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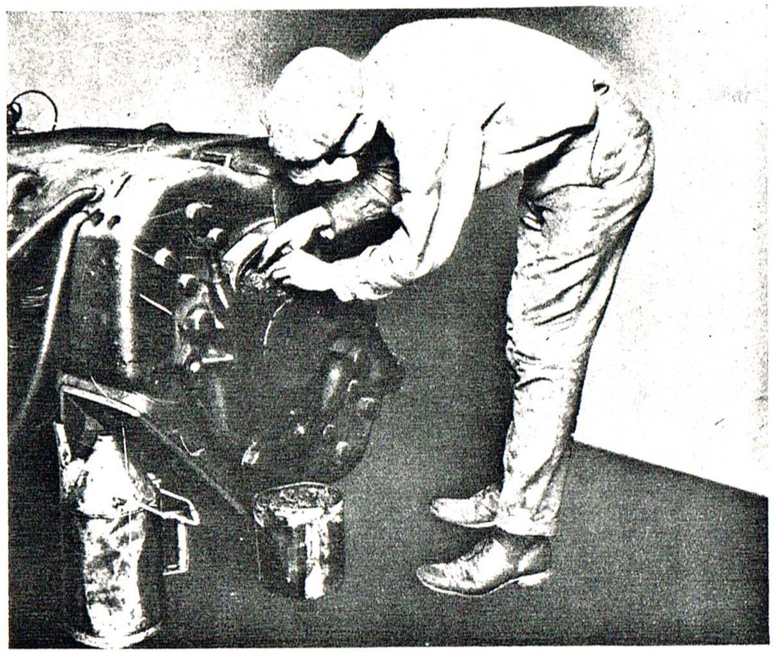
The Care of
RAILWAY MOTOR BEARINGS



Packing a Railway Motor Bearing

BRASS AND BABBITT LININGS

The material used for lining shells must offer the best bearing surface with the least amount of friction and have sufficient strength and ductility to withstand the severe operating conditions of railway service. The alloy used for brass or bronze shells is composed of copper, tin, zinc, and lead, the proportions of which have been determined after many years of exacting and exhaustive tests.

Alloy No. 4 is the equipment standard preferred by many railways for replacements on account of its general recognition as the highest grade bearing alloy obtainable. Alloy No. 80 has been standardized for replacements by many large operating companies and gives nearly as good service as Alloy No. 4 at a considerable reduction in cost.

The composition of these alloys is as follows:

MATERIAL	ALLOY NO. 4	ALLOY NO. 80
Copper	84.0%	78.0%
Lead	0.5	16.0
Tin	12.0	4.0
Zinc	3.5	2.0

Brass and babbitt linings are now almost universally used for armature bearings. This type is preferred to the straight bronze type for the following reasons:

1. A rough or uneven surface due to imperfect machining which might be barely detected will quickly wear out of the babbitt presenting a perfectly smooth bearing surface.
2. When grit or any cutting substance becomes lodged between the shaft and bearings, it imbeds in the babbitt without injury to the shaft, whereas in the bronze bearing, the grit powders and acts as an abrasive lap on both shaft and bearing.
3. All types of linings will run hot on either armature shaft or axle if not properly lubricated. When this trouble develops, the shaft is seldom damaged by the babbitt bearing. In fact, many cases have been noted where the babbitt after running hot and melting or becoming scored on the bearing surface took on a smooth glazed surface by the application of sufficient lubricant without causing the least damage to the shaft. Under similar conditions, the bronze unlined bearings were ruined and invariably damaged the bearing surface of the armature shaft.
4. The babbitt can be held more securely in the brass shell, for it can be sweated in the brass in addition to being anchored by the usual dovetailed grooves. This permits the use of a very thin liner of babbitt or a thickness slightly less than the air gap between the armature and pole pieces. Therefore, in case the lining runs hot and the babbitt melts, the armature cannot rub on the pole pieces without first wearing into the brass shell.

be flooded and the oil wasted. The depths indicated are as measured in the auxiliary oil wells. In most cases axle caps are inclined at an angle of about 60-70 deg., with the horizontal, consequently the oil thus measured would not be a true depth. The depths as listed below are as they would appear on a measuring stick placed in the well.

Railway motor bearings are all of the sleeve type with the exception of a few small motors which have armature bearings of the ball or roller type. Lubrication is provided by means of waste and oil; proper lubrication and care of bearings is something which cannot be over emphasized. In addition to serving their usual function, axle bearings must also support a considerable part of the weight of the motor.

