# Braking It!

## Analyzing awry anchors

Magazines that center around our hobby by their very nature tend to focus on technical stories dealing with performance or appearance, but any performance upgrade to a stock vehicle, or any rod or custom built from the ground up, will require improvements to the brake system or a system properly set up with compatible components.

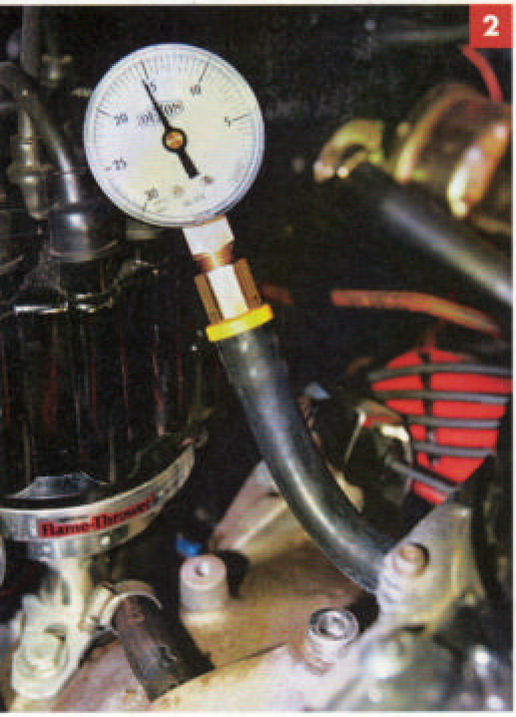
My '46 roadster pickup was the obvious choice, especially as I've not been completely happy with the brake system since getting the truck on the road. While the front and rear brakes are stock Caprice, albeit rebuilt with all new calipers, wheel cylinders, hoses, pads, and shoes, and the combination valve is also from a Caprice, the dual circuit master cylinder and booster were aftermarket items more commonly used on lighter hot rods such as a '32. I didn't know the cylinder bore size and had a feeling the 7-inch booster was too small, but I'd selected it as a 9-inch version would have been too large to fit between the steering column and the inner fender panel. It should also be noted here that the brake pedal is the Caprice item, with the ratio unchanged, though it's modified to offset the pushrod 2 inches to the left in order to align with the booster on the firewall.

The brakes had never felt "right" and it took considerable effort to bring the truck to a halt after the first, and easy, use of the pedal. All things considered then, the system needed inspection, so I put it up on the rack at our Tech Center and unboxed the diagnostic kit.

1

Diagnostic Kit includes a vacuum gauge and hose, pressure gauge, assorted fittings to hook up the pressure gauge to various calipers and wheel cylinders, a syringe to bleed a new master cylinder, and a master cylinder/booster depth gauge. Oh, and an instruction manual, which contrary to most guys' usual opinion, should on this occasion be consulted!

[redacted]

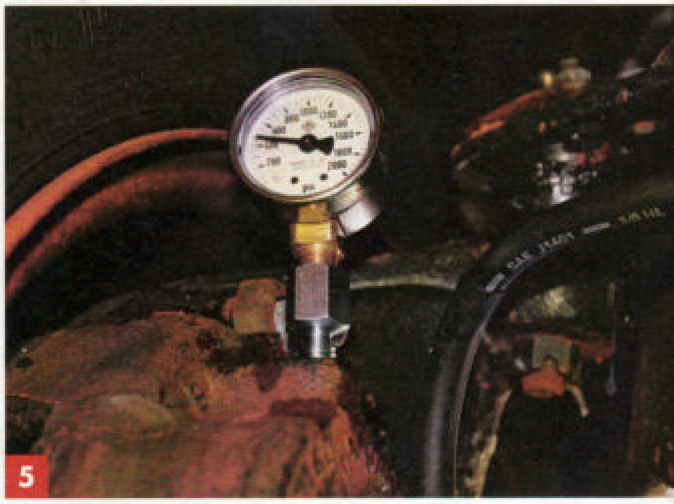


2

The first task was to determine the amount of vacuum the booster was getting. To operate correctly, power brake boosters require at least 18 inHg (inches of mercury) from the intake manifold at idle. With the vacuum hose disconnected, the gauge was fitted in its place, and the best reading achieved was 16 inches, though the gauge shows 15½ here. A performance cam will affect the vacuum, but this is a stock rebuilt motor with an Edelbrock Performer intake and carb, so the vacuum should be unaffected. I elected to conduct all the tests for the purpose of this article with the vacuum at 16 inches. Though Classic Performance Products offers an electric vacuum pump to remedy this, I'm going to investigate further as there has to be a reason the vacuum is so low.

