no backlash or play should be present at the brake pedal or at the operating lever. On Bendix two-shoe brakes, when shortening linkage to remove backlash the mechanic must be sure that he does not expand the shoes from the anchor pins. The cam should just come in contact with the ends of the brake shoes.

On hydraulic brake systems, there should be about $\frac{1}{4}$" free play in the brake pedal before the piston in the master cylinder begins to move.

The hook-up linkage on both mechanical and hydraulic brake systems should be carefully examined. Sometimes the brake levers have more than one hole in which the clevis pin may be placed. These different positions produce a softer or harder brake pedal, as desired.

Lubrication—Regular lubrication of the necessary parts of a brake system is important, in order to get free operation of the system. Such parts as the cross shaft bearings, clevis connections, cable and conduit controls, or any other moving part must be lubricated. Over-lubrication of the front wheel bearings, outer rear axle bearings, and differential must be guarded against to insure against grease-soaked brake lining. When doing a brake job, the mechanic should inspect the grease retainers and replace them if necessary.

Return Springs—To hasten the release action of a brake control system that has been in long service, the uninformed mechanic sometimes will install additional return springs at various points in the brake control system. This is detrimental to satisfactory brake performance, increases the pedal pressure and is unnecessary. It usually will be found that correct lubrication, and proper adjustment, will produce satisfactory operation of the brake control system. All return springs should be checked and weak or broken ones replaced.

Greasy Linings—Much braking trouble will be avoided if the lubrication of the rear axle and front wheel bearings is held to the correct amount and not overdone. Where it is found that the brake lining has become excessively saturated with oil or grease, heavy pedal pressure or possible sensitive brake action will result and the only cure is replacing the brake lining. If molded lining becomes not overly saturated with the lubricant it may be possible to remove the lubricant from the lining with high test gasoline.

Brake Drums and Shoes—When brakes are serviced, the drums should be carefully examined for scoring, heat checking or pitting of the surface. In addition, the drums should be inspected for signs of distortion including warping, bell-mouthing, barrel-shaping and out-of-roundness.

Brake drums can be reconditioned, providing the score marks are not too deep and the drums are not too much out of shape. Care should be taken not to remove too much metal because drums which are too thin heat up rapidly and distort under braking pressures.

It is extremely important to obtain the smoothest finish possible on reconditioned brake drums. Whenever possible, they should be ground to a smooth finish.

Before replacing the drums, all abrasive and metal particles should be removed. During the first few hundred miles of driving, the brakes should not be applied any harder than necessary for a reconditioned brake drum is similar to a rebored engine and must be "broken in" gently.

Brake drums should be reconditioned equally in pairs, so that the two front drums are similar and the two rear drums are the same. Otherwise, the braking effect on one side of the car may not be equal to that on the other side.

When brake drums have been turned out, it is necessary to use brake lining which is oversize in thickness or else place shim stock between the lining and shoes. If shim stock is used, care should be taken

to choose a shim stock which is not compressible and will not soften under brake temperatures.

The brake shoes should be thoroughly cleaned and a brake lining clamp should be used to hold the lining tightly against the shoe for the drilling and riveting operation.

Drill the lining so that rivet heads may be placed down in the material as deeply as it is safe to go without danger of the lining pulling off the shoes. By following this procedure, we leave as much usable thickness as possible for wear purposes. The depth at which rivets may be safely placed varies, depending upon the make and type of brake lining. With some linings, it is safe to drill to a depth of from only about one-half to two-thirds of the total thickness of the material. With American Brakeblok, which has a wire cloth reinforcing back, it is best to drill until the wire cloth is just barely visible. Then the head of the rivet will seat squarely on the reinforcing back, the riveting job will be tight, there will be a maximum of friction material for wear purposes and the braking strains will be evenly distributed throughout the entire segment of lining.

It is especially important to obtain 100% contact between the brake lining surface and the brake drum. Whenever possible, it is helpful to grind the lining on the shoes to the correct drum radius. Machines which mount on the axle spindle and grind the lining on the shoes while they are in place in the assembly do an especially fine job, providing a good quality machine is used.

Chamfer the ends of each brake lining segment back past the centerline of the end rows of rivets. This eliminates end contact which is a frequent cause of brake squeaks. All bolts and nuts in the brake, wheel and drum assembly should be securely tightened.

Factors Affecting Brake Systems—A motor vehicle should leave the service station with the brake control system bearings well lubricated, each wheel free of brake drag and the four brakes balanced. The spring clips holding the chassis springs to the axle must be tight. The wheel bearings must be accurately adjusted to prevent brake drag, due to loose bearings.

Braking sometimes is unjustly blamed when the fault lies with the steering apparatus of the motor vehicle. Front wheels are mounted with a definite amount of caster, camber, and toe-in. After considerable mileage or due to accidents these necessary adjustments become disturbed. Therefore, when the brakes are applied the motor vehicle swerves and becomes difficult to control. Caster and camber as well as toe-in of the front wheels should be periodically checked to insure proper brake performance.

Tire inflation, tire tread wear, condition of brake drums, one front or rear spring more flexible than the other, improperly adjusted road shock dampeners, etc., affect brake systems. These items should always be checked.

Brake Linings—It is important to use a high quality brake lining on all jobs. This insures that the final result will be *safe* brakes, which after all, are one of the greatest features which a motor vehicle can have.

Not only does high quality brake lining produce the maximum degree of *safety* because of its better performance, but it also gives longer life and freedom from noise and scoring. Customer satisfaction is greater and there are fewer complaints and requests for no-charge adjustments.

For best results it is important to reline all shoes of all brakes of a vehicle at the same time. Even though the old brake lining is not completely worn out, it is difficult to obtain the correct adjustment and the proper braking power distribution unless all shoes are relined at the same time.