Bellanca Cruisemaster

Bellanca Aircraft Corporation
New Castle, Delaware

This manual is a transcribed copy of a Bellanca 14-19 Owner's Manual, transcribed in August 2005. Spelling and minor grammatical errors in the original text have been corrected.

Introduction

Your Bellanca Cruisemaster is one of the finest airplanes in the world. In its development you, the owner, have played an important part. Your safety and comfort have always been kept in mind. It was designed for safe, dependable, and economical operation.

The following pages will describe the functions of the various components to enable the pilot to obtain the utmost of comfort, economy and utility from his or her ship. It will also include instructions and sketches to aid in the proper care and maintenance. All of the equipment must be kept in first-class condition to realize the full benefits of the Cruisemaster and with this care your Cruisemaster will give years of top-notch service.

Yours for more enjoyable flying.

Bellanca Aircraft Corporation

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Section I – Operating Details

Propeller

The standard propeller installation is a Hartzell (Model HC-12x20-8) Hydro-Selective unit which will give the Cruisemaster hi-speed performance or selective economy cruise as the pilot desires. During engine warm-up the control handle should be fully in (flat pitch) and when the R.P.M. is up to about 1500 work the handle thru the complete cycle several times to check its operation and fill the propeller piston with warm oil. Do not be alarmed if the engine sounds rough when the prop is in hi-pitch. This roughness is normal when prop is operated in hi-pitch on the ground. It indicates high B.M.E.P. and the approach of detonation.

A Koppers Aeromatic – Automatic Controllable (Model 220-1/0-78A) Propeller, with altitude control, can be installed as an alternate. This propeller, due to its automatic features, requires a minimum of adjustment in the air.

Engine

Oil Level: The oil capacity of the Lycoming O-435A engine is twelve quarts. To check the level, remove the inspection cover in the top cowl and directly underneath is an oil filler neck extension, and dip stick. The oil level is read directly from this dip stick. Tighten cap securely when replacing.

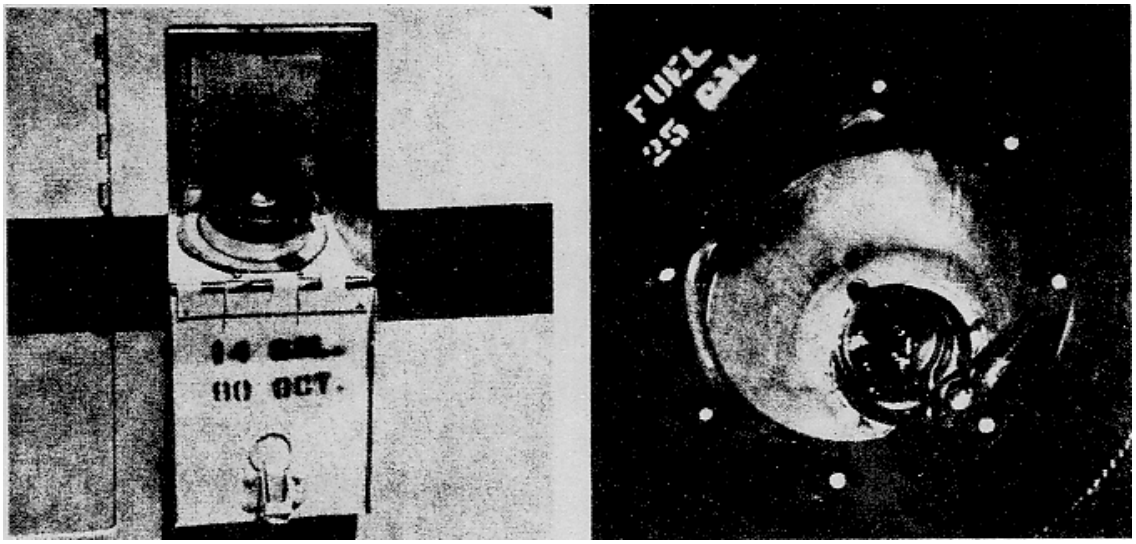
For maximum engine performance, Lycoming (Model O-435A) Operators' Manual should be consulted.

Engine Compartment

The engine compartment should be kept free of an accumulation of oil, grease and dirt to prevent a fire hazard. The firewall bulkhead is stainless steel and any recommended solvent cleaners for grease or oil may be used.

Fuel System

Fuel is supplied to the engine from either of two 20-gallon wing tanks or, in addition, from an auxiliary rear tank of either 14 gallons or 25 gallons. The filler necks for the main tanks are on the top surface of the wings and are appropriately marked. The auxiliary rear tank filler neck is on either the side or top of the fuselage. All filler necks are protected by flush covers which can be easily removed. A good precaution is to visually check the fuel quantity in all the tanks, and the security of the caps and covers before entering the airplane. Fuel is supplied to the engine by the action of the engine driven fuel pump through lines located under the floor which lead to the selector valves. A single fuel line funs forward to the wobble pump and from there to the firewall. Fuel flow from here is through the fuel strainer and then on to the engine pump. After the engine pump, fuel is forced under pressure to the carburetor at which point the line is tapped for the purpose of an outlet to the fuel pressure gauge. See Figure 8.



Fuel Strainer

The fuel strainer provides, not only an excellent filter for any dirt particles which may come through the lines, but also will trap water (condensed moisture) that may have collected over a period of time and overflowed the tank sumps. The strainer is located on the forward face of the firewall and should be drained periodically. It can be reached by raising the side of the engine cowl. Each tank outlet is also equipped with a fine wire mesh finger strainer.

Fuel Tank Drains

The wing fuel tank sump drains are small pipe plugs located on the under surface of the wings near the rear spar. The rear (14 Gal.) tank drain is accessible through an opening in the bottom fabric. This valve requires no safety wire. If your ship is equipped with an auxiliary baggage compartment tank, the drain for that tank will be found under the small access door in the center of the baggage compartment floor. These drains should be periodically checked for possible accumulation of water, drained, and then safetied securely.

Fuel Gauge

Quantity of fuel is indicated by an electrical gauge when the selector switch is turned to the proper tank.

Fuel Tank Selector Valves

The selector valves are located on a small shelf on the pilot's left, for easy operation and visual check. The valves should be in the "off" position when not in use. This is especially true if the ship has the auxiliary rear tank installed, for fuel will drain from the rear tank into the wing tank and then out the overflow if both tank valves are in the "on" position at the same time.

Primer

The primer ordinarily is not required except at cold temperatures. It is used to supply an initial charge of raw fuel to the cylinders to aid in starting the engine. To Operate: First, unlock the plunger by pressing in and at the same time turning the knob to the left, then slowly pull the plunger all the way out and then push the plunger all the way in. This action is called “one stroke of the primer.” Make sure the Magneto Switch is “off” and throttle “closed.” Then give the engine three or four strokes with the primer as the prop is pulled through by hand or by engaging the starter.

Wobble Pump

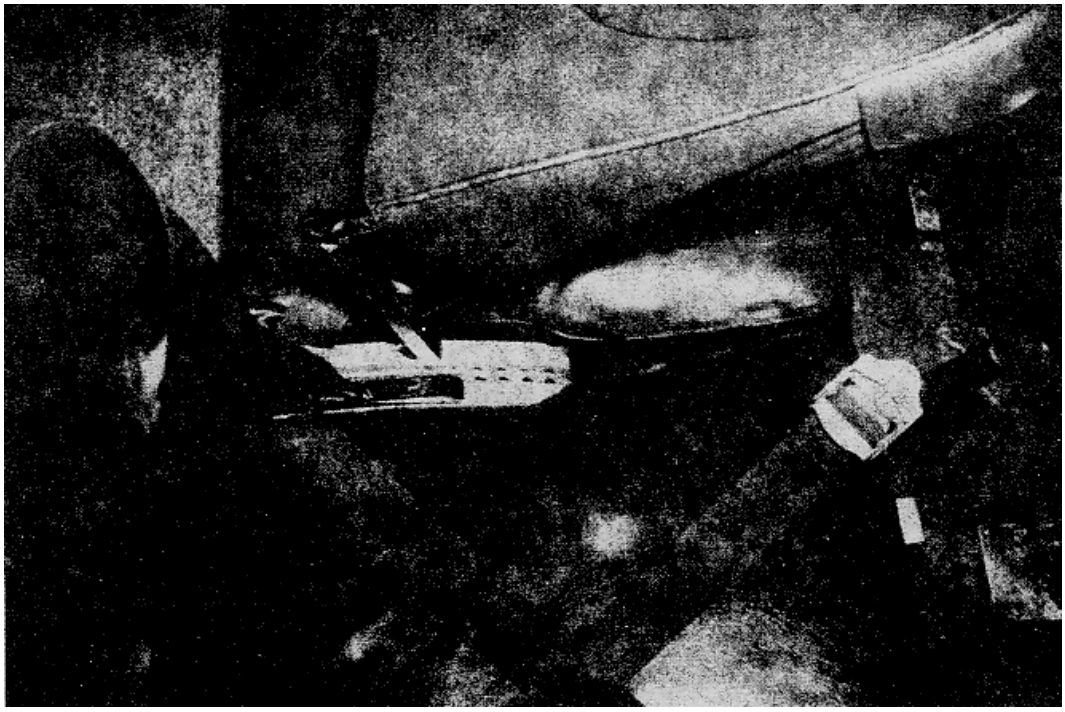
The wobble pump is located on the pilot’s left on a vertical panel just below the instrument board. This pump provides manual means of supply the engine with fuel in case of engine fuel pump failure or when pilot inadvertently drains on gas tank dry and engine cuts out. To Operate: Work the handle fore and aft sufficiently fast to keep the engine operating or about sixty strokes per minute. You will feel a slight resistance in one direction when it is pumping.

Cabin

The cabin compartment is entirely encased in an envelope of fiberglass soundproofing and insulation. The upholstery is a flame-proof fabric, selected by a well known commercial designer with expert taste for pleasing color combinations as well as for the ability to clean easily. Cushions are deep rubber foam to give hours of comfortable, restful travel.

Front Seat Adjustment

The front seat-back hinges at the bottom to provide easy access to the rear seat. It is also easily adjustable on the ground or in flight. The ease with which the seat can be adjusted makes it possible to change instantly from the most comfortable reclining position for a long flight to a more upright one for better visibility on a landing approach or for taxiing. To adjust the seat, simply grasp the top, lift up slightly and then slide fore or aft to the desired position.



Cabin Ventilator

Fresh air for cabin ventilation is supplied by a small vent located on the right side of the plane. It is quickly adjustable for any opening desired.

Cabin Heat

Warm air for the cabin is obtained by a shroud-type heater around the muffler. The control is located on the small shelf on the right side of the ship. When heat is desired in the cabin “pull” the control until the desired result is obtained. The heat will enter both front and rear sections of the cabin from under the seat.

