

ply gives so much more movement and absorbs twice as much shock by the friction between the additional plates.

The center bearing is where the car body rests on the truck bolster. This is located at the center of the truck and is so made that it forms a pivot between the car body and the truck. A pin through the center keeps the bearing plate on the car body from getting away from the truck plate. Some center pins are so designed that they will hold the trucks to the body when the car is derailed. Center plates require lubricating occasionally, which is generally done when cars are being repaired. In order to keep the lubricating oil in place and to form a bearing for the center pin, a wall around the pin hole in the truck plate is a desirable feature.

Side bearings are required to prevent the car from tilting sideways, and as they are located near each side of the truck, they are formed to correspond with the radius from the center. It is not desirable for the car to rest on the side bearing all the time, as it does on the center bearing. If a car is resting hard on its side to try to maintain an average clearance of from $\frac{1}{8}$ in. to $\frac{1}{4}$ in. at each side bearing. If a car is resting hard on its side bearings it is more liable to turn the trucks off the tracks. A side bearing should always be ready to receive the load of the car body temporarily, whether on straight tracks or curved tracks, and to move under it with as little friction as possible, and to allow the load to release itself as soon as necessary. There are many designs of side bearings on the market, some of which are very complicated and expensive. It is desirable that they should be simple in construction and have as few parts as possible. Complicated bearings, which are usually designed to be anti-friction, are very liable to get out of order, and their parts get lost and are difficult to replace. The old style of flat bearings, with an oil well in the centre of the bottom part, gives the least trouble to maintain and probably averages greater efficiency than the more complicated roller bearings.

The swing hangers under truck bolsters enable the car body to ride more easily over curved tracks. If they are properly set, they become lower on the side of the truck which rises on the outer track rail, and higher as the other side becomes lower on the inner rail, thus allowing the springs, bolsters, and side bearings to maintain a more nearly horizontal position for the car body.

Various roller bearing schemes have been tried and are in quite general use, but they are not a great success, as the rollers tend to bed themselves into the surfaces they come in contact with, or they get clogged with dirt and cinders.

The brakes on a truck are attached to the truck frame, and the power required to stop a car is applied by means of metal shoes being forced against the treads of the wheels, thus retarding their tendency to roll on the rails. Generally, this power is applied at a height a little below the center of the wheel, and on one side of the wheel only, and the force in many cases exceeds the load on the wheel. One reason for applying the brakes on one side only is to have the arrangement of parts as simple as possible, but it is far from being the ideal system. The effect of applying the brakes on one side only, is to force the axle journal to one side of the bearing and for the journal box to wear on one side against the truck frame. A better system is to apply the brakes on both sides of the wheels, and this is

known as the clasp brake system. Some of the best passenger cars on this continent are now being equipped with this system, and it has been in use many years in England. It overcomes the bad features of the single sided system already mentioned, and also allows lighter brake beams to be used. One of the troubles with the single sided system is that such great power is applied to the beams that they yield under the strain, and make it difficult to maintain the correct piston travel at the air brake cylinder. Brake beams when new are required to withstand tests equal to the greatest pressure liable to be put on them in service, but it seems necessary that this test should be considerably increased, so that they will be able to withstand the greatest service pressures after they have been in use for years. Trussed brake beams are now becoming universally used for freight cars, as the solid beams deflect too much under heavy cars and are also rapidly failing under light cars. On freight car trucks the attaching of brake fulcrums to the bolsters has a somewhat bad effect, inasmuch as the pressure from the lever causes one side of the bolsters to wear against the columns of the side frames whenever the brakes are applied. This wear is more apparent on trucks which allow the bolsters to have side motion. The suspending of brake beams from the truck frames is much better than suspending them from the bolsters, because the frames move in relation to the wheels and do not have the variable vertical movement which the bolsters get from the springs. Safety supports should be provided for all beams in order to keep them from falling down on the track in case of failure of the ordinary hangers or pins.

