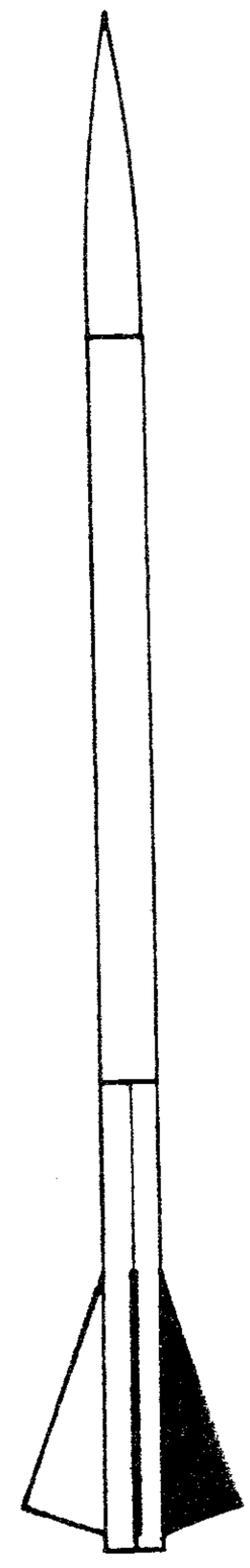
MINI-ALLEGRO



MINI-ALLEGRO PARTS LIST*********
BT-18.23 BODY TUBE
4 BT-7.17 MOTOR TUBES
NCB-18 NOSE CONE
4 MINI-ALLEGRO FINS
SHOCK CORD AND MOUNT
2 1/4" LAUNCH LUGS
24" PARACHUTE
18 CLUSTER BULKHEAD
INS, DEC, BAG, HEADER
CLUSTER REPORT
SCREW EYE
18 BAFFLE

The ACE MINI-ALLEGRO is a scaled down version of our most popular rocket kit. Designed to accept up to four C6 diameter motors, the MINI-ALLEGRO is perfect for a weekend launch. It is very easy to build thanks to the cluster tube fin attachment. The four cluster mount allows you to mix and match motors as well as fly it with only two motors in small fields. It features precut parts , cloth chute, and long nose cone. Skill level 3.

LENGTH: 47"	MOTORS: 4 C6-7
DIAMETER: 1.85"	2 B4-6 & 2 C6-7
FIN SPAN: 6.5"	4 B4-6 or 4 B6-6
Dropstaging OK!	4 A8-3 or 4 D14-10

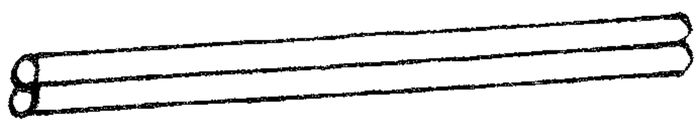
ACE ROCKET MANUFACTURING P.O. BOX 5472
MISSION HILLS, CALIFORNIA 91345

MINI-ALLEGRO

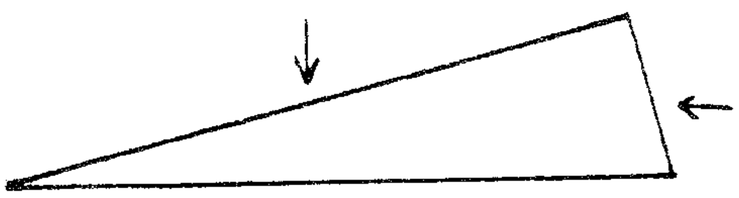
The ACE MINI-ALLEGRO is a scaled down version of the ever popular ALLEGRO cluster rocket. The MINI-ALLEGRO accepts a cluster of four .69" diameter motors (Estes C type). This is an excellent first cluster kit.

