

# THE SCIENTIFIC HEAD

Every phase of hot rodding has its own hot setup. As far as competition heads are concerned, the hot setup has got to be the Air Flow Research 'Velocitors' designed by engineering whiz Warren Brownfield

BY MELVIN HASHMAN

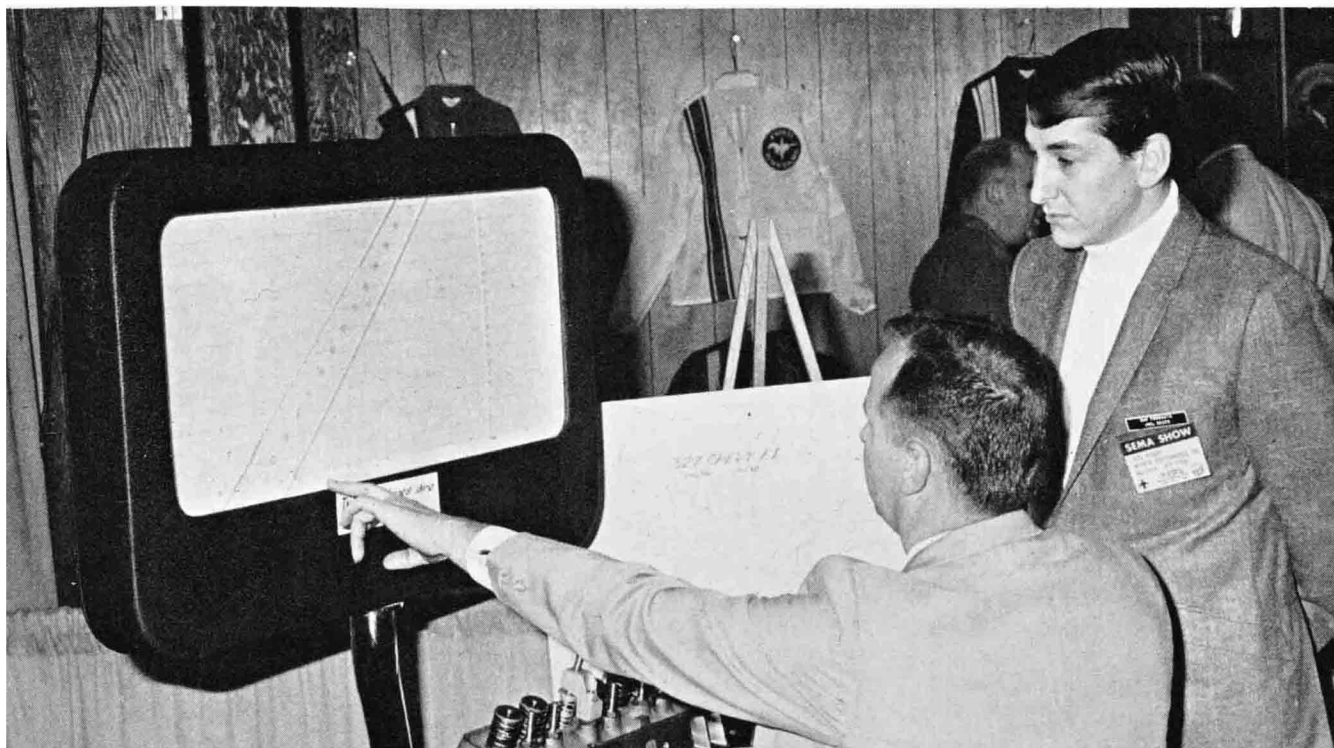
**W**ARREN BROWNFIELD is a quiet, unassuming engineer who is quietly starting a revolution in the drag racing field. He doesn't build racing cars or racing engines and he doesn't drive racing cars. His claim to fame is a high-velocity, high-volume air flow test bench that's used to determine *ultimate* port and combustion chamber size and shape. It's not by any stretch of the imagination a space age machine, but it's light-years ahead of any machines currently being used by the popular head-reworking outfits. Besides its

applications in the basic head reworking field, the Brownfield flow bench can be used for designing ultimate head designs from scratch.

