## Novel Drive for a 2-2-2

There were 24 of the 6' 6" Single 'G' Class 2-2-2 tender locomotives built by William Stroudley Brighton for the L.B.S.C. Railway. They were built in the early 1880's particularly for the London-Portsmouth line in the course of which several some gradients are met. Yet this locomotive coped with these admirably well, and had a useful life for nigh on twenty years. However, when I decided to model one of these locos, the main problem was the method of motorising the single driver so as to obtain sufficient power to haul a decent-sized train. The following notes may provide the answer to some fellow enthusiasts and are offered by a newcomer to scratch-building, at the least to set off a little discussion, argument or experiment.

Taking the drive to single drivers is not usually satisfactory - due to the power bring transmitted to two points only, when under load. This gives rise to some lack of adhesion. Tri-ang attempted to overcome this difficulty on their two single drivers by "Magnadhesion•—which now has been extended to their later models, due to some measure of success. But this is only satisfactory when used in conjunction with steel, or similar rail, to which the magnetic blocks have an attraction, so aiding adhesion.

In the small scales we work in, and when using non-magnetic nickel-silver rail, the problem of lack of adhesion provided by the single driver under load appears difficult to overcome. Extra weight may be stacked in tanks and boilers, but when modelling a small loco with an 18mm. boiler, into which a motor is to be placed, not much can be gained in this direction and it is not, I feel, the complete answer.

However, after pondering on this, the idea came to me of powering the lending and trailing wheels instead. The main advantage of spreading the drive to four points was further enhanced by that of spreading the available weight evenly to the four corners of the chassis. The "drivers" were to be free-wheelers on my model, bearing no weight at all. Having decided on this course, the next problem was that of transferring the drive from the driven axle to the other one. My colleague and fellow scratch-building enthusiast Len Povey, mulled over and scratched one or two of my suggestions, but with hit support I arrived at the method shown in Diagram 1. As can be seen the crux of the system is propeller shaft — similiar to that of a car. The big snag was finding small enough gears fn the job. Since I work in central London I have access to most of the well-known specialist model railway suppliers, but none could provide any of the size of miniature gears I required. However, someone suggested the use of slot-racing car gears, and on investigation I found Scalextric gears could beadily be adapted for my purpose. I have used two of the Scalextric gears provided on some of the earlier Formula 1 cars namely contrate gear No. W/121 which is of nylon end its associated metal spur gear. These are quite cheap and are readily available as spares, so that any spoilt in the stages of construction can be easily replaced. Although the contrate gear is of nylon, I feel that what is good enough for the motor manufacturer - who installs nylon bushes in his cars - is good enough for me! We are said to be living in a modern age so why not take advantage of modern materials —even when modelling the 1880's! The gears should prove to have a useful life of many running hours, and wear can be taken up as will be shown later. In the following notes I shall not quote the specific measurements for' this loco, since the object of the exercise is to show the principle of this method of drive, which can perhaps be adapted for other single drivers.

For drivers 26mm. Romford wheels have been used. Flangeless drivers will be necessary on most layouts with anything but the shallowest curves, since the meshing of the propeller shaft gears allows virtually none of the usual lateral play in the fore and aft axles—which would normally follow a slight curve—and Jackson 16mm. wheels, with the very good plastic spoke inserts, for the leading and trailing wheels. The latter are normally push-fitted on their axles, but since they are to become the "drivers", taking the power of the motor, they will later need to be cemented on to the axles with an epoxy adhesive such as Araldite.

The Jackson axles are only 0·0700in. diameter and therefore require sleeving between the frames to bring them to the normal lin. requisite for the motor-driven gear. For this purpose I used a suitable $^1/_8$" O.D. brass tube cemented over the axles with Araldite. This has to be carefully done so that the tube will not rotate eccentrically round the axle. An alternative method would be to use Jackson wheels in conjunction with Hamblings end-splined $^1/_8$" axles. The end splines of 0.0720in. just cut into the Jackson plastic insulating hubs, and this, with a good cement, would make a secure job. Using Hamblings axles avoids the necessity for sleeving, and perhaps gives a surer power transmission due to the splines cutting into the hubs. However, fibre washers would have to be inserted between the wheels and the frame to ensure that there is insufficient side-play to allow the propeller shaft gears to disengage. With the sleeving method the sleeves themselves will do this. The frames would, of course, be drilled $^1/_8$" for Hamblings axles, whereas for the

