characteristic maneuvers and procedures

chapter 5

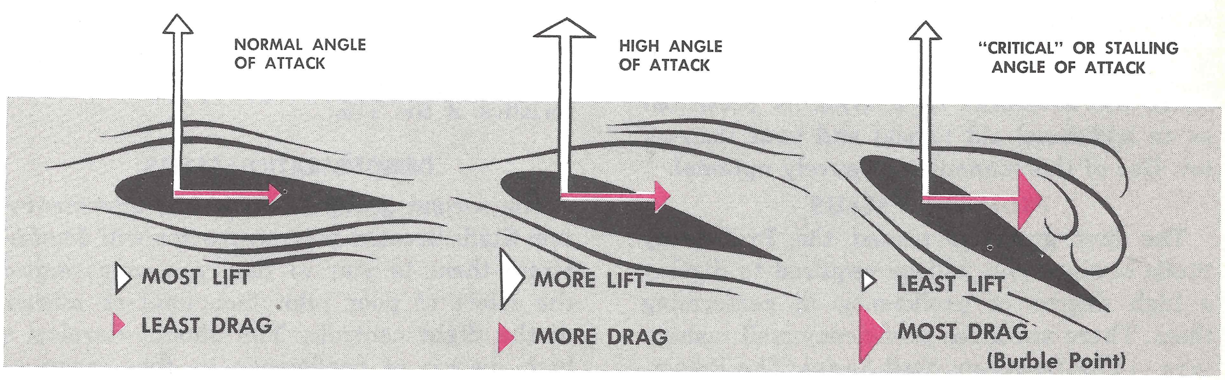
The stall and spin maneuvers presented here are called characteristic maneuvers. These maneuvers are designed to teach you the characteristics of the aircraft and to show you how it reacts in various flight conditions. It is important that you understand these maneuvers and be able to perform them properly as they will enable you to recognize attitudes and characteristics which could lead to abnormal flight conditions. In addition, a thorough knowledge of characteristic maneuvers will aid you in developing proper techniques for coping with abnormal flight attitudes. This knowledge will develop confidence in you as a pilot and show you good reason for having confidence in your aircraft.

THEORY OF STALLS

An aircraft will stall when the force of lift is overcome by the force of drag and/or the force of gravity. When the smooth airflow over the wing surface is disrupted sufficiently and the effective lift is lost, a stall will occur. When an aircraft stalls completely, it becomes a free-falling body and is no longer flying. A partial stall is one in which the various controls are only partially effective.

An aircraft will stall any time its angle of attack is exceeded for the conditions of flight. When the airspeed is extremely low, or the load conditions are great enough, the angle of attack may become greater than the critical or stalling angle. This will cause the smooth airflow to be disrupted, the lift to decrease rapidly, and the aircraft to stall. With these thoughts in mind remember that **AN AIRCRAFT CAN STALL AT ANY AIRSPEED, IN ANY ATTITUDE, OR AT ANY POWER SETTING.**

To become a proficient pilot, you must be able to recognize the flight conditions that are conducive to stalls and know how to quickly apply the necessary corrective action. You will be taught to recognize an approaching stall by sight, sound, and feel.



Lift and Drag

Sight: You can see the abnormally nose-high attitude or the rapid movement of the nose in excessive back-pressure turns.

Sound: You can hear the engine as it begins to labor from the excessive propeller loading. You can also distinguish the diminishing sound of the wind as it blows past the canopy.

Feel: You can feel the control pressures become light and "less effective" at low speeds. During rapid turns, or at high speeds, you can feel the excessive pressure that is forcing you into the seat as well as recognize the excessive pressures that you are applying to the controls.

When an aircraft is stalled, the three control surfaces have lost some, if not all, of their effectiveness. Thus, it is important that you know which control surface begins to lose its effectiveness first.

There is a definite order in which the control surfaces begin to lose their effectiveness. This order is ailerons, elevators, and rudders. The order in which they regain their effectiveness is just the reverse: rudders, elevators, and ailerons. Your instructor will demonstrate the loss and recovery of control effectiveness prior to concentrated stall practice.

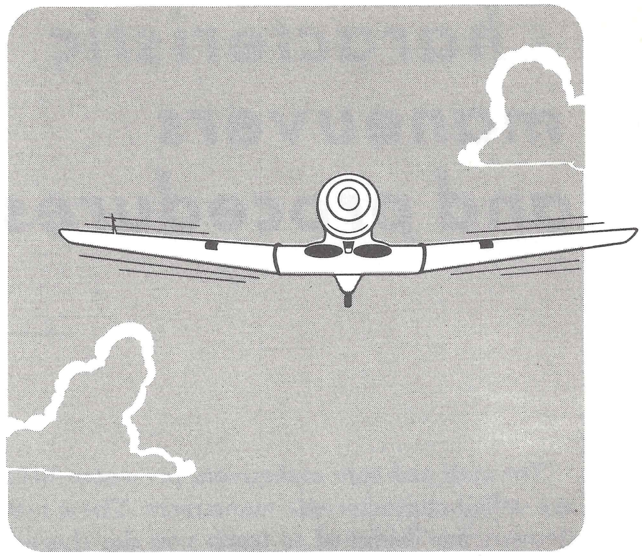
TYPES OF STALLS

The stall maneuvers are divided into two groups: proficiency stalls and demonstration stalls. You are taught both groups to increase your ability in recognizing and recovering from abnormal conditions. They will be practiced at an altitude which will allow you plenty of time to execute safe recoveries. This minimum recovery altitude is 5,000 feet above the terrain.

In addition to the two preceding types of stalls, the APPROACH TO A STALL is presented as an additional aid to you and your instructor. Use of this maneuver is purely optional.

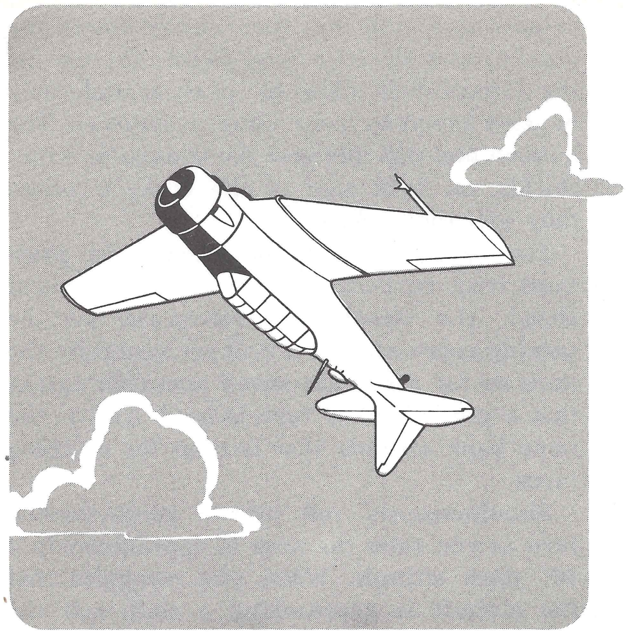
PROFICIENCY STALLS

The first group is named the Proficiency Stalls because you will be required to display a high degree of proficiency in performing them. There are three proficiency stall maneuvers — *The Power-on Stall Series, The Power-off Stall Series,* and *The Landing Characteristic Stall.* Each is important because it simulates a stall condition that could occur from a normal flight maneuver. For example, the power-on stalls are designed to show you what would happen if the aircraft was climbing at an excessively nose-high attitude immediately after a take-off or during a climbing turn. The power-off stalls are designed to show you what would happen if the aircraft was gliding in a nose-high attitude on the base leg, or if an improper turn was made from the base leg to the final approach. The prime reason for the power-off stall straight ahead is to acquaint you with the attitude and flight characteristics of the aircraft in the stall which occurs when landing. The landing characteristic stall is presented to teach you the stalling characteristics of a particular aircraft, so you may anticipate them during a landing. This stall will also demonstrate the stable characteristics of the T-6.



DEMONSTRATION STALLS

The second group is called the Demonstration Stalls because your instructor will demonstrate them to you so that you may realize the effect of poor pilot technique or misuse of the flight controls. You should develop a high degree of proficiency in this group of



stalls. Your instructor will allow you to practice these stalls on dual flights and if you display good aptitude and proficiency, he will clear you to practice them solo. This group of stalls is important because they show you how the aircraft will react in abnormal flight conditions. The demonstration stalls include:

1. *Rudder Controlled Stall,*
2. *The Secondary Stall,*
3. *The Excessive Back-pressure Stall,*
4. *The Excessive Top-rudder Stall,*
5. *The Excessive Bottom-rudder Stall,*
6. *The Elevator Trim-tab Stall,*
7. *The Cross-control Stall.*

Note: At this point, clearing turns are inserted inasmuch as they are necessary for safe execution of all stall and spin maneuvers although the clearing turns are not characteristic maneuvers.

CLEARING TURNS

Before entering any stall or spin maneuver which may result in a large loss or gain of altitude, or a large change in attitude, you must clear the area for proximity of other aircraft. In order to do this, you should execute a series of turns which are called clearing turns.

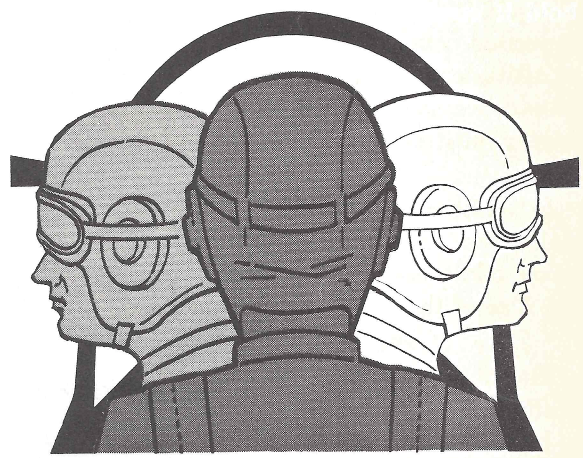
A normal clearing turn is a medium-banked level turn executed to clear the immediate vicinity for proximity of clouds and/or other aircraft. To accomplish a clearing turn, roll into a medium-banked turn and turn 90° while looking above, below, and all around you. In order to clear yourself properly, make at least two of these turns. It is desirable to make these turns in opposite directions, hesitating and clearing after each one. If circumstances dictate otherwise, however, they may both be made in the same direction.

NOTE

Since the operating limits of the gyroscopic instruments may be exceeded while practicing stalls, they should be caged. Your instructor will explain the upset limits of these instruments and will show you how to cage them. Before entering a stall, cage the gyros and call out "GYROS CAGED" to your instructor.

APPROACH TO A STALL — POWER-ON

An approach to a (power-on) stall is just what the name implies, a maneuver in which the aircraft approaches a stall but does not actually stall. (See illustration on page 62.) This maneuver is taught primarily to enable you to recognize an approaching stall through



Look All Around

the three senses of sight, sound, and feel. Later in your training, the approach to a stall will be used as a flight-planning maneuver, that is, to regain altitude that was lost during the performance of a preceding maneuver.

An approach to a stall will normally be performed with the following conditions of flight:

Gyros caged
Throttle at 25″ Hg
Propeller at 1850 RPM
Mixture lean for smooth operation
Gear and flaps up
Canopy fully closed

This maneuver may be executed with the gear and flaps in any optional position but, normally the gear will be retracted and the flaps up.

To execute this maneuver, first clear the area by making at least two medium-banked clearing turns. After you have made certain that the area is clear of other aircraft, initiate control action to raise the nose to approximately a 40° pitch attitude.

As you raise the nose of the aircraft to the desired attitude, maintain directional control with the rudder and keep the wings level by use of the ailerons. Remember that torque will increase as the airspeed dissipates; consequently, you will have to constantly increase the right-rudder pressure to overcome it. Once you have attained the desired pitch attitude, hold it constant until you recognize the indications of a stall and then slowly lower the nose to straight and level flight. Do not let the aircraft stall. (The 40° pitch attitude may be determined by your visual references. The horizon line will intersect the triangular windshields, on each side of the cockpit, where they join the cockpit.)