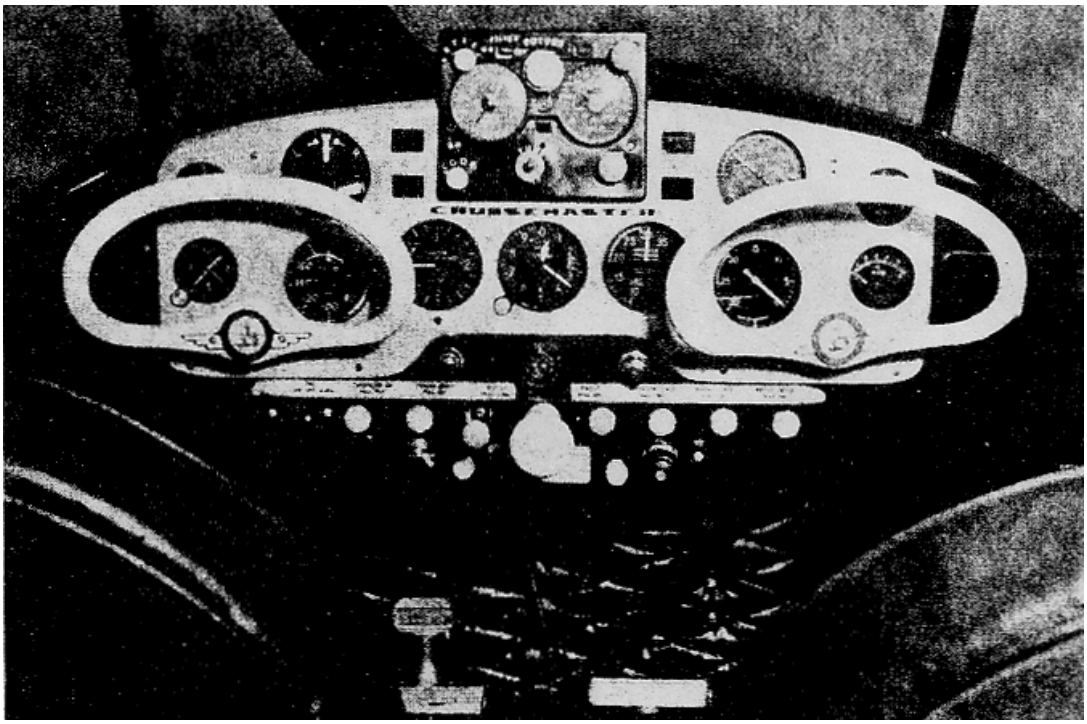
Pilot's Small Window

A small window is provided on the left side of the airplane for visibility in bad weather or for the convenience of the pilot in giving ground instructions to an attendant. He can also reach forward and clean a section of the windshield in flight if necessary. This window can be opened at any airspeed.

Instrument Panel

Your Cruisemaster instrument panel comes equipped with the full complement of blind flight instruments which are arranged to meet the approval of the majority of pilots. It has indirect light for night flights and the intensity of light is controlled by a rheostat located on the sub-panel. In keeping with years of Bellanca designing on cockpit safety, protrusions are eliminated and the edges well rounded.

Space for the additional gyro instruments is available on the left of the panel. If desired, both the artificial horizon and the directional gyro are installed on this side. The Glove Compartment is then eliminated.



Mixture Control

The mixture control is to be always set at "Full Rich" for starting and take-off purposes. Pulling out the control leans the fuel mixture. This mixture control should be used cautiously, in general at 5000 feet and higher, and then used in conjunction with the cylinder head temperature gauge. Too lean a mixture will cause excessive engine heating and result in damage.[1] General practice in stopping the engine is to throttle back and allow engine to idle for a short period to cool, then pull mixture full lean, to idle cut off, open throttle wide, then turn off Magneto Switches.

Carburetor Air Heat

The carburetor heat control operates a valve in the air intake which proportions the hot and cold air entering the carburetor. To provide heated air for the carburetor, pull "out" the control; to provide only cold air for the carburetor, push the control "in" all the way. Carburetor ice can form on the ground with the engine idling. Therefore, just before take-off in icing conditions when you run the engine and test the magnetos be sure and have the carburetor heat in the "on" position. Leave it in that position until you open the throttle for the take-off run. Then, move carburetor heat to the cold position. This gives maximum power for the take-off. Watch the engine for any indications of ice (roughness or loss of R.P.M.) during climb and apply full carburetor heat if the engine shows signs of ice. The correct way to use carburetor heat is to first use full heat to remove any ice that is forming. By trial and error determine the minimum amount of heat required to

[1] Modern note: It is now commonly accepted that leaning below 5000 feet is acceptable and even desirable, there is no need to restrict leaning to only high altitudes. That said, the manual's cautions about high cylinder heat temperatures (CHT) apply when leaning at any altitude and especially with the 14-19 engine/airframe combination.

prevent ice forming, each time removing any ice that is formed by applying full heat. On approach, glide just before reducing power, apply full carburetor heat and leave in full hot position. Push off, i.e. "in" after landing.

Cowl Flap Control

The control for the cowl flap is a "T"-shaped handle located on the sub-panel. It is a locking type and must be rotated before moving to the desired position. The cowl flap should be in the full open position, (pull out), for take-off and climb conditions or at any other time that the cylinder head temperature is rising close to the red mark on the gauge. This flap can be used to advantage when maximum economy is desired. That is: low engine speed, high manifold pressures, a lean mixture and the cowl flap open slightly to help keep the engine temperatures low.

Trim Tab

The trim tab control handle crank operates an auxiliary moveable control surface on the elevator. It is used to relieve the control wheel pressures during flight. Forward direction of the indicator trims nose down and rearward, nose up. The tab is sufficiently powerful to trim the ship, hands off, for nearly all flight attitudes and loading conditions.

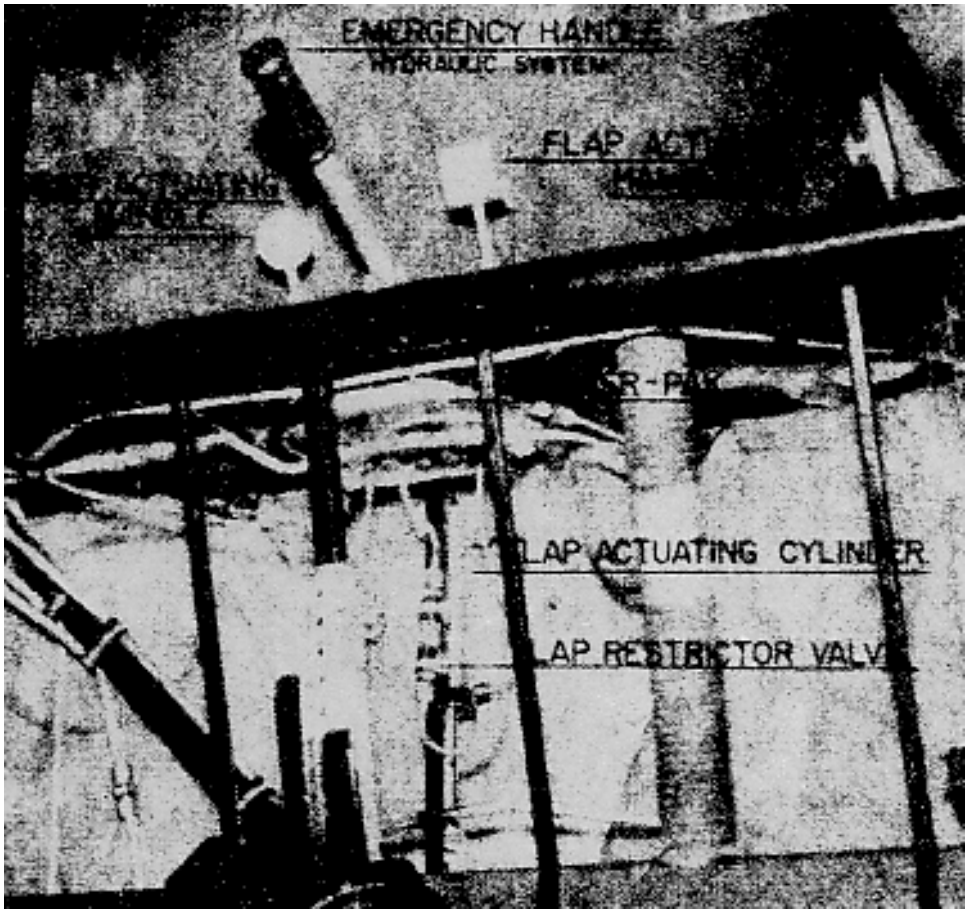
Hydraulic Power System

The Hydraulic Power System is used to actuate the retractable landing gear and raise or lower the flaps. Power for the system is obtained by an engine driven hydraulic pump which operates continuously with the engine circulating fluid through the open center of the reservoir and valves or what is commonly called the Power-Pack. Pressure of the fluid may be as high as 100 P.S.I. at this time. When a valve is moved either up or down, the fluid then flows to the operating cylinder moving the piston in the direction selected.

The system is adequately protected from overload by a pressure relief valve set at 800 P.S.I. An emergency hand pump is provided in case of pump, line or engine failure. A glance at the gauge on the right of the pilot's compartment will give a check on the hydraulic pressures.

Added safety is provided in case of complete hydraulic failure by a gear extension tube and spring which will extend the gear to the locked down position against the air load on the tire. Approximately 80 miles per hour.

The landing gear has automatic downlocks. These downlocks require no special attention from the pilot.



Operation of Landing Gear & Flap

The landing gear and flap operating handles are functional in design and in operation. They are located between the two front passengers on the upright portion of the front seat. To operate, simply grasp the small wheel (to indicate landing gear) or the airfoil section (to indicate flap) and move the handle up or down as you desire the counterpart to move. There will be immediate response as it requires less than two seconds for the entire operation. It can be stopped partway through the cycle by simple releasing the handle which is spring-loaded and will return to neutral locking the fluid in the line at that position. This feature is desirable at times when only part of the entire flap travel is desired. Flap operation time is increased by the installation of a strainer and restrictor in the line. Flaps should not be operated at air speeds above 90 m.p.h. Position of the flap is indicated pictorially by a small mechanical indicator located on the vertical section on the pilot's left, directly below the instrument panel. It has a wire control connected directly to the flap cylinder. The landing gear should be operated at speeds under 125 m.p.h.

