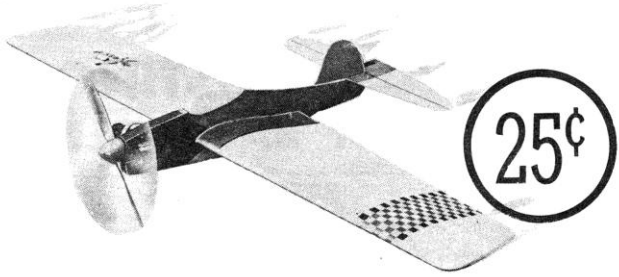
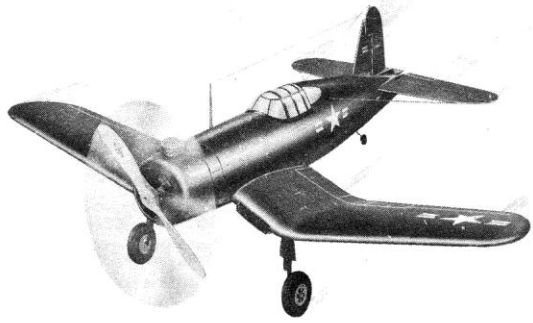
SECRETS OF MODEL AIRPLANE BUILDING

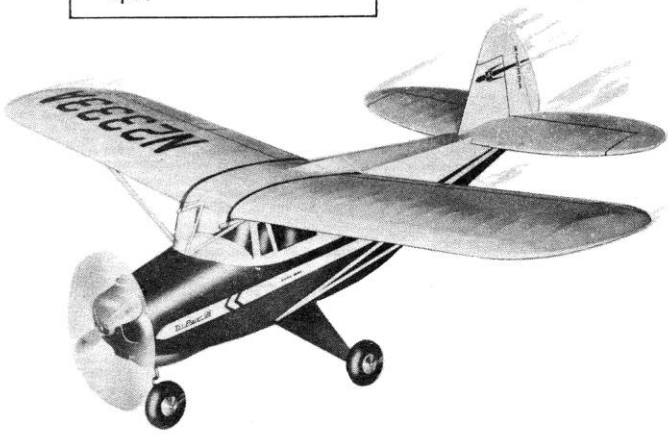


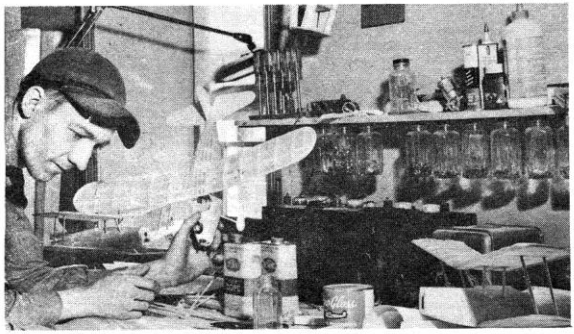
25¢

LEARN PROFESSIONAL SECRETS AND CONTEST WINNER TIPS!

- How to design and build.
- GAS and RUBBER power model tips.
- Fuselage construction and short cuts.
- Wing design and construction.
- Do's and Don'ts of covering and finishing.
- How to adjust for better flights.
- Secrets of successful controline systems.
- How to get the most of your Engine.
- And many, many more tips!







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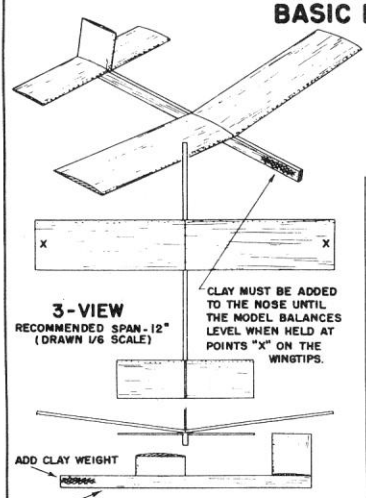
BUILDING - FLYING

AND ADJUSTING FUNDAMENTALS OF BASIC GLIDER DESIGN

BASIC DESIGN:



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

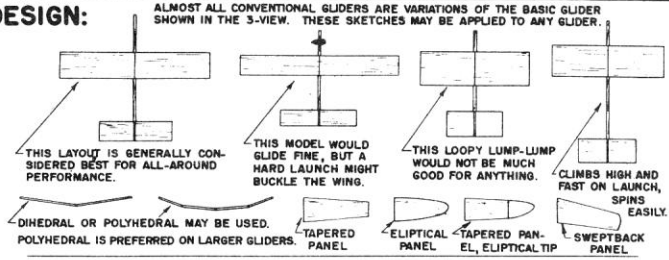
CLAY MUST BE ADDED TO THE NOSE UNTIL THE MODEL BALANCES LEVEL WHEN HELD AT POINTS "X" ON THE WINGTIPS.

ADD CLAY WEIGHT

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.

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



THIS LAYOUT IS GENERALLY CONSIDERED BEST FOR ALL-AROUND PERFORMANCE.

THIS MODEL WOULD GLIDE FINE, BUT A HARD LAUNCH MIGHT BUCKLE THE WING.

THIS LOOPY LUMP-LUMP WOULD NOT BE MUCH GOOD FOR ANYTHING.

CLIMBS HIGH AND FAST ON LAUNCH, SPINS EASILY.

DIHEDRAL OR POLYHEDRAL MAY BE USED. POLYHEDRAL IS PREFERRED ON LARGER GLIDERS.

TAPERED PANEL

ELIPTICAL PANEL

TAPERED PANEL, ELIPTICAL TIP

SWEPTBACK PANEL

WING CONSTRUCTION:

THE WING SHOULD BE FORMED FROM MEDIUM-SOFT SHEET BALSA.

WOOD GRAIN SHOULD BE STRAIGHT, EVEN, AND FREE FROM WARPS.

SEE SIZE CHART

IF BALSA IS TOO SOFT, THE WING MAY FOLD UP IN A HARD LAUNCH.

(SEE AIRFOIL CARVING DETAILS AT RIGHT)

GIVE WING A FINAL SANDING - MARK OFF CENTER - CUT WITH RAZOR BLADE.

WITH DIHEDRAL ADDED, BUTT ENDS WILL NOT MEET.

BEVEL WITH RAZOR FOR FLUSH FIT.

3/4" DIHEDRAL SHOULD BE ADDED FOR EVERY 6" OF WINGSPAN.

CLOSE INSPECTION OF END-GRAIN WILL REVEAL HUNDREDS OF PORES. YOU CAN ACTUALLY BREATHE AIR THROUGH THEM.

THESE PORES ABSORB MOST OF THE CEMENT. FOR THIS REASON THEY MUST FIRST BE GIVEN A PRELIMINARY COAT TO SEAL THEM OFF

SHEET WING STOCK AS SEEN FROM END VIEW.

BASICALLY THE AIRFOIL IS CARVED FROM A RECTANGLE.

THE AIRFOIL DEVELOPS LIFT BY CREATING A VACUUM.

THE BALSA WHICH IS REMOVED CUTS WEIGHT 25%.

FIRST CUT TO ROUGH AIRFOIL WITH A RAZOR BLADE.

THEN SAND OFF HIGH SPOTS, USING COARSE SANDPAPER.

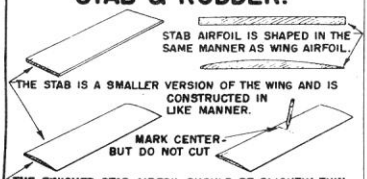
THE FINISHED AIRFOIL MAY LOOK AS SMOOTH AS THIS AFTER THE FINAL SANDING, BUT GLIDER POLISH IS STILL RECOMMENDED.

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:

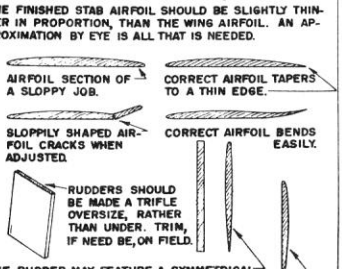


STAB AIRFOIL IS SHAPED IN THE SAME MANNER AS WING AIRFOIL.

THE STAB IS A SMALLER VERSION OF THE WING AND IS CONSTRUCTED IN LIKE MANNER.

MARK CENTER - BUT DO NOT CUT

THE FINISHED STAB AIRFOIL SHOULD BE SLIGHTLY THINNER IN PROPORTION, THAN THE WING AIRFOIL. AN APPROXIMATION BY EYE IS ALL THAT IS NEEDED.



AIRFOIL SECTION OF A SLOPPY JOB.

CORRECT AIRFOIL TAPERS TO A THIN EDGE.

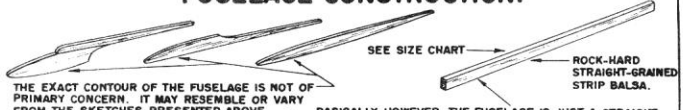
SLOPPILY SHAPED AIRFOIL CRACKS WHEN ADJUSTED.

CORRECT AIRFOIL BENDS EASILY.

RUDDERS SHOULD BE MADE A TRIFLE OVERSIZE, RATHER THAN UNDER. TRIM, IF NEED BE, ON FIELD.

THE RUDDER MAY FEATURE A SYMMETRICAL OR A LIFTING AIRFOIL WHICH AUTOMATICALLY INDUCES LEFT GLIDE CIRCLES. (REVERSE FOR RIGHT.)

FUSELAGE CONSTRUCTION:

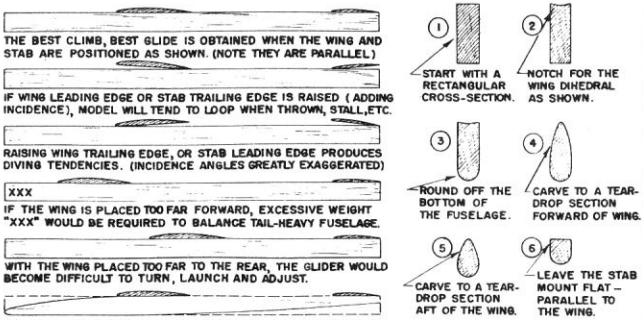


SEE SIZE CHART

ROCK-HARD STRAIGHT-GRAINED STRIP BALSA.

THE EXACT CONTOUR OF THE FUSELAGE IS NOT OF PRIMARY CONCERN. IT MAY RESEMBLE OR VARY FROM THE SKETCHES PRESENTED ABOVE. —

BASICALLY HOWEVER, THE FUSELAGE IS JUST A STRAIGHT STRIP OF BALSA, COUPLING THE WING AND TAIL SURFACES.



THE BEST CLIMB, BEST GLIDE IS OBTAINED WHEN THE WING AND STAB ARE POSITIONED AS SHOWN. (NOTE THEY ARE PARALLEL)

IF WING LEADING EDGE OR STAB TRAILING EDGE IS RAISED (ADDING INCIDENCE), MODEL WILL TEND TO LOOP WHEN THROWN, STALL, ETC.