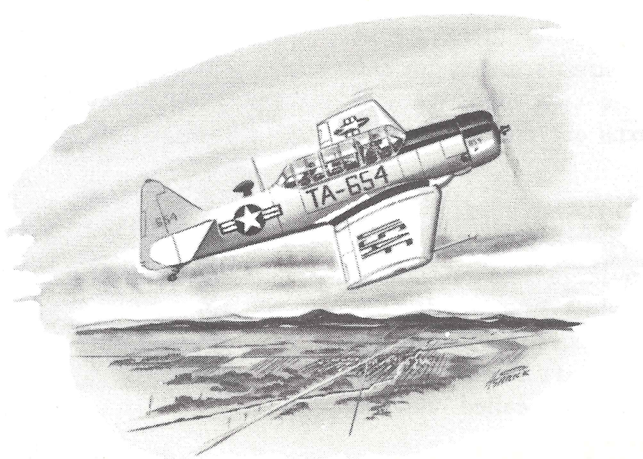
The approach to a stall should be practiced from climbing turns as well as straight ahead. The visual pitch references for the turning approaches to a stall are generally the same as for a straight-ahead approach except that a gentle-banked turn is used. This is the same bank attitude that is used for climbing turns.

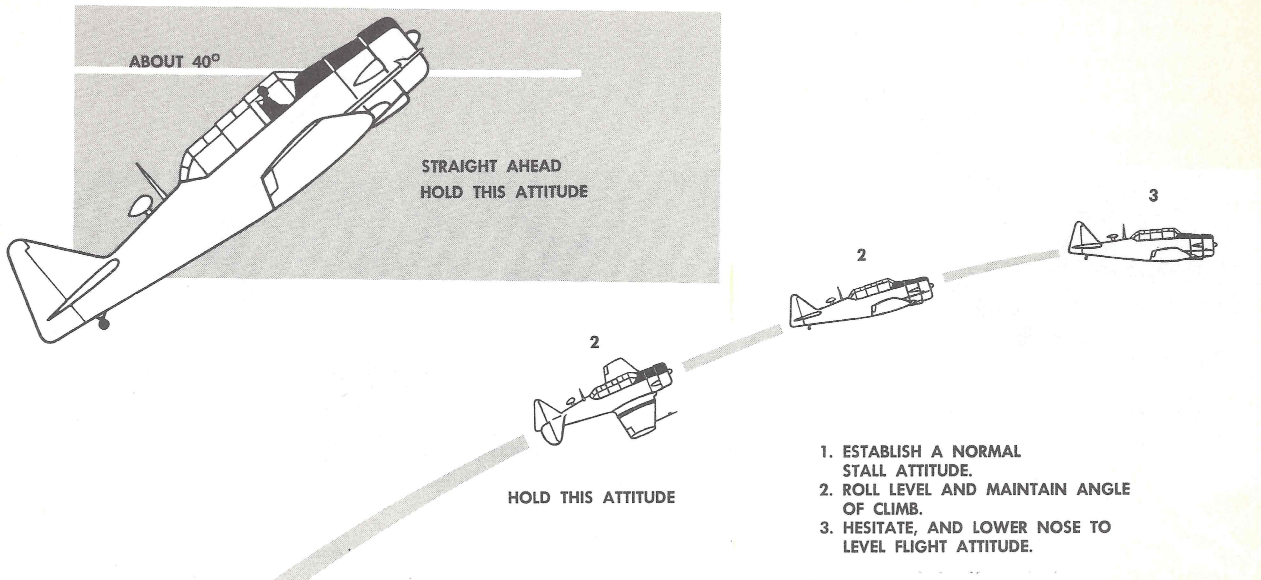
Simultaneously roll into a gentle-banked turn as you raise the nose to approximately a 40° pitch attitude. When you recognize that the aircraft is approaching a stall, roll the wings level. For a moment hold this attitude constant and then lower the nose back to the straight-and-level flight attitude.

Approaches to a stall will teach you to recognize the maximum performance of the aircraft. Practice them frequently.

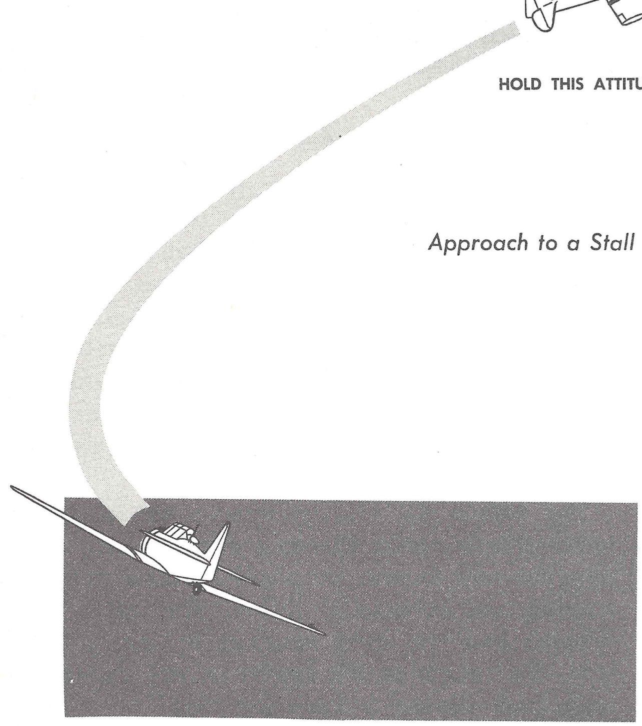
PROFICIENCY STALLS

Proficiency stalls are divided into three categories: power-on stalls, power-off stalls and the landing characteristic stall. An understanding of these maneuvers will help you to recognize a complete stall and to execute a proper recovery. Practice in these stalls will also improve your landing technique.





Approach to a Stall — Right and Left



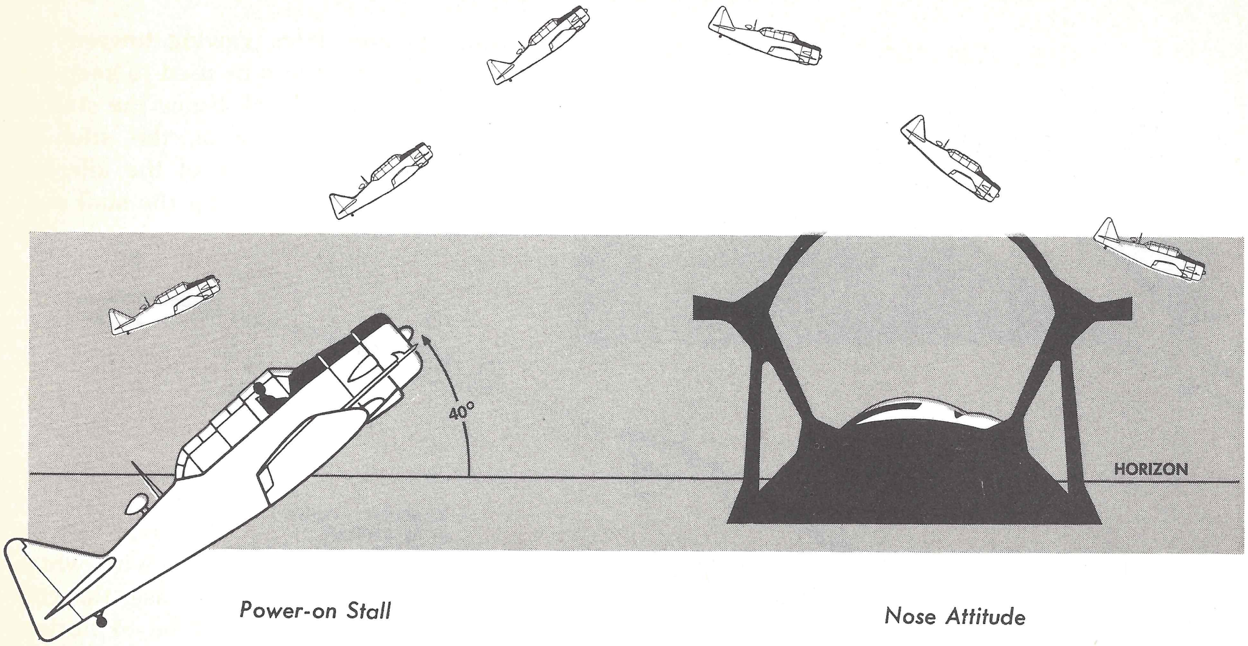
Power-on Stalls

Power-on stalls will be executed in a series of three: one straight ahead, one to the left, and one to the right. (See illustration on page 66.) Although the straight-ahead stall is usually executed first, the sequence in which they are accomplished is not important. The conditions of flight are as follows:

Gyros caged
Throttle at 25″ Hg
Propeller at 1850 RPM
Mixture lean for smooth operation
Gear and flaps up
Canopy fully closed

Before executing these maneuvers, first clear the area by making at least two medium-banked clearing turns. It will not be necessary to clear before each individual stall maneuver, unless you pause too long between them and fly out of the area that you have cleared. Normally, one set of clearing turns will suffice for the series.

To execute the straight-ahead, power-on stall, smoothly raise the nose to approximately a 40° pitch attitude. Maintain directional control with rudder and keep the wings level by use of the ailerons just as you did in the straight-ahead approach to a stall. Hold this attitude constant until the stall occurs.



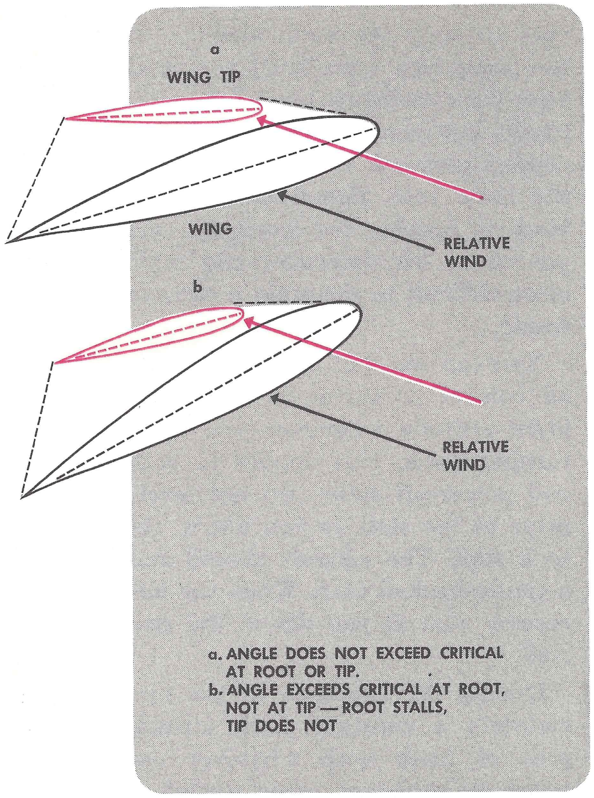
Power-on Stall *Nose Attitude*

When you recognize the stall, recover by simultaneously applying positive forward stick pressure and opening the throttle to the sea-level stop. Apply rudder pressure as necessary to keep the nose of the aircraft from yawing as it comes down, and aileron pressure, as necessary, to keep the wings level. Normally, additional right-rudder pressure will be necessary to overcome the gyroscopic action of the propeller as the nose is lowered. Allow the nose to continue down to an attitude slightly below the normal cruising speed, straight and level flight attitude. The wings should be level as the nose passes through the horizon. Hold this attitude constant until you feel pressures on the controls which indicate that the aircraft has regained positive flying speed; then smoothly raise the nose back to straight and level flight and retard the throttle to 25″ Hg.

The possibility of a wing dropping during a stall, and the proper corrective action, bears further detailed discussion at this point. Most modern aircraft are so constructed that the wing will stall progressively outward from the wing root to the wing tip. This is accomplished by building the wing in such a manner that the wing tip has less angle of incidence than the wing root. This will cause the tip to always have a smaller angle of attack than the root. Remember, the stall is caused by an excessive angle of attack, so the root exceeds the critical angle before the tip, thereby stalling first. This construction is called "wash-out," and on the T-6 it is 2 degrees on each wing, that is, the wing tip has 2 degrees less angle of incidence than the root.

The reason the wing is constructed in this manner is to retain aileron control as long as possible, and to give the aircraft more stable stalling characteristics. When the stall is broken, and the wing resumes its lift function, the return of lift begins at the tip and progresses inward to the wing root.

Whenever a stall recovery is effected promptly by forward-stick action, power, and rudder control, a complete stall is normally averted. As soon as the stick starts forward, the stall usually breaks. This means the wing tips and ailerons are regaining lift and control immediately. You can readily see, then, that as soon as the stall is broken, the ailerons may be used to level the wings. This can be accomplished even as the high nose attitude is being decreased. It should be emphasized that the use of aileron immediately during the



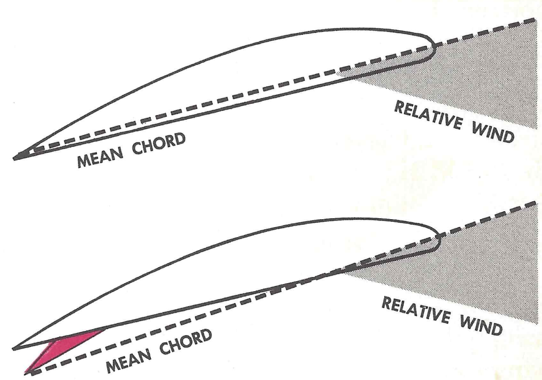
Washout of Wing Tips

recovery from a stall requires a great deal of finesse to avert an aggravated stall condition.