Jackson axles a 49 drill I used. When using Romford gears, the spur-gear boss extension (without the grub screw) has to be cut off, and the "back" bosses of both nylon contrate gears have also to be removed. One "front" boss on a nylon gear will have to be shortened, so that this gear and the reduced Romford gear will fit between the frames. These nylon gears have then to be carefully and evenly drilled or filed out, with an kin. round rat-tail file, so as to be a tight press fit on the sleeved axle. (They may be cemented on.) The rear axle takes the motor-driven spur gear and a contrate gear, back to back. The motor-driven gear will then be slightly off-centre, but with a Romford 40 to 1 gear this has no apparent detrimental effect on the running of the model. The front axle takes the other contrate gear, but this should face the opposite way to the rear axle, otherwise your axles will spin in different directions! Keep the contrate gears well over to the same side of the frame, so that the propeller shaft will lie almost parallel to the frame.

The propeller shaft is 1-5mm. or $^1/_8$". silver-steel rod carried in a length of tube. I used the same brass tube as for the sleeves. Though a trifle large, it may be knurled over at each end so that the steel rod is a nice fit. The rod is slightly filed at each protruding end to accept the miniature steel gears, which can be pushed and tapped on. These have a slightly conical inside diameter, so make sure they go on the right way round. Two 12 BA nuts are soldered to the brass tube a little way from each end (see Fig. 2), and lying in the same plane as the shaft. The shaft is supported in place by means of two 12 BA countersunk screws passing through 12 clear holes in one side of the frame, then through 12 BA lock-nuts, then the shaft-nuts, through further lock-nuts into 12 clear holes in the opposite frame. By loosening the lock-nuts and gently turning the screws, the shaft may be moved back or forth to enable the spur and contrate gears to mesh, when the lock-nuts can be tightened.

At this stage the wheels may be pushed on and the chassis run along a length of track to ensure that the gears are running freely. Meshing the fore and aft gears correctly is critical, and the nylon gears may take a little "running in". But after spending a little time on careful and gradual adjustments the chassis should run freely. No appreciable wear of the nylon gears should take place for some time, but if necessary a limited amount may be taken up in the above fashion.

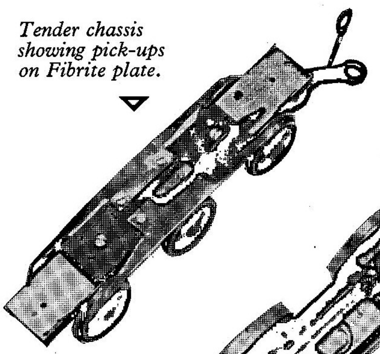
The 26mm. drivers must be carefully sited so as to have no effect on the outer wheels by raising them at any uneven spots in the rail. To ensure this, I heightened the $^1/_8$" holes for the axle by carefully filing them vertically about $^1/_8$". The holes may be filed downwards minutely to ensure that the wheels always impinge on the rails. But take care that the wheels cannot drop too far, or the tyres may drop below the level of the rail on your tighter curves, and will not rise at the straights, so causing derailment. There should be no fore-and-aft play, or waddle, or the free running will be affected. The weight of the wheels themselves should be sufficient for them to bear upon the rails and so turn. Fix a temporary pick-up, check that the chassis runs smoothly on the rails with the imitation drivers turning freely, then cement the Jackson wheels to their axles. Oven hardening is not advised here, or your plastic bushes, let alone the in-serts, may turn to splodge!

With the propeller shaft lying between the chassis, and the desirability for having this accessible for the occasional adjustment, the pick-up should be fitted elsewhere. You may also have noticed that the common method of earthing the loco by the chassis-axle-wheel rail route is prohibited due to the plastic hubs on the Jackson wheels. The Romford drivers may not be used for pick-up or earth, since pressure from the pick-up plates would deter free-wheeling; and further, if only these points are utilised, your loco will stop dead at dead frogs! It is advisable therefore to provide a full positive and return circuit through the tender (this is shown in Diagram 2).

