

W A C O A I R C R A F T

Models: RNF,KNF, INF

i n s t r u c t i o n s

TABLE OF CONTENTS

<u>TITLE</u>	<u>PAGE</u>
General Information, Liabilities,	1
Uncrating Export Boxes	1
Unloading Carload Airplanes	2
General Assembly Instructions	4
center section	4
landing gear	5
brake	6
tail assembly	8
wing rigging	10
propeller	14
stabilizer control	15
Oleo Shock Strut	16
Gasoline System	17
Fire Extinguishers	18
Propellers	19
Cleaning Aircraft	19
Starting the Aircraft Motor	20
Heywood Starter	20
Warner Motor	21
Kinner Motor	22
Menasco Motor	23
Flight Training in Model F	24
Racing	25
Instructions for ordering	26
Parts list	28
Accessories	45
Raw Materials	45
Bolt List	46

### GENERAL INFORMATION

Waco airplanes are usually sold for flyaway at our field at Troy, Ohio. The airplanes prepared for flyaway delivery are completed, carefully inspected, test flown, reinspected and held in our hangar until customer arrives for delivery. Please note that it is a policy of our company not to build a surplus of airplanes for warehouse storage. Your Waco airplane will be strictly new when delivered to you.

Domestic shipment of airplanes is made by carload lots, there being no extra charge for loading your airplane in a carload, if instructions are given to this effect when order is placed. IN this case follow the assembly and rigging instructions. You will find Wacos easy to assemble.

Wacos for export shipment are set up, inspected, test flown dismantled and carefully packed. The model "F" is crated complete in a single crate for export shipment, the crate measuring 706 cubic ft. The net weight of the shipment being 1210 lbs. the gross weight 2873 lbs. and at 40 cubic ft. per measurement ton it figures 17.65 measurement tons.

### Transportation Liabilities

The Waco Aircraft Company does not hold itself liable for damage to airplanes or parts in transit from the factory. If a shipment is received in a damaged condition, have the delivery man or transportation company make a notation of the damage and file your claim with the carrier. In case of concealed damage, do not attempt to remove from shipping container or endeavor to repair, but call carrier and have claim agent inspect the damage before filing your claim with the carrier.

### Uncrating Export Box

The box should be placed at some point where a hoist will be available for lifting one end of the airplane.

First remove the top of the box; then remove one side. Use care in doing this as there are fragile parts just inside the box which will be easily damaged if struck with tools while uncrating. Remove all the airplane parts from the open side of the box with the exception of the fuselage itself. Then from one end at a time remove all airplane parts down to the fuselage itself. Remove the ends of the box of course to do this. This will permit the removal of the remaining side and the remaining material.

Further assembly will be done as described under the assembly of airplanes shipped in carload lots, as is the domestic practice.

### Instructions for Unloading Carload Airplanes

Inspect the car carefully to make sure door seals are intact and that the ends of the car are in good condition. Report any damage found to carrier at once.

All cars containing Waco Airplanes are carefully marked "Unload from this side" on the correct side and "unload from the other side" on the wrong side. Care should be taken when cars are spotted to a platform to be sure the right side of the car is next to the platform.

Open the double door as wide as possible. CAUTION: In unloading the carload it is very important that all bracings, bulkheads and dunnage are removed from the car as soon as it is loosened up. Most damage to airplane parts is done by snagging them on some of this loose material when it is not immediately removed from the car.

A packing slip for the carload and any special instructions will be attached to the door post and it is important that you check the items against our packing slip as the car is unloaded. We will not be responsible for any shortage claims made later than three days after the arrival of the car. In case you do not find all of the small parts be sure to look in the baggage compartment and cockpit of the airplane as numerous small parts are packed in these locations.

Remove the fuselage immediately in front of the door and to the left as you look into the car. This fuselage will come out tail first. First remove the 2" x 4" frame bound around the tail post of the first airplane to come out, also the strap over and around the wheel and fork. Then remove all straps around front landing gear fittings at the front of the airplane. At this point it is very desirable to have a dolly to place under the airplane to facilitate handling when the landing gear is off. (Note sketch of the type dolly we recommend). These dollies will be furnished by us at the nominal charge of \$7.50 each, or from this sketch one can readily be made for handling airplanes without landing gear.

If the dolly is available, four men can lift the front end of the fuselage, one man on either side can get hold of the bottom of

the outrigger struts for lift and two men at the front can lift at the crankshaft. This can probably be done easiest by the use of a 2 x 4 about 3 ft. long, with one man on either end of the 2 x 4, With the airplane lifted and moved backslightly, it will set on this dolly and can be easily handled.

In case you do not have a dolly available, the airplane can be carried out by four or five men placed as previously described. It is very important that when it is set down the weight is carried on the landing gear outrigger fittings, making sure the bottom part of the fuselage does not carry any weight.

Continue in the same manner to remove the fuselages on your left, looking into the car.

The fourth fuselage to be removed should be the one on your right closest to the door. This should be backed into the opposite corner and brought out nose first. On some cars where the inside dimensions are a little smaller than standard it is necessary to raise the tail of the airplane as high as five feet to get sufficient clearance to get it out the door.

Remove the fifth airplane tail first. It is always advisable to get all fuselages out of the car before beginning to work above them as a precaution to avoid damage.

Now be sure the car floor is clean, all blocks and dunnage removed so that the wing parts can be laid on the floor if necessary while unpacking the remainder of the car. You will have no difficulty in unloading the remainder of the car, but extreme care should be taken in getting the first two wings out to be sure they are not snagged as there is very little clearance allowed for slipping them out.

It is suggested that the V shaped block at the trailing edge of each wing be removed before attempting to slip the wing out. This will give additional clearance and be another precaution to avoid damage.

GENERAL ASSEMBLY INSTRUCTIONS

Rights and lefts are determined while standing at the tail and looking toward the nose of the airplane.

Bolts and clevis pins should be installed with heads up, forward or outboard. Make it a practice to tighten the nut and insert the cotter key on each bolt as used, never leaving any finishing process to be done at a later date. This will avoid the possibility of leaving out the very important cotter keys.

Center Section

First, prepare the center section for installations by attaching the center section strut to the center section before installing it on the fuselage. The right hand strut can be distinguished as it has clips on both front and rear members for holding the gasoline lines, while the left hand strut has clips on the rear member only. The bolts,  $1/4"$  x  $1-1/4"$  should be inserted with the nuts toward the center of the airplane and locked with cotter keys. (See Illus. # 1).

Now with one man on either side of the center section, place this on the fuselage and attach the struts at the rear fitting on the fuselage first. After the rear fitting bolts are in place, the strut can be attached to the front fuselage fitting. The bolts which secure the center section strut to the fuselage are size  $5/16"$  x  $7/8"$ . The center section cross wires are  $5/16"$  streamline with one end left round for about half its length. Insert the round end of the wire down through the rubber grommet in the top of the cowling. Start the other end of the wire in the fitting, projecting from the under side of the center section. When threads are just started put the terminal on the lower end of the wire and give it the same number of turns that the upper end had at the center section, about two or three are sufficient. While holding the terminal at the lower end from turning, screw driver tighten the wire until the terminal can be slipped over its fitting inside the cowling and secured with a  $3/8"$  clevis pin. The head of this pin should be toward the front.

Draw these wires up quite snugly, being careful that they are exactly the same length. They can be measured by inserting a steel tape through the rubber grommet beside the wire or by the use of a strammel. The gasoline lines can now be fastened to the struts by the above mentioned clips and attached to the tanks by the fittings provided there.

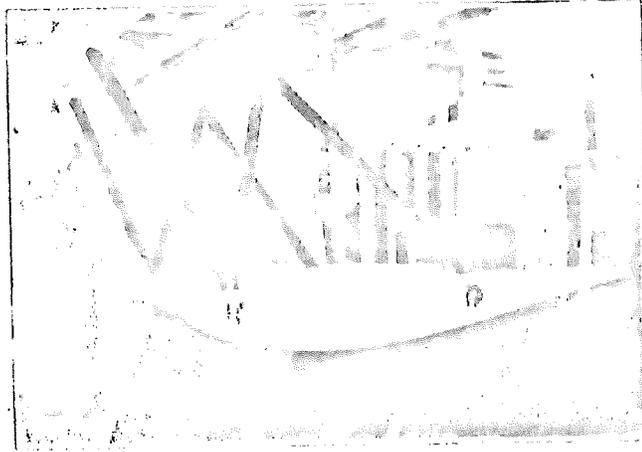


ILLUSTRATION No. 1

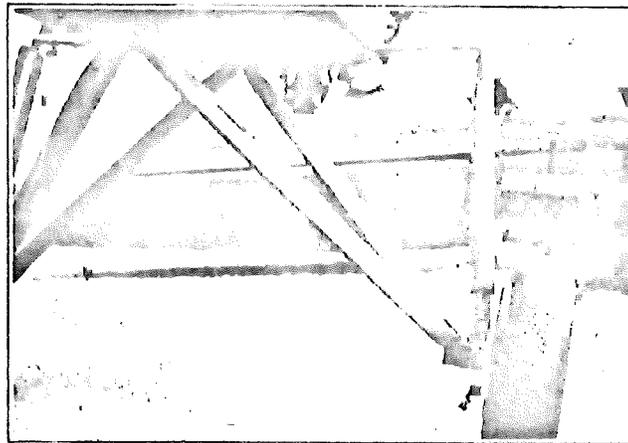


ILLUSTRATION No. 2

### Landing gear

The oleo shock strut should first be filled by removing the plug at the top, pouring in one pint of Gargoyle Teleo oil AA, a sufficient quantity of which is shipped with each oleo strut. After the strut has been filled with oil see that it is kept right side up until installed on the airplane.

This is a transformer oil and can be secured either from your Waco dealer or from your local power company.

Now raise the motor end of the fuselage by attaching a hoist to the motor mount members as near as possible to the firewall. A rope or chain of generous length with suitable padding should be used to prevent denting the tubes.

The landing gear V's with wheel assembled should now be attached to the fuselage, inserting tubular bushings in the upper end of landing gear V. Attach first the upper rear member of the V, then the upper front, using bolts  $\frac{3}{8}$ " x  $2\frac{1}{8}$ ".

The brake control wire passes through a pulley shackle which is fastened to the rear end of the bolt holding the rear landing gear strut in place. See that this shackle is properly attached before tightening these bolts.

The landing gear V attachment bolts should be kept tight at all times. The bushings inserted are not designed to turn, but are a surface to be held stationary by the tight bolt and the landing gear V allowed to hinge on this bushing to prevent any elongation of the holes on the fuselage fitting.

Next attach the oleo shock strut, attaching the upper end of the shock strut to the universal, which is bolted on the outrigger of the fuselage. Then secure the lower end of the oleo shock strut. Note that the brake wire and pulley shackle should be fastened to the rear of the lower bolt with the pulley tab vertical above the bolt.

### Brake

Connect brake control cable. See illustration # 3 for method of attaching brake cable to brake lever.

All Model "F" Wacos are equipped with brakes and are operated by a combination throttle and brake lever. The fore and aft movement of this lever gives the customary airplane throttle action. The movement of the lever at a right angle to this or pulled outward toward the pilot operates the brakes. This lever puts equal tension on both brakes, but for maneuvering the system is so arranged that the rudder pedals automatically release one brake and tighten the other when using the rudder as is normally done in taxiing.



ILLUSTRATION No. 3

The dual controls include the same brake arrangement in front and rear cockpit. At the front of this lever there is provided a slotted fitting operating on a bolt with thumb screw. This can be used to lock the brakes for use as an emergency brake in holding the airplane on an incline or while the motor is being reved up. To use this lock pull the desired amount of tension on the brake lever with the left hand and with the right ahdn tighten the thumb screw against the slotted fitting. This will maintain tension in the brake system.

Likewise, if you wish to make the brake lever inoperative in either cockpit, tighten securely this thumb screw on the lever. This enables the instructor to have brakes in the front cockpit while his student does not have brakes, which is of considerable advantage to instructors. Either trhottle or brake can be readily disconnected by opening the zipper and disconnecting the throttle rod or brake cables, although we suggest that the brakes be locked as above mentioned rather than disconnected and only the throttle be disconnected to be made inoperative.

#### Brake adjustment

Note: Export ships have been flown and had their brakes properly adjusted at the factory. They should, therefore, need little, if any, change when assembled.

With wheels clear of ground with jacks or hoist, have one man get in the cockpit of the airplane to work the brakes and another man at the wheels.

First be sure wheels turn free when brakes are not used. Then have the man in the cockpit put moderate pressure on the brake system. With rudder neutral see that brake wheels have about equal drag on each side. Then with pressure on the brake lever (Throttle) press fully the right rudder pedal. This should enable you to lock the right brake leving the left one without a great deal of drag, and vice versa. If necessary, change brake adjustment sufficiently to get this action. See Illus. # 4.

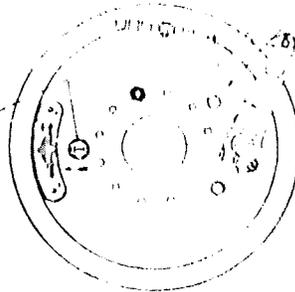
## AIRCRAFT PRODUCTS AIRPLANE BRAKE

## METHOD OF ADJUSTMENT

## Jack Up Axle to Free Wheel

Installation of brake to airplane: tighten brake support bolts with wheel on axle and brake locked to center brakes in brake drum.

Operation - 1 to take up brake: loosen nut and move in direction indicated until brake shoes contact with drum. Release slightly until wheel spins freely. Tighten nut by holding screw driver in slot to prevent stud from turning.



It is important that the angle between cable and lever be maintained at approximately 80° when brake is applied.

Operation - 2: reset lever on scatted shaft allowing 1/2 to 3/4 inch travel to lock brake.

Operation - 3: Adjust turnbuckle provided between brake pedal and lever for proper pedal travel, and to eliminate slack in cable.

ILLUSTRATION No. 4

It will also be noted that when brakes are properly adjusted without using the brake lever (throttle) some braking effect will be exerted on the wheels when the rudder is in extreme position. This is a decided advantage when correcting any tendency toward ground looping. Brakes should not be tight enough to allow wheels to lock without use of brake lever (throttle).

Tail Assembly

Before shipment the empennage is fitted on each airplane and is left as near assembled as is practical in shipment. You will, therefore, experience no difficulty in the reassembly.

Stabilizer and elevators will be shipped assembled and the first operation is to get the stabilizer right side up, which will place the ball nut on top. First, screw this ball nut on the threaded bolt which will be done by having one man in the cockpit work the stabilizer cord which will turn this bolt and let another man hold the stabilizer properly aligned so the threads will start. When the nut has been screwed down to a neutral position, replace the square guide sleeve on the upper end of the stabilizer adjuster screw and lock in place with a washer and cotter key. Attach the rear of the stabilizer to the fuselage with a 1/4 x 1-1/8 " bolt.

The elevator control wires pass through pulleys just ahead of the stabilizer. The wire on the upper pulley should be attached to the upper end of the elevator horn. Adjust the elevator cables and the position of the elevators by means of turnbuckles just aft of the

pilot's seat which may be reached through zippers in the bottom of the fuselage, being careful that not over two threads show from either end of the turnbuckle barrel after adjusting. When properly adjusted the leading edge of the elevator at the extreme point of the balance should have a down travel below the stabilizer when in full down position of approximately 10-1/4" (note: Illustration No. 5 for this measurement.)

Hold fin approximately in position and attach navigation light wires taping them to one side so they will not conflict with any moving parts.

Install the fin by inserting the fin into the tail post bolting it in place with a bolt just above the lower rudder hinge. The bolt is size 1/4" x 1/2". Fasten the front of the fin to the bracket which supports the stabilizer adjuster screw with a bolt 1/4" x 5/8".

Inspect carefully all nuts and cotter keys and then install tail cowl. First, screw front section of tail cowl in place, then hold the two sides which go at the rear of the tail cowl in place and hook the spring at the center. This will hold the two sides roughly in position while the wood screws are inserted along the bottom, one small machine screw inserted at each side in front fastening the upper part of the side cowl to the front cowl and 1/4" x 1-5/8" bolt inserted to hold the two sides together at the rear.

