BUILDING THE 427

From foundry to shaving cream to boxcar

In manufacturing Corvette's 427-cu.-in. powerplant (along with other Chevrolet Turbo-Jet V8's), old-fashioned know-how and painstaking handwork are blended with some of the most highly sophisticated, electronically oriented equipment in the world. At one point, shaving cream is used—to insure quality. It all takes shape outside of Buffalo, New York, at the Tonawanda Engine Plant. On these pages are some of the scenes and words that describe the meticulous quality manufacture of Corvette's powerful 427.

1. From the foundry facility and rough machining stations, bare blocks with main bearing caps come to the assembly line. Block surfaces have been carefully broached and cylinders honed; main and camshaft bearing bores have been line-bored for precise alignment.

2. In the background can be seen the final cleaning tank, where every nook and cranny of the blocks are subjected to ultra-high-pressure jets of hot cleaning solutions and hot-air blasts for drying. After the blocks are thus made "sterile," the first step of assembly is the installation of the camshaft.

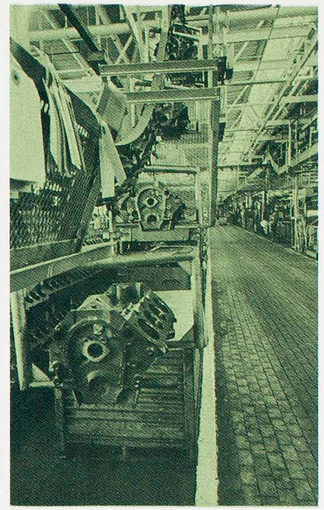
3. All 20 main bearing cap bolts are loosened simultaneously by a multiple-socket air wrench—called a nut-runner. Main bearings are then installed into the caps and lubricated. At this station, the mechanic gently lowers the crankshaft into the block, re-attaches the main bearing caps and rough-tightens them with another 20-socket nut-runner. Each bolt is then torqued by hand.

4. An aluminum alloy and nylon timing gear, timing chain and crankshaft gear are attached as a unit with a special guide-tool. Attaching bolts are installed and rough-tightened. These bolts, too, are tightened with a torque wrench.

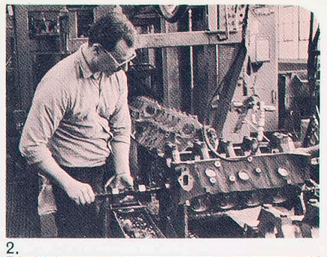
5. A usually time-consuming job of installing pistons and connecting rods becomes a few simple steps when you have the proper tools. Piston, ring and rod assembly are slipped into a tapered cylinder-like installation tool. (The block is still upside-down.) A U-shaped hollow tube with a handle, shown in the photo, is slipped around the rod journal, through the cylinder bore and over the ends of the rod bolts. This guides the connecting rod onto the rod journal to prevent the rod bolts from nicking the journal during installation.

6. With the U-tube on the rod bolts and the piston guide in place, the entire assembly is pushed upward as shown in the illustration. Rod nuts are installed and out come the torque wrenches again.

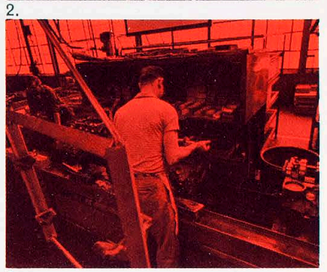
7. After the flywheel and clutch are installed, an operator uses an exotic tool that includes a dial and operating levers. This tool checks alignment, adjustment and smoothness of engagement. It also checks release pressure. Next is oil pump installation (and torqueing) and a double-check to make sure crankshaft oil seals are in place.



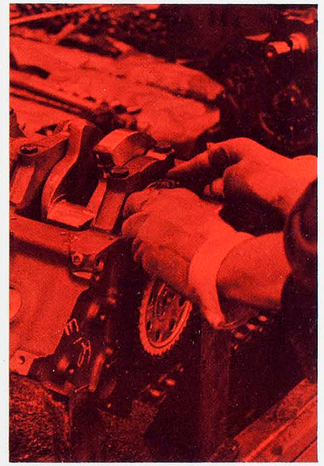
1.