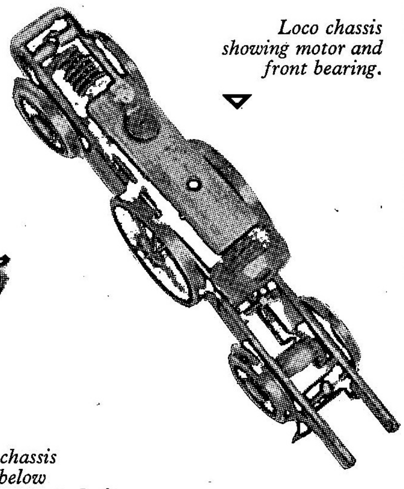
Having used brass channel for the tender chassis, I fixed to the top of this a small fibrite plate. I used my favourite material for pick-ups—copper shim from the front-door draught excluder! From the copper shim I cut two shapes as shown in Diagram 2. Fit these to the fibrite plate so that the pick-ups bear lightly on the tyres of the fore and aft wheels. It is from these pick-up plates that the positive and negative leads are run, down through holes in the chassis, past the drawbar to the loco. The tender is of necessity kept permanently attached to the loco. I have incorporated sprung axles in the tender which ensure that the wheels maintain contact with the rail at any uneven point.

The locomotive runs freely and the drive is not at all noisy. On test, un-weighted, and fitted with a K's Mark I motor, she pulls 5 Tri-ang coaches, or 20 axles, with ease, although I intend her for a train of K's L.B.S.C. 4-wheelers, yet to be built.

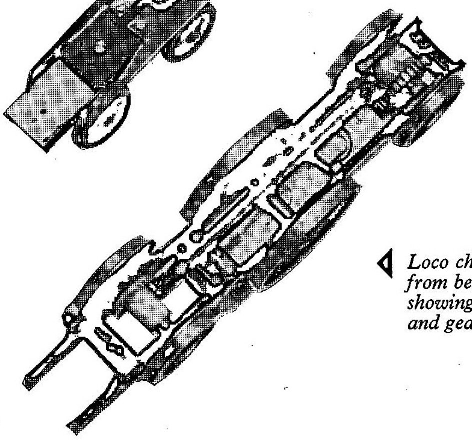
**Illustrations overleaf**



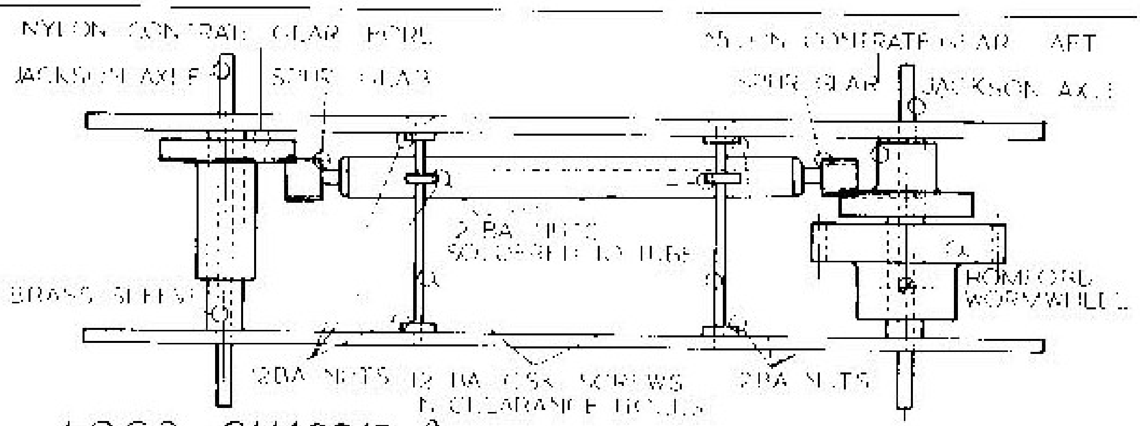
*Tender chassis showing pick-ups on Fibrite plate.*



*Loco chassis showing motor and front bearing.*



*Loco chassis from below showing prop shaft and gears.*




LOCO CHASSIS △

TENDER PICK-UPS ▽