INSTRUCTIONS

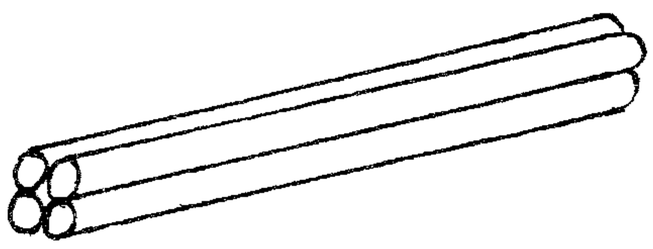
1. Glue two of the BT-7 body tubes together with the ends flush. Align them by setting on a table top. Set aside to dry and repeat with the other two BT-7 tubes.



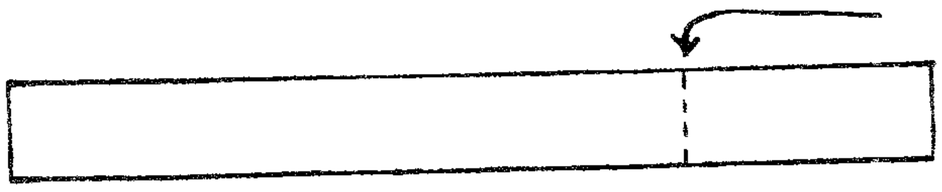
2. Sand the leading and trailing edges of the fins to an airfoil shape with 120 grit sandpaper. Sand the root edge to a wedge to fit in valley between the tubes. Sand the surfaces of the fins with 320 grit sandpaper for a smooth finish.



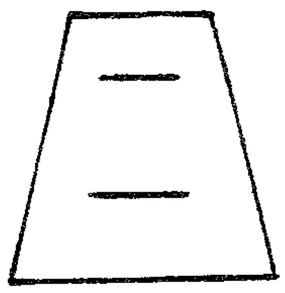
3. Glue the two motor tube assemblies together in a square pattern and align with a table top. Allow to dry and fillet with glue.



4. Glue the ejection baffle (many holes) into the large tube 8" from the top. Apply a bead of glue to the inside of the main tube, insert the baffle, and push in place with a body tube. Wipe excess glue from the inside of the tube where it might interfere with the nose cone. Put tape over one side of the cluster bulkhead to cover the center hole, and put a drop of glue in to fill the hole. This prevents ejection gas from leaking. Set aside to dry.

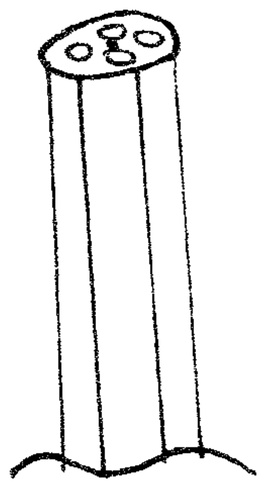


5. Cut two slots in the scrap of body tube 1/2" wide and 1.5" apart. Thread the shock cord through the mount and glue the assembly to the inside of the main tube. Be sure it is far enough down to allow the nose cone to slide on.



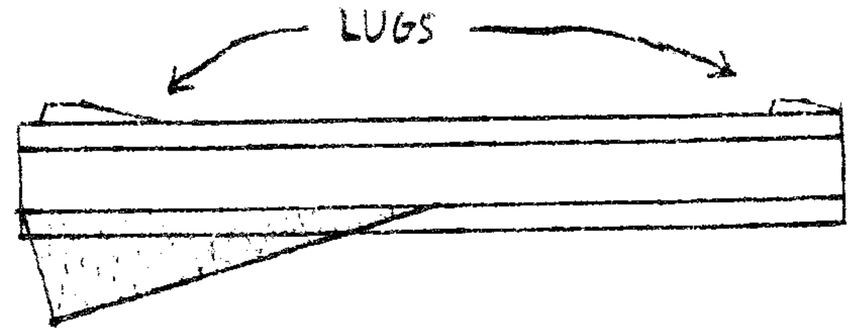
6. Glue the fins to the motor mount assembly 3/8" from the bottom. Glue them on one at a time and visually check for alignment from the back end. Set aside to dry, fillet all fins, let dry.