RAISING WING TRAILING EDGE, OR STAB LEADING EDGE PRODUCES DIVING TENDENCIES. (INCIDENCE ANGLES GREATLY EXAGGERATED)

XXX

IF THE WING IS PLACED TOO FAR FORWARD, EXCESSIVE WEIGHT "XXX" WOULD BE REQUIRED TO BALANCE TAIL-HEAVY FUSELAGE.

WITH THE WING PLACED TOO FAR TO THE REAR, THE GLIDER WOULD BECOME DIFFICULT TO TURN, LAUNCH AND ADJUST.

A MAJOR DESIGN REFINEMENT WOULD SLICE EXCESS BALSA OFF, REDUCING WEIGHT 35%, INCREASING APPEARANCE 100%.

1 START WITH A RECTANGULAR CROSS-SECTION.

2 NOTCH FOR THE WING DIHEDRAL AS SHOWN.

3 ROUND OFF THE BOTTOM OF THE FUSELAGE.

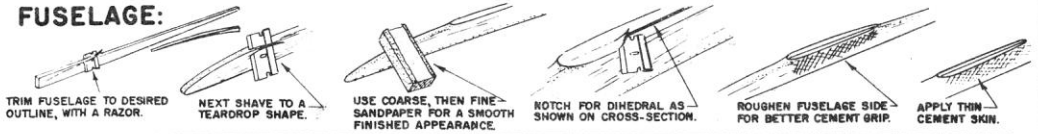
4 CARVE TO A TEAR-DROP SECTION FORWARD OF WING.

5 CARVE TO A TEAR-DROP SECTION AFT OF THE WING.

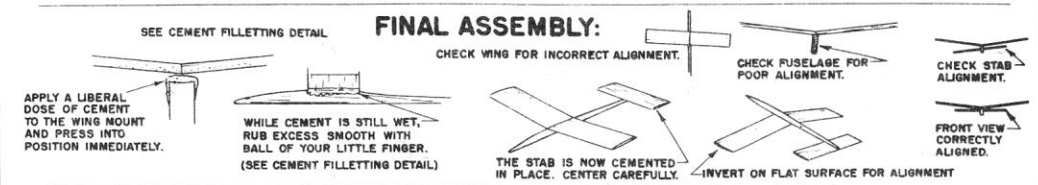
6 LEAVE THE STAB MOUNT FLAT — PARALLEL TO THE WING.

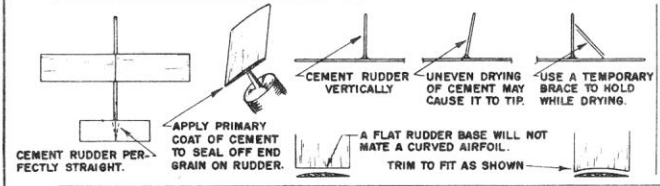
DJM

FUSELAGE:

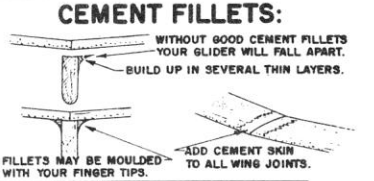


FINAL ASSEMBLY:

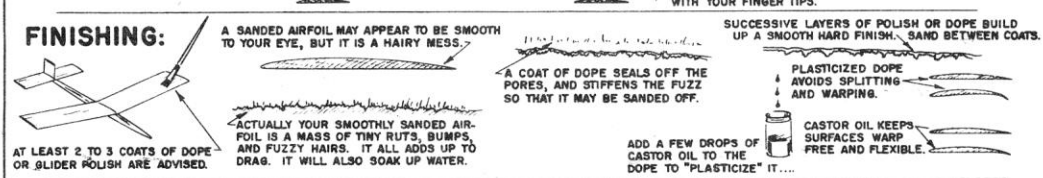




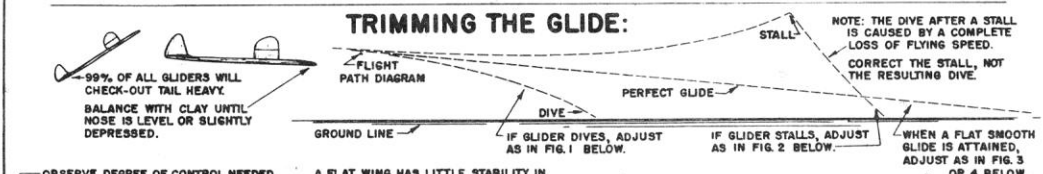
CEMENT FILLETS:

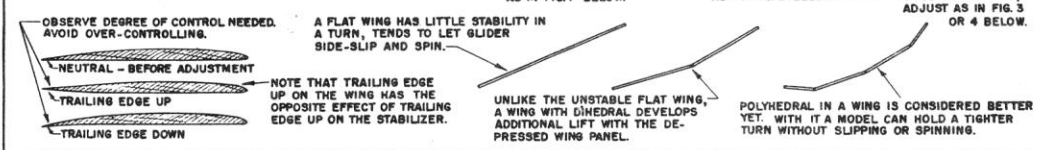


FINISHING:



TRIMMING THE GLIDE:

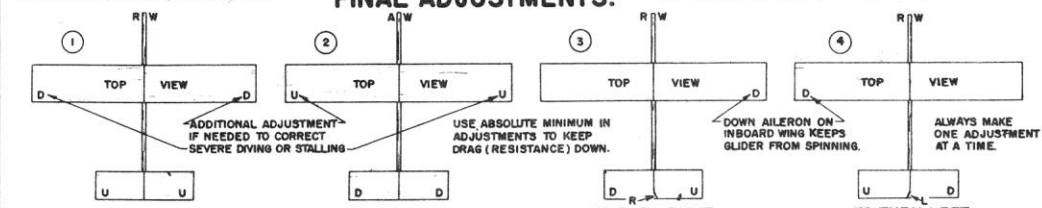




FINAL ADJUSTMENTS:

CODE: L=LEFT, R=RIGHT, D=DOWN, U=UP

AW=ADD A LITTLE WEIGHT, RW=REDUCE WEIGHT SLIGHTLY



IF DIVING: IF GLIDER GLIDES STRAIGHT, BUT TENDS TO DIVE, BEND STAB UP (STEAM WITH BREATH AND BEND) AND REDUCE WEIGHT.

IF STALLING: DO NOT INTERPRET A STALL AS A DIVE. REDUCE INCIDENCE ON STAB FIRST, THEN INCREASE WEIGHT IF NEED BE.

TO TURN RIGHT: TURN TO THE RIGHT INCREASES DIVING TENDENCIES. ANTICIPATE THIS BY REDUCING NOSE WEIGHT, ADDING AILERON.

TO TURN LEFT: LEFT TURN ALSO CAUSES A NOSE-DOWN ATTITUDE. ADJUST FOR A TIGHT CIRCLE, FLAT GLIDE, WITHOUT A STALL OR SPIN.

OPTIONAL LAUNCHING METHODS:

RIGHT HAND LAUNCH:

IF YOU THROW WITH YOUR RIGHT HAND, THE GLIDER MUST BE ADJUSTED TO GLIDE IN LEFT CIRCLES.

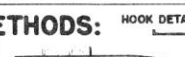
BANK GLIDER TO THE RIGHT AND HEAVE AT AN UPWARD ANGLE. AT TOP OF CLIMB THE LEFT CIRCLE SHOULD TAKE EFFECT.

LEFT HAND LAUNCH:

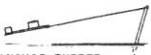
IF YOU LAUNCH LEFT HANDED, THE GLIDER MUST BE BANKED TO THE LEFT AND UP, AND ADJUSTED FOR RIGHT CIRCLES.

WITH CARE IN ADJUSTING AND SKILL IN LAUNCHING, IT IS POSSIBLE TO HIT 100 FT. ALTITUDE WITH A GLIDER.

HOOK DETAIL



CATAPULTING WITH 4 TO 8 STRANDS OF 3/16" RUBBER WILL ACHIEVE TRIPLE THE ALTITUDE OF A HAND LAUNCH.



ANCHOR RUBBER POST FIRMLY IN GROUND, AND LAUNCH AS SHOWN.

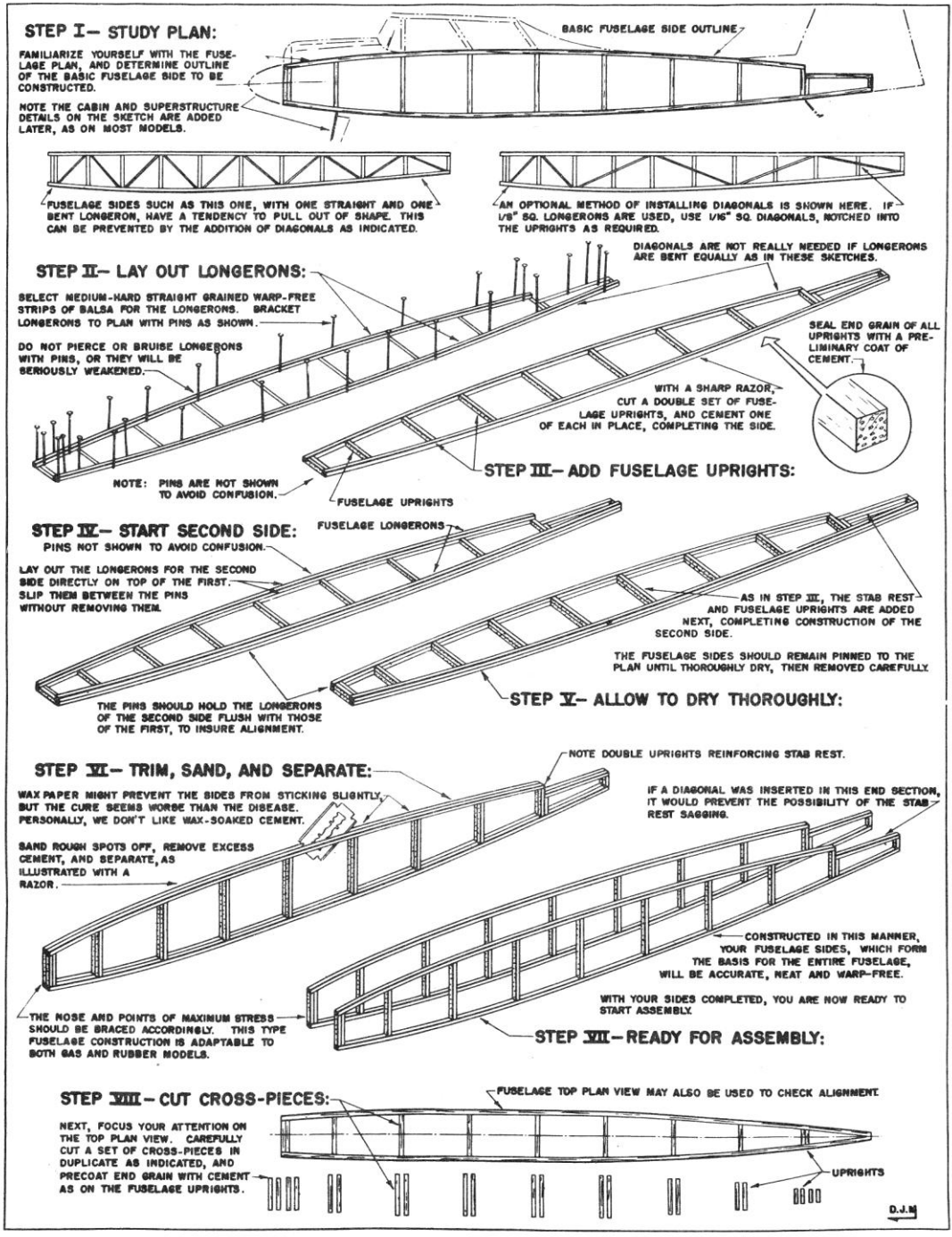
THIS DESIGN MAY BE MODIFIED AND IMPROVED.