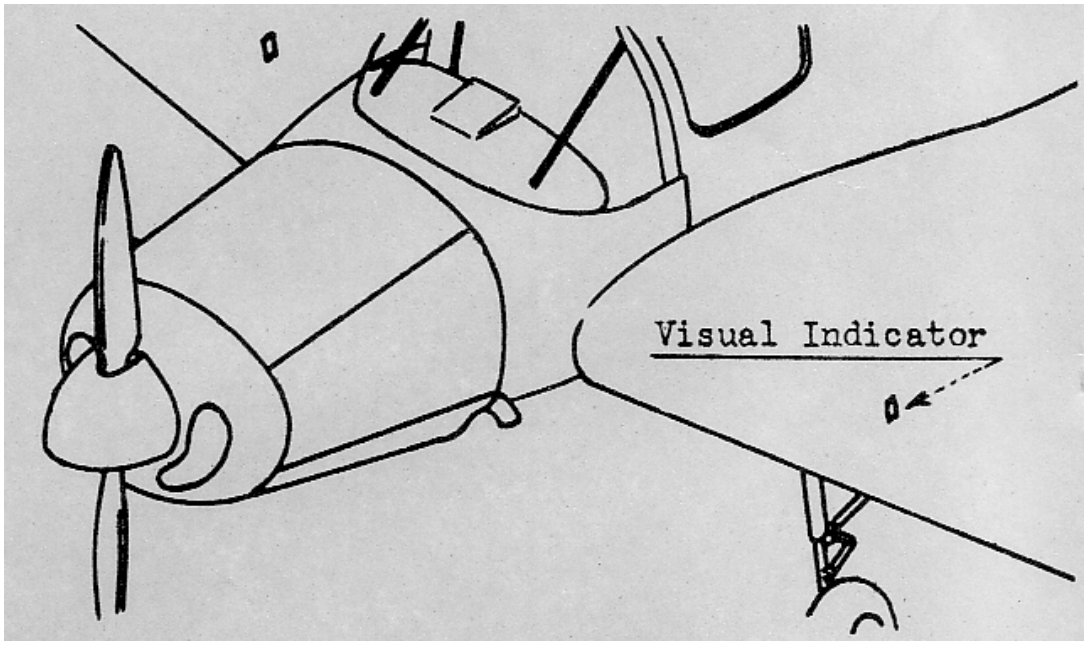
Care must be exercised to prevent inadvertent retraction of the landing gear on the ground. As a precaution against operation by personnel unfamiliar with the ship, it is recommended that the spring-loaded latch which holds the landing gear lever in the down position be engaged. It should be released before starting the engine, for the engine pump will deliver by-pass pressure and foaming of the oil may result. An important

feature of this latch is to allow single hand operation for extending the landing gear when using the emergency handle.

Indication

Indication of landing gear position is given by appropriately marked and colored lights on the instrument panel. Red, indicating landing gear is up; Green, indicating gear down and locked. There are separate indicator lights for both positions. The intensity of these indicator lights in controlled by a rheostat located on the sub-panel.

An additional visual indicator is installed on each wing and is merely a metal strip mounted on the landing gear trunnion so that it will extend or retract through a slot in the leading edge of each wing as the gear is operated. When the wheels are retracted, the indicator extends slightly and is dark in color. With the gear down, the indicator protrudes further from the wing and is painted a light contrasting color. The indicator system is easily visible from the cabin.

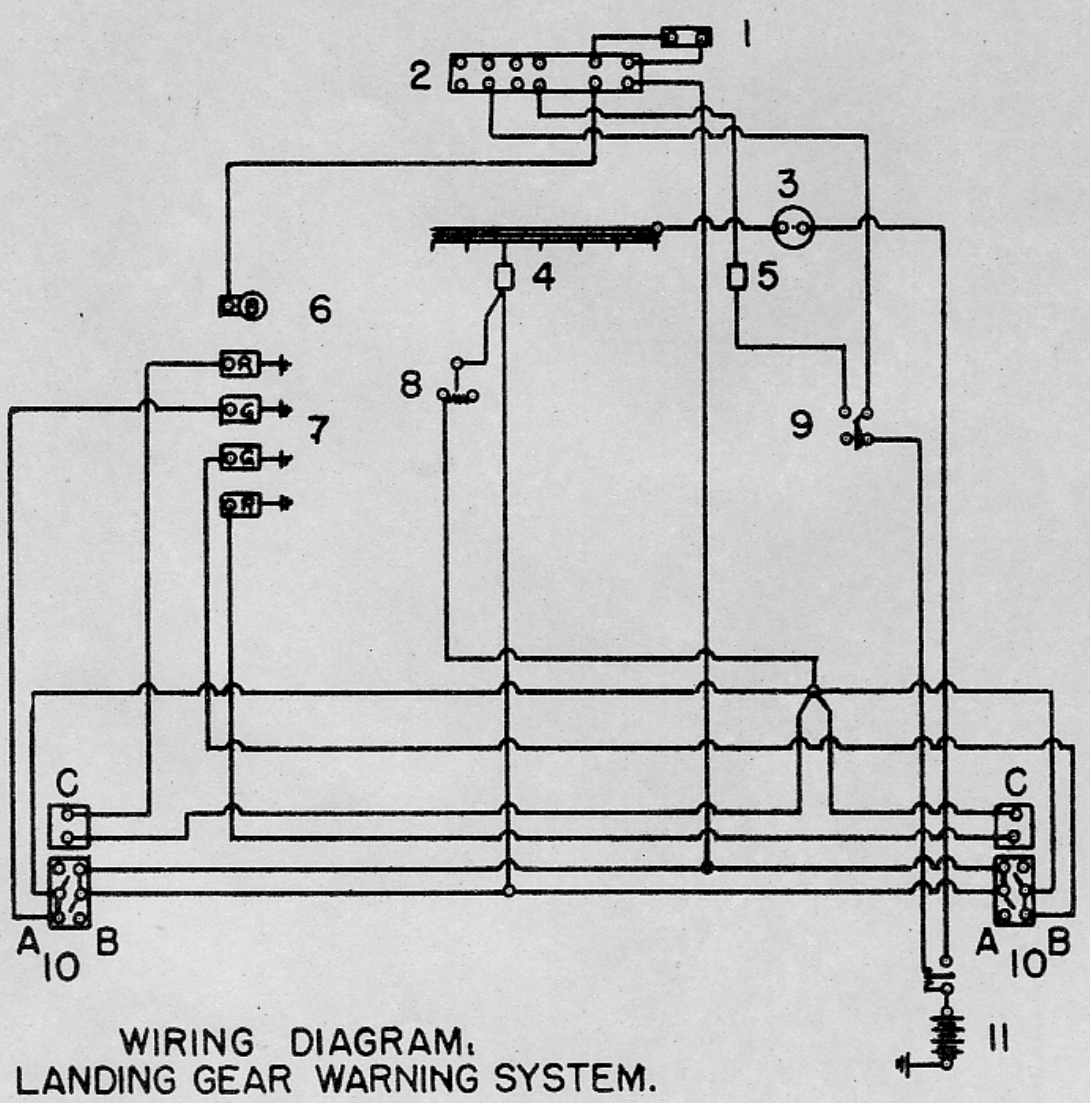


Landing Gear Warning System

This system provides an audio reminder in the form of a bell that the landing gear has not been extended before making a landing which may result in severe damage. This hook-up includes two switches. With the gear up a switch is actuated mechanically from the carburetor by simply throttling to 1400 R.P.M. and under. This switch closes the circuit and sets off the bell… the bell being mounted on the underside of the instrument panel. The bell will continue to ring until the throttle is opened to go around again or until the microswitch, mounted on the landing gear drag strut, is actuated indicating wheels down and locked. Normal operation is such that the bell is seldom heard (except for the recommended pilot “checking” procedures) as the gear is lowered before the throttle is reduced for the landing.

KEY TO DIAGRAM

1 - Throttle Switch
2 - Terminal Block
3 - Ammeter
4 - Fuse Block
5 - 10 Amp. Fuses
6 - Warning Bell
7 - Warning Signals
8 - Signal Lts. Rheostat
9 - Master Switch
10 - Micro D.P.D.T. Switches
Gear Down -A-Norm. Open
B-Norm.Closed
C - Gear Up -Norm. Open
11 - Battery & Relay



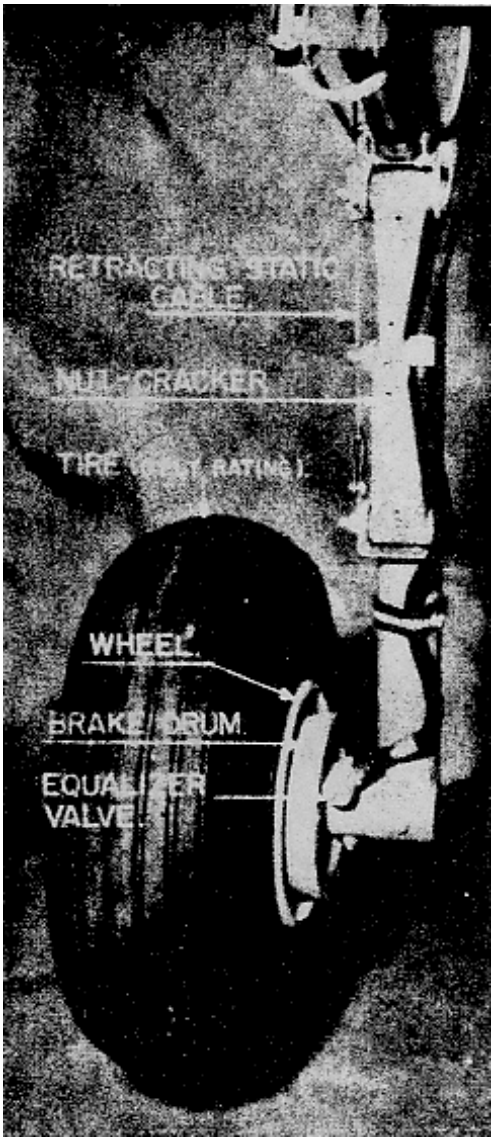
WIRING DIAGRAM:
LANDING GEAR WARNING SYSTEM.

Brakes

The hydraulic brakes are individually operated. The rudder pedals are pivoted so that braking action is applied by pressure with the toe on the rudder pedal to either or both wheels.

Adjustment

The brakes are provided with a valve that has an adjustable spring operating against a diaphragm and holds some pressure against the brake shoe. In operation it functions just like any other mechanical adjuster.



Tires & Wheels

The 6.00 x 6 wheel mounts a 6.00 x 6 6-ply rating tire. A 7.00 x 6 6-ply rating tire can be mounted on the same wheel as alternate equipment.

Parking Brake

The parking brake is operated in conjunction with the toe brakes and is simply a separate valve to lock full pressure in the line. In setting the parking brake, first press the toe brakes to the desired brake pressure. Then pull the control on the panel out to close the valve, releasing the toe brake pressure simultaneously. To release the brake, press in the control while applying full pressure to the toe pedals and then release them.