Fastenings, such as bolts, rivets, pins, cotters, nuts, nut locks, and other parts requiring replacement, should be located and applied so that they will be conveniently accessible for work to be done on them easily.

The modern truck is made almost entirely of steel, and of course has greater strength and staying qualities than those which were formerly made partially of wood, but it has not that extent of resiliency and feeling of easy riding which is a feature in favor of the wood frame trucks. In order to provide the easy riding qualities of steel passenger trucks, resort is made to cushions of softer material, such as wood or rubber, and these are usually inserted under the center plates and over the springs.

Clearances under all circumstances and at all times are a necessary requirement, and provision for easy adjustment to compensate for wear and movement should be made in the design. Vertical clearances should be provided for springs and bolsters to be free when new and without any load, and for all the moving parts to be free under load, when tires, journals, bearings, pins and springs are at their smallest limits. Horizontal clearances should be provided so that trucks can rotate horizontally on all railway track curves. An approximate figure for horizontal clearances for passenger car trucks and one easy to remember is 1 in. for each foot distant from the center pin. Clearances of parts above the top of track rails should be ample, so that when wheels and other parts are worn down to their smallest limits there will be no danger of anything striking the track. Some track switch parts project $2\frac{1}{2}$ in. above the rails, and all truck parts, with the exception of wheels, should always be kept well above that figure.

Friction between moving parts requires some consideration. Steel against steel soon wears away, and steel against iron is little better. Steel against cast iron is somewhat better, but cast iron against chilled cast iron gives still better results. These effects may be noted between journal boxes and pedestals, columns and bolsters, and upper and lower center plates.

Trucks and their parts should, as much as possible, be kept to one standard for each kind, in order to facilitate interchangeability and expedite repairs. One class of truck can be used under various classes of cars, but what is standard for one railway is too often not standard for other railways, and cars are frequently kept out of service for months waiting for unusual material to effect repairs. The M. C. B. standards should always be followed, unless there is a very good reason to do otherwise, and all railways should take an interest in helping that association to adopt the best practices that ingenuity can devise.

The foregoing paper was read before the Canadian Railway Club recently.

Argentine Railways' Requirements.

The railways of Argentina will spend over \$100,000,000 on rolling stock and equipment in the next two years, accord-

The moral—can you grasp it? ing to a statement by F. A. Lagrange, Technical Inspector of the Argentine Government Railways. If the manufacturers of American railway supplies will conform to Argentine railway standards, he says, there will be a market for their products, and even the introduction of American standard equipment, though difficult at any time, will be easier in the immediate future on account of the temporary withdrawal of European competition. European manufacturers, he states, will have to give close attention to necessities at home for some years to come.

The complete system of railways in Argentina has about 11,000 miles of track, of which about 6,500 miles are of 6 ft. 5 in. gauge, about 900 miles of 4 ft. 9½ in. gauge, and about 3,600 miles of the 3 ft. 4 in. gauge. The Argentine Government owns about 1,900 miles, or 18% of the total, which is under the direction of the Administracion de los Ferrocarriles del Estado, a board composed of a chief engineer, a chief of exploitation and an auditor general. It is presided over by an administrator who is appointed by the President of the republic. The other members of the board are appointed by the administrator. All of the railways are under the control of the "Direccion General de Ferrocarriles" (Argentine Administration of Railroads) which is headed by an Argentine engineer.

During the last four and a half years the railways have been unable to obtain materials, so that their maintenance and reserve stocks are very low and an expenditure of about \$100,000,000 for the next two years is probable. In addition to this, extensions are to be built, for several of which there is urgent need. It is expected that they will amount to about 1,000 miles and entail an expenditure of \$75,000,000. This is exclusive of the electric lines, which will also receive considerable attention.

In conclusion, he points out that although the opportunities are favorable for the introduction of American equipment, the market cannot be gained without a struggle, and that success will depend on close study and sound business principles.