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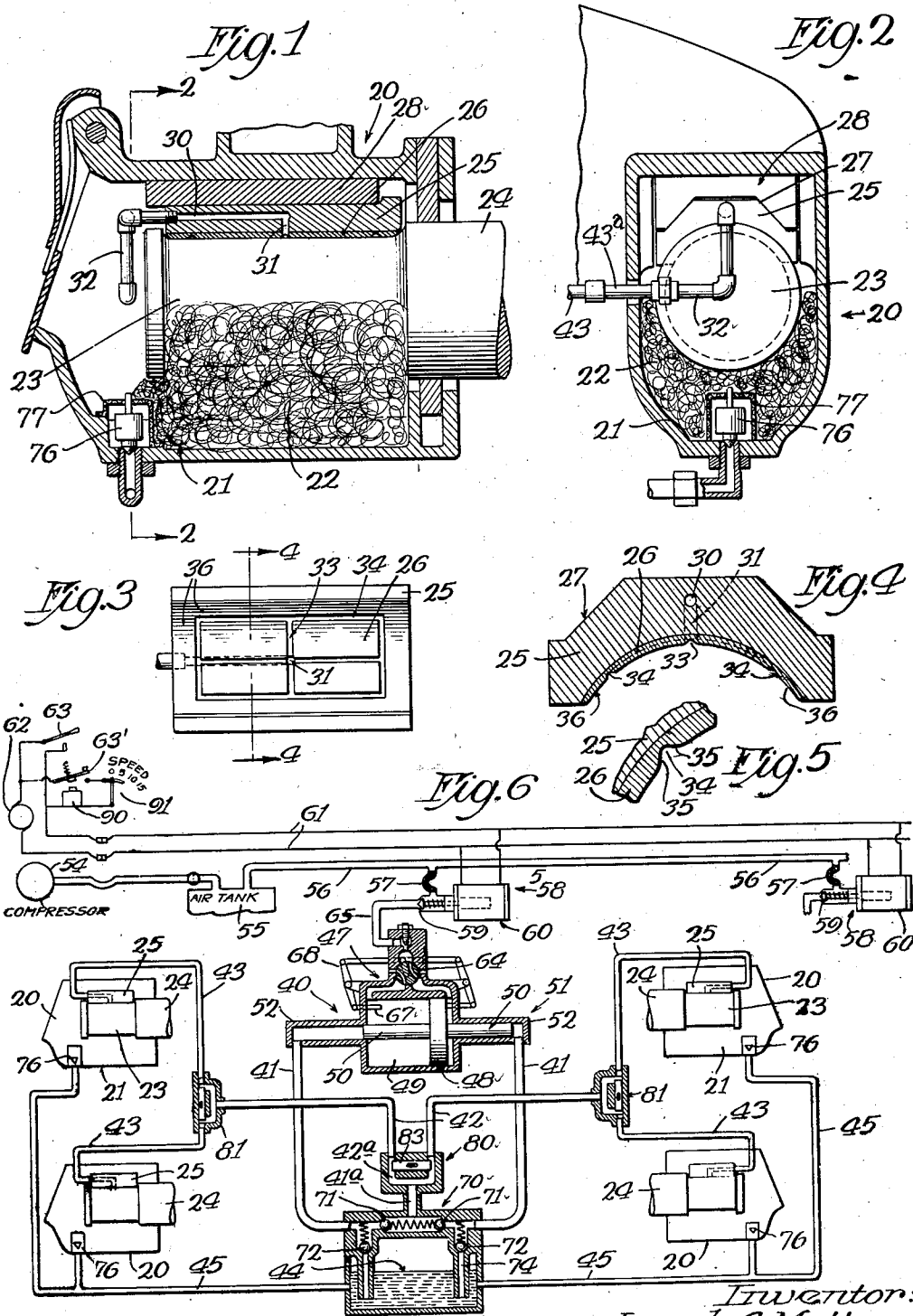
J. A. MOLLER