MASTER THE HAND LAUNCH GLIDER, THEN APPLY THE LESSONS LEARNED TO POWERED MODELS, BOTH FREE-FLIGHT AND CONTROLINE.

DJM

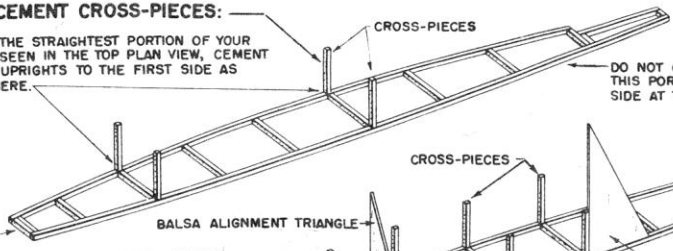
CONCLUSION: THIS IS THE FIRST OF A SERIES OF ILLUSTRATED DATA SHEETS, DESIGNED TO BETTER AQUAINT NEW MODELERS WITH VARIOUS DESIGN CONSTRUCTION AND OTHER ASPECTS OF THE HOBBY. KEEP THIS INFORMATION HANDY FOR YOUR OWN REFERENCE AS WELL AS YOUNGER BUILDERS IN YOUR NEIGHBORHOOD.

BUILT-UP
FUSELAGE CONSTRUCTION

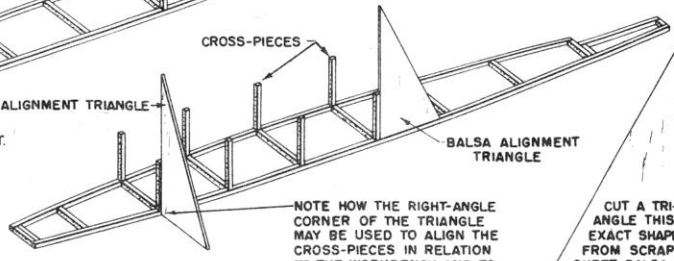


STEP IX— CEMENT CROSS-PIECES:

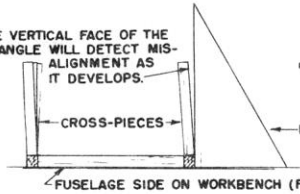
STARTING WITH THE STRAIGHTEST PORTION OF YOUR FUSELAGE, AS SEEN IN THE TOP PLAN VIEW, CEMENT THE REQUIRED UPRIGHTS TO THE FIRST SIDE AS ILLUSTRATED HERE.



DO NOT ADD CROSS-PIECES TO NOSE AS YET.



THE VERTICAL FACE OF THE TRIANGLE WILL DETECT MISALIGNMENT AS IT DEVELOPS.



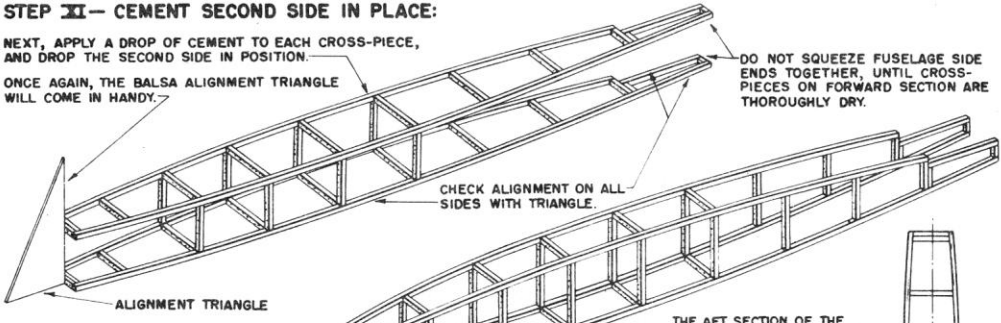
STEP X— ALIGN CROSS-PIECES:

STEP XI— CEMENT SECOND SIDE IN PLACE:

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

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

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

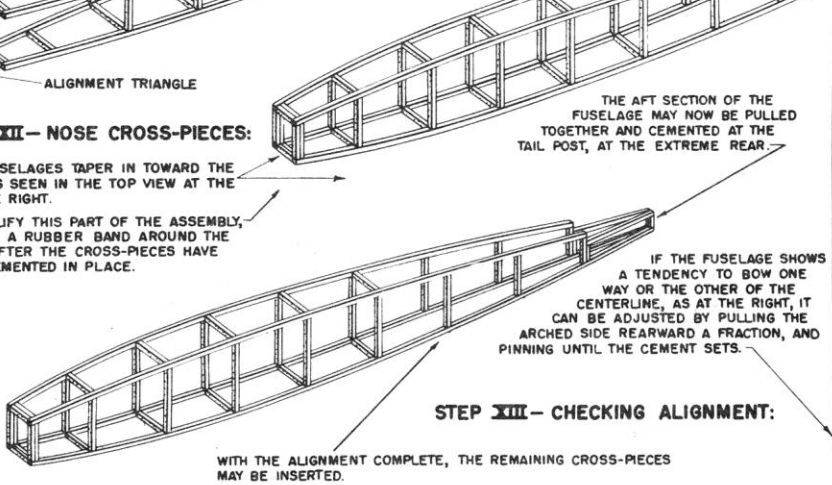


THE AFT SECTION OF THE FUSELAGE MAY NOW BE PULLED TOGETHER AND CEMENTED AT THE TAIL POST, AT THE EXTREME REAR.

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.



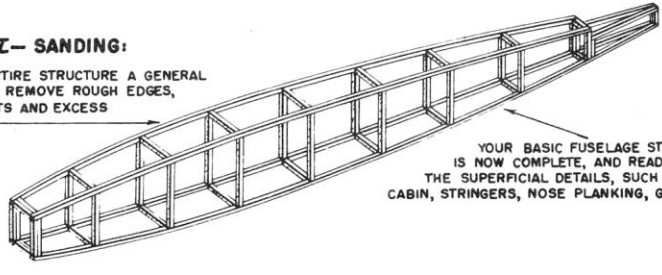
IF THE FUSELAGE SHOWS A TENDENCY TO BOW ONE WAY OR THE OTHER OF THE CENTERLINE, AS AT THE RIGHT, IT CAN BE ADJUSTED BY PULLING THE ARCHED SIDE REARWARD A FRACTION, AND PINNING UNTIL THE CEMENT SETS.

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

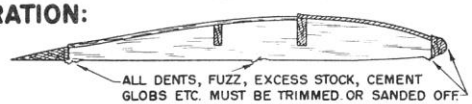
COVERING & FINISHING

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.

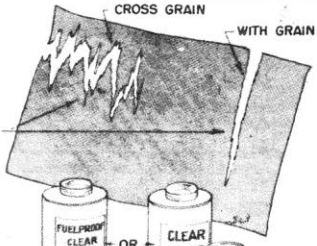
SILKSPAN: WHITE ONLY – APPLY WET OR DRY – CAN BE APPLIED WET OVER COMPOUND CURVES.
SKYSAIL: COLORS ONLY – APPLY WET OR DRY – CAN BE APPLIED WET OVER COMPOUND CURVES.
JAP TISSUE: SCARCE AS HEN'S TEETH. LIGHT – REQUIRES LESS DOPE – MUST BE APPLIED DRY.
CHINA SILK: DIE TO DESIRED COLOR – VERY DURABLE – 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:

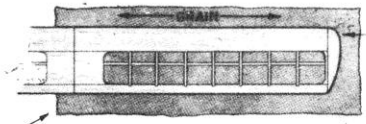


ALL DENTS, FUZZ, EXCESS STOCK, CEMENT GLOBS ETC. MUST BE TRIMMED OR SANDED OFF.

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.

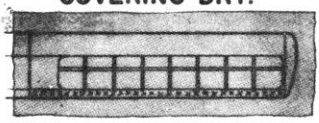
GRAIN RUNNING CHORDWAYS CAUSES SAG BETWEEN RIBS.

MATERIALS:

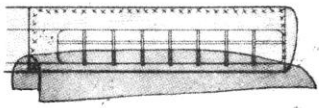
FOR GLOW-PLUG POWERED MODELS, EITHER FUELPROOF CLEAR DOPE OR REGULAR DOPE AND HOT-FUEL PROOFER IS NEEDED, – ALSO, PINS, RAZORS, BRUSHES AND COVERING.

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

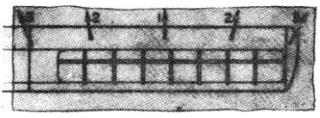
COVERING DRY:



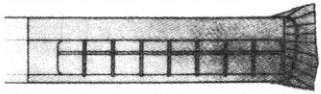
STEP I – CUT A LARGE ENOUGH PIECE OF COVERING MATERIAL FOR CONVENIENCE.



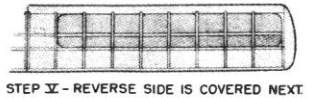
STEP II – APPLY THICKENED DOPE TO T.E., THEN PRESS TISSUE IN PLACE. WHEN DRY ADD DOPE AS INDICATED BY "X" MARKS



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.

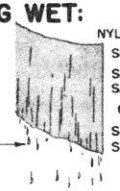
DOUBLE-COVER YOUR MODEL IF YOU SEE FIT. A FEW COATS OF CLEAR DOPE SHOULD BE APPLIED TO THE FIRST LAYER. DOPE SECOND LAYER ON TO AVOID AIR BUBBLES. CROSS-GRAIN TISSUE TO LOCALIZE PUNCTURES.

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.

