Ben Owen

WHEELS AND BRAKES

I received a call from a pilot who was having difficulty in holding her aircraft during run-ups past about 1200 rpm. The aircraft was equipped with heel brakes by Scott, similar to those used in the Piper Cub. The Scott heel brakes are a low pressure system and are designed to operate with drum expander and other drum brakes. This particular system was mismatched with Rosenhan wheels.

The average person is estimated to be able to put 100 lbs. of pressure on rudder pedals or brakes. Of course, a larger pilot could put considerably more, and a smaller pilot somewhat less.

Leverage and Hydraulic Power Transfer

The Acro Sport series of aircraft uses a dimension from the brake pedal to the hinge of 3-3/4 inches. From the brake pedal itself, the arm to the master cylinder is 1-1/2 inches long. These are basically at right angles to each other, and develop a ratio of 2-1/2:1. This leverage enables the 100 lb. brake force from the pilot's foot to be converted into 250 lbs. at the master cylinder. The brake pedal moves considerably more than the master cylinder lever it actuates, by the laws of leverage.

The Cleveland master cylinder 10-5 has a 9/16th inch bore. The formula for a circular area is: (pi) x Radius^2. The area of this particular cylinder is .2485 sq. in., 250 lbs./.2485 sq. in. equals 1,006 p.s.i. of pressure running through the line from the master cylinder to the wheel cylinder.

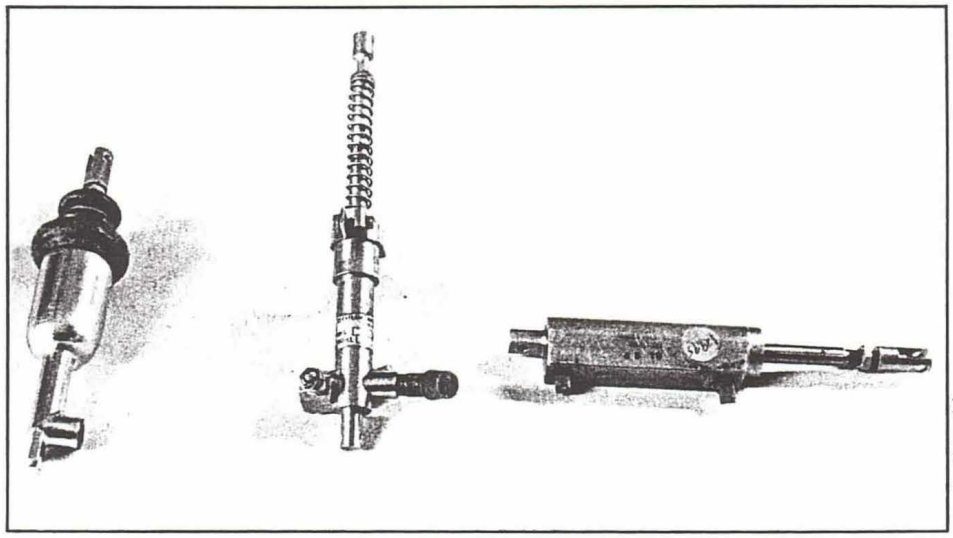
The wheel cylinder on this particular Cleveland brake pad is 1-1/2 inches in diameter. The area is 1.767 sq. in. at the wheel cylinder piston. The aforementioned 1,006 p.s.i. acts upon this 1.767 inches and puts a 1,778 lb. force at the brake disk. This force is adequate to hold the aircraft at full power run-up, and to even skid the wheels if the brakes are applied too harshly when moving. Some examples of brake system dimensions are shown elsewhere on this page. The first five examples could be used on aircraft similar to the Acro Sport, and are basically "high pressure" systems compared to the Scott type. The best thing is to use matched master cylinders and brake cylinders from the same manufacturer. We assume a brake set up giving 250 lbs. at the master cylinder.

The Scott comes with its own heel brake arm, which is about 5-1/2 inches long to a 1 inch arm for the lever arm from the arm itself to the cylinder. This gives it a 5.5 to 1 ratio. 550 lbs. can be developed at the master cylinder, assuming a 100 lb. pressure.

We understand that one of our members had a Gerdes brake, which has a larger wheel piston, and reportedly could not be used with Cleveland and Rosenhan master cylinders.

Cleveland has a suggestion for conditioning the brake linings . . . the aircraft should be taxied 1,500 feet at approximately 1200 rpm and held 5-10 mph with the brakes. After conditioning, the brake should hold the aircraft on a full power run-up. If not, I would suggest the conditioning was done improperly, or that you may have a mismatch from master cylinders to wheel cylinders. As always, when buying look for package deals and compare prices.

More on this subject next month.

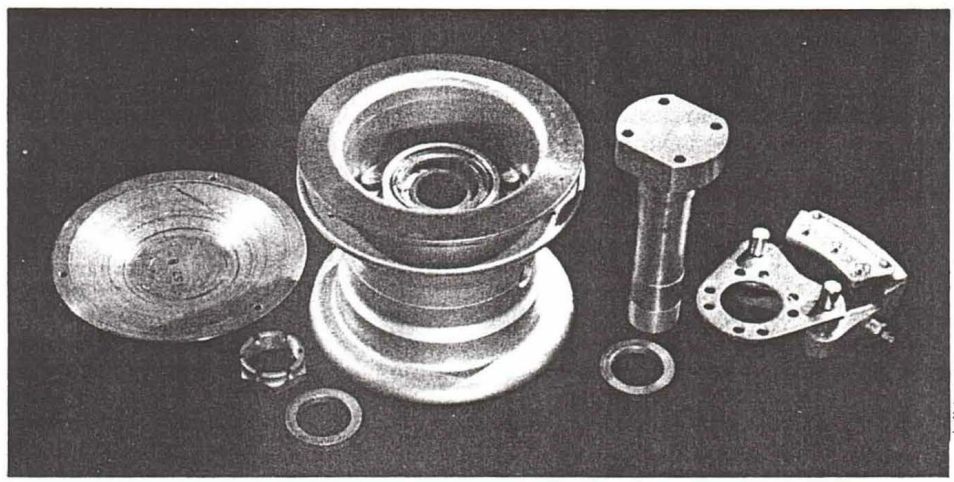


Jim Koepnick

Ben Owen selected these Cleveland 5.00 x 5 wheels and brakes for his homebuilt. The axles are anodized for corrosion protection.

TYPE	BORE Inches	PISTON AREA Sq. In.	PRESSURE p.s.i.	STROKE inches	DISPLACEMENT cubic inches
Matco or Rosenhan	1/2	.1964	1,273	.875	.172
Cleveland 10-5	9/16	.2485	1,006	1.25	.311
Cleveland 10-35	5/8	.3068	815	1.2	.368
ACS A-110	5/8	.3068	815	1.5	.460
Gerdes	5/8	.3068	815	1.5	.460
Scott	2-5/16	4.2	131	Not Shown	.80

NOTE: About 2% of Rosenhan brakes have 5/8" bores.



Jeff Isom

Brake master cylinders — left to right are Rosenhan, Cleveland and Gerdes. This Rosenhan cylinder has its own reservoir, while the others must be supplied with a reservoir.