This aggravated condition can be explained more fully here. Let us say, for instance, that the right wing dropped during a stall. If excessive aileron pressure was applied to raise the wing, the stick would be moved to the left and the right aileron would move down. This downward moving aileron is now imposing an even greater angle of attack, and consequently a greater drag, on the wing that has dropped. In this way, the aileron is causing the wing tip to be stalled to an even greater degree because of the excessive angle of attack; at the same time it causes the nose to yaw in the direction of the low wing because of the additional drag. In this case, the only control left to prevent the aircraft from yawing excessively and entering a spin, is the rudder. The rudder should be used in such a manner as to prevent the nose from yawing toward the low wing. That is, it should be used to keep the nose attitude straight ahead. Since the stall is broken almost immediately as the stick is moved forward, judicious use of the ailerons may be effected without causing the stall condition to become aggravated. It is for this reason, therefore, that we say ailerons may be used to level the wings immediately after the stall is broken, provided directional control is maintained with the rudder. Remember, *the primary use of the rudder in stall recoveries is to maintain directional control.*

Actually, if a wing is *completely stalled,* the use of aileron would probably be ineffective and would aggravate the stalled condition regardless of the amount of finesse with which the aileron was applied. In this case, the correct recovery technique would be to initiate the proper positive forward-stick action to decrease the angle of attack and break the stall; and maintain directional control with the rudder until the aircraft began "flying" again. At this point the ailerons should be applied to level the wings.

Because of the feel and timing required to use the ailerons properly in stall recoveries, your instructor may require that you do not use the ailerons during your initial training in stall recoveries. He may teach you at first to break the stall with positive forward-stick pressure, and not to use the ailerons to level the wings until the nose has reached the hori-



Angle of Attack at Wing Tip Increased by Aileron zon. As you become more adept at stall recoveries, you will be required to become proficient in the use of ailerons whenever you effect a stall recovery.

The technique described in the preceding paragraphs will apply to any stall recovery.

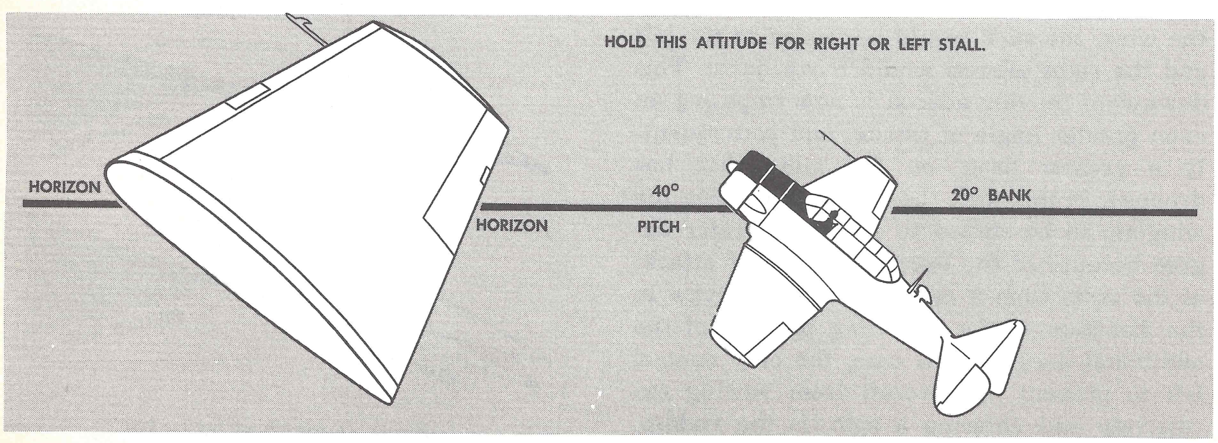
The turning stalls are executed in much the same manner. From a straight and level flight attitude, simultaneously roll into a gentle-banked turn and raise the nose to approximately a 40° pitch attitude. After this attitude has been established, hold it constant until the stall occurs. When the aircraft stalls, recover, just as you did in the stall straight ahead.

When the aircraft is in this nose-high turning attitude, you will find that the angle of bank has a tendency to increase. This is because the airspeed is decreasing and the aircraft begins flying in a smaller and smaller circle. This causes the outer wing to have an increasingly greater relative lift than the inner wing, thus causing an overbanking tendency. Because of the decreasing lift on both wings, you will find the pitch attitude attempting to lower. In addition, the airspeed is decreasing constantly, and since the power setting remains the same, the effect of torque becomes more prominent.

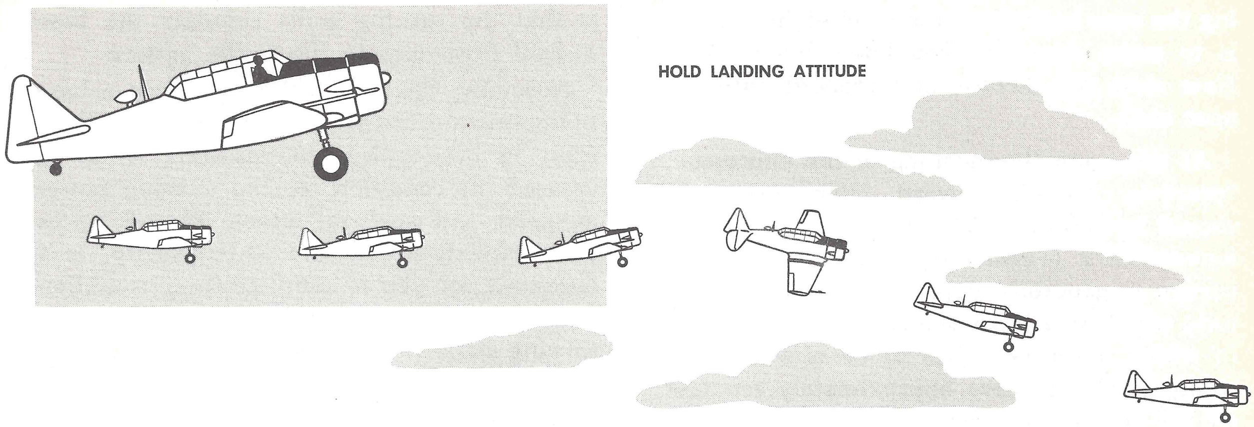
In order to compensate for these characteristics, and to maintain a constant flight attitude until the stall occurs, you will have to constantly keep increasing top-aileron pressure to keep the bank attitude constant. At the same time, you must constantly increase back-stick pressure to maintain the pitch attitude, and also constantly increase the right-rudder pressure to keep the nose turning at the same rate. Remember, if you allow the bank to become too steep, the vertical component of lift decreases and makes it even more difficult to maintain a constant pitch attitude.

You can see that it is necessary to increase all control pressures to maintain a constant flight attitude whenever you are performing turning stalls. This applies to both power-on and power-off stalls. Do not level the wings prior to the stall as you did in the approach to a stall. The aircraft should stall while in a gentle-banked turn. When the aircraft stalls, recover just as you did in the straight-ahead stall.

During the approach to the turning stalls, maintain a constant pitch attitude and degree of bank with whatever control pressures are necessary, even though the controls appear to be crossed. In the turning stall to the right, the controls will be crossed to some extent because right-rudder pressure will be used to overcome the torque effects and left-aileron pressure must be used to keep the bank from increasing. Good coordination is determined by the reaction of the aircraft and not by the position of the controls.



Turning Power-on Stall



Power-off Stall

Do not hesitate too long in straight and level flight before going into the other stalls in a series. It is not necessary to gain cruising airspeed after each recovery. Go immediately into the next stall, regardless of the airspeed reading.

Power-off Stalls

You will practice power-off stalls for the purpose of becoming proficient in recognizing stall conditions that may occur in the traffic pattern, and especially in the type of stall which occurs during a landing without flaps. Since these stalls simulate a traffic pattern and landing condition, the conditions of flight for them will be very similar to those of the pre-landing procedure. They are:

Gyros caged
Throttle closed
Propeller at 1850 RPM
Mixture adjusted for smooth operation
Gear down
Flaps up
Canopy closed

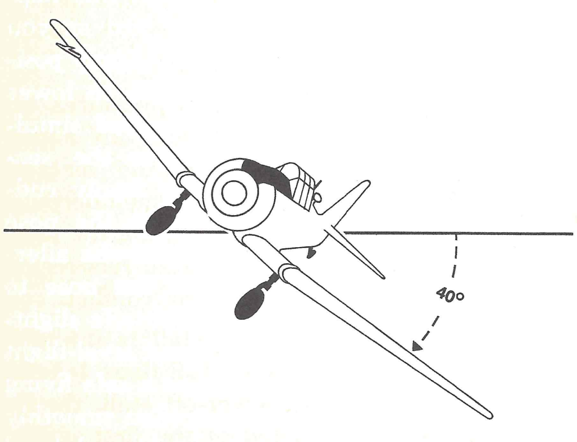
Power-off stalls are also executed in a series of three: straight-ahead, to the left, and to the right. Although the straight-ahead stall is usually executed first, the sequence in which they are accomplished is not important.

To begin the series of stalls, first lower the landing gear just as you would on the 45° entry leg of a traffic pattern. After the gear check has been accomplished, execute at least two medium-banked clearing turns to clear the area. After you roll out of the last clearing turn, close the throttle just as you would at the key position on the base leg. Maintain the altitude until the airspeed dissipates to 100 MPH, and then establish a 100-MPH gliding attitude. Trim the aircraft and hold this attitude. The rest of the procedures depend on which stall you are going to execute first.

For the straight-ahead stall, imagine yourself on a final approach for a landing and then simply execute a round-out to the three-point (landing) attitude. Hold this attitude constant until you recognize the first indication of a stall. This first indication is at the moment when you must bring the stick back more rapidly than usual to maintain the three-point pitch attitude. At the same time you will feel the aircraft shudder slightly. When this happens, execute a normal recovery just as you did in the power-on series of stalls. Apply positive, straight-forward stick pressure to lower the nose to a safe flying attitude, and simultaneously advance the throttle to the sea-level stop to increase the thrust. Apply rudder pressure as necessary to keep the nose straight. Level the wings as soon as the ailerons become effective, and allow the nose to pass through the horizon to an attitude slightly below the normal cruising speed level-flight attitude. When you have attained a safe flying attitude, hesitate momentarily; then smoothly bring the nose back up to straight and level flight. The reason for hesitating before bringing the nose back up to the level flight attitude is to make sure that you have flying speed. Now close the throttle and proceed with the next stall.

At this point the meaning of the expression "positive, straight-forward stick pressure" should be amplified. The degree or amount of forward-stick pressure used during a stall recovery is generally dependent upon the altitude which you have available and the speed in which a recovery has to be effected. For example, if you were approximately ten feet off the ground in a three-point attitude and a stall occurred, unlike the procedure for a stall at altitude, a stall at ten feet does not call for your pushing the stick abruptly forward. Rather, you *relax* the back pressure and allow the angle of attack to decrease slightly, simultaneously adding the necessary power to increase the thrust and lift. During stall practice at altitude, the term "positive, straight-forward stick pressure" will be construed to be a positive, forward movement of the stick for the purpose of decreasing the pitch attitude to insure a more rapid increase of airspeed and lift, with the loss of altitude not of prime importance. Ultimately, however, a normal power-off stall recovery will be executed by *relaxing* the back pressure on the stick.

Basically, the turning stalls are the same as the stall straight ahead. The only difference



Turning Power-off Stall

is that the turning stalls simulate the base-to-final turn used in the traffic pattern.

Normally, the stall which occurs in a base-to-final turn is caused by these two conditions: First, a nose-high turn resulting in a decreased lift condition for the existing power, airspeed, and angle of attack; second, excessive back-stick pressure. Accordingly, it is necessary for you to simulate these conditions in order to get the most benefit from these turning stalls.

