

# POPULAR SCIENCE

FOUNDED MONTHLY 1872

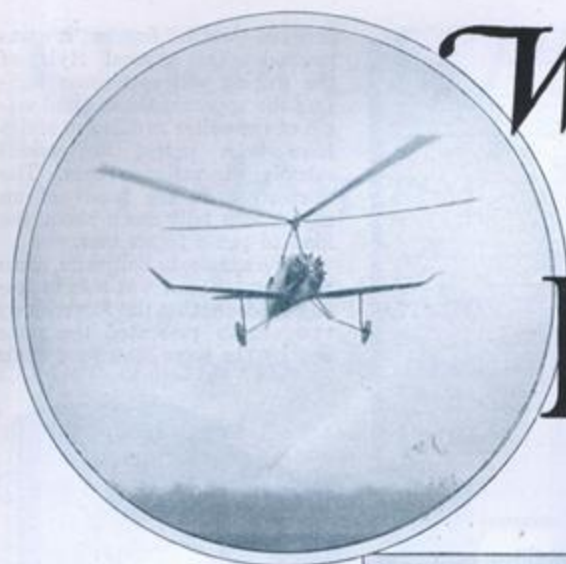
MARCH • 1931

25 CENTS



Successful Helicopter!

See actual photographs page 70



# Will Autogiro Banish Present Plane?

By ASSEN JORDANOFF

At thirty miles an hour, the autogiro drifts lazily along far above the earth.

I HAVE just had the biggest thrill of my twenty years of flying. I have piloted an autogiro. And I have seen this amazing windmill plane "do the impossible."

It is, I am positive, the flying craft of the future.

At Pitcairn Field, fourteen miles from Philadelphia, Pa., James Ray, chief test pilot for the Pitcairn-Cierva Company, explained the design of the strange machine and took me for a passenger hop. We landed at the far side of the field. The spinning windmill over our heads slowed down. Its four yellow vanes, long and slender like blades of grass, drooped to a standstill above the bright green fuselage. Ray climbed from the rear cockpit.

"All right," he said, "you can take her up now."

I settled into the pilot's cockpit and buckled the safety strap. Ahead of me, at the nose of the conventional fuselage, was a 225-horsepower Wright Whirlwind engine and its steel propeller. Beneath me was the small black stabilizing plane with ailerons and curiously upturned ends. At the rear were the usual tail surfaces of an airplane. But above me was the striking feature of the strange machine.

At the top of a mast of three black steel tubes was the "rotor head" to which the long windmill, or rotor, vanes were attached. Each vane was free to move up and down. When the ton and a half mass of the machine is supported by these vanes there is nothing to keep them from "coning up," like an umbrella turned wrong-side-out—except centrifugal force!

The only bracing wires on the windmill are small "droop wires" placed above the vanes to keep them from dropping to the ground and becoming damaged when at a standstill. In an autogiro, you "ride on centrifugal force." By the time the windmill is spinning at a hundred or more revolutions a minute, centrifugal force is stiffening out the vanes with a pull of



