THE SPIN

Following the discussion of several tales of persons involved in uninitiated spin training, or accidental participation in unanticipated spin maneuver, and the discussion of self taught spins gone bad Bill Tinkler was asked to provide input from his vast library reference of vintage documents for the education of others.

Spins are an acrobatic/aerobatic maneuver, and like all unusual operations should not be attempted without proper instruction in proper equipment with full safety gear and precautions.

To do otherwise is foolish.

Spins are not themselves inherently dangerous, but any botched entry or exit can overstress the airplane severely, or result in unfortunate damage to the aircraft and damage to the pilot. If you are a Luscombe owner, your airplane is a 60+ year old design, and likely has been modified and repaired many times. Despite maintenance to maintain 'type design' , there are changes in condition likely to exist of which the operator is unaware, and for which operational discretion should be undertaken.

Please read and enjoy. The end of this section is a reprint of the CIVIL PILOT TRAINING MANUAL , Civil Aeronautic Bulletin #23 dated September 1940, provided by Bill Tinkler from his vast aviation library.
(My library is only half vast)

This section is dedicated to Bill whom I regard as a long time friend, Scholar, and wise sage who imparts aviation knowledge and experience. He never gets it wrong, which is why he is here to teach us all today.

Captain William (Bill Tinkler) UAL Retired, has a 50 year, unblemished safety record, recognized by FAA Citation and declaration on January 12, 2005.
Congratulation Captain Tinkler

Thanks Bill for your unwavering safety demonstration

SPINS

Definition.—By definition a spin is "a maneuver in which an airplane descends along a helical path of large pitch and small radius while flying at a mean angle of attack greater than the angle of attack at maximum lift * * * A spin which is continued by reason of the voluntary position of the control surfaces, recovery from which can be effected within two turns by neutralizing or reversing all the controls, is called a normal spin, or controlled spin."[7] The maneuver frequently is called a "tail spin." (See fig. 62.)

Related factors.—A spin is the result of a severe stall which has been developed either intentionally or accidentally. Due to the fact that many fatal accidents have been caused by ignorance of the causes leading up to a spin and of how to recover from it, many students have a deep-rooted subconscious fear of this maneuver. There is no occasion to fear a spin if it is performed under the proper circumstances, one of the most important of which is adequate altitude for recovery.

An airworthy airplane will recover from a spin of its own accord if the controls are released. The maneuver imposes much lighter loads on the structure than a steep bank. This assumes it is properly performed, particularly with respect to recovering from the dive which follows the spin.

It is entirely possible to build an airplane which is spin-proof; in fact there are spin-proof ships now on the market. Such a ship, however, may have characteristics which render it unsuitable for certain training purposes. Since most airplanes will spin under proper circumstances, it is necessary for a competent pilot to be familiar with the maneuver, particularly the approach to it and the recovery from it.

The training in spins is divided into two phases. First is that given prior to solo, which is confined to the fundamentals of entry and recovery and the development