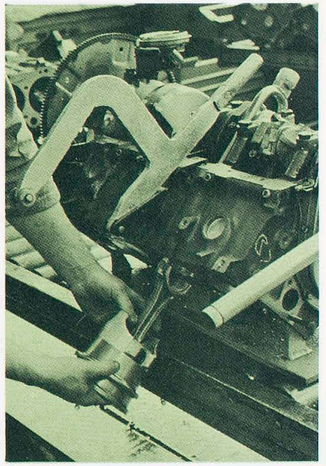
2.



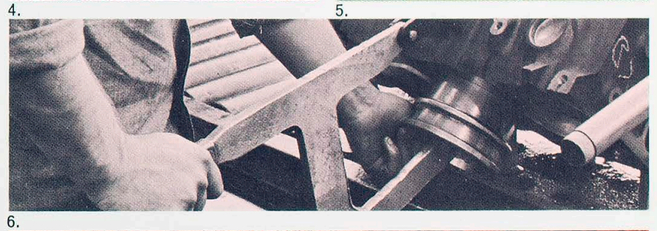
3.



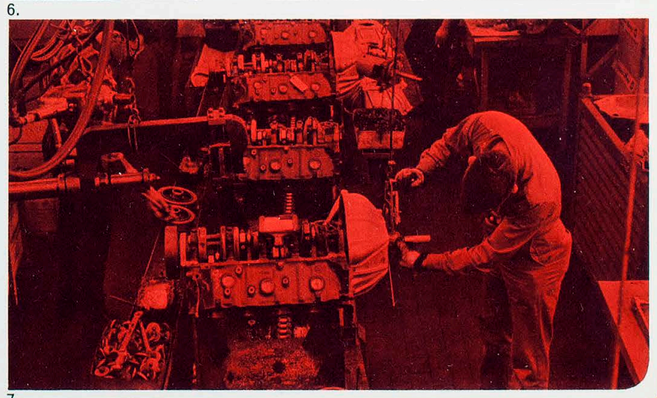
4.



5.



6.



7.

8. This nut-runner, with its 20-odd sockets, looks (with a bit of imagination) like an upside-down milking machine. It's "loaded" with oil pan cap screws, and as the machine is lowered, the individual sockets start to turn. Next, the self-centering oil pan cap screws thread themselves into the crankcase. When all sockets stop turning, the operator knows all screws have been properly tightened.

9. The next stage finds the complete short block assembly automatically turned over for installation of the cylinder heads. And this is where the shaving cream takes on its role. Even though cylinder heads are cleaned and flushed-out, there is a chance that an occasional particle of core sand might still be in the cooling system passages. Shaving cream is squirted into the passages to keep any particles from falling into the precision-machined parts of the engine as the heads are turned over and installed. (Shaving cream dissolves harmlessly in the coolant.) This operation would hardly qualify as "normal," but it's only one of the reasons Corvette engines enjoy an above normal reputation for quality and durability.

10. A day's use of shaving cream is represented by a barrel full of empty cans. The anonymity of brand "X" is maintained; the labels are removed prior to delivery to the assembly line.

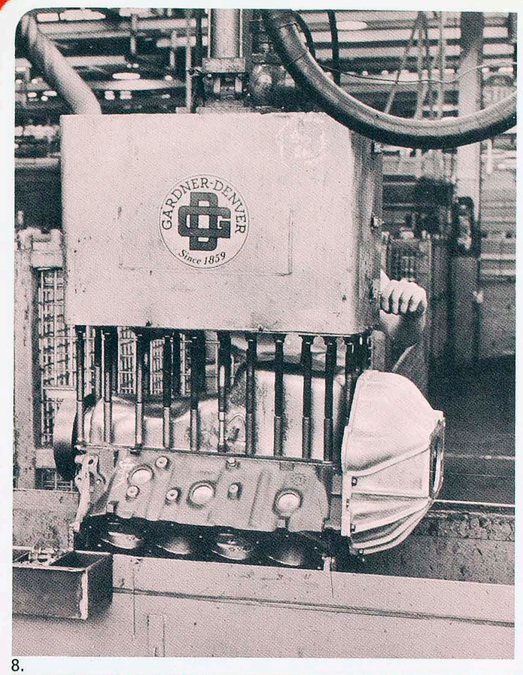
11. Meanwhile, back at the wrench . . . it is each cylinder head bolt that gets personal tightening this time. The quality standards under which this engine is built leave nothing to chance. There is not one nut or bolt that is not double-checked for proper tightness.

