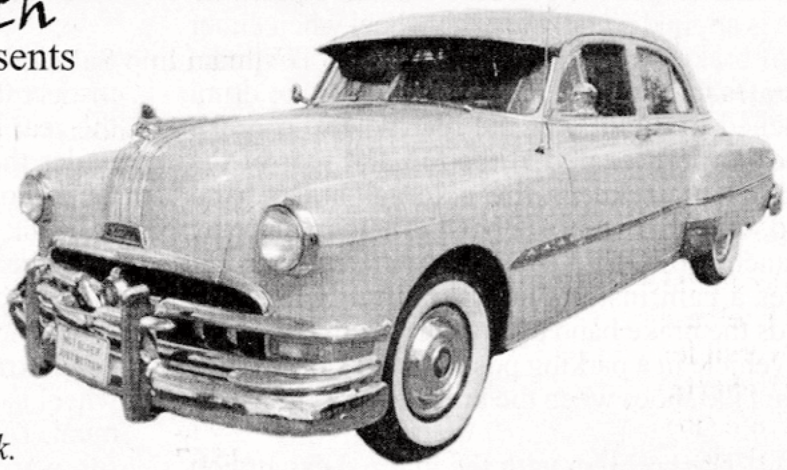
Orest Lazarowich
Presents

Looking Back *but* Moving Forward

A Continuing Series focused on the Repair and Restoration of your old Car and Truck.



The Mechanical Brake System

The brake system is one of the most important parts of the running gear in a vehicle. Once a vehicle is set in motion it has momentum. Brakes are necessary to bring it to a stop or to slow it down. They must also hold the vehicle stationary when stopped. Automotive vehicles use a service or foot brake and an emergency or parking brake. The foot brake is used for stopping the vehicle and is operated by the driver's foot on the brake pedal. The emergency brake allows the driver to stop the vehicle in case of a brake failure or to keep the vehicle from moving when it is parked. It is a secondary brake and totally separate from the service brake.

The earliest brake system as on a horse-drawn coach consisted of a brake lever located at the right-hand side of the driver's seat. This lever is connected to a cross shaft and two sliding beams that connect to another cross shaft with shaped wooden blocks at each end opposite the wheels. Depending on the style of coach this lever can be hand or foot operated. On a stagecoach as the driver pulled back on the reins he applied pressure on the brake lever with his right foot to force the wooden blocks against the steel rimmed wheels and slow down and stop the coach. When steel rims were replaced with solid rubber tires the tire brake wore the solid rubber tire down rather quickly. The tire brake remained popular on coaches and many early automobiles.

During the very early 1900s a single acting band brake was developed for motorized vehicles. A steel brake band or a steel band with some type of brake lining material was used to stop the vehicle. It was anchored at one end and curved against an external rear brake drum or pulley. When the brake lever was pulled it tightened the band around the drum and the vehicle came to a stop. One of the problems with this external brake was if the automobile stalled on a grade and started to roll backwards, the brake band unwrapped and the automobile had no braking. It was necessary to carry a set of chocks to block the wheels. This style of brake didn't last too long, and it was followed by the double acting brake external brake band at each rear wheel. In this style, both ends of the brake band are attached to the adjusting lever. The anchor is placed halfway around the brake band. When the brake pedal is applied one end is pulled up in one direction, and the other end is pulled up in the opposite direction. This binds the drum tightly, and the resistance to turning is equal in both directions holding the vehicle in place. The external brake had no protection against road dirt so the bands and linings wore out quickly and brake material was not of the best quality.