Attach the top and bottom tail wires to the stabilizer using 1/4" x 1-3/4" bolts. The bottom wire is the shorter one. This clip on the stabilizer end of the top tail wire is more nearly straight than that on the upper end. This top tail wire bolt also holds the upper rudder hinge. Attach the rudder being sure to fasten the tail wires and rudder hinge with this bolt. Then attach lower rudder hinge with bolt which is 1-1/4" x 3/4". The upper rudder hinge bolt is 1-1/4" x 1-7/8". Tighten the tail wires being careful that stabilizer is kept straight. When properly adjusted both bottom wires will be the same length and both top wires the same length. Check by eye to see that the fin post is perpendicular to the center section and the stabilizer is parallel to the center section.

Bolt the rudder wires to the rudder horn and adjust turnbuckles until rudder action from stop to stop give comfortable pedal action.

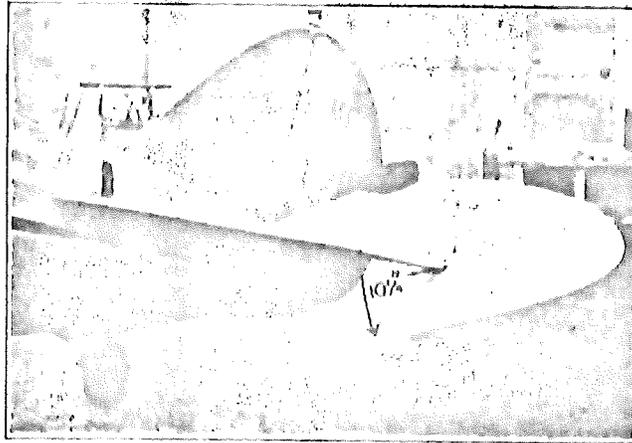


ILLUSTRATION No. 5

### Wing Rigging

Thread the navigation light wires from the upper wings down through the diagonal (center) interplane struts and bolt the struts to rear fitting on upper wing using  $1/4$ " x  $1-1/2$ " bolts. Also attach the front interplane struts to the front fittings on the upper wings. The lower ends of the front struts have adjustment screws. Bolt these lower ends to the diagonal struts using  $1/4$ " x  $3/4$ " bolts.

The wing wires consist of four  $1/4$ " streamline and six  $5/16$ " streamline wires. The  $1/4$ " wires are the landing wires, the longest pair of  $5/16$ " wires are the front flying wires. The other four  $5/16$ " wires constituting double rear flying wire are of equal length.

With one man in the rear cockpit and at least two men handling the lower wing, attach each lower wing to the fuselage using  $3/8$ " x  $2-1/8$ " bolts. Bolt the front spar fitting to the fuselage fitting placing this bolt with head to the rear; then using a  $3/8$ " x  $1-1/2$ " bolt secure the rear spar fitting to the fuselage placing this bolt head front

Attach the rear landing wire to support the wings temporarily until ready to attach the upper wings. Note all streamline wires have the right hand thread at the bottom. It will be necessary to disconnect this landing wire while putting the upper wing in position.

After both lower wings are in place, the upper wings should be installed in the following manner:

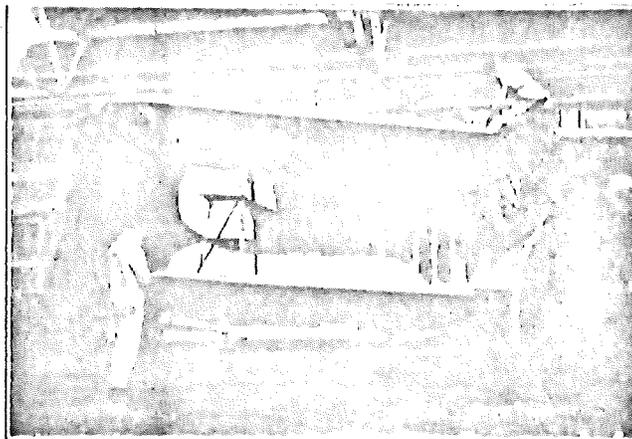
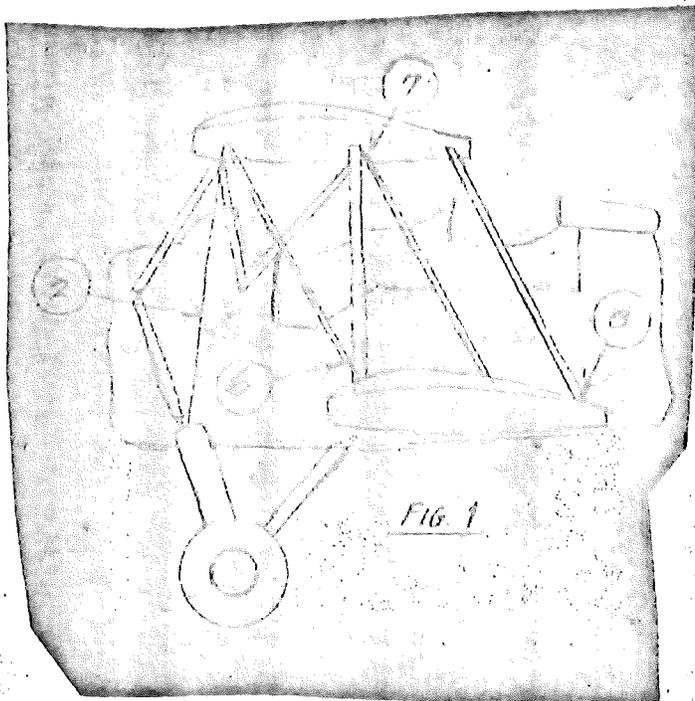


ILLUSTRATION No. 6

(Note Illustration No. 6) After protecting the rear cockpit cowl have a man stand on this cowl and guide the upper wing into position. This man should have four  $5/16$ " x  $1-3/4$ " bolts, threaded for  $3/4$ " together with four pair of taper bushings, one pair to go on each bolt. At least two men will be required to place this upper wing in position and a fourth man will be required to support the lower wing while the upper is being secured.

Loosen the landing wire supporting the lower wing temporarily and place the upper wing in position, being careful to see that landing wire terminals from the center section go down through the patches provided in the upper wing for these terminals. The man on the center section will then bolt the upper wing securely to the center section using bolts and bushings above described. The diagonal wing strut can then be attached to the lower wing and the rear landing wire again screwed in place. The wings on this side will now be self-supporting and the upper wing can be placed on the other side in the same manner.

The front landing wires should be tightened until they measure  $94-1/8$ " between the exposed ends of the terminals. Adjust the rear landing wires and variable front wing struts until the wings are rigged flat. In other words so that the lower surface of the wings appears entirely flat, not warped up or down viewed from wing ends. This can best be observed on the lower wings by standing ahead of the wings in a position where you can sight the lower surface of the wings, on the upper wings by standing behind the wings and sighting the lower surface. In other words the airplane is rigged flat; it is not necessary to make any allowance for propeller torque.



- 1- Center Section Wires
- 2- Front flying wires  
5/16" x 113-1/4" act.len
- 3- Rear flying wires  
5/16" x 109-1/4" act.len
- 4- Front Landing Wires  
1/4" x 96" act. len.
- 5- Rear landing wires  
1/4" x 91-1/8" act. len
- 6-Adjustment for short strut
- 7-Adjustment for long strut
- 8-Adjustment for Aileron Strut

(Note: Act. Len.= actual length of wire.)

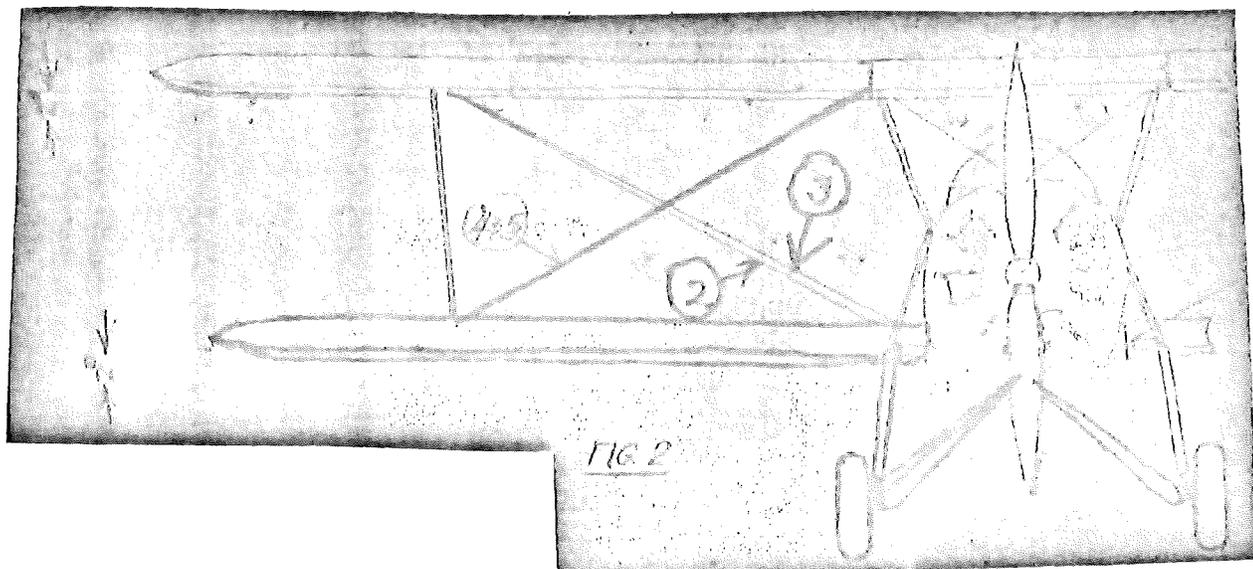


Fig 2

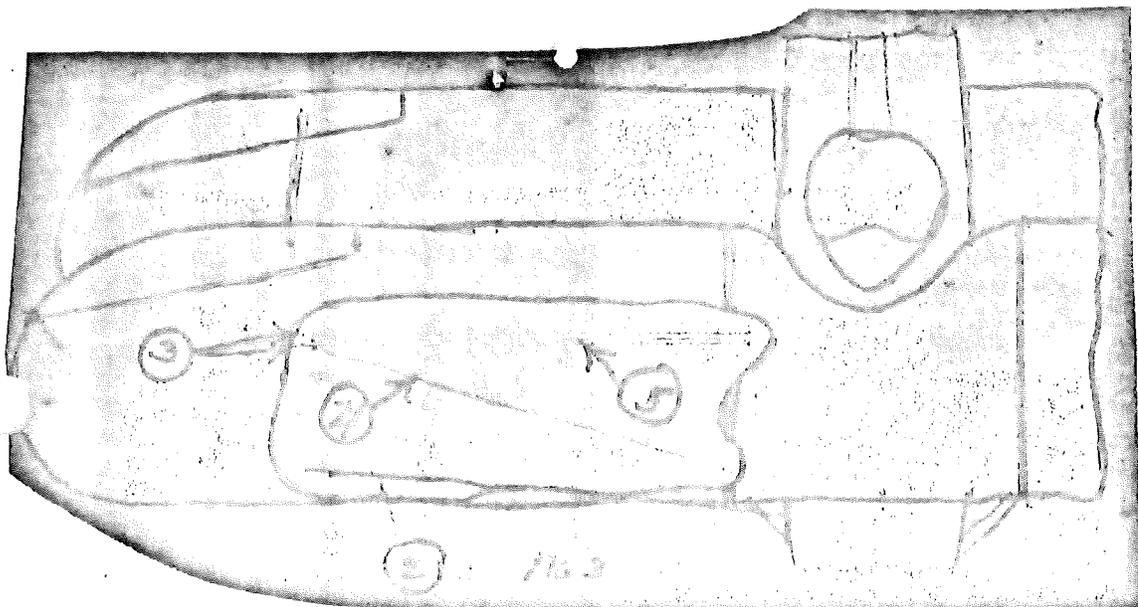


Fig 3

WING RIGGING INSTRUCTIONS

1. remove streamline wire end terminals and screw them back on five complete turns to insure an equal amount of adjustment on each thread end.
2. Bolt center section struts to center section.
3. Mount center section assembly on fuselage.
4. Fasten center section wires.
5. Adjust center section wires so that the distances between pin centers are the same on both wires.
6. Fasten front and diagonal interplane struts on upper wing with adjustment at bottom. (See Figure 1)
7. Mount lower wing on wing fittings on fuselage and insert 3/8" bolts long bolt in front, short in rear. Wing tip must be held up in position until upper wing is mounted and landing wires are fastened and tightened.
8. Fasten long interplane strut to rear of diagonal strut. (figure 1)
9. Mount upper wing on center section, using 5/16" bolts with taper bushings.
10. Bolt interplane strut on lower wing.
11. Put on landing and flying wires, with left hand thread to the top (See drawing). Do not tighten.
12. Draw up front landing wire to 94-1/8" between terminal ends. (fig. 4)
13. Tighten rear landing wire until tension on both wires is equal.
14. Tighten flying wires.
15. Wings are rigged flat as no allowance for propeller torque is needed.
16. Adjust interplane struts.
17. Insert cotters in clevis pins and bolts when all adjustments are made.
18. Connect and adjust aileron push tubes under fuselage so that both lower ailerons are even when control stick is in neutral..
19. Adjust aileron struts so that upper and lower ailerons are even with wing.

Attach and tighten flying wires to hold wings in this position and then attach rear wing struts properly adjusted to maintain this position. If the rear landing and flying wires touch each other, they should be padded to prevent wear. Tighten all wires to a fair tension making sure they are left in a streamline position and attach wing pencils with friction tape.

With the control stick in neutral position adjust aileron control rods so that ailerons will be flush with the lower wings and connect these control rods to the aileron control horn, using 1/4" x 1" bolt. Attach the aileron struts with the adjustment end down using 1/4" x 7/8" bolts and adjusting them so that the trailing edge of the upper aileron will be parallel to the trailing edge of the upper wing.

Lubricate the various working parts of the control system. Use engine oil. Mobiloil Aero "H" summer and Mobiloil Aero "W" winter. Controls will naturally be rather stiff on a brand new airplane until they have been worked in somewhat.

Screw on the inspection plates furnished for the various inspection openings in the wings. Then close zippers in the fuselage cover which have been opened during assembly.

### Propeller

Make sure both propeller hub and propeller shaft are perfectly clean. Cover the propeller shaft with Mobiloil Aero "H". Force the propeller on the shaft tight using the small nut which screws on the end of the shaft. Screw the lock nut on the propeller and lock it with the wire provided. (See page 24 for further propeller instructions.)

### Final Check

Check all bolts, clevis pins and turnbuckles to see that they are properly locked with safety wire or cotter pins. See that lock nuts on all streamline wires are tight.

Fill the oil tank with an oil of the body and character of Mobiloil Aero "H" for use during the warm months of the year and an oil of the body and character of Mobiloil Aero "W" at atmospheric temperatures below 32 degrees F.

Grease rocker arm shafts with grease gun filled with Mobil-grease or a lubricant of similar character.

After filling oil and gas tanks, check all lines for leaks. See motor instruction book for full particulars concerning motor operations.

The airplane is now ready for test flight after the brakes have been tested in taxiing. Taxi the airplane out and try first right brake and then left brake, taxiing enough to make sure the brakes are in correct adjustment and will operate either together or separately as applied.

If properly rigged, the airplane should fly in a normal course with "hands off" for an indefinite period in smooth air. However if it should prove to be a little right wing heavy for instance this can be corrected by lengthening slightly the right rear interplane strut or if left wing heavy the left rear strut.

If any trouble should be experienced in setting up a new airplane, get in touch immediately with the nearest Waco dealer or the factory giving full details and the Serial Number of your airplane.

#### Stabilizer Control

Model "F" stabilizer is controlled by a screw operated by a knotted cord which extends from the front of the stabilizer up the right side to the front of the airplane, thus giving stabilizer control in both front and rear cockpits.