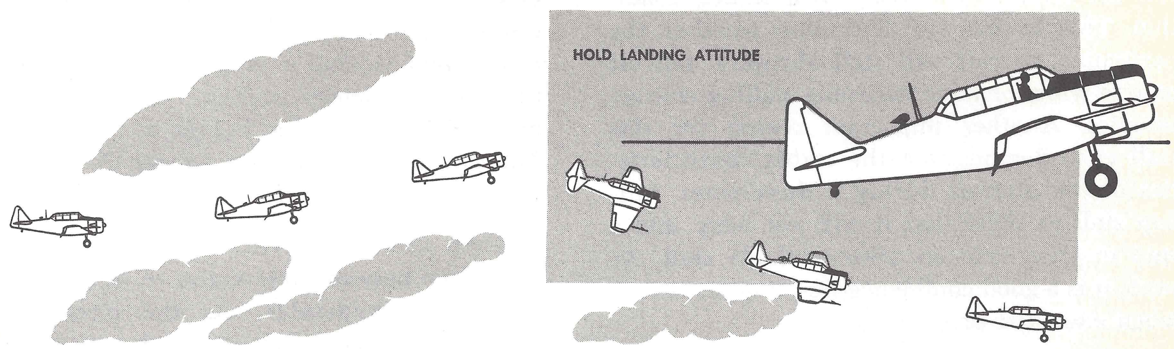
To execute a turning power-off stall, close the throttle at an imaginary key position, maintain altitude until the airspeed dissipates to 100 MPH and then establish a 100-MPH glide attitude and trim the aircraft. Look in the direction that you are going to perform the stall and select a point directly off the wing tip. Imagine this point is the runway. Now roll into a normal base-to-final turn (medium-banked) in a simulated attempt to line up with the imaginary runway.

After the bank has been established, hold it constant and increase back-stick pressure to increase the pitch attitude. This pressure should be sufficient to raise the nose approximately 15° above the horizon and to cause a stall. When the first indication of the stall is apparent, execute a normal recovery just as you did in the straight-ahead stall.

In the execution of the turning stall, the greatest benefit will be derived if the stall occurs when the nose is approximately 15° above the horizon; however, this is dependent on back-stick pressure. Once again you must increase control pressures to maintain the constant bank, and to maintain a constant-pitch attitude until the first indication of the stall is apparent. Left-rudder pressure will be needed to effect proper coordination, because of the absence of torque.

Landing Characteristic Stall

A characteristic stall is a maneuver that is executed to determine the stalling characteristics of one particular aircraft. Aircraft that seem identical may have entirely different stalling characteristics. For instance, one air-



Landing Characteristic Stall

craft may give an adequate stall warning, whereas another may not.

It is important that you know the stalling characteristics of your aircraft in a landing condition, so that you may anticipate them on an actual landing.

The landing characteristic stall is very similar to the straight-ahead power-off stall in that it simulates a landing condition; consequently, the conditions of flight are very similar. These are:

Gyros caged
Throttle closed
Propeller at 1850 RPM
Mixture lean for smooth operation
Gear and flaps down
Canopy closed

You will notice that this stall is executed with the flaps extended, whereas in the power-off stalls they were up. This is because the landing characteristic stall simulates a full-flap landing condition.

Enter this maneuver just as you did the power-off stalls. Lower the gear on an imaginary 45° entry leg to a traffic pattern. After the gear check has been completed, execute at least two medium-banked clearing turns to clear the area. After rolling out of the last clearing turn, close the throttle just as you would at the key position on the base leg. Maintain altitude until the airspeed dissipates to 100 MPH. Lower full flaps and then establish a 90-MPH gliding attitude to simulate a final approach.

After the glide has been established, execute a normal round-out for landing by raising the nose smoothly to a landing (three-point) attitude. Hold this attitude constant until the stall occurs. When the stall occurs, do not execute a normal recovery. Instead, release all rudder pressure and attempt to maintain the three-point landing attitude by smoothly bringing the stick straight back until it is in the full-rear position. When the stick is in this position, you will no longer be able to maintain the landing attitude and the nose will start down. Continue to hold the stick back, however, until the nose reaches the horizon. At this point execute a normal stall recovery. The recovery attitude will necessarily be lower than in the power-off recovery attitude. Execute a normal go-around procedure after returning to level flight.

During this stall the rudder pressures are released so that you may recognize any abnormal stalling characteristics of the aircraft. These characteristics should be remembered so that you may anticipate them during the landing. The point where a normal stall recovery is initiated brings up an apparent conflict.

The landing characteristic stall is intended to simulate the three-point full-flaps landing stall. During a normal power-off stall, the recovery should be initiated at the first indication of the stall, however, the stall recovery in the landing characteristic stall is intentionally delayed. The reason for this delay is to allow the aircraft to remain in a stalled condition. This is done to determine whether the particular aircraft will stall abruptly, fall off on one wing, or have desirable stalling characteristics. Another important reason for this stall is to demonstrate the *stable* characteristics of the aircraft during a three-point, full-flap stall to show that it will *not* whip into a spin or snap into an uncontrollable stall. As such, it is a good confidence-building maneuver when executed properly.

Things To Remember

Stay above the prescribed minimum altitude when practicing stalls.

Always execute at least two clearing turns prior to entering any stall or stall series.

During power-on and landing characteristic stalls, execute the recovery after the stall has occurred. During power-off stalls, execute the recovery at the first indication of a stall.

Learn to recognize an approaching stall by sight, sound, and feel.

All stall recovery procedures are the same: positive, straight-forward stick pressure; throttle to the sea-level stop; rudder to keep the nose straight; and ailerons, when effective, to level the wings.

During a turning stall, constantly and gradually increase all control pressures to maintain the desired attitude until the stall occurs.

Right-rudder pressure must be steadily increased during all power-on stalls to overcome torque effect.

Lower the landing gear while in straight and level flight and just prior to the clearing turns for power-off stalls.

Relax and look around so that you get the greatest benefit from stall practice.

The primary use of the rudder in stall recoveries is to maintain directional control.

SPINS

A spin is an aggravated stall that results in auto-rotation. The aircraft describes a corkscrew path in a downward vertical direction. One wing has more lift than the other; and the aircraft is forced downward by gravity, rolling and yawing in a spiral path. The total lift from the wings is slight, and the average angle of attack may be as high as 35° or more. This angle is considerably greater than the angle of attack encountered in a normal stall.

When the aircraft has begun to spin, the difference between the angles of attack of the wings is considerable. As the aircraft descends, the angle of attack of the inner wing is larger than that of the outer wing, causing the inner wing to be more completely stalled than the outer wing. Since the outer wing has more lift than the inner, it will have a tendency to fly up and over the inner wing. The relative wind, however, is striking the aircraft from below and from the side. The outer wing, trying to fly over the inner wing, causes the aircraft to roll, and the relative wind striking the side area causes the aircraft to yaw. This rolling and yawing is called auto-rotation.

Thus when spinning, an aircraft descends vertically because of gravity, and at the same time rotates about a vertical spin axis. This axis is perpendicular to the surface of the earth. While the aircraft is spinning, its axes are all inclined to this vertical spin axis. Thus, a spin is composed of pitching, rolling, and yawing.

In all normal spins you have control of the lift and drag of the rudder and the elevators. By the use of these controls you may cause, maintain, or remove the conditions for a spin.

You will be taught to perform and practice spins so that you will be able to recognize the entry and be able to recover promptly and automatically from intentional spins. Being able to perform spins and recoveries will actually build your confidence in controlling the aircraft and will improve your orientation in unusual attitudes. In this respect, spins are an excellent introduction to acrobatics. You should practice spins both to the right and to the left in order to attain a high degree of proficiency in performing and recovering from them.

Since you may someday enter an unintentional spin, it will be necessary for you to know how to recover from this maneuver. For this reason, intentional spins are practiced in the primary flying program. The normal intentional spin is a two-turn spin with a precision recovery. Recovery will always be completed at a safe altitude.

The safest type of spin-recovery procedure is the one you will use in primary pilot training. This particular procedure was selected because it proved to be the best method of breaking a spin, and at the same time prevent an excessive loss of altitude. These were the two important factors responsible for its selection.

Although a spin recovery in some types of aircraft may be difficult, the T-6 is a stable aircraft and has good spin-recovery characteristics. If you follow the prescribed procedures, you will have no difficulty in the execution or the recovery from this maneuver.

Your instructor will demonstrate and practice spins with you until you have acquired a satisfactory degree of proficiency. You will not be required to practice solo spins until your instructor is sure that you can safely and promptly recover from them.

Spins will be demonstrated and practiced with the aircraft set up for the following conditions:

Gyros caged
Throttle at 15″ Hg
Propeller at 1850 RPM
Mixture lean for smooth operation
Gears and flaps up
Canopy closed

Minimum recovery altitude 5000 feet above terrain.

The reason for using a 15″ Hg power setting, is to reduce the possibility of a run-away propeller. In so doing, the possibility of a fire hazard in the induction system is also reduced.

Before setting up the aircraft with these flight conditions, cage your gyros and call "Gyros Caged" to your instructor. At this point you should be flying straight and level at normal cruising speed, with the throttle set at 25″ Hg. Trim the aircraft for this straight and level attitude and not for the spin. You are now ready to perform the clearing turns prior to the maneuver. The spin is the only maneuver in primary pilot training that uses two 180° clearing turns. They will be accomplished in the following manner:

From straight and level flight, make a 180° turn to the right or left, using a fairly steep bank. Keep the throttle set at 25″ Hg, and maintain the same altitude throughout the turn. Since considerable altitude will be lost in the spin, be sure that the area below is clear. Roll out of this 180° turn and, while in the straight and level attitude, reduce the power to 15″ Hg. After reducing power, immediately roll into another 180° turn in the opposite direction, again using a fairly steep bank. With the reduced power and subsequent loss of airspeed in this second clearing turn, you must increase back pressure on the stick in order to maintain a constant altitude. At the completion of the second 180° turn, slowly raise the nose to a 30° pitch attitude. This is just slightly lower than the pitch attitude used for the power-on stall. The spin will be accomplished in the same direction as the second clearing turn.

Hold this pitch attitude constant, and just before the stall occurs, lead in with full rudder in the desired direction of spin. The nose will now begin moving in the direction of the spin, and the stall will occur. When you feel the stall, bring the stick straight and fully back, in a smooth manner. The aircraft will now enter the spin. Do not use aileron in the entry or during the spin or before the rotation stops.

Throughout the entire spin you should hold full back-stick pressure and full rudder with the spin. Some aircraft will oscillate excessively and quite a bit of pressure must be applied to the controls to hold them in the proper position.

To remain oriented during the spin, use ground references such as roads, section lines, landmarks, etc. Try to begin the spin while lined up with one of these references, and watch for it as it slides past the nose in the spin. Each time the reference point passes the nose, you have made one turn. Count the number of turns in order to perform a precision spin. Do not stare directly over the nose, but look up to the horizon and then back to the nose. Now look in the direction of the spin for the approaching reference line or point. Follow it with your eyes as it moves past the nose.

In a two-turn precision spin, you will not be required to stop the spin on exactly two turns, but you should start the recovery action when the two turns have been completed. The aircraft will continue to rotate slightly further before the spin actually stops.

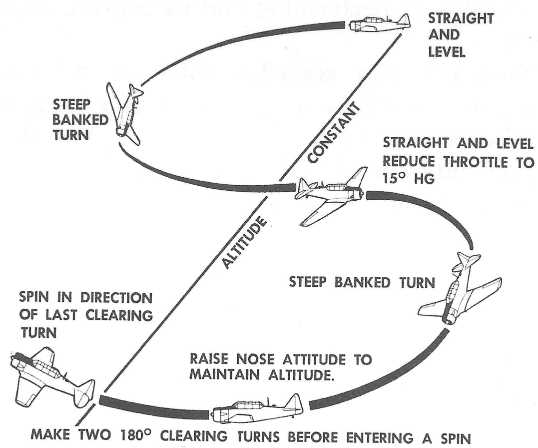
To recover from the spin, first apply full opposite rudder. This will slow the rotation slightly. Hesitate momentarily, then apply a positive, straight-forward stick movement. Maintain this position, do not "pump" the stick. Do not use aileron. You should move the stick aggressively through the neutral position to a point slightly beyond. The movement of the elevators will decrease the excessive angle of attack and break the stall. When the stall is broken, the spin will stop. *Maintain* this straight-forward stick position until the rotation stops, then neutralize the rudders.

A note of explanation may be added at this point. Although the full opposite rudder does slow the rotation, the forward movement of the stick will cause the rotation to accelerate momentarily, and until the spin stops.

It is for this reason you must hold the controls against the spin until it stops.

Avoid holding the stick too far forward after the spin has stopped, since this will result in a pitching motion that may cause momentary engine stoppage, runaway propeller, excessively steep diving angle, and excessive airspeed. It will also cause you to lurch up out of the seat and experience a rough recovery.