12. Initial valve clearance is always adjusted by hand with an "old-fashioned" feeler gauge. Even when hydraulic valve lifters are used, adjustment is still made by hand.

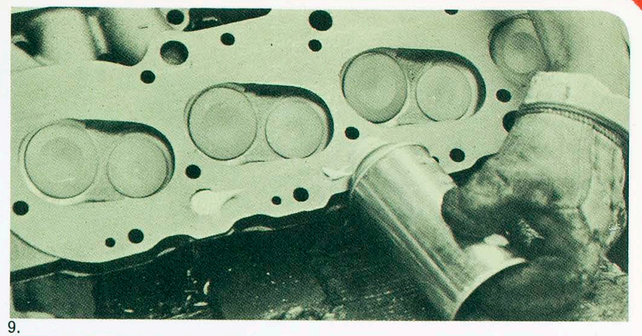
13. After manifolds, water pump and temperature-sending units are installed, quick-connect fittings are attached to the cooling system. High-pressure air is used to check for leaks.

14. With the exception of the carburetor and final installation of engine accessories, the engine is ready to run, and comes off the line for the first time as an assembly. Conveyors then take the engine to the test area.

15. On the test stand, the engine is completely hooked up; oil and water are pumped in and the exhaust system is attached. A hose and fittings pipe liquid petroleum gas into the intake manifold. A permanent starter drive on the stand is used to crank the engine.

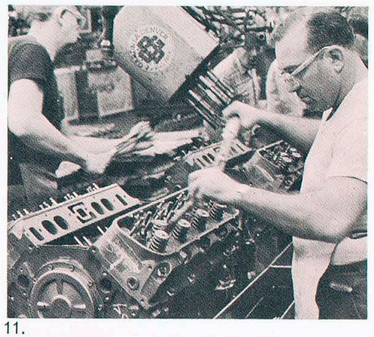


8.

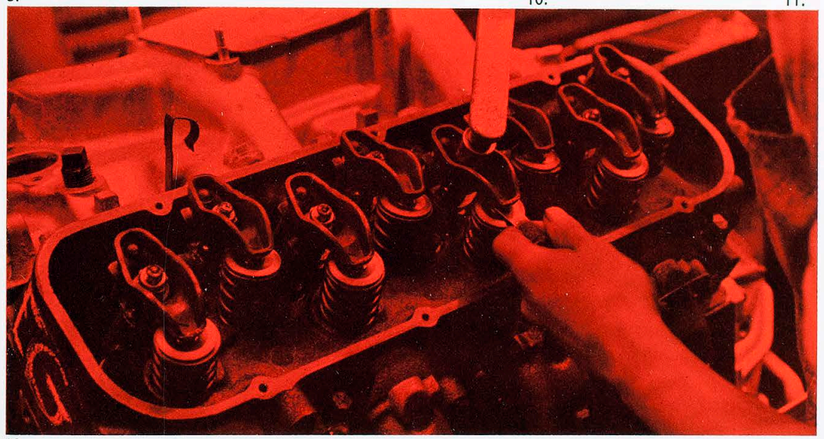


9.

