

# MINNEAPOLIS MAGNETICS, INC.

2915 Huntington Avenue • Minneapolis, Minnesota 55416

**Products Covered**  
Erase, Record and Reproduce  
Heads for AMPEX 300, 350,  
400, 450 and 3100 Series.

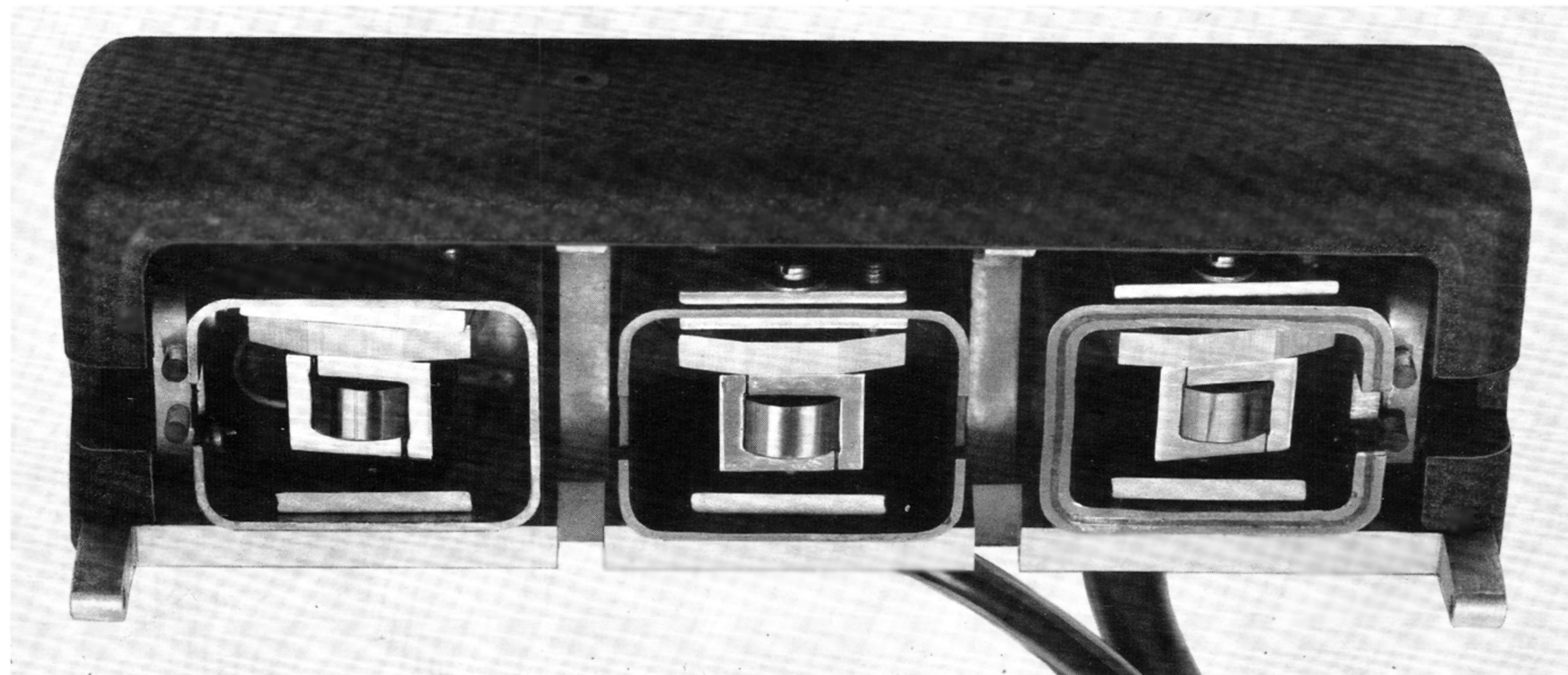
## PICSTALLATION NOTES

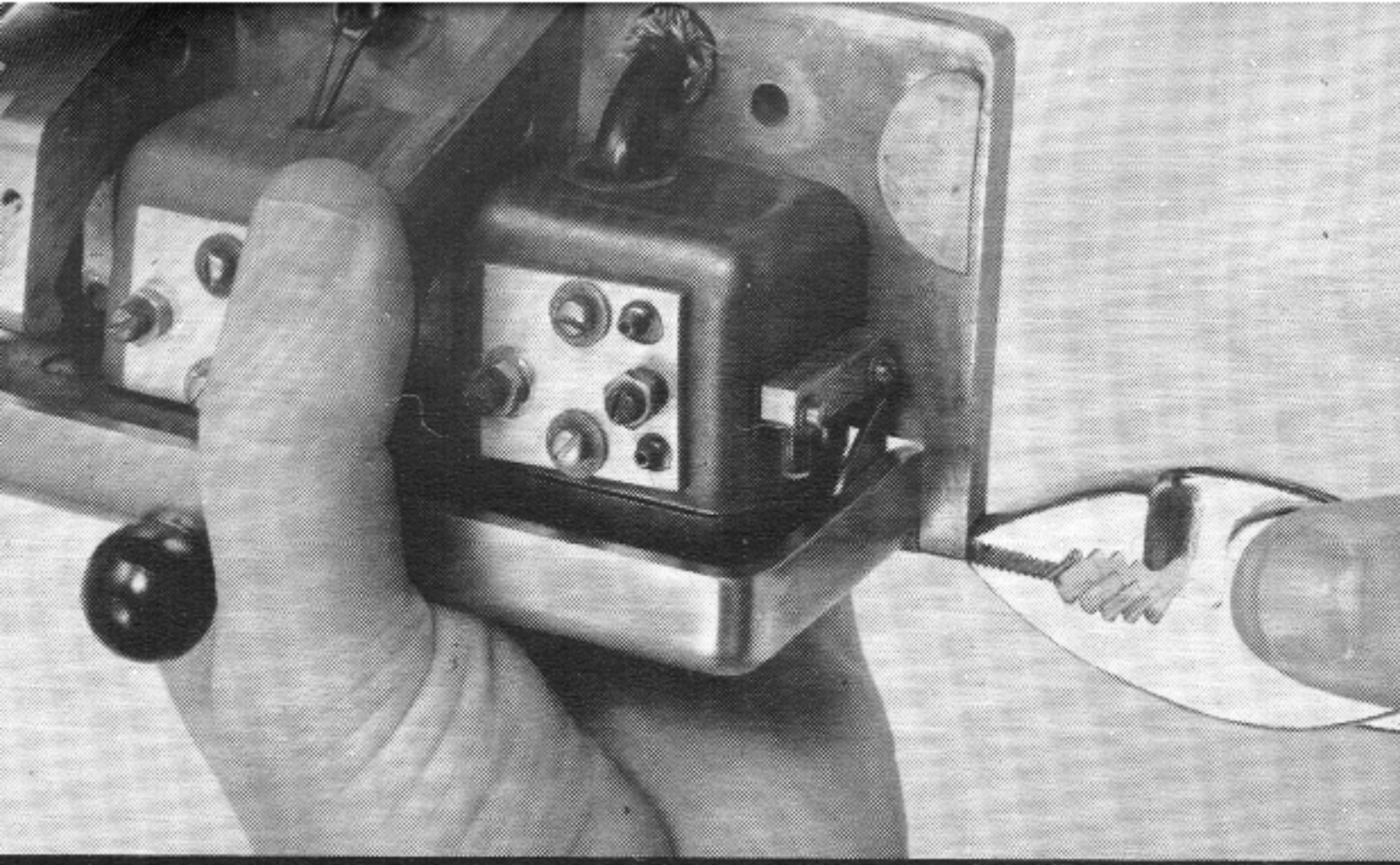
Head replacement in the larger professional Ampex audio recorders using 1/4" tape is a rather straightforward procedure, requiring nothing more than ordinary hand tools and other items usually found around the maintenance room. Among these are: a pair of ordinary pliers, a 1/4" nut driver such as the Xcelite P-8 or equivalent, a set of Allen wrenches (available for under a dollar in most variety or hardware stores if you don't already have them), a screwdriver, needle nose pliers and a soldering iron of the pencil type with about a 30-watt rating. You will also need solvent to dissolve the glyptal seal on the two brass Allen head screws used on the Record and Reproduce head cups to adjust the head for height and face (tilt) and a generous amount of head cleaner to dissolve accumulations of oxide and dirt on the gate, cup shield covers, cups, base plate and glass tape guides. The entire assembly should be given a thorough cleaning while you have it stripped down because it will be a long while before you have occasion to disassemble it so completely again . . . unless you put everything in backwards. It's happened.