Electrical Switches

Magnetos

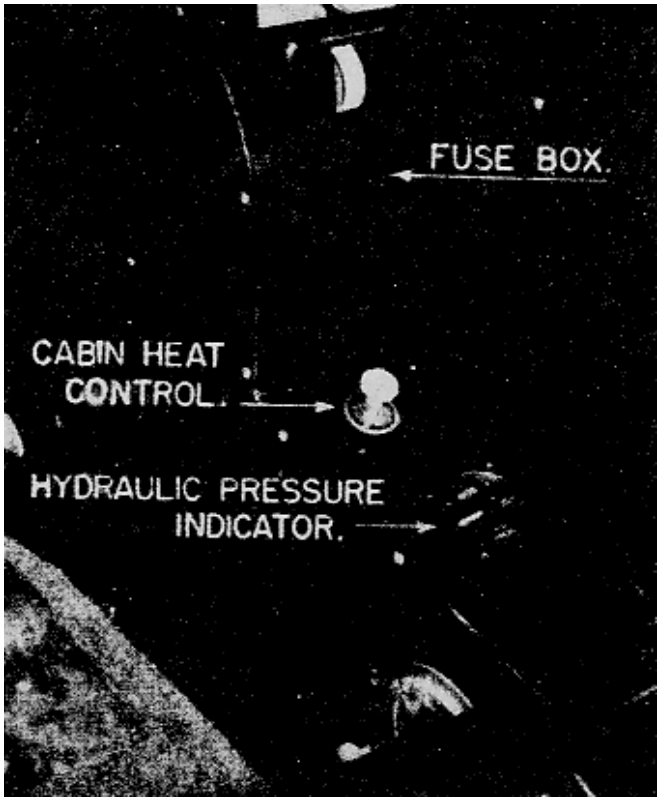
The two magnetos are turned on and off through one switch operated with a key located on the center panel.

Master Switch

The master switch operates a solenoid switch located at the battery in the tail of the ship, turning off all electrical power at the battery. In the event of a short or a malfunctioning of the airplane electrical system, the master switch may be turned off and the engine will continue to run on the magneto ignition system.

Starter Switch

The starter switch is located just above the throttle and can be reached easily without removing your hand from the throttle. It is similar to the type found on most automobiles and operates a solenoid switch at the starter.



Landing Lights

The landing lights are a standard (sealed beam) type and require to special instruction. However, a word of warning to remind the operator that the heat from the landing light is sufficient to distort the plexiglass cover if it allowed to remain on with the ship standing still for some time. The taxi light beam covers a larger area and is the only light to be used while on the ground.

Fuses

The entire electrical system is protected by inexpensive fuses, conveniently located in a fuse panel on the right side of the cabin. A variety of spare fuses for replacement are provided.

Radio

Various aircraft radios have been installed and the planes electrical system is well shielded and bonded to give good radio performance with any set.

Steerable Tailwheel

Taxiing is facilitated by the use of a steerable tailwheel which operates with the rudder. The tailwheel is steerable through approximately 35° to either side of the straight rearward trailing position and automatically becomes full swiveling when turned to a greater angle. The airplane can be moved about easily in the hangar. By using the steerable tailwheel and keeping the heels on the floor, excessive heat and unnecessary wear on the brakes can be avoided. The heels on the floor also applies to take-off and landing procedure.

Take-Off

The shortest take-off run can be obtained by keeping the tail low during the whole procedure. The tab can be set to assist in this. With the tail just a little of the ground the wings are set at a desirable lift angle for take-off. The airplane will "break ground" at approximately 50 m.p.h. and accelerate rapidly to the speed of best rate of climb. It is much better for the engine, if there is no particular reason for getting up and away in a hurry, to throttle back a little after you have cleared your last obstacle and settle for a little less than maximum performance or full throttle and an airspeed of about 100 m.p.h.

Landing

The airport greeters are apt to judge pilot's ability by the smoothness he displays on his landing. The Cruisemaster is designed for perfect landing at low airspeeds. Trimmed for a nose-high condition, the plane all but lands itself. Its gentle response develops the pilot's confidence. Specifically, it is the smooth low stalling speed of 43 m.p.h. (full flaps) and amazing aileron control down to this stall which enables the pilot to develop the "feel" – he becomes a part of his ship and performs landings that are an enviable display of smoothness and precision… He steps out of his plane with a pride that has almost become a tradition among Bellanca airplane owners.

Cruising

A most favorable cruising speed can be obtained at an altitude between 7000 and 8000 feet. A recommended procedure in obtaining this favorable cruising speed is to take the airplane somewhat higher than recommended and to dive gently to the proper altitude and then level off. This procedure will put the airplane on the step for instantaneous cruise.[2]

At this altitude the airplane can be flow at 2550 R.P.M. and 20 inches of manifold without damage to the engine.

Ground Handling

Proper tie-down and ground handling are necessary if the airplane is to remain airworthy. If tied down outside, it must be securely anchored. For example, a gust of 70 m.p.h. will exert a normal load on the wings equal to twice the weight of the airplane or nearly 2000 lbs. more than the weight of the airplane. Ropes attached to the lower drag strut link of the main landing gear and tied to tie-down rings or anchors will do very well provided they are strong enough for this load. The flaps should be left in the fully extended position.

When moving the airplane about, push at the root front edge of the stabilizer or anywhere along the leading edge of the wing. Any spot on the landing gear leg will do also. Push by hand and do not use any sharp object which may puncture the surface. The tail of the airplane may be lifted over small obstructions by grasping the leading edge of the stabilizer near the fuselage. Do not attempt to lift the airplane by the wing. Serious damage may result. See service instructions for lifting.

Section 2 - Care and Service of the Airplane

In order that the airplane may give the performance economy and dependability built into it, certain requirements in its care, inspection and maintenance must be followed. These requirements will assure the owner of a satisfactory service and in the long run pay for the effort many times over.

Engine Maintenance

Engine Maintenance is covered in the Engine Operator's Handbook supplied with each ship.

[2] Modern note: Flying "on the step" is a myth: there is no step. The force equations for drag, lift, thrust and gravity do not solve differently based on whether cruising speeds are approached from a higher airspeed or a lower airspeed. The "step" procedure outlined in this manual merely accelerates the plane to cruising speed faster because of the small dive increasing airspeed, and by having extra energy to play with it is often easier for an inexperienced pilot to trim for the final cruise airspeed. The same resultant cruise airspeed will be reached either by diving down to an altitude or by leveling at the altitude and trimming as the ship accelerates. Level acceleration from climb speed to cruise speed takes longer, however, and it requires a deft touch on the wheel to stay at a level altitude and re-trim the airplane as it accelerates.

Fuel and Oil Requirements

The Lycoming engine should be serviced with only the best lubricants and fuels, aviation grade fuel will give better results than other grades of fuel and will be more economical in the long run. The recommended fuel for the O-435 is 80 Octane rating minimum with a lead content of not more than ½ cc per gallon. Highly leaded fuels are not recommended.

Aviation grade oil is recommended. Change the oil each 50 hours of operation.[3] When adding or changing oil, use viscosity ratings given in the following table:

Outside Temperature Fahrenheit	Recommended Oil Viscosity
Below 40°	SAE 40
Above 40°	SAE 50

Power Plant

The Power Plant used in the Model 14-19 Cruisemaster is a 190 horsepower Lycoming Model O-435-A Engine. It is bolted to the engine mount through rubber bushings providing complete separation of the engine and airframe.

An air filter is incorporated as part of the air intake system and requires attention when loaded with collected material. The service period for this filter will vary with conditions under which it operates. The filter is made up of a cotton covered screen mesh with high oil-retaining ability. The dirt particles stick to the oil on these baffles and soon become loaded. To clean, the filter should be soaked and rinsed in kerosene or a noninflammable solvent. Shake off excess and allow to dry for a few minutes. Recharging is accomplished by dipping filter in SAE 60 oil and then drained face down until excess is removed. When replacing filter make sure felt seal is in place for the filter is only as good as the seal which prevents dirt from leaking past.

Propeller

The propeller has three places that require lubrication every 50 hours. The spinner must be removed but make a mark on the spinner and backplate with a pencil so that it can be replaced in the exact position before removal. The three places that require lubrication are – one in each blade and the jackplate bearing. There are two or more grease fittings in each blade that lubricate the same bearing so the easiest one to reach is the best. Add grease with hand gun until it just starts to show between the blade seal and hub extension.[4] Be careful not to blow out the seal. The jackplate bearing requires little

[3] Modern maintenance note: A 25 hour oil change interval is more prudent on engines not equipped with an add-on external oil filter. With an oil filter, 50 hours is a good interval.

[4] Modern maintenance note: With Hartzell HC series propellers you must remove one of the two grease zerks on the blade clamps before greasing at the second zerk. Otherwise it is very easy to blow out the blade seals due to excessive grease pressure. With a propeller recently overhauled or inspected since the 1990s, use the grease indicated on the stick-on label on the hub. The Hartzell recommended grease is

lubrication and care must be exercised to prevent is being overloaded which will cause it to run hot. The grease fitting will have to be located through one of the holes in the backplate as the propeller is pulled through by hand. Two or three strokes of a hand grease gun will be sufficient lubrication. Use a propeller grease or grease meeting requirements of Specification AN-G-15. Keep blades smooth with wax or polish.

The function and service of your propeller are given in detail in the propeller manual.

Hydraulic Power System

This system operates the retractable landing gear and flaps. Inspect for leaks at all fittings, possible chafing through of the lines, worn or cracked flexible hoses and leaking seals at the cylinders or down locks. Check the oil level in the reservoir and fill with a mineral base hydraulic fluid.[5] The oil level should be approximately ½ inch from the top of the reservoir when the ship is in ground attitude.

If your ship is equipped with an engine driven hydraulic pump there will be two reservoirs to fill. The one on the power-pack must be filled completely full first, then the engine pump reservoir filled to within one half inch of the top.

Caution: The above procedure must be followed in order to eliminate the trapped air in the bottom reservoir.

Landing Gear, Wheels and Tires

The landing gear oleo must be kept filled with fluid to operate as designed. It is the spring oil type and does not store energy to throw you back in the air again after a hard landing but dissipates the energy in oil pressure and heat helping to reduce the loads and smooth out the landings. The filler plug, located near the bottom nutcracker fitting, is removed and the oleo filled with fluid to that level. This is done with the airplane in the normal ground attitude. It is not necessary to jack the ship off the wheels. Fill oleo with an aircraft recommended mineral base hydraulic fluid. There is an "O" ring seal which retains the oil in the lower portion of the oleo leg. If this seal leaks the oil will enter the upper section and will come out the top of the oleo leg when the gear is retracted. Oil near the top of the oleo or top fairing indicates that this "O" ring needs replacement. To replace this ring, raise the airplane off the ground (See instructions for jacking airplane) and retract the gear about halfway. Remove one bolt from the nutcracker and then carefully slide the bottom oleo out of the top section. You will then see the "O" ring piston as well as the bottom piston. The "O" ring can then be easily replaced. It is a standard AN6227-25 "O" ring seal. Care should be taken in replacing bottom oleo so that packing grease between the bushings in the top oleo is not disturbed. The nutcracker bearings are provided with grease fittings as is also the top oleo hinge fitting. All other moving points on the landing gear should be lubricated with a few drops of light machine oil.

Aeroshell 6, however Aeroshell 5 is also usable with limitations on temperatures below -40°F. See Hartzell Service Bulletin HC-SL-61-184.

[5] Modern maintenance note: Use spec 5606 (red) hydraulic fluid.