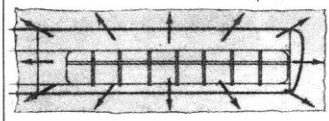
WHEN COVERING WITH WET TISSUE, THE DOPE APPLIED TO HOLD THE TISSUE WILL BLUSH. IF WEATHER IS DRY, IT WILL DISAPPEAR WHEN DOPED.

COVERING WET:

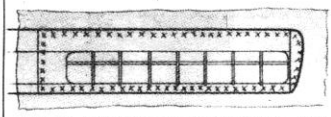
SATURATE TISSUE IN OPEN PAN OF COOL WATER.



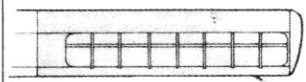
BLOT OR SHAKE OFF EXCESS MOISTURE, BEFORE COVERING.



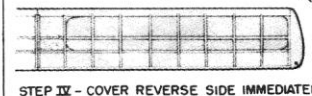
PULL TAUT AND FREE OF WRINKLES AS SHOWN BY ARROWS. KEEP DAMPENING.



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



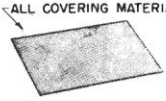
STEP III – TRIM WITH RAZOR AND DOPE DOWN EDGES. (THICK DOPE)



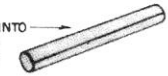
STEP IV – COVER REVERSE SIDE IMMEDIATELY.

D.J.M

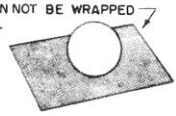
ALL COVERING MATERIAL, WHETHER SILK OR TISSUE, IS ESSENTIALLY AS FLAT AS A PANCAKE.



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



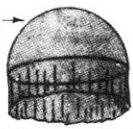
HOWEVER, IT CAN NOT BE WRAPPED AROUND A BALL (WHEN DRY) WITHOUT WRINKLING.



BUT- HALF A BALL IS HALF THE PROBLEM.

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

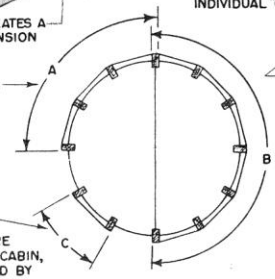
WETTING SILKSPAN, SKYSAIL OR SILK ALLOWS THE FIBRES UNDER PRESSURE TO STRETCH. PULL TO SHAPE SLOWLY, CAREFULLY.



COMPOUND CURVATURES:

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

THE TAPERING AIRFOIL CREATES A CURVE IN THE THIRD DIMENSION



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

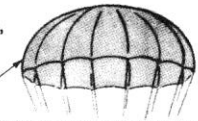
SEG. A- INDICATES AREA WHICH MAY BE COVERED WITH WET TISSUE.

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

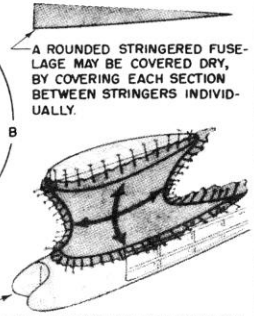
SEG. C- DRY TISSUE.

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

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



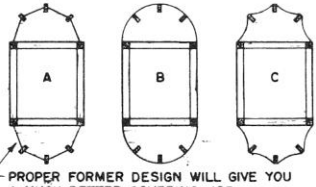
A ROUNDED STRINGERED FUSELAGE MAY BE COVERED DRY, BY COVERING EACH SECTION BETWEEN STRINGERS INDIVIDUALLY.



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

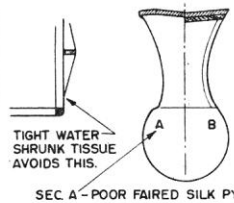
FORMERS DO NOT TOUCH SILK!

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.

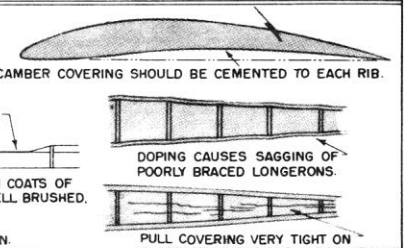


TIGHT WATER SHRUNK TISSUE AVOIDS THIS.

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

ADHESION

USE THIN COATS OF DOPE, WELL BRUSHED.



UNDERCAMBER COVERING SHOULD BE CEMENTED TO EACH RIB.

DOPING CAUSES SAGGING OF POORLY BRACED LONGERONS.

PULL COVERING VERY TIGHT ON SHORTEST DIMENSIONS. AVOIDS WRINKLE.

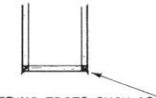
DOPING:

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 ANYWAY. FORGET IT!

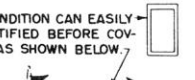
SOAK-OUT

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.

DECALS:

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

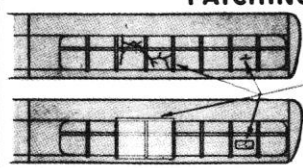
GLOW FUEL RUINS UNDOPED DECALS.

FUELPROOF DOPE OR FUEL PROOFER MAY CAUSE BUBBLING EFFECT.

TISSUE

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

PATCHING:



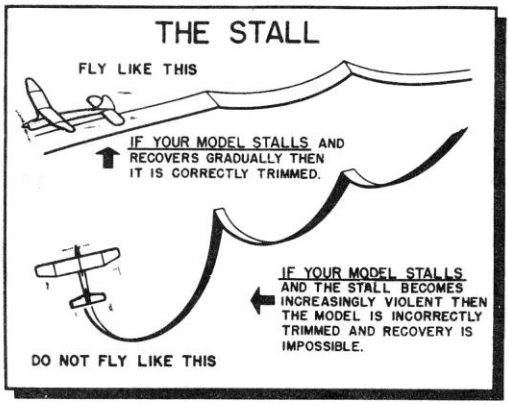
REMOVE RIPPED COVERING WITH A RAZOR. WHENEVER POSSIBLE REMOVE A BIT OF SURROUNDING TISSUE SO PATCH MAY BE CEMENTED TO WOOD, ELIMINATING DOUBLE-COVERING EFFECT. WATER AND DOPE TO MATCH.

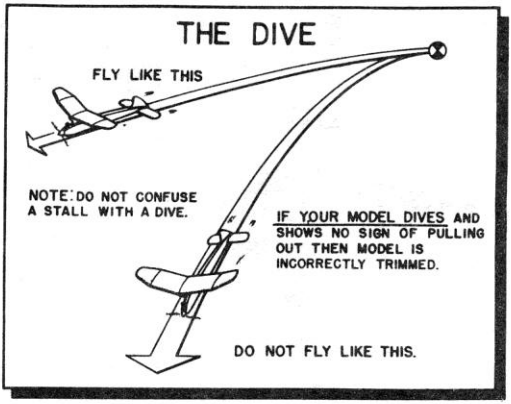
D.J.M

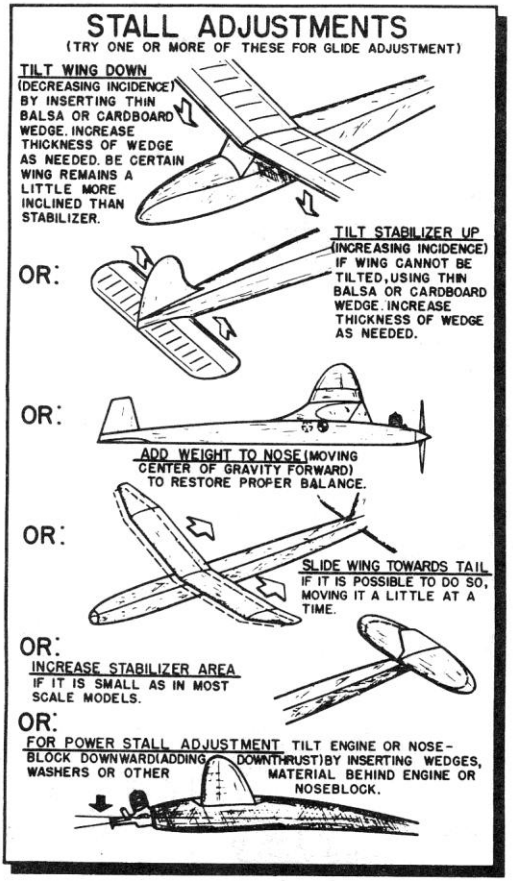
TROUBLE SHOOTING

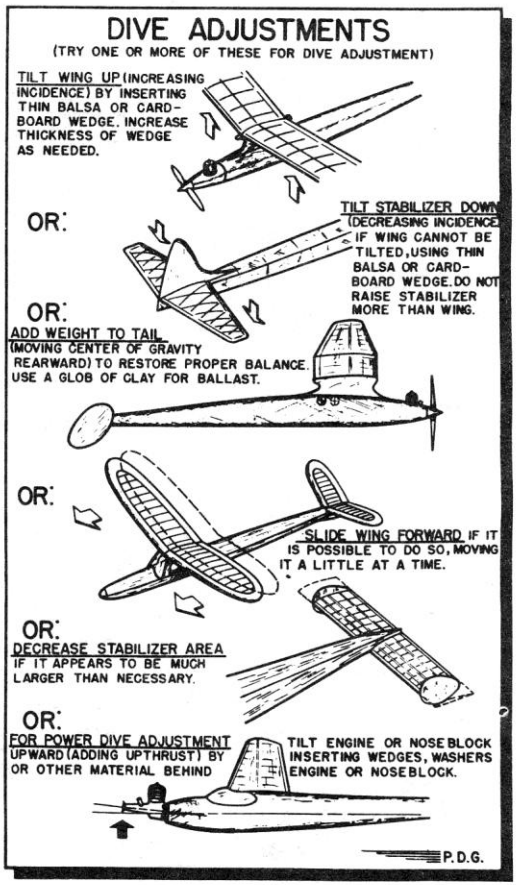
● The drawings on these pages illustrate the basic types of improper flight along with some of the solutions which are commonly used. But, remember, correct flight adjustments are difficult to achieve when you have to combat structural or design defects. So, before you start trimming your model for flight, make preflight checks to see that everything has been done according to the plan and the designer's specifications.