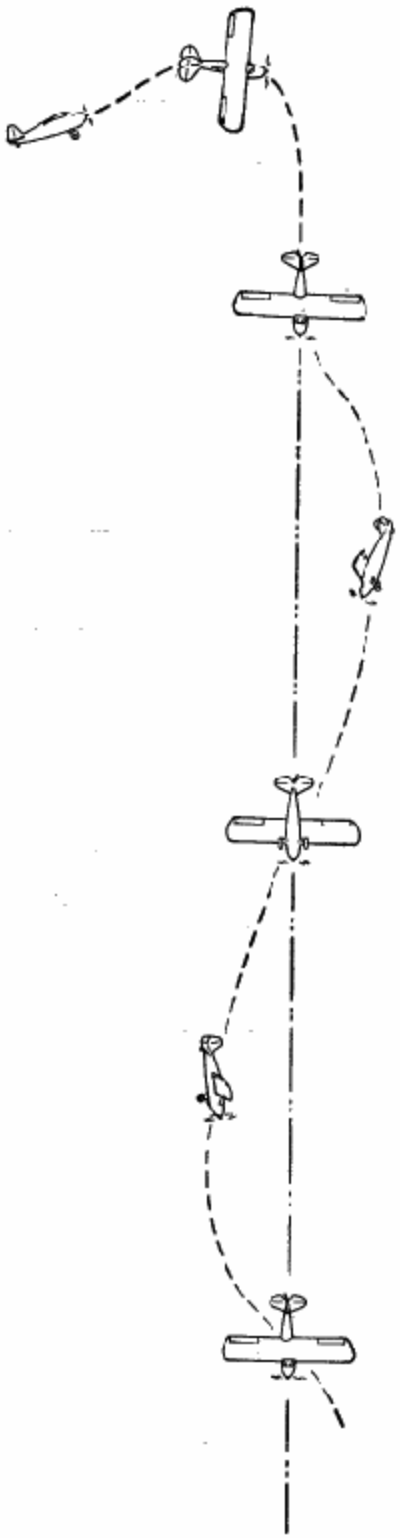

Figure 62.—The spin.

[7] Report No. 474, Nomenclature for Aeronautics.

in the student of confidence to the extent which will enable him automatically to react properly should he accidentally fall into a spin in his early solo work, and give him sufficient experience in sensing the approach of a spin to make such an accident a remote possibility. The second phase of training in spins is that given after solo, during the practice of precision maneuvers, which will teach the student orientation under adverse conditions, accuracy of judgment and timing, and further the perfection of the development of his senses or feel as applied to flying.

Only the first phase will be discussed here. The second will be covered later in stage C of the Restricted Commercial Course.

Before starting a spin, the airplane always should be climbed to a safe altitude—never less than 3,000 feet. If the ship is not stalled completely it may refuse to spin and instead fall into a sloppy spiral. Ships which do not spin readily, even from a full stall, often may be induced to spin by opening the throttle just as the wing drops and closing it again immediately. Easing off on the controls even after a spin is begun is likely to cause the ship to stop spinning and go into a spiral instead.

The loss of altitude during the stall preceding the spin particularly should be noticed and also the feel of the ship. The latter is very important since in making precision landings later on in the course the student is forced to give his attention to the objective rather than the maneuvering of the airplane and, unless the sensations preceding a spin are impressed thoroughly on his mind, he may get into difficulty at low altitudes.

After the student has had some practice in spins from straight stalls, he will be shown by the instructor how a spin can develop accidentally; spins may occur, for example, in an improperly performed steep bank, either as a result of the nose being allowed to get too low or from pulling the turn too tight. In the first case, the airplane is flown into the spin and in the second it falls into the spin as a result of the stall caused by "squashing."

He will also be shown how spins may result from a climbing turn, as a consequence of a too steep climb combined with a skid, and as a result of too shallow a glide, an improper gliding turn, or a skid in a normal turn. In any of these, the resulting stall can develop into a spin.

Some beginners experience a certain amount of dizziness in a spin. This usually is caused by maintaining a fixed stare over the nose of the airplane. The student should force himself to remain relaxed and to observe objects on the ground rather than letting it spin before his eyes. If the vision is concentrated on a given object and held there as long as possible by turning the head, and then the same object is picked up again as soon as possible by turning the head in the other direction, there is little likelihood of dizziness. Furthermore, this practice will be of great value in the execution of precision spins where recovery must be made after a definite number of turns or fractions of a turn.

Execution.—When a safe altitude—3,000 feet or more—has been attained, the throttle should be closed and the ship fully stalled, with the stick hard back. This should be done smoothly and gradually. Just before the nose begins to sink, full rudder should be applied on the side toward which it is desired to spin; that is, right rudder for a right-hand spin or for clockwise

rotation, and vice versa. The ailerons should be kept in neutral through the entire maneuver. The stick should be held all the way back and the rudder hard over until it is desired to stop the spin. Both right and left spins should be practiced.

Recovery.—Recovery from a spin can be accomplished in most of the airplanes used for instruction by simply relaxing pressure on the rudder pedal and then on the stick until the controls are in neutral. Many airplanes will recover before the controls have reached the neutral position; in a few it may be necessary to use opposite rudder and move the stick forward of the neutral position.

