

are secured to the other end of the stalks by clamp fittings into which they are sweated. When this has been done impregnated paper tubes are slipped up over each core, against the shoulder on the insulator. The other half of the box is then bolted up, and the land cable sheath plumbed to a gland, after which the armor is put back and clamped. The box is then filled with compound, which is later topped up under pressure. The completed joint is contained in a concrete coffin filled with bitumen.

The adoption of the separate lead-covered core type of cable for harbor crossings is evidence that the Sydney municipal council recognises that this cable is a much sounder electrical and

mechanical job than the belt type, and has consequently a far better chance of surviving the rather severe conditions likely to be encountered in such locations. Three cables of similar construction but having an area of .15 sq. in. were also laid recently by Siemens Bros. and Co. Ltd. across Middle Harbor, near the Spit. These were each 400 yd. long and weighed approximately 14 tons.

For a most interesting article on 33,000-volt cables, with special reference to the "S.L." type, and a discussion thereon, the reader is referred to the Journal of the Institute of Electrical Engineers, Vol. 65, No. 365, May, 1927, in which a paper by P. Dunsheath, O.B.E., M.A., B.Sc., contains much useful information.

Worm Drive for Electric Tramcars

New Type of Truck Constructed by Melbourne Tramways Board

Experiments are now being made with a new type of truck for use with single truck safety cars in Melbourne. The designs were worked out by the staff of the Melbourne and metropolitan tramways board, and several trucks have been constructed at the board's workshops at Preston. Two of these trucks are equipped with worm driving gear and drum brakes, while the remainder are fitted with the ordinary spur gear drive and wheel brakes. The truck frames are made identical so that, in the event of comprehensive tests with the worm drive proving successful, the trucks equipped with spur drive can be changed over to worm drive without alteration to the framework. By the use of the worm drive and drum brakes it is hoped to reduce very considerably the noise of operation of the cars, and in addition to cut down replacements of bearings, brake shoes, etc. One of the worm drive trucks is now undergoing tests on the tracks. It has a service car body fitted upon it and is used for such work as street watering and track scraping.

Worm drive trucks have been in service in Paris for some years, and are now being tried out in one or two cities in England, and in America. The idea of experimenting with worm drive was in the mind of the chief engineer of the Melbourne tramways board before it had been heard of in other parts of the world, but until the new Preston workshops came into operation there were no facilities for building the trucks and giving them a thorough try-out.

The general arrangement of the worm drive truck is shown in the drawing. The truck is 15 ft. 10½ in. in length and 5 ft. 9½ in. wide over the side frames. The rail gauge is 4 ft. 8½ in., and the journal and spring centres are

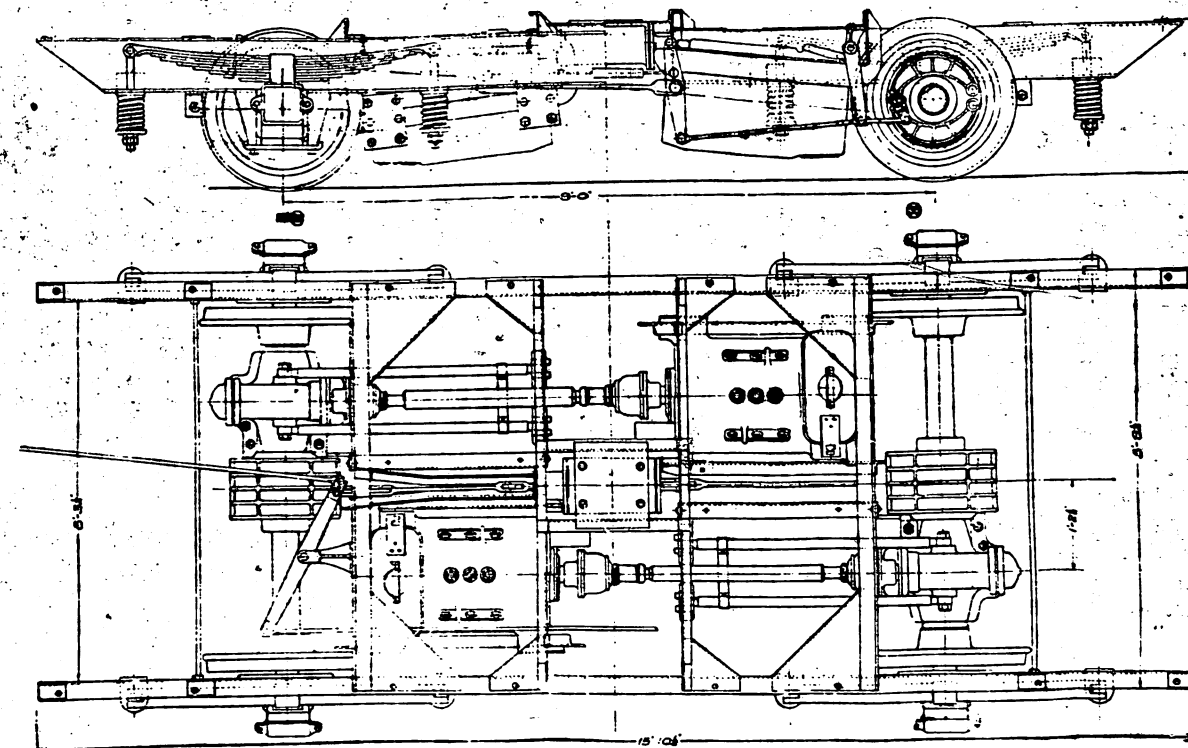
5 ft. 9½ in. apart. The wheels are 26 in. diameter and the wheelbase is 9 ft. The side frames are constructed of 9 in. x 3 in. x 17.46 lb. channel with axle guards of cast steel riveted to the webs and lower flanges. The flanges and webs are cut away to conform to the axle guards and to accommodate the axle boxes. The side frames are connected by four transomes electrically welded to the upper flanges of the channels, and by two stay rods on brackets on the lower flanges. The transomes all lie between the axles; the two inner ones are of 3 in. x 1½ in. x 4.6 lb. channel, and the two outer of 3 in. x 3 in. x ½ in. angle, with welded gusset connections to the side frame channel giving rigidity to the framework. The car body is supported on the truck by eight centre floor bearers resting transversely on the side frames. The centre transomes carry the brake cylinder, the forward ends of the motors and the torque rods from the worm housings. The outer transomes carry the commutator ends of the motors and the intermediate brake levers.