As mentioned earlier, during the spin recovery there is a momentary hesitation between the application of opposite rudder and the ap-



Clearing Turn for Spin

plication of forward-stick movement. This hesitation has a definite duration, or time element, that you will be able to feel instinctively or sense as your proficiency increases. During the initial phase of your training in spins, however, you will be unable to see or feel the rotation slow down when opposite rudder is applied in the recovery. In view of this fact, you will at first be taught a mechanical recovery, and a mechanical means of computing the time required in the hesitation between opposite rudder and forward stick. Even when your proficiency has increased you will find that the sequence of control movements, and the control movements themselves, will be more or less mechanical; however, your timing and knowledge of the need for certain movements will become more or less instinctive.

When you begin receiving instruction in spins, you will be given a series of steps to perform in sequence in order to break or stop the spin. These follow:

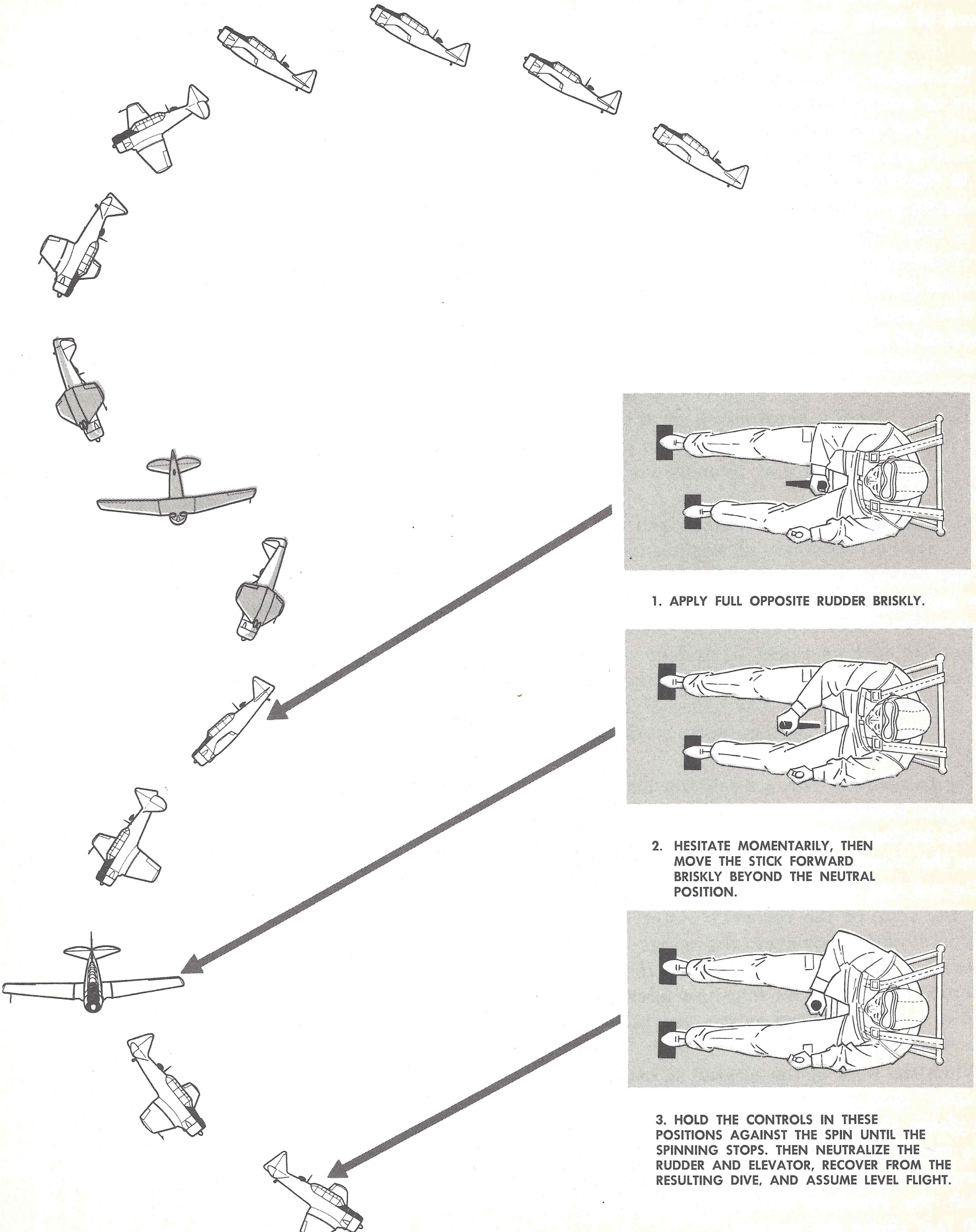
Apply FULL opposite rudder.

Count off approximately two seconds. (One thousand-one, one thousand-two)

Apply aggressive forward-stick pressure.

Neutralize rudder as the rotation stops.

The counting of the seconds takes care of the approximate time it takes for the rudder to slow the rotation. As you become more proficient, you will be able to actually see or feel the rotation slow down, and will be able to ap-



Spin Recovery Procedure

ply forward-stick pressure instinctively instead of using the mechanical counting method.

Remember, as soon as the stall is broken, the spin or rotation stops. Because of the excessively low nose attitude of the aircraft when this occurs, the airspeed will build up rapidly. It is therefore important that the rudder be neutralized immediately as the rotation stops. It is even better to be able to anticipate the neutralization of rudder, so it will be in the neutral position just as the rotation stops.

You can see that if the rudder is not neutralized at the proper time, the increased airspeed acting upon a fully depressed rudder will cause an excessive and unfavorable yawing effect. This places a great strain on the aircraft and may also cause a secondary spin in the opposite direction that may be more violent than the original spin.

As soon as the rotation stops and the rudders have been neutralized, begin smoothly applying back-stick pressure to raise the nose to the horizon. Be careful not to apply excessive back-stick pressure immediately after the rotation stops. Sometimes a student does this because he is too anxious to raise the nose to the horizon. To do so may cause a secondary stall resulting in another spin more violent than the first one.

Try to recover with a minimum loss of altitude, but recovery smoothly and raise the nose to the horizon with the proper timing; otherwise the aircraft may stall again.

Do not use aileron pressure during the entry, the spin, or the recovery. After the rotation is stopped, however, the wings may not be level in relation to the horizon. If this condition is apparent, you may use aileron pressure to level the wings as you are raising the nose back to the horizon.

When the nose of the aircraft is back to the horizon, open the throttle to 25° Hg. This completes the spin as a maneuver. Lost altitude may then be regained by performing an approach to a stall. The minimum altitude at which the recovery should be completed is 5000 feet above the terrain.

SPINS FROM VARIOUS FLIGHT ATTITUDES

All of the preceding information has been given to acquaint you with the entry, the performance, and the recovery from a normal intentional spin. You must remember, however, that a spin could occur from any attitude of flight, either intentionally or unintentionally. For this reason, your instructor will place the aircraft into spins from various attitudes, or will have you cause the aircraft to fall into a spin, both with power on and off.

You may be directed to place your aircraft into a spin from climbing turns, gliding turns, steep turns, acrobatic maneuvers, or from any proficiency maneuver. This practice will help you develop a more instinctive and prompt reaction to the recognition of a spin, with a consequent rapid recovery. If you are able to stop the spin and recover before the full spin develops, it shows a definite alterness, and this is the way you should react in the event of an actual unintentional spin.

You will first be directed to do intentional spins from various attitudes. Your instructor will first demonstrate by the misuse of controls in these flight attitudes how the aircraft is stalled; he will then demonstrate how the controls, when placed in the normal spin position, will cause the aircraft to fall into a spin. He will then have you intentionally spin, for instance, out of a climbing turn. First, you merely increase back pressure on the stick and raise the nose to an excessively high pitch attitude. This will cause the aircraft to stall. Then, apply full rudder in the direction of the turn and bring the stick fully back. The aircraft will enter into a normal spin. Close the throttle and effect a normal spin recovery.

The first corrective action that should be taken during any spin with the power on, is to close the throttle immediately. Don't attempt to set the throttle at 15″ Hg during this practice. This exercise is designed to simulate actual practice in unintentional spins. Power usually aggravates the spin characteristics of an aircraft and makes recovery more difficult.

At times your instructor intentionally will attempt to place the aircraft in a spin and have you try to keep a spin from occurring, or if one does occur, to recover from it as quickly as possible. Attempt a normal spin recovery immediately. If the aircraft falls into the spin with the power on, close the throttle first and then use your recovery technique.

Things To Remember

Be sure to clear all around and well below you since considerable altitude is lost in any spin. The spin is the only maneuver that requires two 180° clearing turns. The first clearing turn is executed with a 25″ Hg power setting. The power is reduced to 15″ Hg while the wings are held level between the turns, and the second clearing turn is executed with a 15″ Hg power setting.

Lead into the spin with the rudder before the stall occurs, and hold full controls with the spin throughout the spin.

Do not stare directly over the nose during the spin; keep your eyes moving in the direction of the spin and watch the reference points. Count the turns to remain oriented.

Remain relaxed at all times.

Apply brisk and aggressive control movements to stop the spin. Remember that the angle of attack is considerably higher than for a normal stall, and a more aggressive stick movement is required to break the stall. (Above all, be sure that the stick is held forward of neutral long enough to insure that the stall is broken.)

Hesitate momentarily between rudder and stick application in the recovery.

If needed, use both hands on the stick for the recovery.

Do not hold stick too far forward for too long. As soon as the rotation stops, neutralize the rudder and begin applying a smooth backstick pressure to raise the nose to the horizon. Watch for excessive back pressure during recovery to straight and level flight to guard against a secondary stall.

Minimum recovery altitude is 5000 feet above the terrain.

RECOVERY FROM DIVES

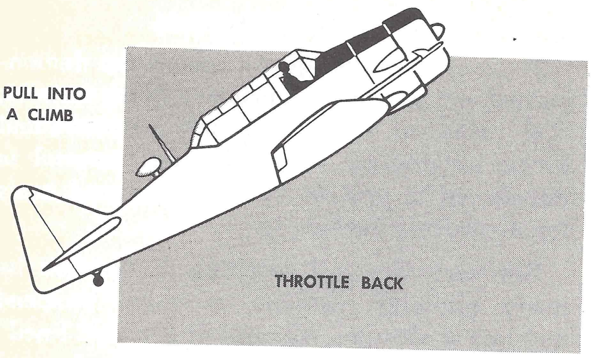
Many of the subsequent maneuvers demonstrated and practiced in primary flying training will result in intentional and unintentional dives; accordingly, the following material is introduced to provide you with a sound basis for a recovery technique.

Recovery from all resulting dives must be made smoothly without excessive airspeed and loss of altitude. All aircraft are "red lined" or have a definite maximum allowable airspeed (T-6 - 240 MPH). This is indicated by a red mark on the face of the airspeed indicator. Should this maximum be exceeded at any time, the pilot should indicate the excess speed in the write-up in the Maintenance and Inspection Record Book. This write-up will result in an over-all inspection of the wing, tail, and control surfaces.

Another factor in recoveries from dives is the "G" or gravity factor that is present at any time a change of direction is made, increasing the wing loading of the aircraft. This increased loading can be identified by the increased seat pressure present whenever backstick pressure is applied. In a high-speed dive, a sharp pull-out may result in the wings, tail, and controls being subjected to undue stress which may "pop" rivets, twist the fuselage, and buckle or completely collapse the wing or control surfaces.

From time to time throughout your training you may "black out," or your vision be impaired during a tight turn or pull-out. This is a normal and momentary condition caused by the loss of blood from the eyes because of centrifugal force and should not alarm you. However, remember that the stresses you are placing on yourself are also being placed on the aircraft. Don't apply these stresses when it is not necessary.

With the increase of airspeed in a dive, the propeller governor is continually moving the propeller into higher pitch until it is in maximum highpitch position. At this time the windmilling effect takes over and increases the RPM in proportion to airspeed, resulting in a



Technique Used for Runaway Propeller

runaway propeller. Consult Section III of your T. O. for the correct procedure to stop a runaway propeller. The tachometer or RPM indicator is also "red lined"; and if this maximum should be exceeded, it should be noted on the Maintenance and Inspection Record Book upon landing.

The pull-out from any dive should be made with smooth back-stick pressure and started before the airspeed has increased to such an extent that the limits will be exceeded. Remember, the airspeed does not stop building up as soon as you begin raising the nose. It may continue to build up until just before level flight is attained.

