AEROMODELLER POCKET DATA BOOK

Originally published in America by FLYING MODELS this valuable collection of data sheets for aeromodellers provides almost a lifetime's collection of information on all aspects of model flying. Where necessary, facts have been amended to meet the requirements of British enthusiasts but many typical American expressions have been retained where international usage has accepted them.

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M.A.P.

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MAP TECHNICAL PUBLICATION

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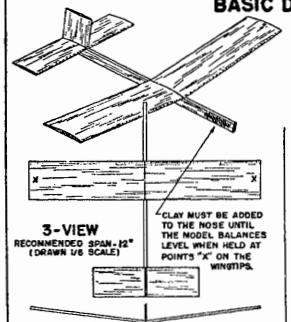
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1. BUILDING, FLYING & ADJUSTING ALL-BALSA GLIDERS

BASIC DESIGN:

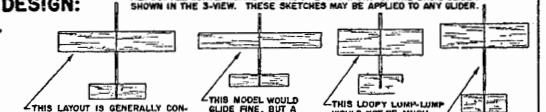
ALMOST ALL CONVENTIONAL GLIDERS ARE VARIATIONS OF THE BASIC GLIDER SHOWN IN THE 3-VIEW. THESE SKETCHES MAY BE APPLIED TO ANY GLIDER.



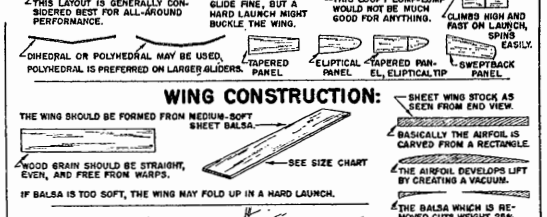
3-VIEW
RECOMMENDED SPAN-12" (DRAWN 1/6 SCALE)

THIS IS THE SIMPLIEST FORM OF GLIDER CAPABLE OF FLIGHT. WITH IT, OR ANY GLIDER, YOU CAN LEARN THE RUDIMENTS OF FLIGHT IN A FEW MINUTES.

FOLLOW THESE SKETCHES CAREFULLY FOR STEP-BY-STEP DESIGN, CONSTRUCTION AND ADJUSTMENT PRACTICES.



WING CONSTRUCTION:

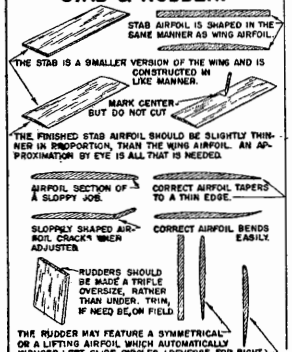


MATERIAL CHART:

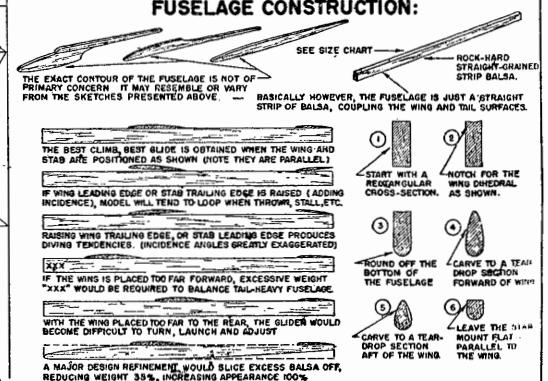
RECOMMENDED WOOD SIZES AND GENERAL DIMENSIONS —

SPAN	CHORD	WING SH	LENGTH	FUSELAGE	TAIL SH.
12"	2"	1/8"	10"	3/16" X 1/2"	1/16" SOFT
14"	2-1/4"	3/16"	11-3/4"	3/16" X 9/16"	1/16" SOFT
16"	2-1/2"	3/16"	13-1/2"	1/4" X 5/8"	3/32" SOFT
18"	2-3/4"	3/16"	15-1/4	1/4" X 11/16"	1/8" SOFT
20"	3"	1/4"	17"	1/4" X 3/4"	1/8" SOFT

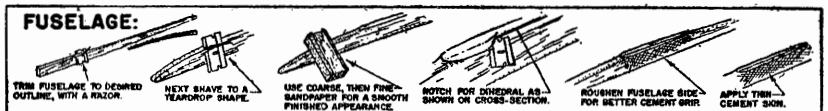
STAB & RUDDER:



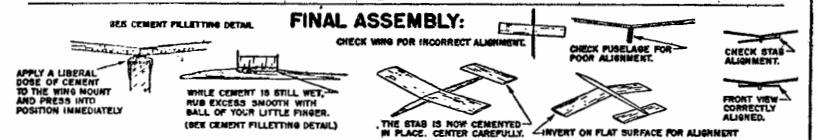
FUSELAGE CONSTRUCTION:

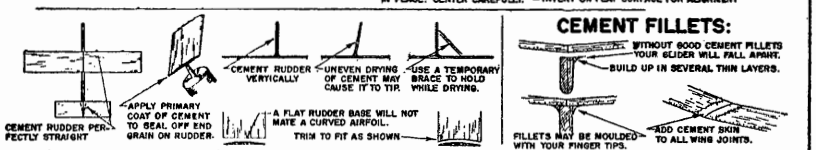


FUSELAGE:



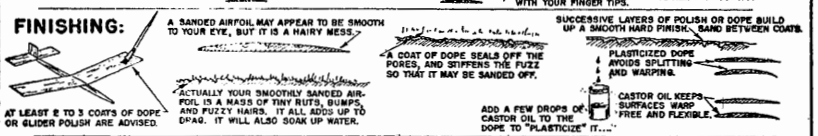
FINAL ASSEMBLY:



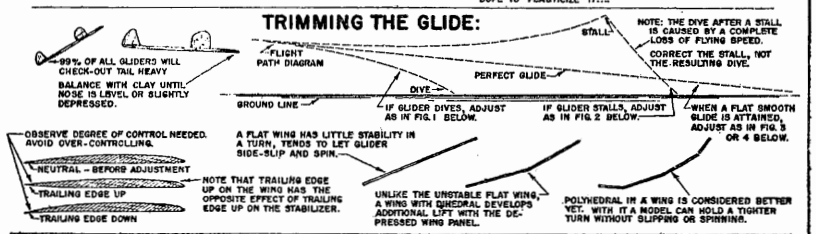


CEMENT FILLETS:

FINISHING:

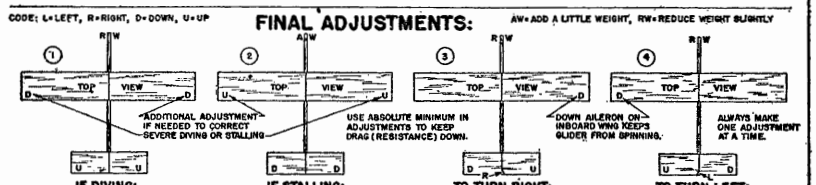


TRIMMING THE GLIDE:

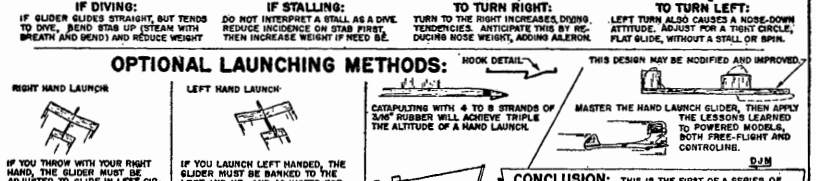


FINAL ADJUSTMENTS:

CODE: L=LEFT, R=RIGHT, D=DOWN, U=UP — AW=ADD A LITTLE WEIGHT, RW=REDUCE WEIGHT SLIGHTLY



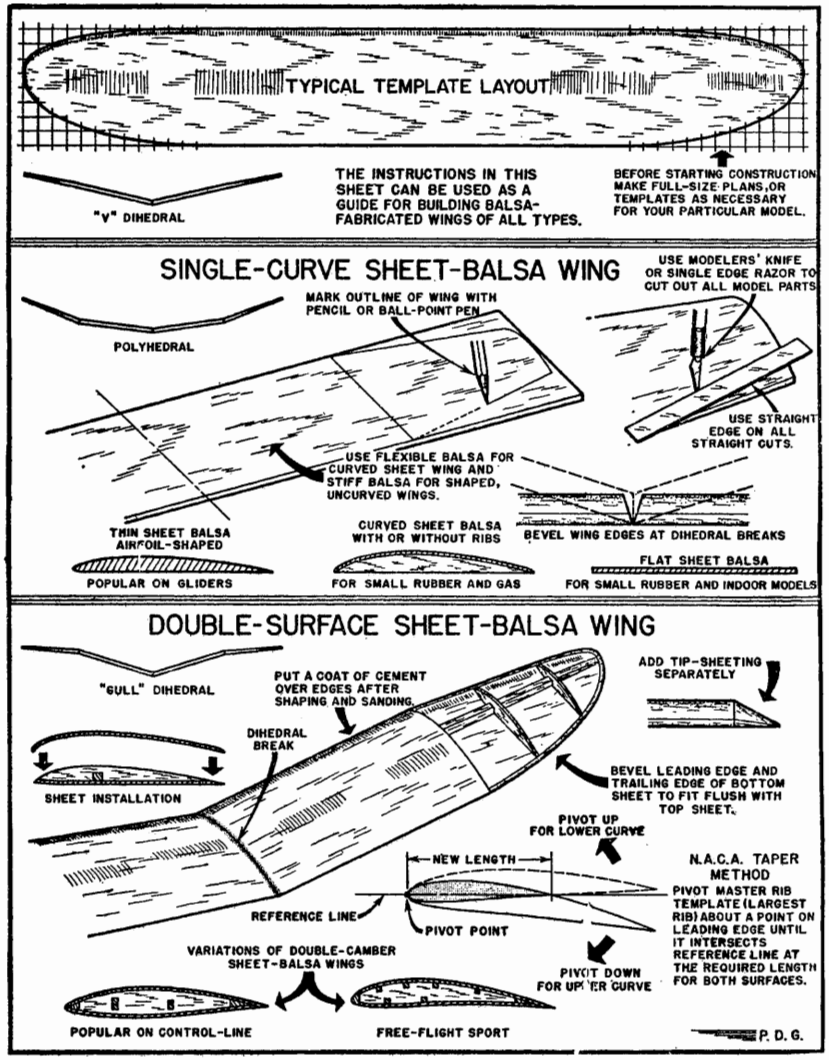
OPTIONAL LAUNCHING METHODS:

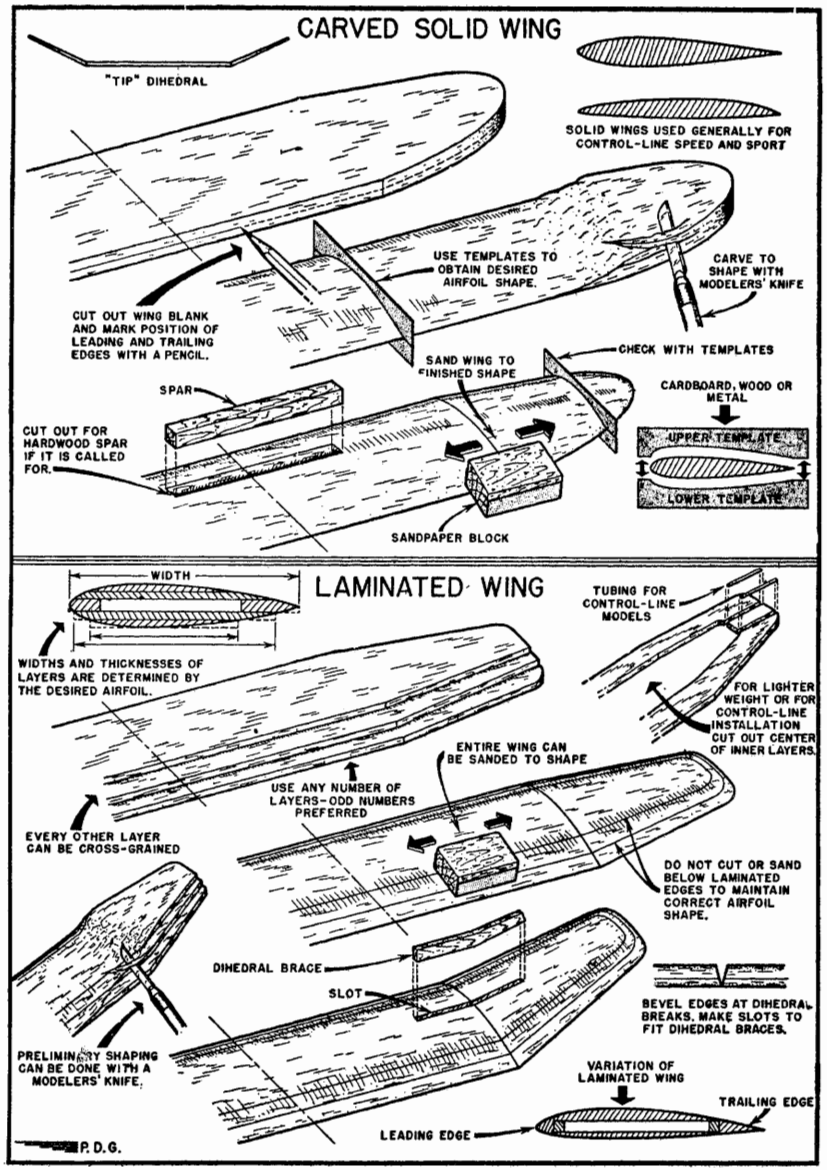


DJM

CONCLUSION: THIS IS THE FIRST OF A SERIES OF ILLUSTRATED DATA SHEETS, DESIGNED TO BETTER ACQUAINT NEW MODELERS WITH VARIOUS DESIGN, CONSTRUCTION AND OTHER ASPECTS OF THE HOBBY. KEEP THIS INFORMATION HANDY FOR YOUR OWN REFERENCE AS WELL AS YOUNGER BUILDERS IN YOUR NEIGHBORHOOD.

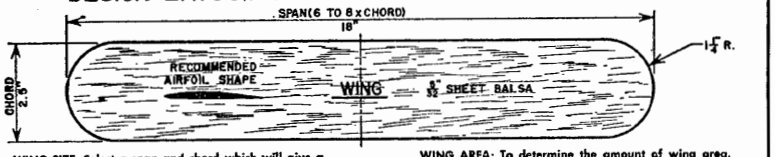
2. BALSA FABRICATED WINGS





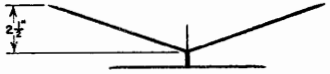
3. CHUCK-GLIDER DESIGN DATA

DESIGN LAYOUT FOR BASIC HAND-LAUNCH GLIDER



WING SIZE: Select a span and chord which will give a wing size from 30 to 50 square inches in area. The span should be six to eight times the length of the chord; the approximate thickness of the wing airfoil, 1/16" to each 1" of chord.

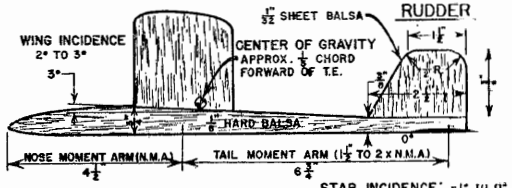
WING AREA: To determine the amount of wing area, multiply the span by the chord; then subtract the area removed in making the semi-circular tips (Area of half-circle is determined by multiplying the radius by the radius and then by 1.57). An airfoil shape similar to the one shown above is recommended, as it will assist in achieving excellent results with maximum stability.



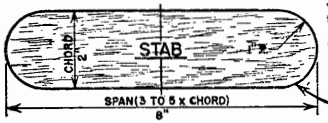
DIHEDRAL
1 1/2" TO 2"/FT.

DIHEDRAL: Dihedral is the angular setting of the wing panels with respect to the horizontal plane of the front view of the model. For simplicity of construction, a V-type dihedral is recommended, as shown above.

FUSELAGE LENGTH: The fuselage length—the total length of the model from the nose to the trailing edge of the stab or rudder, whichever is farther from the nose—should be approximately from three-quarters to the same length as the wingspan. The maximum fuselage depth should be no more than one-third the wing chord. The maximum fuselage thickness should not exceed one-quarter of the fuselage depth.



MOMENT ARMS: The distance between the centerline of the wing and the centerline of the stab is known as the Tail Moment Arm. This should be one and one-half to twice the length of the Nose Moment Arm (the distance between the centerline of the wing and the nose of the fuselage), with the length of both tail and nose moment arms equaling the fuselage length between the nose of the fuselage and the centerline of the stabilizer.



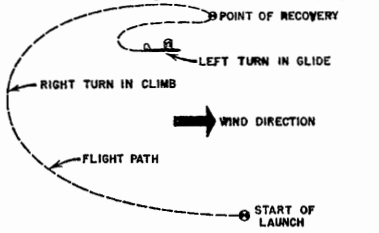
INCIDENCE: Incidence refers to the fixed angle at which the wing or stab is set with reference to the horizontal reference line of the fuselage side view (see drawing). For a basic hand-launch glider, wing incidence should be from 2° to 3°, stab incidence from 0° to 1°. If maximum stability is preferred, use the maximum value for wing incidence and the minimum value for stab incidence.

RUDDER AREA: Select the values which identify the type of rudder used. For a single rudder, the area should be 9% to 11% of the wing area; for a single rudder with tip plates, use 10% to 13%; for double rudders, 12% to 16%.

CENTER OF GRAVITY: The point at which the model airplane is balanced about all its axes is known as the Center of Gravity. When the center of gravity is too far forward, the model will dive, and when too far to the rear, the model will stall. If you follow the proportions set forth for the correct tail and nose moment arms for this glider, the theoretical center of gravity will be located approximately one-third of the wing chord forward of the trailing edge.

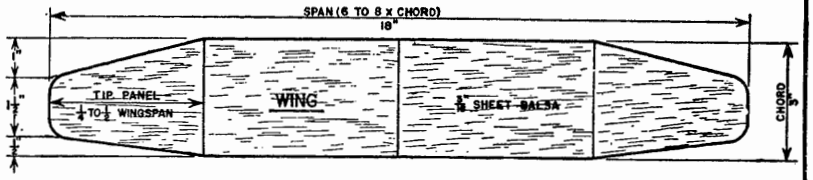
STAB AREA: The size of the stabilizer should range from 35% to 45% of the wing area. Also note that if the tail moment arm selected closely approximates the minimum suggested, then use a large stab area. If the tail moment arm selected is nearer the maximum suggested, then use a small stab area.

ADJUSTING TECHNIQUE: Add ballast in the form of clay to the nose of the fuselage until a glide is obtained with a slight nose-up tendency. For right-hand launch to the right adjust for a left turn: Begin by warping the rudder to the left a little at a time until a wide circle is obtained in the glide. Make final adjustments by warping right inboard wing panel down, or, if recovery is too quick and the model stalls, use right stab panel to delay recovery and tighten turn. In doing so, it may be necessary to remove some clay to compensate for the additional nose-down effect of the stab adjustments.



P.D.G.

DESIGN LAYOUT FOR CONTEST HAND-LAUNCH GLIDER

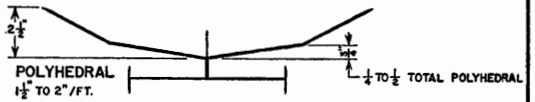


WING SIZE: Select a span and chord which will give a wing area of from 40 to 60 square inches. This size is preferable if your only previous experience has been with a basic hand-launch glider. Use the same chord-to-span ratio limits as on the basic hand-launch glider. A high span-to-chord ratio is preferable on a contest glider. The thickness ratio remains the same as on the basic hand-launch glider.

WING AREA: Determine the amount of wing area using the same procedure as on the basic hand-launch glider, subtracting the area cut away at the wing tips. For a tapered wing panel, figure the area of the cut-away triangles by multiplying one-half the length of each triangle by the width.

RECOMMENDED AIRFOIL SHAPES
Ⓐ
Ⓑ

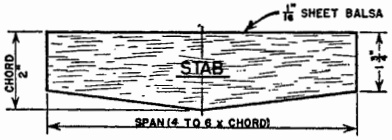
AIRFOIL SHAPE: There are two types of airfoil shapes which can be used. The flat bottom airfoil (A) is recommended as a first design after which an under-cambered section (B) can be employed if desired.



INCIDENCE: Only a small amount of incidence is recommended with a contest hand-launch glider to assist in maintaining a moderate amount of stability without affecting the altitude obtainable in launching.

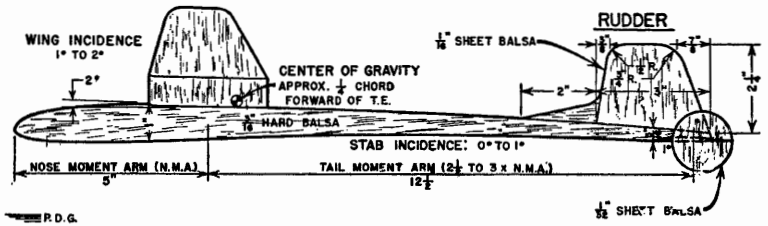
STAB AREA: The stab should be 30% to 40% of the wing area. If previous experience with a contest hand-launch glider is lacking, or launching ability is moderate, use a stab area which closely approximates the maximum suggested, in conjunction with the minimum suggested for the tail moment arm.

POLYHEDRAL: Polyhedral, as shown, is a form of wing panel arrangement preferable to the V-type dihedral, except possibly when the span-to-chord ratio is low. In the design shown, polyhedral is used to best advantage for contest flying.



FUSELAGE LENGTH AND DEPTH: The fuselage length should be one to one and one-quarter the wing span. The maximum fuselage depth should be no more than one-third the wing chord. The maximum fuselage thickness should not exceed one-quarter of the fuselage depth.

RUDDER AREA: Select the set of values which identifies the type of rudder used: For a single rudder use 8% to 10% of the wing area; for single rudder with tip plates, use 9% to 12%; for double rudder, 11% to 15%, after which the procedure is identical to that used for determing stab area. A dorsal rudder design as shown is recommended for optimum directional stability, and can be adapted if a single rudder with or without tip plates is contemplated.



P.D.G.

4. SIMPLE SLAB-SIDER BUILDING

STEP I— STUDY PLAN:

FAMILIARIZE YOURSELF WITH THE FUSELAGE PLAN, AND DETERMINE OUTLINE OF THE BASIC FUSELAGE SIDE TO BE CONSTRUCTED.

NOTE THE CABIN AND SUPERSTRUCTURE DETAILS ON THE SKETCH ARE ADDED LATER, AS ON MOST MODELS.

BASIC FUSELAGE SIDE OUTLINE

FUSELAGE SIDES SUCH AS THIS ONE, WITH ONE STRAIGHT AND ONE BENT LONGERON, HAVE A TENDENCY TO PULL OUT OF SHAPE. THIS CAN BE PREVENTED BY THE ADDITION OF DIAGONALS AS INDICATED.

AN OPTIONAL METHOD OF INSTALLING DIAGONALS IS SHOWN HERE. IF 1/8" SQ. LONGERONS ARE USED, USE 1/16" SQ. DIAGONALS, NOTCHED INTO THE UPRIGHTS AS REQUIRED.

DIAGONALS ARE NOT REALLY NEEDED IF LONGERONS ARE BENT EQUALLY AS IN THESE SKETCHES.

STEP II— LAY OUT LONGERONS:

SELECT MEDIUM-HARD STRAIGHT GRAINED WARP-FREE STRIPS OF BALSA FOR THE LONGERONS. BRACKET LONGERONS TO PLAN WITH PINS AS SHOWN.

DO NOT PIERCE OR BRUISE LONGERONS WITH PINS, OR THEY WILL BE SERIOUSLY WEAKENED.

SEAL END GRAIN OF ALL UPRIGHTS WITH A PRELIMINARY COAT OF CEMENT.

WITH A SHARP RAZOR, CUT A DOUBLE SET OF FUSELAGE UPRIGHTS, AND CEMENT ONE OF EACH IN PLACE, COMPLETING THE SIDE.

NOTE: PINS ARE NOT SHOWN TO AVOID CONFUSION.

FUSELAGE UPRIGHTS

STEP III— ADD FUSELAGE UPRIGHTS:

STEP IV— START SECOND SIDE:

PINS NOT SHOWN TO AVOID CONFUSION.

FUSELAGE LONGERONS

LAY OUT THE LONGERONS FOR THE SECOND SIDE DIRECTLY ON TOP OF THE FIRST. SLIP THEM BETWEEN THE PINS WITHOUT REMOVING THEM.

AS IN STEP III, THE STAB REST AND FUSELAGE UPRIGHTS ARE ADDED NEXT, COMPLETING CONSTRUCTION OF THE SECOND SIDE.

THE FUSELAGE SIDES SHOULD REMAIN PINNED TO THE PLAN UNTIL THOROUGHLY DRY, THEN REMOVED CAREFULLY.

THE PINS SHOULD HOLD THE LONGERONS OF THE SECOND SIDE FLUSH WITH THOSE OF THE FIRST, TO INSURE ALIGNMENT.

STEP V— ALLOW TO DRY THOROUGHLY:

STEP VI— TRIM, SAND, AND SEPARATE:

NOTE DOUBLE UPRIGHTS REINFORCING STAB REST.

WAX PAPER MIGHT PREVENT THE SIDES FROM STICKING SLIGHTLY, BUT THE CURE SEEMS WORSE THAN THE DISEASE. PERSONALLY, WE DON'T LIKE WAX-SOAKED CEMENT.

IF A DIAGONAL WAS INSERTED IN THIS END SECTION, IT WOULD PREVENT THE POSSIBILITY OF THE STAB REST SAGGING.

SAND ROUGH SPOTS OFF, REMOVE EXCESS CEMENT, AND SEPARATE, AS ILLUSTRATED, WITH A RAZOR.

CONSTRUCTED IN THIS MANNER, YOUR FUSELAGE SIDES, WHICH FORM THE BASIS FOR THE ENTIRE FUSELAGE, WILL BE ACCURATE, NEAT AND WARP-FREE.

THE NOSE AND POINTS OF MAXIMUM STRESS SHOULD BE BRACED ACCORDINGLY. THIS TYPE FUSELAGE CONSTRUCTION IS ADAPTABLE TO BOTH GAS AND RUBBER MODELS.

WITH YOUR SIDES COMPLETED, YOU ARE NOW READY TO START ASSEMBLY.

STEP VII— READY FOR ASSEMBLY:

STEP VIII— CUT CROSS-PIECES:

NEXT, FOCUS YOUR ATTENTION ON THE TOP PLAN VIEW. CAREFULLY CUT A SET OF CROSS-PIECES IN DUPLICATE AS INDICATED, AND PRECOAT END GRAIN WITH CEMENT AS ON THE FUSELAGE UPRIGHTS.

FUSELAGE TOP PLAN VIEW MAY ALSO BE USED TO CHECK ALIGNMENT

UPRIGHTS

D.J.M

STEP IX— CEMENT CROSS-PIECES:

STARTING WITH THE STRAIGHTEST PORTION OF YOUR FUSELAGE, AS SEEN IN THE TOP PLAN VIEW, CEMENT THE REQUIRED UPRIGHTS TO THE FIRST SIDE AS ILLUSTRATED HERE.

CROSS-PIECES

DO NOT CEMENT CROSS-PIECES TO THIS PORTION OF THE FUSELAGE SIDE AT THIS TIME.

CROSS-PIECES

BALSA ALIGNMENT TRIANGLE

DO NOT ADD CROSS-PIECES TO NOSE AS YET

BALSA ALIGNMENT TRIANGLE

THE VERTICAL FACE OF THE TRIANGLE WILL DETECT MIS-ALIGNMENT AS IT DEVELOPS.

NOTE HOW THE RIGHT-ANGLE CORNER OF THE TRIANGLE MAY BE USED TO ALIGN THE CROSS-PIECES IN RELATION TO THE WORKBENCH AND TO THE LONGERON ITSELF.

CUT A TRIANGLE THIS EXACT SHAPE FROM SCRAP SHEET BALSA.

CROSS-PIECES

BALSA ALIGNMENT TRIANGLE

BASE MUST FIT BETWEEN UPRIGHTS.

FUSELAGE SIDE ON WORKBENCH (FRONT VIEW)

STEP X— ALIGN CROSS-PIECES:

STEP XI— CEMENT SECOND SIDE IN PLACE:

NEXT, APPLY A DROP OF CEMENT TO EACH CROSS-PIECE, AND DROP THE SECOND SIDE IN POSITION.

DO NOT SQUEEZE FUSELAGE SIDE ENDS TOGETHER, UNTIL CROSS-PIECES ON FORWARD SECTION ARE THOROUGHLY DRY.

ONCE AGAIN, THE BALSA ALIGNMENT TRIANGLE WILL COME IN HANDY.

CHECK ALIGNMENT ON ALL SIDES WITH TRIANGLE.

ALIGNMENT TRIANGLE

THE AFT SECTION OF THE FUSELAGE MAY NOW BE PULLED TOGETHER AND CEMENTED AT THE TAIL POST, AT THE EXTREME REAR.

STEP XII— NOSE CROSS-PIECES:

MOST FUSELAGES TAPER IN TOWARD THE NOSE, AS SEEN IN THE TOP VIEW AT THE EXTREME RIGHT.

TO SIMPLIFY THIS PART OF THE ASSEMBLY, STRETCH A RUBBER BAND AROUND THE NOSE, AFTER THE CROSS-PIECES HAVE BEEN CEMENTED IN PLACE

IF THE FUSELAGE SHOWS A TENDENCY TO BOW ONE WAY OR THE OTHER OF THE CENTERLINE, AS AT THE RIGHT, IT CAN BE ADJUSTED BY PULLING THE ARCHED SIDE REARWARD A FRACTION, AND PINNING UNTIL THE CEMENT SETS.

STEP XIII— CHECKING ALIGNMENT:

WITH THE ALIGNMENT COMPLETE, THE REMAINING CROSS-PIECES MAY BE INSERTED.

STEP XIV— SANDING:

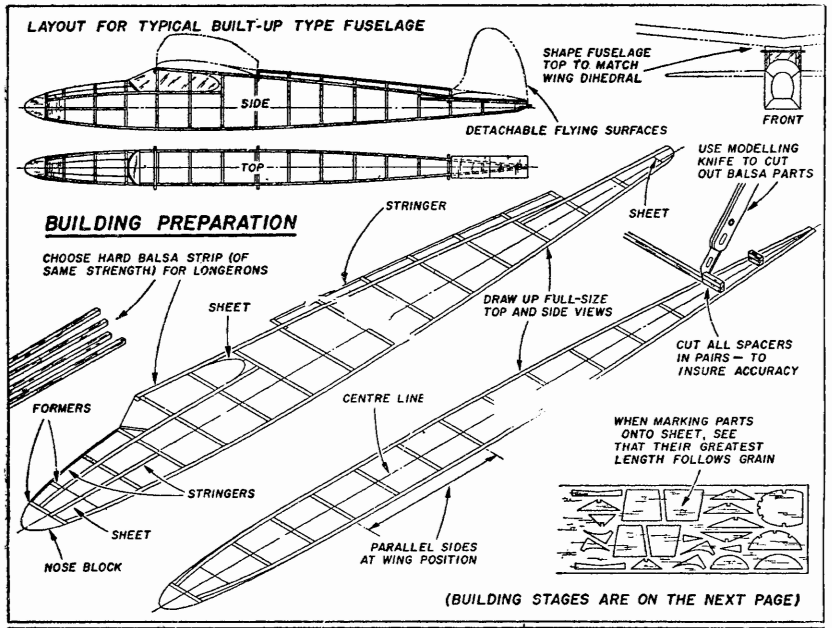
GIVE THE ENTIRE STRUCTURE A GENERAL SANDING TO REMOVE ROUGH EDGES, FINGERPRINTS AND EXCESS CEMENT.