The external band brake continued until the mid 1920s in combination with an internal band emergency (parking) brake and was still installed only on the rear wheels. The service brake pedal and the emergency brake lever are independent of each other, and each is fitted with an

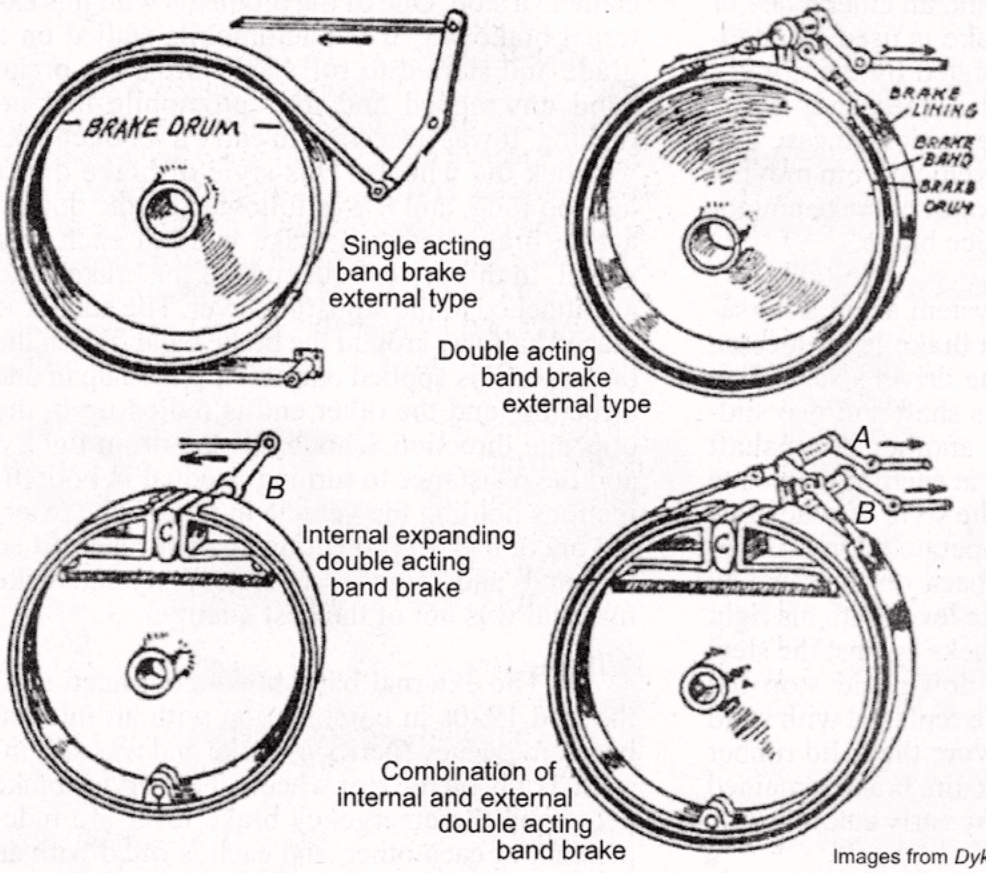
equalizer so that the pressure exerted by the pull rods is applied equally to each wheel when either set of brakes is applied. The service brake pedal operates the external band against a brake drum attached to the hub of the rear wheel. A brake band support located at the top and rear of the backing plate keeps the external brake band rigid. The internal brake band is held in place by an anchor pin. The emergency brake lever engages a cam inside the brake drum which expands the brake band against the drum and holds the vehicle in a parking position. Tension springs retract the shoes when the brake lever is released.

The problem with the internal expanding band was that if it was expanded beyond a certain point it would deflect inward. This would defeat the emergency braking purpose of the band. To stiffen the internal band it was backed by a web of metal very similar to the present type of brake shoes. The band was no longer flexible as it was divided in order to retain the ability to expand against the inner surface of the drum. The brake shoes were pivoted at the anchor end.

External/Internal Brakes

Before you make any brake adjustment inspect the brake mechanism and linings. Raise the rear of the vehicle and place safety stands under the axle tubes. Chock the front wheels. Get a hold of the rear tire and shake the wheel to check for any looseness in the wheel bearing. If the bearings are loose or worn, it will make a difference in the adjustment of the brakes. Inspect the wheels alignment. They should spin dead straight. If the axle shaft is bent or the wheel is damaged it will affect the brake adjustment. Turn the wheel, and check the brake drum for warpage. These early brake drums were pressed from thin steel and when overheated by brake action they would warp during cooling. A warped drum will cause erratic brake action. If the clearance increases or decreases more than 0.010" while the wheel is being turned, the drum should be reconditioned.

