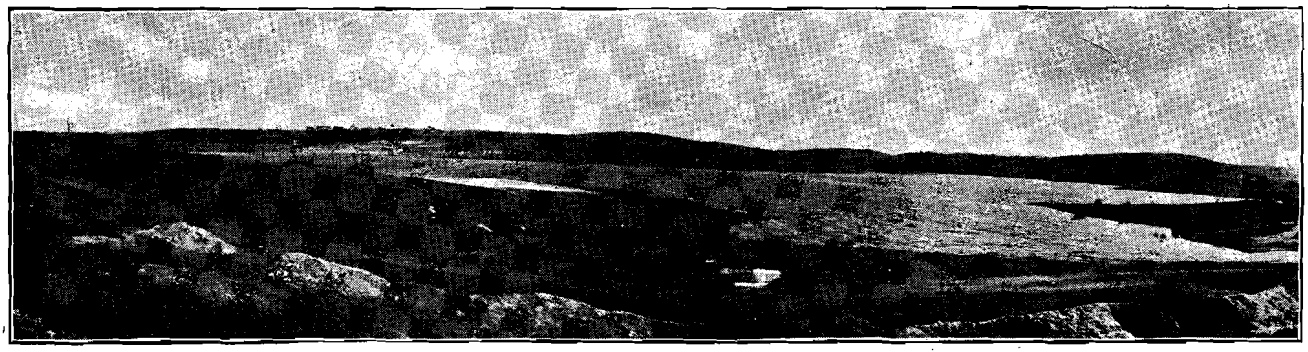


Fig. 4. Tod River Reservoir

SYDNEY UNIVERSITY ENGINEERING CLUB

The fourth annual general meeting of the Sydney University Engineering Club was held on July 29, 1926. The president, Sir Henry Barraclough, was in the chair, and there was a large attendance of members. Reports by the hon. secretary and the hon. treasurer for the year 1925-26 were submitted and approved. The following officers were elected for the year 1926-27:—President, Mr. A. J. Gibson; vice-presidents, Professor J. P. V. Madsen, Messrs. H. H. Dare, J. Vicars; committee, Messrs. C. F. Assheton, H. G. Carter, A. D. J. Forster, L. J. Reynolds; undergraduate members of committee, Messrs. J. J. Budge, B. S. Croft, K. W. King, E. H. Pratten; hon. treasurer, Mr. E. W. Marriott; asst. treasurer, Mr. V. R. Webb; hon. secretary, Mr. H. W. Flashman; asst. secretary, Mr. A. P. Blake.

In handing over the office of president to Mr. Gibson, the retiring president, Sir Henry Barraclough, said that he looked forward to the continued growth of the engineering club, and believed that it would contribute very valuable service to the university and the community. He suggested to the incoming committee that they might now consider the advisability of holding more than one meeting in each term.

Mr. A. J. Gibson said that he valued his connection with the engineering club because of the opportunity it afforded for renewing associations with the university and its graduate and undergraduate members.

Dr. J. J. C. Bradfield gave a very interesting lecture, illustrated with lantern slides, showing the present stage in the construction of the Sydney harbor bridge. Dr. Bradfield extended an invitation to the members to inspect the work associated with the construction of the bridge, and also the city railway, at some convenient date to be arranged.

New Queensland Locomotive

The new B18½ type locomotive recently constructed at the Ipswich workshops of the Queensland railway department has undergone satisfactory trials. This locomotive has been designed by Mr. R. J. Chalmers, chief mechanical engineer, to meet local conditions, particularly with regard to the 3 ft. 6 in. gauge and its restrictions on dimensions and weights.