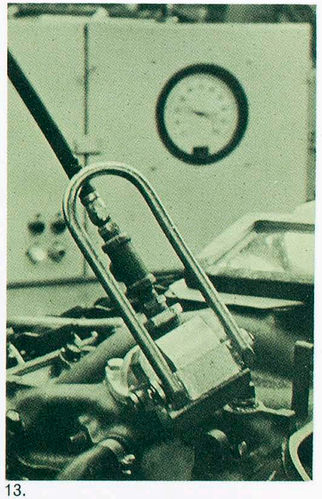
10.



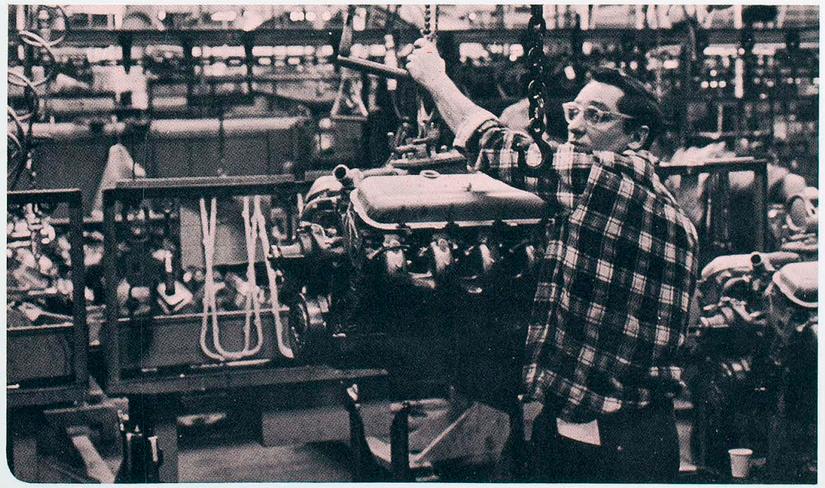
11.



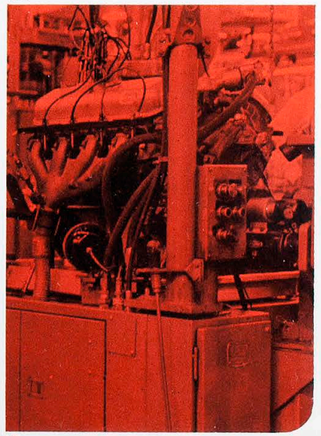
12.



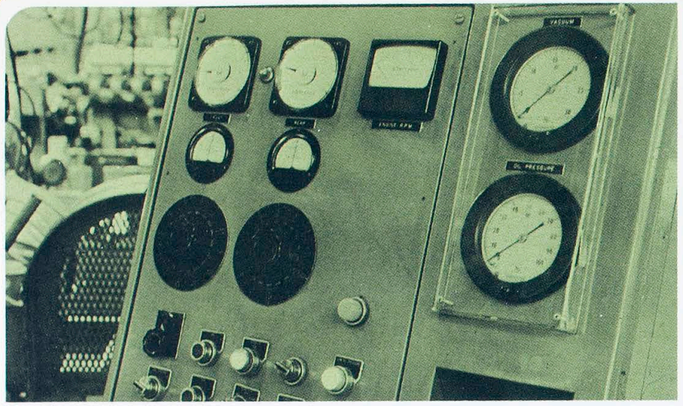
13.



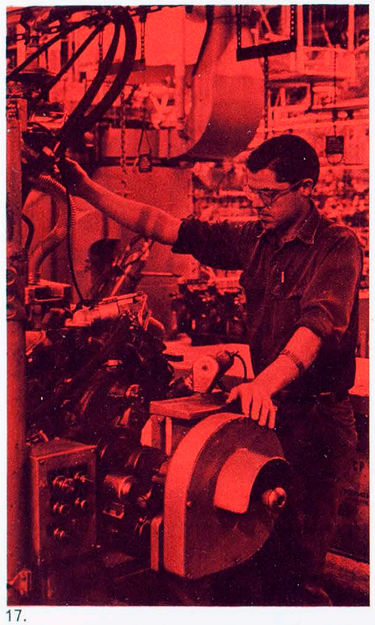
14.