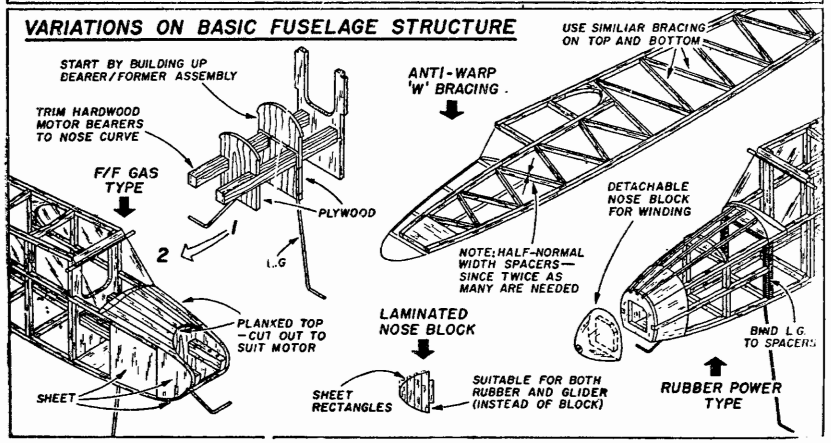
YOUR BASIC FUSELAGE STRUCTURE IS NOW COMPLETE, AND READY FOR THE SUPERFICIAL DETAILS, SUCH AS A CABIN, STRINGERS, NOSE PLANKING, GEAR ETC.

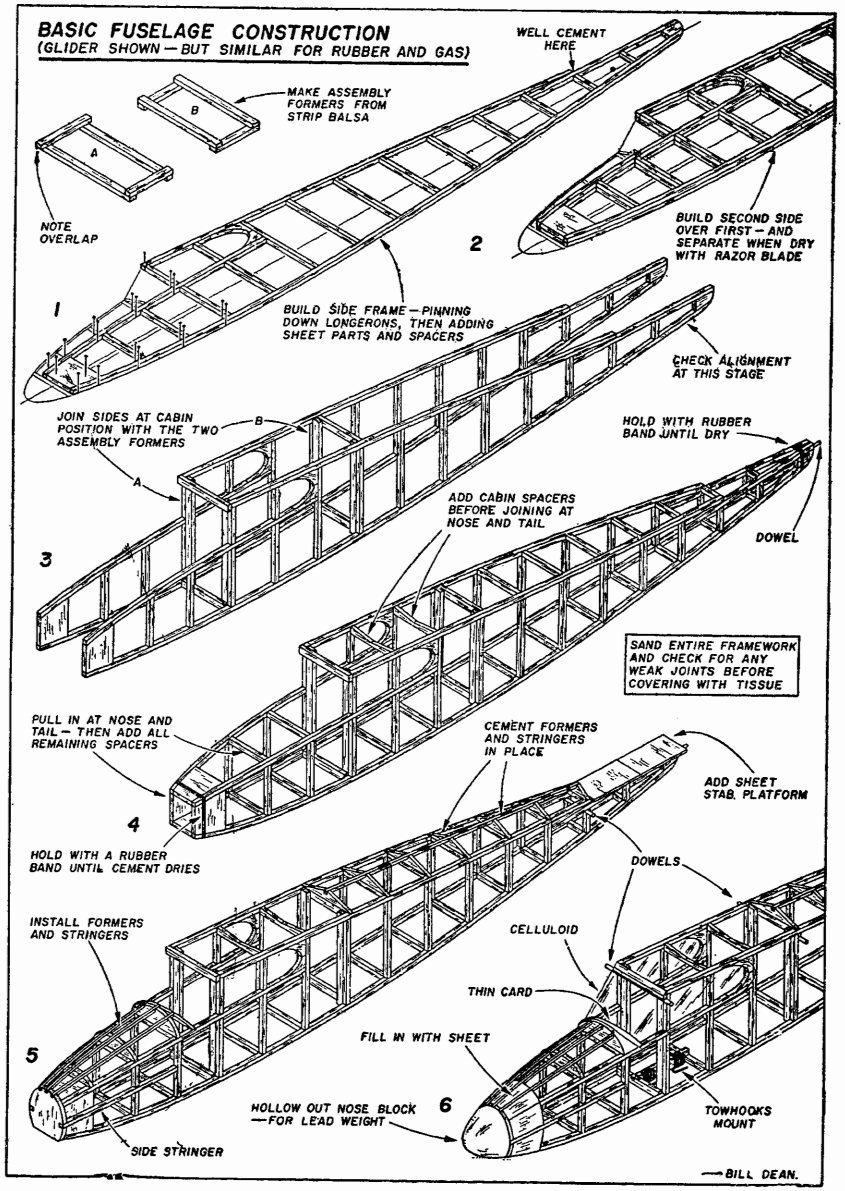
CONSTRUCTION PRINCIPLES OUTLINED HERE ARE APPLICABLE TO MOST MODELS USING THIS TYPE FUSELAGE CONSTRUCTION.

D.J.M

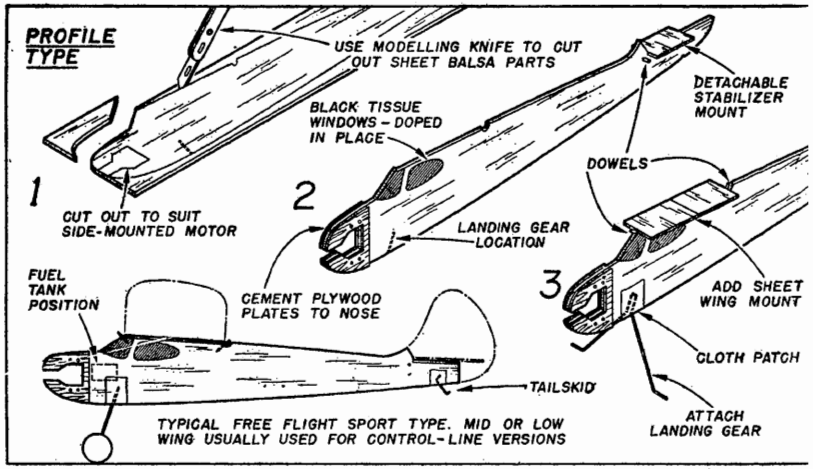
5. CABIN SLAB-SIDERS

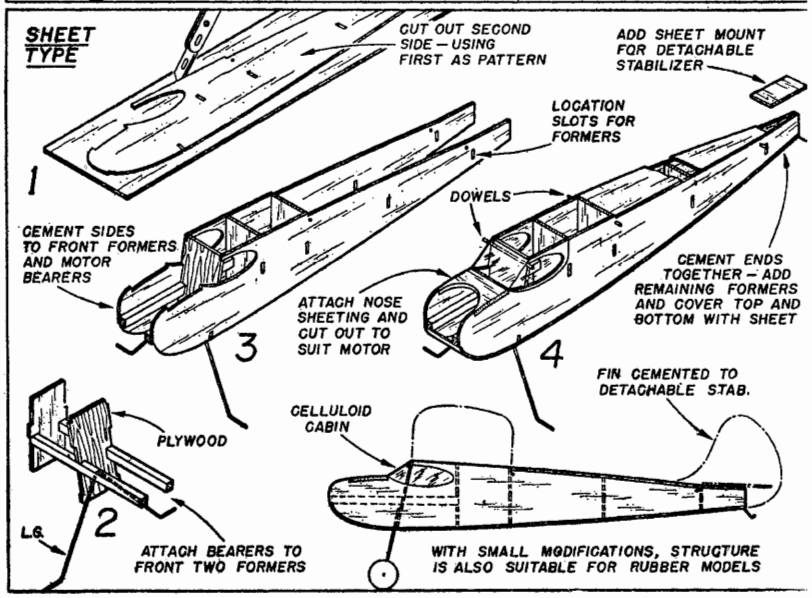


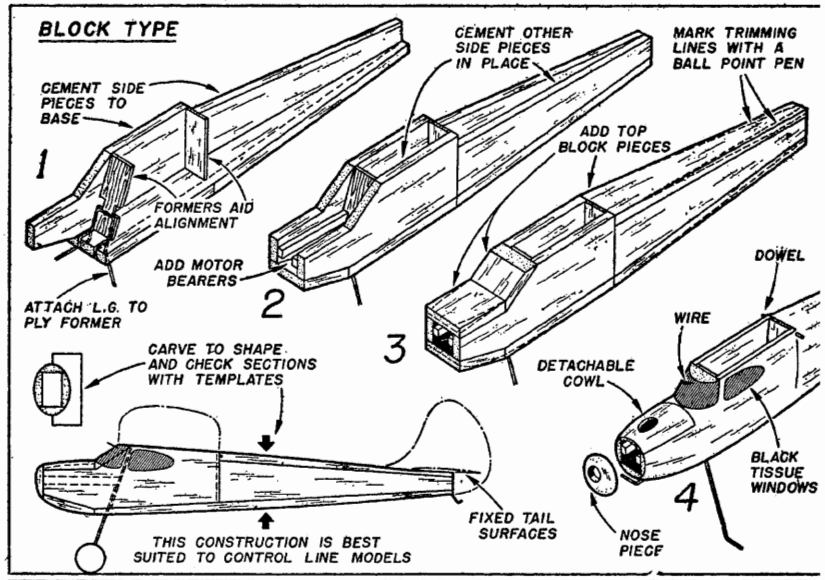


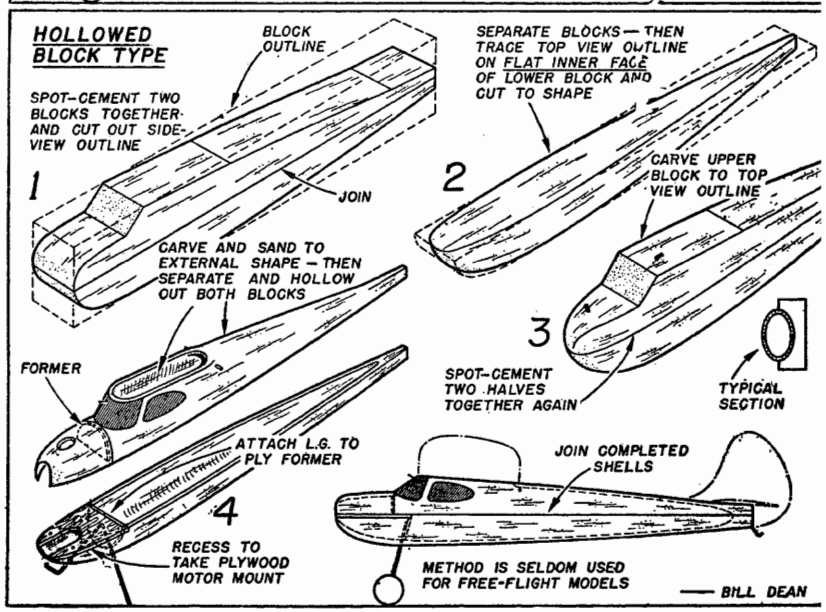


6. SHEET & BLOCK FUSELAGES





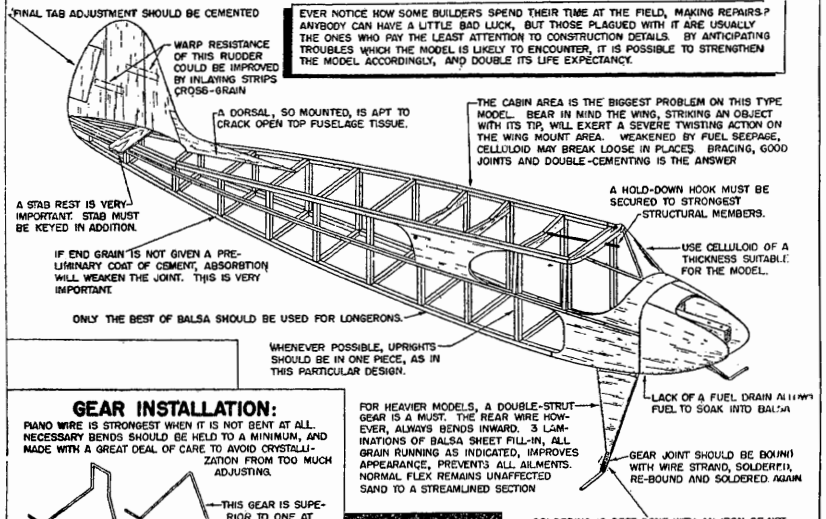




7. MAKING STRONGER FUSELAGES

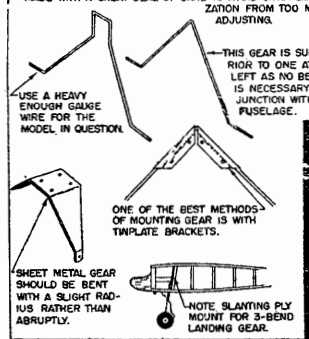
COMMON TROUBLE SPOTS IN CABIN TYPE FUSELAGES:

EVER NOTICE HOW SOME BUILDERS SPEND THEIR TIME AT THE FIELD, MAKING REPAIRS? ANYBODY CAN HAVE A LITTLE BAD LUCK, BUT THOSE PLAGUED WITH IT ARE USUALLY THE ONES WHO PAY THE LEAST ATTENTION TO CONSTRUCTION DETAILS. BY ANTICIPATING TROUBLES WHICH THE MODEL IS LIKELY TO ENCOUNTER, IT IS POSSIBLE TO STRENGTHEN THE MODEL ACCORDINGLY, AND DOUBLE ITS LIFE EXPECTANCY.



GEAR INSTALLATION:

PIANO WIRE IS STRONGEST WHEN IT IS NOT BENT AT ALL. NECESSARY BENDS SHOULD BE HELD TO A MINIMUM, AND MADE WITH A GREAT DEAL OF CARE TO AVOID CRYSTALLIZATION FROM TOO MUCH ADJUSTING.



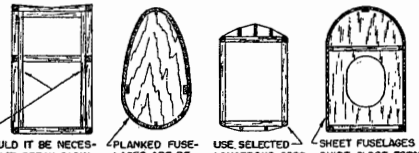
FOR HEAVIER MODELS, A DOUBLE-STRUT GEAR IS A MUST. THE REAR WIRE HOWEVER, ALWAYS BENDS INWARD. 3 LAMINATIONS OF BALSA SHEET FILL-IN, ALL GRAIN RUNNING AS INDICATED, IMPROVES APPEARANCE, PREVENTS ALL AILMENTS. NORMAL FLEX REMAINS UNAFFECTED SAND TO A STREAMLINED SECTION

GEAR JOINT SHOULD BE BOUND WITH WIRE STRAND, SOLDERED, RE-BOUND AND SOLDERED AGAIN

SOLDERING IS BEST DONE WITH AN IRON OF NOT LESS THAN 100 WATTS. ACID CORE SOLDER FOR PIANO WIRE, ROSIN FOR ELECTRICAL WORK

CROSS-SECTIONS:

THERE ARE MANY METHODS OF CONSTRUCTING A FUSELAGE, AND EACH IS BESET IN A DIFFERENT MANNER. THE STRUCTURES BELOW WILL GIVE LITTLE TROUBLE



SHOULD IT BE NECESSARY TO BREAK CABIN UPRIGHTS, STRENGTHEN AS SHOWN ABOVE.

PLANKED FUSELAGES ARE REALLY DURABLE

USE SELECTED LONGERONS, GOOD JOINTS THROUGHOUT.

SHEET FUSELAGES REQUIRE CLOSE FORMER SPACING. NOTE CROSS-BRACES, LONGERONS.

INTERNAL DAMAGE:

PAA-LOAD DUMMY, BATTERIES, RECEIVERS AND ALL HEAVY OBJECTS MUST BE BRACED TO WITHSTAND CRASHES WITHOUT TEARING LOOSE.

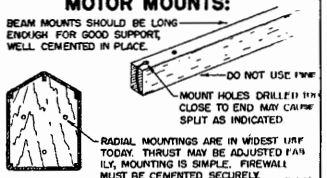


WEIGHTED PAA-LOAD DUMMY MAY BE DOWELED IN PLACE.

JUST A BAD STALL IN THE GLIDE IS ENOUGH TO SEND OBJECT CLEAR THROUGH 4 OR 5 SHEET FORMERS, AS SOON AS THE NOSE IS STRUCK BRACE & GUSSET!

MOTOR MOUNTS:

BEAM MOUNTS SHOULD BE LONG ENOUGH FOR GOOD SUPPORT, WELL CEMENTED IN PLACE.



RADIAL MOUNTINGS ARE IN WIDEST USE TODAY. THRUST MAY BE ADJUSTED EASILY, MOUNTING IS SIMPLE. FIREWALL MUST BE CEMENTED SECURELY.

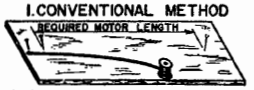
D.J.N

8. RUBBER MOTOR TECHNIQUE

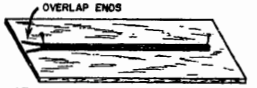
RUBBER MOTORS

METHODS OF PREPARATION

1. CONVENTIONAL METHOD



STEP ONE: MEASURE OUT REQUIRED MOTOR LENGTH AND FASTEN PINS AT EACH END POINT OF REQUIRED LENGTH.



STEP TWO: LAY OUT REQUIRED NUMBER OF STRANDS AROUND THE PIN MARKERS WITH AT LEAST TWO INCHES OVERLAP AT EACH END



STEP THREE: TAKE BOTH ENDS AND TIE A SQUARE KNOT TO COMPLETE MOTOR.

2. "ROPE" TENSIONER METHOD



STEP ONE: PREPARE MOTOR TWICE THE REQUIRED LENGTH USING THE CONVENTIONAL METHOD



STEP TWO: PREWIND MOTOR APPROXIMATELY 100 TURNS.



STEP THREE: HOLDING BOTH ENDS LET MOTOR ENTWINE.



STEP FOUR: BIND ENDS WITH RUBBER TO COMPLETE MOTOR.

TYPICAL MOTOR BEARINGS

FRONT BEARINGS



HOOK & BOBBIN | W-HOOK | ROUND HOOK | TRIANGULAR HOOK | DIAMOND HOOK

REAR BEARINGS



DOWEL & BOBBIN | ROUND HOOK & DOWEL | DIAMOND HOOK & DOWEL | TRIANGULAR HOOK & DOWEL | DOWEL

RUBBER LUBRICANTS

WARM WEATHER. MIX SIX PARTS OF GLYCERINE TO EVERY FOUR PARTS OF TINCTURE OF GREEN SOAP



COLD WEATHER: MIX FIVE PARTS OF GLYCERINE TO EVERY FIVE PARTS OF TINCTURE OF GREEN SOAP.



AVOID: LUBRICANTS SUCH AS CASTOR OIL SHOULD NOT BE USED BECAUSE THEY CONTAIN FATTY MOLECULES WHICH HASTEN RUBBER DETERIORATION



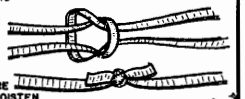
CARE AND STORAGE



WASH MOTOR THOROUGHLY AFTER A DAY'S FLYING OR IMMEDIATELY AFTER A FLIGHT IF IT SHOULD GET DIRTY.



WRAP RUBBER MOTORS LOOSELY IN SOFT CLOTH AND PLACE IN LARGE JAR OR METAL CONTAINER.



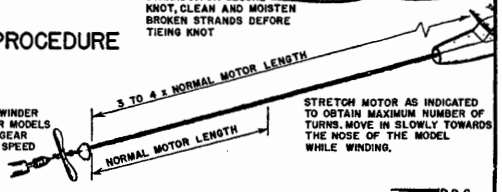
SQUARE KNOT BEST FOR TIEING BROKEN STRANDS. FOR SECURE KNOT, CLEAN AND MOISTEN BROKEN STRANDS BEFORE TIEING KNOT

WINDING EQUIPMENT AND PROCEDURE



USE HEAVY DUTY WINDERS FOR OUTDOOR MODELS FOR SAFETY FASTEN WINDING HOOK SECURELY IN PLACE

USE LIGHT WINDER FOR INDOOR MODELS WITH HIGH GEAR RATIOS TO SPEED UP WINDING.

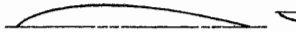


STRETCH MOTOR AS INDICATED TO OBTAIN MAXIMUM NUMBER OF TURNS. MOVE IN SLOWLY TOWARDS THE NOSE OF THE MODEL WHILE WINDING.

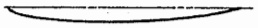
P.D.G

9. AIRFOIL PLOTTING

AIRFOIL TERMS-WHAT THEY MEAN:



UPPER CAMBER: THE UPPER CURVATURE OF THE AIRFOIL.



LOWER CAMBER: THE LOWER CURVATURE OF THE AIRFOIL.



UNDER CAMBER: THE REVERSE CURVATURE OF THE LOWER CAMBER.



DATUM LINE: A REFERENCE LINE ABOVE AND BELOW WHICH THE POINTS FOR THE AIRFOIL CURVE ARE PLOTTED.

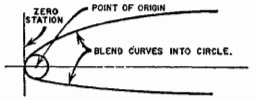


STATIONS: POSITIONS AT WHICH THE POINTS FOR THE AIRFOIL CURVE ARE TO BE PLOTTED. VALUES ARE ACTUALLY PERCENTAGES OF THE AIRFOIL LENGTH MEASURED FROM THE LEADING EDGE OF THE AIRFOIL.

N.A.C.A. 6412

STATION	0	1.25	2.50	5.0	7.50	10	15	20	25	30	40	50	60	70	80	90	95	100
UPPER CAMBER	0.00	2.73	3.80	5.36	6.57	7.58	9.18	10.34	11.14	11.65	11.80	11.18	9.95	8.23	6.03	3.33	1.79	0.12
LOWER CAMBER	0.00	-1.23	-1.64	-1.99	-2.05	-1.99	-1.67	-1.25	-0.78	-0.36	0.20	0.55	0.76	0.85	0.73	0.39	0.16	-0.12

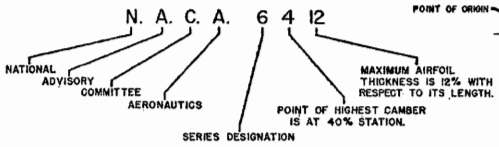
LEADING EDGE RADIUS: 1.58 SLOPE OF RADIUS: 6/20

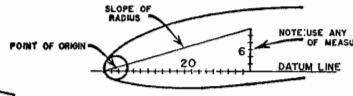


AIRFOIL ORDINATES: EACH AIRFOIL HAS A TABLE OF VALUES WHICH WHEN TRANSFERRED TO THE CORRESPONDING STATIONS ON THE LAYOUT, ABOVE AND BELOW THE DATUM LINE, WILL INDICATE THE POINTS FOR THE AIRFOIL CURVE. THE TOTAL AIRFOIL LENGTH IS CONSIDERED AS 100% WITH THE TABLE OF VALUES DIRECTLY RELATED. EXAMPLE: -1.23 • 1.23% LOCATED BELOW DATUM LINE AT THE SPECIFIED STATION.

LEADING EDGE RADIUS: GENERALLY THE DISTANCE ON THE DATUM LINE FROM THE POINT OF ORIGIN OF THE CIRCLE TO THE ZERO STATION (LEADING EDGE). ONLY EXCEPTION BEING WHEN A SLOPE OF RADIUS IS GIVEN. NOTE: NOT ALL AIRFOILS HAVE A LEADING EDGE RADIUS.

N.A.C.A. CODE BREAKDOWN

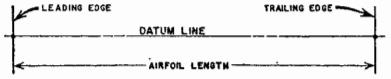




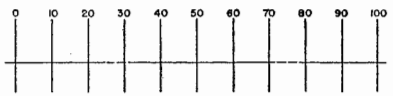
SLOPE OF RADIUS: WHEN A SLOPE IS GIVEN FOR THE LEADING EDGE RADIUS, IT IS TO INDICATE THAT ITS CENTER IS NOT LOCATED ON THE DATUM LINE BUT RATHER ON A DIAGONAL LINE REFERRED TO AS THE SLOPE OF THE RADIUS. A PROPORTION IS GIVEN AS IN THE N.A.C.A. 6412 FOR ITS CONSTRUCTION.

PLOTTING THE AIRFOIL

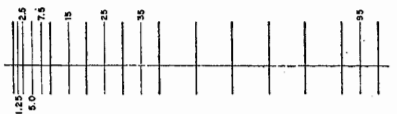
STEP ONE: SELECT AN AIRFOIL LENGTH, TRYING TO USE A SIZE WHICH CAN BE EASILY SUBDIVIDED INTO TEN MAIN STATIONS AND WHERE REQUIRED INTO SUBSTATIONS. EXAMPLE: A 6¼ AIRFOIL LENGTH WILL BREAK DOWN INTO TEN MAIN STATIONS ⅝ APART, ONE PERCENT EQUALLING 1/16.



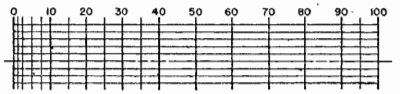
STEP TWO: LOCATE TEN MAIN STATION POINTS.



STEP THREE: LOCATE ALL OTHER STATION POINTS.

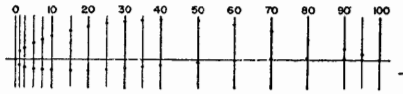


STEP FOUR: DRAW GRID LINES PARALLEL TO, ABOVE AND BELOW DATUM LINE AND SPACED APART 1% - 2% OF THE AIRFOIL LENGTH. NOTE: THIS STEP OPTIONAL, BUT ADVISABLE FOR MODELERS WITHOUT PREVIOUS PLOTTING EXPERIENCE.

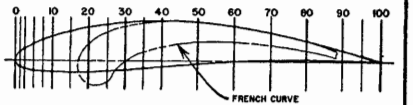


P.D.G.

STEP FIVE: USING TABLE OF ORDINATES LOCATE VALUES FOR UPPER AND LOWER CAMBER AT DESIGNATED STATIONS. NOTE: HORIZONTAL GRID LINES OMITTED FOR CLARITY.



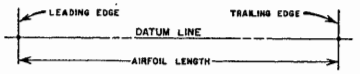
STEP SIX: USING FRENCH CURVES CONNECT THE PLOTTED POINTS TO OBTAIN THE AIRFOIL OUTLINE. SELECT CURVES THAT WILL CONNECT AT LEAST FOUR STATIONS AND BLEND SMOOTHLY WITH PRECEDING CURVE.



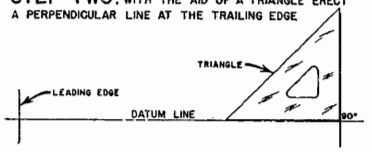
PLOTTING THE AIRFOIL

(SECONDARY METHOD FOR NON-DIVISIBLE LENGTHS)

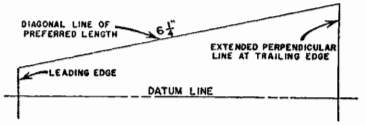
STEP ONE: SELECT DESIRED AIRFOIL LENGTH AND DRAW DATUM LINE



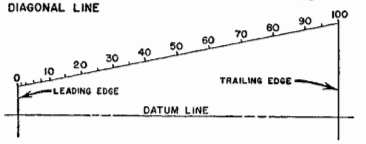
STEP TWO: WITH THE AID OF A TRIANGLE ERECT A PERPENDICULAR LINE AT THE TRAILING EDGE



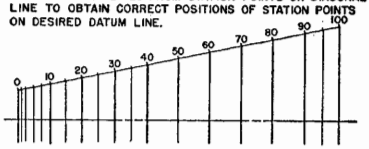
STEP THREE. DRAW LINE FROM POINT ABOVE DATUM LINE AT THE LEADING EDGE TO THE PERPENDICULAR LINE ERECTED AT THE TRAILING EDGE, USING A LENGTH WHICH CAN BE EVENLY SUB-DIVIDED.



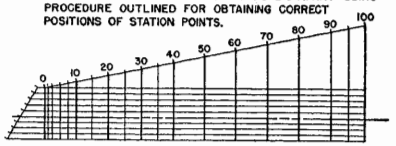
STEP FOUR: PLOT STATION POINTS ON THE DIAGONAL LINE



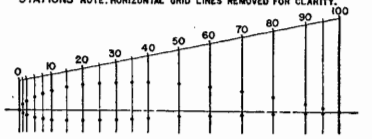
STEP FIVE: WITH THE AID OF A TRIANGLE DROP PERPENDICULAR LINES FROM STATION POINTS ON DIAGONAL LINE TO OBTAIN CORRECT POSITIONS OF STATION POINTS ON DESIRED DATUM LINE.



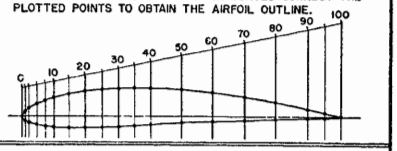
STEP SIX: SPACE GRID LINES 1%-2% APART USING PROCEDURE OUTLINED FOR OBTAINING CORRECT POSITIONS OF STATION POINTS.



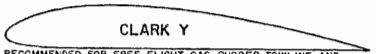
STEP SEVEN: USING TABLE OF ORDINATES LOCATE VALUES FOR UPPER AND LOWER CAMBER AT DESIGNATED STATIONS NOTE: HORIZONTAL GRID LINES REMOVED FOR CLARITY.



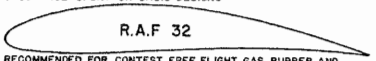
STEP EIGHT: USING FRENCH CURVES CONNECT THE PLOTTED POINTS TO OBTAIN THE AIRFOIL OUTLINE.



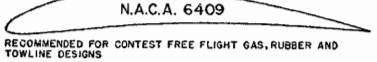
SIX POPULAR AIRFOILS



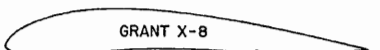
RECOMMENDED FOR FREE FLIGHT GAS, RUBBER, TOWLINE AND U-CONTROL SPORT OR BASIC DESIGNS



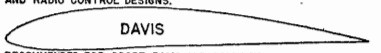
RECOMMENDED FOR CONTEST FREE FLIGHT GAS, RUBBER AND TOWLINE DESIGNS.



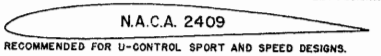
RECOMMENDED FOR CONTEST FREE FLIGHT GAS, RUBBER AND TOWLINE DESIGNS



RECOMMENDED FOR CONTEST FREE FLIGHT GAS, RUBBER, TOWLINE AND RADIO CONTROL DESIGNS.