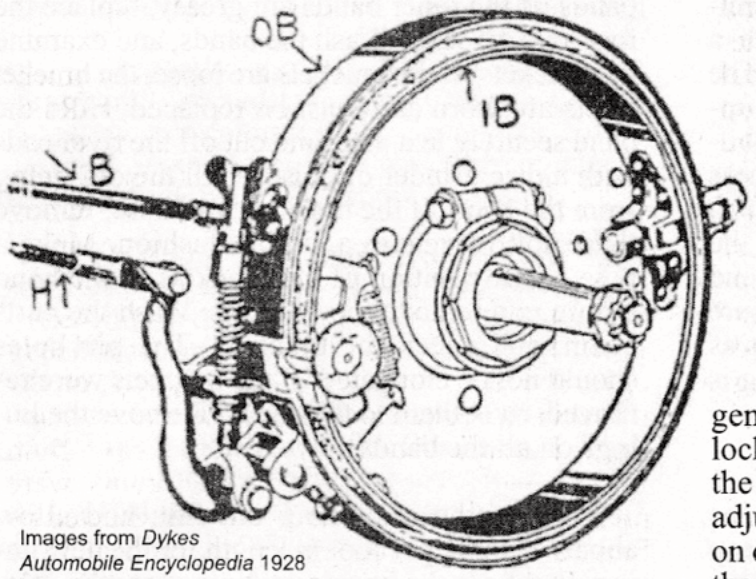
Inspect the brake mechanism, and if it is rusty or caked with crud, clean it. Check the toggles, hinges and levers for wear, and keep them well lubricated. Clevises can be drilled to accept a larger pin. Make sure the cotter pins are in place. With the brakes applied, the operating levers for the external bands should be in a perpendicular position. If the linings are worn, replace the linings before you make any adjustments to the brake bands and rods. If the rivets have scored the drum, remove the wheel, and smooth out the scoring with emery cloth.



Images from *Dykes Automobile Encyclopedia* 1928

Adjusting Rear Wheel Brakes

The following is general information only.



Images from *Dykes Automobile Encyclopedia* 1928

A combination of an internal and external contracting brake on brake drum of rear-wheel hub. OB is the outer or external and IB is the inner or internal. B is the hand-brake rod operating the internal brake. H is the foot-brake rod operating the external brake.

Refer to the service manual for your vehicle. If the lining is not excessively worn, the brakes can be adjusted. There might be a brake pedal stop screw, and if there is, adjust it so that the brake pedal comes to within $3/16$" of the floorboards. Disconnect the brake rods to the external bands. To adjust for clearance at the external brake band look for an adjusting nut below the spring, and adjust the lower half of the brake band. Now, locate the adjusting nut above the spring for the adjustment of the upper half of the brake band. The spring serves two purposes: it keeps the adjusting nuts tight and helps to release the band when the pressure is taken off the brake lever. You may find two more adjusting screws around the circumference of the external band. These are used to fine tune the spacing around the drum. The clearances should be between $1/32$" - $1/16$". If the spacing is not even, use a hammer to remove any high spots on the band so that the band will set at an equal distance all around the brake drum. The wheel must revolve freely. If it binds, loosen the adjustment. If necessary, adjust the equalizer cross bar so it is parallel to the supporting shaft above it, and connect the brake rods. Road test at 20 mph. The vehicle should stop within 30 feet. Feel the drums, and if they are hot, loosen the adjustment.

Adjusting Emergency Brake

There are two types of emergency (park) brakes used on early vehicles. One type uses an internal brake band in the brake drum. The other uses an external brake band against a drum mounted on the mainshaft of the transmission. They are both operated mechanically. Raise the rear of the vehicle on safety stands. For the internal band pull the emergency brake lever to the rear, and engage the lock. Try to turn the rear wheels. If you can turn the wheels, the emergency brake rods need to be adjusted. Some brake rods use a turnbuckle and on others the clevises have to be turned in. Move the emergency brake lever to the 'off' position. Tighten the turnbuckles or turn the clevises in one turn. The wheels must be free to turn. Engage the brake lever, the wheels should lock up. Readjust as necessary. Every 500 miles oil the equalizer bars, clevis pins that connect the brake rods and the pins that connect the brake bands.