For some people, the most awkward step in the entire procedure is re-installing the gate springs. It's actually quite simple but like so many things that are easy to demonstrate, when it comes to putting the information

down on paper, difficulties arise which tend to obscure the ease with which it can be done. Fingers get in the way of the camera. Line drawings help but don't completely get over the idea so a combination of both is needed to do the job. Some users have had chronic grief with these gate springs popping out right and left, even when no heads are being installed! Usually the fun starts when overzealous personnel slam the gate shut instead of closing it gently. Naturally, they are far more talented at knocking out these springs than they are in replacing them. The guy who gets stuck with this chore generally tries to wedge the spring into place without removing the upright as shown in the photographs. Consequently, the spring gets distorted so it won't stay in after it is put in place. To make matters worse, when the gate is slammed the spring is bent into what resembles a U shape. This has the practical effect of shortening the spring length so it can pop out easily. The simple correction is to pre-shape the spring as shown in the line drawings before installing it. Since it is also possible to install the wrong end of the spring as well as putting it in upside down, it goes without saying that if the spring is properly shaped and correctly installed using the method described in these Notes, about 100% of the problems with gate springs are cleared up.

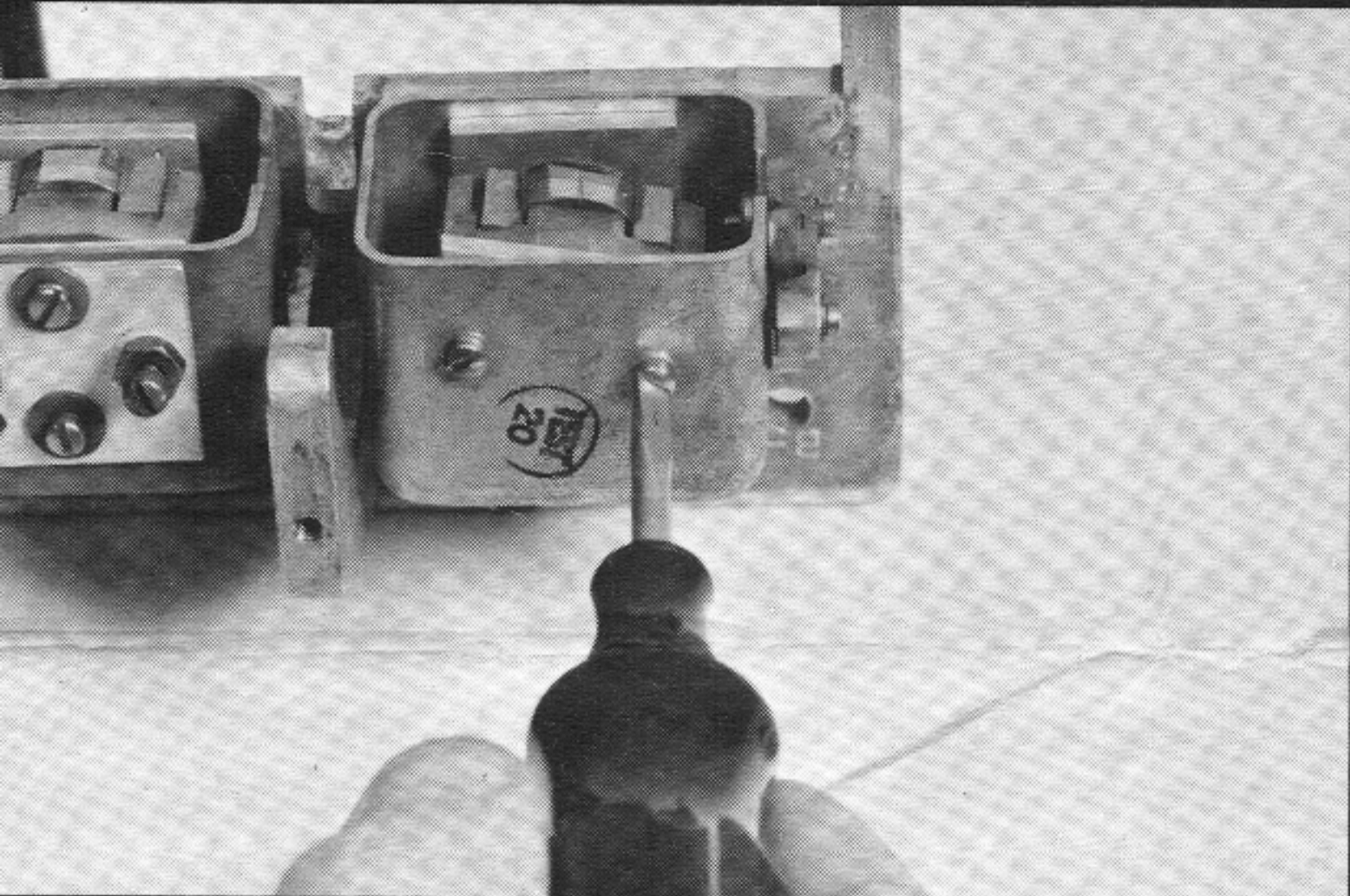
The photograph below shows what your head assembly will look like with the new Minneapolis Magnetics heads installed. Begin by disconnecting the head cables from the electronic chassis. Remove the black cover casting from the head assembly by taking out the two Allen head screws at the top, gently backing the casting away from the gate and slowly lifting up. Some models have the two screws mounting the head assembly to the transport under this casting. On others, these screws are installed from behind the transport. Remove them and place the assembly on your work table. Now proceed to the photographs and install the new heads in the step-by-step order given.