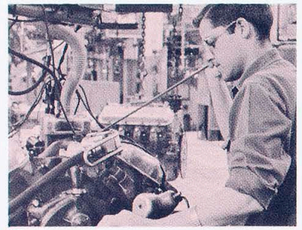
15.



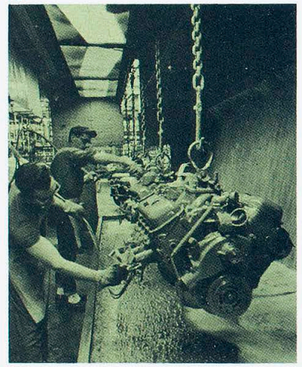
16.



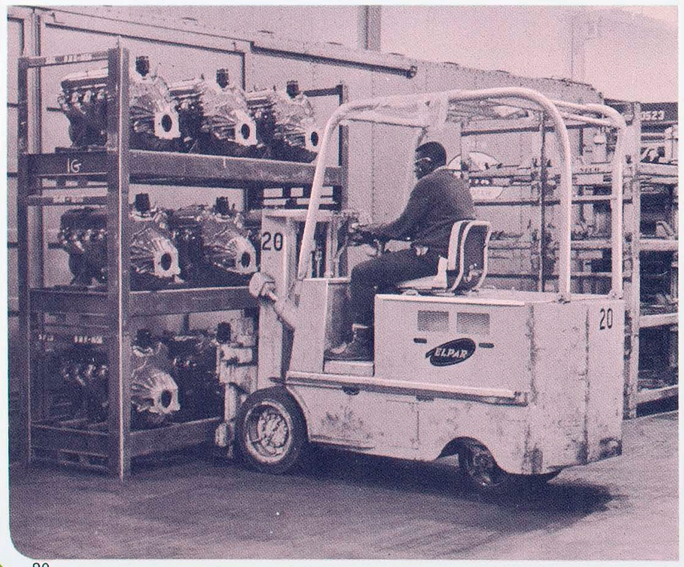
17.



18.



19.



20.

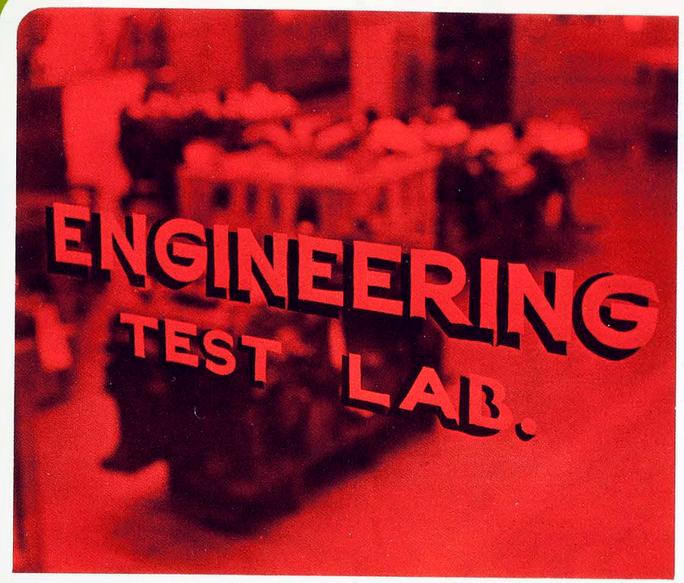
16. A complete instrument board next to the test stand tells the performance of all the components, including an indication of any imbalance.

