ALL NEW PLANE FROM CESSNA / **INFLIGHT TEST**

THE CARDINAL

The accent in the Cardinal is on smooth, flowing lines — from the long, pointed spinner to the swept vertical stabilizer.

Cessna's much-discussed new single-engine plane is here, and it's a collection of design departures which have surprised even the best flying prognosticators

What kind of airplane is the new Cardinal which Cessna is introducing into general aviation for 1968? A surprising one with many new ideas for Cessna. But perhaps it can all be summed up best by saying that it is a lot of plane for the money.

Since the Cardinal is in the $14,000 price class, this places it very close to the very popular Cessna Skyhawk. A new airplane had been expected from Cessna, but it was generally thought it would be much more expensive when it appeared.

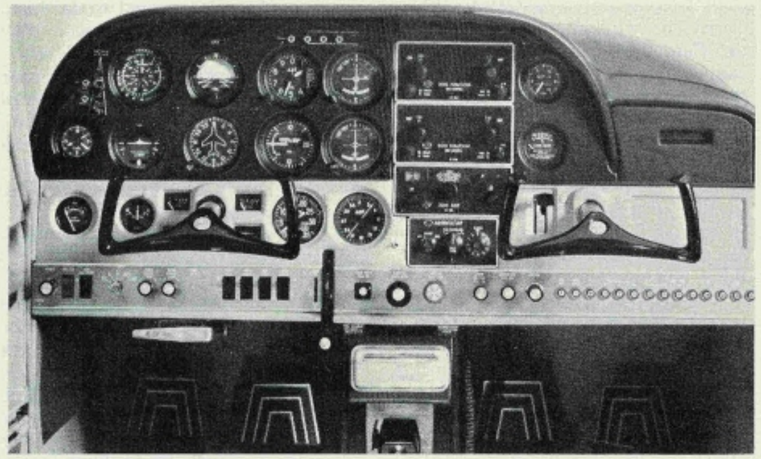
For this report, one of the new Cardinals was flown for several hours one fine day in the wide-open skies over Kansas. It is a fast plane for the money, with a top speed of 144 mph and a cruise of 134 mph. It achieves this speed with a very modest 150 hp. Although there is a superficial similarity between the Cardinal and the Skyhawk, the all-new Cardinal differs in so many ways that its operation and flight characteristics are new in many respects.

The Cardinal and the Cessna 177 are basically the same airplane: the Cardinal is simply the deluxe version. Most noticeable, at first glance, is the cantilever wing, similar to the Cessna Centurion, with no external bracing or struts. Its wing is mounted farther back on the fuselage, which allows a larger windshield and gives the pilot better visibility — particularly overhead.

Power for the Cardinal is a radical change for Cessna. It is a Lycoming engine, and it is the first time in the history of Cessna (with the exception

No other airplane is as easy to enter as is the flat-floored Cardinal. With the wings and landing gear moved back, a step and four-foot-wide doors to facilitate entry, and a floor only 23 inches above the ground, the old preflight contortions are a thing of the past.

Cardinal innovations move right into the cockpit, where the new panel has a surprising shape and some new controls and is canted five degrees toward the pilot for easier viewing.



of 33 old twin-engine AT-8's) that a Lycoming has powered one of its production aircraft. Earlier single-engine Cessnas have used Franklins and Jacobs, but Continentals have been a Cessna constant. With this changeover, Cessna now joins its chief rivals – Piper and Beech – in using Lycomings.

Another great innovation for Cessna is the use of a stabilator in place of the conventional elevators and fixed stabilizer combination. A stabilator is simply a unit that is completely movable without any portion of it being fixed. Here again, Cessna has used a design feature common on the aircraft of some of its principal competitors.

And why a stabilator on the Cardinal? Cessna says that, on this particular aircraft, it means less pilot effort to control the attitude. There is no question but what the stabilator, along with the other new characteristics of the Cardinal design, make the plane handle differently in various maneuvers. The stabilator appears to be more sensitive during a deliberate and intentional stall; there appears to be more buffeting and pitching during the entry into the stall than with comparable other Cessna aircraft, such as the Skyhawk and Skylane. At the same time, however, the Cardinal does not break out of a stall and drop to regain flying speed. Instead, it seems to hold its attitude while buffeting.

During the flareout on landing, the Cardinal again appears to be somewhat more responsive and sensitive than the Cessna with a fixed stabilizer. None of these can be considered as adverse effects – they are merely different from other Cessnas.