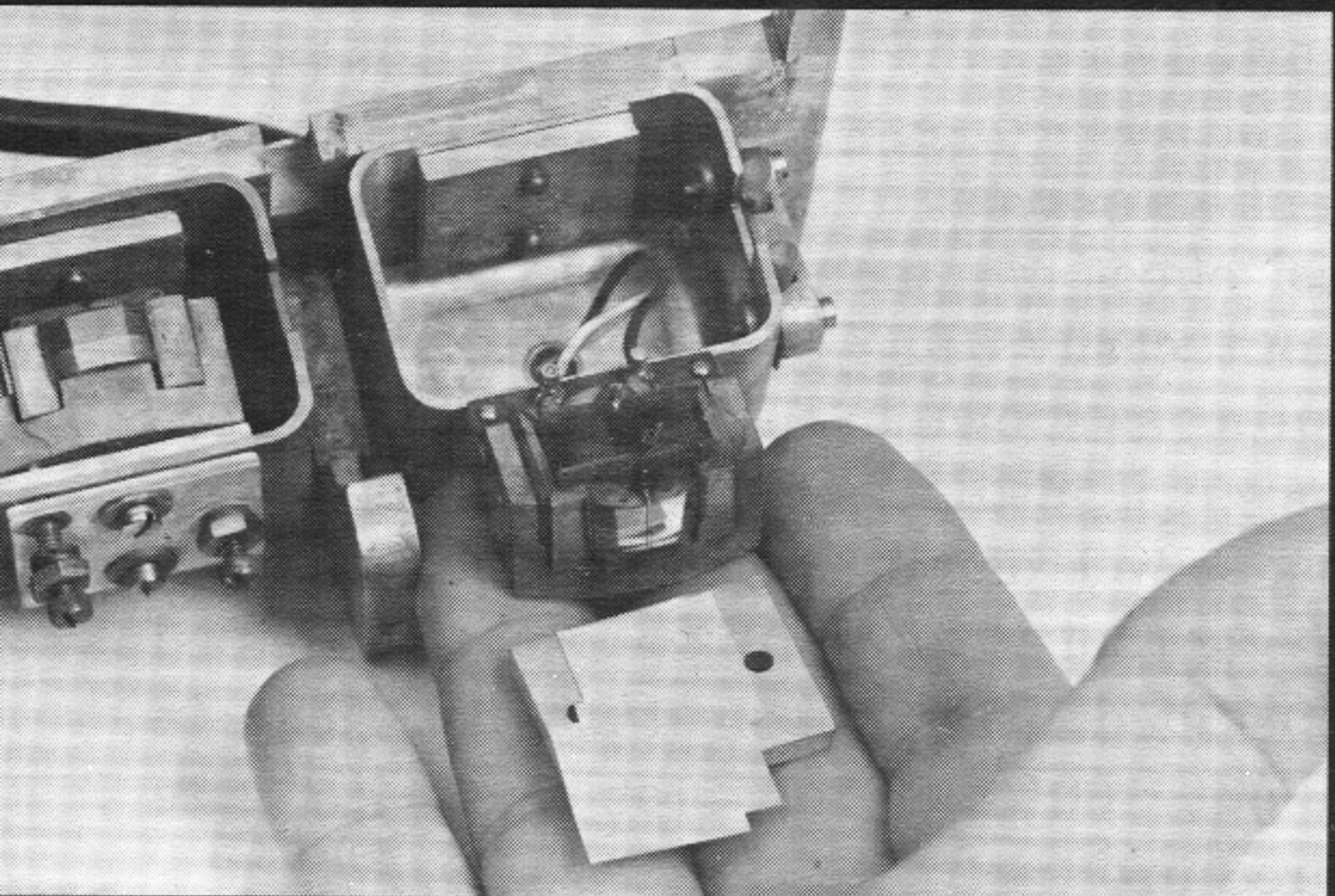
### STEP 1

Position the head assembly as shown. Firmly grasp the gate pin with pliers and pull it out while exerting no pressure against the gate itself which might cause it to bind and make removal of the pin difficult. By placing your thumb on the upright casting and your fingers on the mounting plate, you can cradle the gate in your palm and maintain a good grip on the head assembly without exerting any pressure on the gate. Remove both gate pins. The two gate springs will now fall out. Clean the gate thoroughly. Lay the gate, pins and springs to one side.



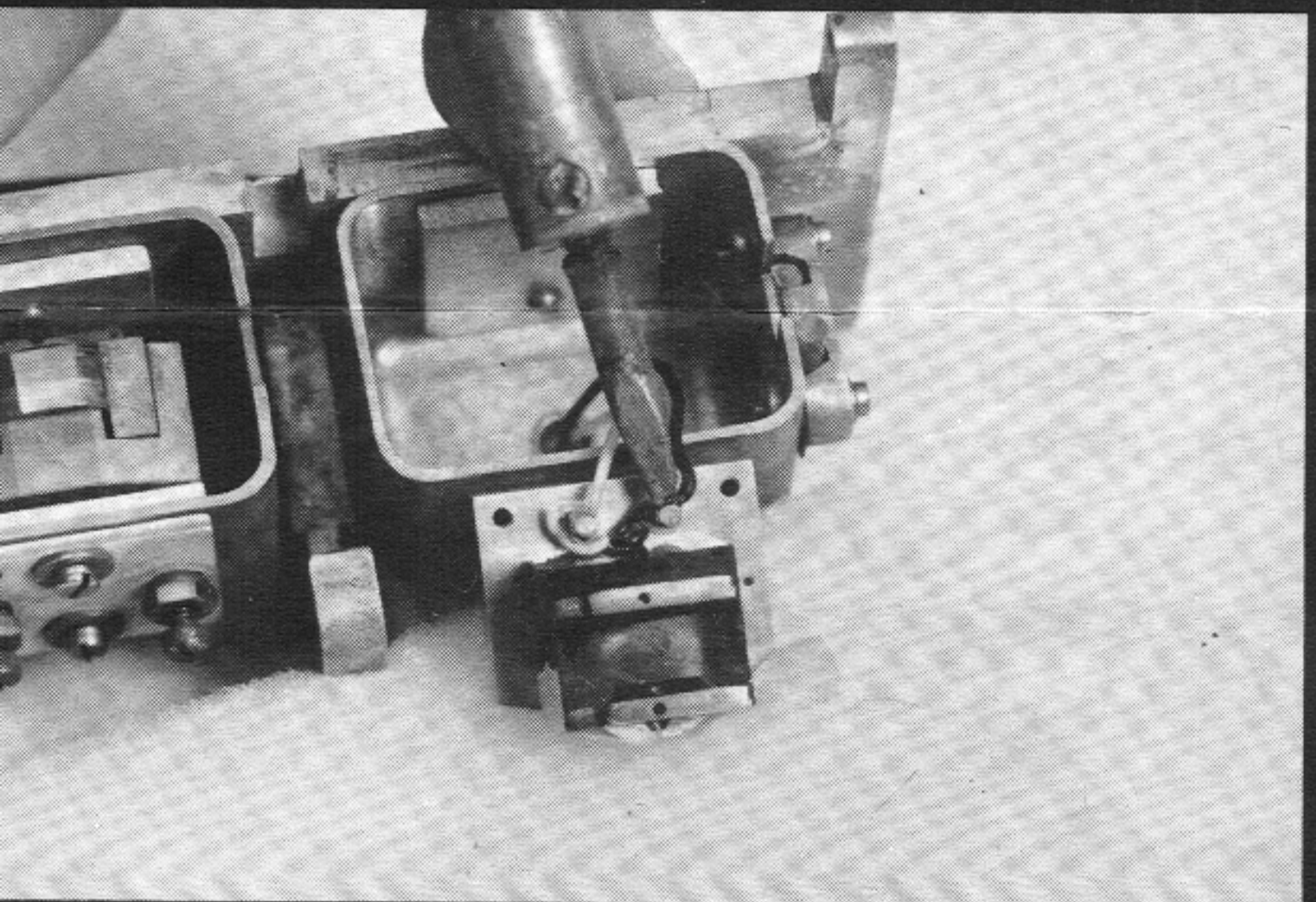
### STEP 2

Remove the two screws holding the erase head in its cup. These screws go through an aluminum spacer plate and into tapped holes in the head block. Brass shims are frequently inserted to adjust the height of the erase head. The number of shims used ranges all the way from none to seven. If you find any, save them for use with the new head.