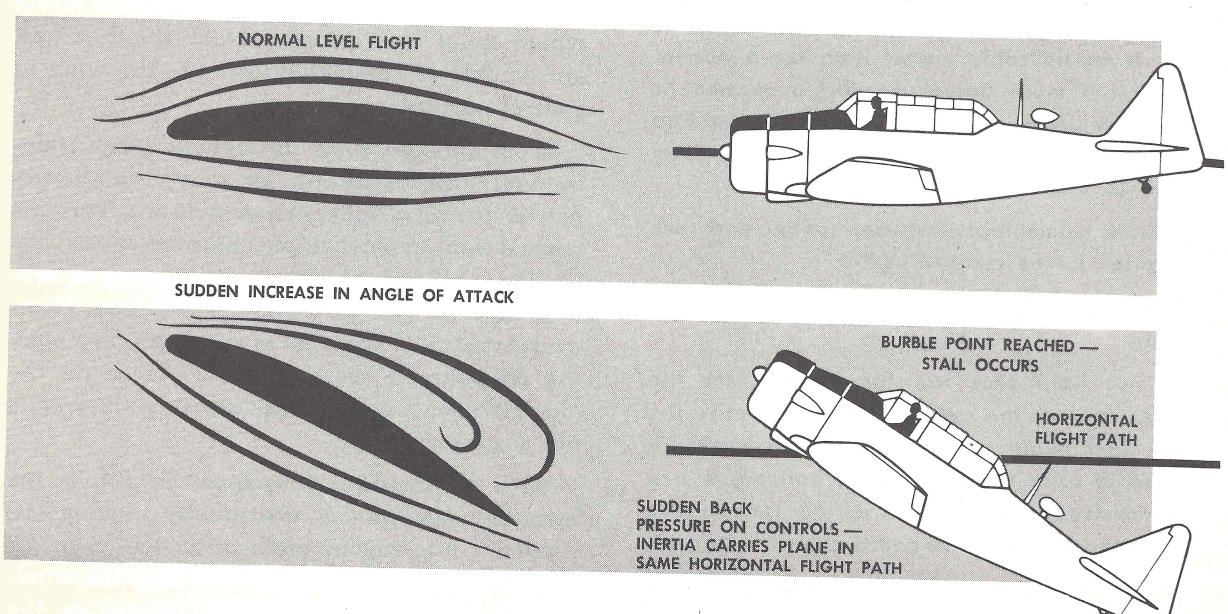
DEMONSTRATION STALLS

Demonstration stalls, as the name implies, are stalls that are demonstrated to you by the instructor. They are used to teach you the result of misusing the flight controls during normal proficiency maneuvers. You will practice these stalls during dual flights with your instructor, and you should not practice them on solo flights until you have been told to do so. You should attain a high degree of proficiency in the performance of these maneuvers, since they are the types of stalls that may happen when you are unprepared for them. You should therefore develop an ability to react promptly and accurately at any time stalls of this nature occur.

Remember you were taught to recognize stalls by sight, sound, and feel. You are also taught that a stall can occur at any airspeed, in any attitude, at any power setting. These demonstration stalls will illustrate and prove these points well, because they will be performed with various flight attitudes, power settings, and conditions of flight.

The demonstration stalls are these:

1. Rudder-controlled Stall,
2. Secondary Stall,



Highspeed Stall

3. Excessive Back-pressure Stall,
4. Excessive Top-rudder Stall,
5. Excessive Bottom-rudder Stall,
6. Elevator Trim-tab Stall,
7. Cross-control Stall.

Recovery from inverted flight will be taught during the recoveries of demonstration stalls, numbers, 3, 4, and 5, and also during your acrobatic training.

The minimum altitude at which the recoveries from all these maneuvers will be completed is 5000 feet above the terrain.

RUDDER-CONTROLLED STALL

The rudder-controlled stall is a practice maneuver designed to teach you the proper use of the rudder for directional control when the aircraft is in a stalled condition. This will also prove beneficial in preventing accidental spins and in maintaining proper directional control during landings.

Since the rudder is the last control surface to lose its effectiveness, the proper use of this control during stalls and low airspeed conditions is very important.

The conditions of flight for this maneuver are as follows:

Gyros caged
Throttle at 25″ Hg
Propeller at 1850 RPM
Mixture lean for smooth operation
Gear up
Flaps up
Canopy closed

Before executing the maneuver, first clear the area by making at least two 90° clearing turns. Since this is a separate maneuver in which there may be a considerable change of altitude, it will be necessary to clear the area before each additional stall.

From the straight and level flight attitude, smoothly raise the nose of the aircraft to the 40° pitch attitude. This is the same attitude used for the normal power-on stall series. Hold the pitch attitude constant with elevators, and hold the wings level by use of the ailerons. Maintain directional control with rudder pressures until the stall occurs. Remember, you will have to gradually increase right-rudder pressure to counteract torque effects.

Since the basic value of this maneuver is to practice maintaining directional control with rudder during a stalled condition, the recovery will not be effected at the same time as a normal recovery. The recovery used in this stall will utilize the same technique as the normal recovery, but will be delayed until the nose of the aircraft reaches the horizon. This allows you to practice rudder control all the way from the 40° pitch attitude down to the horizon.

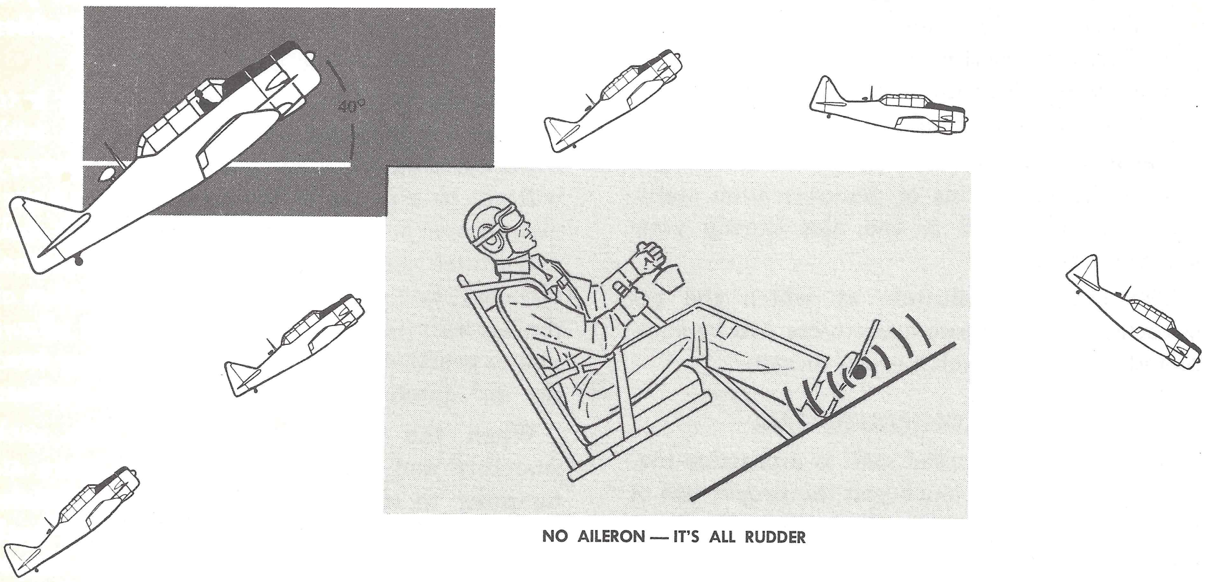
When the stall occurs, bring the stick smoothly and fully back as if you were attempting to maintain the 40° pitch attitude. Do not snap the stick back, or bring it back mechanically, as this technique usually causes the aircraft to stall forcibly and causes one wing or the other to drop abruptly. With the stick in this full-back position, you can no longer maintain the high pitch attitude and the nose of the aircraft will begin lowering toward the horizon. Do not move the stick to either side to use ailerons.

Rudder should be used as it is needed, and not mechanically. If the nose tries to move to one side or another, apply sufficient opposite rudder pressure to keep it from moving. In this respect you are maintaining a constant heading, thereby maintaining directional control by use of the rudder. Care should be used not to over-control with the rudder by using too much pressure. Use whatever pressure is needed to keep the nose from turning. (See illustration on following page.)

If a wing should drop during this practice, the nose would attempt to move toward the low wing. Merely hold enough opposite rudder pressure to keep the nose from moving and the wing will not drop further. *Do not* attempt to raise the low wing with the rudder as you would probably over-control; instead, concentrate on keeping the nose straight.

Throughout this entire maneuver you will find that the rudder pressures will normally be varied constantly. For example, if the nose

ESTABLISH AND HOLD THIS ATTITUDE



NO AILERON — IT'S ALL RUDDER

Rudder Controlled Stall

tried to move to the right you should apply sufficient left-rudder pressure to stop this movement. The nose may then try to move back to the left in the same direction as the rudder pressure you are applying. This is due to the difficulty in exerting the exact amount of rudder to control the yaw when the aircraft is in this stall condition. When this occurs, you will of course have to release this left-rudder pressure and possibly have to exert some right-rudder pressure. This is a difficult maneuver to perform properly. It will take considerable practice in order to effect the proper pressures.

When the top of the cowling on the nose of the aircraft is at the horizon, a normal stall recovery will be effected. That is, you will exert a positive forward-stick action to decrease the angle of attack, and simultaneously open the throttle to the sea-level stop. Since the recovery is effected at the horizon, the nose should be lowered slightly below the attitude used in the normal power-on stall recovery. Do not hold the nose down, but raise it smoothly to the level flight attitude and retard the throttle to 25″ Hg.

SECONDARY STALL

This is a form of high-speed stall and is caused by misuse of the elevators. This stall occurs during the recovery from a preceding stall. It is caused by hastening the recovery by abrupt use of the elevators while attempting to bring the nose up to the horizon again, or attempting to maintain a nose-high attitude with insufficient airspeed.

It is demonstrated to teach you what will happen if you become too anxious to return to straight and level flight after a stall or spin recovery. It also teaches you the value of smooth back-stick pressures at critical airspeeds, and why you should allow an aircraft to begin "flying" again before completing a stall recovery.

This stall is usually demonstrated during the recovery from a normal power-on stall, but it may be demonstrated from any other type of stall recovery. As it is demonstrated during the recovery from a power-on stall, the following flight conditions apply:

Gyros caged
Throttle at 25″ Hg
Propeller at 1850 RPM
Mixture lean for smooth operation

Gear up
Flaps up
Canopy closed

Make at least two clearing turns and perform a power-on stall. When this stall occurs, effect a normal recovery with positive forward action, throttle to the sea-level stop. Allow the nose to lower slightly below the normal cruising speed level flight attitude, and then bring the stick back sharply, as if you were trying to hasten the return to straight and level flight. Continue to increase back pressure on the stick until the aircraft shudders and starts to break to the right or left.

When this happens, apply positive straightforward stick pressure (the same as for a normal stall recovery) and lower the nose slightly below the level flight attitude. If the nose attitude is low when the secondary stall occurs, it may be necessary to lower the nose more during the recovery. Now bring the nose smoothly back to the level flight attitude as in a normal recovery and reduce the power to 25″ Hg.