For the purpose of exploring these flight characteristics, we set the Cardinal up in level flight at 4,500 feet at cruise power. We then reduced engine power and applied full flaps. As the airspeed dropped, we added additional power, and the stabilator was given its maximum trim to hold the nose up. As airspeed dropped, power was increased slowly, and we had to hold some right rudder. Finally, with full flaps, maximum stabilator trim, and 2250 rpm, the Cardinal was slow-flying at an indicated airspeed of 46 mph and holding its altitude. Very easy turns were made to the left and to the right. We then changed the setting to one quarter flaps and found it was necessary to add 50 rpm to maintain altitude. With this trim and power setting, the indicated airspeed was now 48 mph.

During all this, the pneumatic stall warning device was sounding continuously. This warning sound is similar to the one used on the latest Skyhawks and resembles the sound of a cat or a baby crying. This is a changeover from the earlier tab which emitted a beeping sound. The new warning device operates by means of air being drawn out of a tube located in the leading edge of the left wing. On this particular Cardinal, the warning began to sound at an indicated 70 mph, which appeared to be too early. It may simply have been something that needed adjustment on this particular aircraft.

On the inboard section of the leading edge of both wings is a triangular strip about 10 or 12 inches long which has puzzled some observers. This strip is similar to one we found on the military T-33 Jet. Its purpose is to retain aileron control longer during stalls by breaking up the airflow over the inboard wing sections to get stall symptoms while the control surfaces are still flying.

While conducting the slow-flight experiments, we had an opportunity to check out another interesting Cardinal innovation. The Cardinal has doors on

each side, as do other Cessnas in its class. The windows on each side of the Cardinal, however, are fixed and cannot be opened. Instead, the Cardinal has two window vents, very similar to those found on automobiles, which are opened by means of cranks. Unlike the automotive type, however, these window vents open forward into the airstream. Naturally, opening them slightly admits a large volume of air. According to the owner's manual, these windows are not to be opened at speeds in excess of 120 mph. There is no question about their effectiveness as ventilators. It makes one wonder why it took so long to introduce a feature like this into aircraft. We were interested in determining whether opening these window vents had any effect on the directional stability of the Cardinal. What we discovered was that when a vent was opened fully on one side, they put the Cardinal into a very wide, shallow, gentle bank.

In addition to the window vents, the Cardinal has the conventional air nozzles in the ceiling. Almost every type of aircraft, from the lightest plane to an airliner, often has an uncomfortably warm cabin while taxiing in the hot sun. We found that these window vents, on this warm day in Kansas, provided adequate cooling air. It was vastly better than the method of opening one of the doors, which usually brings in such a blast of prop air that it is a question generally of too little or too much.

The doors on the Cardinal are very wide — actually four feet in width. They are located well forward of the main landing gear, open a full 90 degrees, and are contoured to facilitate entry and exit. In this respect, they are a great improvement. However, there are some pilots who wonder whether there will be any problems with these large doors in high ground winds, especially blowing from the rear. The hinges will have to be exceptionally sturdy to stand up against unexpected forces.

The fact that the doors are contoured gives the illusion of the Cardinal fuselage's being somewhat narrower than the Skyhawk's. Actually, the Cardinal measures five inches wider at the forward edge of the rear seat in comparison with the Skyhawk. However, from the pilot's seat, the Cardinal appears to be adequate as far as room is concerned but no better than the Skyhawk or the Skylane.

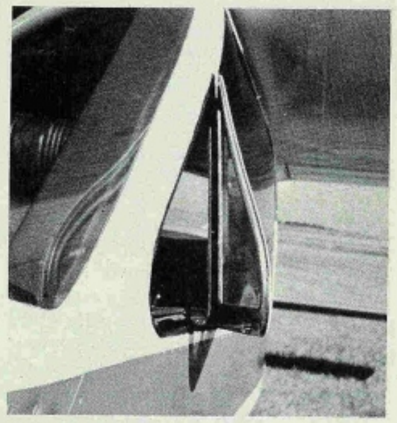
Closing the doors on the Cardinal is somewhat like shutting the doors on a Volkswagen with the windows up. Apparently, the sealing job is so good that the inside air pressure makes it difficult to slam the doors easily. It is almost necessary to crank open one of the window vents.