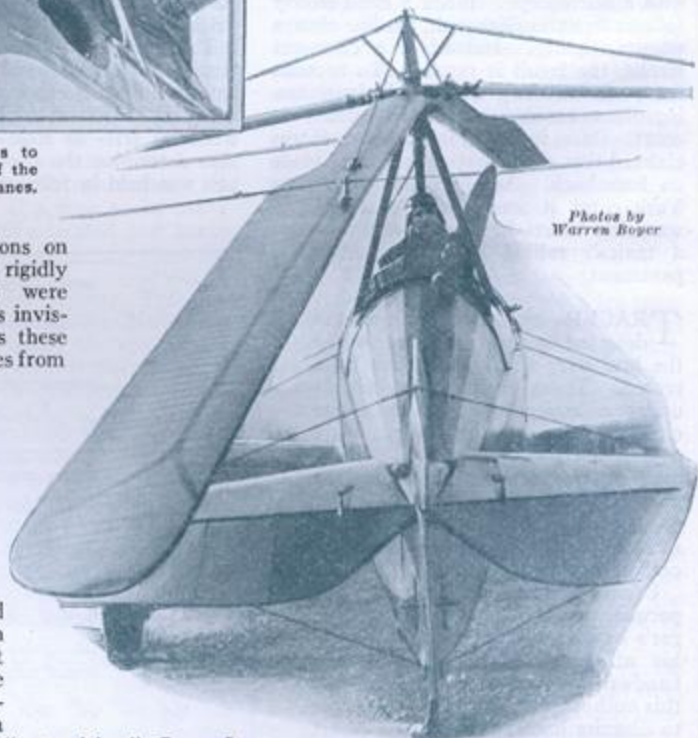
James Ray, right, explains to Jordanoff the mechanism of the new plane's windmill vanes.



Pulling out the knob on the instrument panel connects the vanes with the motor.

more than two tons on every blade. As rigidly as though they were made of steel, this invisible bracing keeps these almost flimsy blades from folding upward.

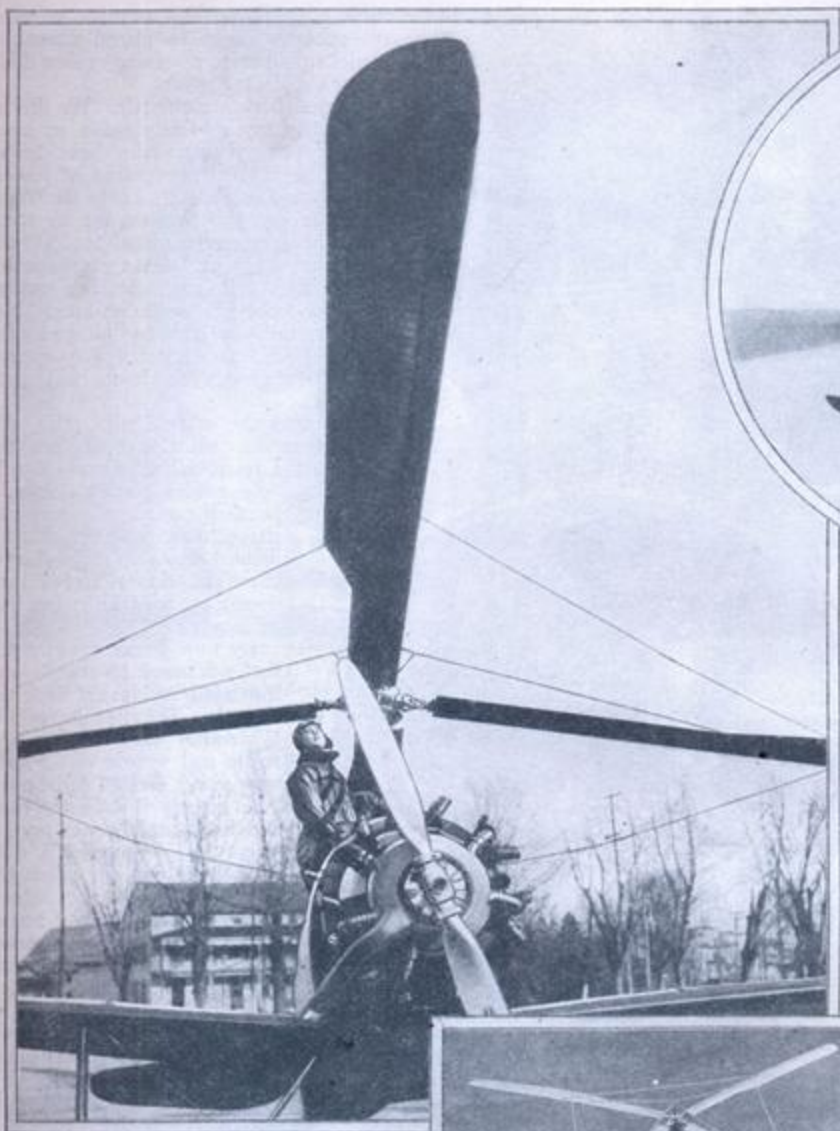
Ray pointed to a small lever at the right of the instrument board marked "rotor brake." That, he explained, holds the windmill from being turned by the breeze when the machine is at rest. Below the center of the instrument panel was a large knob labeled "rotor drive." Instead of taxiing back and forth across the field to get the rotor spinning, the Pitcairn machines are equipped with a drive shaft