7. Remove the tape from the ejection baffle and glue it to the free end (no fins) of the tube cluster. Be sure the holes align over the tops of the tubes. Set upside down to dry. Apply glue fillets to the tube/bulkhead joint. Allow to dry completely.



8. Glue the tube cluster and fin assembly into the rear of the main tube (opposite the shock cord) 2-1/2" so 14-1/2" is extended outside the main tube. Use plenty of glue on this step and set upright to dry. Let dry overnight.

9. Glue one launch lug 3/8" from the back of the rocket on the apex of a motor mount tube. Glue the other lug at the top of the BT-7 tube directly above the other lug. Let dry and fillet with glue.



10. Screw the eye screw into the base of the nose cone, remove the eye, squirt glue into the hole, and reinsert the eye. Tie the shock cord to the eye screw. Tie the parachute to the shock cord 6" from the nose cone. Fold and insert the shock cord and parachute, and install the nose cone.

11. Apply a coat of sanding sealer to all wood parts, let dry, and apply a second heavy coat of sanding sealer. Let dry and sand with 320 grit sandpaper until smooth. Apply a coat of Zynolyte white primer sealer or flat white enamel paint to the entire model. Sand and repeat until all wood grain and body tube seams are smooth. ACE suggests flat black fin and motor mount assembly, fluorescent red main tube, and black nose cone. Or use your imagination!

12. Apply decals as desired.

PREPING AND FLYING

The ACE MINI-ALLEGRO flys with four motors of your choice. First flights should be with four B or C motors. Later you may wish to mix 2 B's and 2 C's or fly it with only two motors. This rocket can be flown with any combination of motors you choose as long as they are symmetrical (similar motors opposite each other). It has been tested with four Composite Dynamics D14 motors and has been drop staged with B14 to C6-7!!!

To prep the MINI-ALLEGRO, insert some wadding in the top of the main tube to protect the parachute. The baffle reduces the need for wadding, but still use some. Fold and insert the shock cord and parachute into the body tube. Socket on the nose cone. Check the fit so it doesn't fall off under it's own weight.

Wrap a masking tape thrust ring on the nozzle end of each motor. Insert the motors into the motor mount tubes and wrap tape over the thrust ring/motor mount tube joint. Insert an igniter into each motor. ACE recommends FSI IA-20 igniter cord for cluster ignition. Simply insert one in each motor and tape them in place. Meet the wicks in the center of the cluster and attach a flashbulb or Estes solar igniter.

Always fly the MINI-ALLEGRO in calm weather from a large launch area. It goes about 2000 feet with C6-7 motors. The launch site should be at least 500 feet on a side. A 1/4" by 5' or longer launch rod is required for safe and stable flights.

ACE INFORMATION REPORT TWO

By Jerry Irvine

CLUSTERING COMPOSITES

"A PRESCRIPTION FOR CLUSTERPHOBIA"

The clustering of composite motors is a tricky business. The nature of composite motors provides some interesting and difficult challanges when clustering. Composite motors typically have a very slow "start up" period in comparison to black powder motors. Since ignition timing is critical in a cluster, a problem arises; how to ignite two or more composites at the same time.

Firstly, one must be sure to use motors that are all the same type. This is important to assure a straight flight. On clusters of four or more, motors can be mixed as long as they are balanced (symmetrical) from side to side. For example, a Mongrel uses five motors. It can be flown with five identical motors, or can be flown with a large central motor and smaller outer motors.

Mixing motors can provide interesting results. Different time-thrust curves can be co-mingled to provide a more useful or fun aggregate time-thrust curve. The most dramatic example of this to date was a Mongrel flight with two G120's, a G62, and two F7's. As you might imagine, the the initial boost under the G120's and F7's was extremely fast. Once the one second G's burned out, the G62 and F7's remained. The G62 kicked off three seconds into the flight leaving the steam machines to complete their task. Upon G120 burnout, the model decelerated visibly, and then accelerated under G62 power. When the G62 burned out, it coasted during the remaining six seconds of burn and six seconds of delay. Ejection was exactly at apogee.