This same sealing perhaps is partly responsible for the Cardinal's being so quiet when in flight. The overhead air vents are not noisy — they are quieter than those on a Cessna Centurion 210 or even a Cessna 310. This possibly may be due to the slower airspeed, but the plane is unquestionably quiet.

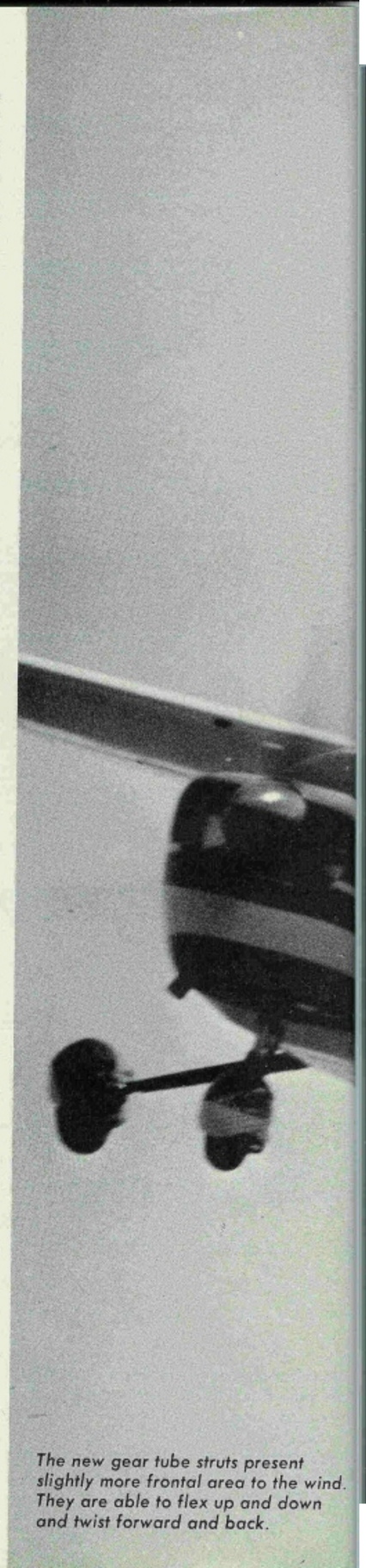
Engine noise is very slight from the inside. From the outside, of course, the four-cylinder engine sounds like the Lycoming that it is. The engine develops 150 hp at 2700 rpm. Normal cruise uses about 7 to 8 gallons per hour and gives the Cardinal a range of up to 800 miles.

The engine is equipped with a carburetor and a fixed-pitch propeller. There is one unusual feature — an electric auxiliary fuel pump and a fuel pressure gauge. Other single-engine Cessnas with high wings and engines with carburetors rely upon gravity flow to supply fuel to the engine. In the case of the Cardinal, with a wing located so far aft, it was possible that in attitudes with the nose very high there would not be an adequate amount of fuel supplied by gravity. Therefore, the Cardinal engine had to be equipped with a mechanical fuel pump, and, whenever there is a mechanical fuel pump, it is necessary that an auxiliary electric pump be available as a backup. Consequently, this auxiliary fuel pump is never used on the Cardinal, either in starting or in flight, unless the fuel pressure gauge reads less than two psi.

There are some changes in the fuel system from other Cessna traditions. The fuel selector lever has only three positions — right tank, left tank, or both tanks. There is no "off" position — which hopefully will henceforth eliminate the possibility of any pilot's inadvertantly shutting off his own fuel supply. There is a shutoff knob forward under the instrument panel for this purpose, but most pilots will rarely ever have to use it.



Gone are the usual Cessna openable side windows. In their place are outward-swinging wind wings which can be cranked open like those on automobiles. Notice also the gear leg; the famous Cessna spring steel struts have been supplanted by conically tapering steel tubes.



The new gear tube struts present slightly more frontal area to the wind. They are able to flex up and down and twist forward and back.

The cowling around the Lycoming engine is rivetless aluminum, except for a fiberglass nosecap just aft of the propeller and spinner. It is not possible to remove this cowling easily for routine preflight inspection. There is a small access door to reach the oil dipstick and the knob for opening the drain to remove water and sediment from the fuel bowl. Unlike other Cessnas, the Cardinal does not have a remote drain knob on the instrument panel. This always has been useless anyway — since, when fuel is drained, the pilot had to get out and go around to look at the ground to see if any water were present.