Photos by Warren Roper

Jordanoff, in cockpit beneath drooping vanes, ready for his first autogiro flight. The autogiro, except for the horizontal windmill vanes overhead, has the appearance of an ordinary plane.





Jordanoff studies the great, flimsy-like vanes, held rigid in flight by centrifugal force.



"I had hardly moved the stick," says Jordanoff, "to lift the tail, when the ship shot up."

told me, the checkered light and shadow made by the whirling rotor sometimes distracts a pilot unfamiliar with the machine.

Now the whistling sound of the rotor was drowned in the roar of the whirlwind. It was bellowing at 1,500 revolutions a minute. The windmill was streaking around at 118. I was ready to take off.

I shoved in the knob of the rotor drive. Hereafter, the air striking the vanes would prevent them from slowing down. I slipped my feet from the brake pedals to the rudder pedals. The released ship raced down the field. I had hardly moved

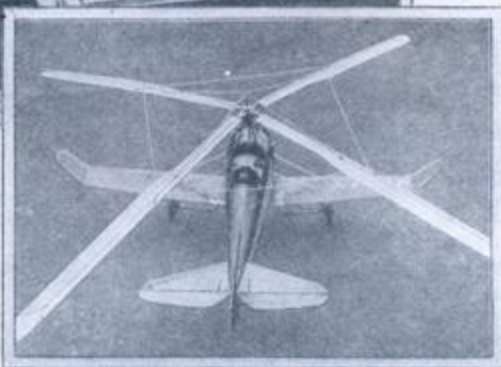
the stick to lift the tail when the ship seemed snatched into the air. An ordinary airplane runs several hundred feet before it takes off, often at a mile a minute speed. The autogyro gets off in less than thirty yards and takes to the air at twenty-five miles an hour.

I was climbing at a steep angle. The fact that an autogyro will take off at an angle from fifty to ninety percent steeper than an airplane has led it to be hailed as the "back yard plane" of the future. Any plot 400 feet square, I was told, will make a four-way flying field for a "windmill plane." Already, a five-passenger cabin autogyro is under construction in England for land-

ing and taking off on roof tops and small plots in large cities.

For private owners, little machines with ten-foot vanes are entirely practicable, designed with vanes that fold together like the blades of a jackknife so the machine can be stored in an ordinary garage.

At an altitude of 600 feet, I leveled off. I had the queer sensation of flying a plane with the wings gone. I glanced upward. The vanes of the rotor were still milling around at dizzying speed. The air was bumpy, filled with up and down currents. But the flexible structure of the machine "ironed out" these ruts of sky travel. The vanes "give" just enough to cushion the drops. Only occasionally did I have to



The only brace wires on the windmill are small drop wires above the vanes to keep them off the ground.

from the engine, to save time. Pull out the knob and the drive is disconnected. Push it in and it is disconnected. In the air, the windmill is never operated by the engine. Its vanes are turned by the air rushing past them.