2,062,250

METHOD OF AND MEANS FOR LUBRICATING RAILWAY CAR BEARINGS

Filed Feb. 12, 1934

4 Sheets-Sheet 1



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METHOD OF AND MEANS FOR LUBRICATING RAILWAY CAR BEARINGS

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4 Sheets-Sheet 2

Fig. 7

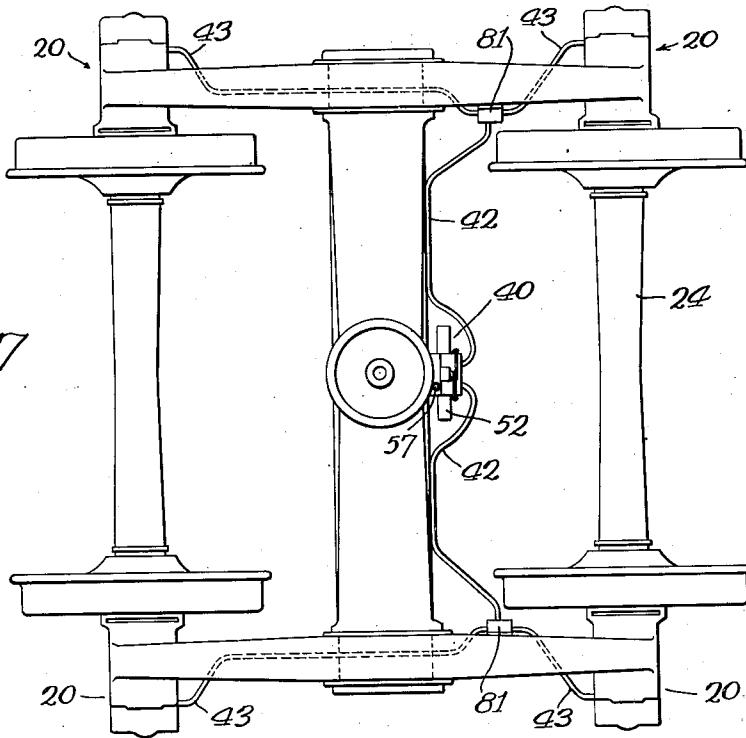


Fig. 8

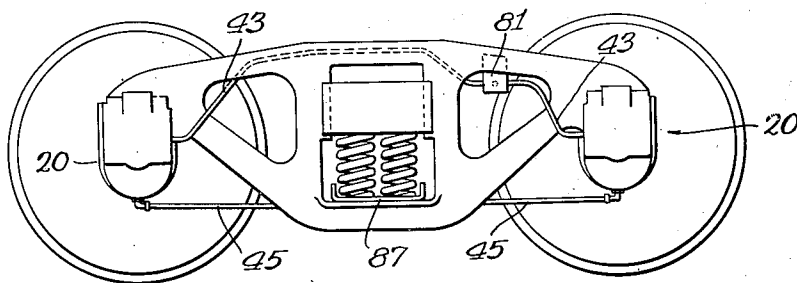
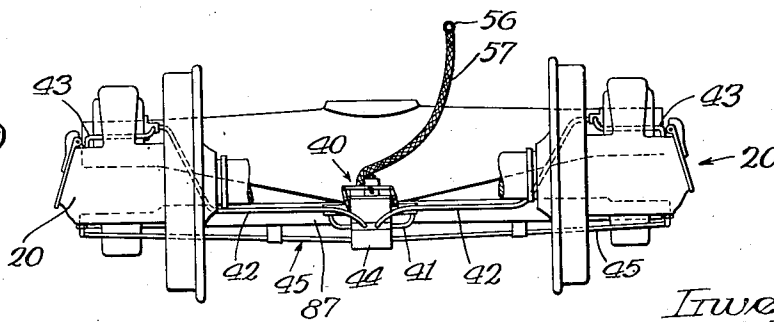


Fig. 9



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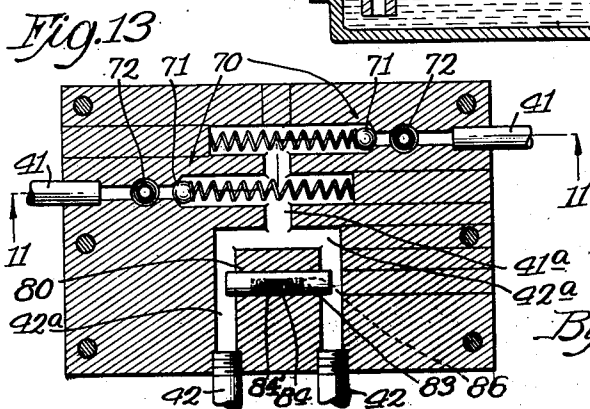
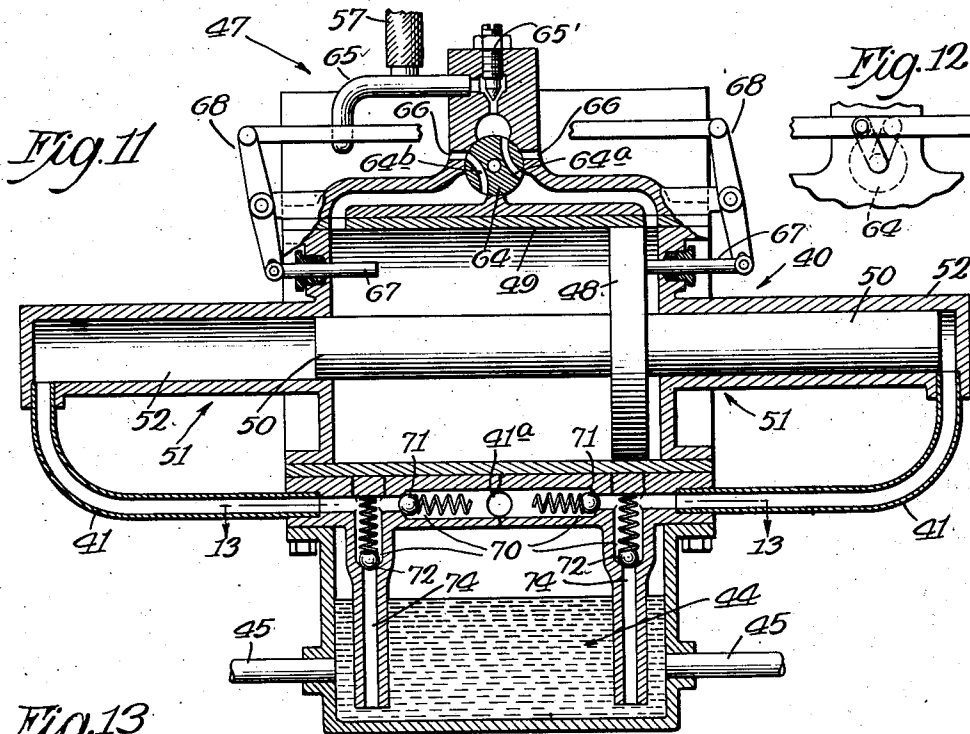
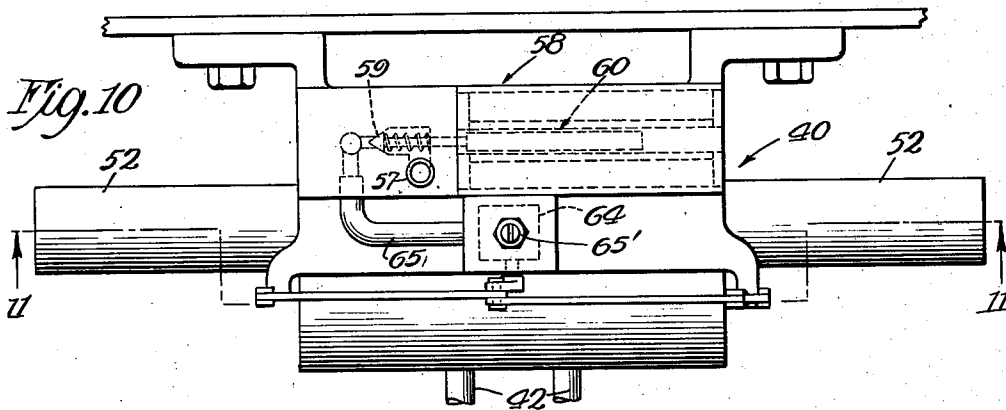
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METHOD OF AND MEANS FOR LUBRICATING RAILWAY CAR BEARINGS