This Lycoming engine is designated as the O-320- E2B, and it will also be used in the 1968 models of the Cessna 172 and Skyhawk. Although Cessna obviously will not admit it publicly, it is quite apparent that the Cardinal will eventually be offered with a higher-hp version. The most likely prospect, of course, is the 180-hp Lycoming.

This Lycoming starts very easily whether hot or cold. The checklist is not significantly new. Mixture is full rich; carburetor heat is cold; the primer is used only during very cold weather; since the throttle itself has an accelerator pump, a few strokes with it prepare for starting; and the throttle is cracked about one-quarter of an inch and the ignition switch turned to "start."

Runup is conventional prior to takeoff. Magnetos are checked at 1700 rpm. Carburetor heat is checked. There is only one additional operation, and that is to check the electric auxiliary pump to see if it is operating properly.

For our first takeoff, we used one notch of flaps and applied full throttle gradually. As the Cardinal accelerated and the airspeed indicated to 50 mph, we gave the trim wheel a little nose up, and the front wheel promptly broke ground. At less than 60 mph, the Cardinal flew itself into the air. There is no rudder trim on the Cardinal. However, there is very little torque or propeller effect indicated, so only a slight touch of right rudder is required. Since the Cardinal is equipped with a turn coordinator, instead of the older style turn and bank indicator, we don't know whether the reduction in yaw is really less or only a difference in registration on the instruments.

The recommended climbout is between 90 and 100 mph, and the best rate of climb is 88 mph. Normal cruising power is between 2200 and 2700 rpm, depending upon altitude.

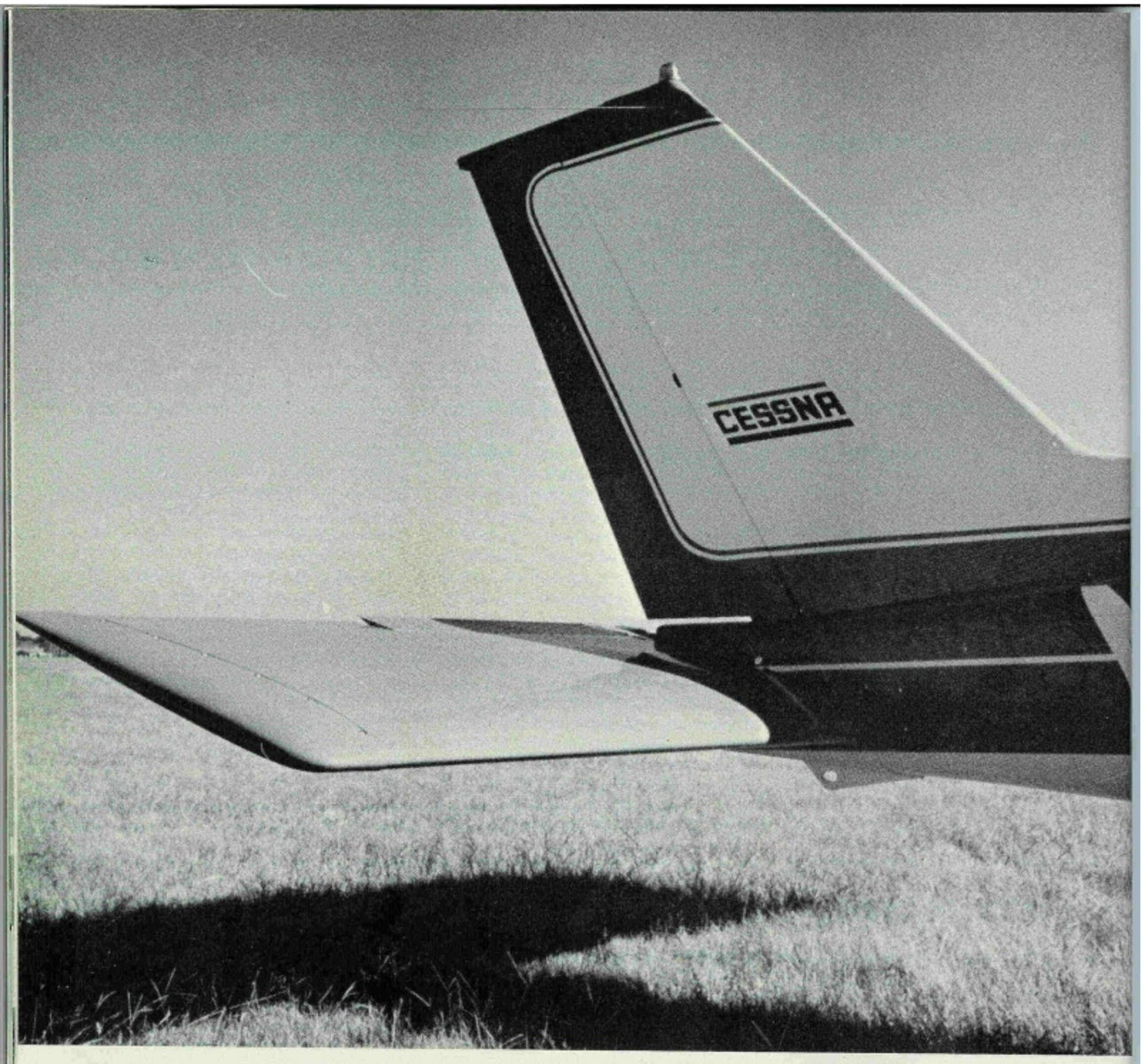
A word should be said here about the arrangement for actuating the flaps on the Cardinal. It is an electric tab, but now similar to the one on the Cessna Skymaster. There is a notch at one-quarter flaps so that the pilot, without looking, can fly either one-quarter flaps or full flaps. This is a minor change but will prove of considerable advantage to the pilot.