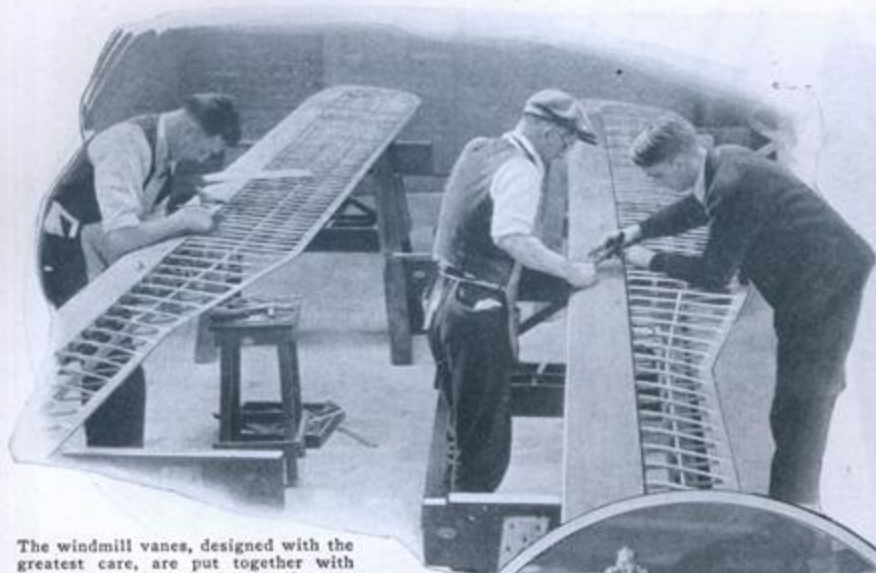
This brings up a common misconception. Many people think the autogyro is a form of helicopter; that its whirling windmill pulls it vertically upward. This is not true. Each vane is a separate airplane wing. It lifts, just as does the usual aircraft wing, by moving rapidly through the air. In the ordinary airplane, the amount of lift given by the supporting surface is entirely dependent upon the forward speed of the machine. Because the vanes of the autogyro turn at high speed, they continue to exert their lift even when the craft has come to a standstill.

With the Whirlwind idling, I pushed ahead on this lever, freeing the windmill. Then I pulled out the knob. The long vanes, extending far out beyond the nose and the tail of the fuselage, began to move. Directly above the knob on the instrument panel is a round-faced dial. It shows the revolutions per minute of

the rotor. Between it and the engine tachometer, a white card gives the number of revolutions of the rotor at different engine speeds.

With my feet on the brake pedals, holding the landing gear wheels, I watched the two instruments. The needle of the engine tachometer advanced to 800. The merry-go-round above my head moved faster. The rotor tachometer showed it was turning sixty-three "revs" a minute. When the Whirlwind was turning 1,000, the rotor was making seventy-nine. The machine rocked and vibrated as the forty-eight-foot windmill speeded up. Faster and faster the reflections of the vanes raced across the glistening black surface of the stabilizing wing. On sunny days, Ray





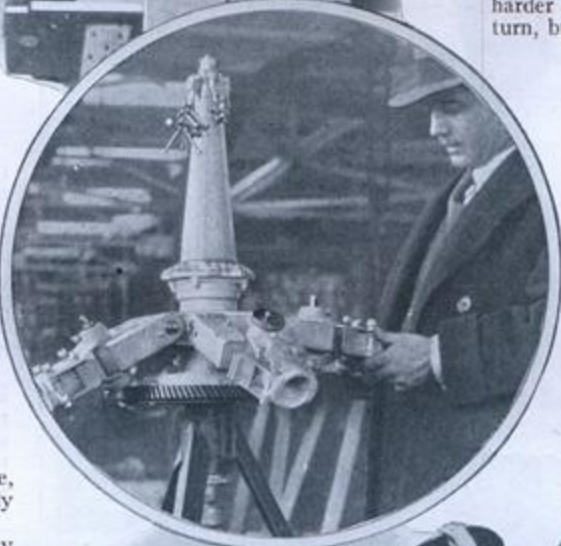
The windmill vanes, designed with the greatest care, are put together with the utmost accuracy in the factory.

move the standard airplane controls by which the machine is guided. The plane almost flew itself.