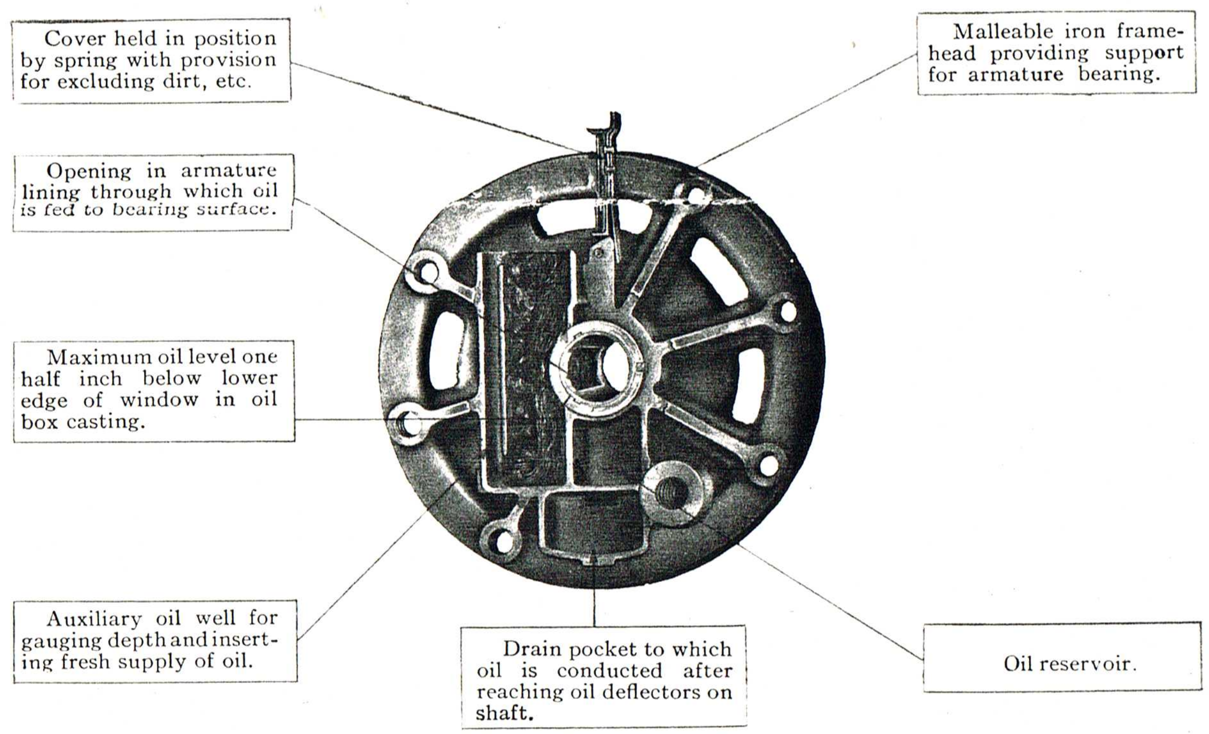
ARMATURE LININGS

The armature linings are carried in motor frameheads which have waste pockets and drain pockets. The standard armature lining consists of a bronze shell lined with babbitt and keyed in the framehead. The babbitt is of such thickness that should the metal melt and run, due to accidental overheating, the armature is prevented from striking the pole pieces by the bronze shell and the armature shaft bearing surfaces are protected from injury. The linings are provided with an opening on one side to allow the oily waste in the pockets to come in contact with the bearing surface of the shaft.

AXLE LININGS

The axle linings of a railway motor are generally of bronze for maximum axle sizes, but malleable iron lined with babbitt is sometimes used for smaller diameters of axle. The two halves are prevented from turning by a clamp fit and are either keyed or doweled. An opening provided in the lining on the low pressure side allows the oily waste in the bearing pockets to come in contact with the axle.