The top speed of the Cardinal is given as 144 mph with cruise at 134 mph. The standard Cessna 177 is rated at three or four mph slower. The only apparent reason for this is the lack of wheel fairings.

Landing the Cardinal follows a familiar procedure. Fuel mixture is rich. Carburetor heat is applied if needed. The approach speed is between 80 and 90 mph. Flaps can be applied to the first notch at 130 mph and full flaps at slower than 105 mph. With full flaps, the Cardinal can be bagged in as slowly as 60 to 65 mph. The flare-out is easy, but speed is lost more slowly than with the Cessnas that have greater frontal area. The proper touchdown is on the main wheels. The rudder control is not unusually sensitive, so there are no directional problems.

The Cardinal is a very nice plane to taxi. It can be cooled down nicely on a hot day. The steering is quick and very responsive. Turns at 180 and 360 degrees in close quarters can be ac-

That smooth aluminum-and-fiberglass cowl has a different shape from the Skyhawk and sports only one exhaust stack — which means there's a four-cylinder Lycoming inside.

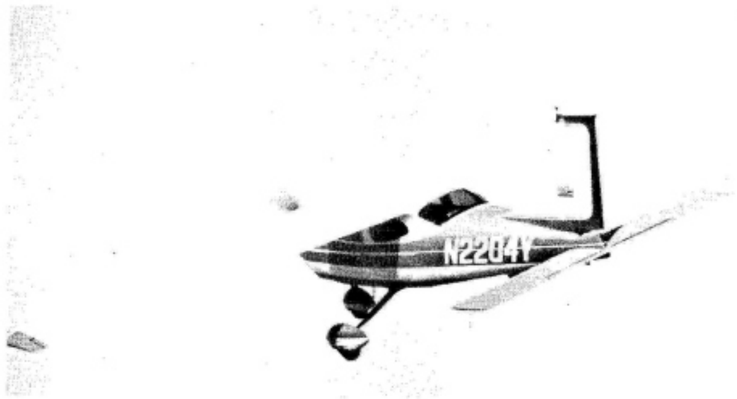


PLANE & PILOT MAGAZINE
INFLIGHT TEST REPORT

Flying Time Three Hours

TEST PLANE	CESSNA CARDINAL
BASE PRICE	$14,500
YEAR	1968
DESIGN TYPE	High-wing monoplane
PILOT & PASSENGER CAPACITY	Four
GROSS WEIGHT	2,350 pounds
EMPTY WEIGHT	1,415 pounds
USEFUL LOAD	935 pounds
BAGGAGE CAPACITY	120 pounds
NUMBER OF DOORS	Two
POWER LOADING (LBS/HP)	15.7
WING LOADING (LBS/SQ FT)	13.6
LANDING GEAR TYPE	Fixed tricycle
WINGSPAN	35 feet, 7.5 inches
WING AREA (SQ FT)	173
OVERALL LENGTH	26 feet, 11.5 inches
OVERALL HEIGHT	9 feet, 1 inch
WHEELBASE	6 feet, 5 inches
WHEEL TREAD	8 feet, 3.5 inches
PROPELLER SIZE	76 inches
PROPELLER TYPE	Fixed-pitch, aluminum
FUEL CAPACITY	49 gallons
NUMBER OF ENGINES	One
MAKE OF ENGINE	Lycoming
PISTON OR TURBINE	Piston
NUMBER OF CYLINDERS	Four
SUPERCHARGED	No
HORSEPOWER RATING	150
CARBURETOR OR INJECTION	Carburetor
TOP SPEED	144 mph
CRUISING SPEED, 75% POWER	134 mph
GALLONS PER HOUR, 75% POWER	7 to 8
RANGE, 75% POWER	780 miles
SERVICE CEILING	12,700 feet
RATE OF CLIMB	670 fpm
TAKEOFF RUN	845 feet
TAKEOFF DISTANCE TO CLEAR 50 FEET	1,575 feet
LANDING ROLL	400 feet
LANDING ROLL CLEARING 50-FOOT BARRIER	1,135 feet
STALL SPEED, FLAPS DOWN	About 40 mph IAS
BEST RATE OF CLIMB SPEED,	88 mph

The easiest ways to distinguish the Cardinal from its relatives in flight are the absence of wing struts and the radically different engine sound.



Another Cessna departure from custom is this completely movable stabilator, which seems to impart a slightly different feeling to the controls during stalls, slow-flight, and landing.

complished with ease.