But you want to know how you can do this, right? There are basicly two types of clustering, electrical and pyrotechnic.

PYROTECHNIC CLUSTERING

This is less desireable than electrical clustering, but is essential if an electric match will not fit easily into the nozzle. If this is the case, a fuse ignitor must be used. For most composite motors, a piece of Thermalite fuse (FSI wick) must be used. Prepare an ignitor for each motor using the wick. Fold the end over about 1/2", for two or three folds depending on the fit through the nozzle. Removal of the fabric wrap and several of the wires will prevent nozzle clog and motor detonation, Slide a piece of plastic (heat shrink) tubing over the wick to prevent premature ignition (ignition at the tail end). Each fuse should be securly taped to its motor to prevent it from falling out on liftoff or ignition or whatever. The fuses (wicks) may meet at the center of the cluster and be ignited by a single flashbulb or electric match (FSI M100). A more accurate and reliable method is to attach a flashbulb ignitor (explained later) to each motor. Be sure the ignition leads fall away easily to avoid removal of the ignitors upon liftoff. This method also reduces some ignition time and thus some error factor. This is what Korey Kline uses with 100% success on his "official ACE kits".

Pyrotechnic clustering can be mixed with electrical clustering on large clusters to get a parallel staging effect. Instant ignition is used on booster motors, and fuse ignition is used on sustainer motors. Try some combinations in a Mongrel type model and see the difference.

ELECTRICAL CLUSTERING

Electrical clustering is by far the best way to cluster. An electric match with a fuse pyrogen (Thermalite) attached is placed in each motor (large nozzle only). The leads of the M100's are hooked up in parallel (all positive leads together, all negative leads together). ELECTRIC MATCHES AND FLASHBULBS ARE NOT CONTINUITY SAFE!! It is because of their very low current requirements that M100's and flashbulbs are so good for clustering, but they are so sensitive that they will go off under the current of a continuity check. Practice clustering with a three cluster rocket like a 2250, 2340, or 2650.

When clustering black powder motors, simply insert the M100 all the way inside. If it doesn't fit in the nozzle, a short length of fuse can be used as a pyrogen, or a small amount of black powder (FFF) can be put in the nozzle to get it going from a flashbulb. Again, each motor must have an individual ignitor.

CLUSTERED STAGING

Clustering on intermediate and upper stages is not recommended unless electronic or mercury switch systems are used for electrical ignition. We don't even do this in California yet! Keep in mind that a good Hefty Hauler flight can be just as satisfying (or more so) as a two stage Mongrel. Don't waste too much money! The less motors per flight, the more flights you get.

CONSTRUCTION NOTES

Always build the model with the more powerful motors in the center or close to the center. Since these models are typicaly heavy and high speed in comparison with other models, a much longer and stronger shock cord should be used. The minimum is a 1/4" x 6' elastic, but double that for safety. Of course, you should always use high quality and heavy duty parts. Ace Rocket Manufacturing can satisfy all of your needs in this area.

FLASHBULB ASSEMBLY

GE type AG-1b flashbulbs may be used, or flashbulbs from flashcubes are good also. Prepare each flashbulb by removing it from the package or cube. Be sure the leads are straight and are single wires to accept the wire wrap tool. Purchase a wire wrap tool from Radio Shack or an electronics supply store along with special wire wrap wire (22 guage or so). The wire comes in many colors and I suggest getting two colors for easy identification of plus and minus in large clusters. For most applications, six inch leads will be sufficient. Strip both ends of each wire lead about one inch. Wrap one wire on each flashbulb lead. I generally make them 20 to 100 at a time to save time and assure a good stock. The end result is a NON-CONTINUITY SAFE instant ignitor of high reliability. The flash is big fun too.