In front the stabilizer cord passes over a pulley just behind the firewall at the extreme right. The pulley fitting has been threaded for a distance of approximately 4". Play can be taken out of the stabilizer cord by tightening this pulley fitting using nut and lock nut provided for this purpose located just ahead of the firewall, and easily reached with right side motor cowl removed.

If the cord stretches so much that all the play cannot be eliminated by this adjustment remove the tail cowl at either side of the fin and work the stabilizer cord until spliced section is at hand. Back off on the adjustment nut at the front as far as possible, then cut a piece out of the cord and splice again at the rear which will give you complete range for adjustment again in front.

Bear in mind that the stabilizer will remain stationary in its setting at any time should the cord come off or break.

If you wish to replace the stabilizer cord at any time, tie one end of the new cord to one end of the old cord and pull it in place in this manner, making the splice at the rear while the tail cowl



Gasoline System

The waco Model "F" carries its gasoline in two tanks in the center section. It is important that vent lines protruding from top of these tanks be kept open at all times. It is also important that gas tank caps fit snugly and do not leak. Occasionally the steel clip fittings which hold these tank caps in place will get pulled out of shape and not have the correct tension. This can be quickly remedied by putting them back in shape with a pair of pliers and if this fails to stop the leak, one or two new cork gaskets should be used on the caps which will stop the leak.

You need not become alarmed if, after filling the tanks completely one tank appears to drain faster than the other. This is normal and there is no set rule as to which tank will drain the fastest under certain conditions. On some airplanes one tank will one day and the other the next. However, as soon as one tank really gets low, the other one will automatically come in as both tanks are connected at all times, being joined together above the shut-off valve.

You will note the right tank has been provided with two outlet lines, one at the front and one at the rear. This is to take care of all conditions and make sure the carburetor gets gas both during a steep climb and a steep descent.

Note that the gasoline gauges owing to their position are not accurate on the ground because with the tail down, as on the ground, all the gasoline runs to the rear of the tank and the gauge may indicate full on the ground when there is less than a quarter of a tank. The gauges, however, are accurate during level flight in the air.

If the tank appears to leak, first make sure that all fittings are tight before going to the trouble of removing the tank. Leaks are usually found to be around the gasoline gauges or one of the fittings and are easily repaired by tightening, or, if necessary, removing and adding filler, such as clear dope or white lead to the threads and replacing. (See maintenance diagram for method of overcoming gasoline gauge leaks.)

## Fire Extinguishers

Care of Pyrene Extinguisher- Be sure that the extinguisher is kept full of Pyrene liquid (up to the level of the filler plug hole) and once every thirty days the extinguisher should be removed from the bracket, the handle unlocked and given a couple of pumps, after which the handle should be properly locked. Then with a downward movement (as used in making the ink in a fountain pen flow) clean the fluid out of the discharge nozzle.

By following these suggestions and the information printed on the label on the extinguisher, you will have an extinguisher that will function properly at the time you need it, and further prolong the life of the extinguisher.

Refill the extinguisher with the genuine Pyrene liquid only .

Care of Flash Fire Extinguisher- Inspect every 90 days to make sure there is sufficient liquid in the fire extinguisher. The most convenient method is to weigh the extinguisher. The pint size when properly filled weighs three pounds and the quart size five pounds and ten ounces. If scales are not handy, unscrew the cap at the top of the extinguisher and the liquid should stand approximately at the bottom of the cartridge when filled to the correct level. If necessary refill with genuine Flash liquid and replace the cartridge, making sure it is screwed tightly in place.

If the fire extinguisher has been used, it is necessary that you refill with liquid and also put in a new cartridge.

Both the Above Extinguishers are made for use on  
Electric fires.

## Propellers

The efficiency and performance of an airplane is vitally affected by the propeller used.

### Metal Propellers

A metal propeller for the Warner or Kinner B-5, 125 H.P. motor in order to give satisfactory performance up to standard, should be of 8 ft. diameter and so adjusted that the motor will turn between 1660 and 1700 at full throttle on the ground. To improve specific performance it may be desirable to change this adjustment slightly. An increase in the ground r.p.m. will give you better take-off and a decrease will give you more economical cruising. The above setting however is what we recommend.

### Wood Propellers

A wood propeller for either for the Warner or Kinner B-5, 125 HP motor should be 93 inches in diameter and should turn 1700 r.p.m. on the ground at full throttle.

## Care of the Airplane

Your Waco airplane is a piece of fine machinery and is deserving of care and attention. When not in use it should be stored in a hangar as near dustproof and fireproof as is available. The finish of an airplane deteriorates much faster when left out in the weather than when properly sheltered.

It is desirable to keep the airplane clean both inside and outside at all times.

With this in mind we advise the upse of a cockpit cover at all times when the airplane is not in use. Even in a hangar it is desirable to use a cockpit cover as it lends so much additional protection.

### Cleaning the Airplane

We advise the use of gasoline for cleaning the airplane finish only when it is absolutely necessary to remove grease spots.

The best method of cleaning the airplane is to use warm water and a flake soap, like Lux, washing a spot of say three square feet at a time and rinsing immediately afterward. Begin at the upper surface of one of the top wings and wash that wing, both upper and lower surface, working in from the top and across to the other side. Then wash the fuselage, tail surfaces and lower wings and last landing gear.

After completely washing and rinsing one surface, say one complete wing, if a chamois is available, go over the surface with the chamois which will add to the smoothness and luster of the finish.

While washing the airplane, one has a good opportunity to inspect the vent patches along the lower side of the trailing edge of wings, center section, ailerons and tail surfaces. These patches should be kept open at all times and it is well to make sure these are open by sticking a small instrument, say a match stub or something of that nature, through the holes as you come to them while washing. Care should be taken to keep water off the motor and also out of the cockpit.

See diagram for full instructions on inspection, lubrication and maintenance.

#### General Procedure for Starting the Motor

1. Check gasoline supply.
2. Check oil supply. Note the neck of the oil tank on your Model F waco extends well down into the tank proper. This is done to insure sufficient expansion space in the oil tank at all times. In filling the tank the oil level should be brought to the bottom of the tank neck.
3. Be sure that gasoline shut-off valve at the right side of pilot's cockpit is turned on.
4. See detailed instructions for each motor as listed below:

#### Heywood Starter

When a Heywood starter is used, please note that the airplane has been provided with a Lunkenheimer priming pump on the Instrument board. When it is cold or after the airplane has been standing for a while and you wish to start, first pump several shots with the primer.

Note on the left side at the outrigger strut there is a small overflow tube and this primer should be pumped until gasoline drops from this tube. This will indicate that the priming chamber is full. Then see that all is clear and turn on your switch with throttle closed, mixture controls full rich and use the Heywood starter.

If the motor does not start, in the first two or three seconds of starter use, stop and allow it to stand about one minute and try

the starter again without using the primer.

If the motor fails to start, make another attempt using the starter and at the same time pumping the throttle (open and close) while the starter is turning. If this fails, it is possible the motor has been loaded and the next trial should be made with the throttle held about half open. If this is unsuccessful, the motor can be backed up as below described to unload it. See motor instruction manual.

Please note in attempting to start the motor without the starter, the primer is of no value because the primer does not go direct to the motor, but rather goes to the starter. Therefore, it should be disregarded in attempting to start the motor without the starter and cranking instructions followed as given below.

#### Warner Motor

1. Carburetor control at the right side of your instrument board is a mixture control and not a primer. Be sure that this control is pushed all the way in, in the full rich position.

2. Pump throttle (open and close) about eight strokes so that gasoline flows from the carburetor. Then close throttle completely.

3. With switch off, spin the motor fast about four turns, the throttle still tightly closed. This gets a charge of gas into the cylinders.

4. With throttle still closed, turn the switch on and crank the motor briskly. In cranking the motor the prop should be allowed to stop at a neutral position between compression strokes or should be backed up slightly from this position so that when the motor is cranked the propeller will be turning quite rapidly as it passes the firing point. This will insure a spark from the magnetos and the inertia will carry the propeller through the right direction rather than allowing it to kick back. The spark should be fully advanced before cranking unless the motor shows a definite tendency to kick back, in which case the spark should be retarded slightly.

If the motor does not start after a reasonable amount of cranking as above described, repeat the procedure. If the motor still does not start and it appears to be loaded, with switch off and throttle full open, spin the motor backwards about eight revolutions turning it fast. Then with switch on and throttle closed, crank motor again.

When the motor is being started by the use of an electric starter

use the same procedure as above described, except that the motors will be turned over by the starter instead of by manual cranking.

See page 25 for instructions on starting with Heywood starter.

See Motor Instruction Manual for further details.

### Kinner Motor

See general procedure for starting the motor.

1. Carburetor control at the right side of your instrument board is a mixture control and not a primer. Be sure that this control is pushed all the way in, in full rich position.

2. Pump throttle (open and close) about eight strokes so that the gasoline flows from the carburetor. Then close throttle completely.

3. With switch on and throttle closed, crank the motor. Please note that all Kinner B-5 motors (125 HP) and most of the Kinner K-5 (90 HP) motors have an impulse coupling on one of the magnetos. The presence of an impulse coupling which is working can be readily detected by a sharp click. This will be heard each time the motor is turned over. Therefore, when a Kinner motor with an impulse coupling is being cranked, it is not advisable to crank it in the regular manner but rather stand well clear of the propeller and with the finger tips of one hand, pull the propeller slowly past the point where the magneto impulse coupling clicks. The motor will start quicker being pulled past the point slowly than if you attempt to crank it in the regular manner.

When a motor is equipped with an impulse coupling and the coupling is not working correctly, it can be readily detected by noticing whether the sharp clicking occurs or not. The cause of trouble will probably be found in the oil getting gummy or heavy in the impulse coupling, and can be quickly remedied by washing out this impulse coupling with a little gasoline and again lubricating with very light oil. This should be done promptly for otherwise the impulse coupling is apt to work part of the time only and it is dangerous to crank the motor with an impulse coupling in this condition.

If the motor does not start after a reasonable amount of cranking as above described, repeat the procedure. If the motor still does not start and it appears to be loaded, with switch off and throttle full open, spin the motor backwards about eight revolutions turning it fast. Then with switch on and throttle closed, crank the motor again.

When the motor is being started by the use of an electric starter use the same procedure as above described, except that the motor will be turned over by the starter instead of by manual cranking.

See page 20 for instructions on starting with Heywood starter.

See Motor instruction Manual for further details.

### Menasco Motor

See general procedure for starting motor.

1. Carburetor control at the right of your instrument board is a mixture control and not a primer. Be sure that this control is pushed all the way in, in full rich position.

2. Pump throttle (open and close) about eight strokes so that the gasoline flows from the carburetor or manifold. Then close throttle completely.

3. With switch on and throttle closed, crank the motor. Please note this motor has an impulse coupling on one of the magnetos. The presence of an impulse coupling which is working can be readily detected by a sharp click which will be heard each time the motor is turned over. Therefore, when a Menasco motor with an impulse coupling is being cranked, it is not advisable to crank it in the regular manner, but rather stand well clear of the propeller and with the finger tips of one hand, pull the propeller slowly past the point where the magneto impulse coupling clicks. The motor will start quicker being pulled past the point slowly than if you attempt to crank it in the regular manner.

When a motor is equipped with an impulse coupling and the coupling is not working correctly, it can be readily detected by noticing whether the sharp clicking occurs or not. The cause of trouble will probably be found in the oil getting gummy or heavy in the impulse coupling, and can be quickly remedied by washing out this impulse coupling with a little gasoline and again lubricating with very light oil. This should be done promptly for otherwise the impulse coupling is apt to work part of the time only and it is dangerous to crank the motor with an impulse coupling in this condition.

If the motor does not start after a reasonable amount of cranking as above described, repeat the procedure. If the motor still does not start and it appears to be loaded, with switch off and throttle full open, spin the motor backwards about eight revolutions turning fast. Then with switch on and throttle closed, crank the motor again.

Please note there is a small hole at the lowest point at the rear of the manifold. As this is a down draft carburetor, this hole is drilled to prevent raw gasoline accumulating in this manifold, so you may have no fear of this trouble. If the motor gets loaded it can be unloaded by turning it backward with switch off and throttle open rapidly about eight times the same as you would unload any other motor.

When the motor is being started by the use of an electric starter use the same procedure as above described, except that the motor will be turned over by the starter instead of by manual cranking.

See page 20 for instructions on starting with Heywood starter.

See motor instruction manual for further details.

### Flight Training in Model "F" Waco

The model "F" Waco has been especially designed for both training and private owner sport use. You will observe that the front cockpit cowl has been made much lower than usual to give an instructor good visibility. You will also observe that the pilot in the rear seat sits up higher than the people in the front cockpit so that he can see over their heads readily which is particularly desirable while landing.

All Model "F" Wacos are supplied with an instruction cushion for use in the front cockpit while training in the airplane. This cushion raises the instructor approximately four inches and allows him to look over the moulded pyralin windshield.

We also supply a small instruction windshield, about size and shape of the visor of a cap which slips on the center of the moulded windshield and forms a vertical screen immediately ahead of the instructor. This will give the instructor protection and allow him excellent visibility.

Please also note that tightening the thumb screw on the brake lever in the rear cockpit renders the student's brakes inoperative while the instructor sits in front with both brake and stabilizer controls in addition to other flight controls. This makes the ideal arrangement for instruction.

Racing

1. You can increase the top speed of the Model "F" Waco about four miles an hour by using a metal propeller in place of the standard wood propeller.

2. A further increase of two miles per hour in the top speed of the airplane can be gained by closing the front cockpit. You will find listed in the price list under Accessories two types of cockpit covers, one which fits over the front windshield and is held in place by lace wires and another type which is a little more efficient used when the front windshield is removed. This second covering is hammered along the leading edge and gives a smoother flow of air. It is also secured by lace wires and fits on after standard windshield has been removed.

3. Further increase of from two to three miles per hour can be secured by fairing the lower wing at the point of attachment to the fuselage. This fairing is of cloth over a built up fillet and the installation requires skilled workmanship. We therefore suggest that it be installed only at the factory by our experienced men. However, we are contemplating building a hammered metal part for this use and if this is available at some future date it will be easy to install on the field.

4. Wheel pants give a very small addition to the top speed and will be supplied on request. However, they are a considerable nuisance for normal operation and are sold largely on account of improved appearance.

5. The greatest gain in speed can be obtained by a speed ring cowl. A single camber speed ring cowl on the Warner motor gives a minimum increase in top speed of five miles an hour and on some combinations this increase has actually been as high as seven miles per hour. The speed ring cowl is also valuable in increasing the speed when a Kinner motor is used, but as the Kinner motor has fewer cylinders the gain in top speed with this motor will be about three and one half miles per hour. We will be glad to give further information on any of the above accessories on request.

The best speed with a standard 8 ft. metal propeller will be obtained with a setting which will allow either Kinner B-5 or Warner 7 cylinder motors to turn 1700 at full throttle on the ground.

## Instructions for Ordering

**Prices:** The prices shown in this book are our best list prices. They are based on manufacturing costs and are kept as low as possible so as to encourage replacement of all new parts that are needed. As costs vary from time to time all prices shown are subject to change without notice. However supplement sheets will be sent you as soon as possible advising of any changes.

**Terms:** All prices are F.O.B. Troy, Ohio and parts shipments (except fuselage) will be sent Express C.O.D. unless otherwise specified. Parts shipped from Distributors stock will usually have small handling charges added to take care of transportation.

**Service:** We endeavor to ship all parts orders the same day they are received. A separate stock room is provided and only service orders are filled from that stock. We carry a complete supply of all Model "F" parts ready for immediate shipment.

**Ordering:** If the following instructions are followed orders can be filled with precision and errors brought to a minimum:

1. Drawings are provided showing the major and most used parts of the Model "F". Note the lines indicating the parts you need and the reference symbols which apply. Reference symbols are BB, BC, etc.