I pulled back the stick and climbed to 1,200 feet. An autogiro's ceiling is around 20,000 feet; its high speed, over two miles a minute. Cierva, its inventor, is planning a racing autogiro which is expected to pass the 200-mile-an-hour mark. The "windmill craft" has withstood vertical dives at 140 miles an hour carrying 600 pounds of sand. It will do anything an airplane will do and, while these stunts have not been attempted yet, there is no aerodynamic reason, Ray told me, why they cannot loop the loop and fly upside down.

At the top of the quick climb, I got my only scare on the flight. I leveled off suddenly. I was watching the rotor tachometer at the moment and saw the needle drop back from 115 to 105. The rotor had lost ten revolutions. Was it slowing down? I shot a glance up at it. The vanes seemed turning slower and slower. But when I glanced back at the instrument the needle was back at 115 again.

Later, I learned that at the top of a fast climb, when the load on the vanes is suddenly lightened, they lose about ten revolutions. But as soon as the weight comes back on them again, they speed up. The greater the weight on the "windmill," the faster it turns. Tests have shown that



In circle, Jordanoff examines the manner in which the vanes are attached to the plane. Above, Ray, right, explains to Jordanoff exactly what the vanes are designed to do.



At left, Jordanoff and Ray inspect the landing gear. In his first landing Jordanoff expected a rough jolt when he hit the ground but he struck with only a slight jar.

there is no conceivable position in which the autogiro might be placed where the blades would cease revolving or slow down below the danger point.

I eased back the throttle. We drifted across the sky at thirty miles an hour. Rolling Pennsylvania hills, light brown winter fields, bluish orchards of leafless trees, spread out below. I gave the Whirlwind the gun and watched the air speed indicator hand creep ahead to 50-70-90-115 miles an hour. On a cross-country flight, the autogiro can maintain a cruising speed of ninety-five miles an hour. In a flight from Philadelphia to Chicago for the National Air Races last fall, Ray covered the 700 miles in six hours and forty minutes.

One after the other I tried skids, side slips, climbing turns, feeling out the machine. I found I had to press slightly harder on the rudder pedal to make a turn, but the stick control was more sensitive than on an ordinary plane. The ship made sharper turns at slower speeds than would be possible in the best of airplanes.

By now I was down to 800 feet. I nosed up slightly into the wind and eased back the throttle. The thunder of the Whirlwind sank away. The rustle and whistle of the spinning vanes seemed to increase. The air speed indicator hand slid back until it was nearing twenty. I was trying a stall. Already I was far below the flying speed of the lightest plane. Subconsciously, I braced myself for the terrific downward plunge or the dizzying

tail spin that follows a stall in an airplane. But nothing of the kind happened. We seemed floating in space.

I looked over the side of the cockpit. We were directly above the high water tower at the edge of the field. The yellow letters circling its top: "PITCAIRN FIELD," were slowly rising toward me. I was settling straight down through the air. The ship was coming down out of the sky like an elevator.

The faster the autogiro settles, the faster the rotor spins, just as a windmill speeds up when the breeze freshens. No matter at what altitude the machine is stalled, it merely settles. In the "flying windmill," the deadly tail spin is unknown. The reason is that the wings continue to rotate at hundreds of miles an hour and so maintain flying speed even though all forward movement of the craft has stopped.

It was a tail spin that led Juan de la Cierva, the Spanish designer, to invent the autogiro. (Continued on page 146)



## MEN WANTED 20 to 35 years old

# RADIO

## First Lesson Free!

Broadcasting  
Television  
"Talkies"  
Manufacturing  
Service  
Sales  
Auto-Radio  
Aviation

### See how easy to learn

See how quickly you can get ready for well-paid positions in fastest growing, most prosperous industry.