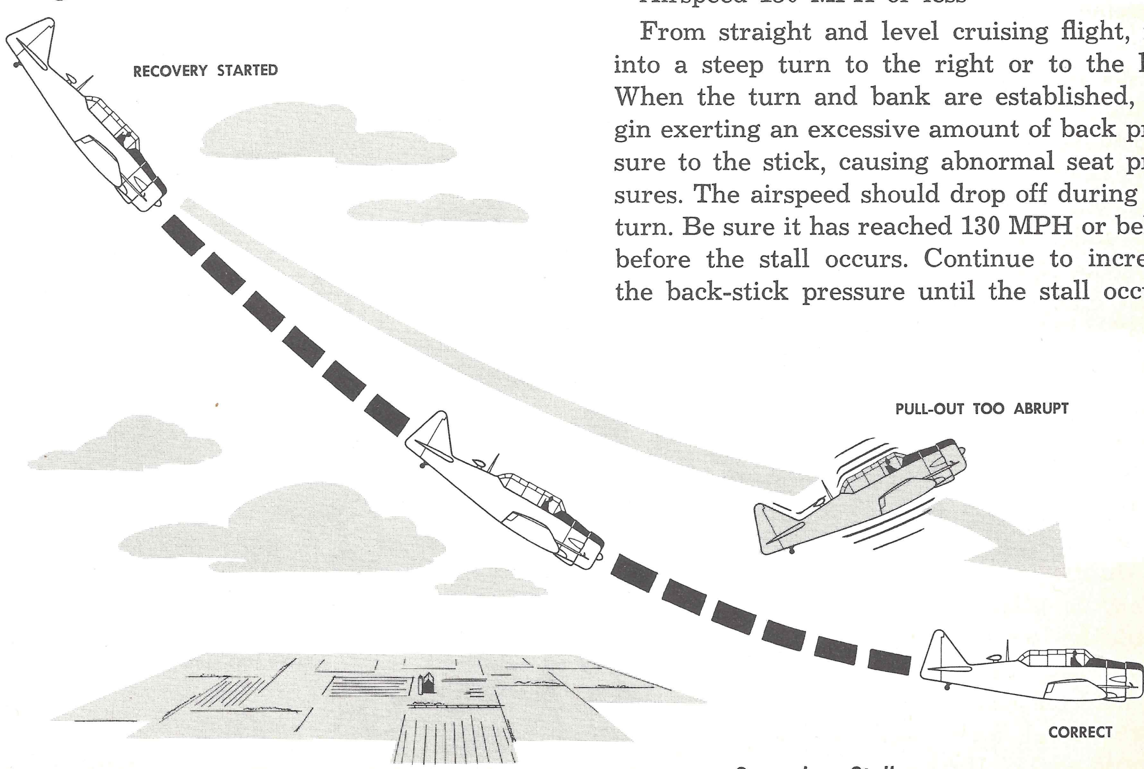
EXCESSIVE BACK-PRESSURE STALL

This stall is caused by excessive back-stick pressure imposing too great an angle of attack during steep turns, in stall and spin recoveries, and during pull-outs from dives. It is demonstrated to teach you that an aircraft may be stalled regardless of attitude. It is an example of a high-speed stall with excessive seat pressures. Although this stall is normally demonstrated in steep turns, it may be encountered at any time excessive back pressures are applied and the angle of attack is increased too rapidly.

Since it is normally demonstrated from a steep turn, the flight conditions will be the same:

Gyros caged
Throttle at 25″ Hg
Propeller at 1850 RPM
Mixture lean for smooth operation
Gear up
Flaps up
Canopy closed
Airspeed 130 MPH or less

From straight and level cruising flight, roll into a steep turn to the right or to the left. When the turn and bank are established, begin exerting an excessive amount of back pressure to the stick, causing abnormal seat pressures. The airspeed should drop off during the turn. Be sure it has reached 130 MPH or below before the stall occurs. Continue to increase the back-stick pressure until the stall occurs.



Secondary Stall

Remember, to break a stall, you must decrease the angle of attack. During a normal stall recovery a positive forward-stick action was used. The excessive back-pressure stall is also broken by decreasing the angle of attack. However, to cause the stall to occur, an excessive amount of back-stick pressure had to be applied. Thus, it is not necessary to consciously exert a forward-stick pressure. Instead, by merely releasing enough of the back-stick pressure to cause the angle of attack to be decreased, you will break the stall. At the same time you should open the throttle to the sea-level stop. Simultaneously, as the stall is broken, use rudder and aileron pressures to coordinate a roll back to straight and level flight. When this has been accomplished, retard the power to 25″ Hg.

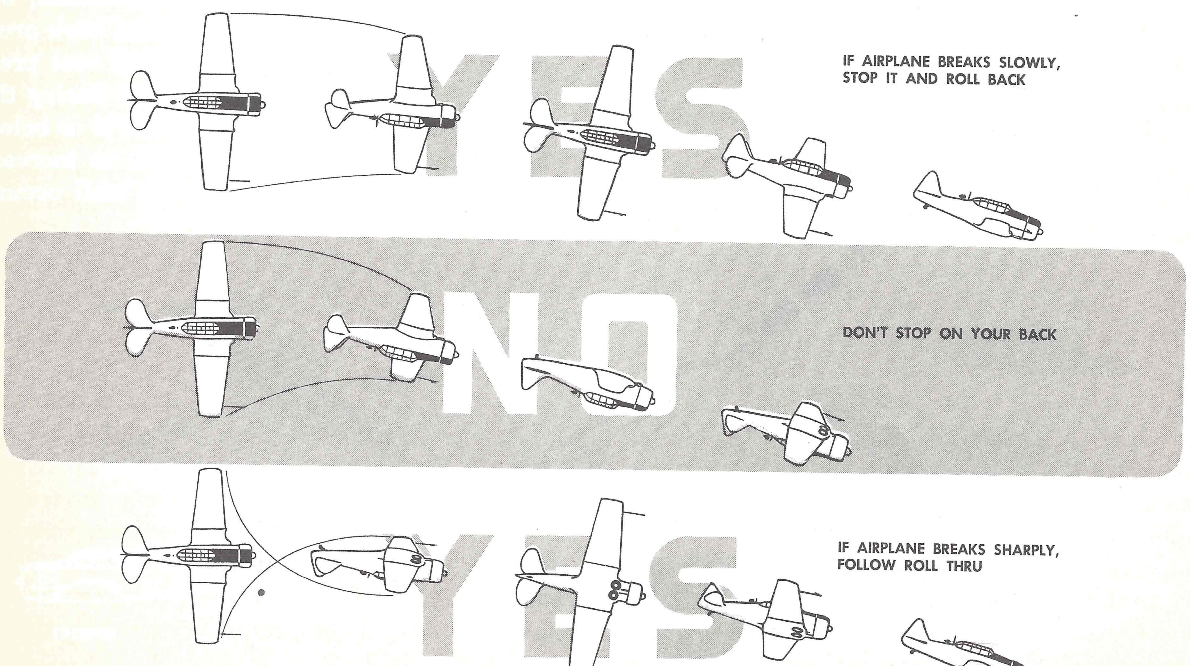
From a steep-turn stall to the left, the aircraft will normally tend to roll or snap to the right and back to straight and level flight. This is due to the rigging of the vertical stabilizer. In this type stall, merely release the excessive back-stick pressure momentarily, simultaneously open the throttle to the sea-level stop, and then return the aircraft to straight and level flight with coordinated stick and rudder pressures. When this is accomplished, retard the throttle to 25″ Hg.

From a steep-turn stall to the right, the aircraft will normally tend to roll or snap to the right also. Again, this is due to the rigging of the vertical stabilizer. If the roll is not too vicious, and can be stopped before the inverted position is reached, momentarily relax the back-stick pressure to break the stall, and simultaneously open the throttle to the sea-level stop. Now stop the roll, and roll the aircraft back to the straight and level flight attitude with coordinated stick and rudder pressures. If the roll cannot be stopped by the momentary relaxation of control pressure before the inverted position is reached, you should allow it to continue or help complete the roll, using coordinated control pressures to return to level flight. When this is accomplished, retard the throttle to 25″ Hg.

This stall should be accomplished from steep turns to the right and to the left.

EXCESSIVE TOP-RUDDER STALL

This stall is caused by a combination of excessive back-stick pressure and the misuse of



rudder in steep turns. As you already know, the proper way to correct a nose-low attitude in a steep turn is to shallow the bank and raise the nose to the proper pitch attitude. This stall will demonstrate what would happen if you tried to raise the nose with top rudder alone.

Since this stall is demonstrated from a steep turn, the flight conditions will be the same as for the excessive back-pressure stall.

Gyros caged
Throttle at 25″ Hg
Propeller at 1850 RPM
Mixture lean for smooth operation
Gear up
Flaps up
Canopy closed
Airspeed 130 MPH or less

From straight and level cruising flight, roll into a steep turn to the right or to the left. When the turn and bank are established, allow the nose attitude to drop to a nose-low turn attitude. Now begin exerting excessive back pressure to the stick to raise the nose. At the same time begin exerting excessive pressure to the top rudder as if you were also using this control to raise the nose. The airspeed should drop off in the turn. Be sure it has reached 130 MPH or below, before the stall occurs. Continue to increase the stick and rudder pressures until the stall occurs.

When the stall occurs, release the existing control pressures to break the stall, and simultaneously open the throttle to the sea-level stop. As soon as the stall is broken, use coordinated aileron and rudder pressures to roll back to level flight. When this has been accomplished, retard the power to 25″ Hg. The recovery technique is the same used in the excessive back-pressure stall.

Because of the position of the flight controls when the stall occurs, the aircraft will normally tend to roll or snap toward the applied rudder. This means it would roll back to the straight and level attitude, or if the roll is particularly vicious, it may roll past this position and on over. If you are alert and quick in applying the recovery technique, you may be able to stop the aircraft in the straight and level flight attitude. If it rolls past this attitude, stop it where you can, and use coordinated stick and rudder pressures to return to straight and level flight.

This stall should be accomplished from steep turns to the right and to the left.

EXCESSIVE BOTTOM-RUDDER STALL

This stall is also caused by a combination of excessive back-stick pressure and misuse of rudder in turns. It will also demonstrate what would happen if you tried to adjust the nose attitude, or tried to speed up the rate of turn with rudder alone. This stall will normally be demonstrated from a steep turn, so the flight conditions will be the same:

Gyros caged
Throttle at 25″ Hg
Propeller at 1850 RPM
Mixture lean for smooth operation
Gear up
Flaps up
Canopy closed
Airspeed 130 MPH or less

From straight and level cruising flight roll into a steep turn to the right or to the left. Since bottom rudder is to be used in this maneuver, it is a good idea to roll into the turn with the nose high to prevent building up excessive speed. When the turn and bank have been established, and with the airspeed well below 130 MPH, begin exerting an excessive back pressure to the stick. At the same time exert excessive pressure on the bottom rudder. Continue to increase the stick and rudder pressures until the stall occurs. Be sure the speed is 130 MPH or below.

When the stall occurs, release the existing control pressures. That is, release some of the back-stick pressure you are holding, and simultaneously open the throttle to the sea-level stop. This will decrease the angle of attack and break the stall. Simultaneously neutralize the rudder. When the stall is broken, roll the aircraft back to straight and level flight with coordinated stick and rudder pressures. When this has been accomplished, retard the throttle to 25″ Hg.

Because of the position of the flight controls when the stall occurs, the aircraft will normally tend to roll or snap toward the applied rudder. This means it would roll toward the inverted position. If the roll can be stopped before the inverted position is reached, return the aircraft to straight and level attitude with coordinated stick and rudder pressures.

If the roll is vicious and cannot be stopped before the inverted position is reached, allow the aircraft to roll (or help the roll if necessary) completely around and back to the straight and level attitude. The control action is identical with that used in the excessive back-pressure stall recovery.

This stall should be accomplished from steep turns to the right and to the left.

ELEVATOR TRIM-TAB STALL

The elevator trim-tab stall is one that occurs from a combination of a large amount of tail-heavy elevator trim, and a large application of power. The stall then occurs because of insufficient corrective forward-stick pressure being applied. It may occur during a normal or emergency go-around procedure, after a simulated forced landing, or after a take-off if the aircraft was not properly trimmed.

As you can see from the above, if this stall were to occur unintentionally, it would probably occur near the ground. Your instructor will demonstrate and allow you to practice this stall to teach you the value of being alert to pitch changes with sudden changes of power and the proper use of controls to overcome excessive pressures. This stall also illustrates the importance of retrimming the aircraft for changing attitudes.

Since this stall would normally occur when the aircraft is in a landing condition, the following conditions of flight apply:

Gyros caged
Throttle closed
Propeller at 1850 RPM
Mixture lean for smooth operation
Gear down
Flaps one-half to full down
Canopy closed

While flying in straight and level flight, lower the landing gear with the normal gear procedure. When the gear is checked down and locked, perform at least two 90° clearing turns.

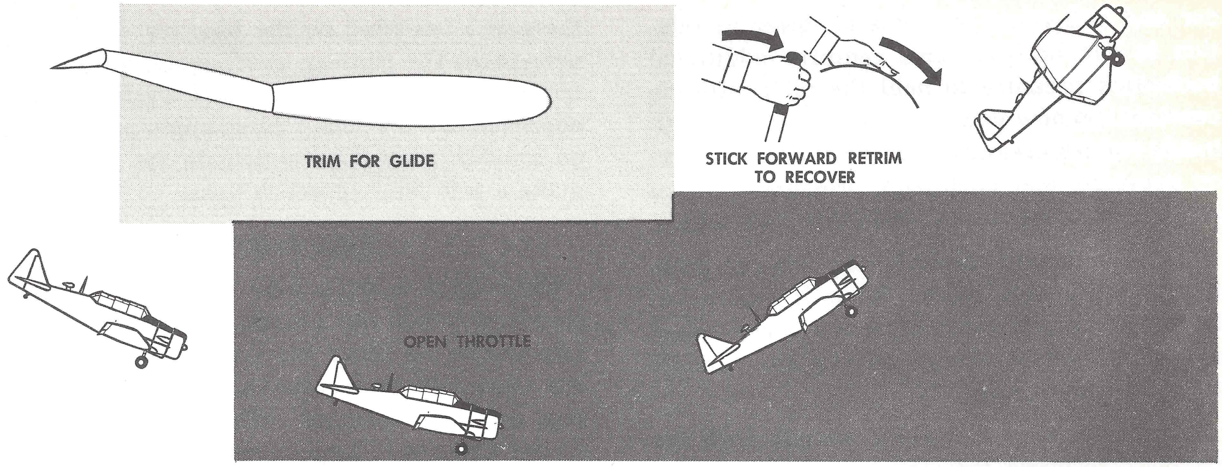
Immediately after rolling out of the second clearing turn, close the throttle completely and hold your altitude until the airspeed reaches 100 MPH. When this has been accomplished, lower the desired flap setting and trim the aircraft for the 90-MPH gliding attitude. This stall could occur with various flap settings, so it should be practiced with this fact in mind.