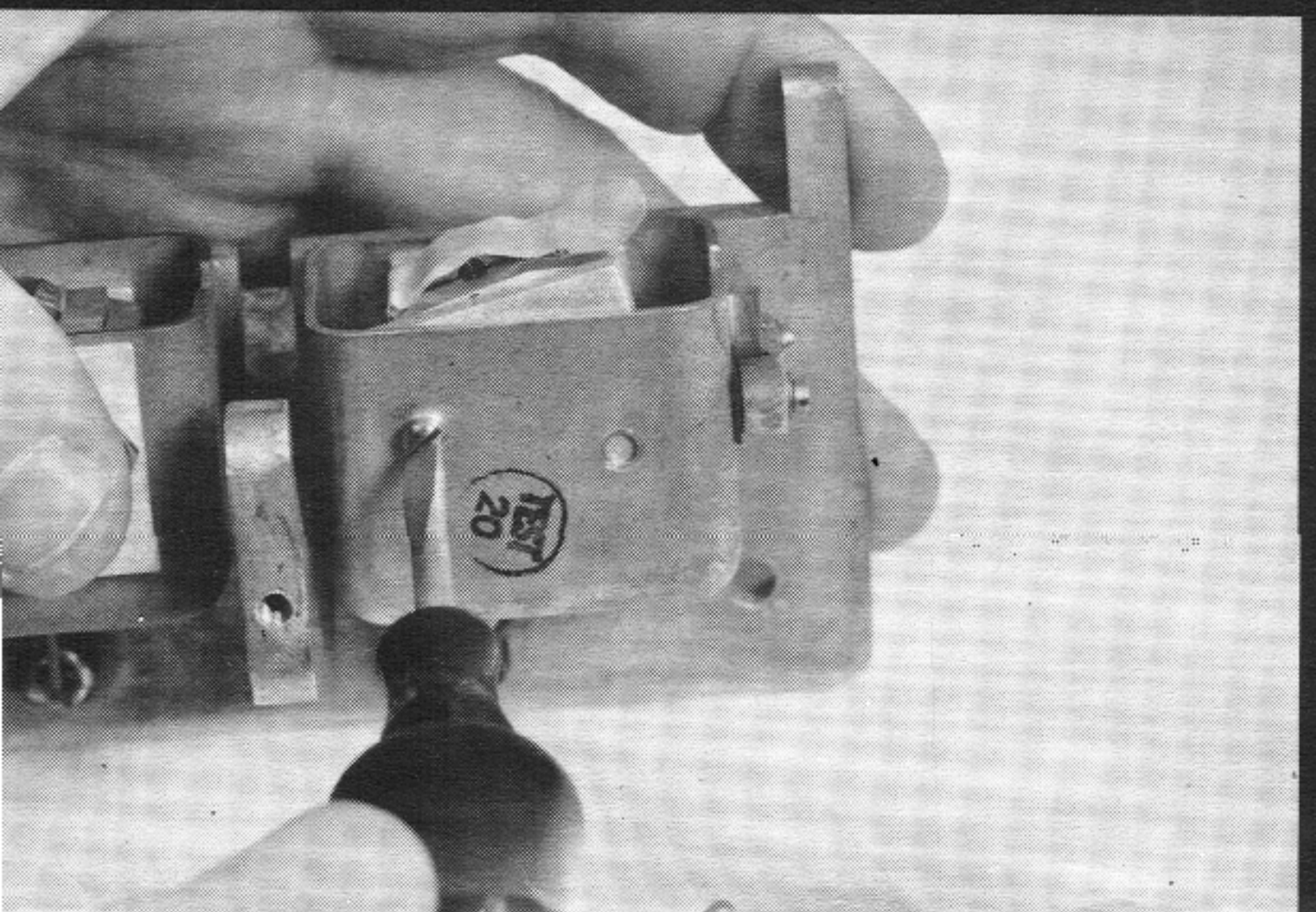
### STEP 3

This view shows the old erase head, the aluminum spacer plate and three brass shims as removed from the erase head cup. Unsolder the head cable lead wires from the pins of the old head. Do not snip them off. There isn't much length to spare . . . particularly on the Reproduce head. Clean out the inside of the cup. When re-connecting leads to the new head pins, wrap the wire on the pin right up to the insulation to avoid bare wire which might short against the head block or mounting cup. Observe how the lead wires are soldered to the pins on the old heads before removing them.



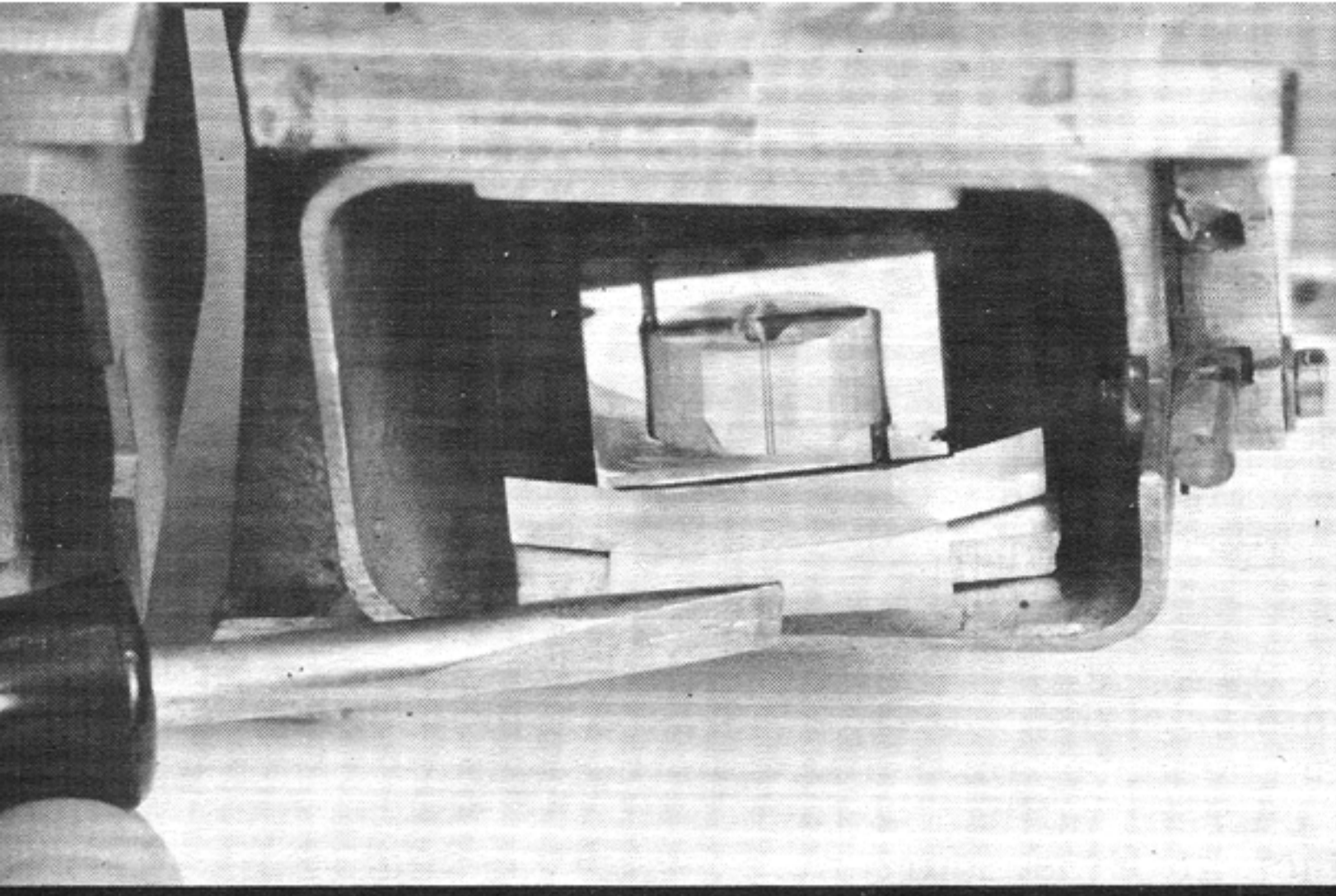
### STEP 4

Place a strip of masking tape over the face of the new MMI head to protect it from scratches. Position one of the pieces of foam from the head package so it will serve as a cushion and support the head while you solder the lead wires. In all cases, one lead is soldered to the head cable shield (usually black) and the other is a co-axial lead (usually white). The color coding of leads on all MMI mono Erase heads is black and white. Solder the black head cable lead to the black lead pin on the erase head and the co-axial cable lead to the other pin. Use a pencil type soldering iron, to avoid overheating the pins and melting the insulation on the head leads.