Filed Feb. 12, 1934

4 Sheets-Sheet 3



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METHOD OF AND MEANS FOR LUBRICATING RAILWAY CAR BEARINGS

Filed Feb. 12, 1934

4 Sheets-Sheet 4

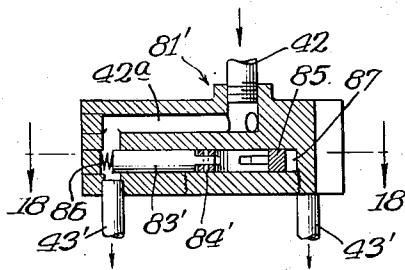
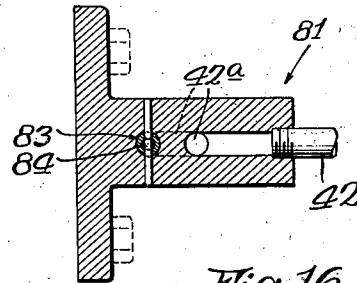
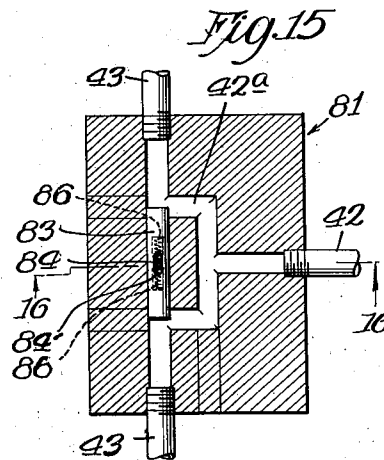
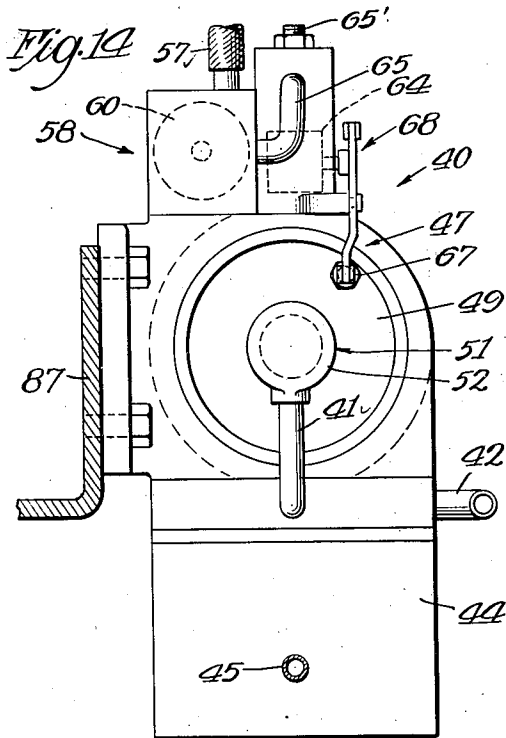


Fig. 17

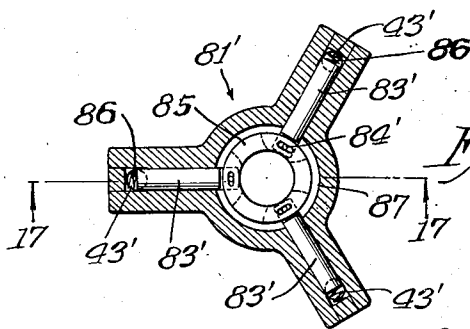


Fig. 18

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UNITED STATES PATENT OFFICE

2,062,250

METHOD OF AND MEANS FOR LUBRICATING RAILWAY-CAR BEARINGS

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Moller and Frederick G. Wacker, Lake Forest,
Ill., trustees

Application February 12, 1934, Serial No. 710,791

24 Claims. (Cl. 184-7)

My invention relates to a method of and means for lubricating railway-car bearings of the commonly-used saddle type and has particular reference to, and the general object of, supplementing the usual capillary feed of lubricant to the bearings by a wick-pad of oily waste, on occasions when the wick-fed lubrication is inherently inadequate, by forcing oil directly between the axle-journals and their saddle-brasses under such high pressure and such adequate conditions of oil distribution and pressure-application that many drawbacks usually suffered in the use of the wick-fed saddle-type of bearing are minimized or substantially overcome.

It is generally recognized that the usual manner of lubricating the conventional saddle-type of railway-car bearings—that is to say, by means of a wick-pad of oil-soaked waste in the journal box, against which the exposed underside of the journal wipes when rotating—is generally satisfactory at all train speeds above some critical speed of low order (usually rated as less than 10 miles per hour), and that when the bearing surfaces are in good condition and the wick oiling is well maintained the friction-reduction, in operation above the critical speed, compares closely to the performance of the more expensive roller bearings with which a good many passenger-trains are now being equipped, but that under various disadvantageous operating conditions, and particularly in the starting of a train, this wick-fed lubrication is so inadequate that many serious expenses and operating disadvantages result, for the avoidance of which resort is being had to roller-bearings despite their expense and various drawbacks of their own.

Ordinarily when a train equipped with wick-lubricated saddle-type bearings is started the bearings have suffered the loss of most of the oil between the bearing surfaces during the time the train was at a standstill, owing to drainage and to the downward pressure of the load-bearing saddles upon the journals, so that the exposed metallic surfaces of the saddles and journals are to a great extent in direct contact; wherefore they offer high frictional resistance to the starting of journal rotation.

Largely as a result of this condition a notably high percentage of wear of the bearings occurs in train-starting; also much power-waste is involved in overcoming the high resistance of the bearings; and resort is often necessary, principally on this account, to jerky starting of the train after preliminary crowding of the cars together to create slack, so that each successive

car may be separately jerked into motion as the slack ahead of it is taken up.

Unduly high bearing friction in saddle type bearings continues to exist, with resultant wear of course, until journal-rotation has entrained an adequate oil-film to give the entire coacting surfaces of the bearings good primary boundary lubrication at least, and it recurs more or less whenever slow-speed conditions prevail, particularly under heavy loads.

My lubricating method contemplates that wick-fed oiling alone will be used when the train is running above critical speed, but supplementally, during the appropriate time relative to the starting of the train, oil may be forced into the bearings in such location with respect to the saddle-brass, and under such heavy pressure in proportion to bearing-load per square inch, that at the time the journals begin turning, and desirably continuing at least until the critical speed for efficient wick-feed is reached, a large portion of the saddle's surface is materially lifted by the forced-in oil body so that the load is in effect "floated" on the oil to the extent, at least, of good secondary boundary lubrication; with the result, among other advantages, that the bearing resistance is reduced to a small percentage of that which ordinarily exists in wick-fed bearings under train-starting conditions, and that the critical speed at which wick-fed lubrication becomes satisfactory, after this high pressure lubrication has been applied, is materially lowered below the usual critical speed for wick-fed bearings; thus facilitating smooth starting of train and quick, smooth acceleration thereof, as well as substantially reducing the power-demand incident thereto and the wear-and-tear on the rolling stock.