Big demand right now from employers for broadcast operators, test-ers, inspectors, service-men, designers, installers, and "trouble-shooters".

### \$40 to \$75 a week—and more!

With free radio lesson we'll send you our amazing combined training and employment agreement—good for help in securing a beginner's job when you're only half way through. Guarantees you help in finding a position, satisfactory in salary, after you finish, or money refunded.

### A World of Opportunities to Choose From

Rockefeller is building a \$500,000,000 "radio center" in New York. 20,000 movie theaters have gone "talkie". Auto-radio is selling like wild-fire. Midget sets are selling at rate of 10,000 a day! Aviation, television, servicing, sales—all these mean highly paid jobs and plenty of them. All you need to get one is the kind of training we give you, backed by a real placement service.



RADIO TESTER  
GIVEN

\$20.00 set analyzer and trouble-shooting job-tickets a part of this training without extra charge.

### Lesson FREE! Mail Coupon

for free radio lesson and book of thrilling facts about this wonder-industry and how to "break in."

**American School**  
Dept. R-348, Drexel Ave. &  
58th St., Chicago

THE AMERICAN SCHOOL  
Dept. R-348, Drexel Ave. & 58th St., Chicago  
Please send without cost or obligation, free radio lesson and job ticket and radio bulletin.

Name \_\_\_\_\_ Age \_\_\_\_\_

St. No. \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

## LEARN AVIATION

—Where "Lindy" Learned!  
Do You Earn \$550 per Month!

Aviation pays big! Air mail and transport pilots received an average salary of \$550 per month during the past year. Mechanics also make good money.

Get into Aviation As Pilot or Mechanic... Special openings for property-trained pilots and mechanics. Our Flying Courses qualify you for best pilot positions. Our Mechanics Course equips you for a good job as Master Airplane Mechanic. We teach you by factory standards.  
Complete Mechanics, Pilots', Radio and Welding Courses. Also Home Study Course. Ground and Flying School government approved. \$20,000 worth of buildings and equipment. Mechanics' School tied in with large-production airplane factory. Reasonable tuition. Part time employment. Write for details, stating age!

**LINCOLN AIRPLANE & FLYING SCHOOL**  
216 Aircraft Bldg. Lincoln, Nebraska

## WILL AUTOGIRO BANISH PRESENT PLANE?

(Continued from page 30)

Although few people know it, Cierva was a famous airplane designer before he turned to his windmill craft. He built the first successful biplane in Spain and constructed the first tri-motored tractor in the world.

In 1910, when he was fourteen years old, he got into the air in a homemade glider by hiring a dozen boys at a penny apiece to pull him at the end of a long rope. Two years later, with a total capital of sixty dollars, he started his first motored machine. The propeller was carved from the wine-soaked wood of an old bar taken from a deserted inn. It was several pounds heavier on one end than the other, so the plane flew like a bucking broncho—but it flew.

LATER, in 1918, he designed a huge, eighty-foot, tri-motored passenger plane that was flown successfully. But the over-confident pilot stalled it in landing and spun into the ground. That spin led Cierva to believe that something was wrong with the entire system of airplane flight. He sought other means of getting off the ground; tried wing-flappers and helicopters. Finally, he worked out the whole theory of the autogiro on paper before he built even a model.

His first machine was built in 1920. It and several others that followed failed to fly. It was not until he gave the vanes complete freedom and depended upon centrifugal force that he succeeded. The first flight over a closed circuit in an autogiro was accomplished at Madrid, Spain, in 1923.

At the Pitcairn factory, machines have been flown practically every day for the past two years. They have been tested thoroughly and are to be put on the market in quantity production this spring.

For about 100 feet, I continued to settle toward the tower. Then I pushed the stick downward, picked up flying speed, and gave the Whirlwind the gun. I swung to the far side of the field and came in for a landing. This can be accomplished in two ways: either by gliding in, as in an airplane, or by "settling in" by a vertical descent. For my first landing, I picked the one I knew best and drifted in with a long slow glide. When I was twenty feet off the ground, I pulled back the stick. The nose of the ship rose and the whirling vanes checked our forward speed just as a crow spreads its wings and checks itself as it alights in a cornfield.