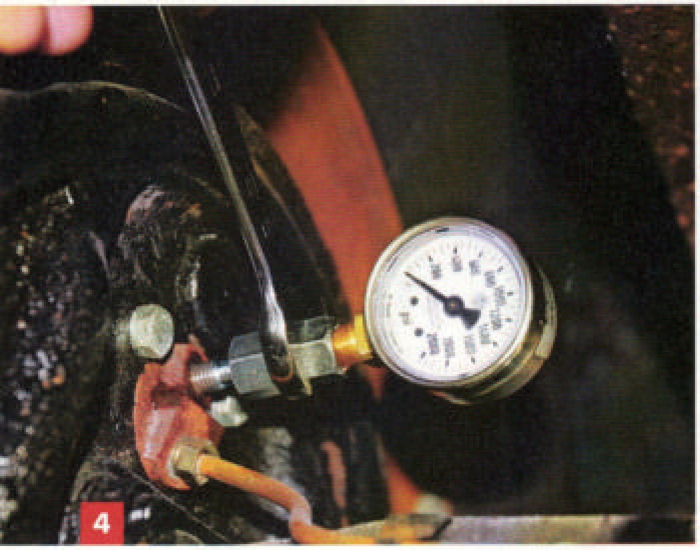
3

The kit includes a number of adapters to fit the pressure gauge, as well as blanking plugs and brass fittings to connect the gauge to junction points in the system if required. Here the gauge is fitted with the adapter for the GM calipers.



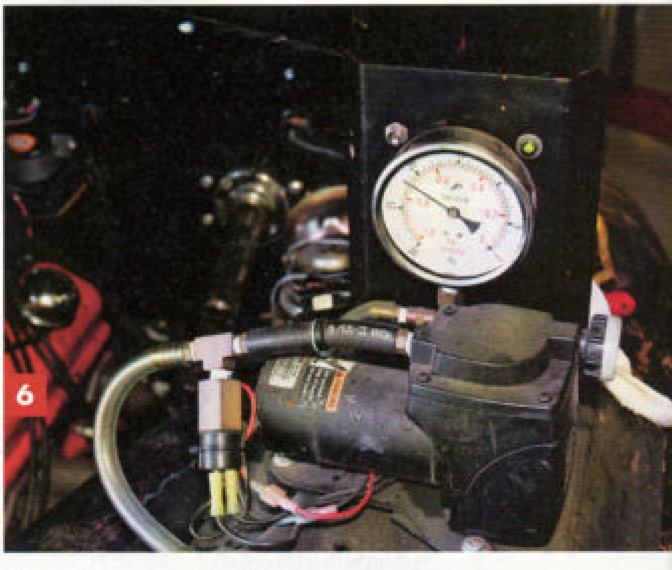
5

Moving to the front, and using a different adapter, the gauge was fitted to the calipers, each registering just under 500 psi. Hmm, more pressure at the rear than the front? No wonder I'm having trouble stopping this thing!



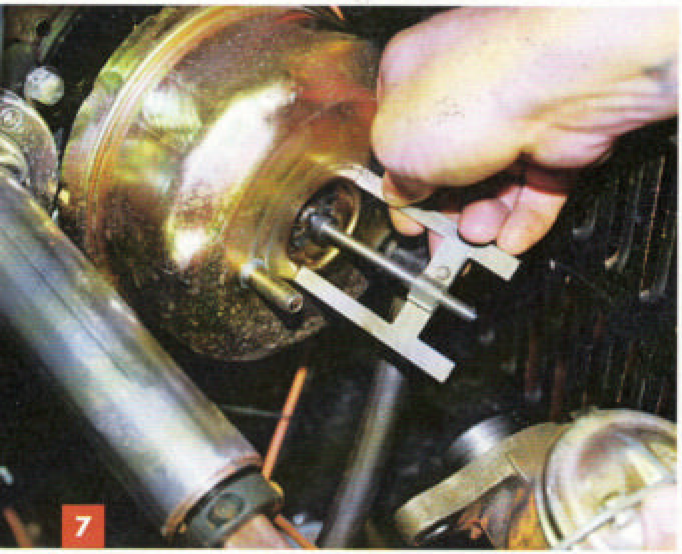
4

Installing the pressure gauge is as easy as removing the bleeder screw and fitting the gauge in its place with the correct-size threaded adapter. Starting at the rear, both left and right wheel cylinders showed 525 psi with the engine running and the brakes applied.