Further, one of my more specific objects is to so apply, distribute and constrain the forced-in oil body that very efficient distribution and pressure-application between the bearing surfaces are assured, such that a strong wedging-lift action is exerted by the oil body against appropriate lift-enhancing groove-surfaces of the brass in narrow zones including ones that are quite remote from the center of the saddle and preferably are parallel to its longitudinal margins.

Another object of my invention, in furtherance of the efficacy and economy of my high pressure lubrication system, is to provide for the lubrication of a limited plurality of the car-bearings from a common oil-pressure source, and to make the distribution of the force-fed oil, as between the different bearings served by pressure-

source, subject to automatic control such as to compensate to a great extent for differences in resistance to oil-escape offered by the several bearings.

Also I advantageously provide a respective reserve-oil reservoir for each oil-pump of the high-pressure lubricating-system, so connected with the pump and the wick-containing oil-wells of the journal boxes served by the pump that a circuit is established for the lubricant; any excess of force-fed oil delivered to a bearing being received in the corresponding journal-box well and surplus oil being returned from the several wells to the reservoir.

Further, I provide for common control of the starting and stopping of all of the oil pumps of the train's high-pressure lubricating system from the locomotive cab, so that the high-pressure lubrication may be availed of whenever needed and may operate on all bearings of the train simultaneously.

Another of my general objects is to attain the stated desiderata, and others which will become apparent hereinafter, through the provision of simple, compact and quite-inexpensive equipment which is applicable to much of the railway rolling-stock now in use and which may be operated in connection with sources of supply of fluid pressure and of electric current that are standard equipment on most present-day trains.

Other and further objects of my invention will become apparent from the following description, taken in conjunction with the accompanying drawings wherein I have shown embodiments of my invention suitable for practice of the method referred to.

In the drawings Figure 1 is a longitudinal section through a railway car journal box and bearing of standard general design but especially equipped for utilization of my invention;

Fig. 2 is a cross-section on line 2—2 of Fig. 1; Fig. 3 is an under side view of the bearing brass;

Fig. 4 is a section on line 4—4 of Fig. 3;

Fig. 5 is an enlargement of a fragment of Fig. 4;

Fig. 6 is a schematic diagram illustrating a preferred equipment for the practice of my invention;

Fig. 7 is a plan view of a conventional railway-car truck, equipped for practice in my invention;

Fig. 8 is a side elevation thereof;

Fig. 9 is an end elevation thereof;

Fig. 10 is a plan view of the power-driven pumping unit;

Fig. 11 is a longitudinal section on broken line 11—11 of Fig. 10;

Fig. 12 is a detail of valve-connections that are broken away in Fig. 11;

Fig. 13 is a horizontal section on line 13—13 of Fig. 11;

Fig. 14 is an end elevation of the motorized-pump assembly;

Fig. 15 is a horizontal section of a pressure-equalizing valve structure;

Fig. 16 is a section on line 16—16 of Fig. 15;

Fig. 17 is a section on line 17—17 of Fig. 18, through a three-way equalizing valve such as may be employed in the high-pressure lubrication of six-journal trucks; and

Fig. 18 is a section on line 18—18 of Fig. 17.

In the drawings, 20 indicates a journal box, generally of standard construction, the lower portion of which constitutes an oil well 21, in which is packed the conventional wick-pad 22 of waste, wiping against the under side of the

journal portion 23 of axle 24; the bearing block 25, of appropriate parti-cylindrical bearing-contour as to its sole 26, having the standard, beveled top-formation 27 coacting with the mating bevels of wedge-plate 28, which is interposed between the saddle and the top of the journal-box 20 so that the load on the saddle-bearing is applied through the wedge-slopes for usual load-distributing effect; the wedging cooperation of these parts tending to maintain the longitudinal borders of each saddle-brass in contact with the journal. The sole 26 of the saddle-block is commonly made of brass and the block, soled with any suitable alloy, is commonly called "the brass". I use the term "brass" in that sense, rather than as limited to a particular alloy of metals.

To receive high-pressure lubricant, an oil duct 30 is formed in the saddle, with its delivery orifice located at the center of the saddle's length and directly above the axis of the journal, this duct being connected at the outboard end of the saddle with piping 32 which leads to the source of oil-pressure supply to be described.

Distribution grooves 33 in the under side of the brass lead from orifice 31 to symmetrically located points in a border-groove 34, the latter being appropriately spaced from and parallel with the margins of the saddle's bearing surface all around the perimeter thereof.

The two courses of border-groove 34 which run parallel to the longitudinal margins of the bearing surface of the saddle and preferably all of the other grooves, are shaped to augment the lifting effect of oil forced into the bearing under high pressure, and to this end I give the grooves a cross-sectional shape which may be generally described as the constantly-progressive spreading of a pair of curves; that is to say, each side wall of the groove being, in cross-section, a curve of progressively increasing radius most nearly radial to the axis of the journal where it merges into the concave bottom of the groove and almost tangent to the surface of the journal where it merges into the parti-cylindrical curvature of the saddle's bearing surface, substantially as shown in Fig. 5; these side-wall curvatures of the grooves being thus of a convex, rather than concave, contour. This character of grooving, I find, contributes materially to the efficacy of the high-pressure oiling.

The marginal surfaces 36 of the saddle-brass beyond the border-groove 34 are uninterrupted, and for best practice it is desirable to have this ungrooved margin or border 36 of considerable width, to constrain the force-fed oil against wasteful freedom to escape from between the bearing surfaces. Specifically, I have found that a solid border of 1.25" width will give excellent results on the brasses for 10" x 6" A. R. A. bearings; and although the border width, in inches, may be decreased somewhat for smaller bearings, the latter are best served if the border width constitutes a larger percentage of total width than in larger sizes.

In the practice of my lubrication method, the oil should be pumped into the bearings under a pressure per square inch that is above the mean tare-load pressure per square inch on the bearing surfaces and for best performance the oil-pressure should be well above the mean expectable full load pressure thereon.

It will be understood, in the last-stated connection, that in standard car-building practice, each "class" or size of standard A. R. A. bearing is designed and rated for a given maximum mean-

load capacity; a car designed for a given maximum load being equipped with bearings of size jointly adequate for that expectable car-load; and the oil pumping equipment of my system should be operatable to develop oil-pressure well above the car's bearing-load rating.