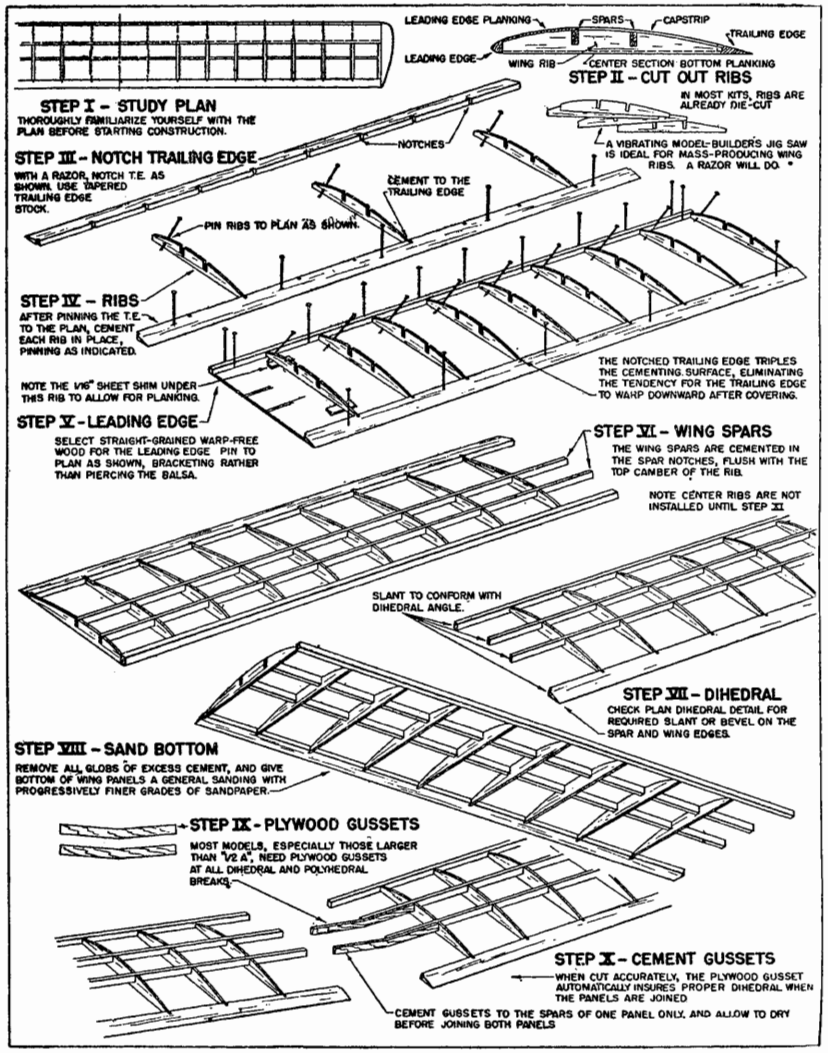
RECOMMENDED FOR SPORT, BASIC AND CONTEST FREE FLIGHT GAS, RUBBER, TOWLINE AND FOR U-CONTROL SPORT AND SPEED DESIGNS.

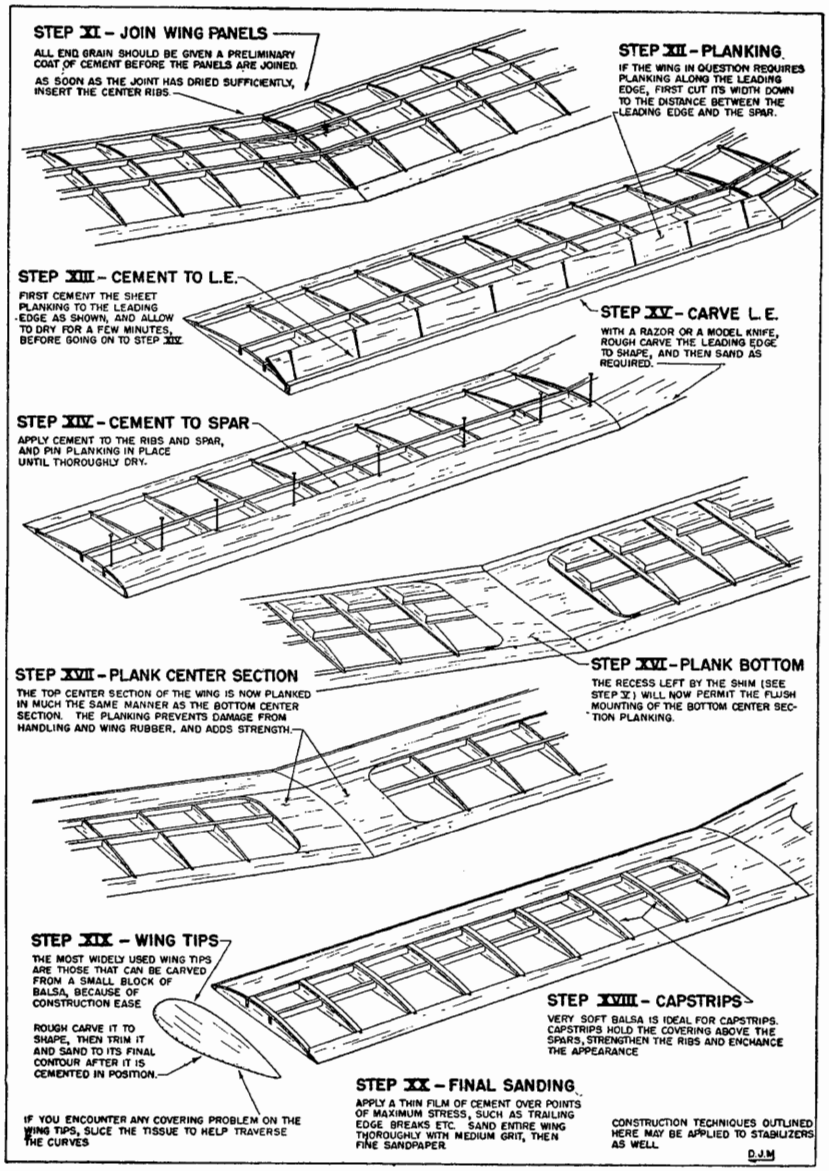


RECOMMENDED FOR U-CONTROL SPORT AND SPEED DESIGNS.

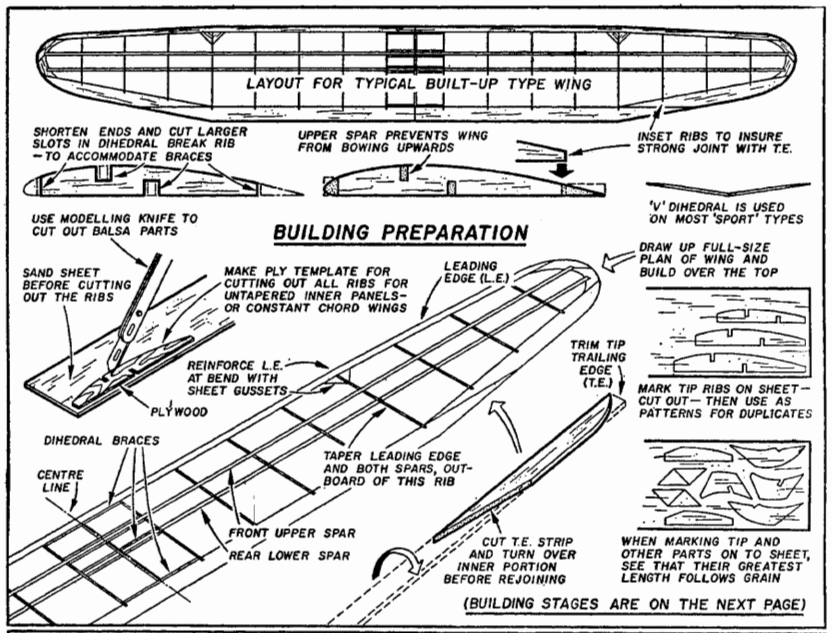
P.D.G.

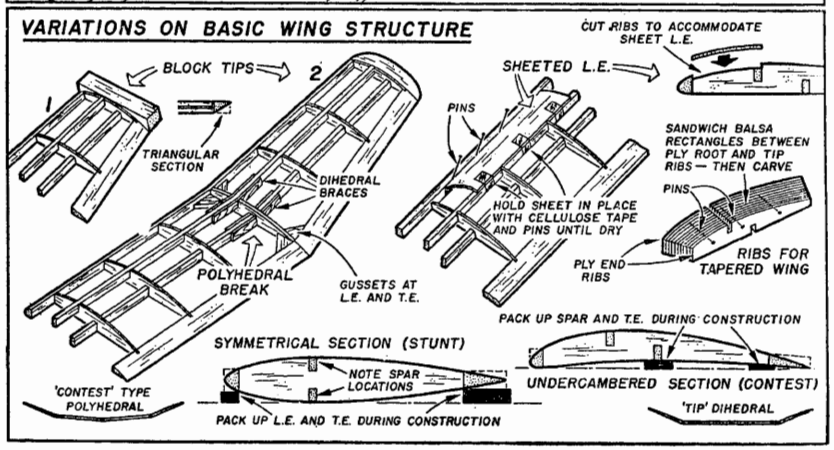
10. BASIC WING CONSTRUCTION

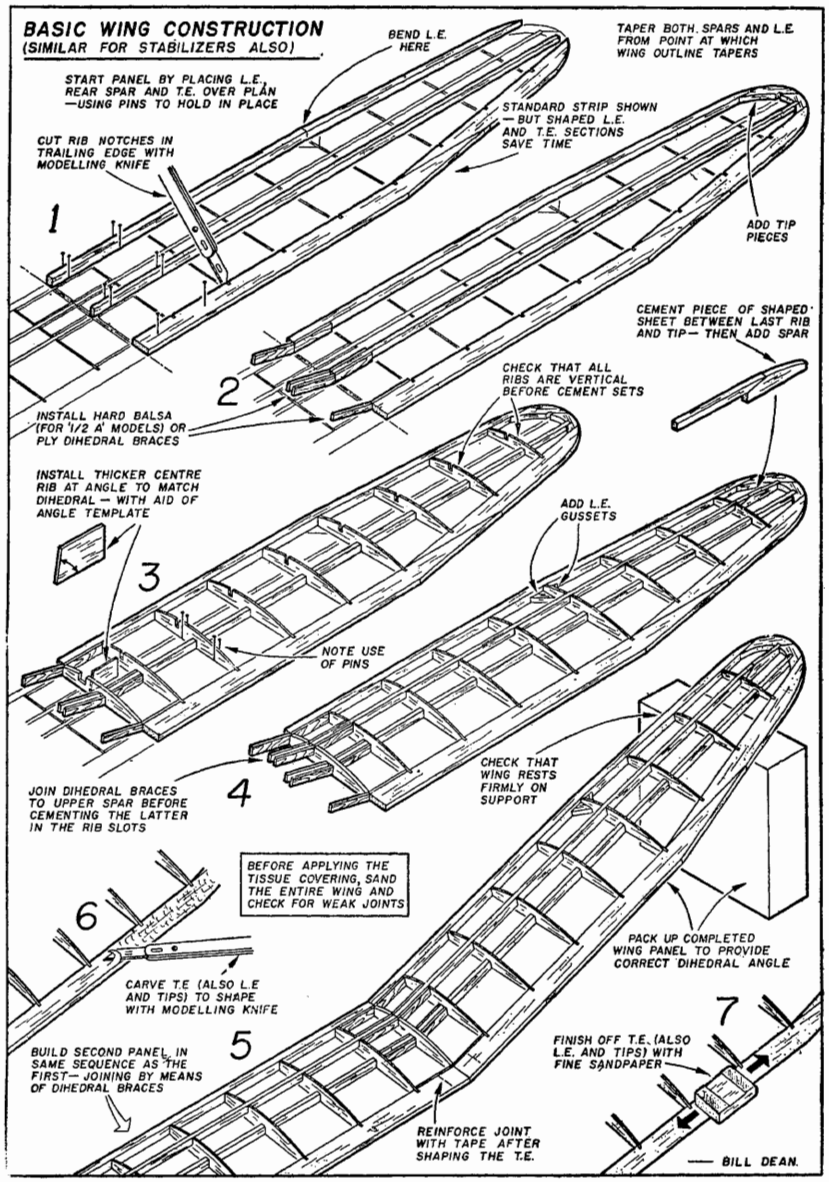




11. MORE COMPLEX WING BUILDING



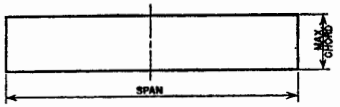




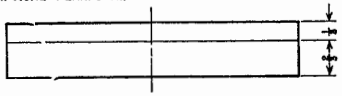
12. ELLIPTICAL WINGS

CONSTRUCTION OF AN ELLIPTICAL PLANFORM

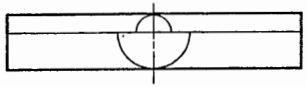
STEP ONE: CONSTRUCT RECTANGLE WHICH WILL ENCLOSE PROPOSED ELLIPTICAL PLANFORM. (MAXIMUM CHORD AND SPAN)



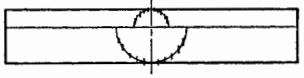
STEP TWO: DIVIDE RECTANGLE INTO TWO SECTIONS - ONE THIRD CHORD FOR LEADING EDGE SECTION AND TWO THIRDS CHORD FOR TRAILING EDGE SECTION. (THIS ARRANGEMENT WILL PRODUCE THE MOST POPULAR FORM OF ELLIPTICAL PLANFORM BEING USED. HOWEVER, THE SECTIONS CAN BE DIVIDED EQUALLY, REVERSED OR ALTERED IN ANY MANNER TO PRODUCE A GREAT MANY OTHER VARIATIONS OF THE ELLIPTICAL PLANFORM.)



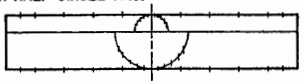
STEP THREE: DRAW TWO HALF CIRCLE ARCS FROM POINT OF INTERSECTION OF CENTERLINE, TANGENT (TOUCHING) TO THE LEADING AND TRAILING EDGES RESPECTIVELY.



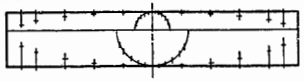
STEP FOUR: DIVIDE HALF CIRCLE ARCS INTO EQUAL UNITS, SUBDIVIDING LAST REMAINING UNIT. FOR SMALL PLANFORMS FOUR TO FIVE UNITS ARE SATISFACTORY, WHILE FOR LARGER PLANFORMS AS MUCH AS EIGHT TO TEN UNITS ARE RECOMMENDED FOR OBTAINING AN ACCURATE ELLIPTICAL PLANFORM.



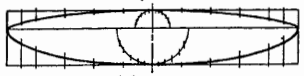
STEP FIVE: DIVIDE THE SPAN OF RECTANGLE INTO THE SAME NUMBER OF UNITS AS THAT OF EACH HALF CIRCLE ARC.



STEP SIX: CONNECT CORRESPONDING UNIT STATIONS BY PROJECTING THEM UNTIL THEY INTERSECT, PRODUCING POINTS ON THE ELLIPTICAL PLANFORM.

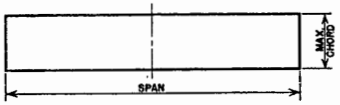


STEP SEVEN: USING FRENCH CURVES CONNECT PLOTTED POINTS TO OBTAIN ELLIPTICAL PLANFORM.

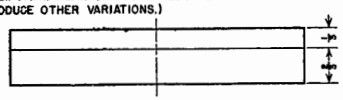


CONSTRUCTION OF A PARABOLIC PLANFORM

STEP ONE: CONSTRUCT RECTANGLE WHICH WILL ENCLOSE PROPOSED PARABOLIC PLANFORM. (MAXIMUM CHORD AND SPAN)



STEP TWO: DIVIDE RECTANGLE INTO TWO SECTIONS - ONE THIRD CHORD FOR LEADING EDGE SECTION AND TWO THIRDS CHORD FOR TRAILING EDGE SECTION. (MOST POPULAR ARRANGEMENT AS IN ELLIPTICAL PLANFORM - CAN ALSO BE ALTERED TO PRODUCE OTHER VARIATIONS.)



STEP THREE: DIVIDE SPAN OF RECTANGLE INTO EQUAL UNITS, SUBDIVIDING LAST REMAINING UNIT.



STEP FOUR: DIVIDE EACH SECTION OF THE CHORD INTO HALF THE NUMBER OF UNITS ON THE SPAN OF RECTANGLE.



STEP FIVE: CONNECT CORRESPONDING UNIT STATIONS BY PROJECTING DIAGONAL LINES.



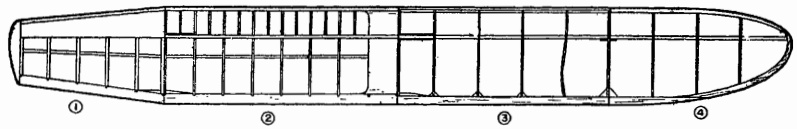
STEP SIX: USING FRENCH CURVES DRAW IN PARABOLIC PLANFORM BY FOLLOWING THE INSIDE PATTERN OBTAINED FROM DRAWING THE DIAGONAL LINES.



P.D.G.

WING STRUCTURAL PROBLEMS:

THE GENERAL TENDENCY TODAY IS TO CONSTRUCT A WING FROM AS FEW PIECES AS POSSIBLE. EXPERIENCED WAKEFIELD BUILDERS AND SUCH CUT CORNERS TO SAVE WEIGHT, BUT THEY STILL RETAIN THEIR DESIRED AIRFOIL, RIGIDITY, AND NECESSARY STRENGTH-WEIGHT RATIO. THE OTHER 98% PREFER A SCANTY STRUCTURE AS IT IS THE PATH OF LEAST RESISTANCE, AND THAT IS WHEN THE TROUBLE STARTS.

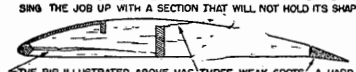


IF UPON GLANCING AT PANELS 1 AND 2, YOU FEEL THE STRUCTURE IS TOO MUCH BOTHER, THEN YOU ARE ONE OF THE 98%. PANELS 3 AND 4 ARE THE ONES THAT ARE THE REAL BOTHER, FOR THE WARP RESISTANCE, STRENGTH AND AERODYNAMIC QUALITIES WILL BE POOR EVEN THO THE INITIAL BUILDING TIME OF PANELS 1 OR 2 MAY BE A FEW MINUTES MORE. THEY WILL STAND UP AGAINST THE RIGORS OF ACTIVE FLYING. CONSTRUCTION DEFECTS AND ADVANTAGES OF EACH PANEL ARE ITEMIZED BELOW.

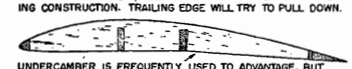
PANEL ①	PANEL ②	PANEL ③	PANEL ④
SHEETED LEADING EDGE MAINTAINS SMOOTH AIRFOIL. CAP STRIPS ON RIBS PREVENT BOWING AS VISIBLE IN PANEL 3. NOTE GUSSET AT TRAILING EDGE. EXCELLENT.	VERY GOOD SUBSTITUTE FOR CONSTRUCTION IN PANEL 1. EASIER TO REPAIR. TOP SPAR PREVENTS PANEL FROM ARCING UPWARD NOTCHED T.E. EXCELLENT.	POORLY SUPPORTED THIN RIBS MAY DEVELOP A BOW. DIAMOND-SHAPED L.E. MAY SPLIT RIBS. TISSUE WILL SAG BETWEEN RIBS. BOTTOM SPAR POOR. T.E. GUSSETS ARE GOOD.	REALLY CRUDE! TIP FAR TOO WEAK, IT'S ALMOST BOUND TO BREAK OR WARP. LAMINATED LEADING EDGE WOULD RELIEVE PRESSURE. SPAR GUSSET WILL PROBABLY FAIL.

AIRFOIL PROBLEMS:

THERE IS NO PERCENTAGE IN PLOTTING AN AIRFOIL AND THEN MESSING THE JOB UP WITH A SECTION THAT WILL NOT HOLD ITS SHAPE.



THE RIB ILLUSTRATED ABOVE HAS THREE WEAK SPOTS. A HARD BLOW MAY SPLIT RIB AT L.E. RIB MAY CRACK ABOVE SPAR DURING CONSTRUCTION. TRAILING EDGE WILL TRY TO PULL DOWN.



UNDERCAMBER IS FREQUENTLY USED TO ADVANTAGE, BUT BEWARE OF WARPS LIKE THIS. BLAME POOR SPAR-RIB FIT.



THE SERIOUS BUILDER PREFERS SECTIONS LIKE THIS, CAPABLE OF HOLDING A TRUE AIRFOIL. NOTE SHEET SPAR WEB BETWEEN RIBS.

TRAILING EDGE:

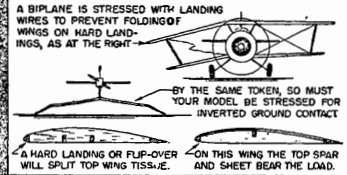
DUE TO THE RELATIVELY SMALL CEMENTING SURFACE OF THE RIB-TRAILING EDGE BUTT-JOINT, IT SHOULD BE STRENGTHENED AS ILLUSTRATED BELOW.



①- GOOD IDEA, BUT TOO DEEP A NOTCH WEAKENS T.E. ②- IS EXCELLENT. ③- TRIANGULAR GUSSETS ARE FINE, BUT MAR THE APPEARANCE. ④- SHEET TRAILING EDGE ALLOWS A DIFFERENT APPROACH. VERY GOOD.

LANDING IMPACT:

A BIPLANE IS STRESSED WITH LANDING WIRES TO PREVENT FOLDING OF WINGS ON HARD LANDINGS, AS AT THE RIGHT—



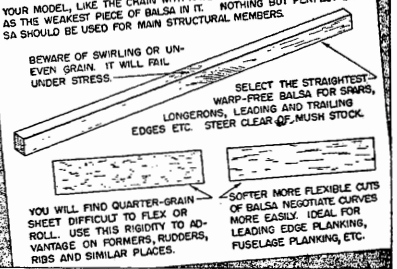
BY THE SAME TOKEN, SO MUST YOUR MODEL BE STRESSED FOR INVERTED GROUND CONTACT

A HARD LANDING OR FLIP-OVER WILL SPLIT TOP WING TISSUE.

ON THIS WING THE TOP SPAR AND SHEET BEAR THE LOAD.

CHOICE OF BALSA:

YOUR MODEL, LIKE THE CHAIN WITH A WEAK LINK, IS ONLY AS STRONG AS THE WEAKEST PIECE OF BALSA IN IT. NOTHING BUT PERFECT BALSA SHOULD BE USED FOR MAIN STRUCTURAL MEMBERS.



BEWARE OF SWIRLING OR UNEVEN GRAIN. IT WILL FAIL UNDER STRESS.

SELECT THE STRAIGHTEST-GRAIN, WARP-FREE BALSA FOR SPARS, LONGERONS, LEADING AND TRAILING EDGES ETC. STEER CLEAR OF MUSH STOCK.

YOU WILL FIND QUARTER-GRAIN SHEET DIFFICULT TO FLEX OR ROLL. USE THIS RIGIDITY TO ADVANTAGE ON FORMERS, RUDDERS, RIBS AND SIMILAR PLACES.

SOFTER MORE FLEXIBLE CUTS OF BALSA NEGOTIATE CURVES MORE EASILY. IDEAL FOR LEADING EDGE PLANKING, FUSELAGE PLANKING, ETC.

VIBRATION:

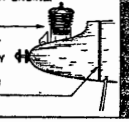
VIBRATION IS THE UNSEEN MODEL KILLER!



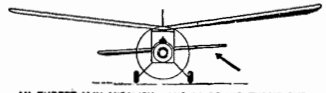
TO SQUELCH IT AT THE SOURCE, SAND PROP BLADES UNTIL PROPER BALANCE IS ACHIEVED. TRY TO AVOID ENGINE SPEEDS WHERE MODEL COVERING IS HEARD RESONANTING WITH ENGINE.

ENGINE MUST BE TIGHT ON MOUNTS.

FOAM RUBBER MAY BE USED IN MANY CASES TO ABSORB VIBRATION.



WARPS-ALIGNMENT:



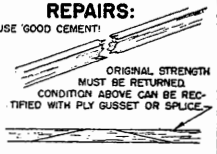
AN EXPERT MAY MISALIGN AND WARP HIS FLYING SURFACES PURPOSELY, BUT IF YOU DON'T UNDERSTAND THE CAUSE AND EFFECTS OF SUCH, YOU HAD BETTER AVOID SLOPPY RESULTS LIKE THE EXAMPLE ABOVE.

WING AND STAB MUST BE SHIMMED INTO ALIGNMENT IN SUCH CASES. STAB REST MUST BE FIRM. LOCK STAB WITH DOWEL PINS TO PREVENT SIDE MOVEMENT.

REMOVE WARPS WITH HOT WATER OR STEAM.

REPAIRS:

USE 'GOOD CEMENT'!



ORIGINAL STRENGTH MUST BE RETURNED. CONDITION ABOVE CAN BE RECTIFIED WITH PLY GUSSET OR SPLICE.

WHEN POSSIBLE, MAJOR REPAIRS ARE BEST MADE AT HOME. DOUBLE COAT ALL END GRAIN WITH SLOW DRYING MODEL CEMENT.

DO THE JOB RIGHT TO AVOID A REPETITION ON THE FIELD.

D.J.N

14. COVERING & DOPING WINGS

COVERING MATERIALS:

SELECT YOUR COVERING MATERIAL FOR THE JOB WHICH IT MUST DO. FOR THE AVERAGE GAS OR RUBBER MODEL, ANY OF THE STANDARD GRADES OF TISSUE WILL DO NICELY. WHEN ADDED DURABILITY IS DESIRED, USE SILK OR NYLON.

SILKSPAN: WHITE ONLY – APPLY WET OR DRY – CAN BE APPLIED WET OVER COMPOUND CURVES

MODELSPAN: ALL COLOURS – APPLY DRY – AVAILABLE IN TWO WEIGHTS

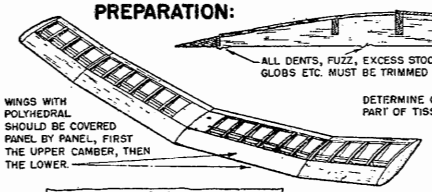
JAP TISSUE: SCARCE AS HEN'S TEETH. LIGHT – REQUIRES LESS DOPE – MUST BE APPLIED DRY

CHINA SILK: DIE TO DESIRED COLOR – VERY DURABLE – EXCELLENT FOR ALL COMPOUND CURVES

NYLON: DIE TO DESIRED COLOR – VERY DURABLE, BUT MUST BE PULLED VERY TIGHT WHEN WET

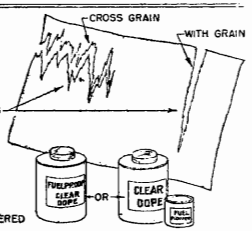
MICROFILM: REFLECTS SPECTRUM, TRANSPARENT. FANTASTICALLY LIGHT – INDOOR MODELS ONLY

PREPARATION:

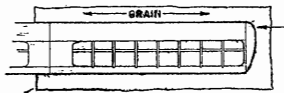


ALL DENTS, FUZZ, EXCESS STOCK, CEMENT GLOBS ETC. MUST BE TRIMMED OR SANDED OFF.

WINGS WITH POLYHEDRAL SHOULD BE COVERED PANEL BY PANEL, FIRST THE UPPER CAMBER, THEN THE LOWER.



DETERMINE GRAIN BY TEARING PART OF TISSUE. IMPORTANT!



A WING WITH PLAIN DIHEDRAL MAY BE COVERED MORE EASILY. NEVER WRAP COVERING AROUND WING IN ONE PIECE.

YOUR GRAIN IN TISSUE MUST RUN SPANWAYS. EXCEPTION IS DOUBLE COVERING TOP LAYER.



GRAIN RUNNING CHORDWAYS CAUSES SAG BETWEEN RIBS.



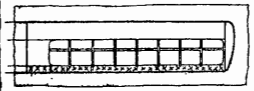


MATERIALS:

FOR GLOW-PLUG POWERED MODELS, EITHER FUELPROOF CLEAR DOPE OR REGULAR DOPE AND HOT-FUEL PROOFER IS NEEDED, – ALSO, PINS, RAZORS, BRUSHES AND COVERING

FOR COVERING DRY AND FOR CEMENTING EDGES, THICKEN DOPE WITH A LIBERAL DOSE OF CEMENT. APPLY WITH PAINT BRUSH.

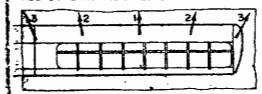
COVERING DRY:



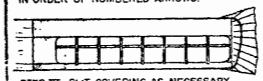
STEP I – CUT A LARGE ENOUGH PIECE OF COVERING MATERIAL FOR CONVENIENCE.



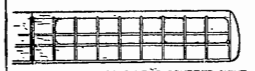
STEP II – APPLY THICKENED DOPE TO T.E., THEN PRESS TISSUE IN PLACE. WHEN DRY ADD DOPE AS INDICATED BY "X" MARKS



STEP III – PULL TAUT AS INDICATED AND IN ORDER OF NUMBERED ARROWS.



STEP IV – SLIT COVERING AS NECESSARY TO NEGOTIATE WING TIP. DOPE EDGES.



STEP V – REVERSE SIDE IS COVERED NEXT. WATER WING PRIOR TO CLEAR DOPING.

DO'S AND DON'TS:

WHEN COVERING A FLAT BOTTOM WING, IT IS NOT ADVISABLE TO DOPE COVERING TO EACH RIB AND SPAR, AS THIS MIGHT CAUSE UNEVEN SHRINKAGE.

IF THE BOTTOM OF YOUR WING IS UNDERCAMBERED, APPLY A COAT OF THINNED-DOWN CEMENT TO EACH RIB AND SPAR TO PREVENT THE COVERING FROM BRIDGING THE CONCAVE SURFACE.

DO NOT USE SILK ON WEAK OR LIGHTWEIGHT STRUCTURES. HEAVILY DOPED SILK HAS BEEN KNOWN TO CRUSH AND WARP FRAMEWORK.

RELY ON COLORED TISSUE OR DYES FOR COLOR ON FREE-FLIGHT MODELS, RATHER THAN EXCESSIVE QUANTITIES OF HEAVY PIGMENTED DOPES.

WHEN USING FUEL PROOF DOPE AND ALLIED PRODUCTS, DO NOT MIX BRANDS. SANDING SEALERS DESIGNED FOR USE WITH THE SAME COMPANYS CLEAR DOPE, MAY CAUSE TROUBLE WHEN APPLIED UNDER A COMPETITIVE BRAND.

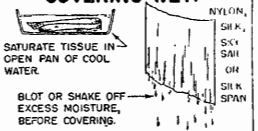
IF YOUR MODEL IS INTENDED FOR USE AS A SEAPLANE, IT IS ADVISABLE TO SPRAY THE ENTIRE FRAMEWORK WITH TWO COATS OF CLEAR DOPE. THIS WILL RETARD ABSORBTION OF MOISTURE. JAP TISSUE IS PREFERRED FOR COVERING, AS IT HAS FAR LESS PORES AND IS THEREFORE EASIER TO WATERPROOF.

DOUBLE-COVER YOUR MODEL IF YOU SEE FIT. A FEW COATS OF CLEAR DOPE SHOULD BE APPLIED TO THE FIRST LAYER. DOPE SECOND LAYER ON TO AVOID AIR BUBBLES. CROSS-GRAIN TISSUE TO LOCALIZE PUNCTURES.

DO NOT DOPE YOUR MODEL IF POSSIBLE, ON WARM HUMID DAYS. THE DOPE WILL TEND TO TURN MILKY-WHITE. (BLUSHING). RETARDER WILL PREVENT AS WELL AS REMOVE IT. THINNER MAY HELP. TRY TO DOPE IN A COOL DRY ROOM.

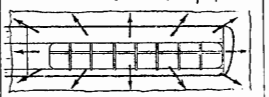
WHEN COVERING WITH WET TISSUE, THE DOPE APPLIED TO HOLD THE TISSUE WILL BLUSH. IF WEATHER IS DRY, IT WILL DISAPPEAR WHEN DOPED.

COVERING WET:

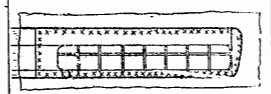


SATURATE TISSUE IN OPEN PAN OF COOL WATER.

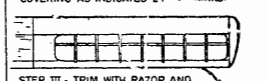
BLOT OR SHAKE OFF EXCESS MOISTURE, BEFORE COVERING.



PULL TAUT AND FREE OF WRINKLES AS SHOWN BY ARROWS. KEEP DAMPENING.



STEP II – APPLY THIN DOPE ON TOP OF WET COVERING AS INDICATED BY "X" MARKS.