When this simulated final-approach glide has been established, smoothly advance the throttle to the sea-level stop. The combination of thrust, torque effect, and back-elevator trim, will cause the nose to rise and pull to the left.

In the first demonstration, your instructor will not take any corrective action and will allow the pitch attitude to increase until the critical angle of attack is exceeded. The aircraft will then stall and fall off to the left. He will then recover, returning to straight and level flight. The reason he allows the aircraft to stall is to show you what will happen if no corrective action is applied.

He will now repeat the process, but this time he will show you the correct way to prevent a stall from occurring. After the throttle is opened and the nose attitude rises fairly high, positive forward-stick pressure should be applied to lower the nose to the *normal climbing attitude*. Hold this forward pressure against the trim, and immediately trim the pressures off the stick and rudder. You will have to roll the elevator trim forward, and also the rudder trim (because you had it rolled all the way back for the glide).

If a stall does occur, use the same corrective action as outlined above. Use positive forward-stick action to decrease the angle of attack and break the stall. Maintain directional control with the rudder and keep the wings level with the ailerons. If this were to



Elevator Trim-Tab Stall

happen during an actual go-around, reduce the power to 30″ Hg after the climbing attitude and a safe flying speed are attained. When this recovery has been accomplished, complete a normal go-around procedure.

Should the aircraft reach a 60° pitch attitude without stalling, a recovery will be effected immediately.

CROSS-CONTROL STALL

This stall is caused by misusing and crossing the controls during a gliding turn. It is used to demonstrate the effect of improper control technique, and is used to show the result of attempting to increase the rate of turn by using rudder pressure alone. It could occur during the final approach turn, and is usually incurred by over-shooting the runway and attempting to speed up the turn by using inside rudder alone. This situation results in a dangerous cross-control condition. It teaches you to always use coordinated control pressures in turns, regardless of the situation.

This stall will be demonstrated from gliding turns, so the conditions of flight should be the same:

Gyros caged
Throttle closed
Propeller at 1850 RPM
Mixture lean for smooth operation
Gear down
Flaps up
Canopy closed

While in straight and level flight, lower the landing gear with the normal gear procedure. When the gear is checked down and locked, perform at least two 90° clearing turns.

After you roll out of the second clearing turn, close the throttle completely and hold your altitude until the airspeed reaches 100 MPH. This stimulates the technique used on the base leg. Now lower the nose, establish a 100-MPH glide and trim the aircraft to hold this attitude.

When the glide is established, roll into a normal gliding turn, using a medium angle of bank. Now simulate over-shooting the runway. The normal thing, of course, would be to steepen the bank slightly and thus increase the rate of turn. However, sometimes you feel as if you should not steepen the bank, and the tendency is to increase inside rudder pressure to speed up the turn. You can simulate this condition by building up pressure on the inside rudder.

Since this will cause the nose to yaw in the direction of the turn, the outside wing is speeded up and gains lift. To keep the wing from rising, you must now apply opposite aileron pressure to hold the bank constant. The inside rudder is also the so-called bottom rudder and will cause the nose to lower in relation to the horizon. This requires additional back-stick pressure to hold the pitch attitude constant. So now you are in a gliding turn with inside rudder pressure, top (or opposite) aileron pressure, and back-stick pressure. As you can see, a cross-control condition now exists.

Continue to increase all these control pressures until a stall occurs. When it occurs, release the existing control pressures and effect a normal stall recovery, opening the throttle to the sea-level stop.

If you are alert and quick enough with the recovery to break the stall before the aircraft falls into an abnormal, vertical spiral or spin attitude, return to straight and level flight as soon as possible. Be careful, of course, and do not attempt to hasten the recovery to such an extent that you cause a secondary stall. When the straight and level flight attitude is reached, retard the throttle to 25″ Hg and effect a normal go-around procedure.

In the cross-control stall to the right, the aircraft stalls with practically no warning. The nose drops straight down, and the aircraft continues to roll to the right. This happens because the rigging of the vertical stabilizer is augmenting the right rudder. When this occurs, break the stall and continue the roll, with the objective of returning the aircraft to straight and level flight with a minimum loss of altitude. Do not open the throttle until you have succeeded in bringing the nose up toward the horizon; otherwise, by applying power when the nose is still pointed toward the ground, it will pull you down that much farther and result in a greater loss of altitude. The stall to the left is not so vicious and can be broken by releasing the existing control pressures. You should be able to recover from the stall to the left before entering an abnormal attitude.

The reason for over-shooting the runway in the first place was because of failure to anticipate the final approach turn. Many times this is due to a tail-wind on the base leg. So remember to anticipate this turn, especially if there is a tail-wind on the base leg. If you do over-shoot the runway excessively, *do not* attempt to speed up the turn and try for a final approach. Do the smart thing, *apply power and go around.* Next time anticipate the turn and make a safe final approach turn.

SLOW FLIGHT

Slow flight is flight near the minimum airspeeds at which the aircraft can still be properly controlled. Since this is the case, it is obvious there will be a relatively high power setting and low airspeed. When this condition exists, there is a large torque effect present, which makes this maneuver an excellent torque and trim exercise.

Slow flight is practiced to show you how the aircraft may be controlled at very low airspeeds. In this respect it will further develop your "feel" of the aircraft, and your ability to use the flight controls properly. This increased proficiency will better enable you to cope with conditions encountered in go-arounds, maximum-performance maneuvers, acrobatics, and other maneuvers that are performed fully or partially in the low speed ranges.

Since we want to practice *slow* flight, we want to obtain all the additional lift and drag possible, so the aircraft should be set up with the following conditions of flight.

Gyros caged
Throttle at sufficient power to maintain altitude and avoid stalling. (Approximately 21-23″ Hg)
Propeller at 1850 RPM
Mixture lean for smooth operation
Gear down
Flaps down
Canopy closed
Airspeed just above normal stalling speed

While flying in straight and level flight, lower the landing gear with a normal gear procedure. Since the nose of the aircraft will be in a high-pitch attitude throughout this maneuver, clear the area before beginning. When the gear is checked down and locked, perform at least two 90° clearing turns. After you roll out of the second clearing turn, close the throttle and maintain a constant altitude as the airspeed dissipates. This will, of course, necessitate increasing the pitch attitude with back-stick pressure. Do not raise the nose abruptly or mechanically. Raise it slowly and as needed to keep from losing altitude while the airspeed drops off.

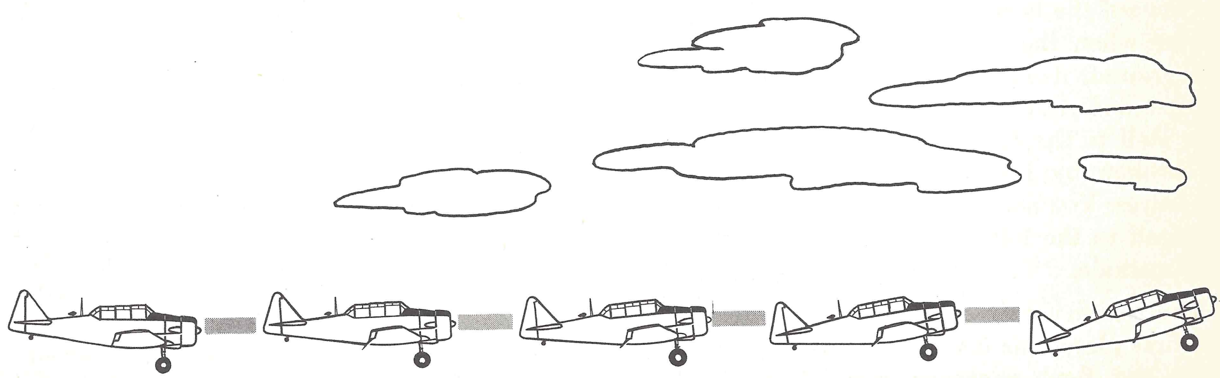
When the airspeed has dropped to 100 MPH, lower *full* flaps. This will supply additional lift to the aircraft and may cause the altitude to increase slightly. The effect of the flaps will also tend to cause the nose to lower. You will feel this through the stick's exerting a forward pressure against your hand. Merely counteract this force with back-stick pressure and hold the nose attitude constant.

The airspeed will now dissipate rapidly because of the additional drag caused by the flaps. Once again you must adjust the pitch attitude in order to maintain a constant altitude. Since the airspeed is decreasing rapidly, you should now open the throttle to approximately 22″ Hg to obtain sufficient thrust to maintain an airspeed just above normal stalling speed and to maintain altitude. This throttle position will vary on different T-6's, but may be used as an approximation and as a starting point. Throughout the maneuver you may find that you have to use constantly varying throttle-elevator coordination. That is, make slight pitch changes with the elevators and slight power changes with the throttle in order to maintain a constant altitude and airspeed.

With the relatively high power setting and low airspeed, considerable right-rudder pressure and right-rudder trim will have to be applied to counteract the effects of torque. You will find that after the right-rudder trim is moved fully forward, you will still have to hold right-rudder pressure with your foot. Back-elevator trim will have to be used to relieve the stick pressures, and to maintain the pitch attitude.

After you have mastered straight and level slow flight, you should begin making gentle turns to the right and to the left. You will now learn the need for smooth and easy control pressures, and will also note the larger range through which the controls must be moved to obtain a desired effect. The reason, of course, is that there is less pressure exerted by the air flowing over the control surfaces; therefore, the control surfaces must be displaced further and present more surface to the relative wind in order for you to gain an effective response.

Remember, to turn an aircraft, you must establish a bank and then the force of lift makes it turn. The rate at which the aircraft turns is caused by the degree of the established bank and the speed at which the aircraft is moving through the air. For a given angle of bank and a given airspeed, the aircraft will turn at a certain rate. The rate of



Slow Flight

turn is directly proportional to the degree of bank, and inversely proportional to the airspeed. That is, if the bank is increased, the rate of turn will increase. If the airspeed is increased and the bank is held constant, the rate of turn will decrease. This means that the slower the aircraft is moving, the greater the rate of turn you will receive from any given angle of bank.

When you are making these turns during slow flight, notice the fairly rapid rate of turn that is produced by a very shallow bank. This shows that it is unnecessary to make steep turns at low airspeeds to make a rapid change of direction. Steep turns can be dangerous at low airspeeds, and besides, you can make a fairly fast turn with a shallow bank during slow flight.

After you have mastered straight and level, and turning slow flight, your instructor will show you the result of making fairly steep turns and the rough use or misuse of the controls during slow flight. He will also show you the effect of raising the flaps quickly.

To determine how the aircraft will stall in a turn during slow flight, roll into a fairly steep bank and attempt to maintain altitude by holding a constant or slightly higher pitch attitude. Notice that when the critical angle of attack is exceeded, the aircraft stalls while trying to increase the lift necessary to maintain altitude.

Next, try rolling into turns and recovering by using the controls roughly, speedily and without proper coordination. Notice how the aircraft wallows and is difficult to control and notice how any excessive control pressure may stall the aircraft.

While flying in straight and level slow flight, raise the flap handle and allow the flaps to come completely up as fast as they will. As the flaps are being raised, attempt to maintain altitude. You will notice the aircraft begin mushing and you will have to raise the pitch attitude to gain additional lift. When this is done, the critical angle of attack is again exceeded and the aircraft will stall. Even if the aircraft fails to stall when the flaps are raised in this manner, considerable altitude may be lost. Therefore, you must always remember to "milk up" the flaps (five to ten degrees at a time) when flying at low airspeeds.

When you finish practicing slow flight, execute a normal go-around procedure. This will return the aircraft to normal flight conditions, and also give you practice in go-around procedures.