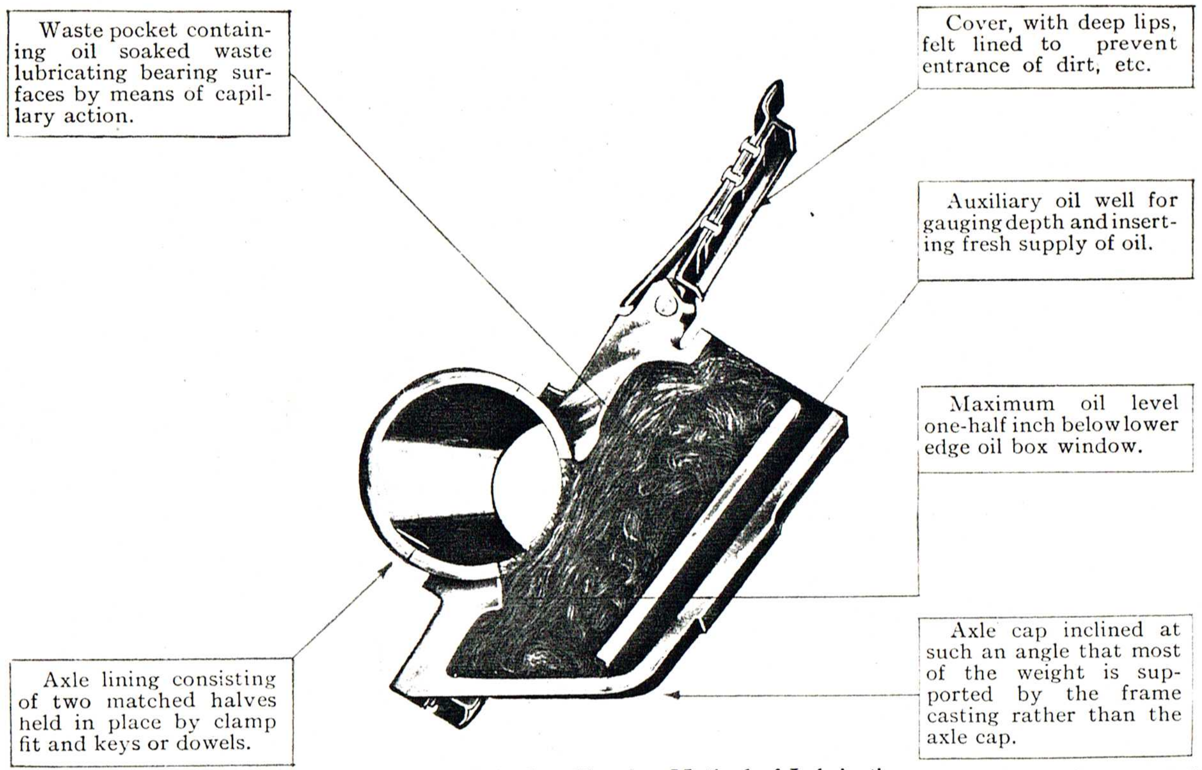
The edges of the openings in the linings are chamfered to assit oil in entering the bearing, and grooves are provided to insure the passage of oil from the bearing surface to the flange which must take the thrust. Every precaution is taken to exclude dirt from the bearing. The bearings are of ample size and with proper care and lubrication should give long life.



Section Through Oil Box Showing Method of Lubrication

IRON AND BABBITT LININGS

Cast or malleable iron shells lined with babbitt have been used quite extensively in old type motors. Where provision is made in a bearing for various sizes of shafts, it is customary to use bronze lining, either babbitt lined or merely tinned for maximum shaft sizes. For the smaller shaft sizes where more bearing metal is required, malleable iron shells with a thick layer of babbitt cost much less than a pole pieces. Therefore, in case the lining runs hot and the babbitt melts, the armature cannot rub on the pole pieces without first wearing into the brass shell.



Section Through Axle Cap Showing Method of Lubrication

BABBITT

The babbitt used in General Electric railway motor bearings has a tin base composition, the proportions being $83\frac{1}{3}$ per cent tin, $8\frac{1}{3}$ per cent copper and $8\frac{1}{3}$ per cent antimony. This is known as Alloy No. 17 and, not only in regard to the proportions of the ingredients but also in regard to methods of mixing, handling and the temperature employed, is the result of exhaustive tests over a period of many years.