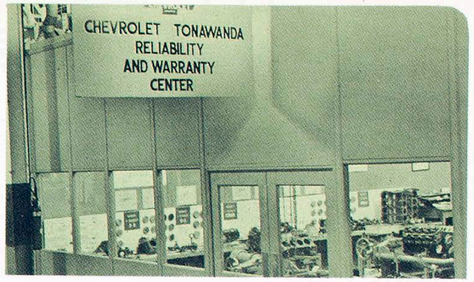
17. Will it start? After months at such a job, the operator begins to take it for granted that every engine *will!* As the engine catches, the operator immediately studies the instrument board to make sure oil pressure is correct. On this brand-new engine, the pressure should be at least 30 psi at 600 rpm. At 1500 rpm, pressure should be in the range of 35-45 psi. In addition to oil pressure, the operator checks manifold vacuum, adjusts timing, checks for possible oil, water or exhaust leaks. There is no tolerance for *any* leaks. All rotating components have been balanced to within ½ oz.-in. before assembly, but at this station, the engine is balanced to *zero!* Final balance is achieved by welding on weights or by precise drilling of the harmonic balancer or flywheel. Maximum speed for any test stand operation has been limited to 1900 rpm.

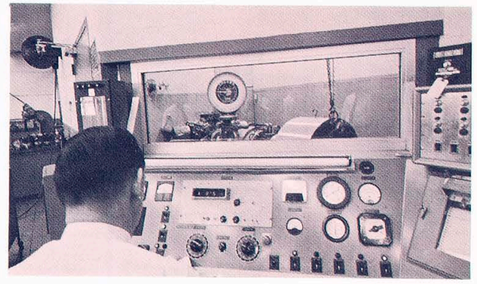
18. Once the engine has passed its first inspection, the operator then uses his "ear-meter" and long stethoscope probe to uncover possible extraneous, unwanted noises.

19. With the myriad of tests completed, the engine is sent to the painting area. Here, preformed masks are placed on the engine to shield all components that shouldn't be painted. With a "wall" of water behind and under the engines, they are sprayed with a quick-drying engine enamel.

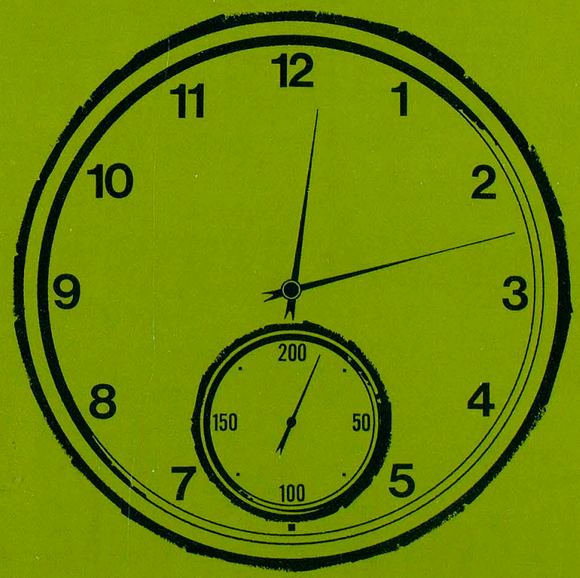
20. From the paint area, engines are removed from the conveyers and placed in nine-engine shipping racks. A fork-lift truck makes the final transfer to the boxcar. Next stop: the Corvette assembly plant at St. Louis.







Some engines don't go to the boxcars



Not all Corvette engines end up in Corvettes. In fact, some never leave the plant—except in pieces in the scrap barrels. A number of engines are taken from each day's production and torn down for minute inspection in the Tonawanda Reliability and Warranty Center.

Other engines are taken from each day's production and put on dynamometer test. In what is called a 200-hour durability test, engines are cycled every 30 seconds. In other words, they are accelerated and decelerated in a 500-rpm range for 200 hours straight. In this constant cycling, manifolds get a cherry red and stay that way for the entire time. With this grueling test procedure, a question would naturally come to mind. How often do the engines scatter? On questioning, one dynamometer operator answered (with a twinkle in his eye), "I don't remember one scattering . . . but then, I've only been here a few years."

After this Spartan service on the dynamometer, the engines are not put to rest, but are subjected to the final test of being completely torn apart, analyzed, sawed, filed, measured for wear and inspected to the smallest detail. Once all the quality control checks have been satisfied, the bits and pieces are consigned to the scrap barrel . . . to be melted down at the Chevrolet foundry to perhaps become another red Corvette engine.