Correct tire pressure is essential for best tire wear and long life. The tire pressure is 30 P.S.I. Oil or grease should be removed with thorough cleansing, using soap and water. The 6.00 x 6 wheel is a two piece type cast of magnesium alloy and equipped with expander tube brakes. Tires are easily removed by jacking up the airplane, removing the wheel and disassembling the two piece wheel. Be sure that all of the air is out of the tire and tube before taking the wheel apart. The tire is reinstalled by reversing the procedure. The wheel axle nut should be tightened finger-tight plus one-half turn.

The landing gear has an intentional camber built in for two purposes. First, it reduces the side load to the spar and secondly, the owner may change the tires around when they wear smooth on one side, thus allowing one-third longer tire wear.

The brake master cylinders, located in the cabin at the rudder and brake pedals, incorporate a reverse reservoir for brake fluid to replace leakage losses. The reservoir should be kept full and requires checking occasionally. Brake fluid should be Univ-No.J-43 (AN-O-366) or equivalent. Adjustment is made at a small valve which traps sufficient pressure to just expand the brake shoe against the drum. A slight resistance is not objectionable but do not allow the brakes to drag or excessive wear will result. If brakes become spongy it is probably due to air in the line and bleeding of the system should correct it.[6]

The tailwheel mounting a solid tire is the full swiveling steerable type mounted on an oleo spring shock unit. The tailwheel tire is removed and replaced by taking the tailwheel apart the same as the main wheel. The oleo requires the same hydraulic fluid used in the main gear. To fill, raise the tail of the airplane from the ground and support by the lower longerons. Remove the two cover plates and unscrew the filler plug located at the extreme top of the cylinder. Fill the oleo with fluid very slowly, insuring that the strut is fully extended. Work the strut up and down several times to remove all trapped air. With the strut extended, oil level should come right up to the plug, as there is a stand pipe inside to insure just the right amount of trapped air for proper action. There is a grease fitting on the collar of the steering mechanism and one in the hub of the wheel requiring grease. All other joints of the nutcracker are lubricated with light machine oil.

Battery

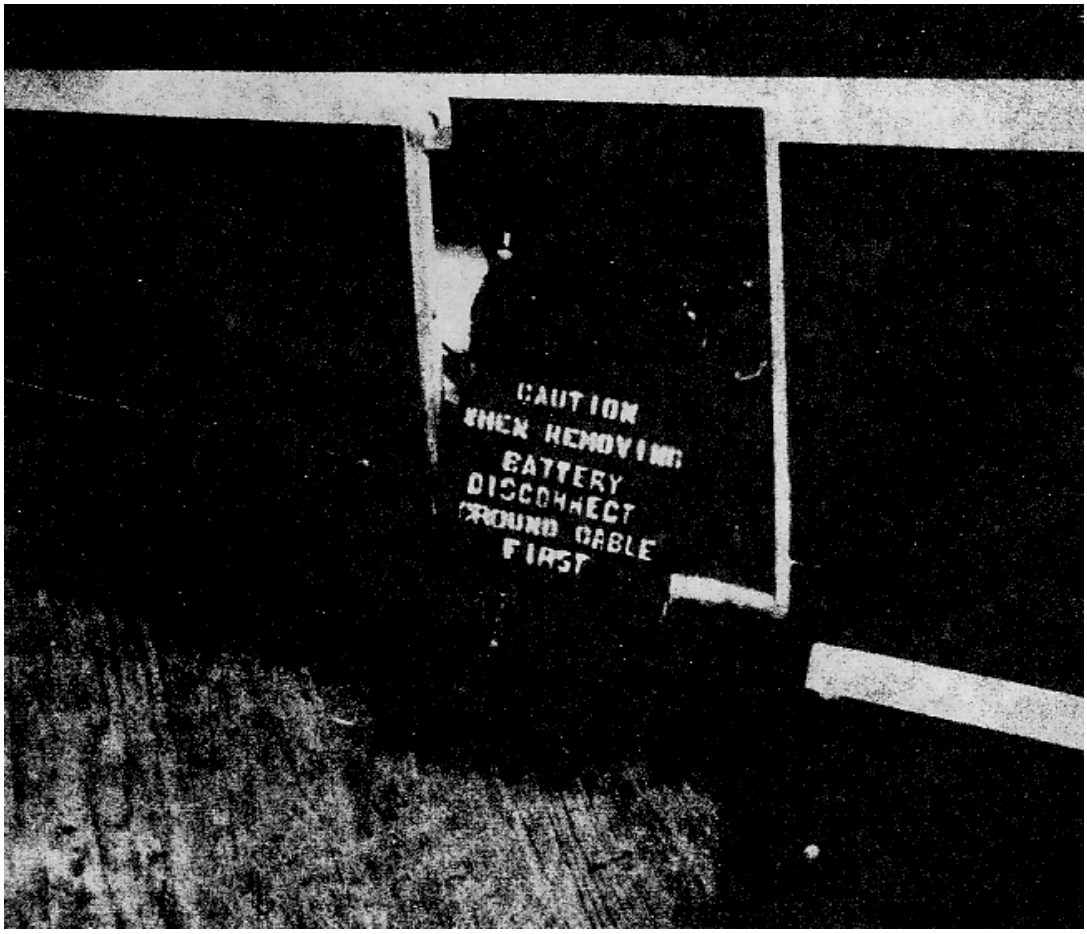
The battery is located just forward of the stabilizer and can be reached through an access door on the right side. Removing one bolt in the hold-down clamp will allow the battery to be slide out on the channels for inspection and service. Be careful of the soft aluminum drain pipe in the bottom of the box.[7]

Maintain the level of the battery electrolyte just even with the small round hole in the top of the plate shield (about two inches from full), by adding distilled water as required. Obtain the water level but do not fill above the hole mentioned above. Wash off any

[6] Modern maintenance note: Most Cruisemasters have had their brakes replaced with Cleveland disc brake systems, therefore the comments about brake adjustment and dragging do not apply. Cleveland systems are usually serviced with 5606 fluid.

[7] Modern maintenance note: I have found you must lift up first before sliding out on the battery rails because of the battery box drain tube. The instructions here are misleading.

spilled acid and corrosion particles with soda water solution to neutralize the acid. Then rinse with clear water.



Make sure the drain in the battery box and battery support channels in the fuselage are open and free from corrosion. If corrosion starts, clean thoroughly and paint with bitumastic or acid proof paint.

Keep battery connections tight and clean. Otherwise excessive voltage may be generated and damage other electrical equipment. Control of the charging current and voltage is accomplished by the generator regulator mounted on the firewall. Only those persons familiar with the operation, adjustment and repair of the control should be permitted to remove the cover of the device.

The ammeter indicates the generator charging rate which will normally be about 10 amps. Discharge generally indicates electrical energy drain in excess of generator output resulting from:

1. Use of a larger number of electrical units.
2. Malfunctioning Generator.
3. A short in the electrical system.

Note (2) and (3) require corrective measures. Failure of the ammeter to indicate will generally be a wiring problem or a malfunctioning generator.

The airplane should not normally be operated with the master switch in the "off" position nor should it be operated without a battery or with the battery disconnected. Damage to the generator and voltage regulator may be the result.

The master switch on the instrument panel operates a solenoid located at the battery. Occasionally, when the battery is allowed to get sufficiently low, it will not have sufficient energy to actuate the solenoid when the switch is turned on, resulting in the generator being unable to charge the battery. In this case, the battery should be removed and recharged.

Windshield and Windows

The windshield is a single piece of molded lifetime plastic. The other windows are cut from flat sheets and have single curvature to fit the ship contour. To clean, wash with plenty of soap and water using the palm of the hand to feel and dislodge any caked dirt or mud. A soft cloth, sponge or chamois may be used, but only as a means of carrying water to the plastic. Dry with a clean damp chamois. Rubbing with a dry cloth builds up an electrostatic charge on the glass so that it attracts dust particles from the air. Wiping with a damp chamois will remove this charge as well as the dust and is therefore recommended. Remove oil and grease by rubbing lightly with a cloth wet with kerosene, hexane, naptha or methanol. Do not use gasoline, alcohol, benzene, acetone, carbon tetrachloride, fire extinguisher, or de-icing fluid, lacquer thinner or glass window cleaning spray as they will soften the plastic and may cause crazing.

If, after removing dirt and grease, no great amount of scratching is visible, the window should be waxed with a good grade of commercial wax. These waxes will fill in minor scratches and help prevent further scratching. The wax should be applied in a thin, even coat and brought to a high polish by rubbing lightly with a dry, soft cloth such as canton or domet flannel. Deep scratches can be removed but it is recommended that this job be accomplished by experienced personnel who follow the manufacturer's directions to obtain the best result with a minimum of distortion. Cracks which may occur should have a 1/8 or 3/16 inch hole drilled at the ends immediately. If the panel is to remain in service it is well to cover with a plexiglass or cellulose acetate path.

Airframe Covering

The fuselage is covered with Grade "A" fabric as are the control surfaces and empennage and are finished with clear and pigmented cellulose nitrate dope which provides a weatherproof and sun-resistant covering. Standard patching methods are applicable.[8] The metal cowl and other parts are primed and painted with a matching

[8] Modern maintenance note: It would be very unusual to find a flyable airplane with cotton covering still on it. Most planes now have Ceconite, Poly-Fiber (Stits) or similar polyester covering with appropriate filler and finishing systems. Consult the airframe logbooks, your mechanic, and modern covering system manuals for appropriate process and patching procedures. Many Bellancas have had enamel or urethane automotive paints applied, which requires careful sanding to patch.

color lacquer. The wings are varnished inside and out, then coated with a surfacer and sanded smooth before the color coat is applied. The entire ship may be cleaned using soap and water with an occasional thorough going over with a good grade of auto body polish, similar to DuPont No. 7. A polish or wax is also advisable for the entire airplane to protect the surface from the elements of the weather and will help keep your ship looking like new.

Upholstery

Keeping the inside of your airplane clean is as easy as cleaning an automobile and points which receive the hardest wear are covered with the best material known, first-class, genuine top leather. The headlining and parts of the seats are covered with wear-resistant fabric. All upholstering materials, including the thick cabin rugs, meet the new requirements set up by the CAA for flame resistance.

If spots or stains get on the upholstery they should be removed as soon as convenient before they have a chance to dry.

When removing them from the leather, simply wash with warm water and soap, rinse with clear, cold water and wipe dry. If cleaning fluid is required for the headlining or floor rugs use one with carbon tetrachloride or a naptha base, using the following procedure:

1. Carefully brush and vacuum all loose particles of dirt.
2. Don't use too much fluid as it may harm the seat padding.
3. Wet a small, clean cloth with the cleaning solution, wringing out thoroughly. Then, open cloth and allow the fluid to evaporate a trifle.
4. Tap the spot lightly with the cloth, but don't rub it. This will pick up particles which are too imbedded to be removed by brushing. Repeat several times, using a clean part of the cloth each time.
5. Moisten another place of clean cloth with cleaner and allow to evaporate until barely damp. Now rub the spot lightly, working from the outside in towards the center. If necessary, repeat several times.
6. Brush again, to remove any further particles which may have become loosened.