Not from the school that believes that if some is good then more is better, Warren Brownfield discovered after extensive testing of professionally-prepared ported and polished heads that in many cases the larger opened-up heads actually flowed less than the same head in stock shape. At this point he decided to go into a full time head design business which has since grown to

become Air Flow Research Co. Soon after getting organized, Warren discovered that shape and not size was the important factor in making a head flow better. As of this writing, more than 12,000 individual tests have been conducted at AFR and testing is still going on.

The key to AFR's success in the head research and reworking field is Warren Brownfield's unique flow bench which reads out directly on a graph or screen in front of the operator. This machine automatically outdates 99 percent of the privately-



Flow bench inventor Brownfield checks the flow capacity of a 327 Chevy F1 head to demonstrate effectiveness of rig to a customer.

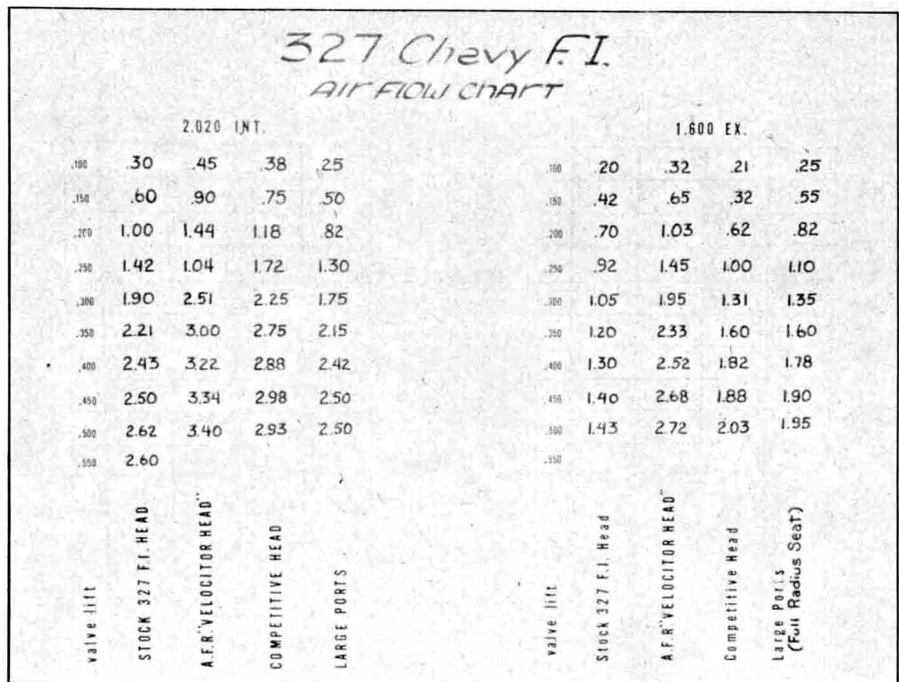
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owned low-volume machines in the field today. There are those who argue that low volume machines' findings just have to be multiplied to arrive at the same conclusions arrived at on the more sophisticated AFR rig. However, this is not so. Air behavior at low velocity is completely different from its behavior at high velocity.