2. Immediately following the drawing showing the parts you need is an alphabetical list of part names for that particular assembly. Also the reference symbols are shown in alphabetical arrangement. Simply locate the symbol guide and under its heading you will find the part number, quantity used and the price each.

3. If you cannot locate the part you want on the drawing refer to the alphabetical list of parts and look under the common name. That is, "Interplane Strut" would be found under "Strut, Interplane."

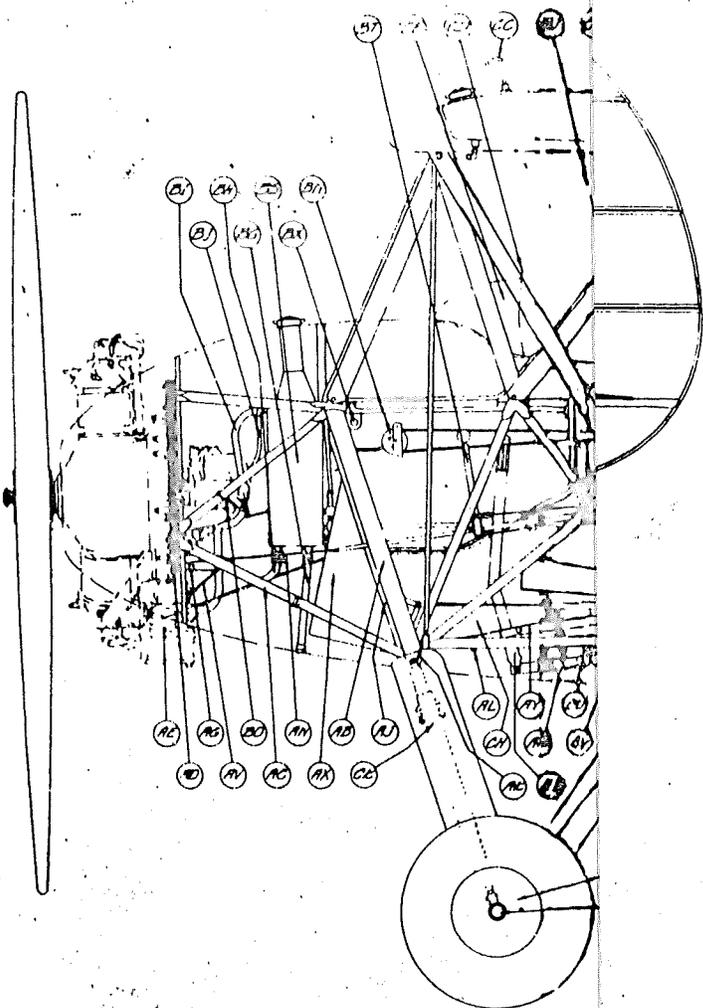
4. Always, specify the factory serial number of your airplane when ordering. This is important as the design of parts changes from time to time and the later type may not fit your ship.

**Damaged Shipments:** We will not be responsible for loss or damage sustained in shipments. However we will gladly assist you to secure an adjustment from the carrier. Our material is always packed in the best of containers and the transportation Company assumes responsibility for damage incurred in transit.

**Shortages:** All shipments are checked and rechecked before leaving our stock room to prevent error and shortages. A packing slip is enclosed with each shipment and claims for shortage must be made within 3 days after receipt of order.

Returned Goods: No material should be returned to us without first securing our wirtten permission. Material sent in without notice will be held at the owners risk for 30 days and will then be disposed of as we see fit. A returned goods notice must be filled out for all returned material. Transporation charges must be prepaid on returned goods or shipment will be refused.

Factory Hours: Our factory is open from 8:00 A.M. to 5:00 PM each week day until Saturday. On daturday we close a 12:00 noon and remain closed all day Sunday. Wire orders should be sent as early in the day as possible to aid us in making immediate shipment.



Parts List

<u>Part No</u>	<u>Description</u>	<u>Qty</u>	<u>Ref No.</u>	<u>Model</u>
<u>Fuselage -Barre:</u>				
9400	Fuselage-barre	1	AA	INF
8000	Fuselage-barre	1	AA	KNF,RNF
9840	Fuselage, front half with motor mount	1	AA	INF
9774	Fuselage, front half with motor mount	1	AA	KNF,RNF
9775	Fuselage, rear half	1	AA	
9589	Fuselage Strut Assy., left outrigger (ready to weld on)	1	AB	
9590	Fuselage Strut Assy., right outrigger	1	AB	
9394	Mount, Motor (metal parts complete)	1	AC	INF
8232	Mount, motor (metal parts complete)	1	AC	KNF,RNF
9591	Mount motor, top V assy.	1	AC	KNF, RNF
9592	Mount motor, left side V assy.	1	AC	KNF,RNF
9593	Mount motor, right side V assy.	1	AC	KNF,RNF
9965	Mount motor, top V assy.	1	AC	INF,
9966	Mount motor, left side V assy.	1	AC	INF
9967	Mount motor, right side V assy.	1	AC	INF
8091	Mount motor, plywood ring	1	AD	INF,KNF
8096	Mount motor, plywood ring	1	AD	RNF

Note: Bare fuselages and front halves are shipped without Serial Number  
In making repairs be sure to stamp the original Serial Number of your  
airplane on the fuselage.

Fuselage Assembly Parts:

8969	Arm, altitude adjusting(adapter for carb.	1	AE	
8281	Bearing stabilizer adjusting universal	1	AF	
8386	Bearing, stabilizer adjusting universal (ball threaded)	1	AF	
9159	Bearing, stabilizer adjusting universal (threaded,ball)	1	AF	
9258	Bearing shims(stabilizer adjusting univer- sal)	4	AF	
8713	Bellcrank Assy. Throttle (at Cowl support ring)	1	AG	INF,KNF
9127	Bellcrank Assy, throttle(at cowl support ring)	1	AG	RNF
9396	Belt, front safety	1	AH	
9397	Belt,Rear Safety	1	AH	
9387	Block, filler (control stick)	2	AH	

<u>Part No.</u>	<u>Description</u>	<u>Qty.</u>	<u>Ref. No.</u>	<u>Model</u>
8176	Block, Large Stringer Shim	8		
9314	Board, Oil Tank	1		RNF
8644	Brake Equalizer Arm	2	AI	
9164	Brake Equalizer Assy., Left.	1		
9165	Brake Equalizer Assy, Right	1		
9035	Brake Wire Assembly	2		
8399	Pulley, Dural, 1-1/2" x 3/8"	4		
8366	Pulley, Dural, 1-3/8" x 1/2"	3		
8360	Pulley, Dural 1-1/2" x 1/4"	4		
8392	Brake Pulley Shackle, Double	2		
8435	Brake Pulley Shackle, Single at lever	2		
9310	Brake Equalizer Arm Stop Brace	2		
8069	Brake Equalizer Tube	2		
8668	Brake Pulley Shackle(lower Brake V)	2		
8638	Brake Pulley Shackle (Upper Brake V)	2		
8135	Bulkhead, left Side Fairing (wood)	1	AJ	
8136	Bulkhead, Right Side Fairing (Wood)	1	AJ	
9447	Bulkhead, No1 Left Bottom Fairing(wood)	1	AK	
9448	Bulkhead, No. 1, right bottom fairing(wood)	1	AK	
9209	Bulkhead No. 1, front floor (wood)	1	AL	
9449	Bulkhead, No. 2, Bottom Fairing (wood)	1	AM	
9453	Bulkhead No. 2, Front Floor (Wood)	1	AN	
8160	Bulkhead No. 3, Bottom Fairing	1	AO	
9450	Bulkhead No. 4, Bottom Fairing	1	AP	
9451	Bulkhead No. 5, Bottom Fairing	1	AQ	
9452	Bulkhead No. 6, Bottom Fairing	1	AR	
9259	Bushing, Long Front Pedal	2		
9359	Bushing, Short Front Pedal	2		
9260	Bushing, Rear Pedal	4		
9365	Bushing, Pulley	3		
8923	Cable Assy. Long Rudder	2	AS	
9223	Cable Assy. Short Rudder	2	AS	
1716	Clip, Engine Control			
8276	Clip, Throttle Control Lock			
9373	Clip, Auxiliary Windshield (top)	3		
9374	Clip, Auxiliary Windshield (Bottom)	1		
1293	Clip, Large Rear Windshield	4		
2002	Clip, Small Rear Windshield	1		
764	Clip, Safety Belt Wire	4	AT	

<u>Part</u> <u>NO</u>	<u>Description</u>	<u>QTY.</u>	<u>Réf</u> <u>No.</u>	<u>Model</u>
9109	Clip, stabilizer rope guide	1		
9574	Control Assy. Engine (Boden controls to carburetor)	1	AU	
2869	Control Bracket, Right Hand Engine	1	AU	
9582	Control Bracket Assy. Mixture	1	AU	INF
9583	Control Bracket Assy. Spark	1	AU	INF
9206	Cord Stabilizer Control	1		
9173	Coupling Gas Shut-off	1		
9329	Cover Front Cockpit Control	1		
9638	Draglink Assy. Magneto	1		INF
9122	Draglink Throttle	1	AV	RNF,KNF
9636	Extension Throttle (Long Throttle Rod)	1	AV	INF
9150	Exhaust Stack (Short for cylinder)	6		RNF
9151	Exhaust Stack (Special for Carburetor-heater)	1		RNF
11035	Exhaust Stack (Special When Carburetor heater is removed)	1		RNF
8968	Extension Magneto Arm	1		RNF
8718	Extension long Throttle rod	1	AW	
8151	Fairing Bay No. 1, Left Bottom longeron	1		
8152	Fairing Bay No. 1, Right Bottom longeron	1		
8144	Fairing Bay No. 1, Left Top Longeron	1		
8145	Fairing Bay No. 1, Right Top longeron	1		
8140	Fairing Bay No. 1, Left Diagonal Strut	1		
8141	Fairing Bay No. 1, Right Diagonal Strut	1		
8143	Fairing, Bay No. 2, Left Top Longeron	1		
8142	Fairing, Bay No. 2, Right Top Longeron	1		
8155	Fairing, Bay No. 2, Long bottom longeron	2		
8154	Fairing Bay No. 2, Short Bottom Longeron	2		
8147	Fairing Bay No. 3, Left top longeron	1		
8146	Fairing Bay No. 3, Right Top longeron	1		
8156	Fairing Bay No. 3, Bottom Longeron	2		
8149	Fairing Bay No. 6, Top Longeron	2		
8157	Fairing Bay No. 7, Side Strut	2		
8150	Fairing Bay No. 7, Top Longeron	2		
8795	Fairing Long door	1		
8796	Fairing Short Door	1		
9681	Felt, Oil Tank	1		
8980	Firewall, Top	1	AX	RNF,KNF

<u>Part No.</u>	<u>Description</u>	<u>Qty.</u>	<u>Ref. No.</u>	<u>Model</u>
9877	Firewall, bottom	1	AX	RNF,KNF
9498	Firewall, top	1	AX	INF
9500	Firewall, bottom	1	AX	INF
9472	Floor Front Cockpit	1	AY	
8197	Floor, Rear Cockpit	1	AZ	
8632	Gauge Assy., Gas Assembly Complete	2	BB	
9252	Gauge Gas, Tubes Only			
9226	Guide, short rudder cable	2		
8975	Guide Stabilizer Rope	3	BC	
8244	Headrest, Pilots(complete)	1	BD	
8246	Headrest, Pilot (bulkhead,upholstered)	1	BD	
8248	Headrest, Pilot(cowhide for upholstery)	1	BD	
9634	Horn, Front Elevator	1	BE	
8178	Horn, Rear Elevator	1	BF	
3559	Hose,Oil 1/2" x 3"	5		RNF,INF
2599	Hose, Gas 3/8" x 3	3		
515	Hose, Oil 3/4" x 3"	5		
8389	Jamb, Door	1		
9032	Line, Oil Drain	1	BG	RNF,KNF
9834	Line, Oil Drain	1	BG	INF
9625	Line, Oil Feed	1	BH	INF
9036	Line, Oil Feed	1	BH	KNF
9204	Line, Oil Feed	1	BH	RNF
9023	Line, Oil Pressure(Gauge)	1		INF
9626	Line, Oil Return	1	BI	INF
9037	Line, Oil Return	1	BI	KNF
9202	Line, Oil Return	1	BI	RNF
9627	Line, Oil Tank Breather	1	BJ	INF
	Line, Oil Tank Breather (3/8" x 30" copper tubing, without fittings)	1	BJ	RNF
9628	Line, Oil Tank By-Pass	1		INF
8194	Off-Set, Left Rear Cockpit Flooring (aluminum strip)	1		
8195	Off-Set ,Right Rear Cockpit Flooring (Alum- inum strip)	1		
8736	Pedal Assy, Left Rudder	2	BK	
8737	Pedal Assy., Right Rudder	2	BK	
8284	Pulley Assy. Stabilizer Adjustment Universal(includes screw on stabilizer)	1	BL	

<u>Part No.</u>	<u>Description</u>	<u>Qty.</u>	<u>Ref. No.</u>	<u>Model</u>
8290	Rod Assy. Gas Shut-off	1	BM	
8387	Screw, Stabilizer Adjusting	1		
8187	Seat, Rear (Without support tube)	1		
8633	Shackle Assy. Stabilizer Rope Pulley	1	BN	
8990	Shield, Left Fuselage Side (Aluminum)	1		
8991	Shield, Right Fuselage Side (Aluminum)	1		
8176	Shims, Large Fairing Stringer	8		
2285	Shims, Stringer	16		
8960	Sill, Door	1		
9189	Spring, Magneto Advance	1	BO	
9120	Spring, Left Rudder Pedal	1		
9121	Spring, Right Rudder Pedal	1		
9193	Spring, Tail Cowl	1		
9151	Stack, Long Exhaust (special when heat is off)	1		RNF
9150	Stack, Short Exhaust (on Warner cylinder)	6		RNF
9151	Stack Exhaust (Special for carburetor heater)	1		RNF
11035	Stack, Exhaust (Special when carburetor heater is removed)	1		RNF
8236	Stick, Front Control (without socket)	1	BP	
8233	Stick, Rear Control (with socket)	1	BQ	
9385	stick Socket, Front Control	1		
8241	Stick socket, rear control	1		
8361	Stirrup, Stabilizer Cord Guide	1	BR	
8138	Stringer, Front (bottom)	2		
9446	Stringer, Center Bottom	2		
8974	Stringer, Side Bottom	2		
8133	Stringer, Side (top)	2		
8137	Stringer, Side (Bottom)	2		
760	Strip, Fairing 3/4" x 7/8"			
759	Strip, Fairing 1/4" x 1-1/8"			
9467	Support, Front Seat (Metal) Dural	1		
9055	Support, Gass shut-off cock	1		
9716	Tank, Oil	1	BS	KNF
8641	Tank, Oil	1	BS	RNF
9411	Tank, Oil	1	BS	INF
8293	Throttle Arm Assy. Inside	2	BT	
8297	Throttle Arm Assy. Outside	2	BT	
8774	Throttle Friction Block (pair)	1		
8279	Throttle lever knob	2		

<u>Part NO</u>	<u>DESCRIPTION</u>	<u>Qty</u>	<u>Ref No</u>	<u>Model</u>
8272	Throttle Lever Assembly	2		
8221	Throttle Lever Connection Link, long	1		
9056	Tie, Bottom Short Stringer	1		
3407	Transfer, Waco	2		
8751	Tube Assy., Front Elevator Control	1	BU	
8099	Tube Assy. Rear Elevator Control	1	BV	
8186	Tube, Rear Seat Support (Dural tube)	1	BW	
9353	Tube, Step	1	BX	
9423	Tube, Torque	1	BY	
8313	Turtle Deck Assembly	1	BZ	
3582	Vents, Gas Tank Air	2	CC	
9190	Washter, Magneto Spring Lock	1		RNF,KNF
9358	Washer step tube leather	1		
9245	Weatherstrip, Front Windshield	1		
9246	Weatherstrip, Rear Windshield	1		
9366	Windshield, Auxiliary	1	CD	
8992	Windshield, Front	1	CE	
9567	Windshield, Rear	1	CF	
9035	Wire Assy, Brake	1		
8924	Wire, Elevator	2	CG	
9205	Wire, Navigation Light (complete set)	1		
9643	Wire Assy. Oil Tank	1		INF
8923	Wire, Long Rudder	2		
9223	Wire, short rudder	2		
8394	Wire Assy., Front Safety Belt	2		
8395	Wire Assy. Rear Safety Belt	2		
9215	Wire, Double Switch (ignition)	1		
9219	Wire, Single Switch (ignition)	1		