ALWAYS CHECK ALL LOCAL LAWS BEFORE FIRING A CLUSTER. BE SURE YOU FIRE FROM A VERY LARGE, CLEAR FIELD. TREAT ALL CLUSTERS AS EXPERIMENTAL, SINCE PROBLEMS MAY OCCUR.

ACE INFORMATION REPORT THREE

STAGING COMPOSITES
By Jerry Irvine
Please review AIR-2 before beginning.

A composite propellant is one that consists of two or more ingredients. Our vernacular of "composite" usually refers to an Ammonium Perchlorate/PBD composite fuel, and "black powder" usually refers to a potassium nitrate, charcoal, and sulfur composite. I sometimes refer to them as composite A and composite B.

I have no intention of listing every possible combination of motors for staging, but rather the methods used for staging and important design concepts for multi-stage rockets. Generally speaking, when staging two or more motors, it is best to put the high thrust motor on bottom and long burn motor on top. This is primarilly because the high thrust is needed to get the model to stabilizing velocity.

Whenever possible, try to have the vehicle weight for each incremental stage as close to optimum weight as possible. Optimum weight charts are available in back issues of Model Rocketeer and Snoar News. Since the rocket loses weight as the flight progresses and stages fall off, it would be wise to use motors with decreasing optimum weights in the upper stages. This specifically calls for high thrust lower stages and low thrust upper stages. Where are end burning composites when you need them?

When you design a multi-stager, it is important to have sufficiently large fins on the lower stages to keep the CG ahead of the CP by at least 1.5 calibers. This may mean the same size fins on all stages like the Centuri Arrow 300 or gigantic fins on the lower stage like the Estes Farside. In any case, use as little fin area as possible to reduce finishing time, materials cost, and especially drag. There is no reason why you can't put a high thrust motor in an intermediate or upper stage as long as the lower motor(s) can lift the rocket with sufficient velocity to stabilize it.

Direct Staging

Direct staging is the most common type of staging. The lower motor has no delay or ejection charge, and when the motor burns to the end of the propellant, it shoots a flame upward (heat and pressure) into the nozzle of the upper motor. The flame touches and ignites the propellant of the upper motor and that thrust seperates the stages as well. Sometimes the pressure even pushes the stages apart before the upper motor is ignited (Pop 'n Stop staging). This is used with black powder motors.

Delay Direct Staging

Delay direct staging is essentially the same except that either the upper motor takes time to build up thrust or a fuse is employed to delay the ignition of the upper motor. The fuse should be either the use of a motor with a delay in the lower stage, or the use of an actual fuse in the upper stage. When using the ejection charge of the lower motor to ignite the upper motor, either composite or black powder motors may be used. When using composite upper motors, it is best to use zero second delay boosters due to the start-up time of the motor.

Brother or RJ Ignition

RJ ignition is the simultaneous ignition of all ignitors of all stages on the ground. They are timed to ignite at the proper times from ignition. This is done using flashbulbs or electric matches to start fuse/pyrogens.