Specifically, for example, I have found that if "Class C" (6" x 10") A. R. A. bearings (grooved as above described but otherwise standard) are started while oil is being forced in under approximately 1250 pounds pressure, the requisite starting pull is lowered, under any bearing load from minimum to full expectable load of approximately 800 pounds per square inch, to so small a percentage of that requisite for starting similarly-conditioned wick-fed bearings as to compare favorably with results obtained by the use of high-grade roller bearings; but it will be apparent that, since a large proportion of railway cars in service are seldom operated under maximum load conditions, equipment for high-pressure lubrication will serve the useful purposes heretofore mentioned in many instances of use, even though the maximum pressure-capacity of the oil-supplying devices, above tare-load pressure, be less than that above stated.

In my preferred equipment of cars for the stated high-pressure supplementary lubrication of the bearings, the installation on each car includes a motor-driven oil-pumping unit 40, suitable to develop a predetermined oil pressure of ample pressure value; such unit being connected to the oil ducts 30 of a plurality of the bearings as by a series of distributively branching pipes or ducts 41, 41^a, 42, and 43 of suitable sizes; and also includes a local oil-reserve reservoir 44, serving the pump-unit 40; a local circulatory system for the oil being completed by connecting the oil well 21 of each journal box 20 of the circuit to the supply source 44, through piping 45.

Although a single oil pump may be used to serve the bearings for both trucks of a car, I deem it advantageous to employ a separate pump and its associated equipment for each truck, to supply only its four or six bearings (as the case may be) with the high-pressure lubricant, thereby to secure numerous advantages.

All of the motor-pump units 40 of the train are connected in common with control devices in the engine cab by which the engineer may start them into simultaneous operation, and the motor of each such unit is connected with a power-source local to the car but which preferably receives its power from the locomotive's air-compressing equipment.

In the particular construction shown in the drawings and schematically diagrammed in Fig. 6, the motor-and-pump unit 40 appurtenant to each car truck comprises a double-acting air-motor section 47, the piston 48 of which, working in cylinder 49, is of relatively large diameter and carries the opposed pistons 50 of the double-acting oil pump 51, these pistons 50 working respectively in extension-cylinders 52 of relatively small diameter.

The air for operating the air motors 47 throughout the train may be supplied from a compressor 54 on the locomotive to air tanks 55 on the respective cars which may be, for example, the auxiliary tanks of the air-brake system. These air tanks are automatically maintained under substantially constant air pressure, and from the outgoing air pipe 56 of each car's tank the air may be led to the respective motors 47 of the two trucks through flexible air-pipes 57, the air supply being cut off

or on by the operation of suitable motor-controlling means 58.

These air-motor controlling devices 58 are preferably themselves controllable from the locomotive cab and are here shown as solenoid-operated valves 59, normally spring-closed to cut off the compressed air supply of their respective air motors; the solenoids 60 which, when energized, open such valves being connected in parallel in the circuit 61 which extends to the locomotive and is there provided with a source of current supply 62 and any suitable form of switch 63 manually operatable by the engineer.

The air motor 47 may be of simple, self-reversing construction, provided with a reversing valve 64 and means for automatically effecting reversal of position of the valve 64 at each end of the motor's piston-stroke.

Thus, with the motor parts in position as shown in Figs. 6 and 11, opening of supply valve 59 will admit air from supply-pipe 57, via connection-duct 65 which is adjustably constricted by needle-valve 65^a and through one port 64^a of the reversing valve 64, to the right-hand end of cylinder 49; while the other port 64^b of the reversing valve 64 connects the left-hand end of the cylinder to one of the exhaust ports 66. The consequent leftward travel of the piston brings it into contact, near the end of its stroke, with a striker pin 67 of the valve-reversing link-mechanism 68, to rock the valve 64 to reverse position and push the opposed striker pin 67 into position to be worked by motor piston 48 on its rightward stroke.

In the oil-circulation system, the outer end of each pump cylinder 52 has its respective flow-pipe 41 connected to a check-valving assembly 70, which is preferably located in the head of the oil-supply tank 44 as best shown in Figs. 11 and 13, such valve assembly, as here shown, providing two pairs of check-valves, respectively associated with the two flow pipes 41 and so arranged that the oil driven out of either cylinder by the out-stroke of its piston 50 is delivered to the common supply-header or duct 41^a for distribution to the car bearings through piping 42, 43; while the other pair of valves permits that piston 50 which is making its instroke to suck oil from the supply in reservoir 44.

Specifically, each pair of the spring-closed check-valves comprises one, indicated at 71, which is interposed between the flow-pipe 41 and the supply-header 41^a and arranged to open under the pressure of oil pumped through its respective pipe 41, while the other valve of the pair, indicated at 72, is interposed between the end of said pipe 41 and a suction tube 74 which dips into the oil in the reservoir, this valve opening toward the associated pipe 41 when the pump creates a suction in said pipe. The oil in the reservoir 44 is under atmospheric pressure, the top of the reservoir having an air vent (not shown).

Thus it will be apparent that on leftward movement of the pump pistons 50 from the position shown in the drawings, oil under pressure will be delivered from the left pump cylinder past the left-hand, upper check valve 71 to the distribution piping, while oil will be sucked into the right-hand cylinder of the pump from the oil reservoir, past the right-hand, lower check valve 72.

The oil which is pressure-fed to the respective bearings obviously finds its way ultimately into the oil wells 21 of the journal box and in order to maintain the desired oil level in the bottom of

each box but to permit the return of surplus oil into the reservoir 44, each box is provided with a float valve 76 controlling the communication of such oil well with the return pipe 45 leading to reservoir 44, such valve preferably working in and being guided by a filter-screen cage 77.

It will be appreciated that the actual oil pressure built up by the pump depends upon the resistance offered by the bearings to the escape of oil, and that this resistance may differ in different bearings, according to amount of load imposed on the individual bearing and also according to the bearing's physical condition. To largely compensate, in distributing the oil, for differences in flow-resistance of respective bearings, I provide at each branch point of the distribution piping (e. g. at 80 and 81, Fig. 6) an equalizing-valve structure which may be of two-way construction as shown in Figs. 13, 15, and 16, or of three-way construction as shown in Figs. 17 and 18, in keeping with the number of branches to be served; such valves acting in response to pressure differences in the branches to vary the effective flow capacities of the branches.

Thus, in serving the bearings of a four-wheeled truck from a common supply-header 41^a, as in Fig. 6, a two-way equalizer 80 governs the branch pipes 42, 42 leading across to respective sides of the truck and a similar two-way equalizer 81 governs distribution from the respective pipe 42 to the pipes 43, 43 leading to the two adjacent journal-boxes 20. For a six-wheeled truck, three-way equalizers 81' (Figs. 17, 18) will be used in lieu of the two-way ones 81, to feed the three journal boxes on each side of the truck.