Cowling:

8289	Blank, Instrument bulkhead (for consolidated panel)	1		
8200	Blank, Instrument bulkhead (for Pioneer panel)	1		
9161	Clip, luggage door catch	2		
9287	Cover, cockpit door inside (metal)	1		
9286	Cover, Cockpit door outside	1		
8903	Cowl Assy. Front Cockpit	1		
8981	Cowl, Assy. Rear Cockpit	1		
9031	Cowl, Front Tail	1		
9029	Cowl, Left Side Tail	1		
9030	Cowl, Right Side Tail	1		

<u>Part NO</u>	<u>Description</u>	<u>Qty.</u>	<u>Ref. NO.</u>	<u>MODEL</u>
9243	Cowl, Nose	1		KNF
9248	Cowl, Left Side	1		KNF
9249	Cowl, Right Side	1		KNF
9247	Cowl, Top	1		KNF
9250	Cowl, Nose	1		RNF
9256	Cowl, Left Side	1		RNF
9257	Cowl, Right Side	1		RNF
9255	Cowl, Top	1		RNF
9645	Cowl, Left Side (With Exhaust ring)	1		INF
9647	Cowl, Right Side (with Exhaust ring)	1		INF
9651	Cowl, Bottom (with Exhaust ring)	1		INF
9649	Cowl, Top (with exhaust ring)	1		INF
9641	Cowl, Nose (without exhaust ring)	1		INF
9662	Cowl, Left Side (without exhaust ring)	1		INF
9663	Cowl, Right Side (without exhaust ring)	1		INF
9666	Cowl, Top (without, exhaust ring)	1		INF
9028	Door Assy. Cockpit	1		
9288	Lining, Cockpit door (Fabricord)	1		
8988	Moulding, cockpit door	1		
9563	Moulding, set of cockpit	1		
9222	Pan, Oil	1		
9389	Pin, large cowling	3		
9390	Pin, Small cowling	7		
9301	Plate, bottom skuff (door sill)	1		
9300	Plate, front skuff (door sill)	1		
9302	Plate, rear skuff (door sill)	1		
8746	Ring Left cowling support	1		KNF
8747	Ring, Right Cowling Support	1		KNF
8754	Ring, Left Cowling support	1		RNF
8755	Ring, Right Cowling Support	1		RNF
9654	Ring, Left Cowling Support	1		INF
9655	Ring, Right Cowling Support	1		INF
8990	Shield, Left Fuselage (aluminum)	1	CH	
8991	Shield, Right Fuselage (aluminum)	1	CH	
9214	Shield, Instrument board (rear of front cockpit)	1		
9303	Spacer, Cowling (rear motor cowl)	4		
8244	Streamline, Headrest	1		
835	Stud, Cowling,	10		RNF,KNF
9479	Stud, Cowling	10		INF

<u>Part NO</u>	<u>Description</u>	<u>QTY</u>	<u>Ref NO</u>	<u>Model</u>
9368	Windshield, Auxiliary	1		
8992	Windshield, Front	1		
9567	Windshield, Rear	1		
9253	Wires, Side Cowl Lace	2		

UPHOLSTER PARTS:

8246	Bulkhead Assy., Headrest (pilot)	1		
9199	Cushion, Front Seat Back	1		
9462	Cushion Assy., Front Seat Bottom (single type only available)	1		
9194	Cushion, Rear Seat Back	1		
3624	Cushion, Rear Seat Bottom	1		
9564	Felt, Cockpit roll (padding) pr. ft. Lace, Shoe	8 ft.		
9562	Roll, set cockpit (front & rear) leather	1		
9437	Roll, front cockpit (leather only)	1		
9438	roll, rear cockpit (leather only)	1		
9207	upholstering, left side fabricoid	1		
9208	Upholstering right side fabricoid	1		

Tail Surfaces:

8508	Elevator, Left covered	1		
8509	Elevator, right covered	1		
8510	Elevator, left uncovered	1		
8511	Elevator, right, uncovered	1		
8480	Fin, covered	1		
8481	Fin, Uncovered	1		
8496	Rudder, Covered	1		
8497	Rudder, uncovered	1		
8512	Stabilizer, Covered	1		
8513	Stabilizer, uncovered	1		

Landing Gear:

	Brake Mechanism Assy. Left Less wheel (Aircraft Products 6.50 x 10)			
	Brake Mechanism Assy. Right less wheel (Aircraft Products 6.50 x 10)			
265	Bushing, landing gear (top of V struts)	4		
263	Cap, hug	2	CI	
9313	Clip, brake wire guide			
	Discs, brake wheel (6.50 x 10ACP)	2	CJ	
	Oil Landing gear transformer No. 6 per gal			
9961	Oleo, cylinder assy. (with retainer collar			

<u>Part NO</u>	<u>Description</u>	<u>Qty.</u>	<u>Ref NO</u>	<u>Model</u>
8269	Oleo Leather cup washer			
9960	Oleo, piston Assembly complete			
8639	Shackle, brake equalizer pulley	4		
232	Spring, landing gear shock, large	2	CK	
233	Spring, Landing gear shock, small	2	CK	
9038	Streamline, alnding gear shock strut	2	CK	
8250	Strut Assy. Landing Gear Shock Bare	2	CK	
	Tire 6.50 x 10			
	Tube 6.50 x 10			
9481	Vee, Left Landing Gear, less streamline	1	CL	
9482	Vee, Right Landing gear, less streamline	1	CL	
9487	Vee Assy. Left Landing gear, streamlined	1	CL	
9488	Vee Assy. Right Landing gear streamlined	1	CL	
9495	Vee Streamline Fairing, Front landing gear (Balsa Wood)	2		
9496	Vee Streamline Fairing, Rear Landing gear (Balsa Wood)	2		
8353	Universal, Shock Strut	4		
264	Washer,, Wheel	8		
8360	Wheels, Pulley (1-1/2 x 1/4) dural	4		
	Wheel only, brake(6.50 x 10 ACP)			

Tail Wheel Assembly:

9565	Tail Wheel Only Complete with tire and tube size 10 x 3	1	CM	
	Axle	1	CM	
	Bearing	1	CM	
8101	Bushing, Support Assy. Bronze Casting (Wheel)	2	CM	
8166	Discs, shock strut tail wheel rubber Fitting Zerk Grease	14	CN	
9722	Fork	1	CN	
8164	Shock strut Assay. Complete	1	CN	
8167	Shock strut bottom tube assembly	1	CN	
8171	Shock Strut top tube Assembly	1	CN	
8642	Spring	1		
8112	Spring Retainer	1		
8102	Support Assembly	1	CO	
	Tire	1		
	Tube	1		
8165	Washters, shock strut spacer (metal)	6		

<u>Part</u> <u>NO</u>	<u>Description</u>	<u>Qty.</u>	<u>Ref</u> <u>NO</u>	<u>Model</u>
<u>Struts, Wires &amp; Other Parts Used in Rigging:</u>				
8283	Bearing, Stabilizer Adjustment Guide	1	CP	
8414	Bushing, Wing Attachment taper	8		
3097	Clip, Fin Wire	2		
3096	Clip, Stabilizer Wire	4		
2997	Cover, Aileron Slot	4		
9275	Cover, Left Aileron Bellcrank	1		
9276	Cover, Right Aileron Bellcrank	1		
194	Hinge, Elevator	4		
9126	Hinge, Rudder	2		
9634	Horn, Front Elevator	1		
8178	Horn, Rear Elevator	1		
2127	Lights, Set Navigation	1		
9381	Plug, Rudder stop	2		
9306	Link, Aileron Driga	2	CR	
9329	Plate, Front Cockpit Control Cover	1		
9221	Plate, Top Wing Inspection	4		
8425	Rod Assy., Aileron Push Tube	2		
3481	Rope, Set of Tie Down	1		
8470	Screw, Interplane Strut Adjustment	4		
9043	Stick Interplane Wire	2		
8428	Strut Assy. Left Aileron	1	CS	
8429	Strut Assy. Right Aileron	1	CS	
8514	Strut Assy. Left Center Section	1	CT	
8515	Strut Assy. Right Center Section	1	CT	
8476	Strut Assy. Diagonal Interplane	2		
8474	Strut Assy., Front Interplane	2	CV	
8475	Strut Assy., Rear Interplane	2	CW	
5-465	Wire, Center Section, 5/16-24 x 48 1/2"	2		
5-113	Wire, Front Flying, 5/16-24 x 115"	2		
5-109	Wire, Rear Flying 5/16-24 x 111"	4		
4-96	Wire, Front Landing 1/4-28 x 97-3/4"	2		
4-9125	Wire, Rear Landing, 1/4-28 x 93"	2		
4-40	Wire, Bottom Tail, 1/4-28 x 41 1/2"	2		
4-455	Wire, Top Tail, 1/4-28 x 47"	2		
<u>Covers &amp; Patches:</u>				
9242	Aileron Cover	4		
9241	Center, Section Cover	1		

<u>Part NO</u>	<u>Description</u>	<u>Qty</u>	<u>Ref NO</u>	<u>Model</u>
9315	Cockpit Cover	1		
9238	Elevator Cover.	2		
9235	Fin Cover .	1		
9239	Fuselage Cover	1		
3440	Landing Gear Fairing Cover for 1 V	2		
9328	Motor Cover	1		
9333	Pulley Covers (Bottom Fuselage) metal	2		
9236	Rudder Cover	1		
9237	Stabilizer Cover (One Side)	2		
9220	Tail Wheel Cover	1		
9240	Wing Cover	4		
9265	Aileron Push Rod Patch Assy. (bottom fuselage)	2		
3444	Center Section Gas Tank Cap Patch	2		
3450	Center Section Patch (Strut)	4		
3453	Center Section Patch (two holes for wire terminals)	2		
9445	Fin Inspection Patch	1		
9024	Gas Shut-off Patch (cockpit lining)	1		
9455	Landing Gear Shock Strut Streamline rawhide patch	4		
1989	Rudder Wire Patch	2		
1147	Rudder Wire Rawhide Patch ( fuselage frame)	2		
9444	Safety Belt Wire Patch, Rear	2		
9213	Stabilizer Rope Fabricoid patch (cockpit lining)	1		
9263	Tail Wheel Fabricoid Patch Assy. (with eyelets) (sewed to fuselage cover)	1		
9268	Wing Fitting patch, large (bottom fuselage)	2		
9271	Wing Fitting Patch, Small(bottom fuselage)	2		
1995	Wire Fitting patch	4		
370	Vent Patch	44		

Wings:

8423	Wing, left lower, covered	1		
8424	Wing, Right lower, covered	1		
8421	Wing, left upper, covered	1		
8422	Wing, Right upper, covered	1		
8402	Wing, left lower, uncovered	1		
8403	Wing, Right lower, uncovered	1		
8400	Wing, left upper, uncovered	1		
8401	Wing, Right upper, uncovered	1		

<u>Part</u>			<u>Qty</u>	<u>Ref</u>	
<u>NO</u>	<u>Description</u>			<u>NO</u>	<u>Model</u>
<u>Wing Parts:</u>					
8425	Aileron Push Rod (Long)				
8811	Bellcrank, Left Aileron		1	EE	
8812	Bellcrank, Right Aileron		1	EE	
8961	Block Assy., Left Aileron Rod Guide		1	EF	
8962	Block Assy., Right Aileron Rod Guide		1	EF	
9067	Block, Footwalk Center Attachment		2		
9062	Block, Front Footwalk Attachment		4		
9063	Block, Rear Footwalk Attachment		2		
8838	Block, Solid End Rib Nose		6		
2357	Block, plywood Utility (large)		72		
1357	Block, Plywood Utility (medium)		112		
9066	Braces, Footwalk Center		4		
9065	Braces, Footwalk Side		4		
9163	Braces, Plywood		4		
8839	Braces, Solid End Rib Compression		2	EG	
8685	Braces, Long Solid End Rib		8	EH	
8686	Braces, Short Solid End Rib		16	EI	
8687	Braces, A No. 2 Solid Tail Rib		4	EJ	
3650	Bracket, Left Aileron Bellcrank		1	EK	
3651	Bracket, Right Aileron Bellcrank		1	EK	
9112	Capstrip, Main Front Spar Reinforcement		2		
9114	Capstrip, Rear Spar Reinforcement top		2		
9718	Clip, internal brace wire		16	EL	
8462	Clip, Internal Brace Wire		16	EM	
8468	Clip, Internal Brace Wire		16	EN	
8466	Clip, Internal Brace Wire		16	EO	
1067	Coppers, Narrow Trailing Edge		24	EP	
1066	Coppers, Wide Trailing Edge		12	EP	
9064	Cross Pieces, Footwalk		18		
9334	Cross Pieces, Footwalk		2		
2085	Fairing, 1/4" Round				
9103	Fairing, Left Lower Terminal		1		
9104	Fairing, Right Lower Terminal		1		
9116	Fairing, Upper Front Flying Wire terminal		2		
9185	Fairing, Upper Rear Flying Wire terminal		2		
9117	Fairing, Left & Right Upper Front landing wire terminal		2		
9118	Fairing, Upper Rear Landing Wire Terminal		2		

<u>Part No.</u>	<u>Description</u>	<u>Qty</u>	<u>Ref NO</u>	<u>Model</u>
8623	Fitting, Front Lower Root Plate	4	EQ	
8627	Fitting, Rear Lower Root Plate	4		
8441	Fitting, Left Upper Wing Root Plate	4	EQ	
8442	Fitting, Right Upper Wing Root Plate	4	EQ	
8771	Fitting, Left Upper wing front strut plate	2	ES	
8772	Fitting, Right Upper Wing Front Strut Plate	2	ES	
8606	Fitting, Upper Front Flying Wire pull	2	ES	
8383	Fitting, Lower Front Landing Wire pull	2	ES	
8419	Fitting, Upper Wing Rear Strut Plate	4	ET	
8420	Fitting, Lower Wing Rear Strut Plate	4	ET	
8446	Fitting, Upper Rear Flying Wire pull	4	ET	
8413	Fitting, lower rear landing wire pull	2	ET	
9060	Former, Lower Solid End Rib Nose(Balsa)	2	EU	
9227	Frame, Left Aileron Bellcrank (lower)	1	EV	
9228	Frame, Right Aileron Bellcrank (lower)	1	EV	
9176	Frame, Left Front, Inspection (upper)	1	EW	
9177	Frame, Right front inspection (upper)	1	EW	
9178	Frame, Left Rear Inspection (upper)	1	EX	
9179	Frame, Right rear Inspection (upper)	1	EX	
8607	Front, Upper strut plate reinforcemnt (plywood)	4		
8594	Gusset, Rectangular (rib)	28		
10240	Gusset, Rectangular (rib)	752		
9098	Gusset, Large False Rib	8		
2371	Gusset, Tail (rib)	56		
8677	Leading Edge, Wing (wood)	4	EY	
8702	Leading edge, dural (top camber) including tips	4	EY	
8703	Leading Edge, Dural (bottom camber ) including tips	4	EY	
8704	Leading Edge, Dural (top camber) tip only	4	EY	
8706	Leading Edge, Dural (bottom camber) tip only	4	EY	
2133	Navigation Light Base	2	EZ	
	Navigation Light Bulb	2	EZ	
	Navigation Light Shell	2	EZ	
	Navigation Light Bracket	2	EZ	
2093	Moulding, Wing Walk	2	EZ	
8625	Reinforcement, Lower Wing Root fitting (plywood)	4		
9113	Reinforcement, Additional Front Spar	2		