6

I know I said I would conduct all tests with 16 inches of vacuum, but I borrowed this bench tester vacuum pump and hooked it up to the booster just to see what difference more vacuum would make. With 23 inches of vacuum, the front brakes both registered 600 psi, proving that the additional vacuum provided an extra 100 psi at the front brakes. I didn't bother measuring the rears as this was just an experiment.



7

Talking over my brake problems with the guys at Classic Performance Products revealed that they sell a double diaphragm booster in 7-inch diameter, so a quick trip to their shop saw me leave with what I hoped would cure the problem. While I had the master cylinder removed from the booster, but not disconnected from the brake lines, I used the depth gauge from the kit to check the cylinder and booster. All was good, with 0.020-inch clearance between the pushrod and the cylinder piston. If this is adjusted incorrectly it may cause the brakes to drag if too tight, or give too much free play at the pedal if the gap is too large.

While the master cylinder was off, I also measured the bore diameter, and came back from CPP with a slightly smaller one in addition to the booster, dropping from 1 inch to $\frac{15}{16}$ inch.

8

Here's the old (right) and the new (left). Both share the same mounting bolt pattern but the double diaphragm version is a littler longer. While this wouldn't be a problem in many cars, it will cause interference issues in my pickup. I temporarily unbolted the inner fender at the bottom for clearance.

9

With the double diaphragm booster fitted, and with the vacuum back at 16 inches with the motor at idle, the front brakes showed almost 700 psi. A huge improvement! This compares well with Classic Performance Products' own specs which state that a dual diaphragm 7-inch booster with 23 inches of vacuum will provide 175 psi of "free pressure" (the pressure the booster can provide, as opposed to "manual pressure," that exerted manually on the pedal without the booster) with 100 pounds of weight applied to a pedal with a 7:1 ratio and a 1-inch bore master cylinder. The rear brakes now both showed 650 psi, proving that the proportioning valve was working. Up to 500 psi, the front and rear will be supplied the same pressure, then over 500 psi, the rear will get approximately half of what the front is supplied.

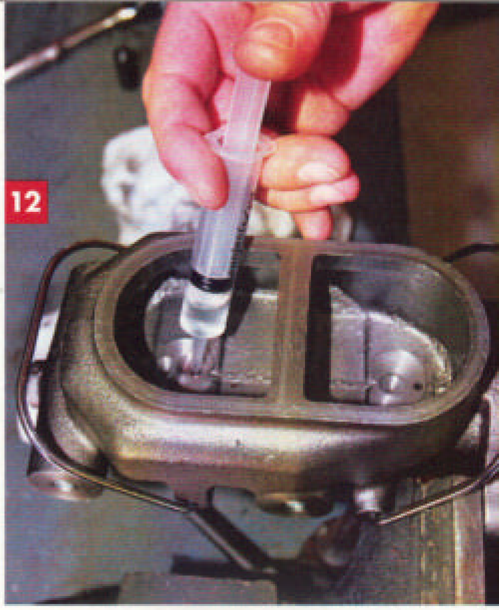
10

The final step in my quest for better brakes was to swap out the 1-inch bore master cylinder for the slightly smaller bore cylinder from Classic Performance Products, reasoning that the smaller bore might give more pressure at the expense of a little further pedal travel. CPP's cylinder is supplied with four bungs to seal the outlet ports during bench bleeding, as well as a rubber boot and bore adapter. Manual brake applications require the pushrod extend a couple inches into the master cylinder in order to prevent it from accidentally falling out. The adapter (arrow) is therefore needed in power brake 'shallow bore' applications.

11

With the master cylinder clamped in a bench vise, the bungs were tightened in the outlet ports.