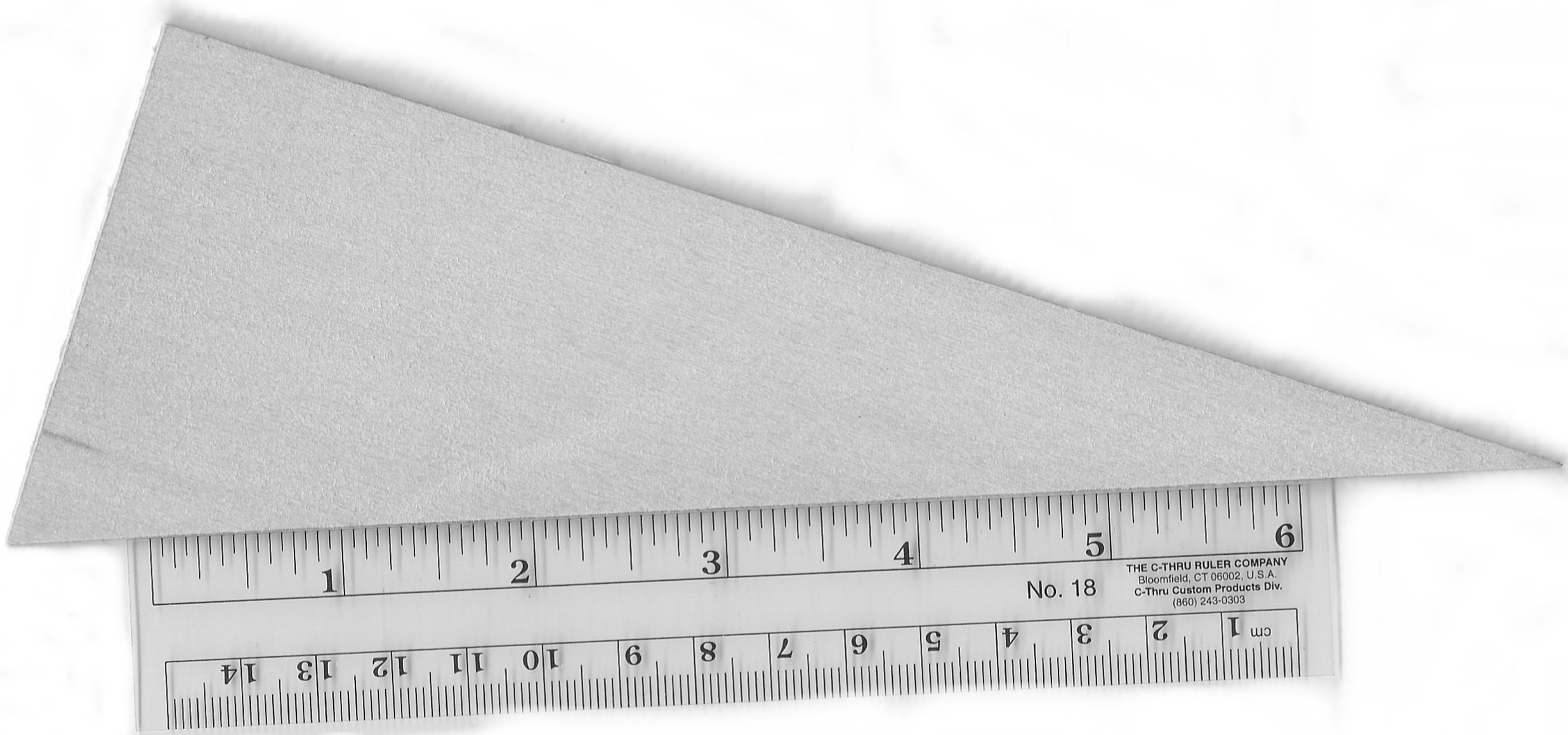
Flashbulbs are used on each stage ignitor and the lower motor is ignited as quickly as possible. The remaining fuses are timed based on that. Upper flashbulbs are attached to the fuses so they can fall off easily on boost. The upper fuse length is determined by the lower motor burn time plus ignition time, plus desired staging delay, minus upper motor start time. This method is commonly used with composite motors.

Mercury Switch Ignition

This staging method is electrical in nature as opposed to the previous pyrotechnic methods. The deceleration of the model activates a "switch" to start the ignitor for the next stage. A mercury switch can be obtained from a Radio Shack or other electronics supply store. For three or more stages, seperation switches are needed too.

When the model decelerates upon motor burnout, the mercury inside the glass switch flys up and touches metal contacts to complete the electrical circut. Since the motor will ignite immediately when the switch is moved in the right direction, a safety switch is required to prevent accidental ignition during prepping! This method will not work well with long burn motors or regressive motors.