To adjust the external type emergency brake set the emergency brake lever to fully released position. Locate the anchor bolt on the closed side of the brake band, and adjust the band clearance to $1/64$" (0.015"). Then adjust the band for clearance at the open end of the band. There may be a guide bolt that adjusts the upper and lower halves of the band. If there is, adjust this bolt until there is equal clearance between the upper and lower halves of the band. Locate the band adjusting nut that is on the bolt going through the spring. Turn the nut in until there is a slight drag, and then back it off until the drum is free to turn. Check for wear at the clevises and pins that connect the emergency brake to the emergency brake lever. Replace/repair the worn parts as necessary. Apply the emergency brake. Drum must not turn. Readjust the band if it does.

Relining Brake Bands

The following are general procedures for relining brake bands. Refer to your service manual for specific instructions. Before you start make sure you have a source that stocks and sells

rivets and woven band linings. Upgrade to a semi-metallic woven type of lining. Check with a clutch and brake shop or a machinery dealer. The brake band and the lining must be flexible so upgrading to a bonded lining will limit this flexibility. Buy the correct size of rivets for the thickness of the band and the lining. Remember that you will countersink the rivet about half way into the lining. The hollow tube of the rivet should extend as far as the back surface of the band. Make sure the internal linings are of the same thickness as an unworn part of the old lining. If the lining is too thick, it will interfere with the brake drum.

Raise the rear of the vehicle, and place safety stands under the axle tubes. Remove the hub cap. Use a strap wrench or a proper hub cap wrench to protect the hub cap from damage. Using a pipe wrench can damage the hub cap. Remove the cotter key and the axle nut. Unless you have been driving with a loose axle nut the wheel and brake drum will not come off easily. Spray the axle shaft and hub with rust buster. Give the spray time to work. You need a type of puller that screws onto the hub, and the threads must match. Tighten the center bolt into the end of the axle. Hit the bolt with a mighty swing of a ten pound sledge hammer. The wheel should break loose. If not, spray again, tighten the center bolt, and swing that sledge. If you do not have a puller, lower the wheel you are working on to the floor. Back off the axle nut flush with the end of the axle. Have a buddy hold a hardwood block against the nut, and you hit the block with a sledge. This should loosen the wheel, or spray and try again.

The brake drums are mounted on the inner parts of the rear wheel hubs. The spokes are located between the brake drum and the rear wheel hub. Make sure the fasteners are tight. Clean the outside and inside brake surfaces with sandpaper. Check the inside and outside of the brake drum for wear caused by the rivet heads as the linings wear. There is not much material on some of these drums. If the wear is greater than half the drum thickness, replace the drum.

Unhook the brake rods and any adjusting mechanism, and remove outer and inner brake bands. If the inner bands are greasy, replace the rear axle oil seals. Wash the bands, and examine the brackets. If the brackets are loose, the bracket rivets are worn and must be replaced. Hold the band securely in a vise, and cut off the rivet ends with a disc grinder or chisel. Pull the old lining from the band. If the brackets are loose, remove these solid rivets in a similar fashion. Make a note of the position of the brackets to the band before you remove the brackets. Wash the parts again, and check the brackets. The pin holes should not be elongated. If the brackets were removed, rivet them to the bands. Remove the linings on all the bands.

Lay the old lining out flat, and allow about ¼" more per foot in length for the new lining. Purchase the necessary lining lengths. Purchase the rivets. Fit the lining to the band. Clamp the ends first, and then clamp the middle where the lining has bulged out. The brake lining must be tight to the brake band. Mark the position of the lining to the band. With the clamps in place and starting at one end, drill through the lining using the holes in the band as a guide. Use a bit just slightly larger than the rivet diameter. Remove the lining from the band, and countersink the holes in the lining about half way so that the rivets do not contact the drum when installed. Nail the lining to a board when countersinking. Reinstall the lining on the band, and seat the rivets in the lining. Rivet the ends of the brake band first, then the middle and then the rest. Support the head of the rivet on a proper sized pin punch, and use a blunt end center punch to set (peen) the rivet. Two hits with a hammer should do it. Too many hits will shear off the rivet or drive the rivet head further into the lining which could separate. If your club has a tool inventory, it might have a brake rivet tool. This will make the procedure easier. Bevel the leading and trailing edges of the lining with a disc grinder. Reline the remaining bands.