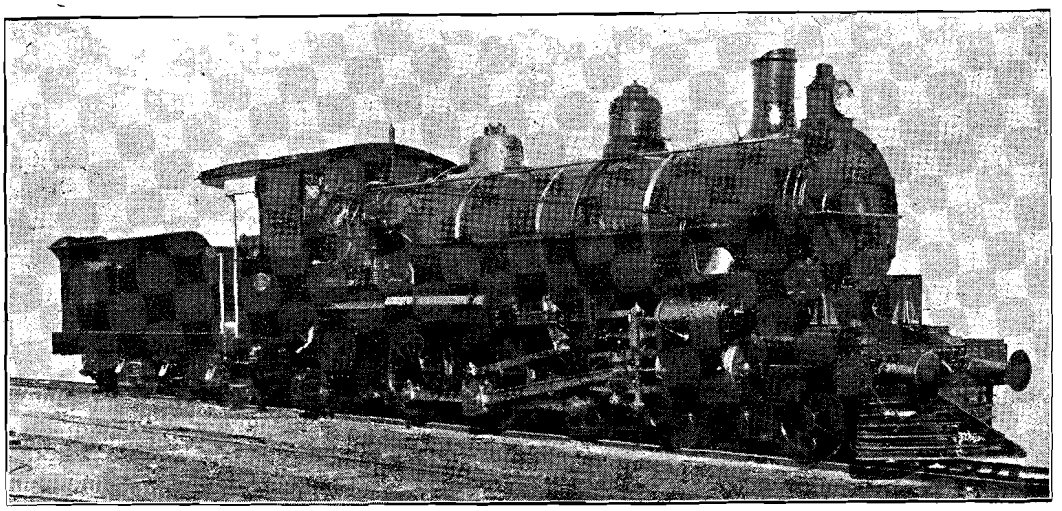


Fig. 1. Type B 18½ Locomotive, Queensland Railways

pressure of 160 lb. per sq. in. It is equipped with a Robinson 21-element superheater, and inside admission piston valves. The valve motion of the Walschaert type is designed to afford maximum accessibility and convenience in repairs. The cylinders are fitted with 8-in. piston valves, which are the standard on these railways, and interchangeable with other piston valves now

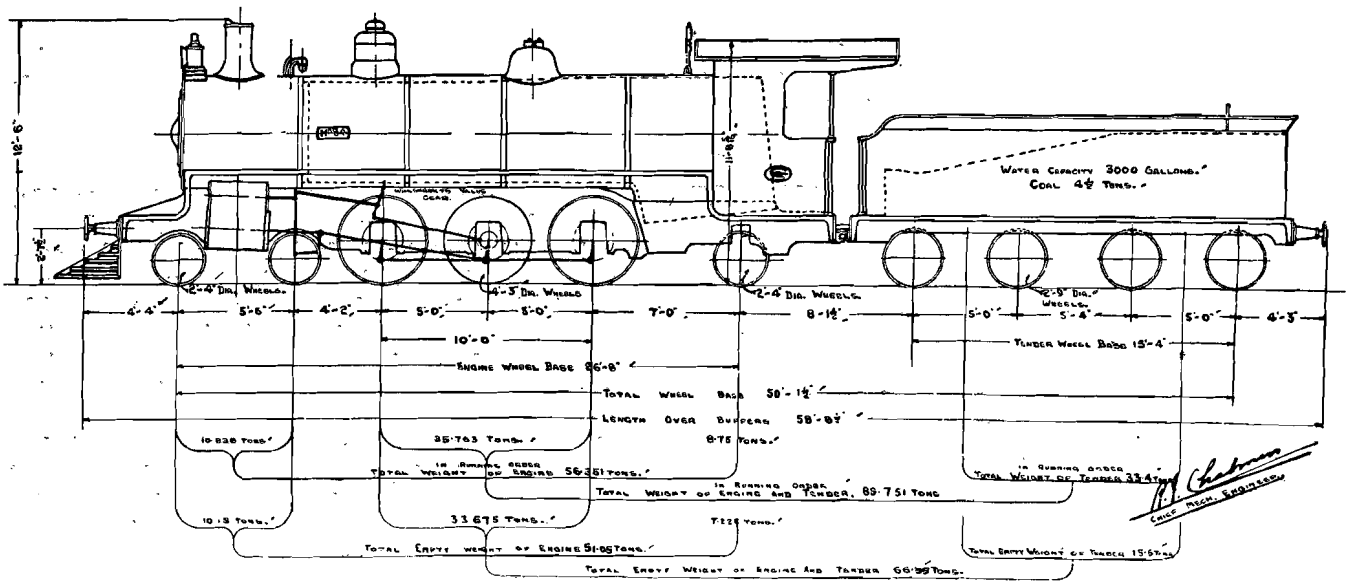


Fig. 2. Elevation with Dimensions of Type B 18½. Locomotive, Queensland Railways

The boiler is of the wide firebox design, having sloping back and throat plates, and conical barrel fitted with copper firebox and copper-coated steel tubes 2 in. in diameter. The boiler is fitted with three 3-in. safety valves, set at a working

running. Top feed from the injectors (Sellor's) has been introduced for the first time.

The Westinghouse air brake is provided, with a 10 x 10⅝ in. air compressor and ample reservoir capacity, in order that the locomotive may work

safely on any of the many range sections of the line. Hydrostatic lubricators are used, with pipes to the cylinder, and outside steam pipes on each side of the locomotive. The oil passes through an atomiser in the steam pipes.

The weights on the coupled wheels are compensated, and further compensation is provided between the rear coupled wheels and the pony track. The weight of the locomotive empty is 51 tons 1 cwt. and in working order 56 tons 7 cwt., while the total weight of engine and tender in running order is 89 tons 15 cwt.