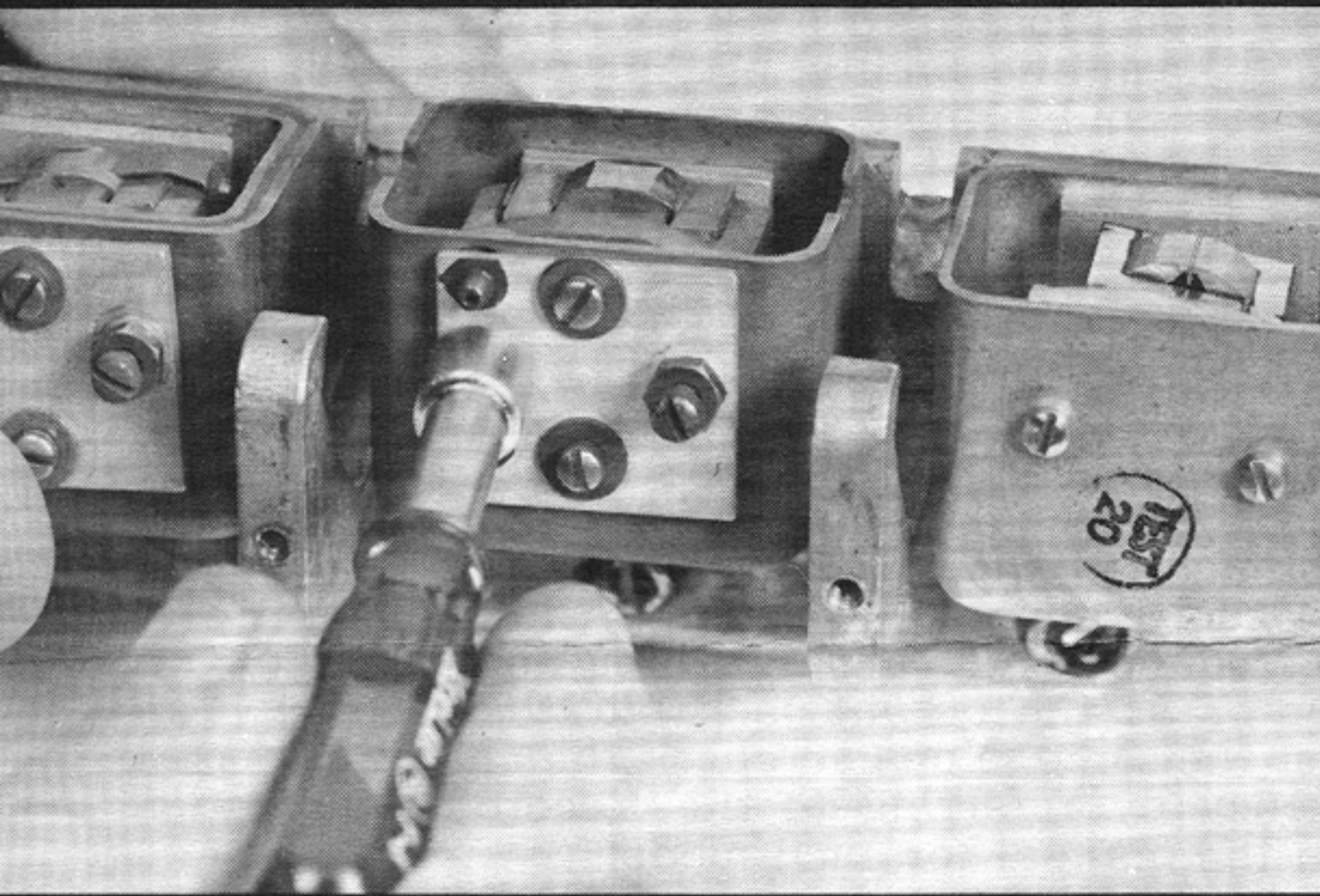
### STEP 5

Place the aluminum spacer on top of the head block and insert the new Erase head at an angle as shown so you can get one mounting screw started. Swing the head and spacer plate into position and start the other screw. Remove the masking tape from the face of the head.



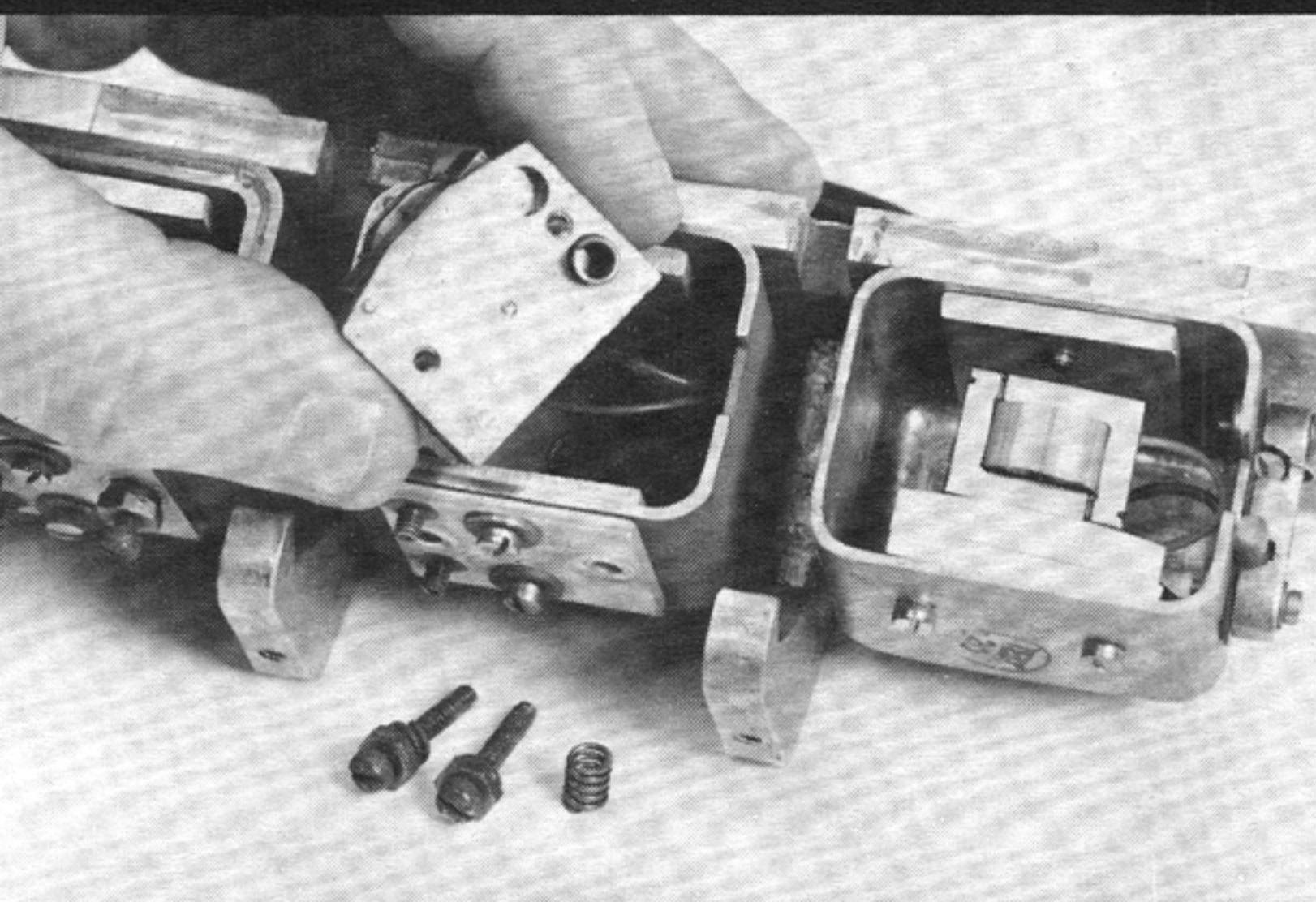
## STEP 6

With both mounting screws tightened just enough to hold the head in place, slip the old shims (if any) between the top of the head block and the bottom of the spacer plate. These shims must slide between the threads of the two mounting screws. Gently press them with the blade of a screwdriver until they are flush with the front of head block. Tighten the screws by alternating between first one and then the other. Do not tighten down one securely and then the other. This tends to cant the head to one side at an angle. This completes installation of the Erase head.



## STEP 7

Since the procedure is identical for both the Record and Reproduce heads, only one will be shown. Use a  $\frac{1}{4}$ " nut driver to loosen the nut under the head of each mounting screw and then continue to turn so you can remove the screws with the nut driver. This will insure that each nut is directly beneath the screw head which is just where it ought to be.



## STEP 8

Remove the two pressure springs. Save these and the two mounting screws to install the new head. When unsoldering leads from any of the old heads, do just that. Don't cut them off or you might not have enough length to make connections to the new head. This is particularly true of the Reproduce head. Clean out the inside of the cups before installing a new head. You'll be amazed at how much oxide and dirt you'll find.