Any of these methods or a combination thereof can be used reliably if proper care is taken during preping. Always fly a motor single stage before you try it in a multi-stage rocket so you will know what to expect. Especially with composite motors.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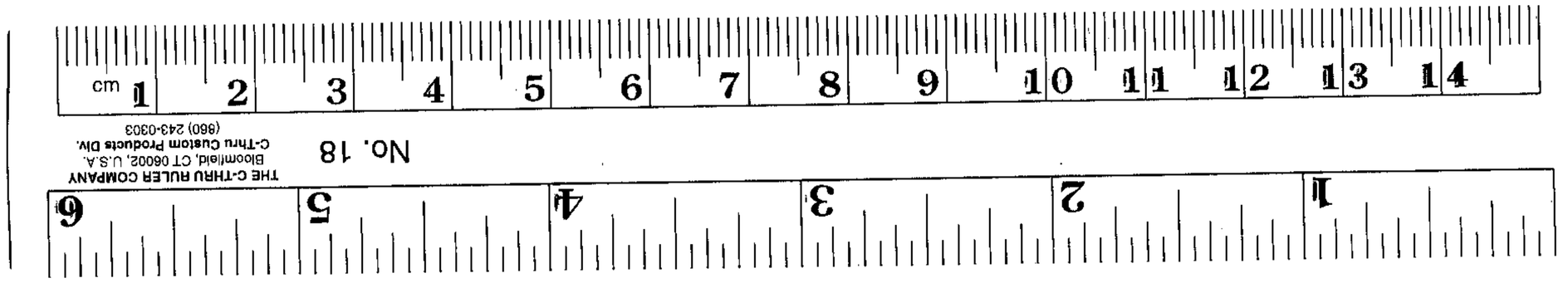
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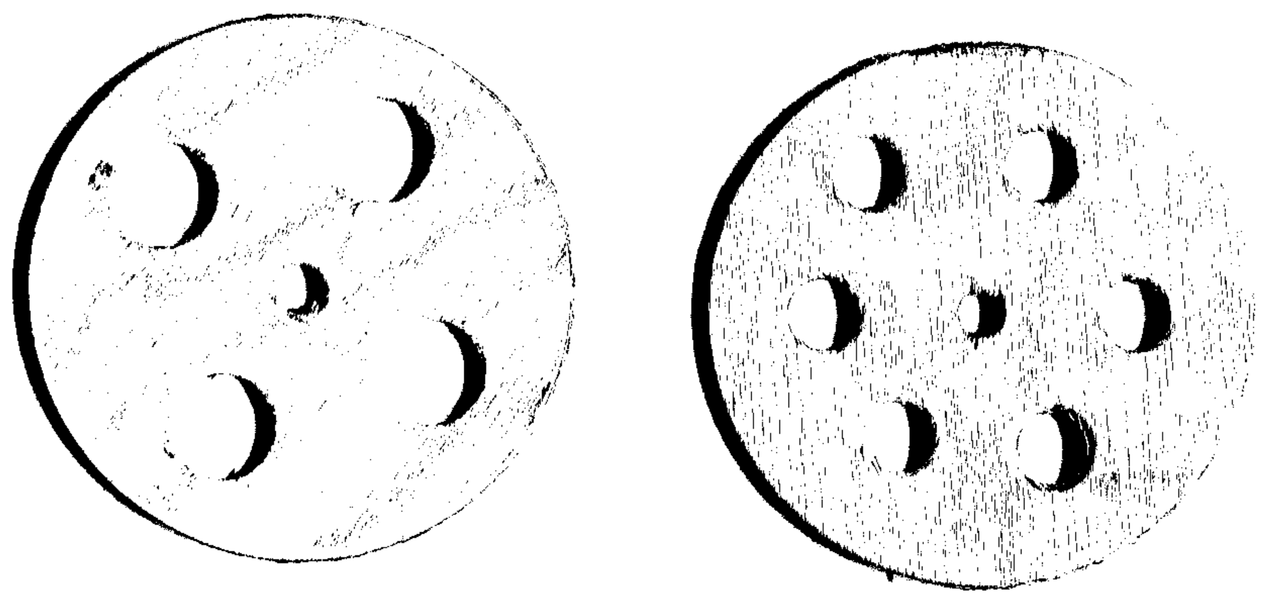