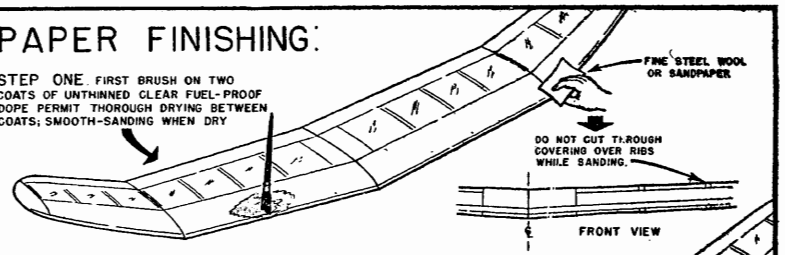
STEP III – TRIM WITH RAZOR AND DOPE DOWN EDGES. (THICK DOPE)



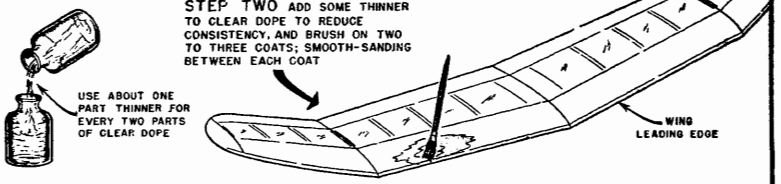
STEP IV – COVER REVERSE SIDE IMMEDIATELY

C.J.M

PAPER FINISHING:

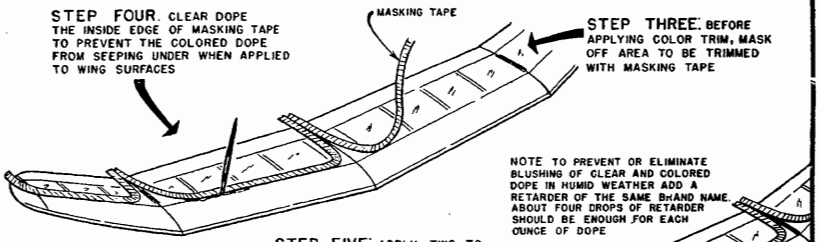


STEP ONE. FIRST BRUSH ON TWO COATS OF UNTHINNED CLEAR FUEL-PROOF DOPE PERMIT THOROUGH DRYING BETWEEN COATS; SMOOTH-SANDING WHEN DRY



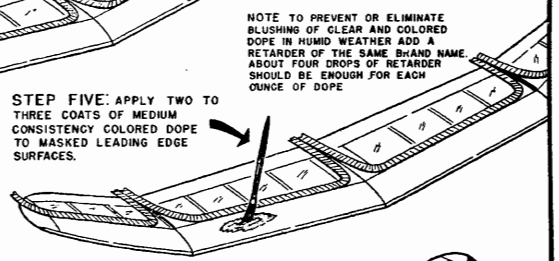
STEP TWO ADD SOME THINNER TO CLEAR DOPE TO REDUCE CONSISTENCY, AND BRUSH ON TWO TO THREE COATS; SMOOTH-SANDING BETWEEN EACH COAT

USE ABOUT ONE PART THINNER FOR EVERY TWO PARTS OF CLEAR DOPE



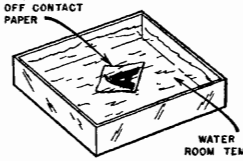
STEP FOUR. CLEAR DOPE THE INSIDE EDGE OF MASKING TAPE TO PREVENT THE COLORED DOPE FROM SEEPING UNDER WHEN APPLIED TO WING SURFACES

STEP THREE. BEFORE APPLYING COLOR TRIM, MASK OFF AREA TO BE TRIMMED WITH MASKING TAPE



NOTE TO PREVENT OR ELIMINATE BLUSHING OF CLEAR AND COLORED DOPE IN HUMID WEATHER ADD A RETARDER OF THE SAME BRAND NAME. ABOUT FOUR DROPS OF RETARDER SHOULD BE ENOUGH FOR EACH OUNCE OF DOPE

STEP FIVE. APPLY TWO TO THREE COATS OF MEDIUM CONSISTENCY COLORED DOPE TO MASKED LEADING EDGE SURFACES.

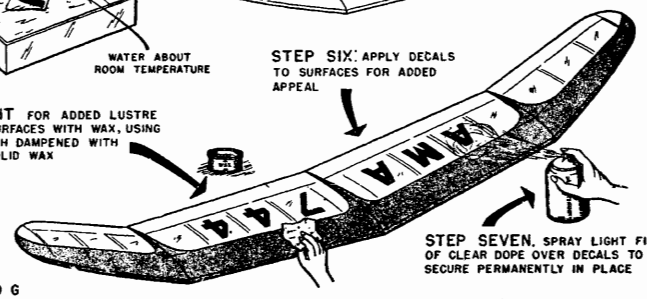


PERMIT DECAL TO SOAK ONLY UNTIL IT CAN BE SLID OFF CONTACT PAPER

WATER ABOUT ROOM TEMPERATURE

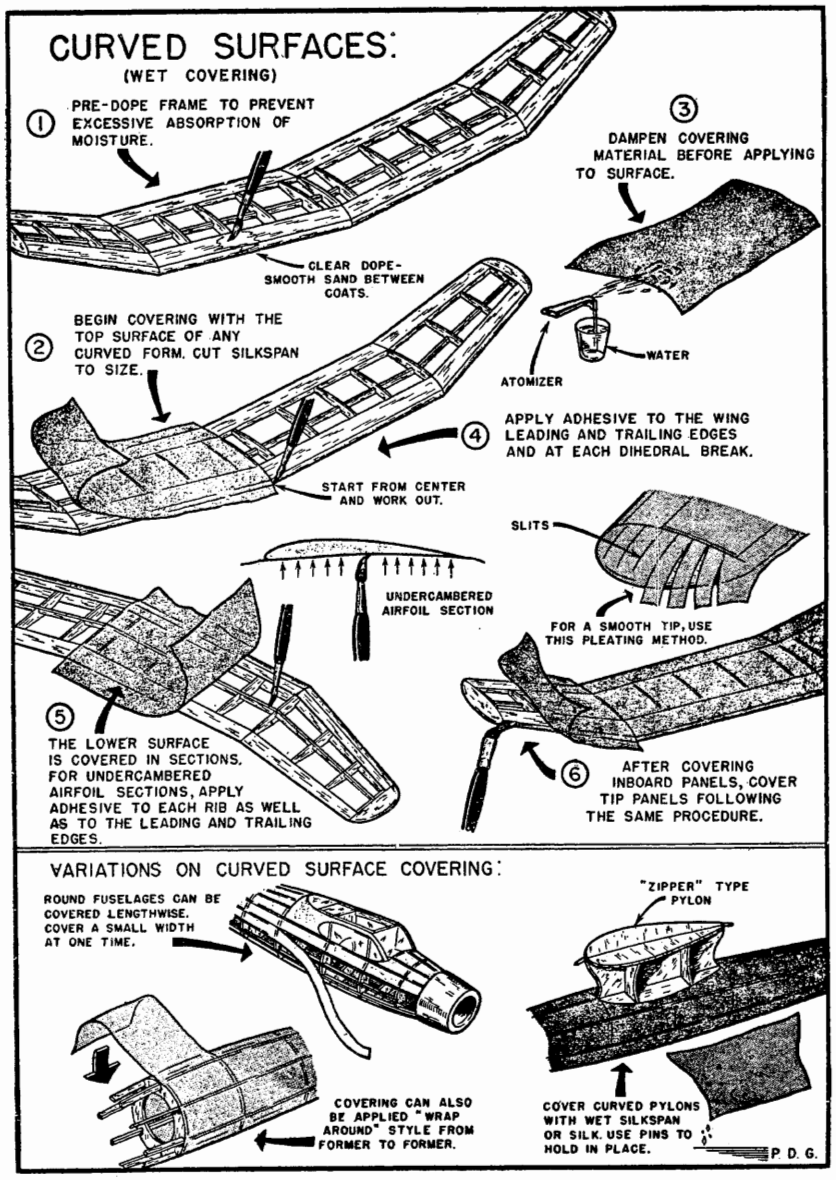
STEP SIX. APPLY DECALS TO SURFACES FOR ADDED APPEAL

STEP EIGHT FOR ADDED LUSTRE RUB DOWN SURFACES WITH WAX, USING A SOFT CLOTH DAMPENED WITH LIQUID OR SOLID WAX

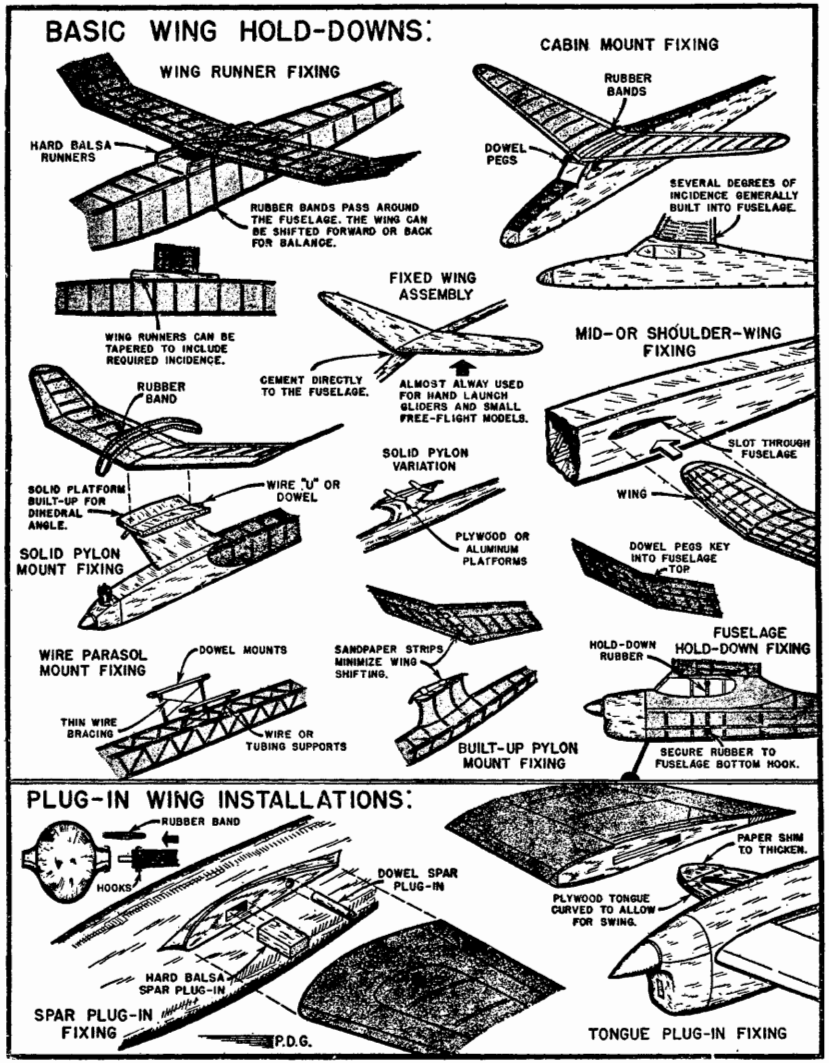


STEP SEVEN. SPRAY LIGHT FILM OF CLEAR DOPE OVER DECALS TO SECURE PERMANENTLY IN PLACE

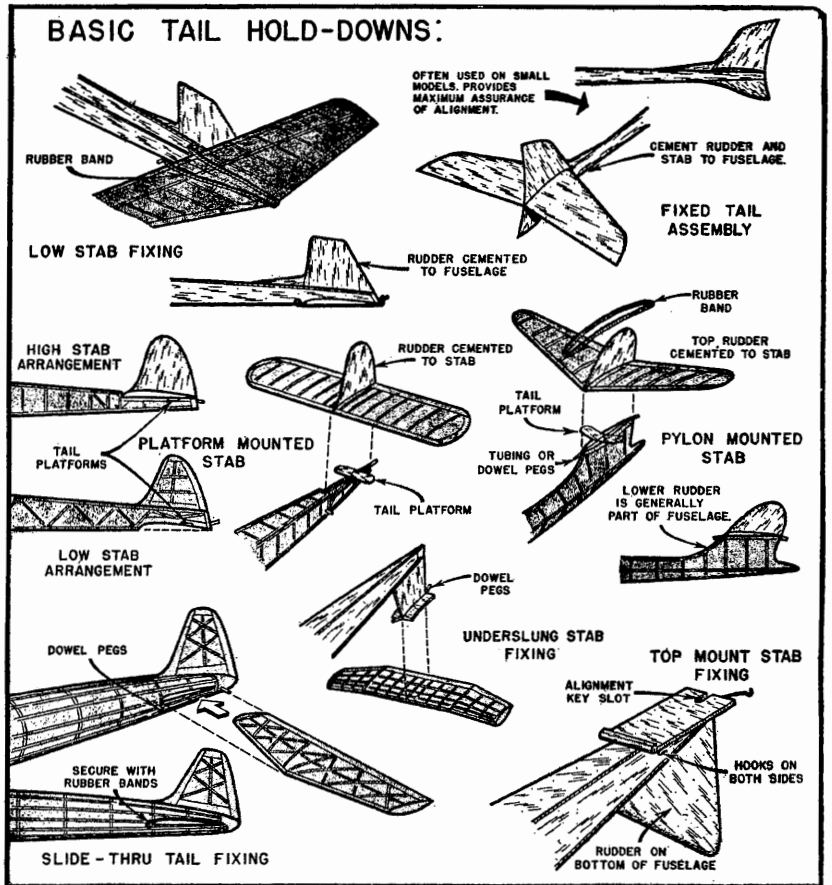
P D G



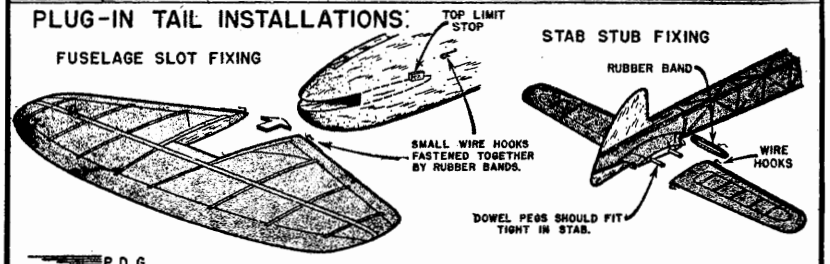
15. WING ATTACHMENT METHODS



BASIC TAIL HOLD-DOWNS:



PLUG-IN TAIL INSTALLATIONS:



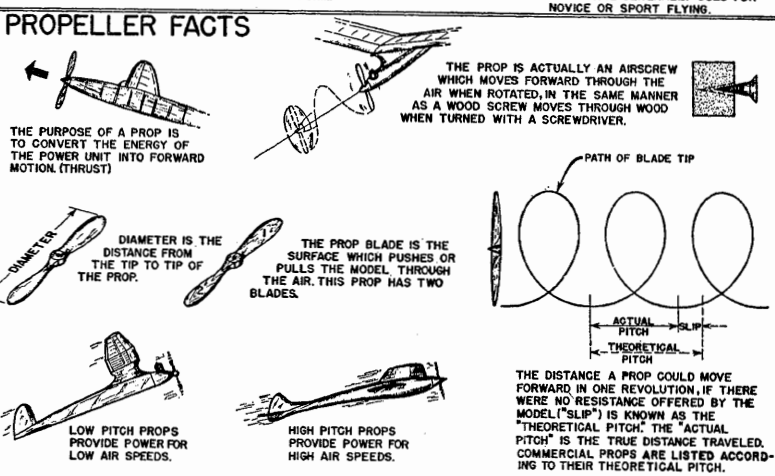
P. D. G

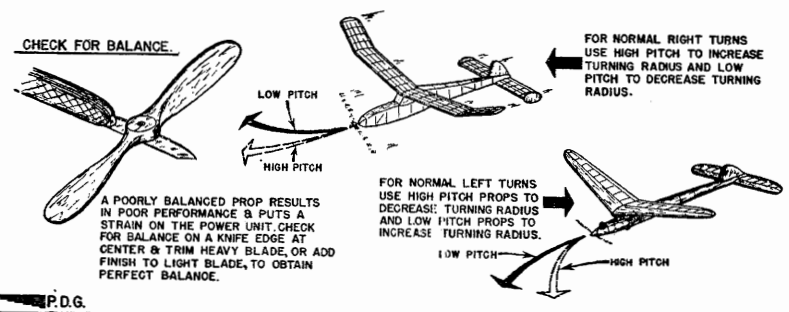
16. PROPELLERS FOR ALL PURPOSES

PROPELLER CLASSIFICATIONS



PROPELLER FACTS

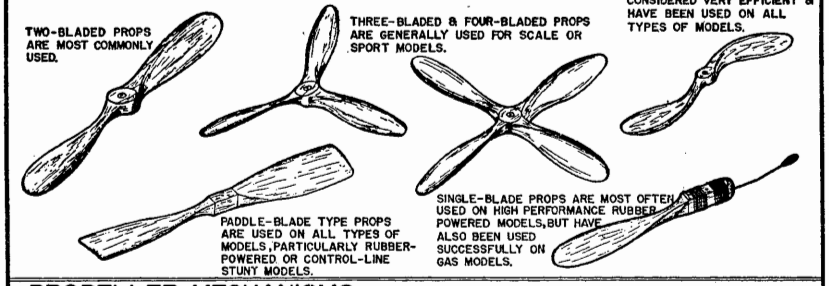




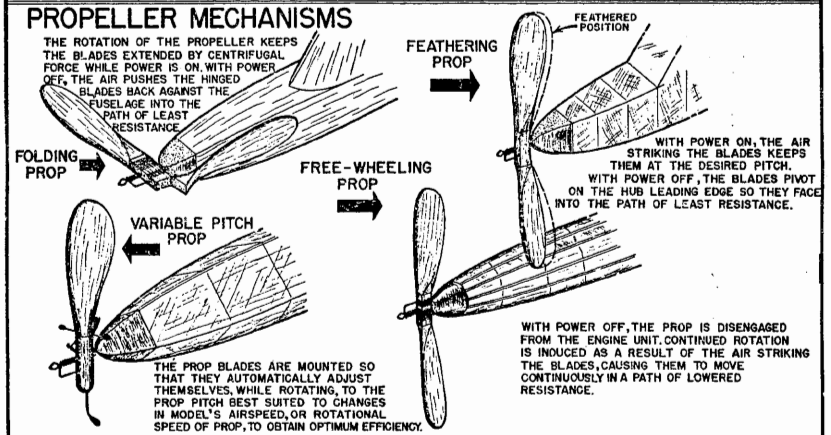
P.D.G.

17. ENGINE MOUNTINGS

POPULAR PROPELLER TYPES



PROPELLER MECHANISMS



PROPELLER SELECTION (RECOMMENDED PROP SIZES, IN INCHES, FOR VARIOUS MODELS)

FREE-FLIGHT GAS						CONTROL-LINE					
LOW PITCH		MED. PITCH		HIGH PITCH		LOW PITCH		MED. PITCH		HIGH PITCH	
DIA.	PITCH	DIA.	PITCH	DIA.	PITCH	DIA.	PITCH	DIA.	PITCH	DIA.	PITCH
5	2	5	3	5	4	4	2	4	3	4	4
6	2	6	3	6	4	5	2	5	3	5	5
7	3	7	4	7	5	6	3	6	4	6	6
8	3	8	4	8	5	7	3	7	5	7	7
9	3	9	4	9	6	8	4	8	6	8	8
10	3	10	5	10	6	9	4	9	7	9	9
11	4	11	5	11	7	10	5	10	7	10	10
12	4	12	6	12	8	11	5	11	8	11	11
13	4	13	6	13	9	12	6	12	9	12	12
14	5	14	7	14	10	13	7	13	10	13	13

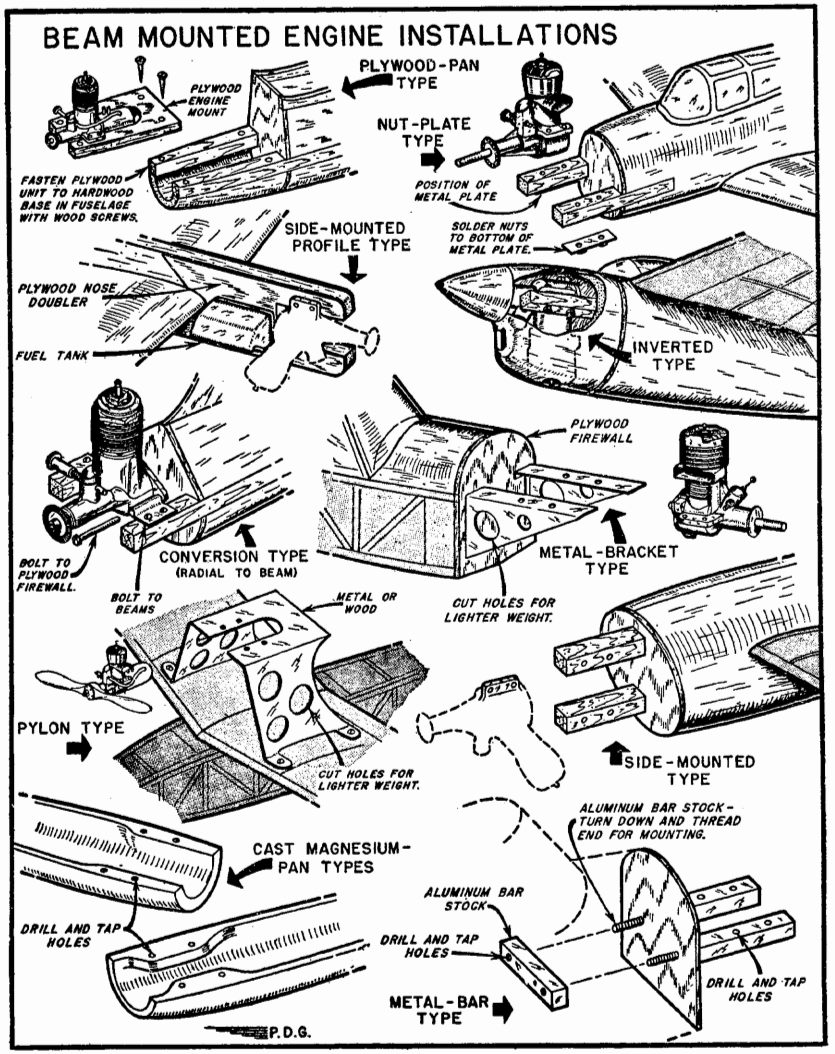
LIMITED RUBBER						WAKEFIELD					
LOW PITCH		MED. PITCH		HIGH PITCH		LOW PITCH		MED. PITCH		HIGH PITCH	
DIA.	PITCH	DIA.	PITCH	DIA.	PITCH	DIA.	PITCH	DIA.	PITCH	DIA.	PITCH
7	6	7	9	7	13	13	13	13	19	13	25
8	7	8	10	8	14	14	14	14	20	14	28
9	7	9	11	9	15	15	15	15	21	15	30
10	8	10	12	10	17	16	16	16	22	16	32
11	8	11	13	11	19	17	17	17	23	17	34
12	9	12	14	12	21	18	18	18	25	18	36
13	10	13	15	13	23	19	19	19	27	19	38
14	11	14	17	14	25	20	20	20	29	20	40
15	12	15	19	15	27	21	21	21	31	21	42
16	13	16	21	16	29	22	22	22	33	22	44

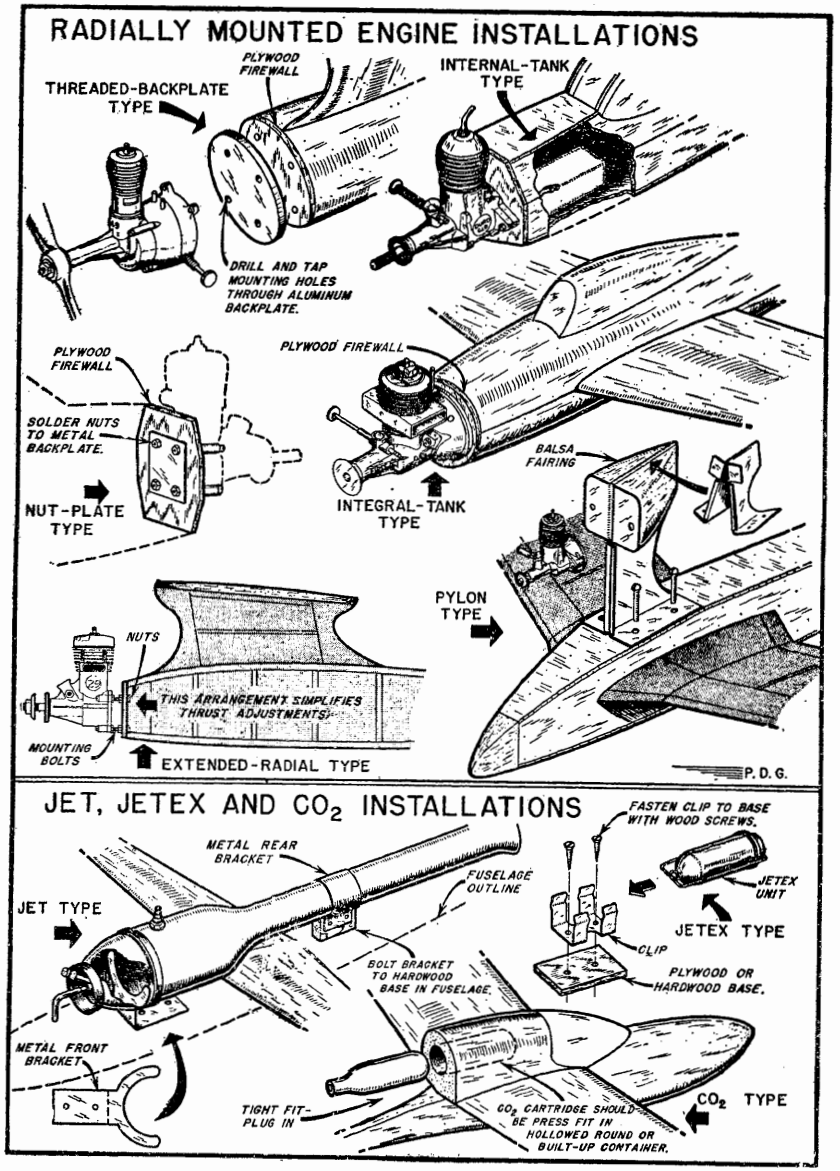
INDOOR STICK						INDOOR CABIN					
LOW PITCH		MED. PITCH		HIGH PITCH		LOW PITCH		MED. PITCH		HIGH PITCH	
DIA.	PITCH	DIA.	PITCH	DIA.	PITCH	DIA.	PITCH	DIA.	PITCH	DIA.	PITCH
11	11	11	16	11	22	9	7	9	12	9	17
12	12	12	18	12	24	10	8	10	13	10	18
13	13	13	19	13	26	11	8	11	14	11	19
14	14	14	21	14	28	12	9	12	15	12	20
15	15	15	22	15	30	13	10	13	16	13	22
16	16	16	24	16	32	14	11	14	18	14	24
17	17	17	25	17	34	15	12	15	19	15	26
18	18	18	27	18	36	16	13	16	20	16	28
19	19	19	28	19	38	17	14	17	22	17	30
20	20	20	30	20	40	18	15	18	23	18	32

P.D.G.

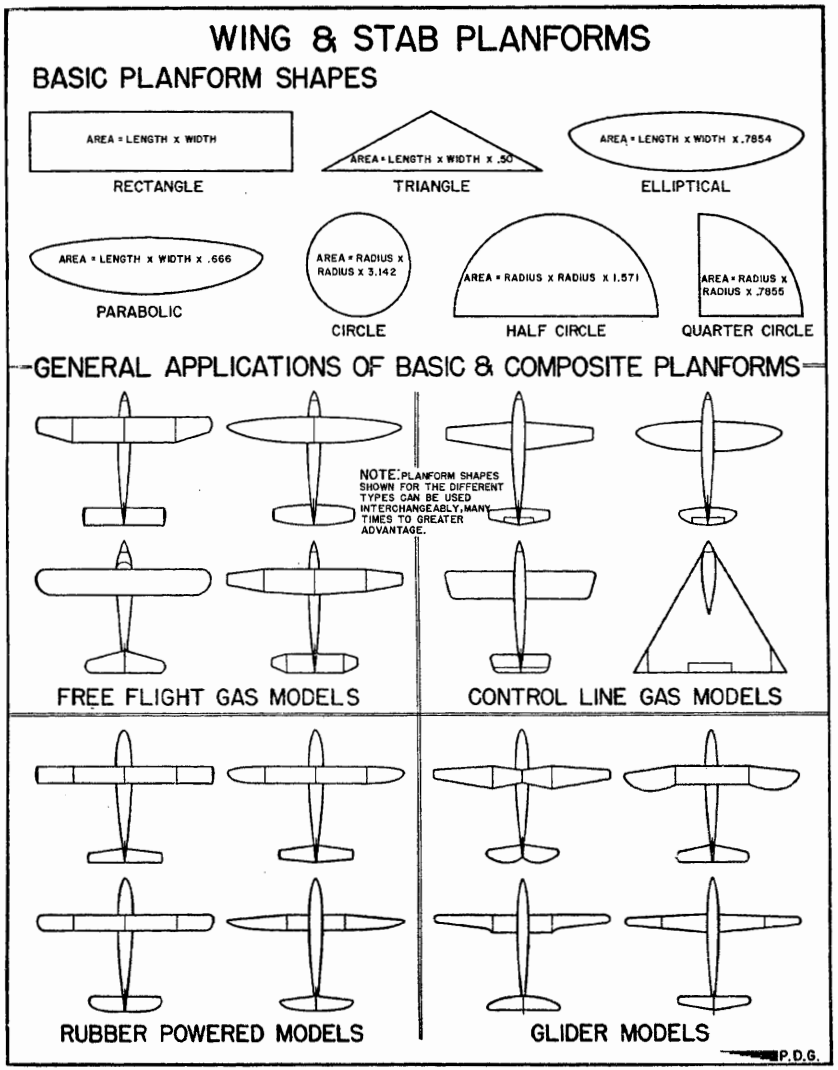
THE PITCH SHOWN IN THESE TABLES IS THE THEORETICAL PITCH!

BEAM MOUNTED ENGINE INSTALLATIONS



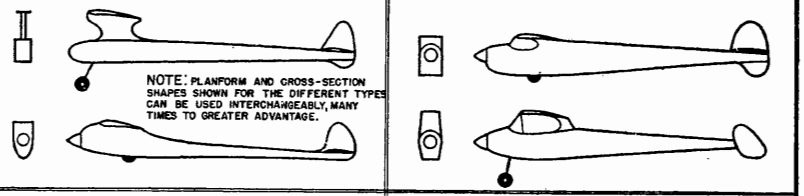


18. PLANFORMS IN GENERAL



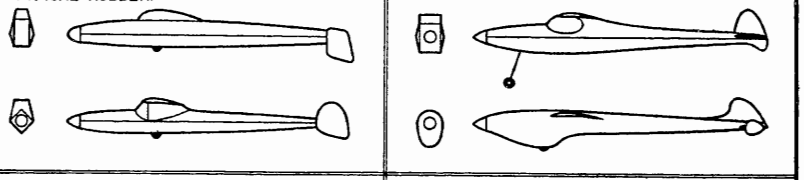
FREE-FLIGHT

TYPICAL GAS:



NOTE: PLANFORM AND CROSS-SECTION SHAPES SHOWN FOR THE DIFFERENT TYPES CAN BE USED INTERCHANGEABLY, MANY TIMES TO GREATER ADVANTAGE.