The instrument panel has been revised extensively. It is canted five degrees for better viewing from the left seat. Illumination at night is accomplished by lighting the bottom two-thirds of the panel by an overhead light, while the upper third of the panel is lighted from beneath the overhang. This same overhang minimizes reflections during the day. Just about everything has been provided for on the panel. There is a place for marker beacons. The fuel pressure gauge is new. The jack for headphones is difficult to find, since the lettering is blocked by the primer lever. The fuel shutoff lever is located on the left side of the console, and the knob is visible only when pulled back into view. Thus, if you cannot see the knob, the fuel has not been shut off. The directional and horizontal gyros are of the non-tumbling type. As standard equipment, the Cardinal has a turn coordinator, which looks as if it is made by Brittain. It is perhaps ironic that the turn coordinator is standard, and there is now an extra charge of $10 for those who prefer to have the old needle and ball indicator in its place.

The Cardinal flown for the test flight had the outer ring on the airspeed indicator for making corrections for temperature and altitude. This unit has been an optional extra on Cessnas for some time. On virtually every Cessna flown, however, the temperature digits cannot be read from a normal position, because the surface of the instrument panel overlaps the ring too far and blocks the view. This is an inconvenience that calls for a prompt factory fix.

With the Cardinal, Cessna introduces its own wing-leveler system. This unit, which is attached to the turn coordinator and the vacuum system, simply keeps the wings level automatically. It is an extra-cost option and runs about $1,000 on the Cessna 177 and about $550 on the Cardinal. However, the Cardinal flown for the purpose of this report was not equipped with the wing-leveler, since it had in the panel the Cessna Nav-O-Matic 300. This is a single-axis autopilot offering two-directional control. With it, the pilot can dial in turns to a preselected heading, hold to an omni, or intercept an omni radial and track inbound. On the Cardinal, this is an $1,800 extra. For those who want the most, there is a Nav-O-Matic 400 for $3,700 extra, and this has the same features as described for the 300. In addition, it offers an altitude hold, and climbing or descent is dialed in by the pilot.

We tested the Nav-O-Matic 300 briefly during the flight by tuning it to the omni setting and tracking inbound to the Wichita VORTAC. The unit is simple to operate.

Such extras, of course, take the Cardinal up into a much higher price class. At the present time, it is a lot of aircraft for the money. Insofar as equipment is concerned, those items standard on the Cardinal which are not on the Cessna 177 include the two gyro instruments, the rate of climb indicator, the turn coordinator, a few other odds and ends, and more luxurious appointments, including the wheel fairings.

The Cardinal looks very different from other high-wing Cessnas. The styling is low and sleek. As a matter of fact, the floor of the cabin is only 23 inches from the ground. The landing gear has departed from the Cessna steel strut practice — although the effect is now much the same. The main gear legs are conically tapering tubes which flex forward, backward, up, and down to keep the plane smooth and level.

All in all, the plane is decidedly a surprise from this phenomenally successful manufacturer, and it will be interesting to watch how it's accepted.