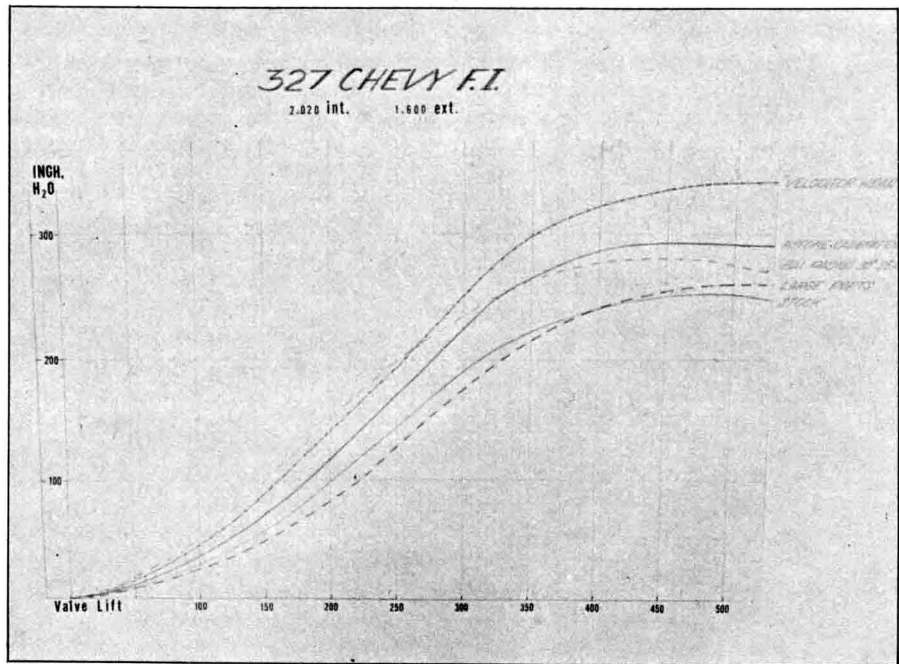
On a low-velocity machine the port may appear to be functioning through the full range of valve lift. Flow through the same head placed on a high-velocity machine may be approximately the same up to half of the valve lift and then begin to drop or fail to increase in flow as valve lift is increased. The problem lies in the fact that air will turn abruptly at low speeds where it will not at high speeds. Consequently, air flow will not increase and in some cases may even decrease at high velocity. The velocity capacity of the AFR machine has been determined by tests on high-speed engines.

Warren has discovered that all non-supercharged engines reach approximately the same combustion chamber vacuum at maximum output. At this point the engine requires more horsepower to pull the vacuum than it gains from incoming air. At AFR they run their tests at maximum engine vacuum. In making a test they try to repeat the exact conditions in a cylinder. To do this a sleeve the same inside diameter as the bore of the engine being tested (approximately 3 inches long) is placed on the base of the cylinder head, the valves are installed with a light spring in place of the regular valve spring and an adjustment fixture's positioned on the stem. The head is then placed over the opening of the machine. The valve is adjusted to .100-inch lift via the fixture. Then the valve is opened at .050-inch intervals and the flow calibrations are recorded on a chart at each interval. This gives the technician a clear picture of the flow characteristics of the port.

By keeping extremely detailed charts on comparative port sizes, port shapes, flow ratings, combustion chamber shapes, etc., Warren Brownfield has been able to come up with truly ultimate performance heads. In some cases very little can be done to improve exhaust port size and shape, while extensive modifications are required in the intakes for maximum power. The same goes for combustion chamber shape. Extensive tests have



Comparison chart shows flow potential of stock, modified and "Velocitor" custom heads.



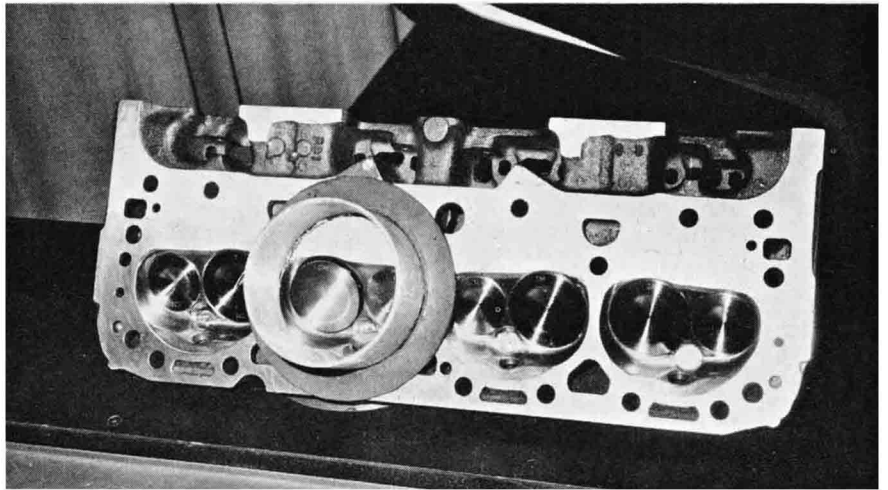
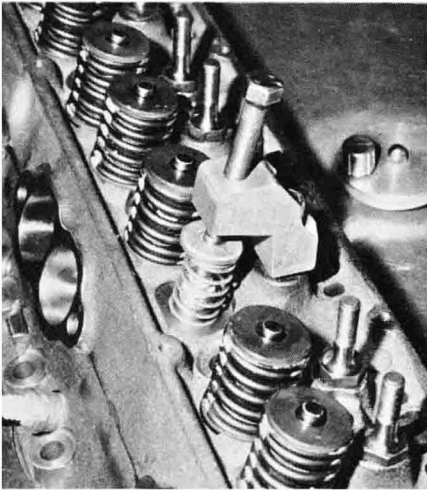
Machine's graph shows comparison flow ratings at all stages of valve lift—0 to .500-inch.

