Hints for the Motorist

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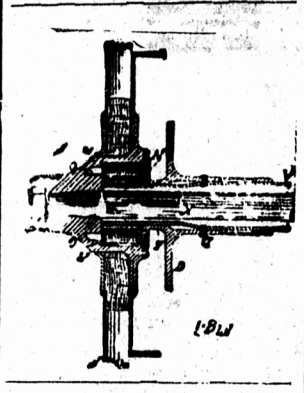
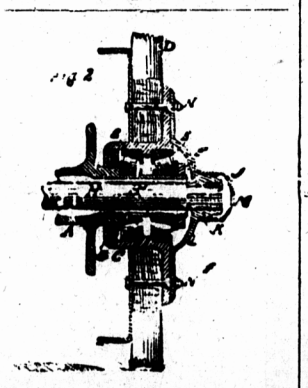
THE REAR AXLE

In the article on "The Bevel Gear Drive," the type of construction described was that in which the whole differential unit das mounted independently upon bearing supported upon a differential carrier formed integrally with the axle-casing. In this construction the axle-shafts take no part in supporting the differential, their inner ends simply being "fluted" into the hubs of the main differential gears. The shafts thus carry the driving effort only, not being subjected to the weight of the differential unior to bending streasses incident to the driving effort. In Fig. 1 is represented, in principle, another and an earlier type of construction in which the differential unit is not supported upon its own bearings, set into the housing structure, but is carried directly upon the axle-shafts. This construction is found on few models of cars, but is that employed in the make of car that is in most extensive us. Here A is the inside end of the axle-casing, in cross-section, fitted with an internally projecting hub portion C, which is machined with a recess in which is supported the spiral roller bearing H. B is the inner end of one of the axle-shafts which run in bearing H and which is rigidly fastened into D—one of the two master-gears of the differential—the other axle shaft (not shown) being similarly arranged with its inside end fast in the other master-erential unit are represented as follows: E ,the ring-gear, F-the bevel driving pinion and G the differen-gear. Other parts of the differtial frame with the studs that carry the differential-pinions merely indicated at K. At J are represented thrust washers, acting between the differential unit and the hub C to limit end play and regulate the mesh of gears E and F. It is plain that, in this construction, the shaft B i ssubjected to bending stresses due to the tooth pressure between the pinion and gear and the reaction of the bearing. In other words is has to resist not only twisting, but very heavy deflecting forces, and there is a strong tendency to cause the shafts to break inside the roller bearing. Incidentally the shafts, being rigidly fixed in the differential gears, cannot be removed without disassembling the whole "rear-nd." Fig. 2. Represents a method of rear-wheel mounting, in which A is the outer end of the tubular shaft casing and K is the portion of the cylinrical extension of the casing which houses and anchors the brakes. This also provides a cylindrical recess, formed by the portion L, in which is placel the conical roller bearing G which can be adjusted therein by the bearing retainer C, that is threaded internally into L. Felt washers H are ftted on each side of bearing G to exclude dirt and retain lubricant, the inner one beinc intended to prevent the great lubricant from escaping from the tubular housing. B is the outer portion of one of the axle shafts, its tapered end running in bearing G, the adjustable feature of which enables end-play in the shaft to be taken up. The internally tapered hub D of wheel M is keyed to the tapered shaft-end and drawn onto it securely by thec ottor-pinned castle nut F, hub cap E being screwed onto D to dustproof the parts. In this construction, the bearing is placed between the axle-shaft itself and the shaft housing, the weight of the car acting through the housing and bearing upon the shaft, while the reaction of this load acts through the wheel and bearing upon the shaft in the contrary direction, so that there is a bending effect upon the portion of the shaft from the bearing outward, in addition to the twisting stress or torque of the driving power. Axles are commonly described in respect to the degree in which their shafts are "floated" or free from bending at their ends and the two figures here presented are shown in order to illustrate an axle construction which does not embody in any degree the "floating" principle—both ends of each shaft being subjected to bending. Fig. 2 should show a plain roller-bearing like that in Fig. 1, instead of a tapered roller-bearing, in order to follow more closely the construction used in the axle of the most widely used make of car. When a wheel-mounting like that shown in Fig. 2 is employed with a differential gear construction such as that shown in "The Bevel Gear Drive" article, viz., one supported in a differential carrier, a form of axle often spoken of as the "semi-floating" is the result. The inside ends of the axle shaft "float," without tranverse restrain or bending stresses in the differential gears, but the outside ends do not "float," being restrained in the outboard bearings and having to resist bending stresses due to the load and to road shocks.