<u>Part NO</u>	<u>Description</u>	<u>Qty.</u>	<u>Ref NO</u>	<u>Model</u>
9110	Reinforcement, Main Front Spar	4		
9111	Reinforcement, Rear Spar	4		
8823	Rib, Left Lower Solid End	1	FF	
8824	Rib, Right Lower Solid End	1	FF	
8661	Rib, Left Upper solid end	1	FF	
8662	Rib, Right Upper solid end	1	FF	
8663	Rib, A No. 1, Left Upper Light Compression	2	FG	
8664	Rib, A No. 1, Right Upper light compression	2	FG	
8879	Rib, Solid Nose (wing walk)	2	FG	
8825	Rib, Solid Center (wing walk)	2	FG	
8829	Rib, Lower solid tail (wing walk)	2	FG	
8517	Rib, A No. 1, Light	8	FH	
8933	Rib, A No. 1, Left Lower Light Compression	1	FI	
8934	Rib, A No. 1, Right Lower Light Compression	1	FI	
8665	Rib, A No. 2, Left Light Compression	2	FJ	
8666	Rib, A No. 2, Right Light Compression	2	FJ	
8523	Rib, No 3 Light	4	FK	
8867	Rib, A No. 4, Left Lower Light compression	1	FL	
8868	Rib, A No. 4, Right Lower Light Compression	1	FL	
8865	Rib, A No. 4, Left Upper Light Compression	1	FL	
8866	Rib, A No. 4, Right Upper Light Compression	1	FL	
8527	Rib, A No. 5, Light	4	FM	
8669	Rib, "B" Left upper light compression	1	FN	
8670	Rib, "B" right upper light compression	1	FN	
8529	Rib "B", light (lower)	2	FN	
8531	Rib, "C" light (upper)	2	FO	
8833	Rib, "C" left lower light compression	1	FO	
8834	Rib "C" right lower light compression	1	FO	
8671	Rib, Left False	2	FP	
8672	Rib, Right False	2	FP	
8926	Rib, A No. 2, Left lower solid tail	1	FQ	
8927	Rib, A No. 2, Right lower solid tail	1	FQ	
8519	Rib A No. 2, Left upper solid tail	1	FQ	
8520	Rib A No. 2, Right Upper solid tail	1	FQ	
8593	Rib, Nose Gusset "A" light	70		
9162	Saddle, A No. 2, Solid Tail Rib Brace	4		
9148	Spar, Left Lower False (with hinges)	1	FR	
9149	Spar, Right Lower False (with Hinges)	1	FR	
9183	Spar, Left upper false (with hinges)	1	FR	

<u>Part NO</u>	<u>Description</u>	<u>QTY</u>	<u>Ref NO</u>	<u>Model</u>
9184	Spar, Right upper false (with hinges)	1	FR	
8451	Spar, Left Upper Front	1	FS	
8452	Spar, Right Upper Front	1	FS	
8455	Spar, Left Lower Front	1	FS	
8456	Spar, Right Lower Front	1	FS	
8449	Spar, Left Upper Rear	1	FT	
8450	Spar, Right Upper Rear	1	FT	
8453	Spar, Left Lower Rear	1	FT	
8454	Spar, Right Lower Rear	1	FT	
8607	Strap, Upper Front Wing Reinforcement (metal)	4	FU	
8407	Strap, Upper Rear Wing Reinforcement(metal)	4	FV	
8678	Strip, Inner Wing Bow End	4	FW	
8679	Strip, Middle Wing Bow End	4	FW	
8680	Strip, Outer Wing Bow End	4	FW	
8564	Trailing Edge, Wing (lower)	1	FX	
8563	Trailing Edge, Wing (upper)	1	FX	
8471	Tube, Long Wing Compression (dural)	8	FY	
8472	Tube, Short Wing Compression (dural) (at Strut fitting)	4	FY	
8443	Universal, interplane strut	12	FZ	
8681	Wedge, False wing Spar	4		
9058	Wing Walk (plywood)	1		
9719	Wire, Wing Internal Brace, 1st bay, upper	8	GG	
9717	Wire, Wing Internal Brace, 1st bay, lower	8	GG	
9074	Wire, Wing Internal Brace, 2nd Bay, upper	12	GH	
9072	Wire, Wing Internal Brace, 2nd bay lower	4	GH	
9074	Wire, Wing Internal Brace, 3rd Bay, Upper and lower	12	GI	
9719	Wire, Wing internal Brace, 4th Bay, Upper	8	GJ	
9717	Wire, Wing Internal Brace, 4th bay, lower	8	GJ	
<u>Ailerons:</u>				
8494	Aileron, left lower, covered	1		
8495	Aileron, Right lower, Covered	1		
8492	Ailerom Left Upper, Covered	1		
8493	Aileron, Right Upper, Covered	1		
8431	Aileron, left lower uncovered	1		
8432	Aileron, Right lower, uncovered	1		
8433	Aileron, Left upper. uncovered	1		
8434	Aileron, Right upper, Uncovered	1		

<u>Part NO</u>	<u>Description</u>	<u>Qty.</u>	<u>Ref NO.</u>	<u>Model</u>
<u>Aileron parts:</u>				
8898	Fitting, left lower aileron strut attachment	1	HH	
8899	Fitting, Right lower aileron strut attachment	1	HH	
8759	Fitting, left upper aileron strut attachment	1	HH	
8760	Fitting, Right upper aileron strut attachment	1	HH	
8437	Fitting, left lower aileron horn	1	HH	
8438	Fitting, Right lower aileron horn	1	HH	
2825	Hinge, left and right aileron (inter-changeable)	1	HI	
8521	Rib, Left Aileron solid end ( No. 1)	2	HJ	
8522	Rib, Right Aileron Solid end (no. 1)	2	HJ	
8524	Rib, No. 2, Aileron light	4	HK	
8526	Rib No. 3, Aileron light	4	HL	
8528	Rib No. 4, Aileron Light	4	HM	
8530	Rib No. 5, Aileron Light	4	HN	
8532	Rib No. 6, Aileron Light	4	HO	
8999	Spar, left lower aileron front (with hinges)	1	HP	
9000	Spar, Right lower Aileron Front (with hinges)	1	HP	
8997	Spar, Left Upper aileron front (with hinges)	1	HP	
8998	Spar, Right upper aileron front (with hinges)	1	HP	
9377	Spar, left lower aileron rear	1	HQ	
9378	Spar, Right lower aileron rear	1	HQ	
9375	Spar, left upper aileron rear	1	HQ	
9376	Spar, Right upper Aileron Rear	1	HQ	
8565	Trailing edge aileron	4	HR	

Center Section:

9749	Center section, Covered with tanks	1		
9825	Center section, covered, without tanks	1		
9750	Center Section, uncovered, without tanks	1		

Center Section Parts:

8818	Brace, short solid end rib	6	II	
8685	Brace, long solid end rib	6	II	
8461	clip, Internal brace wire (double)	2	EK	
8464	clip, Internal Brace Wire	4	IL	
8935	Fairing, Brace Wire Terminal	2	IM	
8919	Fitting, Gas Tank Retainer (metal triangle)	2	IN	
8920	Fitting, Gas Tank Retainer (metal Triangle)	4	IO	

<u>Part NO</u>	<u>Description</u>	<u>Qty.</u>	<u>Réf NO</u>	<u>Model</u>
8415	Fitting, left root (front or rear)	4	IP	
9416	Fitting, right root (front or rear)	4	IP	
8409	Fitting, Center Section Brace Wire (pull)	2	IP	
8385	Fitting, Front landing wire (pull)	2	IP	
8411	Fitting, rear landing wire (pull)	2	IP	
9695	Flange, pipe 1/4" (aluminum) welds to tank	5		
9696	Flange, pipe 1/2" (aluminum) (welds to tank)	2		
8632	Gauge Assy, gas	2		
8791	Hand grip	2	IQ	
8790	Hand grip plywood reinforcement	4	IQ	
8931	Leading edge, bottom dural	1	IR	
8930	Leading edge, top dural	1	IR	
8781	Leading edge (spruce)	1	IR	
9761	Rib, Center (compression)	1	IS	
9752	Rib, Left solid end	1	IT	
9753	Rib, right solid rod	1	IU	
8787	Rib, long tail	2	IV	
8788	Rib, Intermediate tail	2	IW	
8789	Rib, Short tail	1	IX	
8780	Rib, nose, open	5	IY	
8786	Bottom Cap strip	4	IZ	
9201	Bottom cap strip reinforcement	4	IZ	
8405	Spar, front	1	JJ	
8406	Spar, Rear	1	JK	
9759	Supports, solid rib gas tank	4		
	Tank, left gas (old type aircraft products)	1		
	Tank, right gas (old type aircraft products)	1		
9687	Tank, left gas (aluminum)	1		
9688	Tank, right gas (aluminum)	1		
8595	Tank, left gas (terneplate)	1		
8596	Tank, right gas (terneplate)	1		
	Tank caps, gas			
	Tank Cap, gas			
	Tank Cap gasket (cork)			
8566	Trailing edge	1	JL	
8443	Universal, Interplane strut	4	JM	
8819	Wire Assy. Internal brace	4	JN	

Note: on Model "F" Wacos up to serial number 3389 the gasoline tanks were self-supporting from a flange formed on their top, In that

<u>Part</u> <u>NO</u>	<u>Description</u>	<u>Qty.</u>	<u>Ref</u> <u>NO</u>	<u>Model</u>
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case certain parts are different as listed in the following:

8778	Rib, left solid end	1		
8779	Rib, right solid end	1		
8783	Rib, center (compression)	1		
8782	Strip, solid end rib top cap			
8875	Strip, solid end rib bottom cap			
8784	Strip, center compression rib top cap			
8786	Strip, center compression rib bottom cap			
9765	Strip, spar top cap			
9765	Strip, spar bottom cap			

Accessories:

Speed ring cowl for Warner Engine  
 Metal Front cockpit cover (used over regular windshield)  
 metal front cockpit cover (with detachable windshield)  
 combination exhaust speed ring cowl for Warner engine  
 Fire Extinguisher (pyrene-pint size)  
 Fire Extinguisher (flash-ping size)  
 Gas Strainers for RNF, KNF, INF

Raw Materials:

Cable, head 1/8"  
 Cloth, Wing (grade A)  
 Cord, linen, for hand sewing  
 Cord, linen for rib sewing  
 cord, shock 5/8"  
 cork  
 dope, aluminum  
 dope, clear (5 gal, lot)  
 dope, pigmented  
 dope, red brown two  
 duck, waterproof  
 fabricord, (specify color)  
 funnel, large-with neck  
 funnel-large  
 funnel, small  
 Gimp  
 glue

Raw Materials (CONT'D)

lacquer (for cowling)  
 nails (cover tacks)  
 paint, exhaust  
 plywood, mahogany 1/16"  
 plywood, mahogany 3/16 "  
 plywood, mahogany 1/4"  
 plywood, mahogany 3/8"  
 plywood, mahogany 1/2"  
 powder, aluminum  
 retarder, dope  
 tape, friction  
 tape, pinked (2" 100 yds. per roll)  
 thinner, dope  
 Thinner, lacquer  
 tubing, copper 1/8"  
 tubing, copper 3/16"  
 tubing, copper 1/4"  
 tubing, copper 5/16"  
 tubing, copper 3/8"  
 tubing, copper 1/2"  
 varnish  
 wire, safety

Bolt List for Model "F" Waco:

All bolts are of Army and Navy standard made from 2330  
 Nickel steel heat treated to an ultimate tensile strength of 125,000 lbs.  
 per square inch and are cadmium plated. To measure the length of a bolt  
 measure from the under side of the bolt head to the upper side of the  
 cotter key hole. This gives the useful length.

In the bolt sizes the first number is a diameter, the next  
 number of S.A.E. threads to the inch, the third number is the useful  
 length, measured as per the above.

BOLT List

1/4"-28x 1/2" bolt and nut, fin to fuselage

1/4"-28 x 5/8" bolt and nut

Used on: Elevators to rear elevator horn  
 front and rear safety belt wires  
 front wing strut to diagonal strut  
 magneto arm extension  
 short rudder wire to front pedals  
 stabilizer adjustment to fuselage  
 stern post to fin

1/4"-28 x 3/4" Bolt and nut

used on: Brake pulleys to top of landing gear V  
 Long rudder wire to rudder pedals  
 rudder cables to rudder horn  
 stabilizer hinge  
 wing struts (top rear and bottom front)

1/4"-28 x 7/8" bolt and nut

used on: aileron strut to lower aileron  
 brake pulleys to fuselage at shock strut  
 for dual brake wires  
 front pedal to fuselage  
 elevator wire pulleys

1/4"-28 x 1" bolt and nut

used on: aileron strut fitting to aileron spars  
 (upper and lower wings)  
 aileron strut to upper aileron  
 rear of center section strut to fuselage

1/4"-28 x 1-1/8" bolt and nut

used on: aileron control rod to aileron horn  
 internal drag wires to front and rear spars  
 (center section)  
 root fittings to center section spars  
 root fittings to front and rear spars (upper wings)

1/4"-28 x 1-1/4" bolt and nut

used on: compression tubes to spars (upper and lower wings)  
 internal drag wires to front and rear spars  
 (upper wings)

1/4"-28 x 1-3/8" bolt and nut

used on: bottom rear wing struts to wing  
 rear wing strut to top of diagonal strut  
 throttle bellcrank

1/4"-28 x 1-1/2" bolt and nut

used on: diagonal wing struts (top and bottom)  
 front and rear center section strut to center  
 section  
 throttle lever

1/4"-28 x 1-5/8" bolt and nut

used on: front wing struts to upper wings  
 stern post to fin

## Bolt List(Cont'd)

1/4"-28 x 1-3/4"	bolt and nut used on: stabilizer wires to stabilizer wing root fittings to front and rear spars (lower wing)
1/4"-28 x 1-7/8"	bolt and nut used on: internal drag wires to front and rear spars (lower wings)
1/4"-28 x 2"	bolt and nut used on: front elevator tube to rear stick socket hub cap to axle top and bottom rudder hinges
1/4"-28 x 2-1/8"	bolt and nut used on: tail wheel fork to support
1/4"-28 x 3"	bolt and nut used on: front stick socket to torque tube rear stick socket to torque tube
1/4"-28 x 301/2"	bolt and nut used on: torque tube bearing cap to fuselage
5/16"-24 x 3/4"	bolt and nut used on: elevator control wire to rear elevator horn elevator to elevator horn
5/16"- 24 x 1"	bolt and nut used on: front of center section strut to fuselage
5/16"-24- 1-1/8"	bolt and nut used on: aileron bellcrank bracket to false spar (lower wings) aileron control rod to aileron bellcrank (lower wing) center section strut universal to rear spar (center section) spar bracket fittings to front and rear spars (lower wing)
5/16"-24 x 1-1/2"	bolt and nut Used on: bottom oleo universal to strut tail wheel spring to fuselage universal strut fittings to front and rear spars (upper and lower wings)
5/16"-24 x 1-5/8"	bolt and nut used on: bottom oleo universal to landing gear V tail wheel shock strut to fuselage tail wheel shock strut to piston Assy.
5/16"-24 x 1-3/4"	bolt and nut used on: front elevator tube to front stick socket tail wheel support assembly to fuselage upper wing fittings to center section fitting (4 special)

5/16" x 24 x 2" bolt and nut  
used on: torque tube to front elevator horn

5/16"-24 x 2-3/8" Bolt and nut  
used on: (8) Warner motor to plywood mounting board

5/16"-24 x 2-1/2" bolt and nut  
used on: Warner motor to plywood mounting ring (holds cowl ring)

5/16"-24 x 2-5/8" bolt and nut  
used on: Oleo strut to outrigger.