PROPER OIL LEVELS

The maximum oil level in the bearing pocket should not be above a point one-half inch below the lower edge of the opening in the oil box casting. The minimum depth of oil should not be less than one inch depending somewhat on the shape and size of the waste pocket. The accompanying table indicates the maximum and minimum depths of oil to be carried in armature and axle bearings of some modern G-E railway motors. The bearings should not be filled above the maximum depth or the bearings may

PROPER DEPTHS OF OIL IN INCHES—G-E STANDARD RAILWAY MOTORS

Motor	Axle Bearings Axle Caps		Armature Bearings Pinion End		Armature Bearings Commutator End	
	Min.	Max.	Min.	Max.	Min.	Max.
GE-201-G	40	75	50	95	25	60
GE-203-P	25	60	50	75	25	60
GE-240-A	40	75	50	95	25	70
GE-247-A-D	25	55	40	60	25	60
GE-254-A	25	70	40	75	25	60
GE-258-C	25	55				
GE-263-A	25	55	40	75	25	70
GE-264-A-B	25	55	40	70	25	55
GE-265-A-C	25	55	40	60	25	55
GE-275-A-D	40	75	40	60	25	60

Section Through Oil Box Showing Method of Lubrication

IRON AND BABBITT LININGS

Cast or malleable iron shells lined with babbitt have been used quite extensively in old type motors. Where provision is made in a bearing for various sizes of shafts, it is customary to use bronze lining, either babbitt lined or merely tinned for maximum shaft sizes. For the smaller shaft sizes where more bearing metal is required, malleable iron shells with a thick layer of babbitt cost much less than a straight bronze shell. It is standard practice to use bronze linings for axle bearings except where the thickness of the shell would exceed $\frac{5}{8}$ of an inch, in which case malleable iron and babbitt are used.

REBABBITTING BEARINGS

The bearing shells are first rough bored in the dovetailed anchored grooves, slotted through the body and turned in each end. First, clean the bearing lining thoroughly, removing all of the old babbitt and any foreign matter in order to obtain a clean bright surface to which the babbitt will adhere. After cleaning, brass linings should be tinned in a bath of half and half solder (melting point 178 deg. Centigrade) and pour the babbitt while still hot from the tin bath. The best results are obtained by preheating the shell and jig to a high temperature nearly equal to that of the babbitt. The latter will then flow freely into anchored grooves and adhere firmly to the tin surface. Then bore and ream the babbitt shell to size and finish the outside.

Heat the babbitt to a temperature of 500 to 550 deg. Centigrade (but not more than 550 deg. or decomposition of the alloy will take place). The dross which rises to the top of the metal should be cleaned off with a ladle before dipping the babbitt from the kettle. Be sure none of this dross is allowed to get into the bearing.

When pouring armature linings, use nothing but new metal. Under no circumstances mix babbitt from old linings in the pot with the new metal. Babbitt melted from old linings may be used for journal or axle bearings.

A rough estimate of the temperature of the babbitt may be made by dipping a pine stick in the pot. If the metal is hot enough to be poured, it will quickly set the stick on fire. However, the most reliable method is to determine the temperature with a thermometer or with a pyrometer. When babbitting iron shells, it is essential that all of the inner surfaces to which the babbitt must adhere are thoroughly clean. Dovetails are provided in the flange as well as in the body of the shell to anchor the babbitt. Heat the shells to the temperature of the babbitt, place them in jigs and pour the babbitt. Then bore the lining and ream to size and finish the outside and ends.

METHOD OF PACKING BEARINGS

Successful operation of a bearing and the long life of a lining depend on the maintenance of the film of oil between the two metallic surfaces. As long as the film is unbroken, friction is minimized and heating is avoided. The oil is fed continually to the active surfaces through the waste packing by capillary action. Use live and elastic waste with long threads. Before packing the waste in the bearing soak it in the suitable grade of oil for at least twenty-four hours. To obtain the best results, the waste should be placed in the pocket, as follows:

String the waste out vertically and pack it lightly but securely in position against the shaft using small quantities and taking care that there are no lumps which will cause vacant spaces; if the oil is to feed correctly, there should be no breaks in the string of waste between the oil supply and the point of contact, for gaps tend to destroy the capillary action.

Auxiliary oil wells are provided in most modern railway motors for replenishing the supply of oil and gauging its depth. Use these wells when renewing the oil supply since they conduct the oil to the bottom from whence it is fed up through the waste, thus avoiding the introduction of dirt to the bearing surface. If no oil wells are provided, press the waste toward the opening in the lining and pour the oil down the outside wall of the pocket. Pouring oil on top of the waste will only crush it down and pack it in too solidly.

INSPECTION

The consumption of oil depends on the mileage made, the condition of the bearings and the severity of the service. The frequency of inspection can best be determined by experience on a particular line, keeping in mind that new equipment should always have careful attention. It has been found to be necessary at intervals of from ten days to three weeks. A few drops of oil may save ten times their cost in babbitt at a critical time. The packing should be turned over occasionally and particular care taken to see that the lining flanges are being properly lubricated.

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