TYPICAL RUBBER:

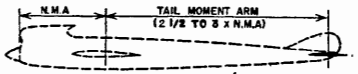


TYPICAL TOWLINE:



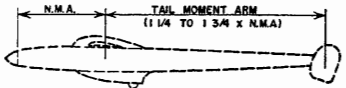
GENERAL APPLICATION OF MOMENT ARMS:

SPEED:



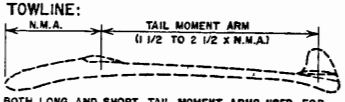
FOR MAXIMUM CONTROLLABILITY, LONG TAIL MOMENT ARM IS DESIRABLE. CENTER OF GRAVITY GENERALLY LOCATED AROUND WING LEADING EDGE DUE TO HIGH CONCENTRATION OF WEIGHT AT THE NOSE. THE USE OF SWEPT FORWARD WING PANELS WILL AID IN OBTAINING A MORE DESIRABLE CENTER OF GRAVITY LOCATION WITH MINIMUM FUSELAGE LENGTH.

RUBBER:



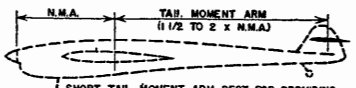
MODERATELY LONG TAIL MOMENT ARM DESIRABLE BUT NOT EASILY OBTAINED BECAUSE OF LENGTH AND WEIGHT OF RUBBER MOTOR. REAR MOTOR BEARING LOCATED WELL FORWARD OF STABILIZING SURFACES ASSISTS IN OBTAINING A MORE DESIRABLE ARRANGEMENT.

TOWLINE:



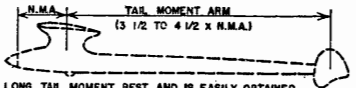
BOTH LONG AND SHORT TAIL MOMENT ARMS USED. FOR EASIER TOWING AND TIGHTER GLIDING CIRCLE, SHORT TAIL MOMENT ARM DESIRABLE. LONG TAIL MOMENT ARM DESIRABLE IN GUSTY WEATHER. BALLAST IS USED TO OBTAIN CORRECT CENTER OF GRAVITY LOCATION.

STUNT:



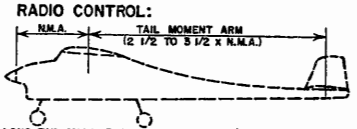
SHORT TAIL MOMENT ARM BEST FOR PROVIDING RAPID CONTROL RESPONSE AND TIGHT BUT SMOOTH MANEUVERS. CENTER OF GRAVITY GENERALLY LOCATED SLIGHTLY FORWARD OF BELLCRANK POSITION.

GAS:



LONG TAIL MOMENT BEST AND IS EASILY OBTAINED BECAUSE OF HIGH CONCENTRATION OF WEIGHT AT NOSE. CENTER OF GRAVITY POSITION WILL VARY DEPENDING ON THE PARTICULAR DESIGN AND THE PROPORTIONS OF THE SURFACES.

RADIO CONTROL:



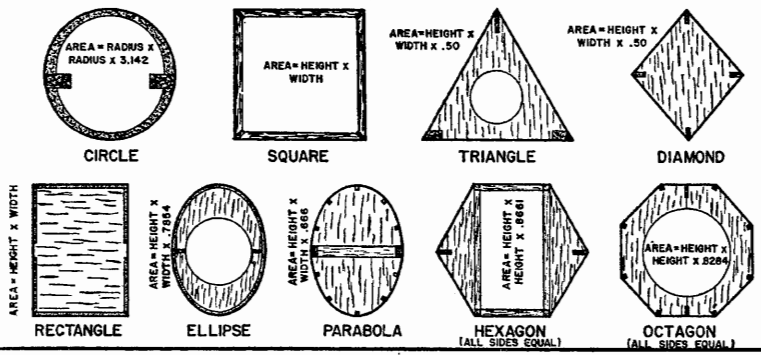
LONG TAIL MOMENT ARM COMMONLY USED, BUT NOT ESSENTIAL. CENTER OF GRAVITY GENERALLY LOCATED 1/4 TO 1/3 FROM THE WING LEADING EDGE - EASY TO OBTAIN BEST POSITION BY SHIFTING LOCATION OF THE RADIO EQUIPMENT

P.D.G.

19. CONTROL LINE PLANFORMS

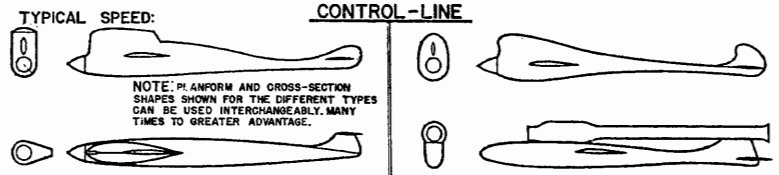
FUSELAGE AND RUDDER PLANFORMS

BASIC FUSELAGE CROSS-SECTION SHAPES:



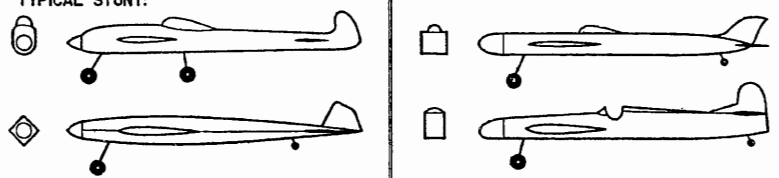
GENERAL APPLICATIONS OF BASIC AND COMPOSITE PLANFORMS CONTROL-LINE

TYPICAL SPEED:

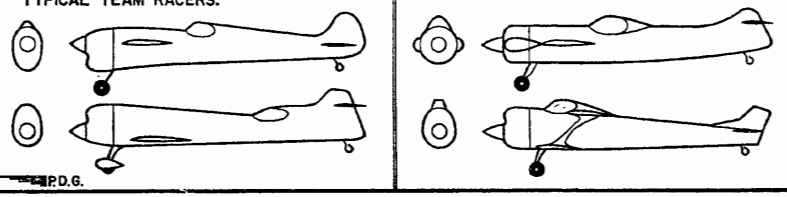


NOTE: PLANFORM AND CROSS-SECTION SHAPES SHOWN FOR THE DIFFERENT TYPES CAN BE USED INTERCHANGEABLY, MANY TIMES TO GREATER ADVANTAGE.

TYPICAL STUNT:

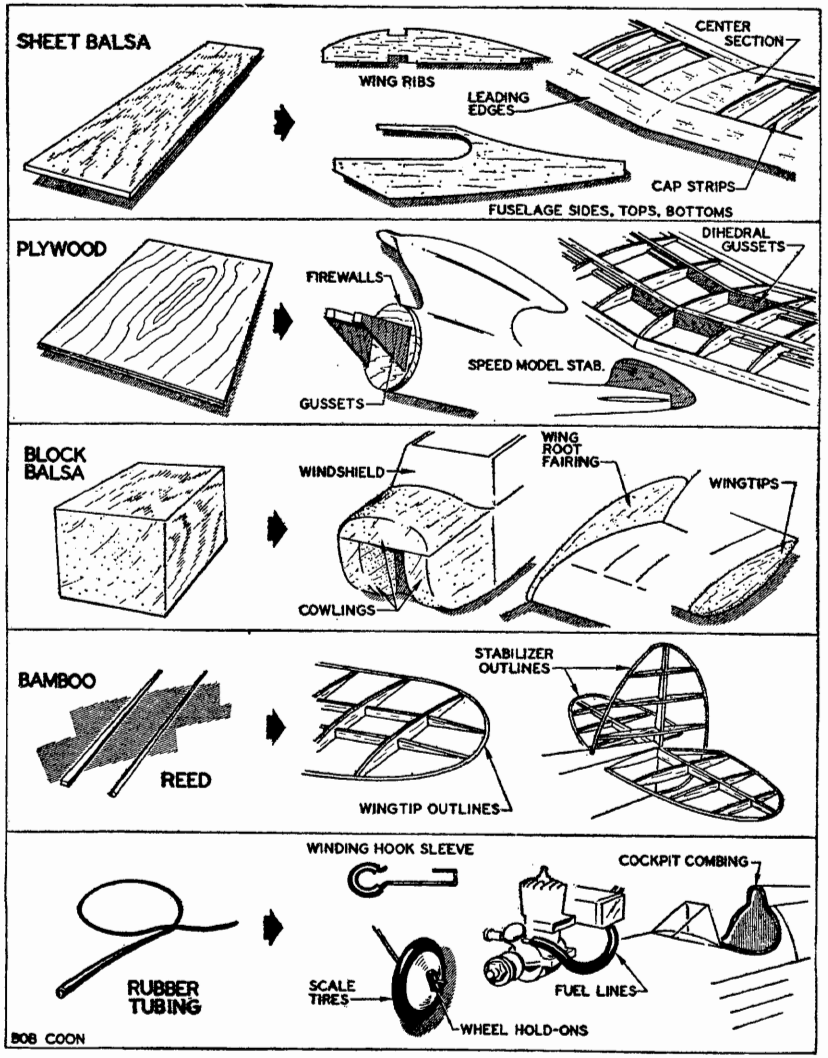


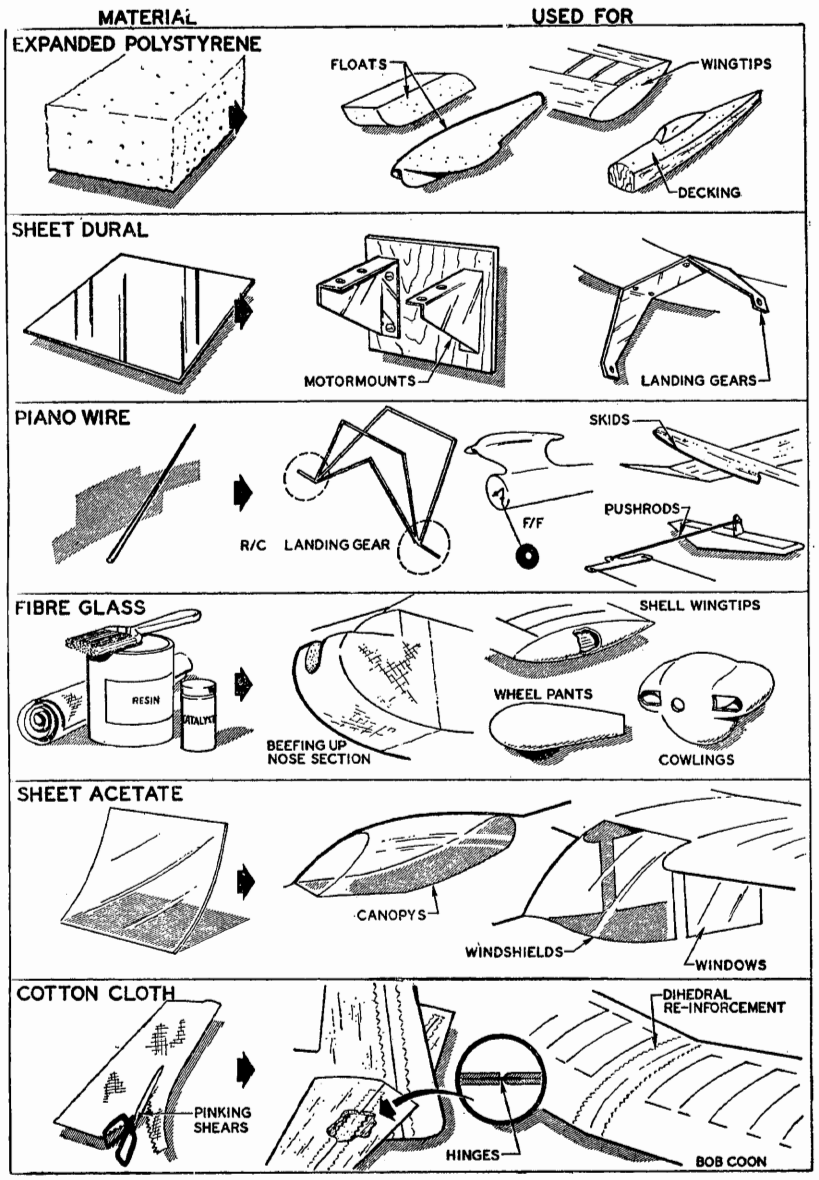
TYPICAL TEAM RACERS:



P.D.G.

20. USE OF MATERIALS

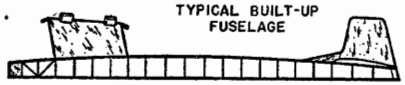




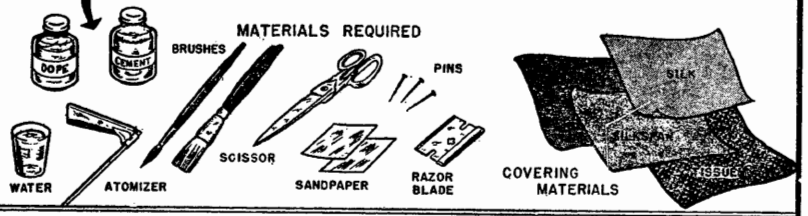
21. FUSELAGE COVERING PROCEDURE

FLAT SURFACES:
(DRY COVERING)

USE A 50-50 MIXTURE AS AN ADHESIVE.



MATERIALS REQUIRED



COVERING WITH TISSUE PAPER

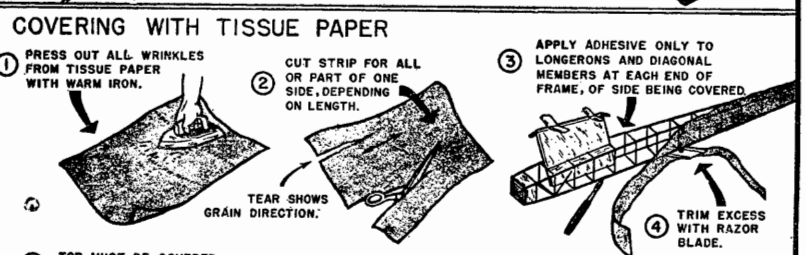
① PRESS OUT ALL WRINKLES FROM TISSUE PAPER WITH WARM IRON.

② CUT STRIP FOR ALL OR PART OF ONE SIDE, DEPENDING ON LENGTH.

TEAR SHOWS GRAIN DIRECTION.

③ APPLY ADHESIVE ONLY TO LONGERONS AND DIAGONAL MEMBERS AT EACH END OF FRAME, OF SIDE BEING COVERED.

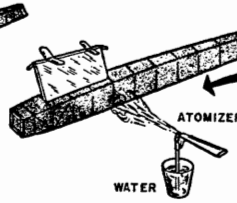
④ TRIM EXCESS WITH RAZOR BLADE.



⑤ TOP MUST BE COVERED IN SECTIONS AROUND THE PYLON.

⑥ DAB TRIMMED EDGES WITH COVERING ADHESIVE, WHERE NOT SECURELY ADHERED, AND SMOOTH OUT WITH FINGERS.

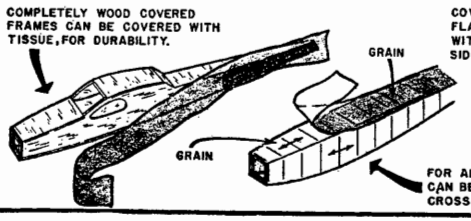
⑦ SPRAY COVERING WITH WATER, UNTIL THE COVERING IS COMPLELY DAMPENED. DO NOT SOAK COVERING!



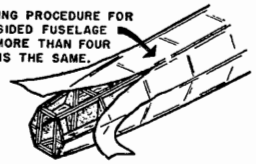
LARGER MODELS CAN BE COVERED WITH WET-SILK, SILKSPAN, OR SKYSAIL, BUT NOT WITH TISSUE BECAUSE IT FALLS APART.

VARIATIONS ON FLAT SURFACE COVERING

COMPLETELY WOOD COVERED FRAMES CAN BE COVERED WITH TISSUE, FOR DURABILITY.



COVERING PROCEDURE FOR FLAT-SIDED FUSELAGE WITH MORE THAN FOUR SIDES IS THE SAME.



FOR ADDED STRENGTH, MODELS CAN BE DOUBLE-COVERED, CROSS-GRAIN SECOND LAYER.

P. D. G.

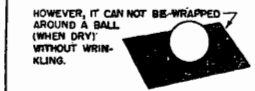
ALL COVERING MATERIAL, WHETHER SILK OR TISSUE, IS ESSENTIALLY AS FLAT AS A PANCAKE.



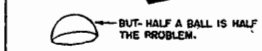
IT MAY BE ROLLED INTO A TUBULAR SHAPE QUITE EASILY, WET OR DRY.



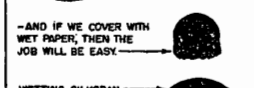
HOWEVER, IT CAN NOT BE WRAPPED AROUND A BALL (WHEN DRY) WITHOUT WRINKLING.



BUT- HALF A BALL IS HALF THE PROBLEM.



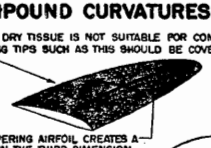
-AND IF WE COVER WITH WET PAPER, THEN THE JOB WILL BE EASY.



WETTING SILKSPAN, SKYSAIL OR SILK ALLOWS THE FIBRES UNDER PRESSURE TO STRETCH. PULL TO SHAPE SLOWLY, CAREFULLY.

COMPOUND CURVATURES:

AS DRY TISSUE IS NOT SUITABLE FOR COMPOUND CURVES, WING TIPS SUCH AS THIS SHOULD BE COVERED WET.



A PARACHUTE IS A PERFECT EXAMPLE OF THE INDIVIDUAL "GORE" METHOD OF COVERING.



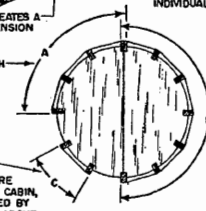
THE TAPERING AIRFOIL CREATES A CURVE IN THE THIRD DIMENSION

NOTE CROSS-SECTION WITH SEGMENTS "A, B, C"

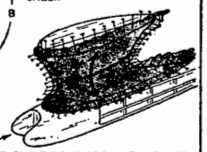
SEG. A- INDICATES AREA WHICH MAY BE COVERED WITH WET TISSUE.

SEG. B- MAY BE COVERED WITH ONE PIECE OF SILK.

SEG. C- DRY TISSUE.



A ROUNDED STRINGERED FUSELAGE MAY BE COVERED DRY, BY COVERING EACH SECTION BETWEEN STRINGERS INDIVIDUALLY.



COMPOUND CURVATURES ARE OFTEN FOUND AFT OF THE CABIN, AND MAY ALSO BE COVERED BY THE METHODS DESCRIBED ABOVE.



FAIRED SILK PYLONS ARE DIFFICULT. USE WET SILK ONLY. PULL VERY TIGHT IN ALL DIRECTIONS. HOLD WITH PINS, CEMENT.

FORMERS DO NOT TOUCH SILK!

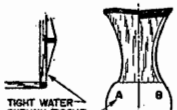
COVERING HINTS:



PROPER FORMER DESIGN WILL GIVE YOU A MUCH BETTER COVERING JOB.

SEC. A- RECOMMENDED FOR BEST RESULTS.
SEC. B- FORMERS WILL CAUSE BULGES.
SEC. C- FAIR, BUT COVERING MAY ADHERE.

TIGHT WATER-SHRUNK TISSUE AVOIDS THIS.

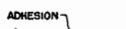


SEC. A- POOR FAIRED SILK PYLON DESIGN.
SEC. B- GOOD WING MOUNT, UNDERCUT FORMER.

UNDERCAMBER COVERING SHOULD BE CEMENTED TO EACH RIB.

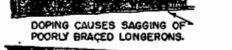


ADHESION



USE THIN COATS OF DOPE, WELL BRUSHED.

DOPING CAUSES SAGGING OF POORLY BRACED LONGERONS.



PULL COVERING VERY TIGHT ON SHORTEST DIMENSIONS. AVOIDS WRINKLE

DOPING:



USE A GOOD KNOWN GRADE OF DOPE IS THE BEST ADVICE WE CAN GIVE YOU. THINNER IS TO DOPE WHAT TURPENTINE IS TO PAINT. KEEP YOUR DOPE THIN AND APPLY IN SMOOTH EVEN STROKES. DRY WELL BETWEEN COATS.



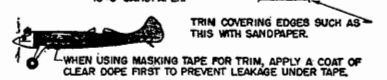
USE A GOOD BRUSH, BRISTLES SET IN RUBBER.

FINISHING:

LIGHTLY SAND OFF ROUGH SPOTS, EDGES ETC. WITH 10-0 SANDPAPER.



TRIM COVERING EDGES SUCH AS THIS WITH SANDPAPER.



WHEN USING MASKING TAPE FOR TRIM, APPLY A COAT OF CLEAR DOPE FIRST TO PREVENT LEAKAGE UNDER TAPE.

WARP REMOVAL:

TRAILING EDGE TROUBLES

YOUR TRAILING EDGE (FRONT VIEW)

WARPED TRAILING EDGE (COVERED)

STRAIGHT LEADING EDGE, WARPED T.E. RESULT- INCREASED DRAG.

CURE: STEAM, OR TRY EXTRA COAT OF DOPE ON CONVEX SURFACE. INCREASED SHRINKAGE MAY HELP.



STEAM-OUT
EXCELLENT FOR A SMALL MODEL, BUT A TEA KETTLE VS. A SIX FOOT WING IS SELDOM ENOUGH.

TWIST TO DESIRED POSITION, STEAM, HOLD TILL COOL.

DOPE-OUT
DOPE PANEL, HOLD TILL DRY. DOPE PANEL AGAIN, HOLD TILL DRY, REPEAT WITH EACH COAT. THIS METHOD CONDUCIVE TO SUICIDE. NEVER WORKS WELL ANY-WAY. FORGET IT!

SOAK-OUT
THIS METHOD WILL PROVE VERY EFFECTIVE.

SOAK WARPED PANEL IN VERY HOT FAUCET WATER. TWIST IN OPPOSITE DIRECTION, DRY FAST OVER HEAT. HIGHLY INFLAMMABLE.

OCCASIONALLY RUBBER-MODEL FUSELAGES DEVELOP A SLIGHT TWIST BEFORE COVERING. SEE CROSS-SEC.



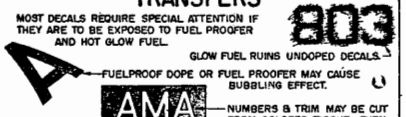
THIS CONDITION CAN EASILY BE RECTIFIED BEFORE COVERING AS SHOWN BELOW.



SLIP RUBBER MOTOR INTO FUSELAGE, AND WIND MOTOR UNTIL FUSE. TWISTS BACK TO NORMAL. LOCK PROP & COVER.

TRANSFERS

MOST DECALS REQUIRE SPECIAL ATTENTION IF THEY ARE TO BE EXPOSED TO FUEL PROOFER AND HOT GLOW FUEL.

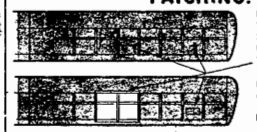


GLOW FUEL RUINS UNDOPED DECALS.

FUELPROOF DOPE OR FUEL PROOFER MAY CAUSE BUBBLING EFFECT.

NUMBERS & TRIM MAY BE CUT FROM COLORED TISSUE, THEN DOPED ON.

PATCHING:



REMOVE RIPPED COVERING WITH A RAZOR. WHENEVER POSSIBLE REMOVE A BIT OF SURROUNDING TISSUE SO PATCH MAY BE CEMENTED TO WOOD, ELIMINATING DOUBLE-COVERING EFFECT. WATER AND DOPE TO MATCH.

D. J. M

22. ALL ABOUT DETHERMALISERS

WEIGHT-SHIFTING DETHERMALIZERS:

SPOOL TYPE

CEMENT THREAD TO WINGTIP OPPOSITE NORMAL GLIDE TURN. (IF RIGHT TURN, ATTACH THREAD TO LEFT WING)

TIMER

WHEN TIMER ROD GOES IN, TIMER FALLS FREE AND STRING UNWINDS.

FALSE BACK ON TIMER

WING-TIP TIMER-SPOOL ARRANGEMENT

TIMER WRAPPED WITH APPROXIMATELY 50 FT. OF THREAD

TIMER HELD IN PLACE WITH SHEET BALSA ON SIDES AND TOP. (SIDES OMITTED FOR CLARITY.)

AS SOON AS TIMER-SPOOL STRIKES GROUND, THE UNBALANCED CONDITION DISAPPEARS AND THE MODEL RESUMES ITS NORMAL TURNING DIRECTION, THUS COUNTERACTING THE SPIN.

DROP-WEIGHT TYPE

RECOMMENDED FOR HAND-LAUNCH GLIDERS

RUBBER BAND

TINFOIL PROTECTION

FUSE

THREAD IS TIED TO REAR PART OF FUSELAGE.

BALLAST (SCREW, NUT OR BOLT IS FASTENED TO THREAD)

RUDDER-DISTURBANCE DETHERMALIZERS:

SPIN-TAB TYPE

LIMIT STOP

RUBBER BAND

WIRE ROD FASTENED TO TIMER DISENGAGES WIRE LOOP ON RUDDER TAB.

WIRE LOOP

TAB "SPIN" DETHERMALIZER DEVELOPED BY DICK KORDA, WHICH CAN BE OPERATED BY FUSE OR TIMER.

SPLIT-RUDDER TYPE

RUBBER BAND

TWISTED RUBBER BAND

FUSE

RUDDER "SPLIT" TYPE DEVELOPED BY PAUL E. DEL GATTO IS FUSE-OPERATED. RECOMMENDED FOR TAILLESS AIRCRAFT.

STABILIZER-DISTURBANCE DETHERMALIZERS:

THREAD LIMIT STOP

POP-UP TYPES (MOST POPULAR)

EXTENSION ARM

TIMER-OPERATED POP-UP TYPE

PIVOT TAIL SURFACES WITH TENSIONED RUBBER BAND FASTENED TO HOOK ON RUDDER AND TO DOWEL OR HOOKS ON FUSELAGE SIDES.

FUSE-OPERATED POP-UP TYPE

RUBBER BAND

FUSE

TINFOIL PROTECTION

TUBING

WIRE

TINFOIL PROTECTION

POP-AROUND TYPE

RUBBER BAND, UNDER TENSION, PULLS STAB UP AND AROUND.

POP-AROUND STAB ARRANGEMENT DEVELOPED BY BOB BURAGAS GIVES SNAP RESPONSE AND EXCELLENT DRAG ACTION. CAN BE FUSE OR TIMER-OPERATED.

SPIN-TAB TYPE

FUSE

RUBBER BAND

BOTTOM VIEW

FOR FIXED STABS ON SMALL RUBBER-POWERED OR GAS MODELS A FUSE-OPERATED TAB CAN BE USED. DEVELOPED BY PAUL E. DEL GATTO.

P.D.G.

FUSELAGE-DISTURBANCE DETHERMALIZERS:

DROGUE TYPE

NOT RECOMMENDED FOR LARGE MODELS

CHESTER LANZO DEVELOPED HINGED CABIN AND FUSELAGE DOOR DETHERMALIZERS, BOTH OF WHICH ARE TIMER-OPERATED.

LOU ANDREWS DEVELOPED THIS TYPE, WHICH PRODUCES THE SAME EFFECT AS A POP-UP TAIL.

SPLIT-FUSELAGE TYPE

WING-DISTURBANCE DETHERMALIZERS:

RUBBER BAND

LIMIT STOP

60°

TIMER-OPERATED WING POP-UP ARRANGEMENT DEVELOPED BY ED SCHLOSSER.

BEST FOR SMALL GAS, RUBBER-POWERED MODELS, OR TOWLINE GLIDERS.

POP-UP TYPE

REALISTIC TIMER-OPERATED, FULL-SPAN WING FLAPS WHICH DROP AT LEAST 60° ARE VERY EFFECTIVE. COPIED FROM FULL-SCALE GLIDERS AND DEVELOPED BY ARMAND VASQUEZ.

RUBBER BAND

TUBING

TIMER

FLAPS

FASTEN TO FUSELAGE SIDES OR ADDED MEMBER

FLAP TYPE

PARACHUTE DETHERMALIZER:

CHUTE SIZE DATA

WING AREA	A	B
100 TO 200 SQ. IN.	16"	8"
200 TO 300 SQ. IN.	18"	9"
300 TO 400 SQ. IN.	20"	10"
400 TO 600 SQ. IN.	24"	12"
600 TO 800 SQ. IN.	28"	14"
800 TO 1000 SQ. IN.	32"	16"

DEVELOPED BY HENRY STRUCK

RUBBER BAND

A

A

STRONG CORD

NYLON

B

B

CHUTE PATTERN

B

PARACHUTE IS PACKED IN FUSELAGE. FUSE OR TIMER-OPERATED DOOR OPENS AND PARACHUTE DROPS OUT. CHUTE CORD IS FASTENED AT TAIL. WHEN IT OPENS IT DRAGS BEHIND MODEL.

RUBBER BAND ACROSS FUSELAGE INSURES PROPER EJECTION OF PARACHUTE.

FASTEN TO TAIL

TRIPPING DEVICES:

FUSE TYPE

FUSE

SNUFFER TUBE.

A BURNING FUSE IS THE MOST COMMON TRIPPING DEVICE. HAZARD IS MINIMIZED BY HAVING FUSE REST IN SNUFFER TUBE. A CYLINDER OF DRY ICE CAN BE INSERTED IN SNUFFER TUBE INSTEAD OF BURNING FUSE.

PUSHROD SECURED TO TIMER ARM

STRING (PULLS TAIL DOWN)

RUBBER BAND (SUPPLIES TENSION TO HOLD TAIL DOWN)

TIMER-ACTUATED ROD SLIDES THROUGH STAB

HOLD-DOWN HOOK. TENSIONED RUBBER BAND RAISES STAB.

TIMER TYPE

TIMER PLUNGER

PROVIDES TRIPPING LEVERAGE

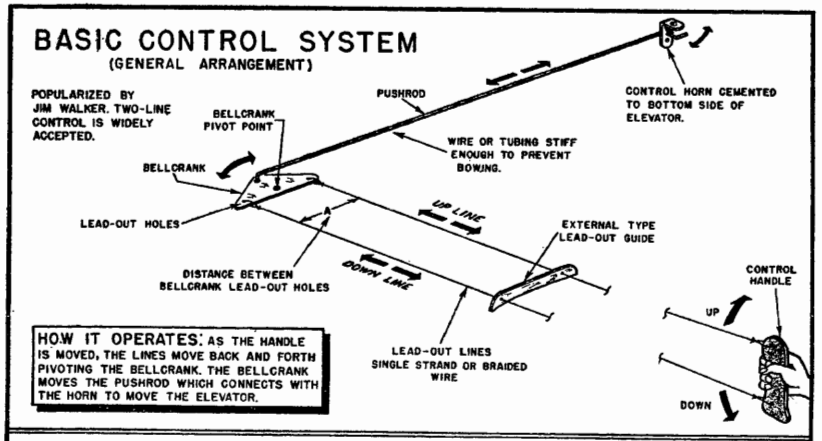
REMOTE TRIPPING DEVICE DEVELOPED BY JOHN TATONE

P.D.G.

23. CONTROL LINE EXPLAINED

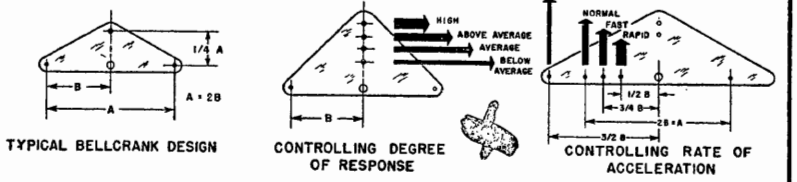
BASIC CONTROL SYSTEM
(GENERAL ARRANGEMENT)

POPULARIZED BY JIM WALKER. TWO-LINE CONTROL IS WIDELY ACCEPTED.



HOW IT OPERATES: AS THE HANDLE IS MOVED, THE LINES MOVE BACK AND FORTH PIVOTING THE BELLCRANK. THE BELLCRANK MOVES THE PUSHROD WHICH CONNECTS WITH THE HORN TO MOVE THE ELEVATOR.