Wash the backing plate and the anchors for the bands. Install the new seals at this time. If the brake cam bushing is worn, it must be replaced so that the emergency brake can be adjusted properly. Replace the retracting spring, if it has lost tension. Install the inner brake band

on one side. Clean away any rust in the wheel hub and on the tapered axle. Adjust the internal band. Fit the wheel and drum to the axle without the axle key in place. The drum should slide freely over the brake band lining. Fit the key to the axle, and slide the wheel and drum onto the axle. Torque the axle nut to specifications. Install the external band. Service the other side. Adjust the external brake bands. Connect the linkage. Connect the emergency brake rods. With the emergency hand lever in the 'off' position adjust the emergency brake linings. The wheel must turn freely after adjustment. Apply the emergency brake. The brakes must lock the rear wheels. Readjust if necessary.

By the late 1920s traffic conditions were changing, and band brakes were losing their effectiveness where higher braking force was needed. As engine power increased the two-wheel rear brake system evolved into the four-wheel brake drum system on many vehicles. The exposed brake linings were moved inside the brake drum. A brake backing plate protected the brake shoes and braking action from dirt and water contamination. The brake shoes were cam operated by brake rods or cables attached to the brake pedal. One style of emergency brake used an internal expanding band inside the rear drums. Others used a contracting band on the transmission brake drum. Cables, clevises, rods, cross shafts and levers were used to adjust the brakes. Follow every step in the service manual to properly adjust the four-wheel brake system. In 1923 Buick became the first of the volume manufacturers to offer the four-wheel mechanical brake system on its vehicles.

The Ford Model T continued to use rear wheel brakes until 1927. At about 35 mph these brakes will stop the car safely. At higher speeds it becomes a bit more thrilling, and in hilly country the thrill can lead to panic. The brake pedal operates the brake band in the transmission. A set of cast iron shoes in the rear drums are controlled by the emergency brake parking lever located on the left side of the frame. When the lever is pulled back the parking brake is set and the transmission is moved to neutral. One of the most popular upgrades for a Model T was the brake upgrade. There were external-contracting types with the Rocky Mountain brand being the best known. There are two types of Rocky Mountain brake kits available. One for the earlier models 1908-1925, and one for the 1926-27 models. Installing a Rocky Mountain brake kit gives the model T an external drum brake in addition to the original parking brake and internal drum brake. There were internal-expanding drum kits offered by a number of vendors including Warford. There was also a Todsmith adapter kit for Model T front wheels to provide the Model T with four-brakes