The power plant you use is a very im-







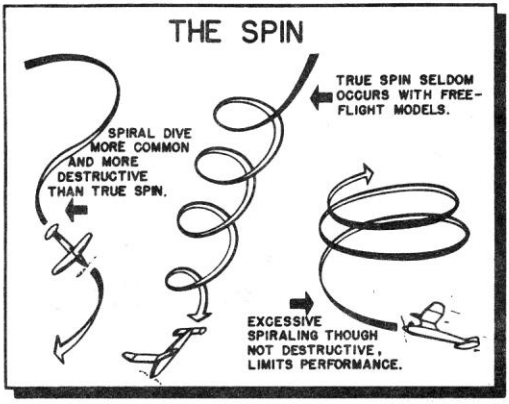


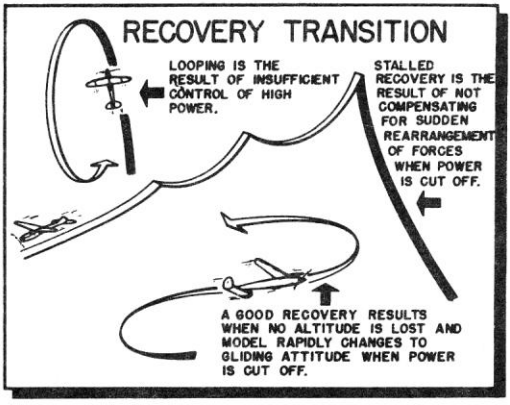
AND ADJUSTING FOR BETTER FLIGHTS

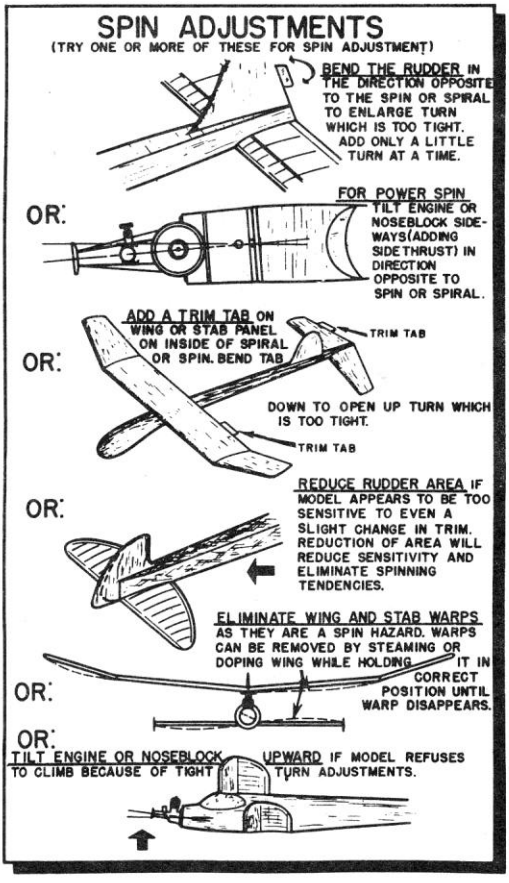
portant factor. If it is larger than that which has been recommended, you will have to exert extra caution when adjusting. On the other hand, a smaller power plant gives you more leeway. Top-notch flights will depend on how good the adjustments are for the power that is available for the climb—and the glide trim.

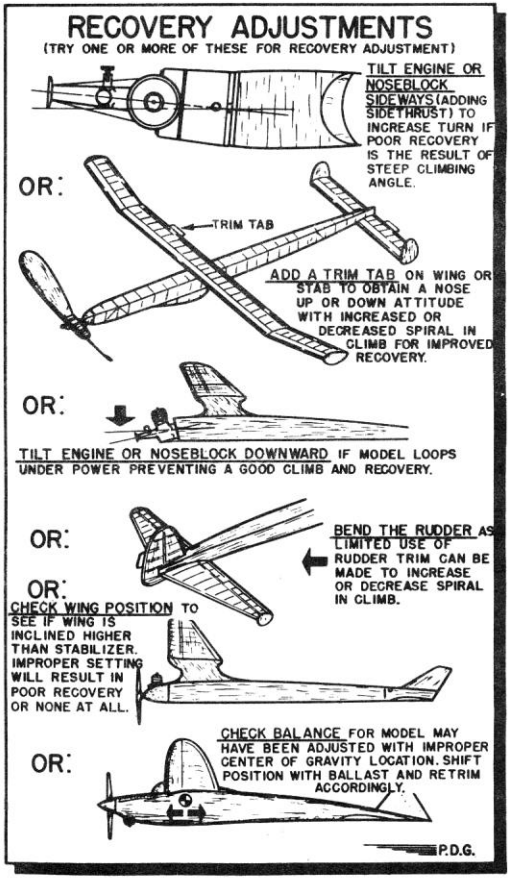
Excessive warps which occur during the construction of the model should be doped or steamed out. Minor warps generally can be disregarded.

Detachable flight surfaces can be the cause of flight variations unless they are keyed into place. Check to see that each unit is correctly aligned with the other units. If flight performance is still erratic, try the suggestions herewith.





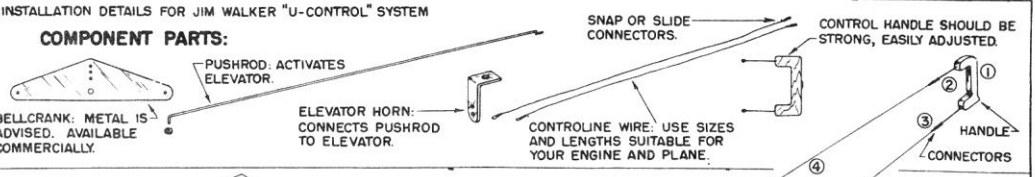




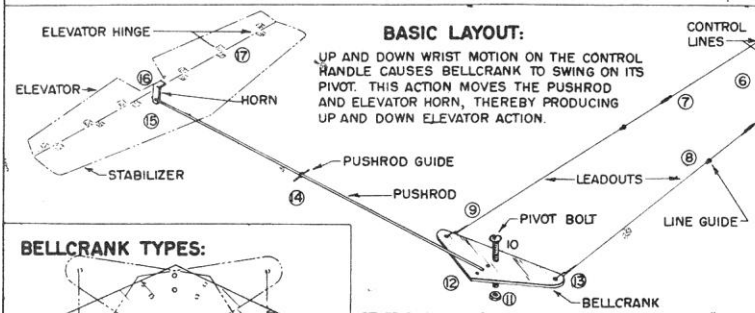
CONTROLINE SYSTEMS

INSTALLATION DETAILS FOR JIM WALKER "U-CONTROL" SYSTEM

COMPONENT PARTS:



BASIC LAYOUT:

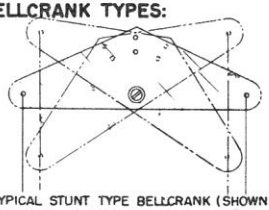


UP AND DOWN WRIST MOTION ON THE CONTROL HANDLE CAUSES BELLCRANK TO SWING ON ITS PIVOT. THIS ACTION MOVES THE PUSHROD AND ELEVATOR HORN, THEREBY PRODUCING UP AND DOWN ELEVATOR ACTION.

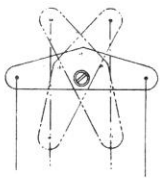
FIRST INTRODUCED ON THE A.J. FIREBALL, THE "U-CONTROL" SYSTEM HAS GAINED WIDESPREAD POPULARITY.

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:



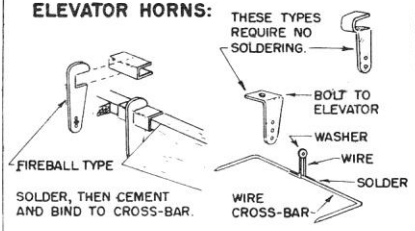
TYPICAL STUNT TYPE BELLCRANK (SHOWN 1/2 SCALE) IN NEUTRAL AND UP AND DOWN ELEVATOR POSITIONS.



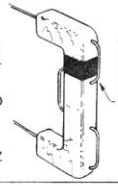
NOTE WHAT OCCURS WHEN TOO SMALL A BELLCRANK IS USED. LEADOUT WIRES TRAVEL TOO FAR, NECESSITATE SLOTS IN FUSELAGE. LEVERAGE ALSO IS LOST.

FOR ELECTRICAL TWO SPEED SYSTEMS, USE BAKELITE BELLCRANK.

ELEVATOR HORNS:



CONTROL HANDLES:

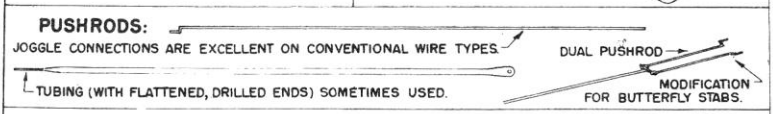


SIMPLEST OF ALL STEEL CABLE INSTALLATIONS IS SHOWN HERE.

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

MANY EXCELLENT HANDLES ARE AVAILABLE COMMERCIALLY.

PUSHRODS:

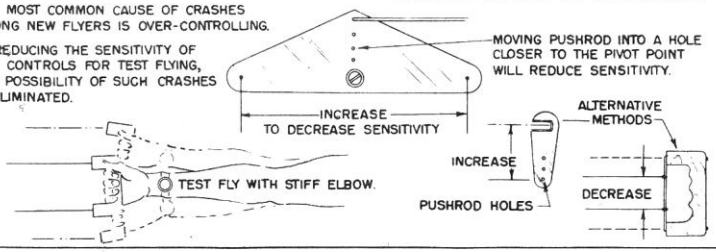


SENSITIVITY:

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.



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.

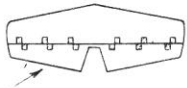
⑮ ELEVATOR HORN (AS SHOULD ALL CONNECTIONS) MUST FORM A SNUG FIT WITH PUSHROD TO PREVENT PLAY.

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.

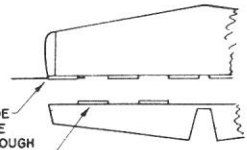


DOPE AND GLUE ON FLEXIBLE EDGES MAY CRACK THE CLOTH. THE CLOTH ALSO LEAVES A BUMPY EFFECT, MARRING APPEARANCE OF THE TAIL ASSEMBLY.

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

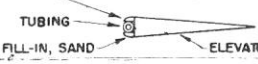
THE INTERLOCKING WIRE HINGE IS EXCELLENT FOR SCALE JOBS.

TUBING AND WIRE HINGE.



SLIDE WIRE THROUGH TUBING

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

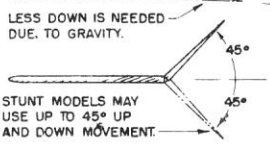


TUBING — FILL-IN, SAND — ELEVATOR

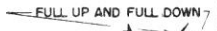
ELEVATOR MOVEMENT:

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

LESS DOWN IS NEEDED DUE TO GRAVITY.



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



FULL UP AND FULL DOWN

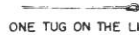
IF ELEVATOR IS STILL IN UP POSITION WHEN DOWN ELEVATOR IS DESIRED, SLIDE STAB TOWARD REAR.

CEMENT STAB IN POSITION ONCE PROPER MOVEMENT IS OBTAINED.

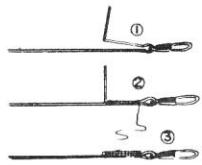
CONNECTIONS:

BIND AND SOLDER

CONNECTIONS SHOULD BE STRONG, PULL TESTED.