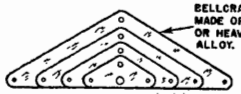
BELLCRANK AND CONTROL HORN DESIGN



TYPICAL BELLCRANK DESIGN

CONTROLLING DEGREE OF RESPONSE

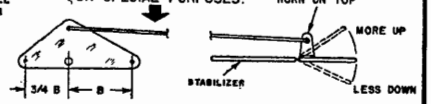
CONTROLLING RATE OF ACCELERATION



BELLCRANKS GENERALLY MADE OF THIN GAUGE STEEL OR HEAVY GAUGE ALUMINUM ALLOY.

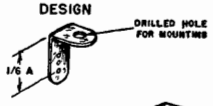
THESE BELLCRANKS HAVE THE SAME CONTROL RATIO DISREGARDING HANDLE EFFECT.

FOR SPECIAL PURPOSES:

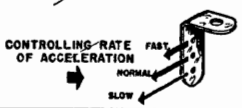


ASYMMETRICAL BELLCRANKS CAN BE USED TO VARY UP AND DOWN RELATIONSHIP

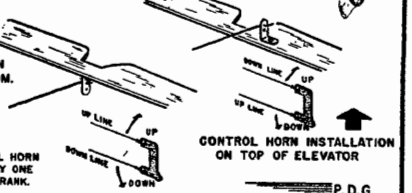
TYPICAL CONTROL HORN DESIGN



CONTROL HORN INSTALLATION ON ELEVATOR BOTTOM.



NOTE: A CONTROL HORN IS FUNDAMENTALLY ONE HALF OF A BELLCRANK.

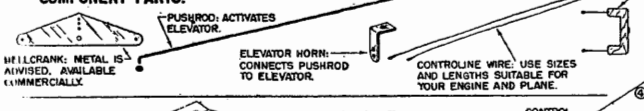


P.D.G.

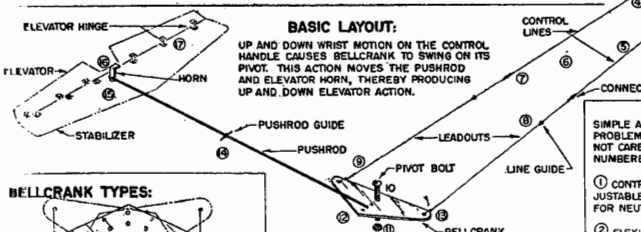
24. BASIC CONTROL LINE

INSTALLATION DETAILS FOR JIM WALKER "U-CONTROL" SYSTEM

COMPONENT PARTS:



BASIC LAYOUT:

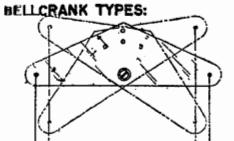


UP AND DOWN WRIST MOTION ON THE CONTROL HANDLE CAUSES BELLCRANK TO SWING ON ITS PIVOT. THIS ACTION MOVES THE PUSHROD AND ELEVATOR HORN, THEREBY PRODUCING UP AND DOWN ELEVATOR ACTION.

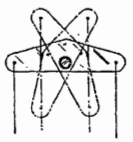
FIRST INTRODUCED ON THE A.J. FIREBALL, THE "U-CONTROL" SYSTEM HAS GAINED WIDESPREAD POPULARITY.

OTHER POPULAR CONTROLINE SYSTEMS INCLUDE THE "MONO-LINE", DESCRIBED IN FEB. 1952 FLYING MODELS, AND THOSE OF VARIOUS KIT MANUFACTURERS, DESCRIBED IN THEIR KIT PLANS.

BELLCRANK TYPES:



TYPICAL STUNT TYPE BELLCRANK (SHOWN 1/2 SCALE) IN NEUTRAL AND UP AND DOWN ELEVATOR POSITIONS.

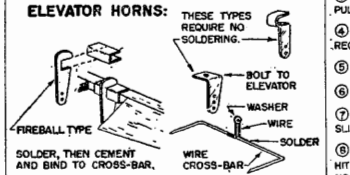


NOTE WHAT OCCURS WHEN TOO SMALL A BELLCRANK IS USED. LEADOUT WIRES TRAVEL TOO FAR, NECESSITATE SLOTS IN FUSELAGE. LEVERAGE ALSO IS LOST

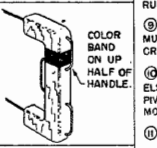


FOR ELECTRICAL TWO-SPEED SYSTEMS, USE BAKELITE BELLCRANK.

ELEVATOR HORNS:



CONTROL HANDLES:



SIMPLEST OF ALL STEEL CABLE INSTALLATIONS IS SHOWN HERE.

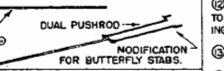
READILY ADJUSTABLE. IT MAY BE ADJUSTED TO CORRESPOND TO NEUTRAL ON ANY MODEL.

MANY EXCELLENT HANDLES ARE AVAILABLE COMMERCIALLY.

PUSHRODS:

SINGLE CONNECTIONS ARE EXCELLENT ON CONVENTIONAL WIRE TYPES.

TUBING (WITH FLATTENED, DRILLED ENDS) SOMETIMES USED.



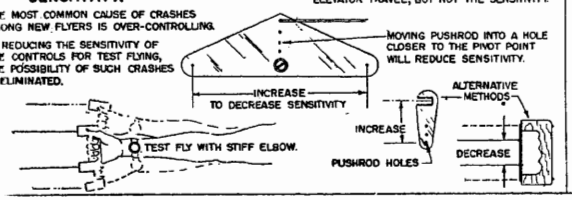
SENSITIVITY:

THE MOST COMMON CAUSE OF CRASHES AMONG NEW FLYERS IS OVER-CONTROLLING.

BY REDUCING THE SENSITIVITY OF THE CONTROLS FOR TEST FLYING, THE POSSIBILITY OF SUCH CRASHES IS ELIMINATED.

REDUCING BELLCRANK SWING REDUCES ELEVATOR TRAVEL, BUT NOT THE SENSITIVITY.

MOVING PUSHROD INTO A HOLE CLOSER TO THE PIVOT POINT WILL REDUCE SENSITIVITY.



PROBLEMS:

SIMPLE AS THIS CONTROL SYSTEM IS, PROBLEMS CAN CREEP IN IF WE ARE NOT CAREFUL. TROUBLE SPOTS ARE NUMBERED ON LAYOUT SKETCH.

① CONTROL HANDLE SHOULD BE ADJUSTABLE SO THAT IT MAY BE SET FOR NEUTRAL ELEVATOR ON ANY MODEL.

② FLEXIBLE STEEL CABLE HANDLE LEADOUTS ARE ADVISED. BRONZE CABLE, CATGUT, FISHLINE, ETC. WILL BREAK UNDER STRESS.

③ WEAK CONNECTORS ARE DANGEROUS. PULL TEST TO AVOID ACCIDENTS.

④ DO NOT USE THINNER WIRE THAN RECOMMENDED FOR YOUR ENGINE.

⑤ LINES MUST BE FREE OF KINKS.

⑥ LINES SHOULD BE CORRECT LENGTH.

⑦ ALL WIRE CONNECTIONS SHOULD BE SLIP-PROOF, SOLDERLESS, WRAPPED.

⑧ LINE GUIDE ON WING MUST NOT HIT CONNECTORS, OR CHAFE ON LINES. NO LINE GUIDE IS NEEDED IF LINES RUN THROUGH WING.

⑨ WIRE CONNECTION AT BELLCRANK MUST NOT SNAG ON FUSELAGE SIDE, OR LIMIT BELLCRANK MOVEMENT.

⑩ IN LARGE OR HIGH POWERED MODELS, A BEARING IS ADVISED AT THE PIVOT. ANCHOR PIVOT BOLT MOUNT TO MOTOR MOUNTS FOR SAFETY.

⑪ SOLDER NUT TO PREVENT LOOSENING.

⑫ IF LESS MOVEMENT OF THE ELEVATORS IS DESIRED, USE PUSHROD TRAINING HOLES (NEARER PIVOT) IN BELLCRANK.

⑬ USE LARGEST BELLCRANK POSSIBLE.

⑭ FRICTION COUPLED WITH AIR PRESSURE TEND TO "BOW" THE PUSHROD. IT CAN WRECK YOUR MODEL. SUPPORT IT IN CENTER WITH A GUIDE.

⑮ ELEVATOR HORN (AS SHOULD ALL CONNECTIONS) MUST FORM A SNUG FIT WITH PUSHROD TO PREVENT PLAY.

⑯ CROSS-BAR (CONNECTING ELEVATORS) MUST BE STRONG, WARP RESISTANT. USE HARDWOOD OR PIANO WIRE.

⑰ HINGES MUST BE RUGGED, FUEL-PROOF, WARP-PROOF, UNAFFECTED BY VIBRATION AND FRICTION-FREE.

ELEVATOR HINGES:

THE CRINOLINE CLOTH HINGE IS EASY TO MAKE, SHORT LIVED.

DOPE AND GLUE ON FLEXIBLE EDGES MAY CRACK THE CLOTH. THE CLOTH ALSO LEAVES A BUMPY EFFECT, MARRING APPEARANCE OF THE TAIL ASSEMBLY.

HINGES SUCH AS THESE, AVAILABLE AT YOUR HOBBY SHOP ARE EASY TO INSTALL, TROUBLE FREE.

THE INTERLOCKING WIRE HINGE IS EXCELLENT FOR SCALE JOBS.

TUBING AND WIRE HINGE

SLIDE WIRE THROUGH TUBING

LENGTHS OF TUBING CEMENTED TO STAB AND ELEVATOR MAKE AN EXCELLENT HINGE. COVER WITH BALSA, SAND.

TUBING

FILL-IN, SAND

ELEVATOR

ELEVATOR MOVEMENT:

FOR TRAINING PURPOSES LIMIT YOUR ELEVATOR MOVEMENT TO 5° DOWN, 15° UP.

15°

5°

LESS DOWN IS NEEDED DUE TO GRAVITY.

45°

45°

STUNT MODELS MAY USE UP TO 45° UP AND DOWN MOVEMENT

FULL UP AND FULL DOWN

IF ELEVATOR IS STILL IN UP POSITION WHEN DOWN ELEVATOR IS DESIRED, SLIDE STAB TOWARD REAR.

CEMENT STAB IN POSITION ONCE PROPER MOVEMENT IS OBTAINED.

CONNECTIONS:

BIND AND SOLDER

CONNECTIONS SHOULD BE STRONG, PULL TESTED.

ONE TUG ON THE LINES AND THIS CONNECTION WILL BREAK.

① BEND CONTROLINE WIRE, SLIP SNAP OR SLIDE CONNECTOR ON.
② BIND AS SHOWN WITH SINGLE STRAND OF ELECTRICAL WIRE.
③ BEND LEG OF WIRE DOWN, CONTINUE BINDING. DO NOT SOLDER.

BELLCRANK MOUNT:

BELLCRANK

C.G.

BELLCRANK -25% FROM L.E.
C.G.- 33% FROM L.E.

YOUR MODEL IS A POTENTIAL WRECK, IF ITS BELLCRANK IS NOT RIGIDLY MOUNTED.

IF YOUR BELLCRANK IS ATTACHED TO ANYTHING BUT THE MOUNTS, IT MAY SUDDENLY TEAR OUT.

SCREW PLYWOOD BELLCRANK MOUNT TO MOTOR MOUNTS.

LINE GUIDE:

RUNNING CONTROLINES THROUGH THE WING WHENEVER POSSIBLE, LESSENS DRAG AND ELIMINATES THE NEED FOR A LINE GUIDE.

NO LINE GUIDE IS NEEDED ON THIS WING.

NO LINE GUIDE IS NECESSARY

LINE GUIDE LOCATION FOR BIPLANE

NOTE LINE GUIDE

FLIGHT TRIM:

IMPROPER TRIM ACCOUNTS FOR MANY CRASHES. THE MODEL MUST HOLD TIGHT ON THE LINES AND FLY WITH ITS WINGS PARALLEL TO THE CONTROLINES AT ALL TIMES.

IF A CONTROLINE MODEL IS ALLOWED TO BANK, IT WILL LAND AND TAKE-OFF ON ONE WHEEL, TEND TO FLY INSIDE CIRCLE, SLACKENING LINES.

BANKING MAY BE TRIMMED BY WARPING THE TRAILING EDGE OF THE INBOARD PANEL DOWN, (WASH-IN) AND THE TRAILING EDGE OF THE OUTBOARD PANEL UP (WASH-OUT)

① STANDARD ADJUSTMENTS ARE NUMBERED BELOW.

② ③ ④

FIXED AILERONS ARE EXCELLENT FOR TRIMMING BANKING TENDENCIES. TACK LIGHTLY WITH CEMENT, UNTIL FINAL ADJUSTMENTS ARE MADE. AILERONS REPLACE WING WARPING METHOD AT LEFT.

① SLIGHT RIGHT RUDDER
② SWEPTBACK CONTROLINES
③ LEAD WEIGHT IN OUTBOARD TIP
④ RIGHT THRUST WHEN NECESSARY.

ELEVATORS SHOULD BE PROPERLY ALIGNED ON THE CROSS-BAR, TO PREVENT BANKING.

REEL AND LINES:

KINKED WIRES SHOULD BE JUNKED, NOT STRAIGHTENED. THEY ARE NOT SAFE. USE PRECAUTION INSTEAD OF PLIERS.

CUT ONE 6" DIA. 3/8" PLYWOOD DISC

CUT TWO 7" DIA. 1/8" PLYWOOD DISCS.

DRILL 1/4" HOLE THROUGH DISC CENTERS. CEMENT TOGETHER, ALIGNING HOLES.

NOTCH AT ANGLE

CONTROLINES

CRANKING KNOB

7" DIA 1/8" PLYWOOD DISCS

SCREW

WASHER

DOWEL

WASHER

SNAP OR SLIDE CONNECTORS HOOK ON FLAT HEAD NAIL

FLAT HEAD NAILS

CRANKING KNOB

6" DIA. 3/8" PLYWOOD DISC

HANDLE SCREW, WASHER

A HEAVY RUBBER BAND STRETCHED FROM THE SCREW TO THE DOWEL ON THE OPPOSITE SIDE, HOLDS THE CONTROL HANDLE IN POSITION.

RUBBER BAND HOLDS THE FLEXIBLE HANDLE CABLES IN PLACE.

D.J.H

25. UNDERCARRIAGES & WHEELS

BASIC INFORMATION

PIANO WIRE IS THE MOST WIDELY USED MATERIAL FOR LANDING-GEAR STRUTS. THIS IS TRUE FOR BOTH FREE-FLIGHT AND CONTROL-LINE MODELS. IT CAN BE OBTAINED AT HOBBY SHOPS IN SIZES UP TO 1/8" IN DIAMETER

DO NOT HEAT WIRE WHEN BENDING

BEND OVER ROUNDED EDGE

FRACTURE

VICE

DON'T BEND WIRE OVER SHARP EDGE

WIRE MUST BE CLEAN AND BRIGHT BEFORE SOLDERING.

HEAT SURFACES WELL. ALLOW SOLDER TO FLOW THROUGH WRAPPING

USE FLUX AND ACID CORE SOLDER

WRAP TIGHTLY, AND EVENLY, WITH SOFT WIRE

TYPE "A" MOUNTING

WASHER

"J"-BOLTS THROUGH PLYWOOD FIRE-WALL

NUT

PIANO WIRE

CAN BE SEWED WITH THIN WIRE AND SOLDERED IF "J" BOLTS ARE NOT AVAILABLE

TWO-WHEEL LANDING GEAR

THE STANDARD TWO-WHEEL GEAR IS BY FAR THE MOST POPULAR IN USE TODAY. THIS TYPE GEAR MAY BE USED ON ALMOST ALL KINDS OF MODEL PLANES, USING FIRE-WALL OR FORMER CONSTRUCTION. IT CAN BE MOUNTED EITHER BY METHOD "A" OR "B"

TYPE "B" MOUNTING

HARD BALSA CORE

PLYWOOD

PLYWOOD

CENTER OF SANDWICH IS THE SAME THICKNESS AS THE WIRE USED FOR THE GEAR

PIANO WIRE

CEMENT WIRE BETWEEN THE FIRE-WALLS IN THE BALSA CORE

SINGLE-WHEEL GEAR

THIS TYPE USED FOR SMALL, LIGHT MODELS.

THIS TYPE USED WHERE LANDING SHOCKS ARE MORE SEVERE ON HEAVIER MODELS

BIND WITH SOFT WIRE AND SOLDER

MOUNT IN MODEL THE SAME WAY AS TWO-WHEEL GEAR

TRIKE GEAR:

A COMBINATION OF THE SINGLE AND DOUBLE LANDING GEARS MAY BE USED TO BUILD A TRICYCLE-GEARED MODEL.

SHEET-METAL GEAR

NUT

WASHER

PLYWOOD PANEL FIRMLY ANCHORED IN FUSELAGE

BEND OVER ROUNDED EDGE

BOLT

24-ST ALUMINUM

6-32 MACHINE SCREW USED AS AN AXLE

TAP OUT HOLE FOR AXLE

STRUT

NUT

BOLT

WASHERS

NUT

LOCK NUT

WHEEL OUTLINE

THE 16 SWG. SHEET ALUMINUM LANDING GEAR IS USED ON TEAM RACERS, SPORT AND SOME STUNT MODELS. WHILE IT ADDS TO THE LOOKS OF THE MODEL, THIS GEAR DOES NOT STAND UP UNDER HARD CONTINUOUS USAGE.

SHOCK-ABSORBING GEAR

REAR STRUT ROTATES IN TUBING, SECURELY FASTENED TO FORMER

FAIRING MADE FROM SCRAP WOOD AND COVERED WITH SILK

RUBBER BAND HOLDS FRONT PART OF GEAR TO FORMER

BIND WITH SOFT WIRE, AND SOLDER

THIS TYPE OF GEAR IS USED TO MINIMIZE LANDING SHOCK. R/C MODELS MAY USE A HEAVIER VERSION OF THIS SYSTEM.

THIS GEAR IS OFTEN RIGIDLY MOUNTED WHEN USED IN SCALE MODELS OF THE WORLD WAR I TYPE.

WING-MOUNTED GEAR

GEAR IS BOUND TO WING SPARS WITH HEAVY THREAD AND CEMENTED SECURELY IN PLACE.

WING CENTER SECTION SHOULD BE REINFORCED TO TAKE LANDING SHOCKS.

SPARS

THIS TYPE OF GEAR MAY BE USED ON FLYING SCALE, STUNT AND SPORT MODELS.

SCALE LANDING GEAR

MOUNT IN FUSELAGE IN THE CONVENTIONAL MANNER

BIND WITH SOFT WIRE, AND SOLDER

BALSA FAIRING MAY BE ADDED

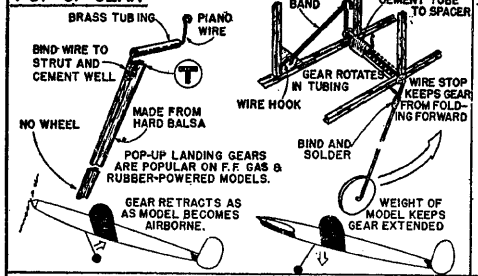
SHOCK BARS MADE FROM LIGHTER WIRE THAN MAIN GEAR.

SMALL, STRONG RUBBER BANDS ARE STRETCHED BETWEEN SHOCK BARS.

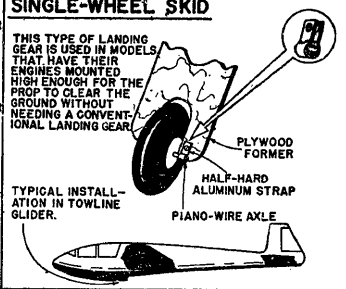
THIS TYPE USED WHERE HEAVY LANDING SHOCKS ARE ENCOUNTERED

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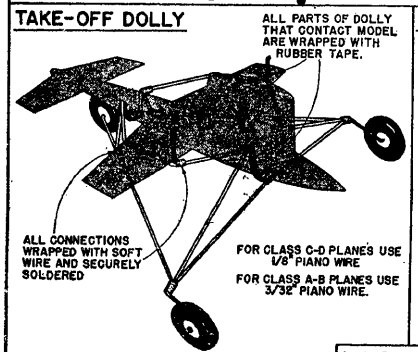
POP-UP GEAR



SINGLE-WHEEL SKID

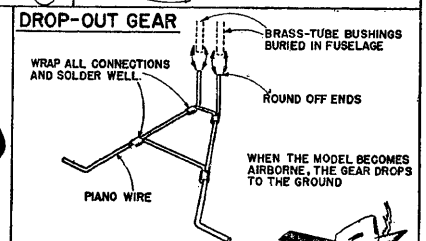


TAKE-OFF DOLLY



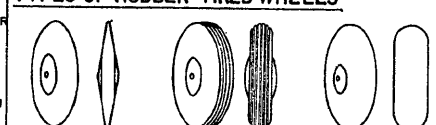
THE TAKE-OFF DOLLY SHOULD HAVE A LOW CENTER OF GRAVITY AND SHOULD SUPPORT THE MODEL EVENLY UNDER THE FUSELAGE AND THE WINGS. IT SHOULD TRACK OR SLIGHTLY TURN OUT FROM THE CIRCLE. CARE SHOULD BE TAKEN IN SOLDERING ALL THE CONNECTIONS, AS THE DOLLY IS SUBJECTED TO SEVERE STRESS IN OPERATION—ESPECIALLY ON ROUGH FIELDS. THE DOLLY SHOULD BE PAINTED WITH A GOOD FUEL-PROOF DOPE OR ENAMEL TO PREVENT RUST AND CORROSION. THE WHEELS SHOULD BE KEPT WELL OILED AT ALL TIMES.

DROP-OUT GEAR



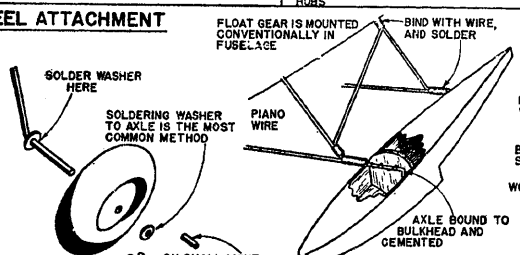
THE USE OF DROP-OUT GEARS HAS BEEN CONFINED TO CONTROL-LINE SPEED MODELS ALMOST EXCLUSIVELY. THEY'VE BEEN USED SUCCESSFULLY IN STUNT AND COMBAT MODELS ALSO.

TYPES OF RUBBER-TIRED WHEELS



STREAMLINE	TREADED	BALLOON
SPONGE OR SOLID RUBBER WITH BRASS HUBS	SEMI-PNEUMATIC ALUMINUM HUBS	FULLY PNEUMATIC WOODEN OR ALUMINUM HUBS

WHEEL ATTACHMENT



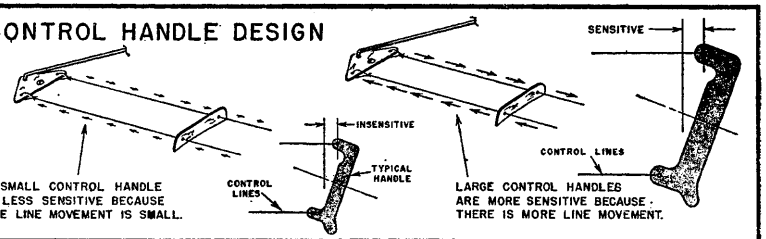
FLOAT ATTACHMENT

SKI ATTACHMENT

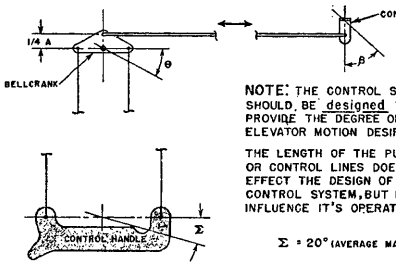
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26. C/L HANDLES & OPERATION

CONTROL HANDLE DESIGN



BASIC SYSTEM IN OPERATION



NOTE: THE CONTROL SYSTEM SHOULD BE designed TO PROVIDE THE DEGREE OF ELEVATOR MOTION DESIRED

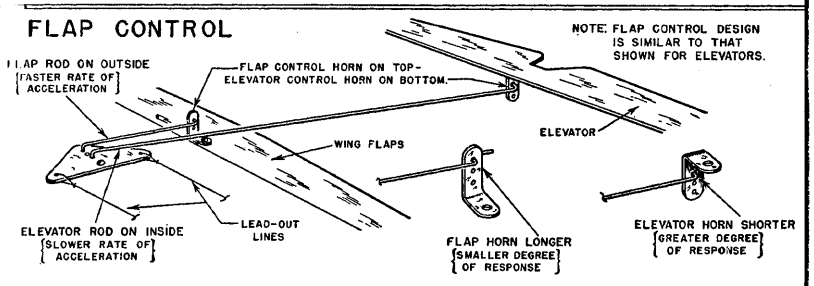
THE LENGTH OF THE PUSHROD OR CONTROL LINES DOES NOT EFFECT THE DESIGN OF THE CONTROL SYSTEM, BUT IT WILL INFLUENCE IT'S OPERATION.

Σ = 20° (AVERAGE MAXIMUM)

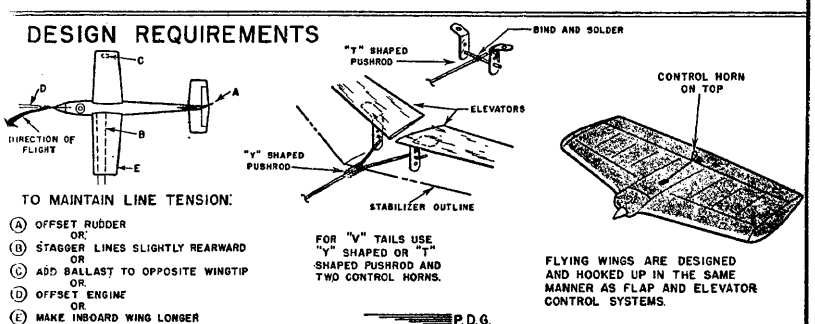
EXAMPLES OF DESIGN

BELL-CRANK	CONTROL HANDLE	CONTROL HORN	Σ	θ	β
3"	5 1/2"	3/4"	20°	37°	33°
3"	5"	5/8"	20°	34°	36°
3"	4-1/2"	1/2"	20°	30°	41°
2"	5"	1/2"	20°	50°	45°
2"	4-1/2"	1/2"	20°	46°	40°
2"	4"	3/8"	20°	40°	46°
1-1/2"	5"	1/2"	20°	70°	50°
1-1/2"	4-1/2"	3/8"	20°	64°	54°
1-1/2"	4"	5/16"	20°	57°	61°

FLAP CONTROL



DESIGN REQUIREMENTS



TO MAINTAIN LINE TENSION:

- (A) OFFSET RUDDER OR
- (B) STAGGER LINES SLIGHTLY REARWARD OR
- (C) ADD BALLAST TO OPPOSITE WINGTIP OR
- (D) OFFSET ENGINE OR
- (E) MAKE INBOARD WING LONGER

FOR "V" TAILS USE "Y" SHAPED OR "T" SHAPED PUSHROD AND TWO CONTROL HORNS.

FLYING WINGS ARE DESIGNED AND HOOKED UP IN THE SAME MANNER AS FLAP AND ELEVATOR CONTROL SYSTEMS.

P.D.G.

27. TEAM RACING & SPEED FLYING

F.A.I. & S.M.A.E. LINE LENGTHS				
CLASS	DISPLACEMENT	LINE LENGTH	DISTANCE	Nº OF LAPS
½A T/R	0 - 1·5 CC	38' 2½"	5 MILES	110
I & T/R	0·5 2·5 CC	1592 M (52' 2¾")	1 KILOMETRE	10 (T/R 100)
II	2·51 - 5·0 CC	1592 M (52' 2¾")	1 KILOMETRE	10
III & JET	5·1 - 10·0 CC	1909 M (65' 3½")	1 KILOMETRE	8
SMAE 17R B	0 — 5 CC	60'	5 & 10 MILES	70 & 140

GENERAL INFORMATION

A RECORD-BREAKING SPEED RUN IS NOT DUE TO A HOPPED-UP ENGINE OR SUPER-SECRET HOT FUELS, AS IS GENERALLY BELIEVED. ATTENTION TO DETAIL IN ALL PHASES OF SPEED FLYING IS THE KEY TO A REALLY FAST FLIGHT. A SO-CALLED HOT FUEL RUNNING IN A DIRTY ENGINE OR A BEAUTIFULLY CONSTRUCTED & FINISHED PLANE WITH A POOR FUEL SYSTEM NEVER WINS CONTESTS. GOOD SPEED FLYING IS THE RESULT OF A CHAIN OF WELL-THOUGHT-OUT DETAILS CAREFULLY CARRIED OUT & YOU ARE ONLY AS FAST AS THE WEAKEST LINK IN THAT CHAIN.

THESE DETAILS ARE AS FOLLOWS:

1- A WELL-CONSTRUCTED PLANE OF ADVANCED DESIGN. KIT OR ORIGINAL

2- A GLASS-LIKE FUEL-PROOF FINISH.

3- A PROVEN RACING ENGINE WELL TAKEN CARE OF.

4- A RELIABLE CONSISTENT FUEL

5- A FOOL-PROOF FUEL-SYSTEM (TANK)

6- A THOROUGHLY FLIGHT TESTED PROPELLER

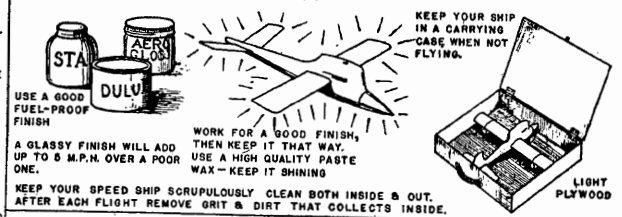
7- A RELIABLE TAKE-OFF DOLLY OR HAND LAUNCH

8- A SET OF A.M.A. SPECIFIED CONTROL LINES

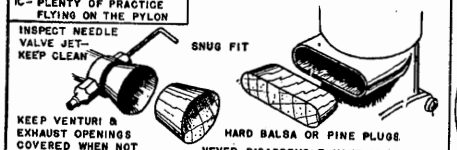
9- CLEANLINESS- THIS APPLIES TO ALL EIGHT POINTS MADE ABOVE

10- PLENTY OF PRACTICE FLYING ON THE PYLON

1 & 2 IF BUILDING A SPEED SHIP FROM A KIT OR FROM MAGAZINE PLANS, FOLLOW INSTRUCTIONS TO THE LETTER. WHEN DESIGNING YOUR OWN SHIP, USE ACCEPTED BUILDING METHODS. DON'T SHORT CUT ON STRENGTH & RIGIDITY.

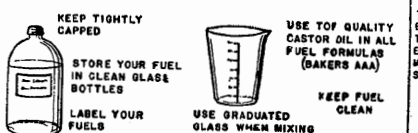


3 YOUR ENGINE, WHEN IT COMES OUT OF THE BOX, IS A PRECISION MECHANISM. KEEP IT THAT WAY. TREAT IT AS YOU WOULD A FINE WATCH. BREAK IT IN ACCORDING TO INSTRUCTIONS.



NEVER DISASSEMBLE YOUR ENGINE UNLESS REPLACING PARTS. FLUSH IT OUT WITH CLEAN ALCOHOL AFTER THE DAY'S FLYING.

4 FUELS ARE GENERALLY THOUGHT TO BE THE "BIG SECRET" OF SPEED FLYING. IN REALITY "SUPER" FUELS MAY HARM YOUR ENGINE. ONCE A GOOD FUEL IS FOUND, STICK WITH IT. CONSTANT CHANGING & EXPERIMENTING LEAVES NO BASIS FOR COMPARING FLIGHT RESULTS IN OTHER FIELDS.