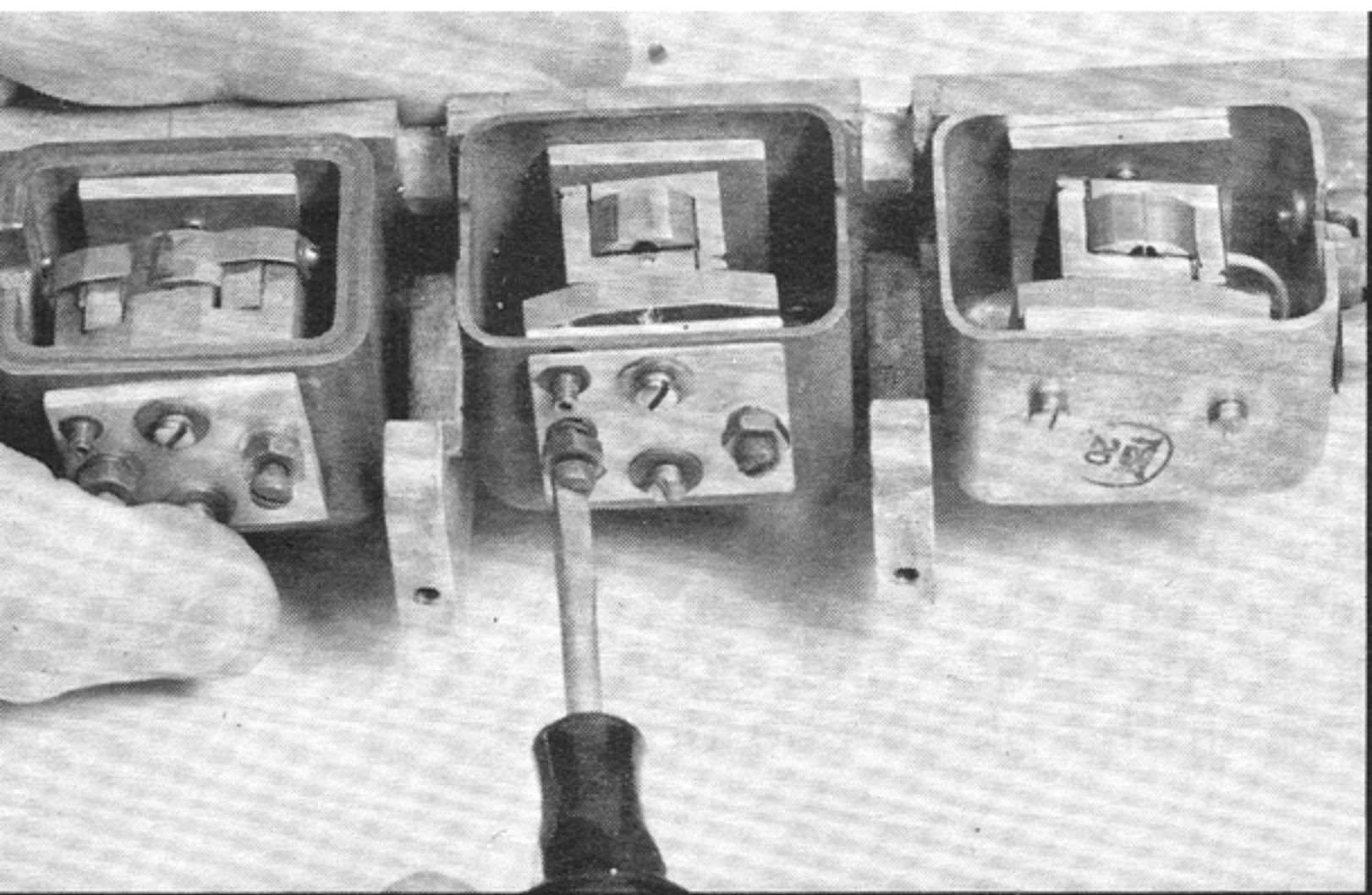
## STEP 9

Before installing the new head, apply a few drops of solvent to dissolve the glyptal seal on the two Allen head screws used to adjust the height and face (tilt) of a new head. In most cases these screws will require no adjustment but the time to make certain they **are** adjustable is now. Both these screws are made of soft brass and the head is easily stripped. Make sure the wrench will seat firmly and about  $\frac{1}{8}$ " deep before attempting to turn them. Two new replacement screws of the same type but made of steel are included with each MMI Record or Reproduce head in case they are needed.



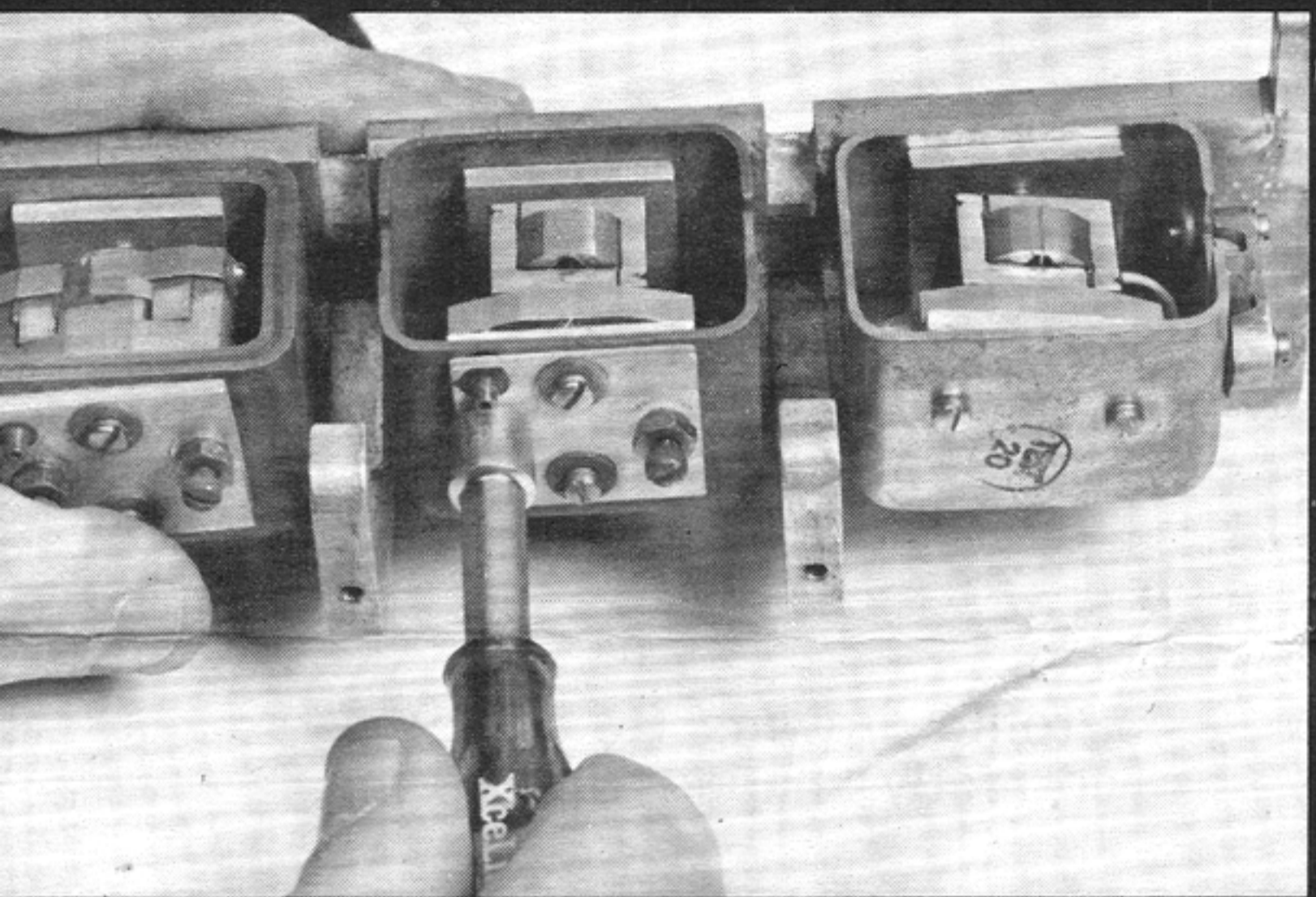
## STEP 10

Place masking tape over the face of the new head to protect it, solder the lead wires to the head with a pencil soldering iron, install the pressure springs as shown and just before inserting the head in the cup and installing the mounting screws, check again to make sure you can turn the two Allen head screws. Color coding used on all MMI mono Record heads is black and red. Black and green are used on Reproduce heads. Solder the black head cable lead to the MMI head pin with the black lead and the co-axial cable lead to the other pin. Avoid overheating the head pins.