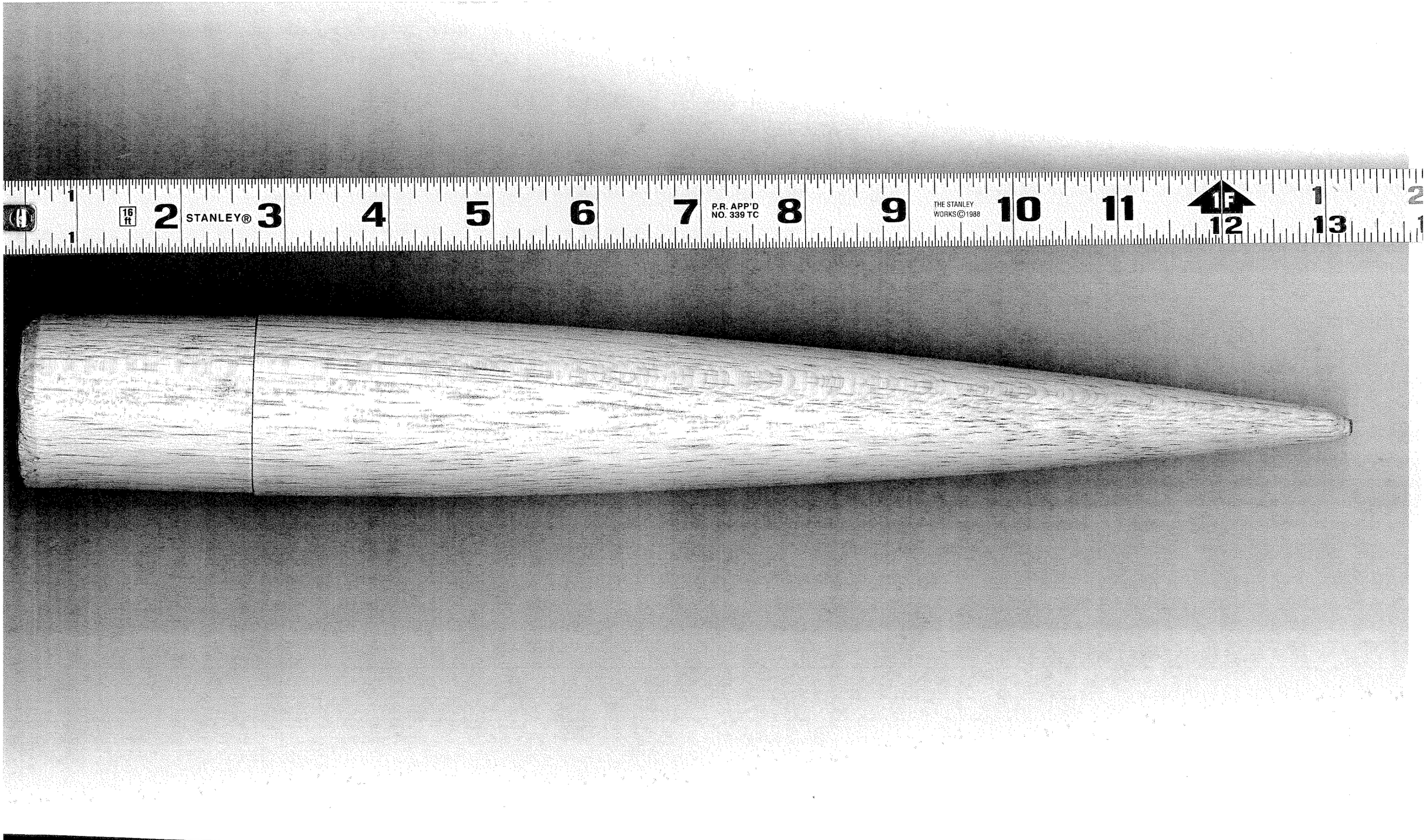
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