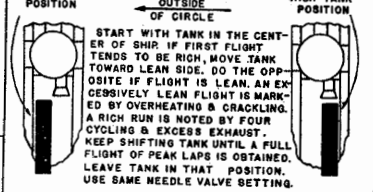


THERE ARE EXCELLENT NAME BRAND RACING FUELS ON THE MARKET BELOW ARE A FEW PROVEN FORMULAS FOR DEPENDABLE USE

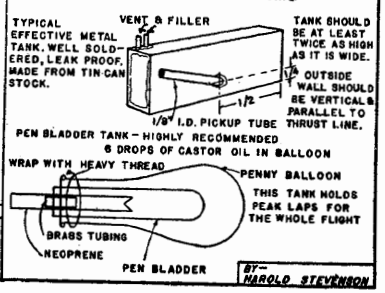
BREAK-IN FUEL	GOOD ALL AROUND FUEL	CONTEST FUEL
2 ½ PARTS METHANOL 1 PART CASTOR OIL	3 PARTS METHANOL 3 PARTS NITROMETHANE 2 PARTS CASTOR OIL	8 PARTS NITROMETHANE 7 PARTS METHANOL 5 PARTS CASTOR OIL 1 C.C. AMYL ACETATE PER PINT

5 A GOOD SPEED TANK IS ONE THAT WILL GIVE YOU PEAK ENGINE PERFORMANCE FOR THE REQUIRED NO. OF LAPS; NO MORE, NO LESS. MANY SPEED FLYERS USE TANKS MUCH TOO LARGE, HOPING TO JUDGE WHEN THE PEAK LAPS WILL OCCUR. BESIDE GIVING THE ENGINE UNNECESSARY WEAR, IT IS DIFFICULT TO OBTAIN CONSISTENT PEAK LAPS THIS WAY.

TRY THE METHOD BELOW FOR CONSTANT SPEEDS:

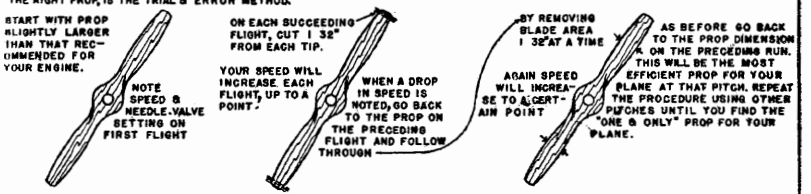


START WITH TANK IN THE CENTER OF SHIP. IF FIRST FLIGHT TENDS TO BE RICH, MOVE TANK TOWARD LEAN SIDE. DO THE OPPOSITE IF FLIGHT IS LEAN. AN EXCESSIVELY LEAN FLIGHT IS MARKED BY OVERHEATING & CRACKLING. A RICH RUN IS NOTED BY FOUR CYCLING & EXCESS EXHAUST. KEEP SHIFTING TANK UNTIL A FULL FLIGHT OF PEAK LAPS IS OBTAINED. LEAVE TANK IN THAT POSITION. USE SAME NEEDLE VALVE SETTING.



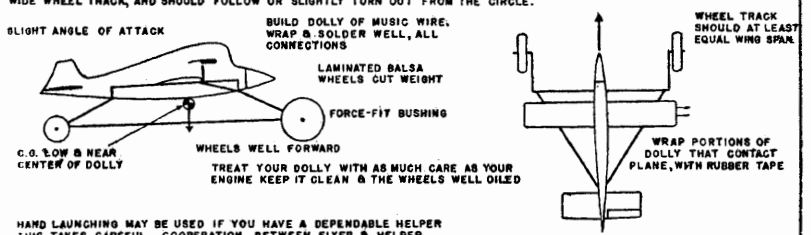
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6 THERE IS ONLY ONE PROPELLER THAT WILL GIVE PEAK SPEED FOR YOUR PARTICULAR ENGINE-PLANE COMBINATION. NO TWO SPEED JOBS WILL ATTAIN THEIR MAXIMUM SPEEDS WITH EXACTLY THE SAME PROP SADLY ENOUGH, THE ONLY PRACTICAL WAY TO FIND THE THE RIGHT PROP, IS THE TRIAL & ERROR METHOD.



WHEN YOU HAVE FOUND THE RIGHT PROP, MAKE UP A GOOD SUPPLY. FINISH YOUR PROPELLERS AS WELL AS YOU FINISH YOUR PLANE. DON'T MAKE BLADES TOO THIN, OR PITCH WILL CHANGE IN FLIGHT. NEVER FLY WITH AN UNBALANCED PROP: ENGINE DAMAGE WILL RESULT.

7 THE TAKE-OFF DOLLY YOU USE SHOULD HAVE THE FOLLOWING REQUIREMENTS- LIGHT IN WEIGHT, LOW CENTER OF GRAVITY, WIDE WHEEL TRACK, AND SHOULD FOLLOW OR SLIGHTLY TURN OUT FROM THE CIRCLE.



TREAT YOUR DOLLY WITH AS MUCH CARE AS YOUR ENGINE. KEEP IT CLEAN & THE WHEELS WELL OILED

HAND LAUNCHING MAY BE USED IF YOU HAVE A DEPENDABLE HELPER. THIS TAKES CAREFUL COOPERATION BETWEEN FLYER & HELPER

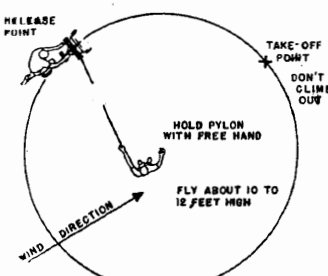
DOLLY TAKE-OFFS ARE RECOMMENDED FOR ALL AROUND CONSISTENT PERFORMANCE, ESPECIALLY FOR BEGINNERS

GIVE YOUR DOLLY A COAT OF FUEL PROOF PAINT, TO PREVENT RUSTING & CORROSION

8 MAKE UP YOUR CONTROL LINES CAREFULLY TO THE EXACT DIMENSIONS CALLED FOR IN A.M.A. RULES. THE LENGTH IS MEASURED FROM THE FRONT OF THE HANDLE TO THE CENTER LINE OF THE AIRPLANE. IF YOU ARE OVER THE LENGTH FOR YOUR CLASS, YOU WILL CUT DOWN ON YOUR SPEED. IF YOU ARE UNDER SIZE, YOU WILL NOT BE PERMITED TO FLY. FOLLOW THE DIRECTIONS IN THE A.M.A. RULE BOOK IN MAKING UP CONNECTIONS. KEEP YOUR LINES CLEAN & DRY WHEN THERE IS THE SLIGHTEST DOUBT ABOUT THE SAFTY OF LINES- DON'T FLY.

9 IF YOU ARE HAVING TROUBLE IN SPEED FLYING NOW OR IF YOU ARE CONTEMPLATING GOING INTO SPEED, START & START RIGHT NOW AND MAKE YOUR MOTTO CLEANLINESS. SEVENTY-FIVE PERCENT OF YOUR TROUBLES CAN BE ELIMINATED BY THE SIMPLE EXPEDIENT OF KEEPING YOUR PLANE, ENGINE, FUEL, LINES, DOLLY, TOOLS AND ALL YOUR EQUIPMENT CLEAN.

10 THE FIRST CONSIDERATION, WHEN GOING OUT FOR A DAYS SPEED FLYING, IS SAFTY. MAKE SURE ALL SPECTATORS ARE WELL BACK FROM THE CIRCLE. ALSO AN EXPERIENCED HELPER IS VALUABLE, IN SEEING THAT PROPER SAFTY MEASURES ARE TAKEN IF POSSIBLE FLY ON A SMOOTH, CLOSE-CROPPED GRASS FIELD. YOU WILL HAVE TO FLY OFF PAVEMENT AT MANY CONTESTS, WHICH IS ROUGH ON YOUR AIRPLANE. SO STICK TO GRASS WHEN PRACTICE FLYING.



NEVER SIGNAL FOR RELEASE UNLESS ENGINE IS RUNNING RIGHT

INSTRUCT YOUR HELPER TO REMOVE THE DOLLY FROM THE FLIGHT PATH AFTER TAKE-OFF. IN LANDING, "FLY" THE MODEL TO THE GROUND SPEED SHIPS HAVE A HIGH STALLING SPEED SO GET HER DOWN QUICKLY AND SMOOTHLY.



DON'T FLY THE PYLON LIKE THIS YOU WILL HAVE A HARD TIME KEEPING UP WITH A REALLY FAST RUN.



KEEP YOUR FEET IN CLOSE TO THE BASE OF THE PYLON

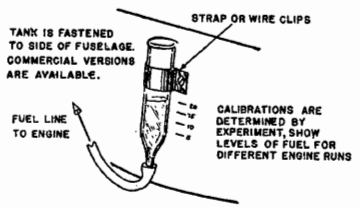
AFTER MANY TEST FLIGHTS, YOU WILL KNOW HOW LONG IT TAKES YOUR PLANE TO REACH PEAK SPEED. ANTICIPATE THIS AND SET ON THE PYLON AS SOON AS PEAK SPEED IS REACHED.

ONCE YOU HAVE IRONED OUT ALL THE "BUGS" IN YOUR SHIP, DON'T FLY EXCEPT IN COMPETITION. IF YOU BREAK THE NATIONAL SPEED RECORD AT YOUR LOCAL FIELD, IT DOESN'T GO IN THE RECORD BOOK. FLY ONLY WHEN IT COUNTS.

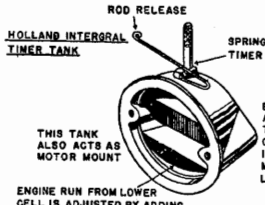
28. TANKS & TIMERS

FREE-FLIGHT

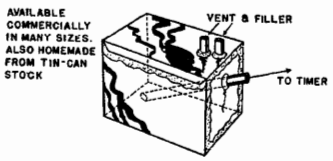
EYEDROPPER TANK



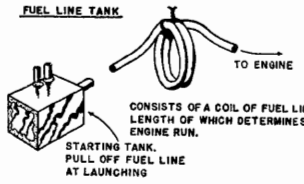
HOLLAND INTERGRAL TIMER TANK



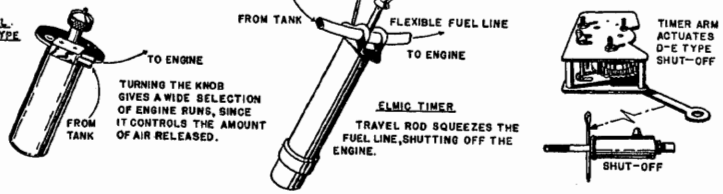
STANDARD TYPE F-F TANK



FUEL LINE TANK



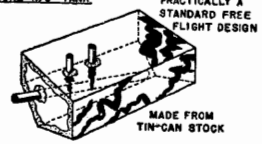
TIMERS TO LIMIT ENGINE RUNS



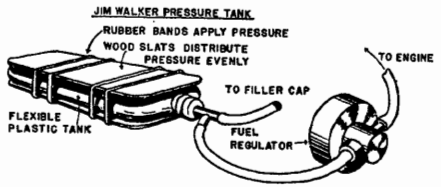
TANKS AND ACCESSORIES MAY BE BOUGHT TO FIT YOUR MODEL

RADIO-CONTROL

TYPICAL R/C TANK



JIM WALKER PRESSURE TANK

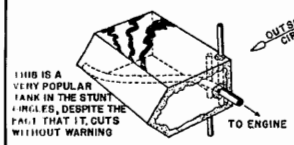


A VARIATION OF THE "CLANK TANK" IS ALSO USED IN R/C (SEE STUNT TANKS)

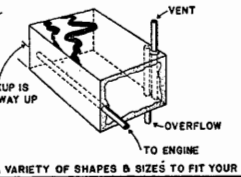
BY HAROLD STEVENSON

CONTROL-LINE STUNT, SPORT & FLYING SCALE

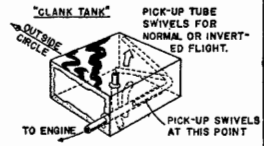
TYPICAL "WEDGE" TANK



SQUARE TYPE ONE OF THE BEST STUNT TANKS IN USE TODAY



"CLANK TANK"



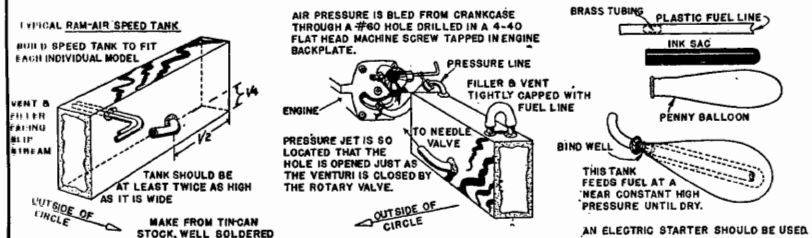
THIS TANK IS ALSO USED FOR AEROBATICS IN RADIO CONTROL F-F MODELS

STUNT TANKS MAY BE PURCHASED IN A VARIETY OF SHAPES & SIZES TO FIT YOUR MODELS

BLED

TRUE PRESSURE TANK

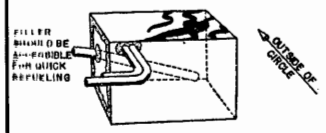
PEN-BLADDER PRESSURE TANK



AN ELECTRIC STARTER SHOULD BE USED.

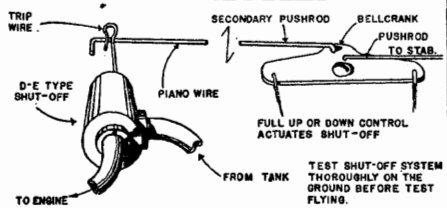
TEAM RACING

LENGTH X WIDTH X DEPTH MUST = NO MORE THAN 1.80 CU. IN.



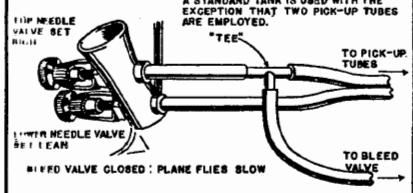
NO MORE THAN ONE OUNCE OF FUEL IS ALLOWED IN THE ENTIRE FUEL SYSTEM

TYPICAL TEAM RACER SHUT-OFF SYSTEM



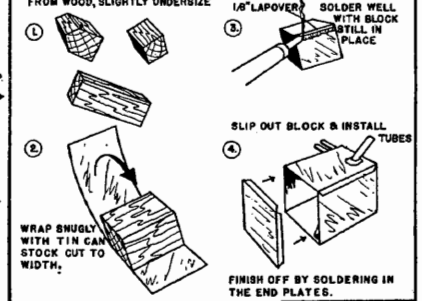
NAVY CARRIER EVENT

TWO-SPEED, TWO NEEDLE-VALVE SET-UP



LOCAL HOBBY-DEALERS CARRY PARTS FOR TWO-SPEED HOOK-UPS. THIS SYSTEM IS IDEAL FOR SMALL MODELS WHERE SPACE IS AT A PREMIUM.

TANK CONSTRUCTION

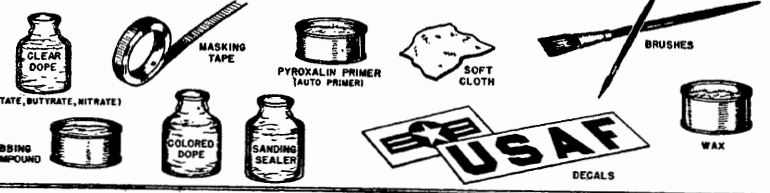


BY HAROLD STEVENSON

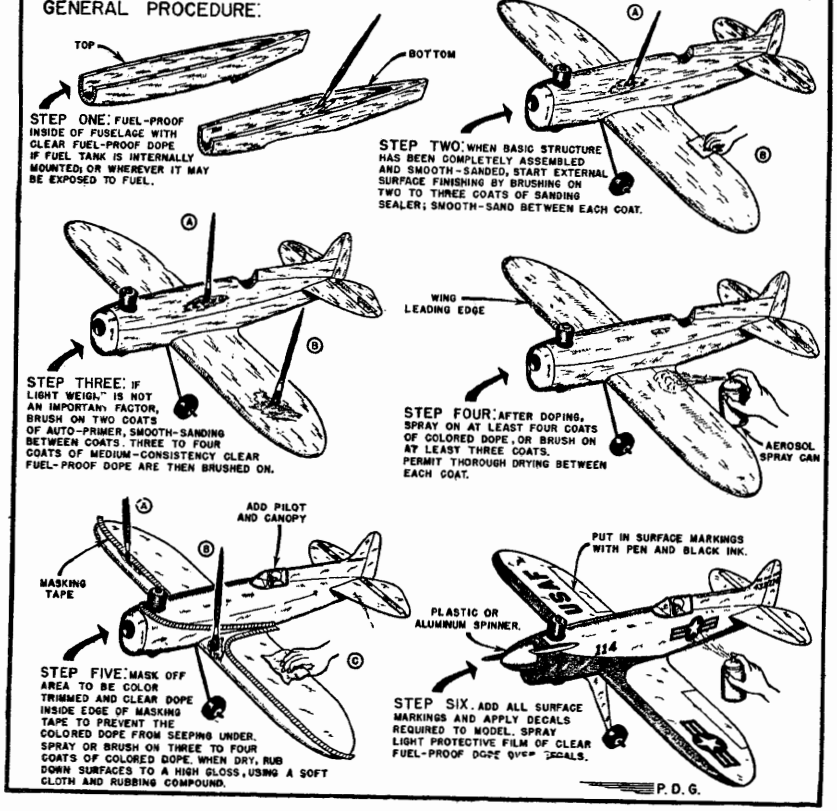
29. FINISHING & DECORATING

WOOD FINISHING:

MATERIALS REQUIRED

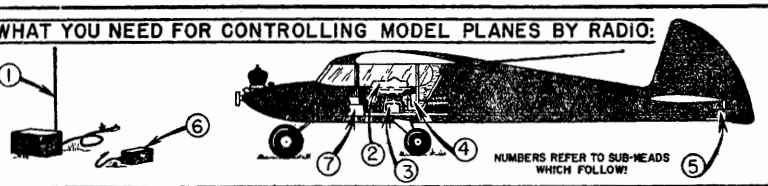


GENERAL PROCEDURE:

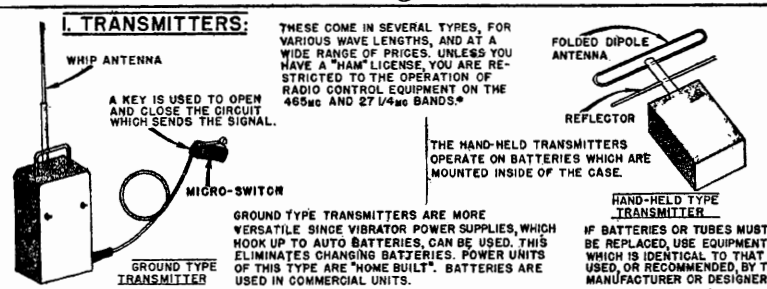


30. SINGLE CHANNEL RADIO CONTROL

WHAT YOU NEED FOR CONTROLLING MODEL PLANES BY RADIO:



1. TRANSMITTERS:



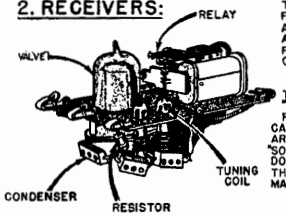
THESE COME IN SEVERAL TYPES, FOR VARIOUS WAVE LENGTHS, AND AT A WIDE RANGE OF PRICES. UNLESS YOU HAVE A "HAM" LICENSE, YOU ARE RESTRICTED TO THE OPERATION OF RADIO CONTROL EQUIPMENT ON THE 465MC AND 27 1/4MC BANDS.*

THE HAND-HELD TRANSMITTERS OPERATE ON BATTERIES WHICH ARE MOUNTED INSIDE OF THE CASE.

GROUND TYPE TRANSMITTERS ARE MORE VERSATILE SINCE VIBRATOR POWER SUPPLIES, WHICH HOOK UP TO AUTO BATTERIES, CAN BE USED. THIS ELIMINATES CHANGING BATTERIES. POWER UNITS OF THIS TYPE ARE "HOME BUILT". BATTERIES ARE USED IN COMMERCIAL UNITS.

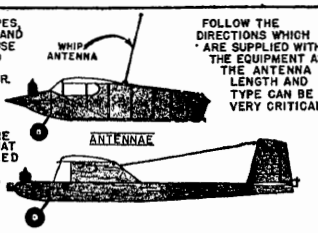
IF BATTERIES OR TUBES MUST BE REPLACED, USE EQUIPMENT WHICH IS IDENTICAL TO THAT USED, OR RECOMMENDED, BY THE MANUFACTURER OR DESIGNER.

2. RECEIVERS:



THESE COME IN SEVERAL TYPES FOR VARIOUS WAVE LENGTHS, AND AT A WIDE RANGE OF PRICES. USE A RECEIVER THAT IS DESIGNED FOR OPERATION ON THE SAME CHANNEL AS THE TRANSMITTER.

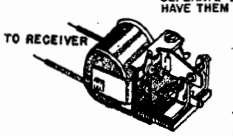
THE BASIC TYPES ARE THE "HARD VALVE" AND "SOFT VALVE" RECEIVERS. VACUUM VALVES ARE CALLED "HARD" WHILE THOSE THAT ARE FILLED WITH GAS ARE CALLED "SOFT". BOTH TYPES WORK WELL. DO NOT USE VALVES OTHER THAN THOSE RECOMMENDED BY THE MANUFACTURER OR DESIGNER!



FOLLOW THE DIRECTIONS WHICH ARE SUPPLIED WITH THE EQUIPMENT AS THE ANTENNA LENGTH AND TYPE CAN BE VERY CRITICAL!

3. RELAYS:

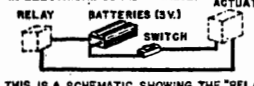
THESE COME IN SEVERAL TYPES AND ARE USUALLY PURCHASED AS SEPERATE UNITS. SOME RECEIVERS HAVE THEM BUILT IN



WHEN BUYING A RELAY CHOOSE ONE WITH A RESISTANCE VALUE OF ABOUT 8000 OHMS

THEY ARE ELECTRO-MAGNETIC SWITCHES.

RELAYS ARE USED TO CONTROL THE ACTUATOR CIRCUIT. THEY OPERATE ON THE RECEIVER'S CHANGE IN ELECTRICAL CURRENT VALUE.



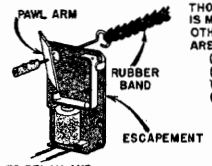
THIS IS A SCHEMATIC SHOWING THE "RELAY TO ACTUATOR" CIRCUIT. SOME UNITS NEED UP TO 6V. SO CHECK THE SPECIFICATIONS.

THE RELAY CONTACTS CAN BE ADJUSTED TO PROVIDE OPTIMUM OPERATION WITH ANY RECEIVER

4. ACTUATORS:

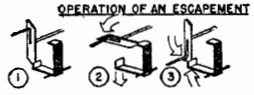
THESE COME IN SEVERAL TYPES AND AT A WIDE RANGE IN PRICE. THOUGH THE SIMPLE ESCAPEMENT IS MOST COMMON, THERE ARE MANY OTHERS IN USE. SOME OF THESE ARE:

(A) COMPOUND ESCAPEMENTS
(B) PULSE MOTORS
(C) SERVO MOTORS
(D) SOLENOIDS



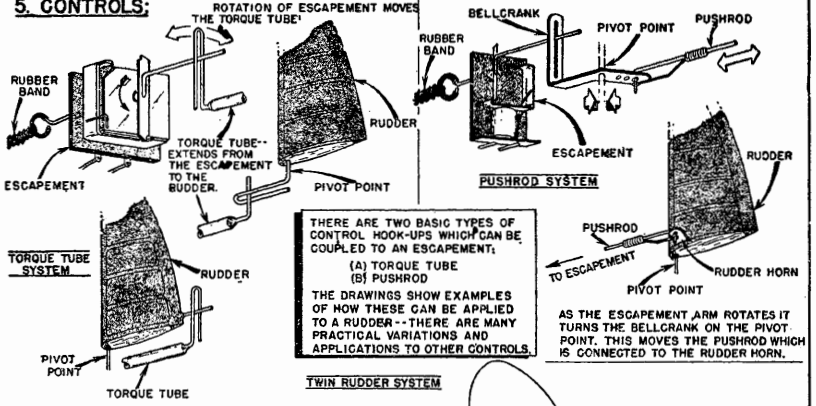
ESCAPEMENTS MOVE THE CONTROLS WITH POWER DERIVED FROM A WOUND RUBBER BAND OR SPRING.

OPERATION OF AN ESCAPEMENT



1. NO SIGNAL
2. SIGNAL ON--ARMATURE PULLS TOWARD COIL AND ALLOWS PAWL ARM TO MOVE 90°
3. NO SIGNAL--TURNS 90°

5. CONTROLS:



THERE ARE TWO BASIC TYPES OF CONTROL HOOK-UPS WHICH CAN BE COUPLED TO AN ESCAPEMENT:

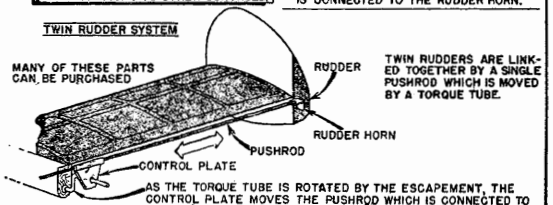
(A) TORQUE TUBE
(B) PUSHROD

THE DRAWINGS SHOW EXAMPLES OF HOW THESE CAN BE APPLIED TO A RUDDER--THERE ARE MANY PRACTICAL VARIATIONS AND APPLICATIONS TO OTHER CONTROLS.

AS THE ESCAPEMENT ARM ROTATES IT TURNS THE BELLCRANK ON THE PIVOT POINT. THIS MOVES THE PUSHROD WHICH IS CONNECTED TO THE RUDDER HORN.

THE MOVEMENT OF THE TORQUE TUBE FROM RIGHT TO LEFT IS APPLIED TO THE CONTROL SURFACE BY ONE OF THE CONTROL LINKAGES SHOWN ABOVE.

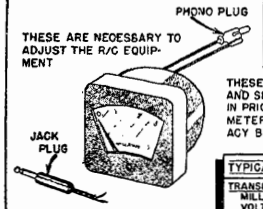
TWIN RUDDER SYSTEM



TWIN RUDDERS ARE LINKED TOGETHER BY A SINGLE PUSHROD WHICH IS MOVED BY A TORQUE TUBE.

AS THE TORQUE TUBE IS ROTATED BY THE ESCAPEMENT, THE CONTROL PLATE MOVES THE PUSHROD WHICH IS CONNECTED TO A RUDDER HORN ON EACH OF THE RUDDERS.

6. METERS:



THESE ARE NECESSARY TO ADJUST THE R/C EQUIPMENT

THESE COME IN VARIOUS TYPES AND SIZES AND AT A WIDE RANGE IN PRICE. THE HIGHER PRICED METERS OFFER GREATER ACCURACY BUT ARE NOT A NECESSITY.

TYPICAL METER VALUES.	
TRANSMITTER	
MILLAMPS	0-50
VOLTS	0-6, 0-150
RECEIVER	
MILLAMPS	0-3
VOLTS	0-6, 0-100

ALL OF THE METERS LISTED ARE DIRECT CURRENT (D.C.)

THE METERS SHOULD HAVE PLUGS ATTACHED TO THEM SO THAT THEY MAY BE READILY INSERTED INTO, OR REMOVED FROM, THE CIRCUITS WHICH MUST BE CHECKED FOLLOW THE MANUFACTURER'S OPERATING INSTRUCTIONS AT ALL TIMES!

ACCESSORIES:

SCREWDRIVERS ARE VERY POOR TOOLS FOR TUNING RADIO EQUIPMENT AS THE METAL IN THEM DISTURBS THE CIRCUIT



PLASTIC TUNING WANDS, SUCH AS TV REPAIRMEN USE, CAN BE OBTAINED AT ALL RADIO SUPPLY HOUSES. WHEN YOU TUNE YOUR EQUIPMENT DO NOT HOLD ON TO ANY PART OF IT AS THIS WILL ALSO DISTURB THE CIRCUIT. DOUBLE CHECK BY STANDING AWAY AND TESTING.

WHEN INSTALLING THE R/C EQUIPMENT IN YOUR MODEL YOU WILL NEED SMALL ACCESSORIES SUCH AS:

HOOK-UP WIRE
NUTS AND BOLTS
PLUG SOCKETS

HERE SOME OF THE OTHERS WHICH YOU WILL NEED.



KEEP A FEW SLIDE SWITCHES ON HAND. RECEIVERS USUALLY REQUIRE THE DOUBLE POLE-SINGLE THROW (DPST) TYPE. A SINGLE POLE-SINGLE THROW (SPST) TYPE IS USED IN OTHER PARTS OF MODEL, SUCH AS THE ACTUATOR CIRCUIT.

7. BATTERY EQUIPMENT:

THESE COME IN VARIOUS TYPES AND SIZES. IT IS NECESSARY TO CHOOSE THE TYPE WHICH IS BEST SUITED TO THE SIZE OF YOUR MODEL.





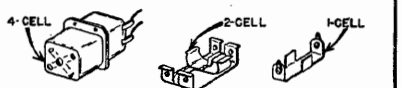
TRANSMITTER		RECEIVER	
B.103, B.136	90V+1-5V	B.122, B110	22-5 V
AD.1, D.18, D.19	1-5 V	B.123, B105	30 V
B.101	67-5 V	D.18, 1915	1-5 V

CONSULT YOUR LOCAL CHEMIST FOR HEARING AID BATTERIES!



THESE CHARTS LIST CODE NUMBERS OF BATTERIES THAT ARE COMMONLY USED WITH R/C EQUIPMENT.





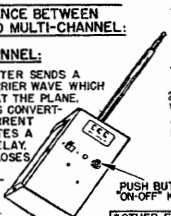
BATTERY BOXES ARE A CONVENIENT WAY TO MOUNT SMALL BATTERIES INTO A MODEL. THESE ARE AVAILABLE IN VARIOUS TYPES AND SIZES.

31. MULTI-CHANNEL RADIO CONTROL

THE DIFFERENCE BETWEEN SINGLE- AND MULTI-CHANNEL:

SINGLE-CHANNEL:

THE TRANSMITTER SENDS A 27.255 MC* CARRIER WAVE WHICH IS RECEIVED AT THE PLANE. THIS SIGNAL IS CONVERTED INTO A CURRENT WHICH OPERATES A SENSITIVE RELAY. THE RELAY CLOSES AND OPENS A PAIR OF ELECTRICAL CONTACTS THAT OPERATE THE CONTROL CIRCUIT. (SEE TM DATA SHEET NO. 11 FOR FULL DETAILS)



27.255 MEGACYCLE* CARRIER-WAVE IS AT RADIO FREQUENCY AND CANNOT BE HEARD BY THE HUMAN EAR.

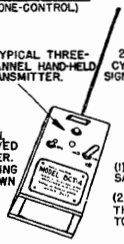
*OTHER EQUIPMENT IS AVAILABLE FOR 465 MEGACYCLE OPERATION.

MULTI-CHANNEL:

(TONE-CONTROL)



A TYPICAL THREE-CHANNEL HAND-HELD TRANSMITTER.



IN THE TRANSMITTER SHOWN, THE CONTROL STICK IS MOVED IN THIS MANNER. SEE THE WIRING DETAIL SHOWN BELOW FOR COMPLETE UNDERSIDE DETAILS.