3/8"-24 x 1-1/4" bolt and nut  
used on: strut plate reinforcement strap to rear spar (upper wing)  
lower rear wing root fittings to fuselage (2)

3/8"-24 x 1-3/8" bolt and nut  
used on: Warner plywood board to fuselage (6)  
Spar bracket fitting to rear spar (upper wing)

3/8"-24 x 1-1/2" bolt and nut  
used on: Warner plywood board to fuselage (hold cowl ring at top and right side) (2)

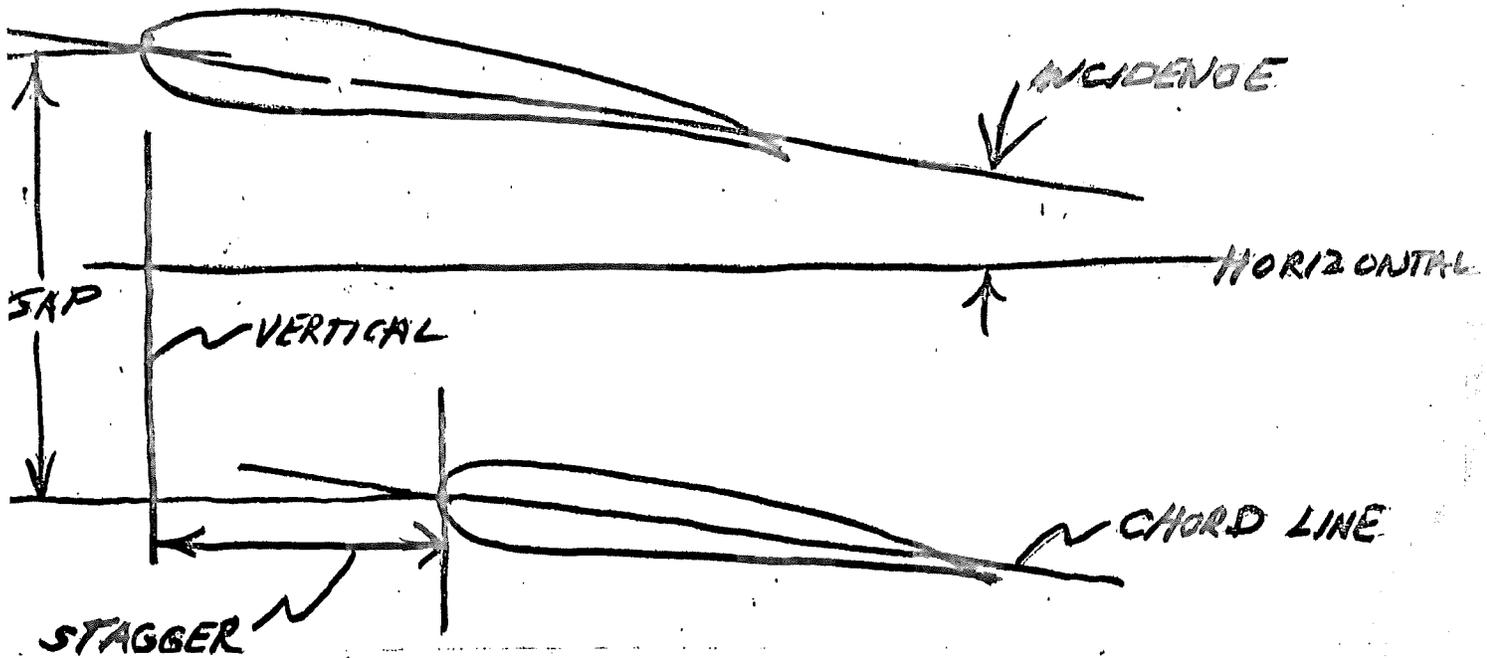
3/8"-24 x 1-5/8" bolt and nut  
used on: front and rear landing wire pulls to spars (lower wing)  
Kinner plywood board to fuselage (6)  
landing wire pull to rear spar (center section)  
strut plate reinforcement strap to front spar (upper wings)  
Warner plywood board to fuselage (1) (holds cowl ring at left side)

3/8"-24 x 1-3/4" bolt and nut  
used on: Kinner plywood board to fuselage (2) (holds cowl ring at top and left side)  
landing wire pull to front spar (center section)

3/8"-24 x 1-7/8" bolt and nut  
used on: flying wire pull to rear spar (upper wing)  
Kinner plywood board to fuselage (1) (holds cowl ring at left side)  
Spar bracket fitting to front spar (upper wing)

3/8"-24 x 2-1/8" bolt and nut  
used on: flying wire pull to front spar (upper wing)  
landing gear V to fuselage  
lower front wing root fittings to fuselage (2)

# RIGGING



## AIRCRAFT IN LEVEL FLIGHT

STAGGER		28 1/2 "
GAP (ROOT OR TIP)		54 "
INCIDENCE	UPPER	0°
INCIDENCE	LOWER	0°
DIHEDRAL	UPPER	2°
DIHEDRAL	LOWER	2°
SWEEP	BACK	0°

# The WACO AIRCRAFT COMPANY



TROY, OHIO  
U.S.A.

September 29, 1944

SERVICE BULLETIN #151

To all airports and flying services

Subject: MAINTENANCE MANUAL COVERING WACO AIRPLANES  
MANUFACTURED FROM 1929 TO 1942 INCLUSIVE

The writer receives many requests each week from mechanics, flight operators, and students, asking for a maintenance manual covering the various open and closed airplanes manufactured by this company to date. This data has been available in the past in separate manuals prepared for each of the various models, but many of those manuals are now out of print and not available for distribution. In view of this we have given some thought to preparing two manuals, one of which will contain maintenance information regarding all the open cockpit Waco airplanes and the other the cabin models manufactured from 1929 to 1942 inclusive.

The manuals, if compiled, would include general maintenance information on all the various models, including landing gear, rigging, and other data, and would be supplemented by a rigging diagram, shock strut drawing, tail wheel assembly installation, wiring diagram, lubrication chart, service bulletins, etc.

We estimate that based on present costs we would be required to sell such manuals for from \$2.50 to \$3.00 per copy, and we are, therefore, sending this letter to all airport operators and flying services with the hope that those persons who would be interested in purchasing such manuals when available will advise us to that effect.

Enclosed is an addressed postal card and we would appreciate your advising us your thoughts on the subject briefly. An indication that you would be interested in purchasing such manuals at this time will not be considered as an obligation to purchase in the future. In other words, we simply hope to have some indication from the industry as to whether or not it would be of any practical value to publish the maintenance manuals mentioned and the quantity that might be required.

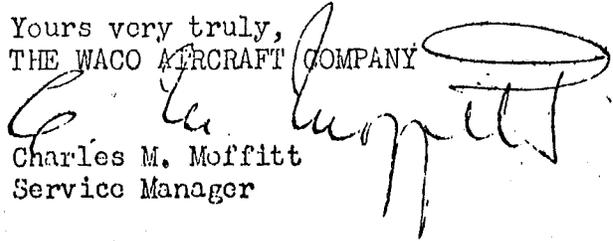
WACO AIRCRAFT COMPANY  
TROY, OHIO, U. S. A.

Service Bulletin #151  
Page Number Two

There is also a possibility that some mechanics who work on Wacos may have ideas which they would like to see in the manuals, and if so we would be pleased to have them passed on to us for our consideration.

Yours very truly,  
THE WACO AIRCRAFT COMPANY

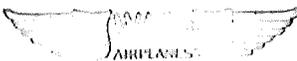
Charles M. Moffitt  
Service Manager

A handwritten signature in cursive script, appearing to read 'C. M. Moffitt', is written over the typed name and title. The signature is fluid and somewhat stylized, with a large loop at the end of the last name.

CMM:deb

Encl.

# The WACO AIRCRAFT COMPANY



TROY, OHIO  
U.S.A.

July 3, 1945

SERVICE BULLETIN #154

(To all owners of Waco airplanes models RNF, INF, KNF, and MNF)

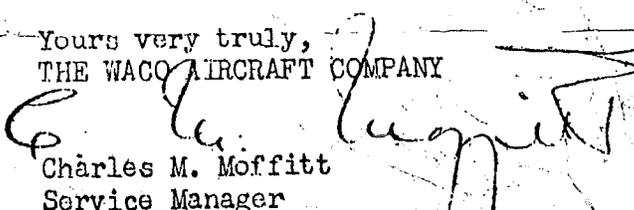
Subject: FUEL LINES

The Civil Aeronautics Administration has reported to this company an accident to a model RNF airplane resulting from the copper fuel line breaking at the carburetor fuel inlet fitting. Investigation showed that no rubber hose connection had been used at the point mentioned and that breakage was caused by vibration at that point.

The Waco models mentioned above were manufactured by this company in 1930 and 1931, and in view of this it is suggested that all owners carefully check all fuel lines and make sure that these incorporate either approved type flexible hose connections on each end of all metal fuel lines, or that approved type flexible fuel lines are used. Fuel lines which connect parts of the fuel system subject to relative motion should be revised immediately by installing hose connections or as indicated by using approved flexible hoses attached with hose clamps or equipped with approved type quick removable end fittings.

The above requirement is being added to the Special Notes on subject model and will, therefore, be a requirement the next time your airplane is brought up for inspection. However, this company recommends the inspection and change be made immediately.

Yours very truly,  
THE WACO AIRCRAFT COMPANY

  
Charles M. Moffitt  
Service Manager

CMM:deb

# The WACO AIRCRAFT COMPANY



TROY, OHIO  
U. S. A.

November 28, 1931

GENERAL LETTER NO. 210

Subject: MODEL F OLEO STRUTS

The landing performance of the Model F WACO airplanes can be materially improved by shortening the oleo struts an inch and one quarter. This change widens the tread of the landing gear approximately five inches and materially decreases the tendency of the airplane to ground loop. We believe it is worthwhile changing the oleo struts on all WACO F's now out and have decided to make up a stock of short oleo pistons which we will ship on request.

The new pistons will be shipped express c.o.d. at \$3.00 per set and an open account charge of \$12.00 will be made until the old pistons are returned.

We will ship with the pistons instructions for their replacement and the net cost to you on this change will be the shipping charges both ways plus \$3.00 for a new type piston plus about two hours' labor on the installation.

We suggest that you pass this information on promptly to all owners as we believe the improvement well worth making.

Yours very truly,  
THE WACO AIRCRAFT COMPANY

# The WACO AIRCRAFT COMPANY



TROY, OHIO  
U.S.A.

General Letter 548  
September 23, 1937

## SERVICE BULLETIN

TO ALL OWNERS OF MODEL QCF WACO'S:

SUBJECT: Center Section Spar Fittings

Recently while recovering a center section of a model QCF WACO it was discovered the spar had a crack at the spar end where the strut fitting is attached to the rear spar, which apparently had been caused by rough ground handling.

On the next annual inspection of your WACO QCF, or the next time you have the cover open, we suggest you remove this strut attachment fitting and carefully examine the spar at that point, and if you do find a split we have worked out a new design of spar end fitting that can be installed without requiring you to install a new spar, and these fittings have the added advantage of further distributing the load to avoid future trouble at this point. These fittings are only \$3.25 per set, which includes the fittings for both rear spar ends. When ordering please ask for the fittings and instructions in accordance with WACO SK-363 which is the number covering this parts assembly.

Very truly yours,  
THE WACO AIRCRAFT COMPANY

# The WACO AIRCRAFT COMPANY



TROY, OHIO  
U. S. A.

January 7, 1938  
General Letter #561

## Subject - OIL IN OLEO SHOCK STRUTS

We are rather worried about the general lack of oil in shock absorber struts which we have examined recently. We believe you are not paying sufficient attention to the maintenance of the undercarriage. A shock absorber strut without oil is a strut which will put possibly ten or twenty load factors into the structure instead of the limited six load factors which are the design requirements.

In other words when there is no oil only a portion of the load can be absorbed by the spring, which is capable of absorbing only a small percentage of the absorption capacity of the strut when properly filled with oil.

It is easy to check the oil in the oleo struts. Have them inspected at each motor check period and fill them to a height four inches from the top of the struts when the airplane is standing normally on level ground. The later models have a gauged rod attached to the bottom of the filler plug.

In filling the shock struts use General Electric #6 Transformer oil, electric refrigerator compressor lubricating oil, or Lockheed brake fluid. If neither of these is available, a half and half solution of castor oil and alcohol may be used. If the above oil isn't obtainable locally we can supply it promptly.

In the future any damage claims involving the undercarriage will first be investigated from the standpoint of proper oil being in the oleo shock struts, and if proper oil is not found no claims will be considered. This is important and we urge you to give it your careful attention.

DOF:BZ

THE WACO AIRCRAFT COMPANY  
D. C. Flower

# The WACO AIRCRAFT COMPANY



TROY, OHIO  
U.S.A.

May 2, 1938  
GENERAL LETTER #576

SUBJECT: REAR CENTER SECTION SPARS

TO ALL OWNERS OF QCF AND PCF WACO'S:

Recent inspections have disclosed one or two cases where the rear center section spar on the Model QCF was found to have a crack from the lower bolt hole to the end of the spar at each end.

An investigation shows that this crack is due to long service and drying out of the wood rather than to loads applied. However, to overcome this difficulty, we are mailing you separately by parcel post to this same address, a new set of fittings for each end of the rear center section spar. Full instructions accompany these fittings and they should be installed promptly.

You will find attached with this letter a postcard, and we ask that in return for these fittings we are supplying at no charge, you promptly fill out this postcard and return it to us when the fittings have been installed so our records may be complete in the matter. We also ask that you have an entry made in your log book by a licensed mechanic stating that the fittings have been installed.

Yours very truly,  
THE WACO AIRCRAFT COMPANY

# The WACO AIRCRAFT COMPANY



TROY, OHIO  
U.S.A.

June 15, 1938  
General Letter #578

TO OWNERS OF KMF, RNF, AND INF WACO AIRPLANES

Subject: CENTER SECTION REAR SPAR FITTING

Recent field inspections have disclosed several cases where the rear spar on the above Waco's had split between the last fitting bolt and the spar end. This is largely caused by normal shrinkage and drying of the wood from age and it is a condition that deserves your attention.