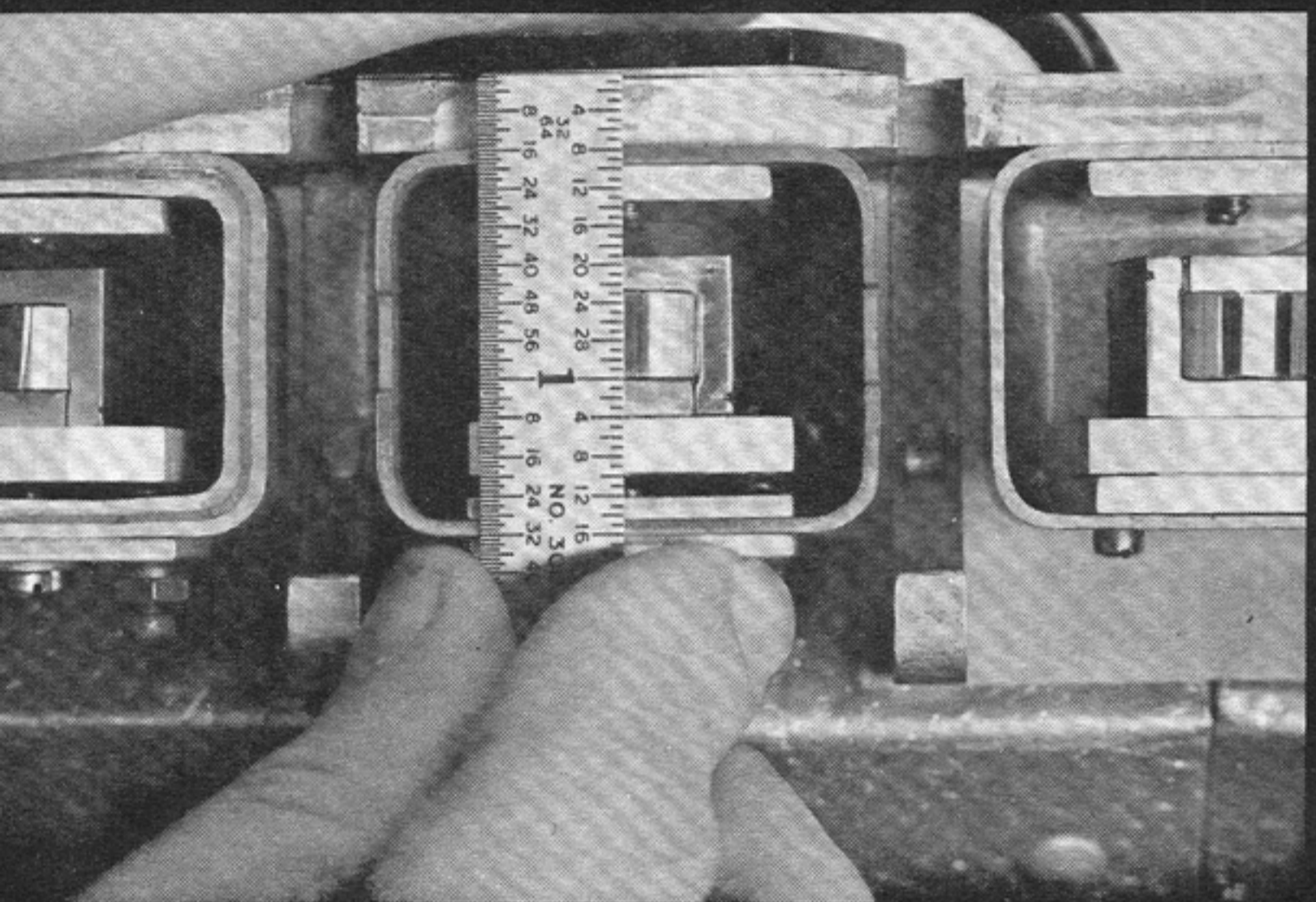
### STEP 11

Insert both mounting screws and turn until they are finger tight. Use the screwdriver to firmly seat each screw. Do not attempt to force them beyond this point. The free threads on each screw are intended to provide adequate travel for the two nuts. The spring-loaded one between the two Allen screws is used to pull the head block up firmly against the points of the Allen screws, thus positioning the block for height and face (tilt). The other nut is turned back and forth to swing the entire head in an arc and is used to azimuth the gap of the head.



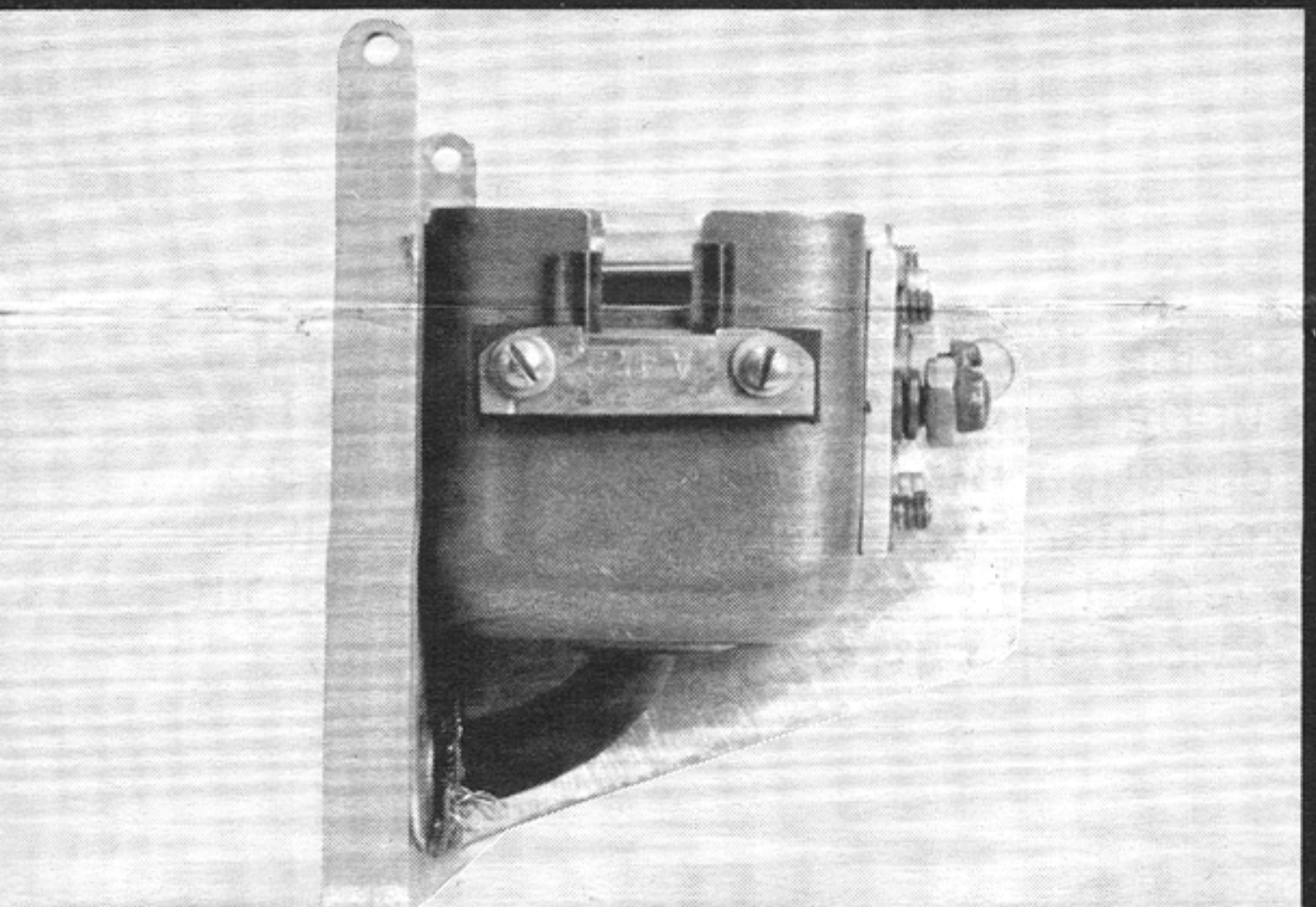
### STEP 12

With the  $\frac{1}{4}$ " nut driver, snug down the nut on the left mounting screw against the spring. Now turn the azimuth nut until the entire head appears to be evenly centered in the cup. It is important to remember that if either of the two Allen screws is to be adjusted for any reason, the nut on the mounting screw located between them must be loosened at least one full turn. If this is not done, the excess pressure caused by the tight nut will either strip the threads or the head of the Allen screws. In severe cases, even the threads in the aluminum top plate can be stripped. Easy does it!