Referring to Figs. 6 and 13, the supply pipe 41^a opens to both of the branch pipes 42 through passages 42^a, and a slidable cylindrical valve 83 normally partially chokes both passages. As long as both pipes 42 offer a substantially equal resistance to oil flow the valve stands in mid-position, but should the resistance to oil flow through one pipe 42 be less than that of the other, the valve moves in the direction of least resistance, further choking the passageway of least resistance. A limiting pin 84 extending through a slot 84' of appropriate length in the valve limits the choking effect of the valve in either direction. Like construction is provided in the two-way equalizer 81, Figs. 15 and 16.

In the three-way equalizer 81' shown in Figs. 17 and 18, three choke valves 83' each slot-and-pin connected as at 84' to a ring 85 which can, to a limited extent, move radially in any direction in the chamber 87 of the valve shell, will work in the same pressure-equalizing fashion with respect to the three-distribution branches 43'. Preferably, either form of distributor is slightly biased to return to mid-position as by very light springs 86 acting on the valves.

Where each supply pipe 43 leads into a journal box, a detachable coupling construction 43^a is provided, removal of which frees the bearing saddle to be taken out.

While the specific construction and arrangement of parts for the practice of my invention may be quite widely varied, it is desirable to arrange the air motor and pump 40, the control solenoid 60 for the motor, the oil reservoir 44, and the equalizing valve 80 which controls the branch piping leading to opposite sides of the truck, all in a compact assembly-unit such as is shown in Figs. 10 to 14, adapted to be mounted on the spring-plank 87 of a standard car truck, as shown in Figs. 7, 8, and 9, and to mount di-

rectly on the respective side frames of the truck the equalizing valves 81 which control the distribution of the oil longitudinally to the bearings on the same side. This arrangement of the equipment for each truck has many advantages, including avoidance of the use of flexible connections in the high-pressure piping, small size and economical construction of each assembly-unit, and ease of maintenance and repair of the units.

In the specific construction herein shown, the differential between the effective areas of the air-motor piston and the oil-pump pistons is about 20 to 1, which is appropriate for very efficacious bearing-lubrication where the air-tank pressure is normally maintained at about 60 pounds and the full bearing-load is of the order of 750 to 800 pounds per square inch. For proper conservation of the air supply, and as well to meet specific bearing-load conditions of different types of cars, the needle-valve 65' in the air-supply line of the motor may be adjusted to vary the average time of piston-stroke. And for insurance of adequate oil supply at all times, the reservoir 44 is desirably built to afford a receptive capacity somewhat in excess of the full capacity of the journal-box-wells 21 that it serves.

My lubrication system as above described is readily susceptible of semi-automatic control, such that when the engineer sets the system into operation the devices will continue to operate until a predetermined train-speed at or above the critical speed is reached—unless the operation of the devices be sooner stopped by the engineer's manual control. In Fig. 6 I have shown means to this end in purely diagrammatic fashion; an armature-equipped switch 63', a holding magnet 90 therefor, and a speed-responsive circuit-breaker 91 being connected in control circuit 61 in parallel with the knife-switch 63. When switch 63' is closed, magnet 90 holds it so until the circuit breaker interrupts the circuit at the predetermined train-speed,—unless the engineer manually opens the switch 63'.

In résumé, as to the operation of the lubrication system above described, it is contemplated that the engineer will start the high pressure lubricating system into operation immediately before starting the train, by closing switch 63 or 63', and that the high pressure oiling will be continued until the train is running at a speed where wick-fed lubrication will be satisfactory. The several air-motor-and-pump units 40, each localized to a respective car truck, are simultaneously set into operation by the opening of the respective solenoid-opened air valves 59 and simultaneously begin their high-pressure oil-delivery to the car bearings. The delivery made to each of the 4 or 6 bearings served by a single pumping unit is substantially equalized through the pressure-differential-responsive action of the distributing valves 80 and 81,—so that variations in load on different bearings of the truck, or differences in tightness of different bearings, will not result in flooding some of the bearings and starving others.

The oil, thus introduced into the distribution grooves 33, 34 of each car-bearing under pressure in excess of the load-pressure per square inch on the bearing, distributes almost instantly throughout the grooved area and, with its lift-tendency enhanced by the wedging-lift-forces exerted on the convex wall portions 35 of the grooves 33, 34, it appreciably lifts the bearing-brass or "floats" it, to the extent at least of thor-

oughly wetting the confronting bearing surfaces. The parti-cylindrical contour of the confronting bearing-surfaces causes their slight separation to be greater directly above the axis of the journal than is their separation at the longitudinal margins of the saddle, and thus the solid, uninterrupted, longitudinal borders 36 of the saddle offer effective resistance to escape of the oil and insure the thorough wetting of the top of the journal—even under a very brief “shot” of high-pressure oil. As the car starts in motion, journal-movement relative to the bearing-brass entrains oil from the saddle groove 34 adjacent the leading edge of the saddle, and tends also to entrain oil, deposited on its underside by the capillary pad or wick 22, to augment the lubrication of the rearward solid borders 36 of the brass.

The setting up of these high-pressure oiling conditions at the time of starting has effect to reduce the critical speed range at which the capillary feed alone will become fully and satisfactorily effective, since the stated wetting of the bearing surfaces, under the high pressure lubrication, is almost instantaneous and is so thorough that it can be continued by wick-feeding much more easily than proper lubrication of a dry bearing can be initiated by wick-feeding. And early availability of the wick-feeding is furthered by the fact that such oil as escapes from the bearing under the high-pressure conditions, being delivered to the fibers from above the oil-well level, insures thorough wetting of the top of the wick pad.

It will be appreciated that under various conditions other than train-starting the high pressure lubrication may be very advantageously used. This may be instanced in the hauling of a train so heavy, or against such a grade, that the locomotive cannot accelerate it under normal wick-feeding condition of its bearings. Resort to the high-pressure lubrication will permit the acceleration to be had where otherwise it would be beyond the locomotive's power.

This application is a continuation-in-part of my co-pending application, filed October 19, 1932, Serial No. 638,552, intended to cover the patentable subject matter set forth in said co-pending application and the additional patentable subject matter disclosed herein.