The ship will come out of the spin into a straight dive at a fairly steep angle, the steepness depending upon whether the stick reaches neutral before the spin is stopped or whether recovery occurs while the stick is still well back of neutral, as is often the case. Recovery from the dive is accomplished by easing back on the stick when flying speed has been regained. If the stick is pulled back too quickly, the ship will simply stall again. If it is not brought back quickly enough, excessive speed will be acquired, which causes unnecessary loss of altitude and causes heavy loads to be imposed upon the structure during the pull-out. After establishing a normal glide, the throttle should be eased open and straight and level flight resumed.

Particularly in light aircraft, it should be remembered that the wings are designed for a certain maximum diving speed. There is no need to acquire much, if any, more than half of this speed in recovering from a spin. However, particularly at first, excitement may cause neglect of this important factor, with possible structural failure as the result. The airplane should be allowed to reach only enough speed to reestablish adequate control. This need not be more than 5 to 20 percent greater than the normal gliding speed.

Reasons for specified use of controls.—From the definition of a spin, it will be noted that the angle of attack is greater than the angle of maximum lift. Unless this high angle is maintained, the ship will not continue to spin and it is for this reason that the stick must be held hard back during the maneuver. The effect of the rudder when the ship is in a stall has already been demonstrated in the practice of stalls. If the rudder is not held fully over, there is a likelihood of stopping the rotation of the ship and producing an ordinary stall or the sloppy spiral already mentioned. The ailerons should not be used, because if the stick is moved to the same side as the rudder, the aileron on the high wing will be down and tend to reduce the speed of that wing. On the other hand, if the stick is moved to the opposite side, the aileron on the low wing will be down, tending to slow the wing down even more, and, in some ships, producing a flat spin from which recovery may be less simple.

Common faults.—1. Using controls too hesitantly in entering the spin, due to an unconscious reluctance or nervousness.

2. Relaxing on controls too quickly after entering spin.

3. Use of ailerons, particularly opposite aileron, in an instinctive effort to lift the low wing.

4. Pulling out of dive too quickly upon recovery.

5. Not pulling out of dive quickly enough.

Execution.—Head into wind, select the point on which the nose is to be held, throttle the engine and gradually stall the ship by pulling the stick back just fast enough to keep the nose slightly above the horizon. Apply rudder on the side toward which it is desired to fall first, holding the stick hard back. As the wing drops, apply full opposite rudder. As soon as the nose comes up and the other wing tends to drop, reverse the rudder again. The maneuver may be continued through as many such stalls and recoveries as desired, but not below 1,500 feet. Each time as the nose comes up, it should bear on the point selected. The ailerons are not used.

Recovery.—Recovery is extremely simple, consisting merely of neutralizing the rudder and easing the stick ahead until flying speed is regained.

Reasons for procedure.—An airworthy airplane will not spin to the right if full left rudder is being applied and vice versa. Accordingly, by applying full rudder on the side opposite to the low wing, the incipient spin in one direction is checked and a tendency to spin in the opposite direction is created.

By holding the stick hard back, no appreciable dive is permitted and the ship is brought out from a fall to one side and prepared for one to the opposite side in the quickest manner possible.

PRECISION SPINS

Definition.—The precision spin is a spin in which the entry and, more particularly, the recovery are made in a specified direction.

Related factors.—While the precision spin basically is the same maneuver as the spins previously discussed (see p. 137), the requirements of precise execution and accurate and controlled recovery aid the student materially in further development of an understanding of control action, knowledge of the characteristics of the airplane being flown, and orientation under difficult circumstances. The maneuver never should be started with less than 3,000 feet of altitude and never should be continued through more than three complete turns.

The entry technique will vary greatly, depending on the individual characteristics of the particular aircraft being used. However, the airplane must be fully in the spin in a quarter of a turn or less. Skidding spirals, or aimless gyrations of a half to three-quarters of a turn, have no place in the precision spin. With some airplanes, it may be necessary to use a blast of the throttle to start the rotation in order to meet this requirement. As previously explained, this blast is given just as the wing falls, with the elevators hard back and the rudder hard over.