A roomy cab is provided; also hand operated rocking double grates, and a water-sprayed self-emptying ash pan with sliding doors operated by pneumatic cylinder controlled from the cab.

Attached to the locomotive is an eight-wheeler standard tender of 3,000 gal. capacity of water, and 4½ tons of coal.

This locomotive is in the nature of an experiment, and, should it prove satisfactory, it is hoped to further improve the hauling capacity by the introduction of a locomotive booster on the pony truck to enable it to handle heavier loads on the mountain ranges.

The principal dimensions, etc., are as follows:–

Gauge, 3 ft. 6 in.
Cylinder, 18¾ in. diameter x 24 in. stroke.
Piston valves, 8 in. diameter.
Steam pressure, 160 lb.
Diameter of driving wheels, 51 in.
Diameter truck wheel—front, 28 in.; rear, 28 in.
Tractive force, 20,060 lb.
Weight on front bogie, 10 tons 16¾ cwt.
Weight on coupling wheels, 35 tons 15¼ cwt.
Total weight, 56 tons 7 cwt.
Weight of tender—empty, 15 tons 10 cwt.; regular, 33 tons 8 cwt.
Total weight of engine and tender (empty), 66 tons 11 cwt.
Total weight of engine and tender, 89 tons 15 cwt. (in running order).
Adhesion factor, 4/1.
Wheel base—rigid, 10 ft.; bogie, 5 ft. 6 in.
Total wheel base—engine, 26 ft. 8 in.; engine and tender, 5,081½ in.
Heating surface—tubes, 1,512 sq. ft.; firebox, 106 sq. ft.; superheater elements, 339 sq. ft.; total, 1,957 sq. ft.
Grate area, 25.3 sq. ft.
Tender—water, 3,000 gal.; coal, 4½ tons.

Ruston Excavators

Up to a comparatively recent period all excavating machines were steam-driven, but it is now common practice to fit them with crude oil engines, petrol-paraffin engines, or electric motors. On the largest machines both oil engines and electric motors are being installed. Electrical energy is generated by means of the crude oil engine to drive the motors for transmitting power to the various motions for digging, slewing and racking.

The oil engine operated machine is exceedingly useful where coal and water are difficult to obtain. In many cases, too, it will be found that the cost of oil fuel is very much less than the cost of coal on the same size of machine. In addition the oil engines have the advantage that there is no waste of time in getting up steam in the morning, waiting for steam during the day, or washing out at the week end. All the machines are driven through clutches of very large size, this being necessary on account of the continuously running oil engine, which is bound to put a certain amount of slip on the friction clutches while they are taking up the load. The illustration, Fig. 1, shows a Ruston dragline machine of this type recently sent to the Sudan

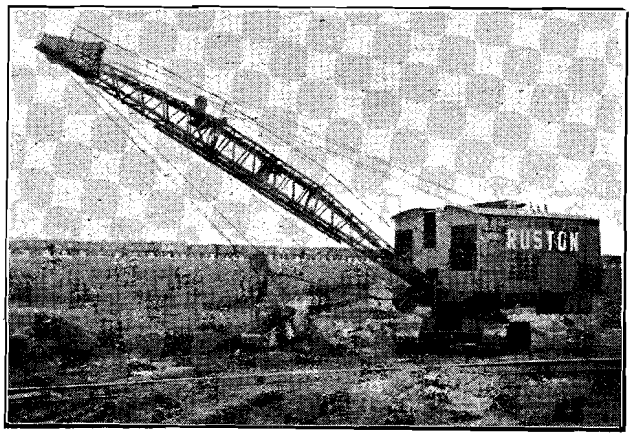


Fig. 1. R. and H. Dragline with ¾-c. yd. Bucket

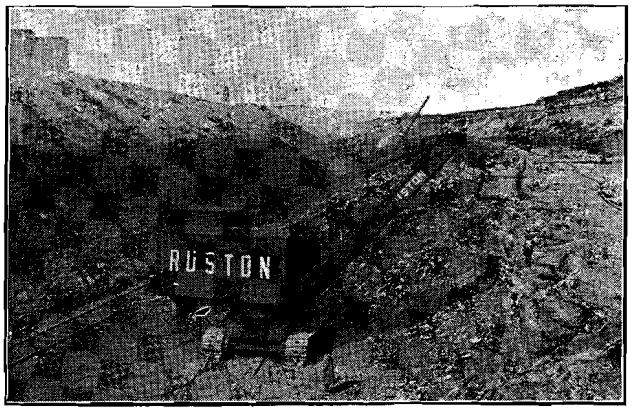


Fig. 2. R. and H. Electrically-operated Crane Navvy, Weighing 85 tons and Mounted on Caterpillar Tractor

for cutting subsidiary canals in connection with the large Gezira irrigation scheme.