I claim:

1. A method of lubricating a saddle-type railway car bearing, which comprises establishing and continuously maintaining feed of fluid lubricant to the exposed underside of the journal from a body of lubricant therebelow, by capillary action; for a time that includes the starting of journal rotation and continues until the journal attains a critical speed for efficient bearing-lubrication by its lubricant entrainment from said capillary feed, forcing fluid lubricant between the journal and the bearing-brass under pressure that is at least sufficient to cause the force-fed lubricant to lift said brass, wet the opposed surfaces of the journal and brass, and cause escape of some of said fluid from between said surfaces so as to augment, in a zone above the first-mentioned body of lubricant and close to the underside of the journal, the lubricant supply of said capillary feed and thereby reduce the value of said critical speed.

2. A method of lubricating a saddle-type railway car bearing, which comprises establishing and continuously maintaining feed of fluid lubricant to the exposed underside of the journal from a body of lubricant therebelow by capillary ac-

tion; for a time that includes the starting of journal rotation and continues until the journal attains a critical speed for efficient bearing-lubrication by its lubricant entrainment from said capillary feed, forcibly lifting the bearing-brass with respect to the journal and wetting the opposed surfaces of the bearing and augmenting in a zone above the first-mentioned body of lubricant and close to the underside of the journal the supply of lubricant for capillary feed, all by forcing fluid lubricant between the journal and bearing-brass under pressure that exceeds the per-square-inch load on the bearing and by so distributing and constraining said lubricant between the bearing surfaces as to apply part of its initial lifting pressure on predetermined narrow zones of said bearing-brass extending to locations nearer to the longitudinal margins of the brass than to its longitudinal axis and in which zones the lubricant exerts a wedging lift between the journal and the brass and from which zones marginally-escaping lubricant augments, as aforesaid, the lubricant supply for capillary feed.

3. A method of lubricating a saddle-type railway car bearing, which comprises establishing and continuously maintaining feed of fluid lubricant to the exposed underside of the journal from a body of lubricant therebelow by capillary action; for a time that includes the starting of journal rotation and continues until the journal attains a critical speed for efficient bearing-lubrication by its lubricant entrainment from said capillary feed, forcibly lifting the bearing-brass with respect to the journal and wetting the opposed surfaces of the bearing by forcing fluid lubricant between the journal and bearing-brass under pressure that exceeds the per-square-inch load on the bearing and so distributing said lubricant to areas closer to the longitudinal margins of the brass than to the longitudinal axis thereof and constraining its flow out of said areas that a substantial part of the initial lifting effect of the lubricant so force-fed is exerted as a wedging action in said zone.

4. A method for lubricating a saddle-type railway car bearing, which comprises establishing and continuously maintaining feed of fluid lubricant to the exposed underside of the journal from a body of lubricant therebelow, by capillary action; for a time that includes the starting of journal rotation and continues until the journal attains a critical speed for efficient bearing-lubrication by its lubricant entrainment from said capillary feed, forcing fluid lubricant between the journal and the bearing-brass under pressure that is at least sufficient to cause the force-fed lubricant to lift said brass, wet the opposed surfaces of the journal and brass, and cause escape of fluid from between said surfaces, so as to augment, in a zone above the first-mentioned body of lubricant the lubricant-supply of said capillary feed and thereby reduce the value of said critical speed; and automatically stopping said force-feeding when approximately the reduced critical speed is reached.

5. A method of lubricating a plurality of saddle-type bearings of a railway car truck, which comprises establishing and continuously maintaining, for each said bearing, a capillary feed of fluid lubricant to the exposed underside of the journal to permit the journal when in rotation to pick up such lubricant for entrainment between the bearing surfaces, and for a time that includes the starting of journal rotation and continues until the journal attains a critical speed

for efficient bearing-lubrication by its lubricant-entrainment, forcing fluid lubricant from a common source to each of said bearings through respective areas of variable flow capacity and varying the relative flow capacities thereof according to pressure-differences in the respective said areas and distributing the lubricant so fed between the journal and brass, all under pressure that is at least sufficient to cause the lubricant so force-fed between the journal and the bearing-brass of each said bearing to lift said bearing-brass with respect to the journal and wet the opposed surfaces of the bearing.

6. In combination with a railway car, an oil pump, means connecting said oil pump with journal boxes of the car to receive oil therefrom, discharge means leading from said pump to deliver oil to the bearings in said journal boxes, an air motor for said pump, a compressed air supply tank, and pressure-supply connections from said tank to said air motor, said air motor being adapted to actuate said pump to supply oil to said bearings under pressure sufficient to separate the bearing surfaces.

7. In combination with a railway car, an oil pump, means connecting the intake of said oil pump with journal boxes of the car, discharge means leading from the outlet of said pump to the bearings in said journal boxes, an air actuated motor for driving said pump, and means for supplying air under compression to said motor, said motor being adapted to actuate said oil pump to supply oil to said bearings under pressure in excess of the per-square-inch load on the bearing surfaces.

8. The combination of a saddle-type railway car bearing having its brass recessed on its underside to provide for oil distribution to recesses in zones laterally remote from its longitudinal median line, the side walls of said recesses in said zones being shaped to meet the concave underside of the brass almost tangentially thereto to cause oil forced into said recesses to exert a wedging lift on the brass, and means for forcing oil into said recesses under pressure sufficient to cause the oil to lift said brass with respect to its journal and wet the opposed surfaces of the bearing.

9. The combination of a saddle-type railway car bearing having its brass provided with an oil inlet duct and with grooves on its underside communicating with said duct to distribute oil between said brass and its journal, said grooves including border-grooves extending longitudinally of the brass remote from its longitudinal median line and said longitudinal grooves having their side walls shaped convexly; and means for forcing oil into said inlet of the brass under pressure at least sufficient to cause the oil to lift the brass with respect to its journal and wet the opposed surfaces of the bearing.

10. In combination with a railway car, means thereon for forcing oil between the bearing surfaces of its bearings under pressure sufficient to cause the oil to lift the bearing brasses with respect to their journals and wet the opposed surfaces of the bearings, said brasses each having an oil inlet duct adjacent its center and oil distribution grooves leading therefrom and communicating with border grooves substantially paralleling and somewhat set back from the margins of the brass, the longitudinally-extending courses of said border grooves having their opposite side walls shaped convexly on curves of progressively increasing radius, and that por-

tion of the brass between said border grooves and the margin of the brass being uninterrupted.

11. In combination with bearings of a railway car, means for supplying lubricant to said bearings under pressure that is at least sufficient to lift the bearing brasses with respect to their journals to wet the opposed surfaces of the bearings, said means including means to supply oil under pressure, oil-delivery connections therefrom distributively branched to said respective bearings and pressure-responsive means, operatively associated with a plurality of branch connections that have a common branching point, for varying the relative flow capacities of said branches in response to pressure-differences therein.