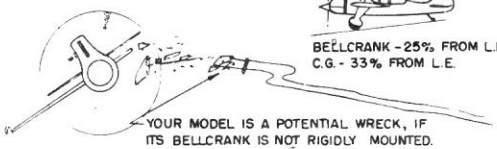
ONE TUG ON THE LINES AND THIS CONNECTION WILL BREAK.



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

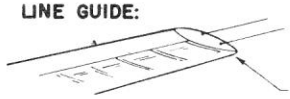


YOUR MODEL IS A POTENTIAL WRECK, IF ITS BELLCRANK IS NOT RIGIDLY MOUNTED.

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

SCREW PLYWOOD BELLCRANK MOUNT TO MOTOR MOUNTS.

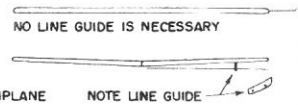
LINE GUIDE:



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.

LINE GUIDE LOCATION FOR BIPLANE



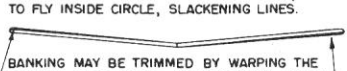
NO LINE GUIDE IS NECESSARY

NOTE LINE GUIDE

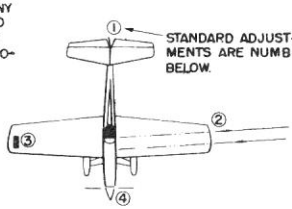
FLIGHT TRIM:

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)



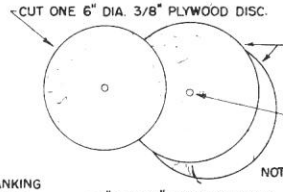
STANDARD ADJUSTMENTS ARE NUMBERED BELOW.

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

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

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

REEL AND LINES:

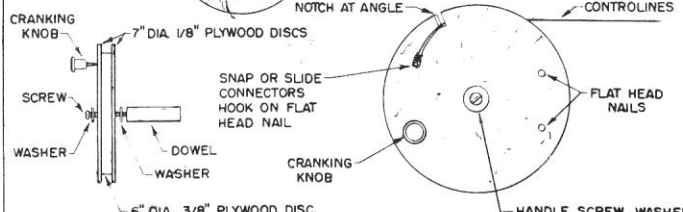


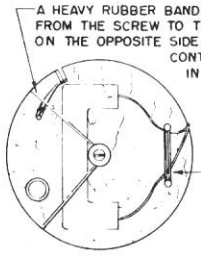
CUT ONE 6" DIA. 3/8" PLYWOOD DISC.

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

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

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





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.M

CONTROL LINE TIPS

by H. A. Thomas

Reprinted through courtesy of "Air World" magazine and Polk's Model Craft Hobbies, Inc.

PREFLIGHT adjustments share equal importance to the pilot's skill and experience in all control-line flying. Design factors, of course, are of fundamental importance; a model of faulty design can be too much of a handicap for even the best "pilot"

Simply stated, the design of a control model ought to include: 1. Good proportions, 2. An adequate tail moment arm, 3. A stabilizer exceeding the elevators in area, 4. A stable wing section, and 5. A center of gravity location toward the wing leading edge. (Regarding wing sections, we can simply state that those having a slight upturning on the lower entering edge have been found to be consistently more stable and more easily controllable than those without.)

Taking for granted that you have a model of good flight potentialities—a popular kit type, perhaps—we will outline the preflight adjustments which may aid you in handling it successfully.

Flying anti-clockwise, a model ordinarily needs only slight trimming to maintain adequate line tension. Moving the wing guide slightly rearward to produce a very slight yaw is a favorite method of many builders. Often this is all a fast plane will require. A tab offset to turn the plane outward is a good test-flight precaution. Offsetting the thrust line is seldom, if ever, required. The wing ought to be warp-free or slightly warped to hold the inner wing up. Never use extreme adjustments; let the speed of the model govern the amount of tab setting: the higher the speed, the finer the adjustment.

Balance is of utmost importance as your first experience with a tail-heavy model will quickly demonstrate. Nose-heaviness can be tolerated to some extent but tail-heaviness invariably brings out the worst in any model. If we tried to condense this entire text into one sentence, it would be something like: *Make certain that the model is not tail-heavy.* From the leading edge, about 25 per cent of the chord distance is a good location for the balancing point.

With the model now seeking to fly level and tending to hold the flight lines tautly, we will mention the bellcrank linkage which governs our control over it. The accompanying sketch points out the lever arms and how their relative lengths dictate control sensitivity. Most experienced "pilots" prefer a not-too-sensitive system, which means: Leave the elevator horn fairly long, the spacing of the bellcrank holes fairly far apart, and the push rod hole quite near the pivot center. Elevator area ties in with these factors, too, in deciding how quickly the model is to respond to our control handle movements.

In the interests of safety, a sketch has been included to show the flight lines and their terminals. Incidentally, the Academy of Model Aeronautics recommends that no strings, cords, or swivels be used and that the lines be sufficiently strong to withstand a pull-test of ten times the model's weight. Never use lines of less than .008 diameter —.012 to .014 are best for class C models and the new braided lines are highly recommended.

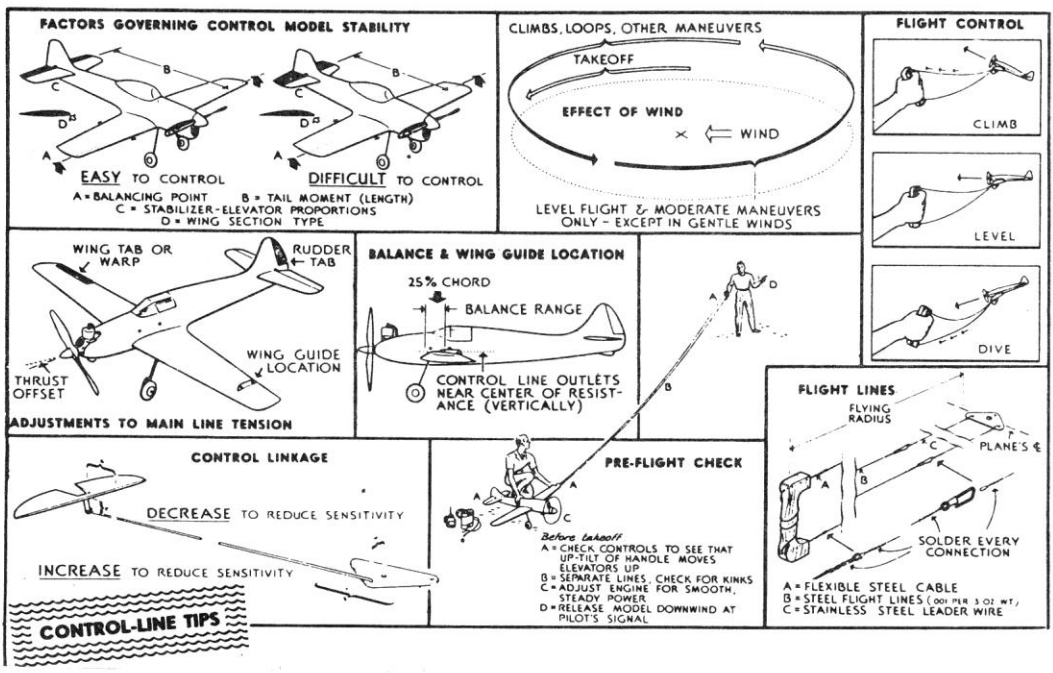
The milder the breeze, the better are your chances of "soloing" successfully. In wind, the model at a constant airspeed is altering its ground speed plus and minus the wind velocity in each circuit. Picture it this way: Flying in a 15 mph. breeze is identical to flying in calm air from the top of an auto which is moving at 15 mph! It is at once apparent that the difficult part of the circle is the upwind portion where the tendency to drift inward opposes the model's outward tension on the lines. Since control is entirely dependent on line tension, the takeoff and other critical parts of the flight should be made on the safer downwind side.

In preparing the model for takeoff, make a sort of ritual of checking the line attachments to see that controls have not been accidentally reversed. Glance also at rudder tab or other adjustments and separate the flight lines. Smooth, constant power is most desirable in control flying; use fresh flight batteries and adjust the mixture carefully. Finally, when all is ready, the assistant awaits a final signal from the pilot before releasing the model.

Flying technique varies with the individual and with the type of model. A tail-down takeoff is safest, one in which the model rolls on three points with elevators up and leaves the ground in this attitude. On becoming airborne, controls must be quickly neutralized to prevent stalling. Bear in mind the importance of flying speed and become accustomed to the natural tendency of the model to settle a bit on the downwind side and to balloon as it heads into the wind. Never move the handle without being ready to reverse it with a quick neutralizing movement.

Do not risk an accident by maneuvering the model violently when it is near the end of its fuel supply. At the instant the engine stops, lower the nose and establish a normal glide. Near the ground, slowly flare the glide out until the elevators are full up at the landing.

Control-line flying is based on natural reflexes and most people learn it quickly—Learn your plane's characteristics, maintaining airspeed; remember the wind direction and velocity.

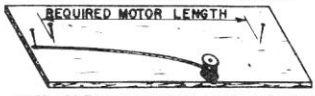


POWER PLANTS

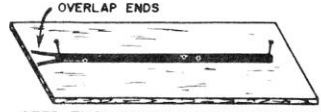
RUBBER MOTORS

METHODS OF PREPARATION

1. CONVENTIONAL METHOD



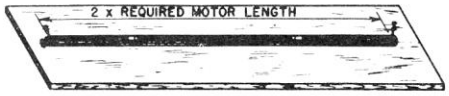
STEP ONE: MEASURE OUT REQUIRED MOTOR LENGTH AND FASTEN PINS AT EACH END POINT OF REQUIRED LENGTH.



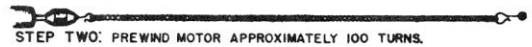
STEP TWO: LAY OUT REQUIRED NUMBER OF STRANDS AROUND THE PIN MARKERS WITH AT LEAST TWO INCHES OVERLAP AT EACH END.

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.



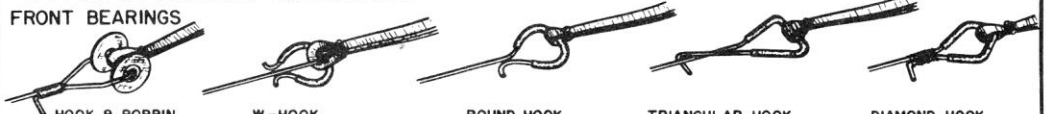
STEP TWO: PREWIND MOTOR APPROXIMATELY 100 TURNS.

STEP THREE: HOLDING BOTH ENDS LET MOTOR ENTWINE.

STEP FOUR: BIND ENDS WITH RUBBER TO COMPLETE MOTOR.