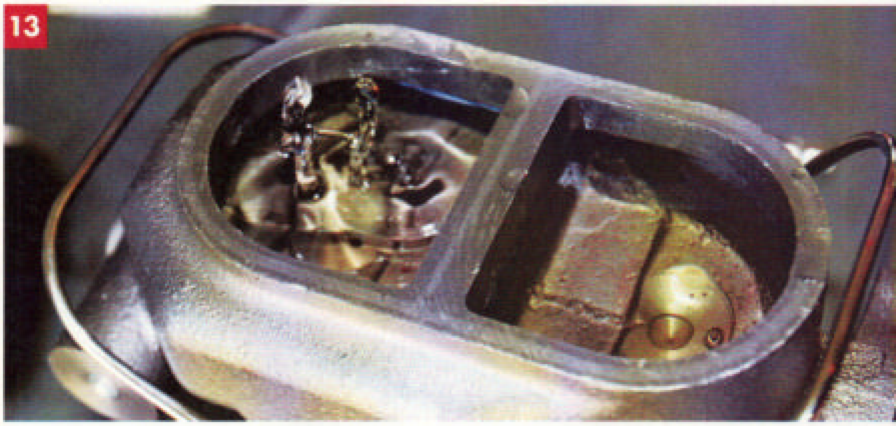
## Braking It!



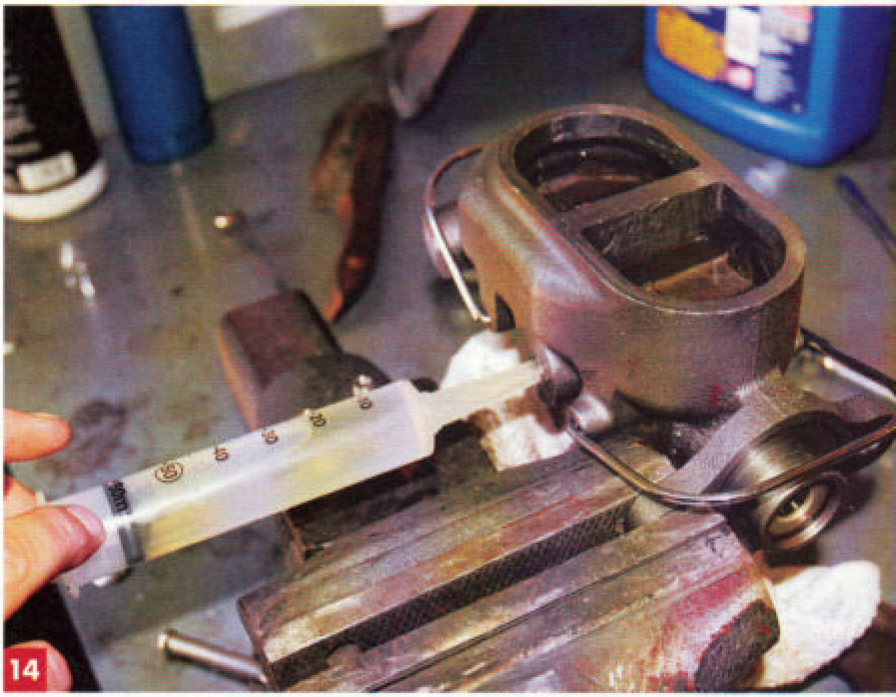
12

I used this small syringe from CPP to fill the bore of the master cylinder with brake fluid without trapping any air. Be sure not to mix silicone and regular brake fluid if you're working on an existing system.

Using a rod to act as the booster pushrod, I slowly operated the master cylinder to release any air bubbles.



13



14

The bungs were removed individually and the large syringe from the kit was used to "back-bleed" the master cylinder through the outlet ports. A surprising amount of air was released back into the reservoir during this stage. The bungs were then refitted in order to install the master cylinder on the car.

15

The master cylinder was then fitted to the booster, after checking the bore depth again. With permanent bungs in the left-side outlet ports, the brake lines were fitted to the right side one by one, each one left slightly loose and the pedal gently applied to bleed air. The whole system should be bled, but this sometimes can work, and did in this case.

16 With the booster and master cylinder fitted, I again checked the pressure at each wheel; the rears still showed 650 psi and the fronts were up to 750 psi. It is recommends they should be 800 psi for disc brakes and 500 psi for rear drums, so the pickup's a lot closer than when I started, but not quite ideal. However, the brakes work much better now, and feel like those on a modern car.