The car is sprung on helical and semi-elliptic springs. The weight is taken from brackets on the lower flanges of the side channels, through the eight helical springs and the links running up through them to the semi-elliptic springs and thence directly on to the axle boxes. The top links of the semi-elliptic springs have slotted knuckles at each end, in which the links are fitted and secured by pins. The riding height of the truck can be adjusted by nuts on the links, below the helical springs.

The motors are of the usual traction type, of 50 h.p., one motor to each axle, with the armature shaft in the same line as the worm shaft. Each motor is suspended by angles, near the centre line of the car by the usual suspension

lugs, and near the side frames by the bearing cap stud holes. A hollow shaft with a Spicer joint at each end transmits the power from each motor to its worm. The staff of the tramways board has designed its own worm gear and housing, fitted throughout with roller bearings and with ample strength in the housing to take braking shocks. For the trial trucks, however, a simpler type of worm gear with bronze axle bearings was imported from the makers of the motors. The ratio of this imported gear is

The brake drums are of cast steel, of the internal expanding type, 1 ft. 4 in. inside diameter, with strengthening and cooling ribs cast on the outside. They are mounted on the centres of the axles by separate bosses to which they are attached by spigots and six ¾ in. diameter studs. The shoes are of cast steel, of 9-in. face lined with brake lining ½ in. thick. They are supported at one side on a double-pin arm, and on the other by a hollow cam and lever working on a single arm. The lower and upper shoes are



Worm Drive Truck for Class X Safety Car

31 to 6, which is slightly higher than the spur gear ratio used with the same motors on the other cars. Two hollow torque rods attached 8 in. above the axle centres connect each worm housing with the truck frame.

Both hand and air braking are installed. The hand brake rods are pinned to a horizontal hand brake lever, with a connecting link to the cylinder live lever in the usual manner. The power brake (of the straight air brake type) is operated by a 6 in. x 12 in. cylinder placed on the truck centre line with the cylinder levers hung vertically. The cylinder live lever is supported by a slide between the transomes, just below the cylinder crosshead. The pull from the cylinder lever to the intermediate lever is along the truck centre line, and is transferred to a point opposite the cam lever by the double arm intermediate lever.

held together by a spring as in motor lorry practice. The arms are of alloy steel, and are bolted on heavy flanges on the worm housing. The cam is so shaped that it will give the same leverage at any angle.

The weight of a complete safety car on the worm drive truck will be 24,300 lb. One of these trucks is on view at the all-electrical exhibition now in progress at the Exhibition building, Melbourne.

The Wellington city council proposes to spend £337,000 during the next five years upon extensions to the tramway system, new cars, etc. The money will be obtained from surpluses on operations for the year 1927, 1928 and 1929, from reserve funds, from loan moneys in hand and from new loans.