TYPICAL MOTOR BEARINGS

FRONT BEARINGS



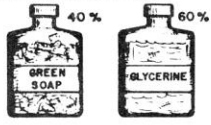
HOOK & BOBBIN | W-HOOK | ROUND HOOK | TRIANGULAR HOOK | DIAMOND HOOK

REAR BEARINGS

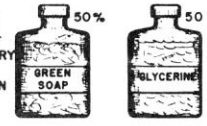
DOWEL & BOBBIN | ROUND HOOK & DOWEL | DIAMOND HOOK & DOWEL | TRIANGULAR HOOK & DOWEL | DOWEL

RUBBER LUBRICANTS

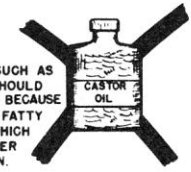
WARM WEATHER: MIX SIX PARTS OF GLYCERINE TO EVERY FOUR PARTS OF TINCTURE OF GREEN SOAP.



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

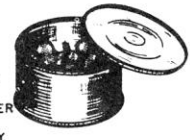


AVOID: LUBRICANTS SUCH AS CASTOR OIL SHOULD NOT BE USED BECAUSE THEY CONTAIN FATTY MOLECULES WHICH HASTEN RUBBER DETERIORATION.

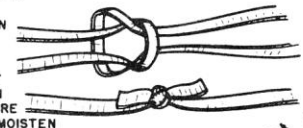


CARE AND STORAGE

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.

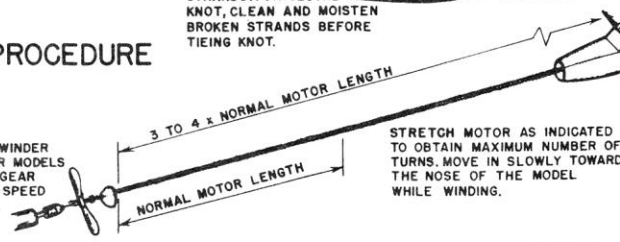


SQUARE KNOT BEST FOR TIEING BROKEN STRANDS. FOR SECURE KNOT, CLEAN AND MOISTEN BROKEN STRANDS BEFORE TIEING KNOT.

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.

Twenty Reasons Why Your Engine Won't Start

Compiled by AUBREY KOCHMAN

Reprinted From *"AMERICAN MODELER"*

■ Countless words have been written on the importance of breaking in properly a new engine. There is no doubt that all of these were meant well, but most accounts assume the new engine starts without a hitch. We have been told to run the engine slowly, not so slowly, don't rev it up during the first five minutes, 10 minutes, hour, two hours, etc., etc. and more etc. But what about getting the engine started in the first place?

Most manufacturers include an instruction sheet which gives general information concerning starting procedures and correct prop size. Some go so far as to tag each engine with the needle valve setting found to be correct at the time the engine was tested at the factory. However, so many variables such as fuel potency, atmospheric conditions, type of starter employed (hand or mechanical) can affect this adjustment that the factory setting may not be correct under dissimilar conditions.

After more than twenty years of experience in running model powerplants, conducting tests and inspecting production runs, we have learned to follow systematically a check list whenever we run into a balky starter. The following check list analyzes the 20 most common reasons why a glow plug engine will not start and run as it was designed to do. You may detect more than 20 here, but in most cases these overlap or are closely allied to the 20 main reasons.

Before proceeding further, let us all remember one thing: In the majority of cases hard starting is not the fault of the engine. It is more likely to be your own inexperience or your inability to diagnose properly the cause. Internally there is practically nothing that can be wrong or broken on a new engine, so don't take it apart just to satisy an inquisitive nature. In fact, as soon as you do disassemble your engine, the factory guarantee is void. However, the removal of the glow plug or glow head or the needle valve is not generally frowned upon by most manufacturers unless the parts have been mutilated. Disassembling any part of an engine requires the proper tools. It is for this reason that most manufacturers can at a very nominal charge supply an all-purpose tool precisely engineered to fit their product. Under no condition should you ever use pliers to grip the cylinder barrel or head! If after going through the following check list you still encounter difficulty, the smart thing to do is return the engine to the factory while still under the guarantee. Include a legible detailed letter (type or print if you have poor handwriting) explaining the exact nature of your complaint and be sure to include your return address.

(1) WEAK BOOSTER BATTERY

Remove the glow plug from the engine and attach the battery leads to it. The wire element should glow a bright red. A faint glow means the battery is weak. Forget about starting your engine until you replace the battery.

(2) BAD GLOW PLUG

This is pretty rare in a new engine but the element can be broken or become shorted out to the inside wall of the glow plug due to rough handling in shipment. To check, remove the glow plug from the engine and attach the battery leads to it. If the plug does not glow at all and the battery is known to be fresh, very gently poke the element with a toothpick until it is not touching the inside wall of the plug. If this does not help, closer inspection will likely show a broken wire.

(3) OVER-PRIMING OR OVER-CHOKING

This is without a doubt the greatest cause of poor starting. A definite relationship of air to fuel must be maintained for the fuel to burn properly. In our model engines the amount of air drawn into the crankcase is fixed by the size of the air intake tube. The needle valve only controls the amount of fuel to be mixed with the air.

A higher fuel-to-air ratio is referred to as a *rich mixture*. This condition is detected easily by low-speed running and excessive smoking from the exhaust ports. As the fuel-to-air ratio increases, the fuel will reach the point where it is no longer flammable and the engine will not start. The engine is then considered choked up or *flooded*.

To clear the engine, turn the needle valve all the way in (clockwise) and flip the propeller smartly and as rapidly as possible until the engine fires. In extreme cases where the engine fails to fire in say, 10 to 15 flips, it may be necessary to remove the glow plug and invert the engine to allow the excess fuel to drain out through the plug hole.

It's a good idea to learn the proper amount of fuel necessary for quick starts before you even fill the tank. One or two drops of fuel injected directly into the exhaust ports is usually sufficient for most Half-A engines. Due to the inaccessibility of the air intake hole on most reed-valve designs, over-choking is almost impossible. However although they require a slightly larger prime they can still be overprimed and thus become flooded.

(4) MIXTURE TOO LEAN

This condition is the direct opposite of that which caused a flooded engine. The engine usually does not fire at all or runs out the prime at high speed and stops abruptly. To cure, turn the needle valve counter-clockwise a quarter turn at a time until the engine continues to run.

(5) AIR LEAK IN FUEL LINE

This condition has same symptoms as a lean mixture except that opening the needle valve does not cure it. Check the fuel line to see if there is fuel in it. If not, suspect an air leak at either the tank end or the needle valve end and replace the fuel line with a tighter fitting one. In the case of reed valve designs, visual inspection of the fuel line under actual operating conditions is not possible as the fuel line is generally located inside the fuel tank. However, it should be replaced if it is a loose fit to the needle valve body. If the engine still does not draw fuel into the line check for . . .

(6) CLOGGED OR KINKED FUEL LINES

This includes the tank and the needle valve body. Disconnect the fuel tank and blow through both the filler pipe(s) and the one leading to the engine. In many cases the clogging is caused by a thick oil residue which remained in the tank from previous day's running. However, if the tank is a new one the needle valve body should be examined first. Do not remove the needle valve body (spray bar) unless absolutely necessary. Simply pass a wire through the body to clean it out.

In reed-valve designs a speck of dirt can become lodged in the reed assembly and thus render the reed inoperable. It is not advisable to disassemble the reed until you have checked all other possibilities. Most reeds are extremely delicate and require very careful handling. If dirt is suspected, first try swishing the reed assembly around in a small tumbler of glow fuel. If this does not dislodge the dirt and you must disassemble the reed unit, make absolutely certain that it is reassembled exactly as it was, taking care not to bend or puncture the valve.

(7) SPRAY BAR IN WRONG POSITION

Look down into the air intake tube. If you can see hole in the spray bar, it is in the wrong position. Most spray bars have a single hole which should be positioned in the exact center of the air intake tube and must be facing downward. On some of the older engines two holes 180 degrees apart were used. These should also be positioned in the exact center of the intake tube but facing fore and aft. To cure, loosen the lock nut if there is one and carefully turn the bar until the hole is correctly positioned. This condition would be an extremely uncommon one in reed valve engines and would necessitate replacing the fuel tank assembly.

(8) (9) LOOSE BACKPLATE; LOOSE HEAD

Both these conditions can be suspected when your engine suddenly shows a loss of power and will not run at its normal high-speed needle valve adjustment but must be run at a richer setting. A loose backplate reduces crankcase compression and thereby reduces the volume of fuel-air mixture drawn into the crankcase. This reduces the power potential of a full fuel charge with a resulting drop in engine power. A loose cylinder head is more easily noticed since leakage around the head is usually much greater and at times even audible. Due to the reduced head compression, the full power of the fuel charge is reduced, thus resulting in a loss of engine power. To cure tighten with the proper size wrench. If either of these conditions is a persistent offender, suspect . . .

(10) LOOSE ENGINE MOUNTINGS

Excessive vibration is the major cause of both poor starting and failure of an engine to rev up. There is but one cure Select mounts of sufficient size and strength and *bolt* the engine to them. Don't ever use nails or carpet tacks; don't ever nail your engine to a tree! (Yes, we've seen it done!)

(11) LOOSE PROPELLER

It's almost impossible to start an engine with a loose propeller. Incorrect flipping can cause an engine to kick the prop off. The higher the compression ratio of an engine or the larger its displacement, the more smartly must the propeller be flipped. The initial flip must carry the propeller past top "dead center" of the piston travel. A weak flip usually causes the engine to backfire and this in turn is what throws the propeller. A single loud hollow-sounding *pop* usually indicates a loose prop.

(12) PROPELLER TOO SMALL

Just as with a loose propeller, too small a prop can be the culprit when your engine pops with each flip, backfires repeatedly and cracks your knuckles. If and when finally started the engine will only run steady at high speed and needle valve adjustment becomes very critical. Propellers too small for hand starting such as are used on speed models are usually flipped by mechanical starting devices.

(13) PROPELLER TOO LARGE

Engine starts quite easily, due to the added flywheel action, idles well for the same reason, but will not rev up. Requires a rich needle valve adjustment. Too large a propeller is to be avoided, especially during the break-in period, as it tends to overload the engine and causes it to run excessively hot.

(14) FUEL TANK TOO HIGH

Suspect this condition when your engine floods itself. That is, it starts out fine, then gradually slows down and shows the symptoms of an engine running on a very rich mixture. The real villain in this condition is gravity. Fuel flows downhill to the engine at a greater volume than the engine can burn. Reed valve engines show much the same symptoms when the air intake hole becomes clogged.

(15) FUEL TANK TOO LOW

When this condition exists, the engine runs out the *prime* but does not draw fuel from the tank. Some engines will draw fuel with the tank positioned as much as 10 inches below the engine while others require the tank be as close to the engine as possible. If you notice air bubbles intermixed with fuel within the transparent fuel line, the tank is either vibrating excessively or is incorrectly positioned.