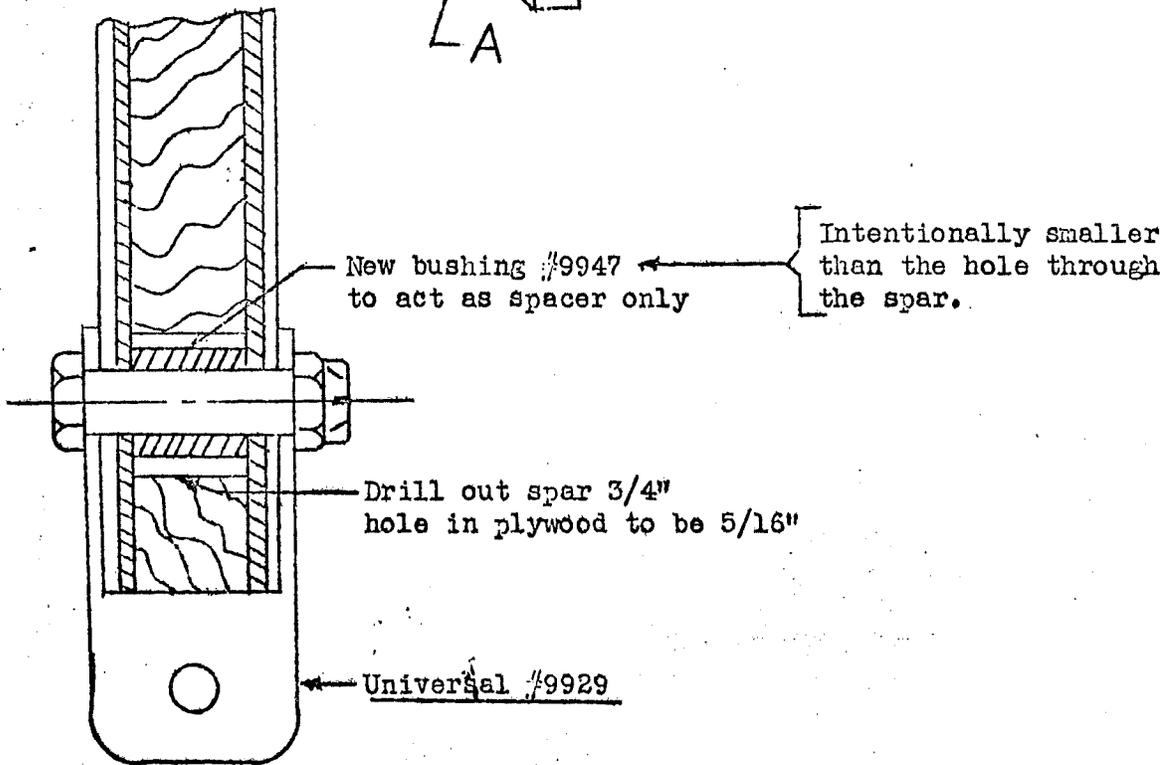
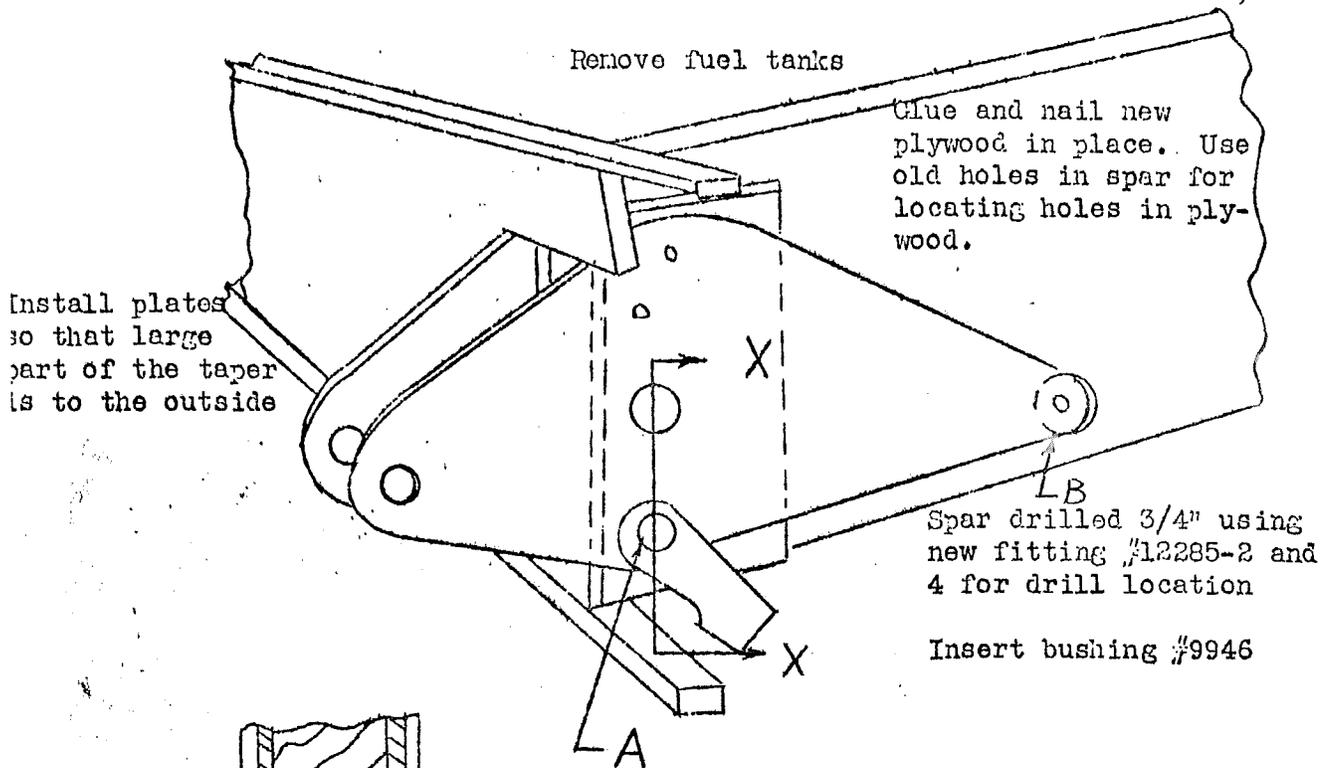
We have designed a special long fitting which the Civil Aeronautics Authority have approved for installation on spars that have the short crack at the end as above described, and the Authority will require the installation of these new fittings on all Waco F's at the time the annual licenses are renewed.

Although the youngest of these planes is over six years old and most of them are about eight years old and far out of guarantee, we will nevertheless supply a set of these fittings for each plane for a special price of \$8.40 net, if you will give us the serial number and complete address of the present owner of the plane for which these parts are ordered.

We suggest that you install these fittings on your Waco F in accordance with the enclosed Waco drawing SK-408 at your earliest convenience, and make a note of this installation in your log book before the next annual inspection of the plane.

THE WACO AIRCRAFT COMPANY

Encl.

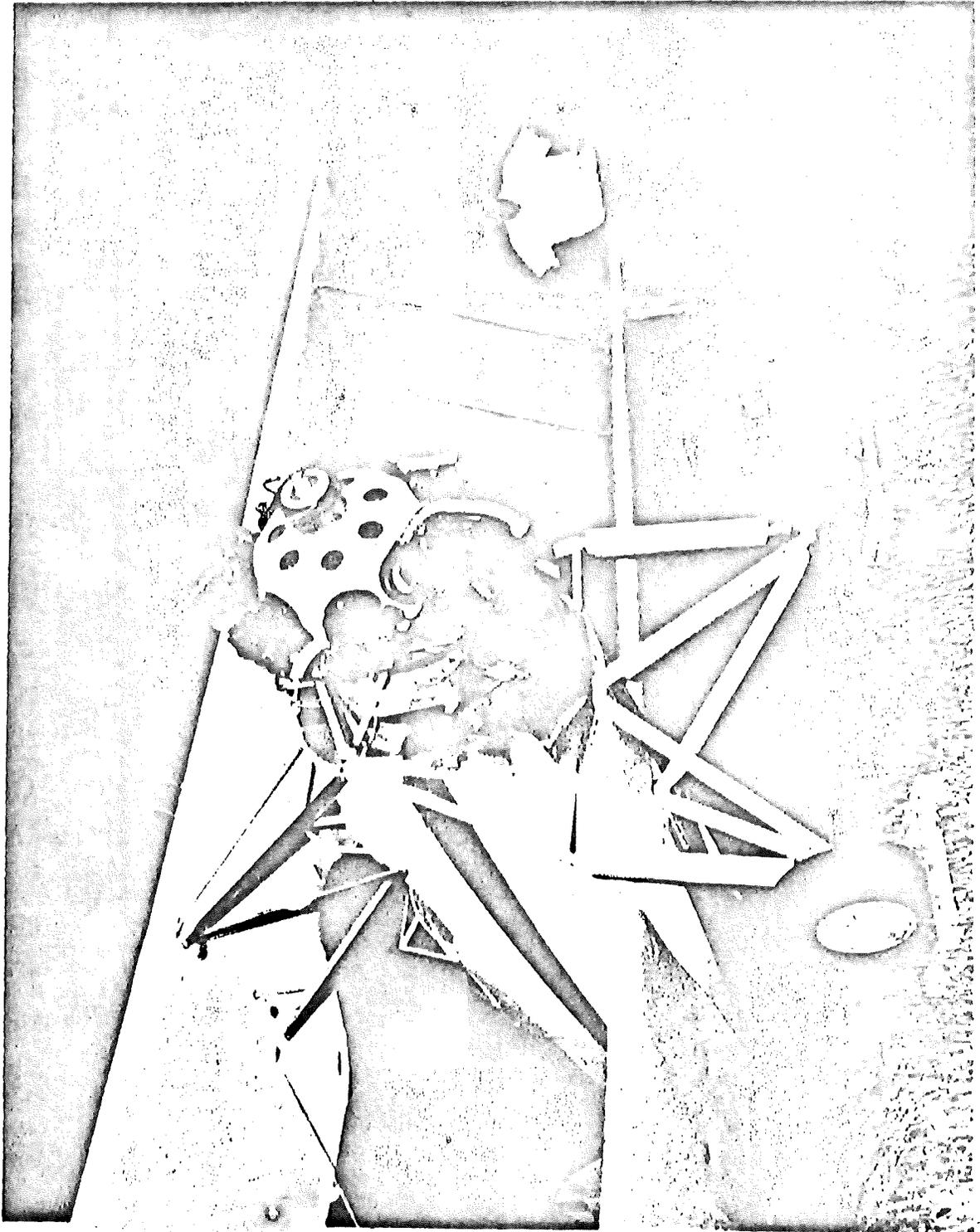


INSTALLATION INSTRUCTIONS  
FOR SPAR PLATES ON "N" CENTER  
SPAR

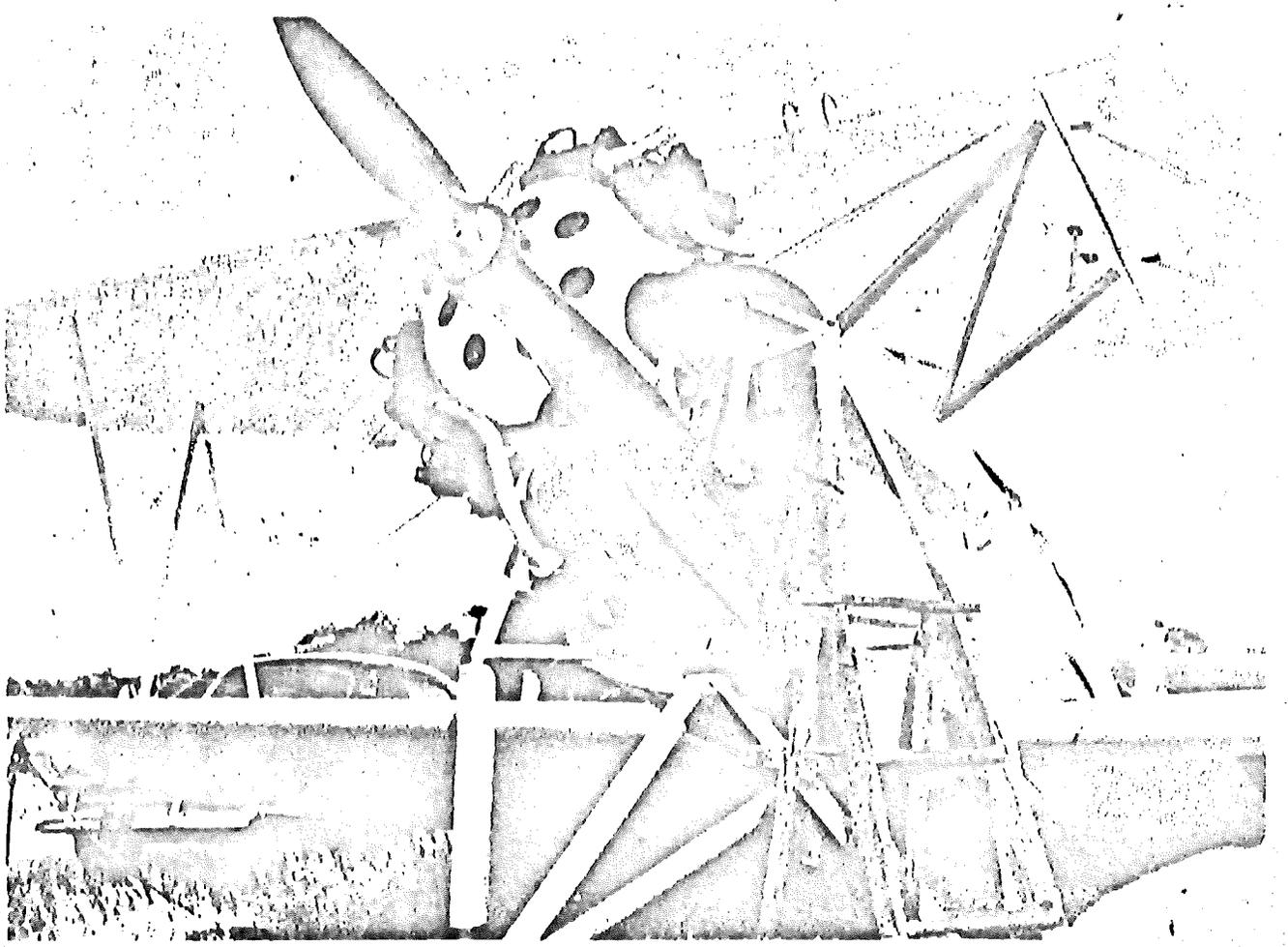
THE WACO AIRCRAFT COMPANY  
TROY - OHIO

May 6, 1938

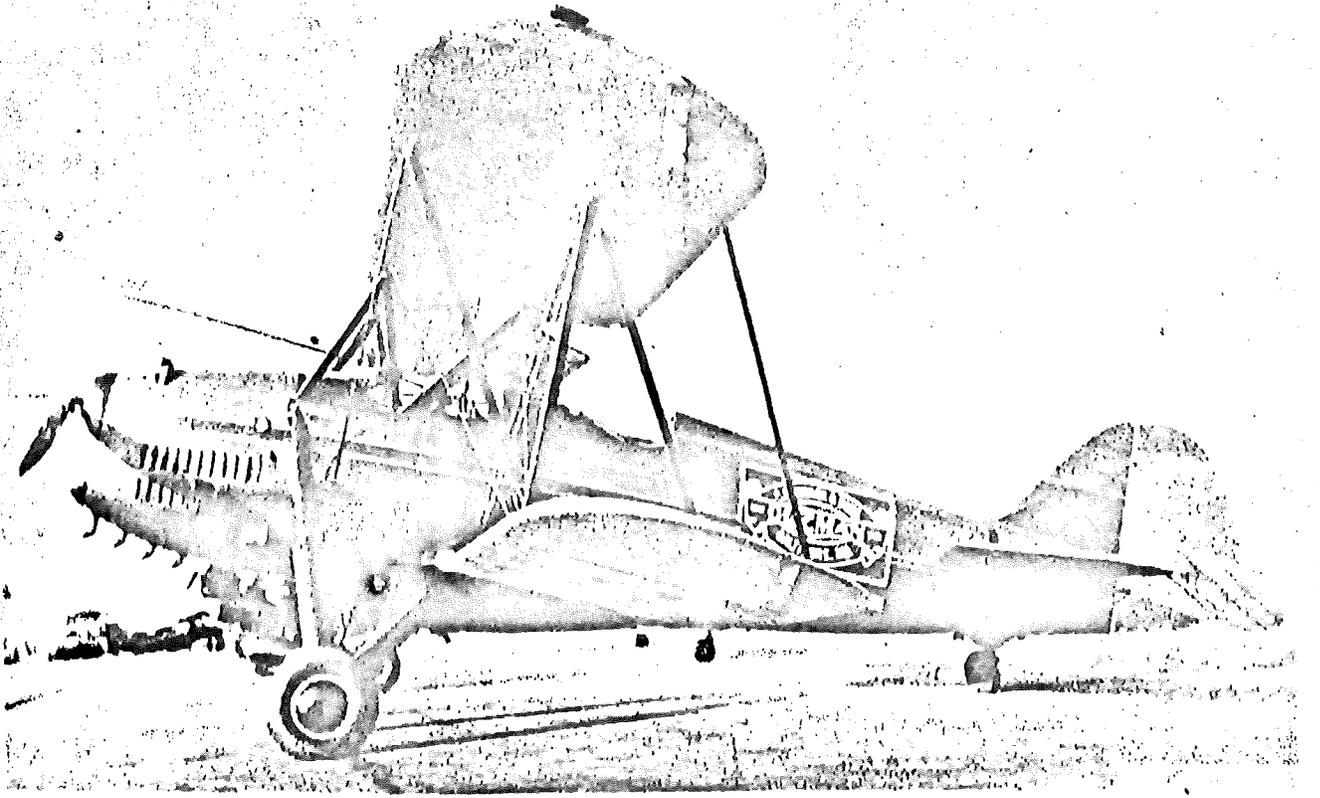
SK-408



Waco RNF showing proper exhaust pipe connection to structure's letter box



W. R. F. + slant pipe configuration on Warner



W. R. KNF Merisio Motor