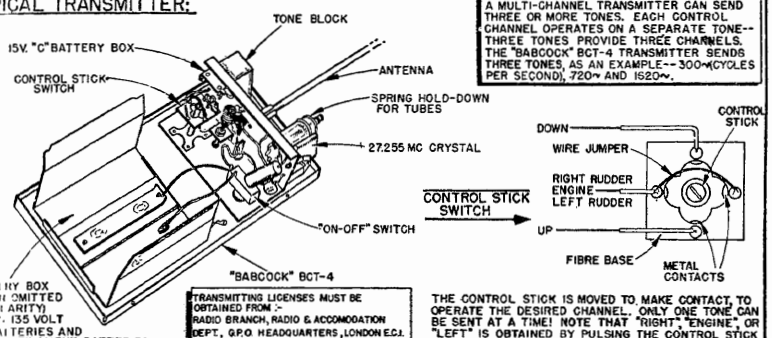


27.255 MEGACYCLE (MILLION CYCLES PER SECOND) BROADCAST SIGNAL IS A COMBINATION OF:

(1) A 27.255 MC CARRIER-WAVE -- SAME AS SINGLE-CHANNEL.

(2) AN AUDIBLE SOUND OR TONE. THE RECEIVER SORTS OUT THE TONE AND DISCARDS THE 27.255 MC.

TYPICAL TRANSMITTER:



A MULTI-CHANNEL TRANSMITTER CAN SEND THREE OR MORE TONES. EACH CONTROL CHANNEL OPERATES ON A SEPARATE TONE--THREE TONES PROVIDE THREE CHANNELS. THE "BABCOCK" BCT-4 TRANSMITTER SENDS THREE TONES, AS AN EXAMPLE--300~(CYCLES PER SECOND), 720~ AND 1620~.

TRANSMITTING LICENSES MUST BE OBTAINED FROM:-
RADIO BRANCH, RADIO & ACCOMODATION DEPT., G.P.O. HEADQUARTERS, LONDON E.C.1.
NO TESTS REQUIRED.

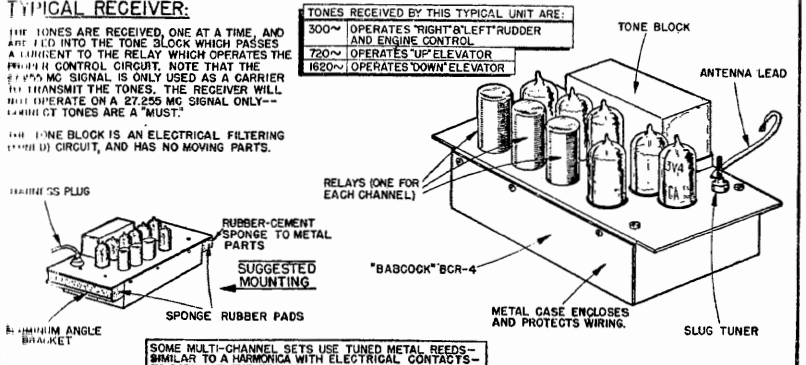
THE CONTROL STICK IS MOVED TO MAKE CONTACT, TO OPERATE THE DESIRED CHANNEL. ONLY ONE TONE CAN BE SENT AT A TIME! NOTE THAT "RIGHT", "ENGINE", OR "LEFT" IS OBTAINED BY PULSING THE CONTROL STICK BACK AND FORTH UNTIL THE MODEL RESPONDS TO THE PROPER CONTROL.

TYPICAL RECEIVER:

THE TONES ARE RECEIVED, ONE AT A TIME, AND ARE FED INTO THE TONE BLOCK WHICH PASSES A CURRENT TO THE RELAY WHICH OPERATES THE PROPER CONTROL CIRCUIT. NOTE THAT THE 27.255 MC SIGNAL IS ONLY USED AS A CARRIER TO TRANSMIT THE TONES. THE RECEIVER WILL NOT OPERATE ON A 27.255 MC SIGNAL ONLY--CORRECT TONES ARE A "MUST."

THE TONE BLOCK IS AN ELECTRICAL FILTERING (TUNED) CIRCUIT, AND HAS NO MOVING PARTS.

TONES RECEIVED BY THIS TYPICAL UNIT ARE:	
300~	OPERATES "RIGHT" & "LEFT" RUDDER AND ENGINE CONTROL
720~	OPERATES "UP" ELEVATOR
1620~	OPERATES "DOWN" ELEVATOR

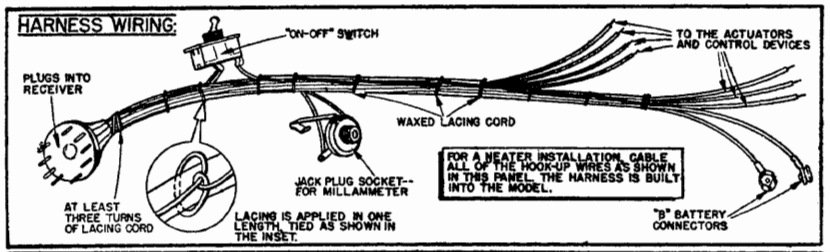


SOME MULTI-CHANNEL SETS USE TUNED METAL REEDS--SIMILAR TO A HARMONICA WITH ELECTRICAL CONTACTS--TO SORT OUT THE TRANSMITTED TONES.

BY BOB BURAGAS

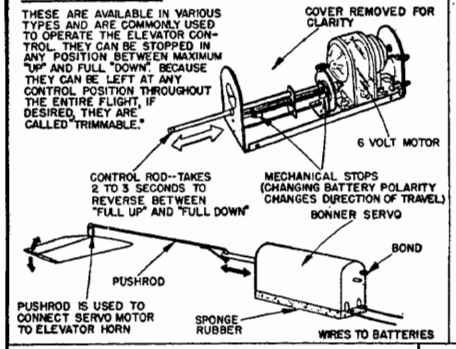
32. R/C CONTROL SYSTEMS

HARNESS WIRING:



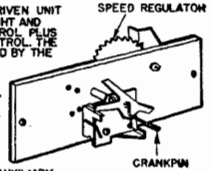
SERVO MOTORS:

THESE ARE AVAILABLE IN VARIOUS TYPES AND ARE COMMONLY USED TO OPERATE THE ELEVATOR CONTROL. THEY CAN BE STOPPED IN ANY POSITION BETWEEN MAXIMUM "UP" AND FULL "DOWN". BECAUSE THEY CAN BE LEFT AT ANY CONTROL POSITION THROUGHOUT THE ENTIRE FLIGHT, IF DESIRED, THEY ARE CALLED "TRIMMABLE."



COMPOUND ESCAPEMENT:

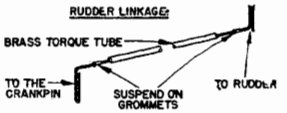
THIS IS A RUBBER-DRIVEN UNIT WHICH SUPPLIES RIGHT AND LEFT RUDDER CONTROL PLUS ONE AUXILIARY CONTROL. THE RUDDER IS ACTIVATED BY THE CRANKPIN.



THE AUXILIARY CONTROL IS HOOKED TO A PAIR OF ELECTRICAL CONTACTS WHICH CLOSE EVERY THIRD OPERATION.

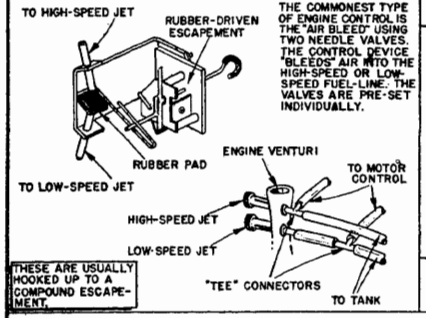
THE COMMONEST AUXILIARY CONTROL IS AN ENGINE CONTROL AND CUT-OFF.

RUDDER LINKAGE:



SEE "BONDING"- BELOW

MOTOR-CONTROL ESCAPEMENT:



THE COMMONEST TYPE OF ENGINE CONTROL IS THE "AIR BLEED" USING TWO NEEDLE VALVES. THE CONTROL DEVICE "BLEEDS" AIR INTO THE HIGH-SPEED OR LOW-SPEED FUEL-LINE. THE VALVES ARE PRE-SET INDIVIDUALLY.

THESE ARE USUALLY HOOKED UP TO A COMPOUND ESCAPEMENT.

ACCESSORY EQUIPMENT:

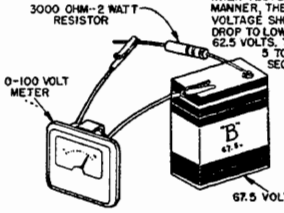
AS WITH SINGLE-CHANNEL R/C EQUIPMENT, IT IS NECESSARY TO HAVE AN ASSORTMENT OF MILLAMMETERS AND VOLTMETERS--OR A MULTIMETER.

A PLASTIC TUNING WAND IS A "MUST" FOR BEST RESULTS

HEADPHONES ARE NESSARY TO TUNE MOST RECEIVERS.



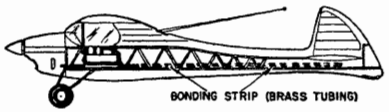
"B" BATTERY TEST:



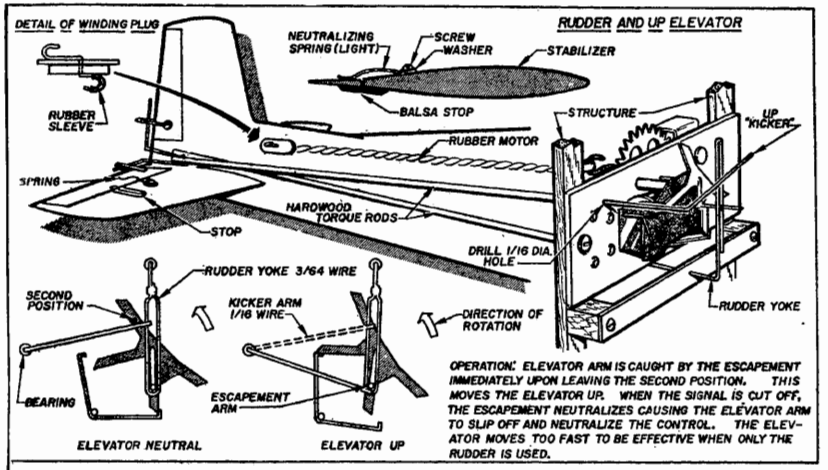
WHEN TESTED IN THIS MANNER, THE BATTERY VOLTAGE SHOULDN'T DROP TO LOWER THAN 62.5 VOLTS. TEST 5 TO 10 SECONDS!

BONDING:

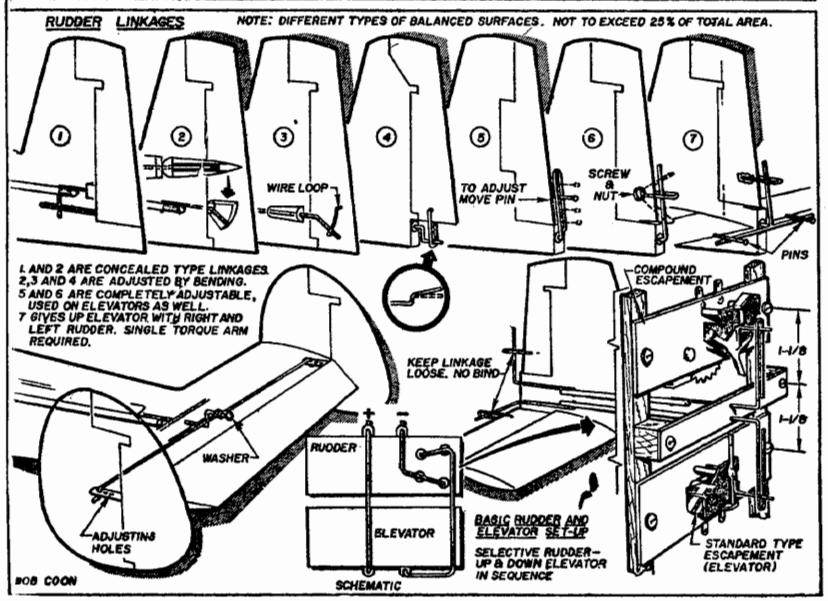
OPTIMUM PERFORMANCE RESULTS WHEN ALL OF THE METAL PARTS IN THE MODEL ARE BONDED TOGETHER ON A COMMON GROUND, EXCEPT ANTENNA!

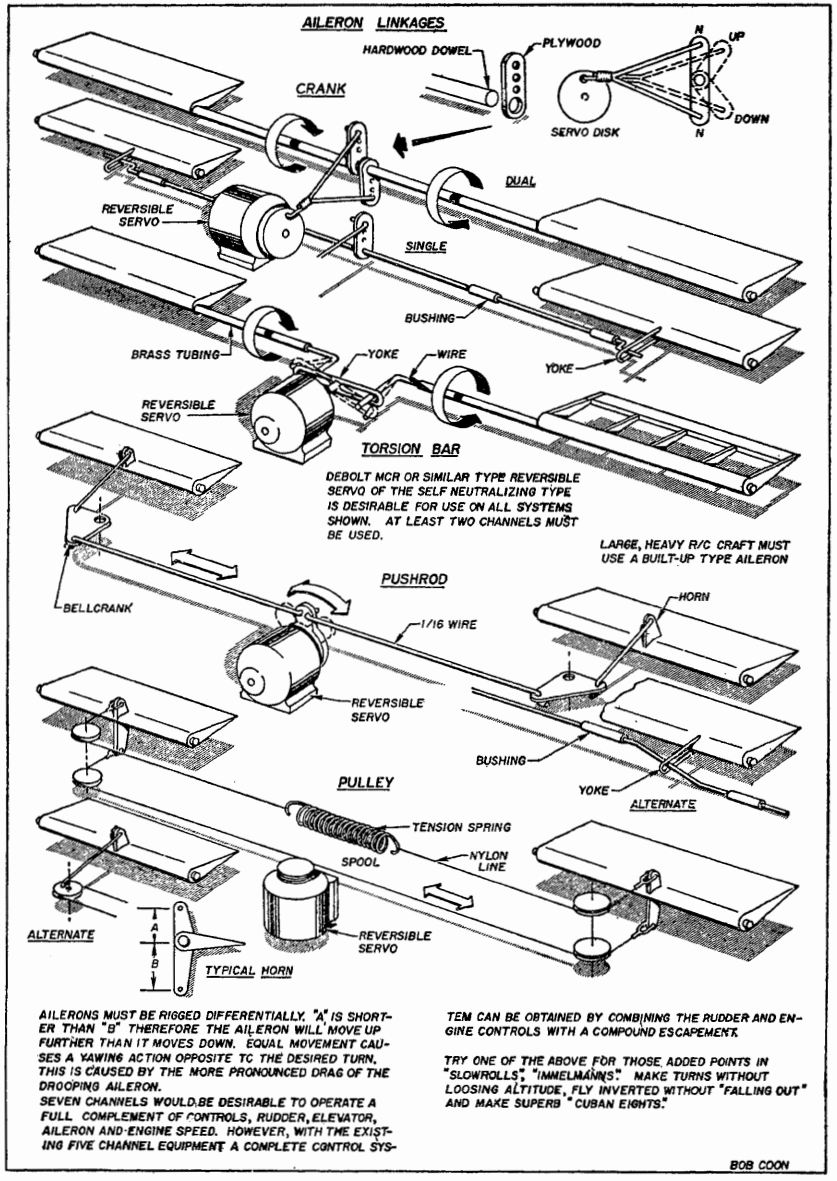


WIRE THE ENGINE, LANDING GEAR STRUTS, ACTUATOR CASES AND FRAMES, PUSHRODS, CONTROL HINGES, RECEIVER BASE, ETC. TO BONDING STRIP



OPERATION: ELEVATOR ARM IS CAUGHT BY THE ESCAPEMENT IMMEDIATELY UPON LEAVING THE SECOND POSITION. THIS MOVES THE ELEVATOR UP. WHEN THE SIGNAL IS CUT OFF, THE ESCAPEMENT NEUTRALIZES CAUSING THE ELEVATOR ARM TO SLIP OFF AND NEUTRALIZE THE CONTROL. THE ELEVATOR MOVES TOO FAST TO BE EFFECTIVE WHEN ONLY THE RUDDER IS USED.





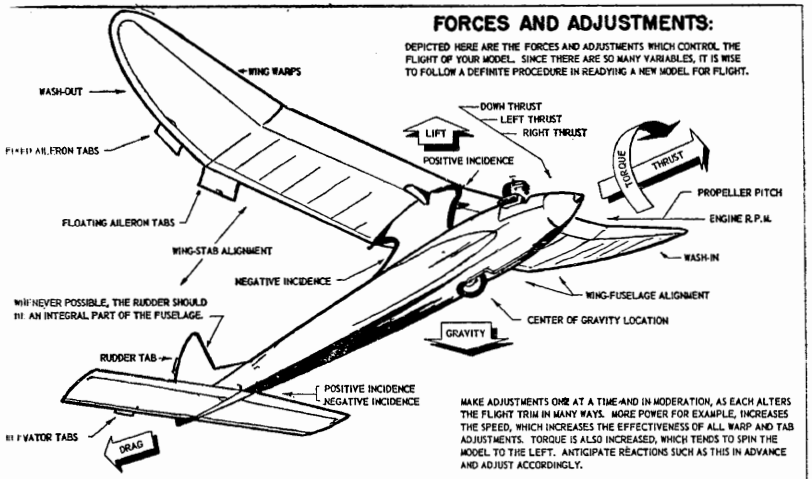
AILERONS MUST BE RIGGED DIFFERENTIALLY. "A" IS SHORTER THAN "B" THEREFORE THE AILERON WILL MOVE UP FURTHER THAN IT MOVES DOWN. EQUAL MOVEMENT CAUSES A YAWING ACTION OPPOSITE TO THE DESIRED TURN. THIS IS CAUSED BY THE MORE PRONOUNCED DRAG OF THE DROOPING AILERON.

SEVEN CHANNELS WOULD BE DESIRABLE TO OPERATE A FULL COMPLEMENT OF CONTROLS, RUDDER, ELEVATOR, AILERON AND ENGINE SPEED. HOWEVER, WITH THE EXISTING FIVE CHANNEL EQUIPMENT A COMPLETE CONTROL SYSTEM CAN BE OBTAINED BY COMBINING THE RUDDER AND ENGINE CONTROLS WITH A COMPOUND ESCAPEMENT.

TRY ONE OF THE ABOVE FOR THOSE ADDED POINTS IN "SLOWROLLS," "IMMELMANNS." MAKE TURNS WITHOUT LOOSING ALTITUDE, FLY INVERTED WITHOUT "FALLING OUT" AND MAKE SUPERB "CUBAN EIGHTS."

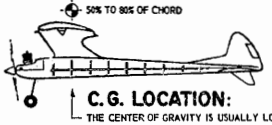
BOB COON

33. FREE FLIGHT TRIMMING



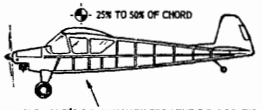
WASH-OUT:

WARPING TRAILING EDGE OF WING TIP DOWN IS CALLED WASH-OUT. THIS KEEPS THE FROM STALLING-OUT BEFORE THE MAIN PANELS.



C.G. LOCATION:

THE CENTER OF GRAVITY IS USUALLY LOCATED FURTHER BACK ON THE CHORD ON PYLON TYPES.



YOUR MODEL'S C.G. MAY VARY FROM THE C.G. LOCATION SHOWN ON THE KIT OR MAGAZINE PLANS, DUE TO SLIGHT DIFFERENCES IN WOOD WEIGHT, ENGINE WEIGHT ETC. THIS IS NOT CRITICAL, AND MAY BE ADJUSTED FOR.

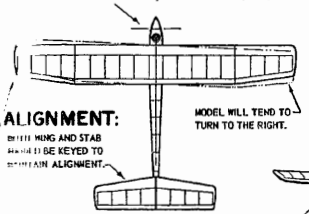
FLOATING AILERON:

SOME TIMES AN ADJUSTMENT IS REQUIRED FOR GLIDE TRIM ONLY. TRY A FREELY HINGED WEIGHTED CELLULOID TAB. IN CLIMB IT WILL HAVE VERY LITTLE EFFECT.

WASH-IN:

WARPING THE TRAILING EDGE OF WING TIP DOWN IS CALLED WASH-IN. WHEN MODEL IS IN TIGHT CIRCLE, THIS HELPS KEEP INSIDE WING UP.

TEST FLY WITH 0° SIDE THRUST UNLESS OTHERWISE ADVISED.



ALIGNMENT:

BOTH WING AND STAB SHOULD BE KEYED TO MAINTAIN ALIGNMENT.

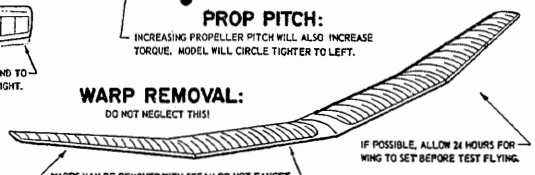
MODEL WILL TEND TO TURN TO THE RIGHT.

PROP PITCH:

INCREASING PROPELLER PITCH WILL ALSO INCREASE TORQUE. MODEL WILL CIRCLE TIGHTER TO LEFT.

WARP REMOVAL:

DO NOT NEGLECT THIS!



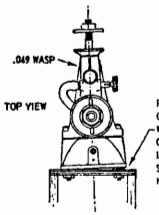
WARPS MAY BE REMOVED WITH STEAM OR HOT FAUCET WATER. TWIST SLIGHTLY IN OPPOSITE DIRECTION. HOLD OVER HEAT SOURCE UNTIL IT IS WELL SET

IF POSSIBLE, ALLOW 24 HOURS FOR WING TO SET BEFORE TEST FLYING.

YOUR WING STRUCTURE MUST BE STURDY, OR IT WILL NOT BE ABLE TO HOLD AN ADJUSTMENT.

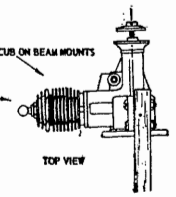
EITHER STAB MAY PURPOSELY BE MISALIGNED FOR TRIM ADJUSTMENTS. THIS IS NOT FOR BEGINNERS.

THRUST ADJUSTMENTS:



THE THRUST OF THE ENGINE IS OF PRIMARY IMPORTANCE IN CONTROLLING THE FLIGHT UNDER POWER. DOWN THRUST IS USED TO CONTROL LOOPING TENDENCIES, WHILE LEFT AND RIGHT SIDE THRUST CONTROL TURN IN CLIMB.

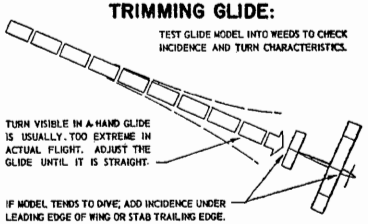
RADIALLY MOUNTED ENGINES MAY BE GIVEN SIDE AND DOWN THRUST WITH WASHERS INSERTED BEHIND CRANKCASE. IF TOO TIGHT TO LEFT UNDER LOW PBWER, ADD RIGHT THRUST IN SMALL DEGREES. IT MAY ALSO PROVE NECESSARY TO ADD MORE DOWNTHRUST.



ADDING LEFT OR RIGHT THRUST TO BEAM MOUNTED ENGINES IS MORE DIFFICULT. AT TIMES IT MAY BE POSSIBLE TO MOUNT YOUR ENGINE ON ITS SIDE AND ADD WASHERS ON MOUNTING BOLTS AS PICTURED HERE. OBLONG HOLES IN MOUNTS WILL ALLOW ADJUSTMENT.

TRIMMING GLIDE:

TEST GLIDE MODEL INTO WEEDS TO CHECK INCIDENCE AND TURN CHARACTERISTICS.



TURN VISIBLE IN A HAND GLIDE IS USUALLY TOO EXTREME IN ACTUAL FLIGHT. ADJUST THE GLIDE UNTIL IT IS STRAIGHT.

IF MODEL TENDS TO DIVE, ADD INCIDENCE UNDER LEADING EDGE OF WING OR STAB TRAILING EDGE.

NEVER INTERPRET THE DIP AFTER A STALL AS A DIVE.



STALLING:

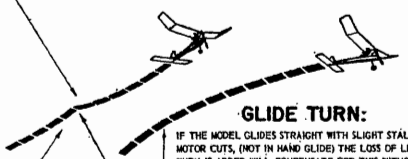
TEST GLIDE INTO THE WIND WITH THE NOSE DEPRESSED. IF A STALL IS DETECTED, ADD A THIN SLIVER OF WOOD UNDER THE TRAILING EDGE OF WING OR STAB LEADING EDGE. (NEG. INCIDENCE)

NEVER TRY TO GLIDE YOUR MODEL UPWARD.

WHEN PROPERLY ADJUSTED, YOUR MODEL WILL BE BUOYANT IN GLIDE, FLOATING GENTLY INTO A LANDING WITHOUT ANY TENDENCY TO STALL.



IF SLIGHT STALL INCREASES WITH EACH DIP, REMOVE A LITTLE INCIDENCE.

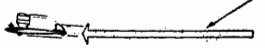


GLIDE TURN:

IF THE MODEL GLIDES STRAIGHT WITH SLIGHT STALL AFTER MOTOR CUTS, (NOT IN HAND GLIDE) THE LOSS OF LIFT WHEN TURN IS ADDED WILL COMPENSATE FOR THIS WITHOUT TRIM.

HITTING RISING AIR CURRENTS MAY CAUSE SLIGHT STALL IN GLIDE.

HAND LAUNCH MODEL INTO WIND IN LEVEL ATTITUDE. RUN WITH MODEL AND LET IT FLY OUT OF YOUR HAND.



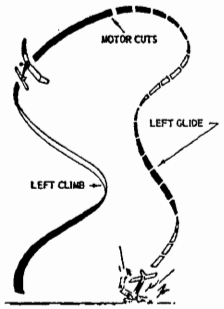
FIRST POWER FLIGHT:

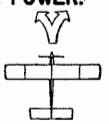
PLACE PROP ON BACKWARDS AND THROTTLE ENGINE DOWN. A CALM DAY AND A 10 SECOND MOTOR RUN IS ADVISED. TEST OVER WEEDS TO PREVENT DAMAGE IF IT SHOULD SPIRAL IN. OBSERVE POWER FLIGHT AND GLIDE FOR FURTHER TRIM.

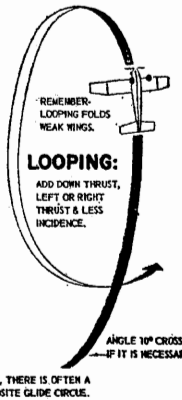
TURN UNDER POWER:

MOST PYLON JOBS CLIMB TO THE RIGHT WHILE SHOULDER WING AND CABIN AIRPLANES TRY TO CLIMB TO THE LEFT.

ALWAYS REMEMBER THAT INCREASING PROP PITCH OR ENGINE SPEED, WILL TIGHTEN CLIMB TOWARD LEFT. THIS CAN LOOP A PYLON OR SPIN IN A CABIN MODEL.

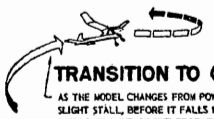






LOOPING:

ADD DOWN THRUST, LEFT OR RIGHT THRUST & LESS INCIDENCE.



TRANSITION TO GLIDE:

AS THE MODEL CHANGES FROM POWER TO GLIDE, THERE IS OFTEN A SLIGHT STALL, BEFORE IT FALLS INTO ITS OPPOSITE GLIDE CIRCLE. SHOULD IT HANG ON THE PROP, THIS STALL MAY BE VERY SEVERE. ADJUST FOR MORE SPIRAL IN CLIMB AND TRY TO GET MODEL TO ROLL OUT. TRIM GLIDE FOR MINIMUM LOSS OF ALTITUDE AFTER THE STALL.

ANGLE 10° CROSS-WIND IF IT IS NECESSARY.

DANGEROUS ADJUSTMENTS:

LEFT CLIMB AND GLIDE, OR RIGHT CLIMB AND GLIDE IS A LITTLE RISKY, SO BE CAREFUL. IF MODEL ACCELERATES TOO MUCH UNDER POWER, AND STARTS TO SPIN IN AS MOTOR CUTS, THE GLIDE TRIM WILL NOT ACT TO PULL MODEL OUT, AS WITH AN OPPOSITE CIRCLE.

D.A.M.

34. TROUBLE SHOOTING

(1) STALL
(2) DIVE

THE STALL

FLY LIKE THIS

IF YOUR MODEL STALLS AND RECOVERS GRADUALLY THEN IT IS CORRECTLY TRIMMED.

IF YOUR MODEL STALLS AND THE STALL BECOMES INCREASINGLY VIOLENT THEN THE MODEL IS INCORRECTLY TRIMMED AND RECOVERY IS IMPOSSIBLE.

DO NOT FLY LIKE THIS

THE DIVE

FLY LIKE THIS

NOTE: DO NOT CONFUSE A STALL WITH A DIVE.

IF YOUR MODEL DIVES AND SHOWS NO SIGN OF PULLING OUT THEN MODEL IS INCORRECTLY TRIMMED.

DO NOT FLY LIKE THIS.

STALL ADJUSTMENTS

(TRY ONE OR MORE OF THESE FOR GLIDE ADJUSTMENT)

TILT WING DOWN (DECREASING INCIDENCE) BY INSERTING THIN BALSA OR CARDBOARD WEDGE. INCREASE THICKNESS OF WEDGE AS NEEDED. BE CERTAIN WING REMAINS A LITTLE MORE INCLINED THAN STABILIZER.

OR:

TILT STABILIZER UP (INCREASING INCIDENCE) IF WING CANNOT BE TILTED, USING THIN BALSA OR CARDBOARD WEDGE. INCREASE THICKNESS OF WEDGE AS NEEDED.

OR:

ADD WEIGHT TO NOSE (MOVING CENTER OF GRAVITY FORWARD) TO RESTORE PROPER BALANCE.

OR:

SLIDE WING TOWARDS TAIL IF IT IS POSSIBLE TO DO SO, MOVING IT A LITTLE AT A TIME.

OR:

INCREASE STABILIZER AREA IF IT IS SMALL AS IN MOST SCALE MODELS.

OR:

POWER STALL ADJUSTMENT. TILT ENGINE OR NOSEBLOCK DOWNWARD, ADDING DOWNTHRUST BY INSERTING WEDGES, SHIMS OR OTHER MATERIAL BEHIND ENGINE OR NOSEBLOCK.

DIVE ADJUSTMENTS

(TRY ONE OR MORE OF THESE FOR DIVE ADJUSTMENT)

TILT WING UP (INCREASING INCIDENCE) BY INSERTING THIN BALSA OR CARDBOARD WEDGE. INCREASE THICKNESS OF WEDGE AS NEEDED.

OR:

TILT STABILIZER DOWN (DECREASING INCIDENCE) IF WING CANNOT BE TILTED, USING THIN BALSA OR CARDBOARD WEDGE. DO NOT RAISE STABILIZER MORE THAN WING.

OR:

ADD WEIGHT TO TAIL (MOVING CENTER OF GRAVITY REARWARD) TO RESTORE PROPER BALANCE. USE A GLOB OF CLAY FOR BALLAST.

OR:

SLIDE WING FORWARD IF IT IS POSSIBLE TO DO SO, MOVING IT A LITTLE AT A TIME.

OR:

DECREASE STABILIZER AREA IF IT APPEARS TO BE MUCH LARGER THAN NECESSARY.

OR:

FOR POWER DIVE ADJUSTMENT UPWARD (ADDING UPTHRUST) BY TILT ENGINE OR NOSEBLOCK INSERTING WEDGES, WASHERS OR OTHER MATERIAL BEHIND ENGINE OR NOSEBLOCK.

P.D.G.

(3) SPIN
(4) RECOVERY