The electrically operated machines are also very popular where energy is available. In these machines three electric motors in the case of a crane navvy, and two in the case of a dragline, replace the steam engines. The electric machines are practically fool-proof in so far as the electric equipment is concerned, as the driver can throw any of the controllers right over, or to any required intermediate position, and automatic contactor gear with which the machines are fitted enables the motors to automatically accelerate in the fastest possible time according to the permissible loading of the motors and the gears. In the same way, if the driver requires to bring the machines to rest he can reverse the controllers and the contactor gear automatically limits the load to safe values. Fig. 2 shows a Ruston No. 20 electrically-operated crane navvy, weighing 85 tons, excavating iron ore.

Messrs. Ruston and Hornsby (Australia) Pty. Ltd., representatives for the manufacturers of Ruston excavators, have a series of interesting bulletins describing the various types of machines which they will be pleased to send to engineers.

THE PORT OF CAIRNS, QUEENSLAND

The city of Cairns lies just north of latitude 17 deg. on Trinity bay, North Queensland. It is the chief centre for a large area of back country, rich in minerals and valuable timbers. A number of sugar mills are in the vicinity, and there is a large area devoted to agriculture and dairying.

The Cairns harbor board came into operation on Jan. 1, 1906. Up to the end of December the board has paid to the government £100,371 as interest on loans and £27,280 as redemption. The total expenditure on revenue account has amounted to £659,457. A statement of receipts and expenditure covering the whole period shows a debit balance of £8,249.

The port is served by 1,500-ft. of reinforced concrete wharfage with a depth of 25 ft. at L.W.S. This wharf is fully equipped with sheds and cranes, and connected with the railway. There is also a special log ramp for dealing with timber. A new wharf 400 ft. in length is under construction to berth oversea vessels. Last year a mechanical sugar handling equipment was completed and ran satisfactorily during the sugar season. There is also a cold storage depot which can be utilised for the storage of perishable products.

The imports during the year 1925 totalled 76,303 tons, a decrease of 19,830 tons as compared with the preceding year. Exports also showed a decrease, the respective figures being 118,964 tons and 125,443 tons. Sugar, 59,748 tons, and timber, 30,604 tons, are the principal exports.

The gross cash receipts for the year amounted to £55,456 and the expenditure £60,244. Shipping and railway strikes were in a large measure responsible for the decreases recorded.

The dredge, Trinity Bay, handled 857,000 c. yd. of which 800,000 was from the channel and the remainder from the berthages. Some 143,000 c. yd. was pumped ashore for reclamations. The net costs of the dredge totalled £12,166, viz., wages £5,898, coal £4,634, stores £343 and repairs £1,290. It is customary to send the dredge to Brisbane annually for overhaul, and she went south in January, 1926. The engineer, Mr. C. N. Boult, states that owing to the continuous pressure of shipping and the consequent short periods that the berthages are available for dredging, a faster plant will have to be procured to meet the increasing demands for depth at the wharves.

LETTER TO THE EDITOR

Electric Battery Locomotives in Tunneling

Sir,—In your issue of April 1 last there appeared an interesting article on B.E.V. electric trucks and locomotives, written by Mr. M. P. McRae.

We think the implication readers will draw from this article, when they read that part which deals with 20-battery electric locos engaged on underground construction work in London, will be that these locos are equipped with "Ni-Fe" batteries. We, therefore, wish to bring to your attention the following facts:—

B.E.V. electric locos have been supplied as follows for underground construction and sewerage work in London:—

	Loco and No. in use	Type Battery Exide-Ironclad	No. in use
Public Works Co., London	B.E.V. (6)	24 IMV.6	9
Perry and Co. (Bow) Ltd., London	B.E.V.	24 IMV.6	5
Unit Construction Co. Ltd., London	B.E.V.	40 IMV.6	1
W. Scott and Middleton Ltd., London	B.E.V.	24 IMV.6	4
Foundations Ltd., London	B.E.V.	24 IMV.6	5
C. Brand and Co., London	B.E.V. (8)	24 IMV.8	11

It will be obvious from the above particulars that the batteries which are performing such useful work in this sphere of the electric traction enterprises are of the "Exide-Ironclad" type in the numbers stated.—Yours, etc.,

E. H. Sharpe,
Per F. A. Staunton.

15 Castlereagh Street,
Sydney, N.S.W.
August 9, 1926.