proven that the open or setback combustion chamber design utilized in the ZL-1, L-88 and ZL-X heads has little to do with the obvious increase in efficiency.

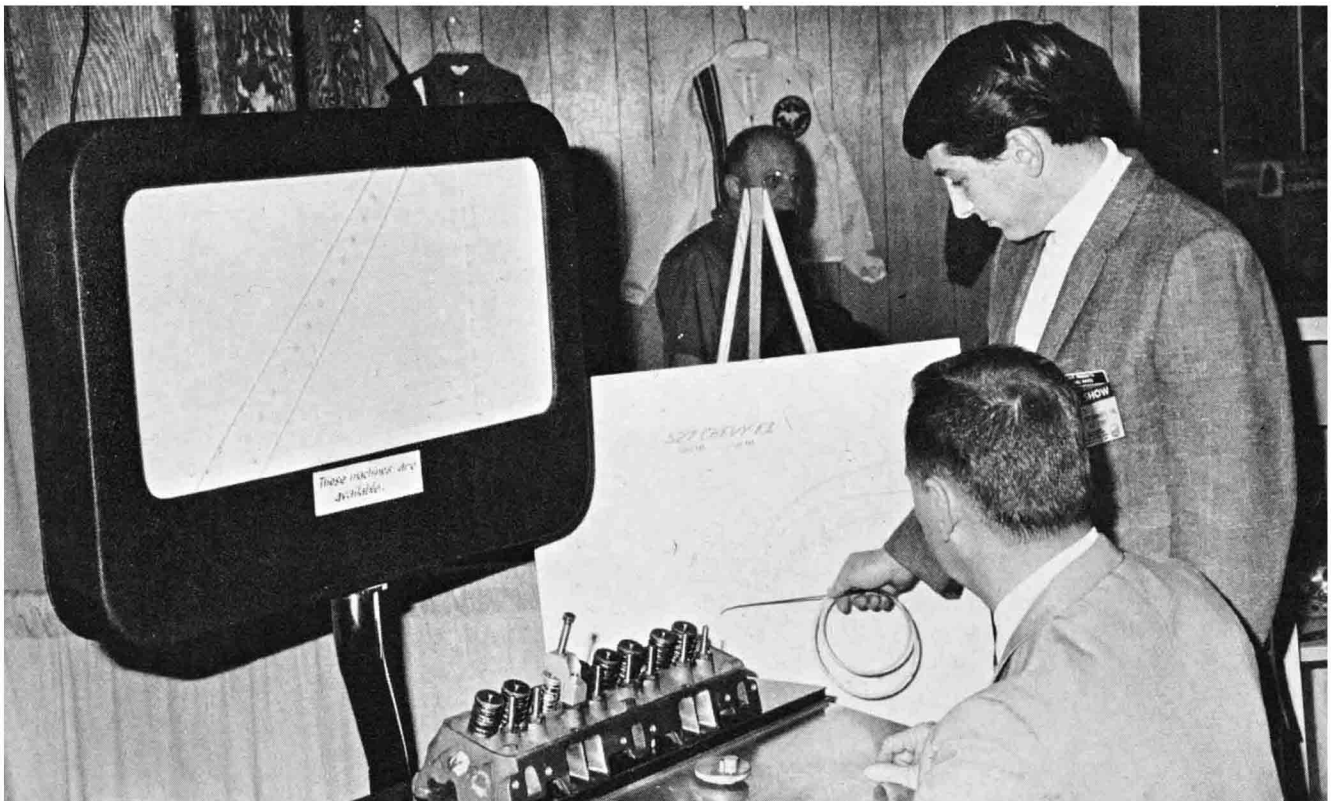
After many months of testing and evaluating port shapes and sizes via cross-sectioning to determine actual capacity of the ports, Warren came up with some interesting information. In almost all models tested, he found the ports to have at least 80 percent more capacity than the valves. This is especially true in the 327 Chevy FI heads which utilize 2.02/1.60-inch valves. So, to open up the ports in the FI heads and re-