12. In a railway car lubricating system, the combination with a plurality of car bearings, of lubricant pumping means, motor means therefor, oil-delivery connections branched at suitable points for delivering oil from said pumping means into said several bearings, and respective equalizing-valve means controlling the branches from each branching point and operating in response to pressure-differences in the connections branching from that point to vary their relative flow capacities.

13. In a railway car lubricating system, the combination with a plurality of car bearings, of lubricant pumping means, motor means therefor, oil-delivery connections branched at suitable points for delivering oil from said pumping means into said several bearings, and equalizing-valve means controlling the branches from each branching point and operating in response to pressure-differences in the connections branching from that point to vary their relative flow capacities, said valve means including transversely slidable valve members in the respective branch connections each movable to vary the flow capacity of its respective branch-connection, said valve members being interconnected for operation in unison, whereby said valves automatically vary the flow capacities of said branches in response to pressure-differences in said branches.

14. In a system for lubricating the bearings of railway cars in a train, car-carried equipment for forcing oil into a plurality of bearings of the car under pressure sufficient at least to cause the oil to lift the bearing brasses with respect to their journals and wet the opposed bearing surfaces, said equipment comprising an oil pump, motor means for driving said pump, oil-delivering connections from said pump, which connections are branched to deliver oil to said respective bearings, automatic means responsive to pressure differences in respective branches to vary the effective flow capacities of such branches, and means on the locomotive for starting and stopping the operation of said motor means.

15. In a system for lubricating a plurality of the journal-bearings of a railway car, means for supplying lubricant to said bearings under pressure that is at least sufficient to lift the bearing brasses with respect to their journals and to wet the opposed surfaces of the bearings, said means including means to supply oil under pressure, oil-delivery connections therefrom distributively branched to said respective bearings, and, in association with each respective branching involved in the system, automatic means responsive to pressure differences between the branches of such branching, to vary the relative flow ca-

pacities as between said branches of the particular branching; and means on the locomotive for starting and stopping the operation of said motor means.

5 16. In a system for lubricating the bearings of railway cars in a train, car-carried equipment for forcing oil into a plurality of bearings of the car under pressure sufficient at least to cause the oil to lift the bearing brasses with respect to their
10 journals and wet the opposed bearing surfaces, said equipment comprising an oil pump, motor means for driving said pump, and oil-delivering connections from said pump to said bearings; and means on the locomotive manually controllable
15 to start said motor means and automatically controlled to stop the operation of said motor means at a predetermined train speed.

17. In combination with a railway car, oil pumping means thereon for forcing oil into a plurality of bearings of said car under pressure that is at least sufficient to cause the oil to lift the bearing brasses with respect to their journals and wet the opposed surfaces of the bearings, an air motor for said pump, an air-pressure source connected with said air motor, and means for regulating the air flow from said supply source to said air motor to vary the speed of said air motor's operation.

18. In combination with a railway car, oil pumping means thereon for forcing oil between the bearing surfaces of a plurality of bearings of said car under pressure that is at least sufficient to cause the oil to lift the bearing brasses with respect to their journals and wet the opposed surfaces of the bearings, an air motor for said pumping means, means for supplying air under pressure to said air motor and having a supply connection therewith, and valve means in said connection for regulating the flow-capacity of said connection.

19. In combination with a railway car, an oil pump for forcing oil between the bearing surfaces of the bearings of a car truck under relatively high pressure, an air motor for said pump operable by air under relatively low pressure, a car-carried source of supply of air under relatively low pressure for said air motor, a flexible piping connection from said air motor to said source of air supply, and non-flexing connections from said high-pressure pump to said bearings, said air motor and pump being mounted on the car truck in fixed position relative to the bearings thereof.

20. In a system for lubricating the bearings of railway cars, car-carried equipment for forcing oil into the plurality of bearings of a car truck, said equipment comprising in one compact structural unit mounted on the car truck an oil pump, motor means for driving said pump, and an oil reservoir having delivery-connection to the pump intake; and also comprising distribution-piping connections from the discharge outlet of said pump having suitable branches for delivering oil into respective bearings of said truck and oil-return piping connections from the journal-boxes of said truck to said oil reservoir, and means for automatically varying the relative flow capacities of different branch connections in response to pressure-differences in said connections.

21. In a system for lubricating the bearings of railway cars in a train, car-carried equipment for forcing oil into a plurality of bearings, said equipment comprising in one structural unit an oil pump, motor means for driving said pump, electrically controlled means operable to start and stop said motor and an oil reservoir having delivery connection to the pump intake and also comprising distribution-piping connections from the discharge outlet of said pump for delivering oil into bearings of the car, and oil-return connections from the respective journal boxes of said bearings to said reservoir; and locomotive-carried equipment comprising a source of current supply and a switch, connected to operate said electrically-controlled means on the car.

22. The combination with a railway car having a plurality of journal boxes enclosing respective saddle bearings and each provided with an oil well, and means for feeding oil from said wells to the respective journals during journal rotation; of power-driven pumping-means for forcing oil between the bearing surfaces of said plurality of bearings under pressure sufficient to cause the oil to lift the bearing-saddles with respect to their journals and wet the opposed surfaces of the bearings; and means for controlling the time of operation of said power-driven pumping means whereby the latter may be operated during the starting of journal rotation and until the critical speed is reached at which the first said oil-feeding means become fully effective.

23. The combination with a railway car having a plurality of boxes enclosing respective saddle bearings, each of which journal boxes is provided with an oil well and with means to maintain capillary feed of oil from the well to the exposed underside of the journal; an oil pump for forcing oil between said bearing surfaces under pressure sufficient to cause the oil to lift the bearing saddles with respect to their journals and wet the opposed surfaces of the bearings, said pump having delivery connections to said several bearings and having its intake connected to said several oil wells, and respective automatic valves in the journal boxes to cut off the oil-well connection to the pump intake before the oil well is emptied.

24. The combination with a railway car having a plurality of journal boxes enclosing respective saddle bearings and each provided with an oil well and with means for feeding oil therefrom to the respective journal during journal rotation; of an oil reservoir having intake connections to the oil wells of the several journal boxes, power driven pumping means for forcing oil between the bearing surfaces of said several bearings under pressure sufficient to cause the oil to lift the bearing saddles with respect to their journals and wet the opposed surfaces of the bearings, said pump having its intake connected to said oil reservoir, and means for controlling the time of operation of said power driven pumping means whereby the latter may be operated during the starting of journal rotation and until the first said oil-feeding means becomes fully effective.

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