Control System

Figures 1 to 6 inclusive outline the control system including travel limits. The use of single .040 brass safety wire for turnbuckles is satisfactory and CAA approved. Rigging method for the various systems is outlined below. For the key to letters also included in the figures, see the lubrication diagram and Fig. 7.

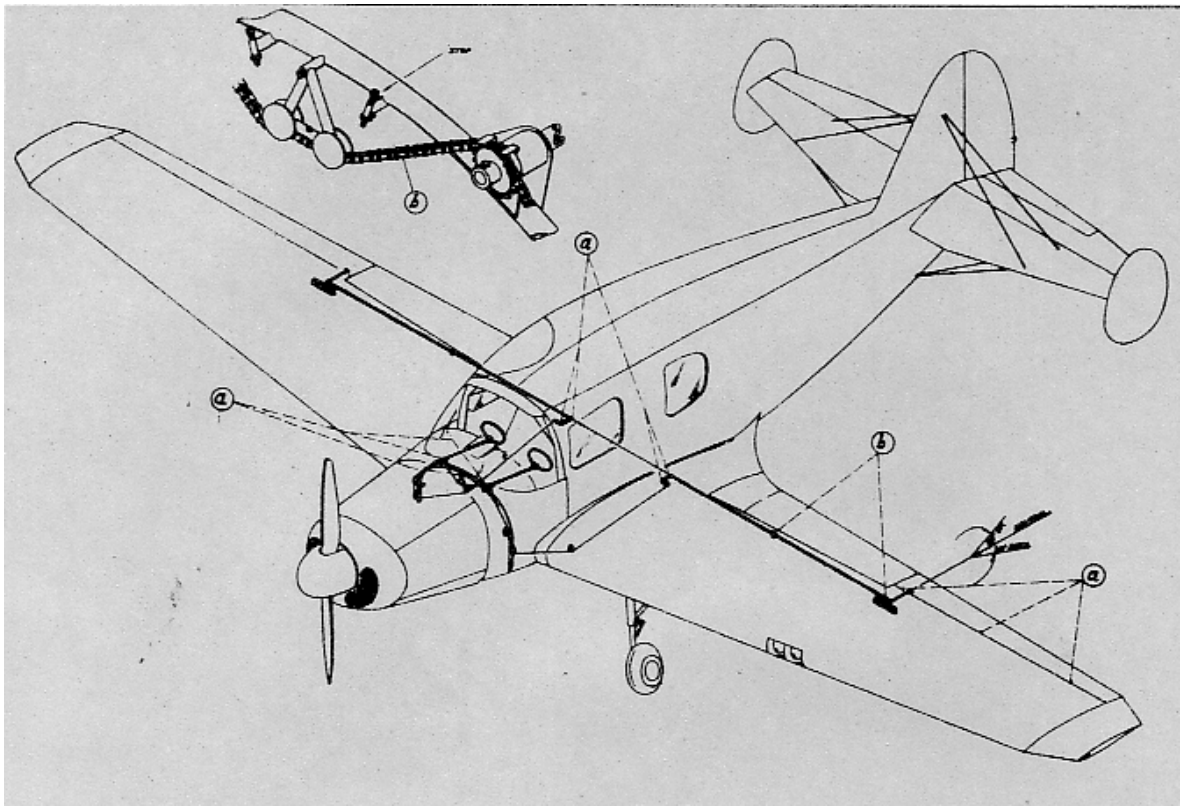


Figure 1 – Aileron Control System

Ailerons

The aileron system is the most difficult to adjust because of the unique horn arrangement out in the wing. This unusual horn allows flush control combined with very sensitive and light wheel forces. To rig the ailerons, start with the control wheels set and clamped in neutral position. Attach the cables to the chain and bellcranks.

Adjust the turnbuckles until the proper tension is obtained. At this time the bellcranks must also be offset and equal distance from the centerline of the ship, and the distance between the hinge points of the bellcranks at the fuselage should be .460 smaller than the distance where the push-rods attach. This difference is very important. The ailerons should then be clamped in neutral and the push-rods adjusted to fit. Install the bolts and check the travel 20° up and 20° down ±1° by adjusting the stops of the quadrant on the control column. If ailerons then have too much travel, the dimension between the push-rod attaching points is too big and should be readjusted. If this procedure is carefully followed there should be no difficulty.

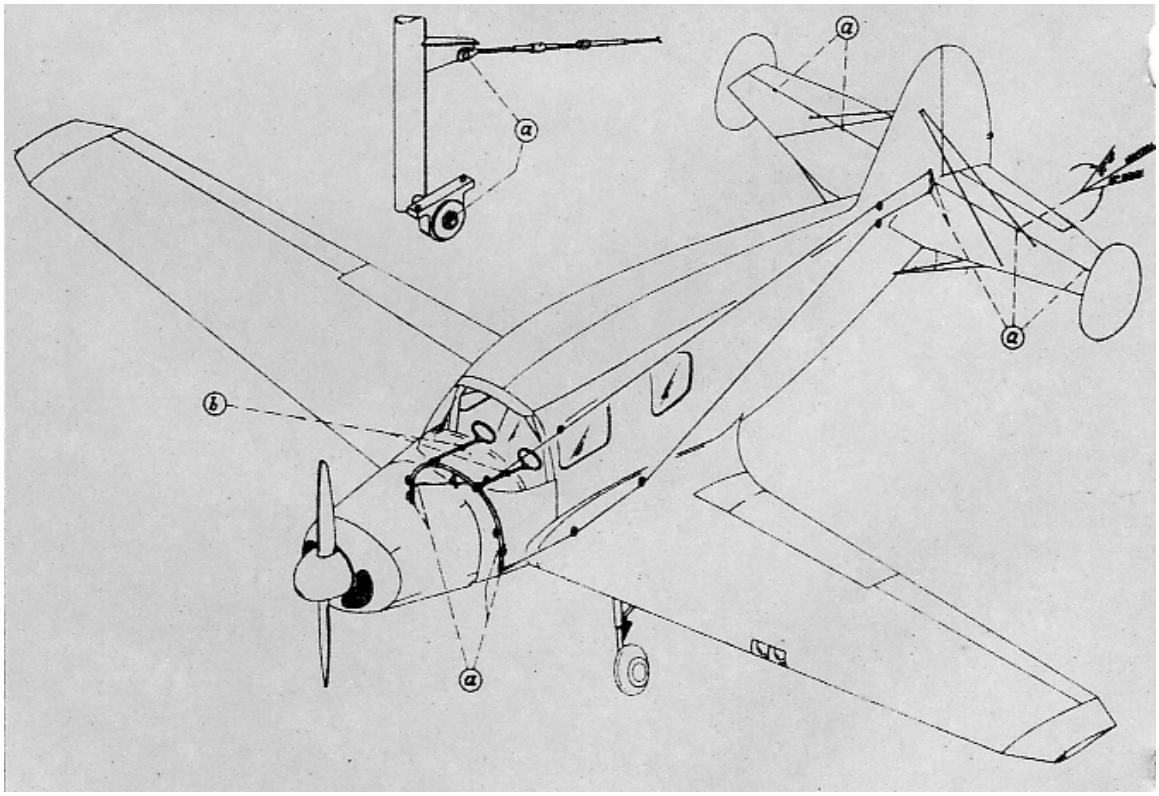


Figure 2 – Elevator Control System

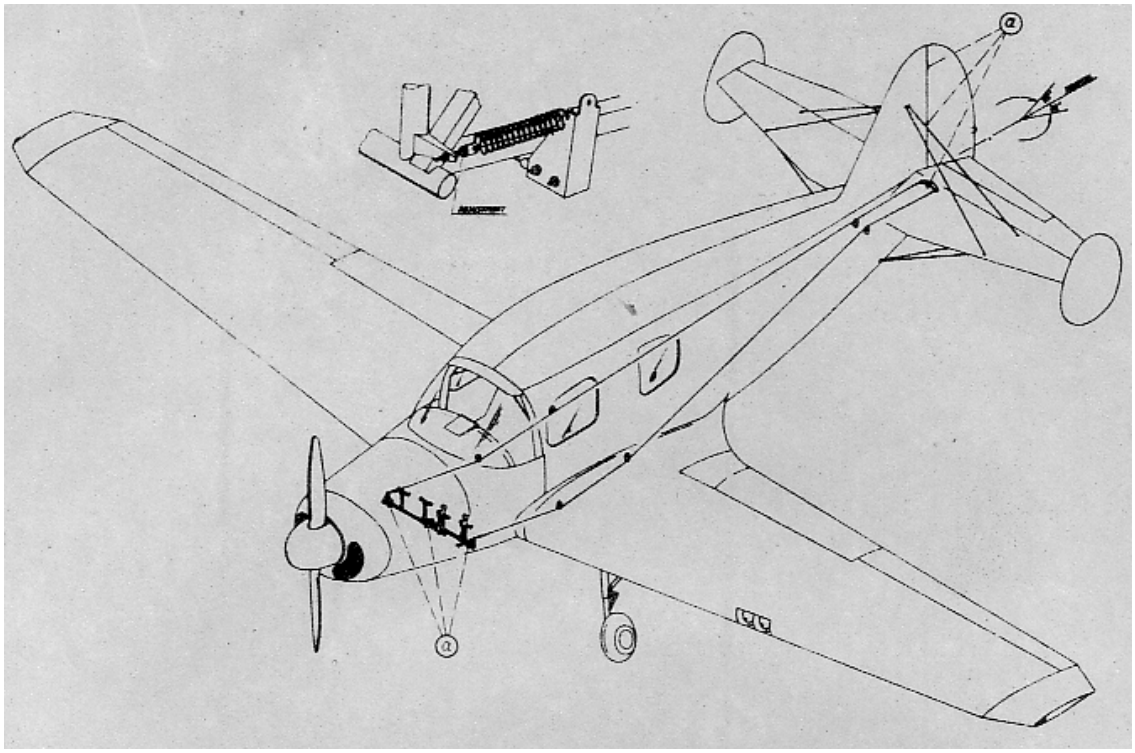


Figure 3 – Rudder Control System

Elevator

The elevator is controlled by two cables, one on each side of the ship. Rigging of the elevator is easily accomplished by first holding the control column back against the rear fixed stop on the instrument panel support, and adjusting the cables until the proper tension and up elevator travel is reached. Then move the control column forward and adjust the stop located on the horizontal fuselage member until the proper down travel is reached. Correct elevator travel is 22° up 15° down.

Rudder

The rudder stops are fixed at the factory and are set for 22° travel to either side of the centerline of the ship. The turnbuckles are adjusted so the rods through the brake pedals line up. If you consider these rods as a single one and move the pedals fore and aft several times you can easily locate the correct position. The rudder pedal spring on one side is adjustable on the ground for maintaining straight flight without rudder pressure. All pilots fly with different power settings and after a few flights you can easily adjust it for your individual requirements.