tain the stock valves would accomplish nothing and in most cases would cause a performance decrease because of lowered air velocity.

The complete AFR story is a lengthy one due to the complexities of the operation. Because of space limitations we will have to take a rain check until a later date. However, Warren is in the process of designing a set of big-block Chevy heads for our A/MP Camaro and as soon as they are finished we'll pass on the hot setup info. We would like to mention that in addition to the research and development programs, Warren and his merry band of flow



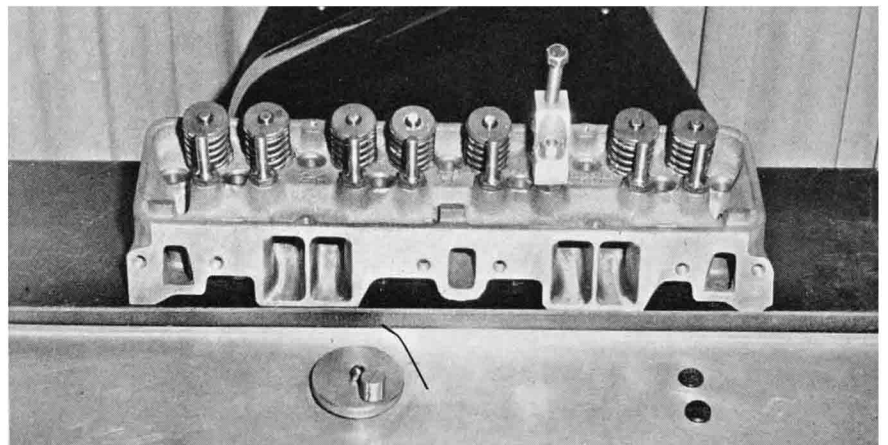
Special jig is used to open valve at .050-inch intervals for super accurate flow testing. To repeat actual conditions in a cylinder on the flow bench, a special sleeve the same size as the bore diameter is fitted to each of the combustion chambers.



After many months of testing and evaluation, the AFR crew has come up with porting and chamber shape combination for all mills.

testers also offer flow tested porting and complete "Velocitor" head services to the general public.

The flow-testing porting procedure includes flow researching prior to the machine work. The machine work entails matching and porting the intakes where necessary, grinding, reshaping and polishing the chambers and reshaping and polishing the exhaust ports. The "Velocitor" heads are the ultimate competition heads available and are built up on flow-tested and ported cores. The valve seats are roughed in with progressive contours and flats shaped by hand,  
*(Continued on Page 76)*



Custom AFR "Velocitor" head (327 Chevy) ready for flow testing on Brownfield's unique bench.

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## HEAD continued

and are the keys to the unequalled flow of these heads. The valves are reshaped and the heads flow-calibrated. The average time spent on a set of "Velocitor" heads is approximately 35 hours. Chevrolet heads cost \$320.

Anyone interested in going this route should contact Warren Brownfield directly at Air Flow Research, 8217 Lankershim Unit 32-MLS, North Hollywood, California 91605

## MERCURY continued

Orange monster. The hood pins, hood scoop, decal lettering, white-lettered Goodyear tires mounted on the styled steel wheels and the Mach I mirrors is all the gilding the basic model needs to give it instant status. The Electric Orange paint is definitely out of sight,

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