(16) FUEL TANK TOO FAR FROM ENGINE

Engine shows same symptoms as when tank is too low.

(17) NEEDLE VALVE FLOAT

This condition, although easily remedied, requires close observation to discover. Symptoms can be almost anything having to do with fuel supply. Check the needle valve position when the engine is running steadily. At the first signs of speed changes, whether high or low, recheck the needle valve adjustment. If it has turned ("floating"), stop the engine and increase the tension of the ratchet or coil spring if your engine is equipped with one, or remove the needle valve and carefully squeeze the slotted portion to increase tension.

(18) STALE FUEL

Unless the cap has come loose, it is pretty impossible to purchase a stale can of fuel. However, if you do not keep the can sealed tightly it doesn't take long for the highly volatile portion of the fuel to evaporate. This leaves a fuel with excellent lubricating qualities but no power.

(19) BROKEN BATTERY LEADS

Don't throw that glow plug away if it doesn't glow, yet looks okay. It could be caused by a battery lead that has become broken inside the rubber or plastic insulation. To check, briefly touch the positive and negative leads together. If the battery is known to be "alive" and no spark occurs, replace the booster leads.

(20) SHORTED GLOW PLUG

Although this happens quite frequently it is easily overlooked even by the experts. Shorting out the glow plug occurs when one battery lead touches the center portion of the plug to which the heating element is attached and also touches the main body of the plug which is grounded to the engine. Thus the current from the battery does not flow through the heating element. This places a terrific drain on the battery and will run it down very quickly. The use of a commercially available glow plug clip will greatly reduce this possibility.

CORRECT STARTING AND BREAK-IN PROCEDURE

Some manufacturers claim their engines require no break-in period. However, most experts will agree that the following procedure is the safest and surest way of starting a brand new engine.

Here is the way we go about it: First mount the engine securely. If the tank is not an integral part of the engine, mount it firmly so that the tank top is level with the needle valve. Now before filling the tank, attach the booster battery leads. With the piston at the bottom of its stroke, prime the engine by squirting a few drops of fuel directly into the cylinder through the now-open exhaust port. Flip the propeller smartly until the engine fires and runs out the prime. Do this until the engine runs out its prime consistently with only a few flips of the propeller.

Now fill the fuel tank and attach the battery leads to the glow plug. Open the needle valve one full turn. Place a finger over the air intake tube and turn—do not flip—the propeller until the fuel line is full. This latter point does not apply to reed valve engines. Next, prime the engine as before and flip the propeller. If the engine runs out the prime and then stops the same as it did before the tank was filled, open the needle valve one-quarter turn, prime the engine. Keep opening the needle valve one-quarter turn at a time and prime the engine before every start until the engine continues to run. As soon as the engine continues to run, disconnect the battery leads. Should the engine stop as soon as the leads are disconnected, it is an indication that the fuel mixture is too rich. Restart the engine and this time before disconnecting the battery leads, lean out the fuel mixture very slightly. In 9 out of 10 cases the engine will still be running rich. However, if it will do so, allow it to run out a complete tank of fuel.

Let the engine cool off, follow the same starting procedure as before but do not touch the needle valve. The engine should start immediately. Halfway through the fourth tank of fuel turn in the needle valve a little at a time until engine speed increases slightly. Run out another tank of fuel at this increased speed. Halfway through the sixth tankful make the first attempt at really revving it up. Some engines, tighter than others, will not rev up at this point and must be run slowly for a longer period. If the engine does rev up and runs steadily through the remaining fuel in the tank and for the next full tankful, the engine may be considered sufficiently broken-in to be safely mounted in a model.

SYMPTOMS	CHECK IN ORDER
Won't fire	1, 2, 20, 3, 4, 8, 9, 18, 19
Fires each flip but does not keep running	3, 4, 12, 13
Stops when battery is disconnected	18
Runs out prime and stops	4, 5, 6, 16, 7, 17
Does not run at steady speed	13, 18, 11, 8, 9
Runs steady but does not rev up	14, 10, 8, 9, 11

GLOW-PLUG GAS ENGINES

SIZES AVAILABLE

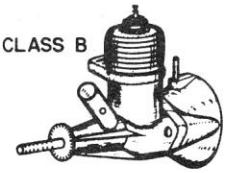
CLASS 1/2 A

.000 TO .050 CU. IN. DISPLACEMENT

CLASS A

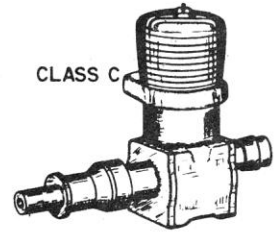
.051 TO .200 CU. IN. DISPLACEMENT

CLASS B



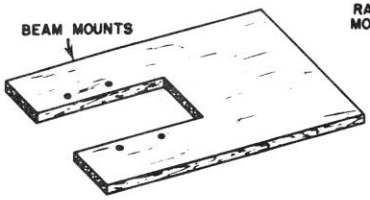
.201 TO .300 CU. IN. DISPLACEMENT

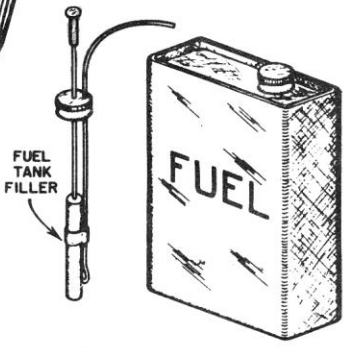
CLASS C

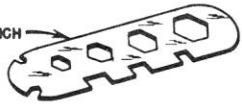


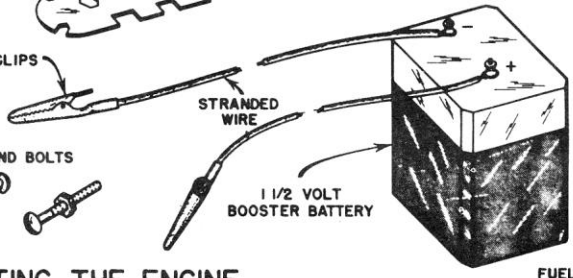
.301 TO .650 CU. IN. DISPLACEMENT

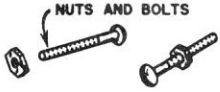
ESSENTIAL EQUIPMENT

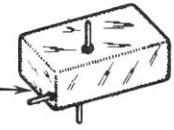






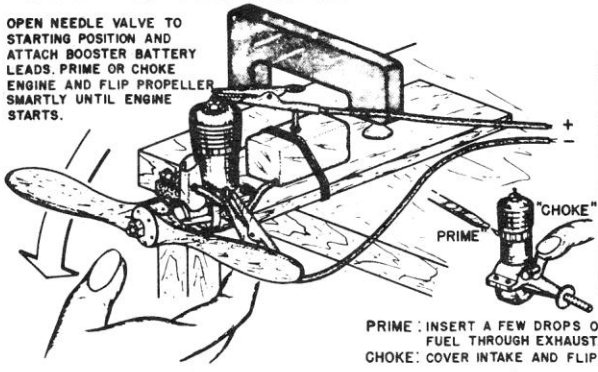






STARTING THE ENGINE

OPEN NEEDLE VALVE TO STARTING POSITION AND ATTACH BOOSTER BATTERY LEADS. PRIME OR CHOKE ENGINE AND FLIP PROPELLER SMARTLY UNTIL ENGINE STARTS.



PRIME: INSERT A FEW DROPS OF FUEL THROUGH EXHAUST.
CHOKE: COVER INTAKE AND FLIP PROP.

ENGINE TROUBLE CHECKLIST

A. WEAK BATTERIES: MOMENTARILY CROSS WIRE LEADS AND CHECK FOR SPARK.

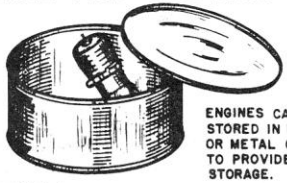
B. DEFECTIVE GLOW PLUG: REMOVE PLUG AND TEST FOR GLOW WITH WIRE LEADS CONNECTED.

C. POOR FUEL MIXTURE: ALWAYS USE FRESH CLEAN MIXTURE RECOMMENDED BY MANUFACTURER.

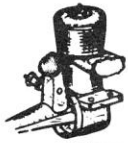
D. IMPROPER NEEDLE VALVE SETTING: FUEL MIXTURE IS EITHER TOO RICH OR TOO LEAN.

E. POOR CONNECTIONS: CHECK FOR BROKEN WIRES OR FRAYED STRANDS.

CARE AND STORAGE



ENGINES CAN BE STORED IN LARGE JARS OR METAL CONTAINERS TO PROVIDE DUSTPROOF STORAGE.



STUFF CLOTHS INTO ENGINE INTAKE AND EXHAUST TO PROTECT FROM GRIT AND DUST.

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TO CLEAN ENGINE: DISASSEMBLE COMPLETELY AND PLACE PARTS IN PURE GAS IN CONTAINER. ALLOW SEVERAL HOURS FOR GAS TO PENETRATE AND LOOSEN SCUM AND DIRT WHICH MAY HAVE ACCUMULATED. WIPE PARTS CLEAN WITH A SOFT CLOTH BEING CAREFUL NOT TO SCORE ENGINE PARTS, PARTICULARLY THE INTERNAL UNITS SUCH AS, PISTON AND INSIDE OF CYLINDER WALL.

P.D.G.

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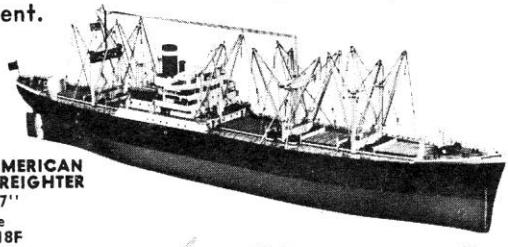

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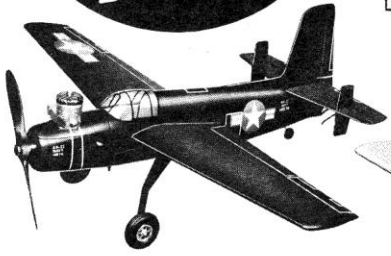

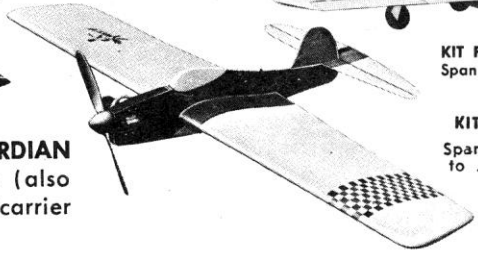

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KIT S-1 RINGMASTER
Span 42" to .35 Engine Size .19

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