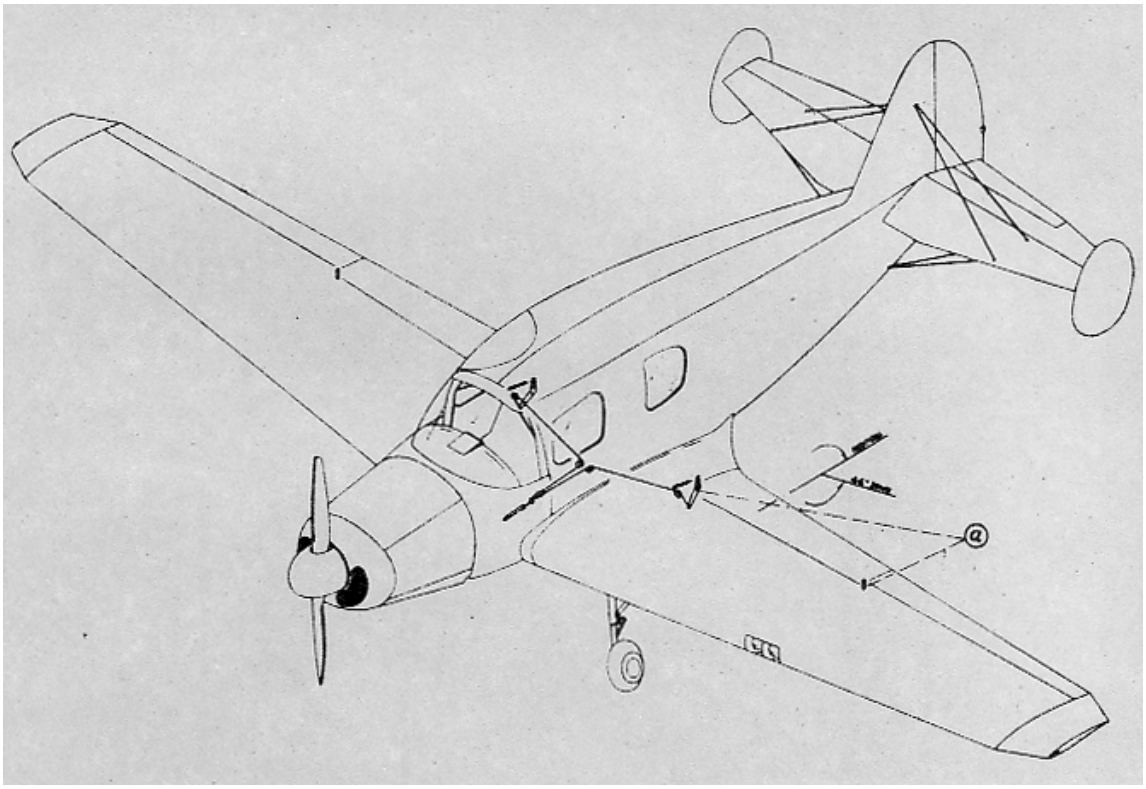


Figure 4 – Flap Control System

Flap

The flaps are operated by two cables attached to a single hydraulic cylinder. The correct down travel is 46° and is maintained by adjusting the turnbuckle when the

hydraulic cylinder is at the end of its stroke. The flaps are returned to their up position by springs.

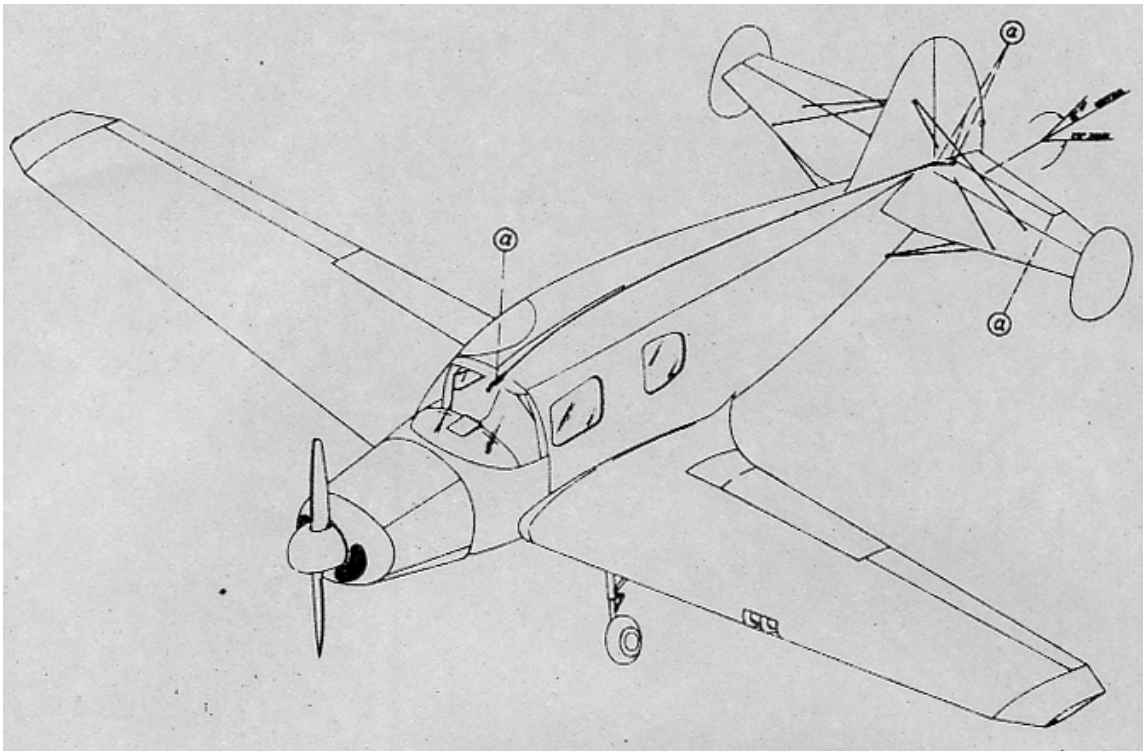


Figure 5 – Tab Control System

Tab

The tab control surface is actuated by a screw jack connected directly to the front handle and indicator by an aluminum torque tube. Stops are incorporated at the forward end in the indicator and are set to give 12° up and 29° down.

Rigging is accomplished by neutralizing the handle and indicator as well as the tab before connecting the component parts. Note: The elevator must be in neutral position also. Neutral position of the indicator is given on the placard but can also be obtained by turning the handle 12 complete turns from the forward (nose down) stop. Adjustment of the link connected to the tab horn is then made to align the tab surface with the rest of the horizontal tail.

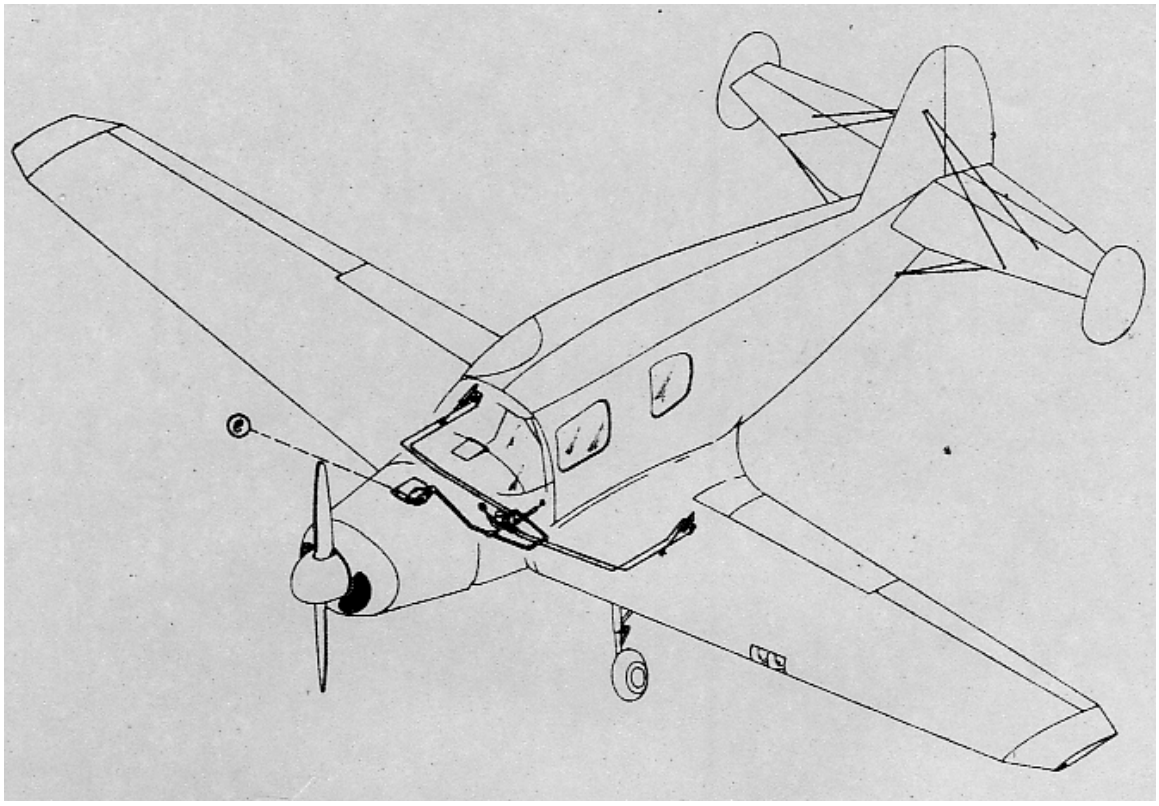


Figure 6 – Hydraulic Power System

Hydraulic Power System

This system requires no rigging as the correct travel is built in each cylinder and the actuated parts supply the stops. The hydraulic system consists of an engine-driven McIntyre or Eastern Industries Pump #102 – 129, a Power Pack and valves Electrol No. 750B, down locks for the landing gear by Adel Products Co. No. 16404 and cylinders by Electrol No. 428-4B and No. 428-4.5B. The system should be thoroughly checked for leaks at tube fittings and seals.