The autogiro is the only heavier-than-air craft that can slow down suddenly. Once Cierva took off toward a row of high trees, saw he could not clear the barrier, jerked back the stick at the last instant, and sat down seventy-five feet from the obstacles. An airplane would have crashed.

I HAD expected a terrific jolt when we hit the ground. Instead, we landed with a comparatively slight jar. Even when the ship descends vertically from high in the air the jolt of landing is about that of crossing a rough railroad crossing at twenty-five miles an hour in a well upholstered automobile. Because there is no long run after touching the earth, an autogiro can sit down on rough ground, even between frozen potato rows, without damage. Any small open space, wider than the windmill, serves as a landing field.

At the National Air Races, Ray was flying from Cicero, Ill., to the field where the contest was held when his engine cut out. He pulled back the stick and settled down on the pavement of a highway directly between two telephone poles, without the slightest damage.

In the thousands of hours that autogiros have been flown, nobody who has piloted

one has been seriously injured. Once, a vane broke off high in the air and the pilot was only shaken up and bruised in landing. That accident occurred when Cierva was experimenting with rigid vanes. Since they have been made flexible there has been no repetition of the trouble.

Before the windmill lost momentum, I shoved the throttle wide open and took off on my second hop. Just clipping the tree tops, I cruised over the countryside at thirty-five miles an hour. A farmer chopping wood in a field stopped to look up. I waved and he waved back.

The most fun in flying is to fly low. And that is as dangerous as dynamite in an airplane. You have to fly up at 2,000 or 5,000 feet to have a safe gliding range in case the engine stops. Such flying is monotonous. It is like passing over a huge map. People are the size of pin heads. You want to see what is going on but dare not take the chance.

All this is changed with the autogiro. You can fly low and slow with safety. In case of engine trouble, you can drop down into any open space; you don't have to pick out a wide and level field.

THE more I flew the autogiro the more enthusiastic I became. Anyone who can learn to drive an automobile can learn to fly a windmill ship. Safety in an airplane depends more on the skill of the pilot. In an autogiro the human factor is reduced immensely. Ninety percent is taken care of by the machine itself.

They told me a student could master a windmill plane in a quarter the time it takes to learn to fly an airplane. The danger of the take-off is eliminated; the difficulty of landing is done away with; the menace of stalling and getting into a deadly tail spin is gone. It is the first plane designed for the average person.

After nearly half an hour in the air, I climbed to 1,000 feet above the center of the field and "settled in." Holding the ship level with the ailerons, I looked over the side of the cockpit and watched the yellow-brown rectangle of Pitcairn Field slowly expand as I settled toward it. A small chrome-yellow training plane scudded below me and sat down on the field with a long run, then taxied to the hangars. I was dropping slightly faster than a walk.

IT WAS like drifting down in a balloon. The earth seemed moving up to meet me. I had no sense of descent. There was no up-draft hitting my face. The spinning vanes above push down a column of air as well as act as a parachute.

Fifteen feet from the ground, I pulled back the stick, dropped the tail, and we sat down on three points. The wheels made less than half a turn on their axles; we rolled hardly six inches. I had landed less than a hundred yards from the first take-off where Ray was still standing.

The windmill overhead slowed down. The rotor tachometer hand touched ninety, then sixty, then forty. As they lost speed, the tips of the vanes began to drop. Finally, with the blades held up by the droop wires, the windmill came to a stop. I pulled back the rotor brake lever, locking it in place, and looked over at Ray. He grinned broadly and said:

"Well, now you are one of the first twenty-five pilots in America to fly an autogiro."

"That," I told him, "will be something to tell the grandchildren—when autogiros are everywhere!"