In recovery, the spin must be stopped exactly at any predetermined number of turns or fraction thereof. Usually spins are given and required by half and full turns, that is, one-half turn, one turn, one and one-half turns, two turns, etc. This means that the recovery may be somewhat different from that employed in the spins previously discussed. Some ships will come out of the spin in a quarter of a turn or less as soon as the controls are neutralized. Others require that full opposite rudder and forward pressure on the stick be used to stop the rotation quickly. It is necessary, of course, to know the characteristics of the particular ship being used in order to perform precision spins. Due to the fact that in most airplanes the fin is offset to correct the torque, the response

to the rudder, in both entry and recovery, may not be exactly the same in left spins and right spins.

In any case, careful operation of the controls is essential. If opposite rudder is held too long, the result will be a sideways, skidding recovery. If the stick is pushed too far ahead, or held ahead too long, the dive may go past the vertical so that the airplane begins to approach inverted flight.

Obviously, precision in recovery requires a high degree of orientation. It will be recalled that in the preliminary spin practice, the student was advised to pick a point, or two points 180° apart, on the ground to make it possible for him to know his position throughout the spin. If two points are used, one or the other will be in view all the time. This is the method used by acrobatic dancers to avoid dizziness when pivoting. In the case of the pilot, it not only prevents dizziness but also enables him to keep track of the amount of rotation. In this connection it is advisable to count the turns, as "one-half, one, one and one-half," and so on.

Development of the ability to retain continuous orientation is the main reason for requiring the perfection of technique in precision spins. The only known method of determining whether or not such continuous retention of orientation has been developed is through having the student demonstrate it. Precision spins also develop a higher degree of technique, knowledge of aircraft characteristics, coordination of controls, control touch, and automatic reaction. They particularly develop discipline in the control of reflex actions.

Execution.—The proper altitude should be attained, the throttle closed, and the ship put into the spin, using the throttle, if necessary, to start the spin without delay. The turns should be counted as previously described with respect to objects on the ground. When within approximately a quarter of a turn (depending upon the airplane) of the desired number, recovery should be begun.

Recovery (normal).—Recovery should be made as quickly as possible, using opposite controls (except ailerons) as necessary for the particular airplane. Recovery should be completed within 10° of the specified number of turns.

Common faults.—1. Use of ailerons in entry or recovery. This is strictly prohibited.

2. Relaxation of the controls during the spin.

3. Overcontrol during recovery.

Recovery.—No difficulty should be experienced in recovering from spins in any of the aircraft used for training provided the load distribution is within the ranges specified by the ship's certificate. However, through careless disposition of baggage or errors in rigging, an airplane which normally spins and recovers without difficulty may develop undesirable spin characteristics. Furthermore, since this manual is intended as a guide for the student throughout his flying career, it is felt that he should be given information which may be of great value in flying airplanes with which he is not familiar.

The National Advisory Committee for Aeronautics has done a large amount of research on spins and the material given below is taken from their Technical Note No. 555, "Piloting Technique for Recovery from Spins." Hence the procedure has come to be known as "The N. A. C. A. Recovery."

(*a*) During a spin, particularly during the last three or four turns of a prolonged spin, before recovery is attempted, the ailerons should be neutral and the elevator and rudder controls should be held all the way with the spin.

(*b*) When applying controls for recovery, the rudder should be moved briskly to a position full against the spin and later, after at least one-half additional turn is made, the elevator should be moved briskly to the full down position.

(*c*) In the event of a vicious spin, the applied controls for recovery should be held for at least five turns before attempting any other measure for promoting recovery.

(*d*) Deliberate spins should be started at an altitude of at least 10,000 feet.

(*e*) When any doubt exists regarding the recovery characteristics of an aircraft, a familiarization method consisting of trials or recoveries at various stages of the translation from straight flight to a steady spin should be employed.

(*f*) Too much confidence should not be placed in these or any other rules, however, for no method of recovery can be regarded as infallible for all aircraft.

SAFETY FIRST,
FOREMOST,
AND ALWAYS