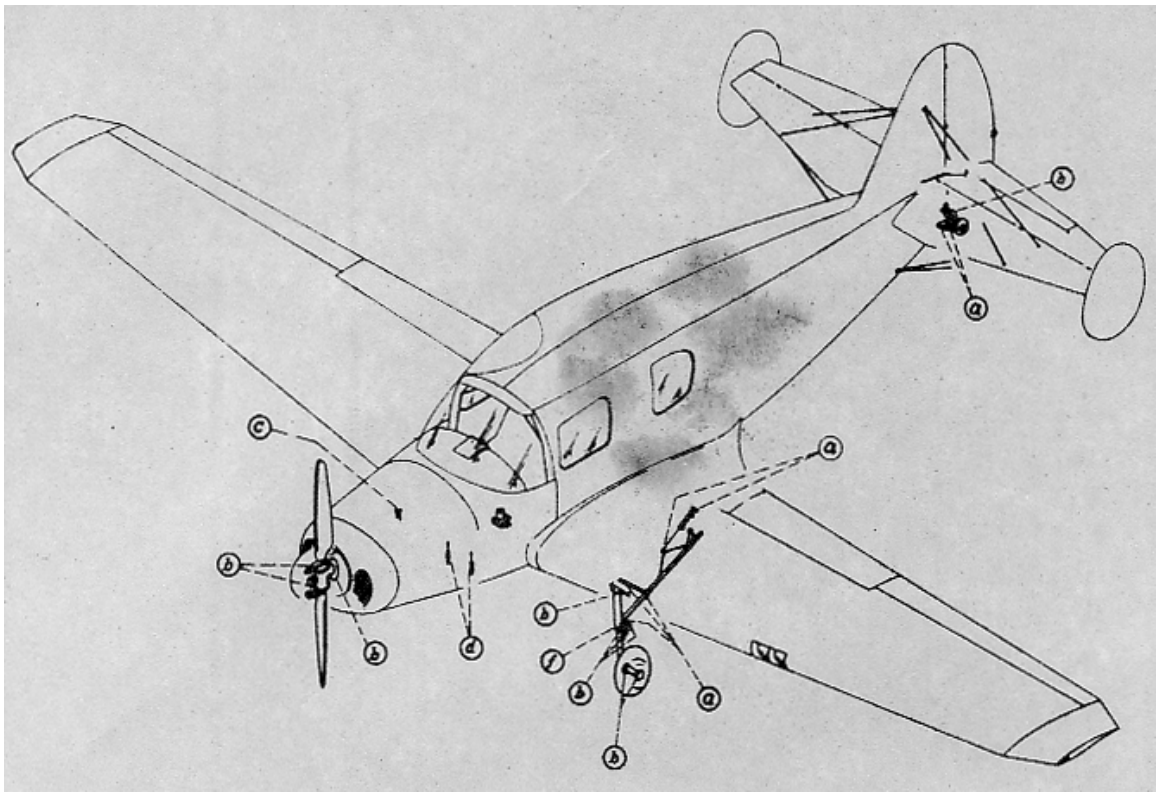


Figure 7 – Lubrication Chart

Lubrication Chart Key

Thorough lubrication should be accomplished at regular intervals to provide maximum wear and smooth operation of your airplane parts.

Lubrication Key

Index Letter	Type Oil	Specification	Time Hours
A	Light Machine or General Purpose	AN-O-6A	25
B	Grease	AN-G-15	50
C	See Page 22	SAE #40 or #50	50
D	Brake Fluid	AN-O-366	50
E	Hydraulic Fluid	AN-O-366	50
F	Oleo Fluid	AC-3586C	100

Note: Oleo fluid is a vegetable base oil.

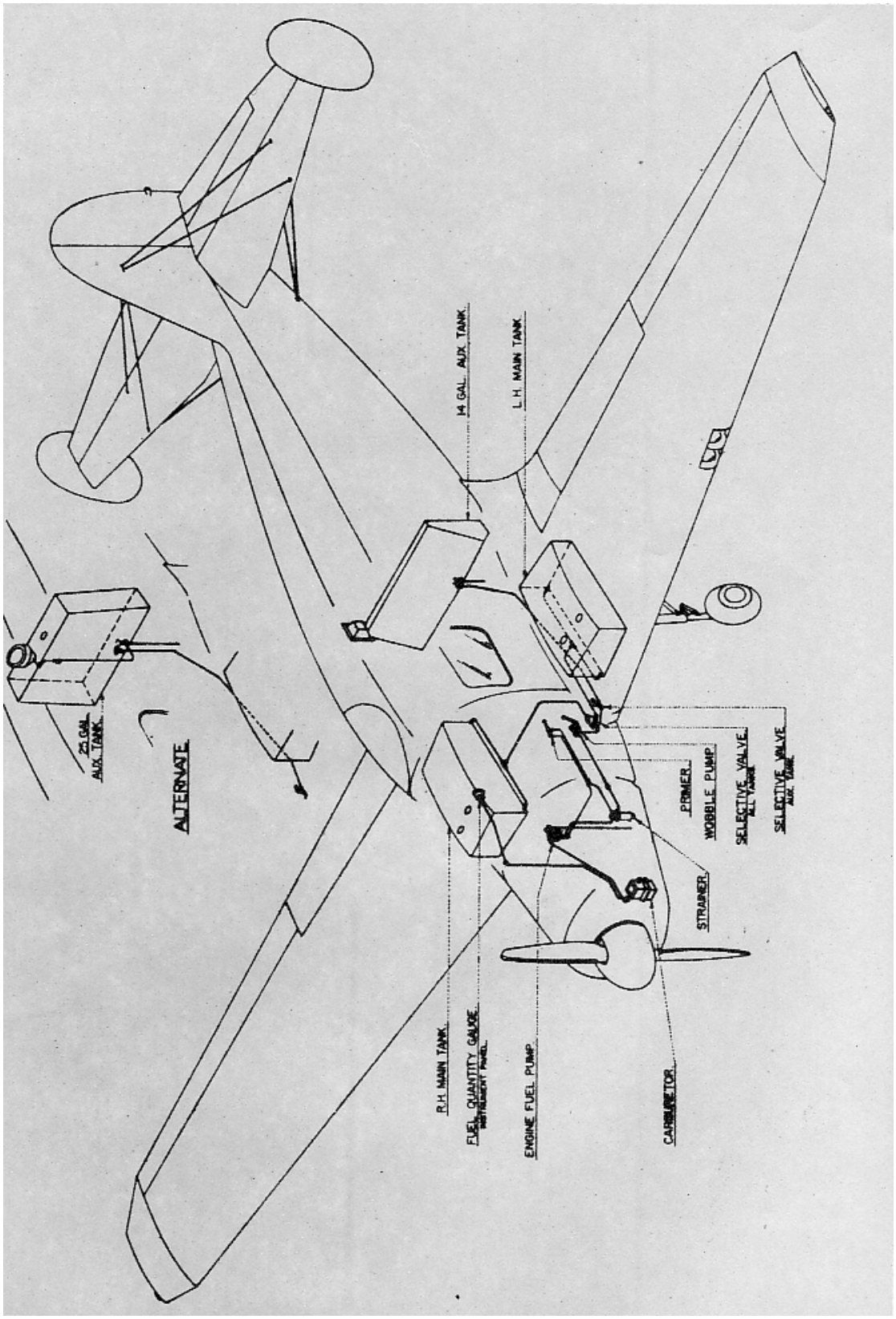
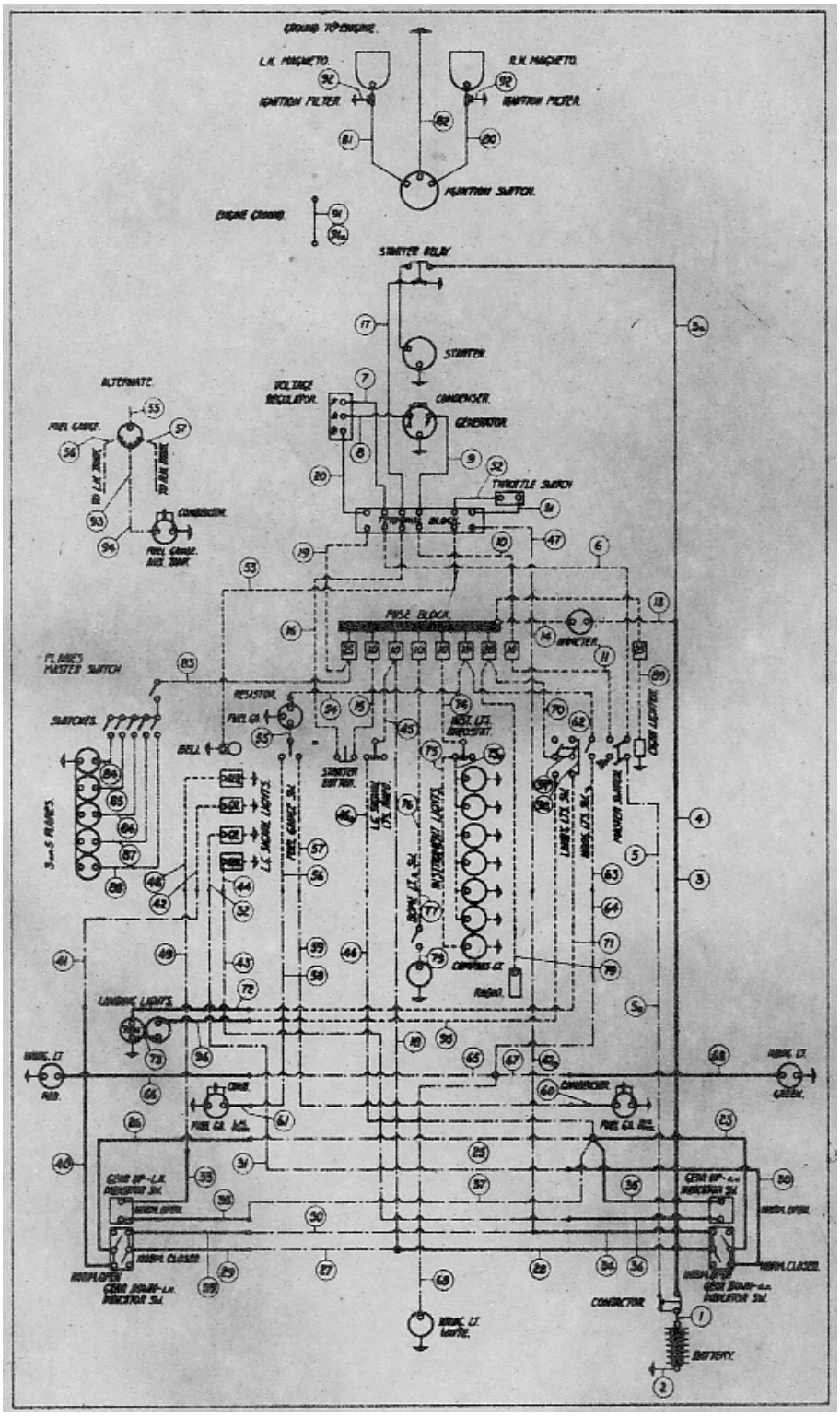


Figure 8 – Fuel System Diagram

Electrical System

Complete electrical system, including accessories, is given in Schematic Fig. No. 9. The numbers indicate wire numbers which can be found on each wire in the actual airplane.



Lifting and Jacking

The airplane may be lifted by an appropriate rope sling at the engine mount fuselage attachment fitting or by the lifting lugs on the engine. A block of wood 2x3x12 inches with small indentation to prevent slipping of the head of the jack may be used inboard of the landing gear fitting if placed parallel and directly under the front spar. It is well to also place a small sheet of non-skid rubber under the block as a further precaution against slipping if this method is used. If the wheels only are to be removed, a small jack placed directly under the axle is best.