Model T Ford Rocky Mountain Brake Assembly

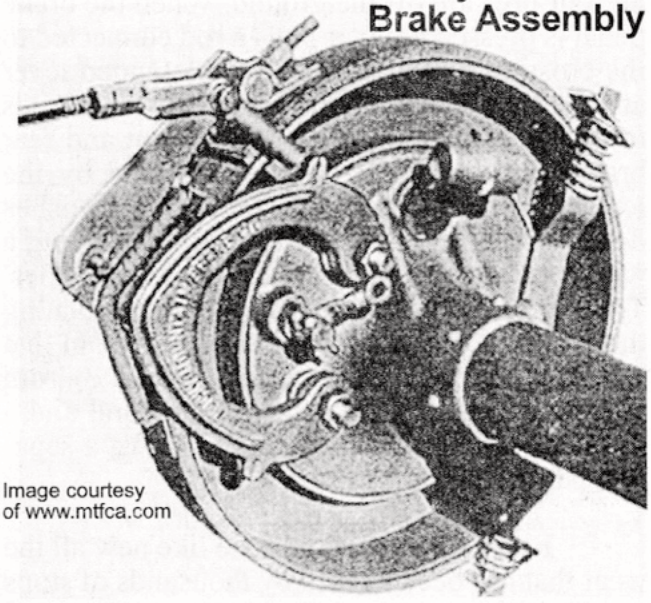


Image courtesy of www.mtfca.com

Ford Model A Four-Wheel Mechanical Brakes

By 1928 four-wheel mechanical brakes using brake shoes were common on most vehicles. When the Ford Model A was introduced to the public in December 1927, it had a four-wheel brake system with the parking brake lever mounted on the left side of the frame actuating all four service brakes. About 5,000 Fords were built before many states declared the Model A brakes illegal. So Ford redesigned the brake system and added a brake band at each rear wheel. A cross shaft and equalizer system operated by the brake pedal engaged the service brakes. The parking brake lever was moved in front of the gear shift lever and operated the emergency

brake. This early Ford redesign used about ten parts, and in November 1928 it was replaced with a simpler system. The November bulletin states "*A new service brake cross shaft has been designed and is now standard on all cars and trucks. The new shaft replaces the old style cross shaft and equalizer assembly, as the old assembly is obsolete and will not be carried for service.*" Ford used mechanical brakes operated by brake rods from 1928 to 1936, and then brake cables from 1937 to 1938.

Brake adjustment Ford Model A

Raise the vehicle on four safety stands so all four tires are off the ground. When the brake pedal is pressed down it pulls a rod connected to the cross shaft which has a double-ended lever attached to each end which pulls the brake rods to operate the brake arms of the front and rear brakes. The front brakes are operated by the lever turning a shaft with a pawl that pushes down on the front brake operating pin forcing a wedge downward that spreads the brake shoes. The rear brakes are operated by the lever rotating the brake camshaft which contains the cam that spreads the brake shoes. The rear brake drum also contains the emergency brake band and a set of levers to expand the band against a separate part of the broke drum.

For the system to operate like new all the wear that has been caused by thousands of stops must be removed. You must check and repair/replace everything from the brake pedal to the rear brake drum wedge. A half-way repair will result in part-way brakes. If the brakes grind or squeal during application, the problem is in the brake drums, and the drums have to be removed to check the brake shoes and linkages. If there is no noise but the brake pedal goes down more than two inches before the car starts to stop, a brake adjustment may help if the following conditions are okay: if the brake pedal wobbles and rubs the floor boards, the bushing or shaft may need replacing. Service the clutch pedal at the same time. Check the front wheels for loose bearings and worn kingpins. The front brake levers should lean forward of vertical. Loose rear wheel axle nuts and/or worn keyways need immediate attention. Gear oil leaks on the rear backing plates indicate worn seals. Clevis pins that are a loose fit through the rods, clevises or levers must be replaced. Bent brake rods should be straightened. Repair these problems before you adjust the brakes.

Brakes must be cold when adjustments are made. Spray the adjusters with rust buster. Disconnect all brake rods at the adjusting end, and loosen the lock nuts on the adjusting clevises. Make sure all brake retracting springs (anti-rattlers) are properly installed on the frame and brake rods. They should pull the brake rods back toward the brake backing plates. Adjust each wheel with the adjusting wedge until the wheel locks. Use an adjustable wrench or a square socket. Pull the brake pedal back all the way, and hold with a short bungee cord. Turn in the brake rod clevises to adjust all the free play out of the brake rod. The clevis pins should be a tight fit. Go to each wheel, and back off the brake adjustment until the wheels turn freely. Adjust each axle the same amount of clicks to prevent the brakes from pulling to one side when applied. Pull the parking brake lever back two clicks. Adjust the emergency brake rods as short as possible. Install new cotter pins.

Test Drive

With the vehicle in motion at about 40 mph apply the brakes. If the vehicle pulls to one side, tighten the adjuster on the other side and check again. The vehicle should stop evenly; the rear wheels will slide and the front wheels should make a heavy road print. You should stop safely within 100 feet. Test the emergency brake on a downhill. It should hold the vehicle in place with no movement. Readjust, if necessary. Happy motoring.

NEXT MONTH
Hydraulic Brakes