In figure 1 is represented, in principle, another method of rear wheel mounting that is very largely used. In this construction, the outer end of the tubular shaft housing A is drawn down to a reduced size at the part B and the portion of the casing C, which includes the brake casing and related parts, is riveted around it at D, the outer end E, of the riveted-on section, forming a shoulder. The hub G of wheel F is recessed to admit the roller bearing H which runs between the inside of the hub and the outer surface of shaft hosuing extension B. Thus the car load, acting downward through the housing, acts directly through housing extension B, bearing H and the wheel while K, the driving shaft, is not concerned at all in resisting it and consequently cannot be subjected to bending stress due to car weight. Wheel hub G is internally tapered end of axle shaft K, where it is secured by a key and by the nut L, over which screws hub-cap M. A dust guard N with felt ring is fitted over the inside of the bearing and the hub recess O is provided to hold bearing lubricant. While the outer end of the axle shaft, in this construction, carries no load, still it is rigidly fixed in the wheel hub and thus is under restraint and cannot be said to be "floated." However, an axle embodying this method of kheel mounting and the practice of floating the axle-shafts in the differential, is often spoken of as a "three-quarters floating" axle. Fig 2 represents the principle invovled in another form of rear wheel mounting. Here A is a cross section of the tubular axle housing, which is shouldered down to a somewhat smaller size at the portion B. The hollow hub C of wheel D is flanged over on the inside and recessed to receive the two taper roller bearings EE, which are adapted to resist not only the load but end thrust in both directions and which run between the inside surface of hub C and B, the supporting portion of the housing. A nut F is threaded externally upon



he end of B, thus serving to hold the wheel in place and to limit the end play in the bearings between it and the shoulder in A. A felt washer G is fitted between the flange of hub C and the axle rousing. In this construction the wheel is mounted entirely independently of the axle-shaft and the car can be towed or otherwise moved, even if the axle-shafts are not in place and the breaking or shaft does ont



allow a wheel to come off. The driving effort is transmitted from the axle-shaft to the road wheel in the fololwing manner: The outer end of axle-shaft H is fluted externally at J, which flutings fit loosely put positively into corresponding internal flutings formed in the hub K of the cup shaped driving flange L, which is bolted to wheel hub C at points N, the driving effort being transmitted through the axle shaft, the faces of its flutings, the abutting facings of the flutings in K into the flange L to the wheel hub and wheel. Hub cap M screws over the threaded hub of driving flange L and excludes dust. An exle embodying this type of wheel mounting and a carrier-mounted differential, with the axle shafts "foated" in its gears is known as a "full floating axle," for the axle shafts are absolutely free from transverse stresses or restraint and serve only to transmit the propulsive force not being affected by the load of the car. Most advanced rear-axle designs embody means by which all mechanical part can be removed, without requiring the removal or disassembling of the housing. By means of a wheel-puller (a form of portable screw-press) wheel that are secured upon tapered axle-shafts can be drawn off. Axle shafts are simply drawn out of thec asing after wheel removal or whithout requiring it—in the case of ful lfloating axles—and the central portion of many hosuings is fitted with hand-holes which, upon the removal of their covers, form openings of such size that the differential unit, when freed from its bearings, can be removed as a whole. Rear wheel bearing lubrication is usually afforded by grease, forced in from a grease-cup projecting through the wheel hub or the housing at such a point as to deliver lubdicant directly to the bearing, but oil, fed through a spring closed aperture, is sometimes employed

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