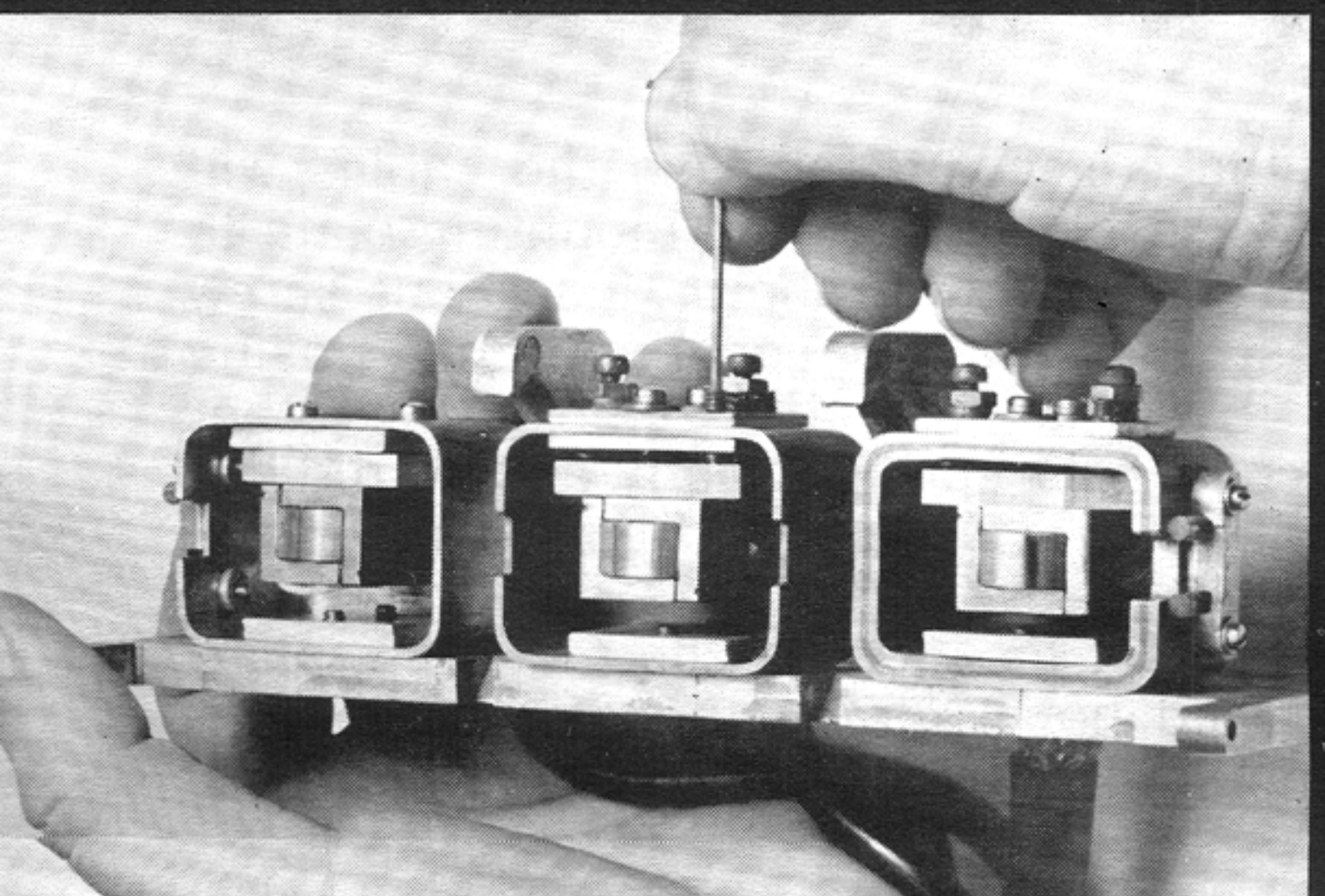
### STEP 13

Hold a flat object against the bottom of the mounting plate as shown. Place a ruler against this surface and check the measurement from the bottom of the mounting plate to the top edge of the head stack. It should be a trifle under 1". A trifle is equivalent to about 1.5 smidgins. This is close enough for all practical purposes since final adjustment is made on the recorder with tape running over the heads. The height of each head stack is a nominal .273". Since the tape is .250", correct head height is that point at which the stack appears to extend an equal amount above and below the tape edges. This will insure even wear on the stack.



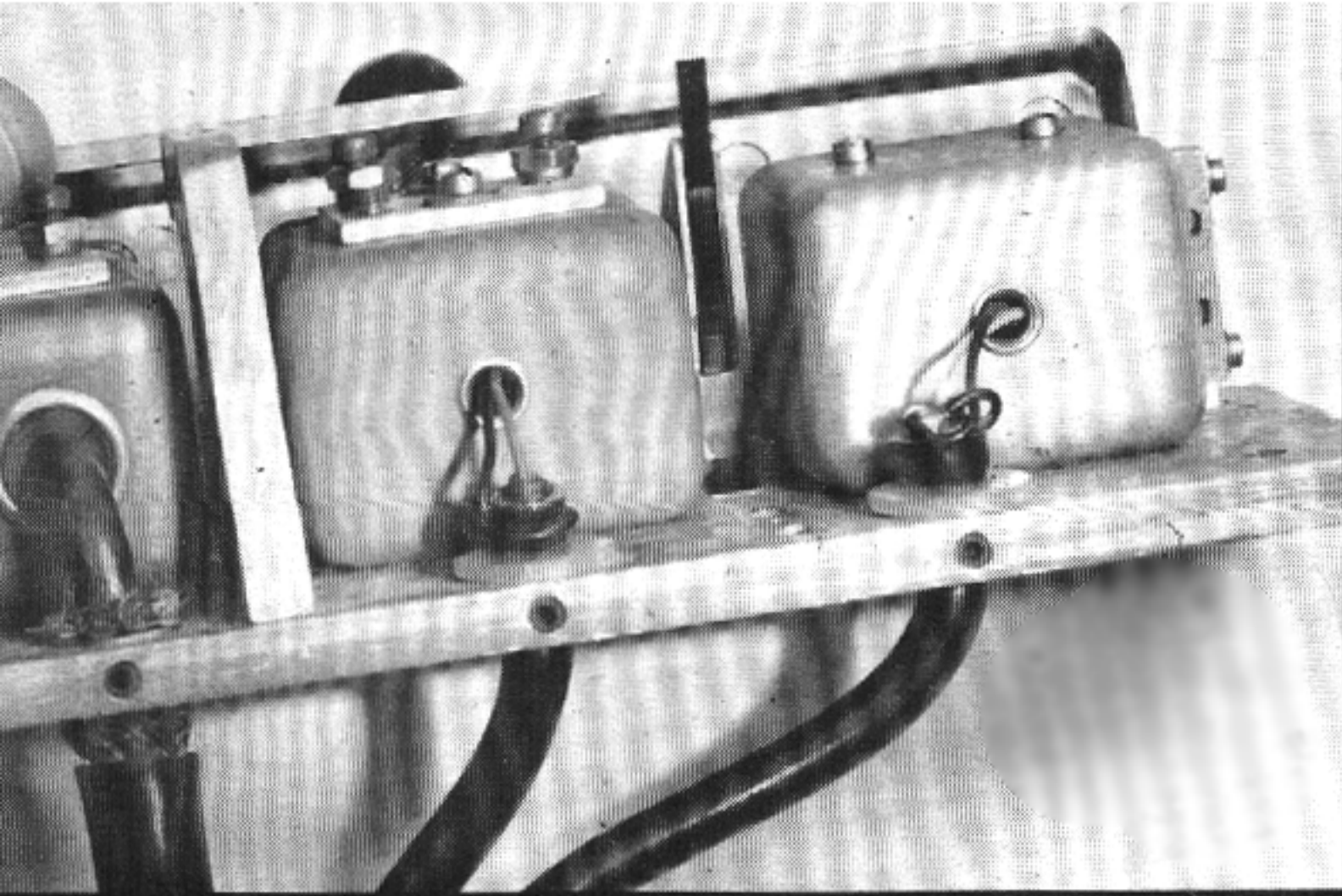
### STEP 14

Position the assembly as shown and sight along the face of the heads across the nest. All three heads should be in a straight line and the face of each head should appear to be squared-up and level, not tilted up or down. There is no provision for adjusting tilt on the Erase head other than shimming it up more in the front than the back or vice versa. Height of the Erase head is controlled by adding or removing shims.



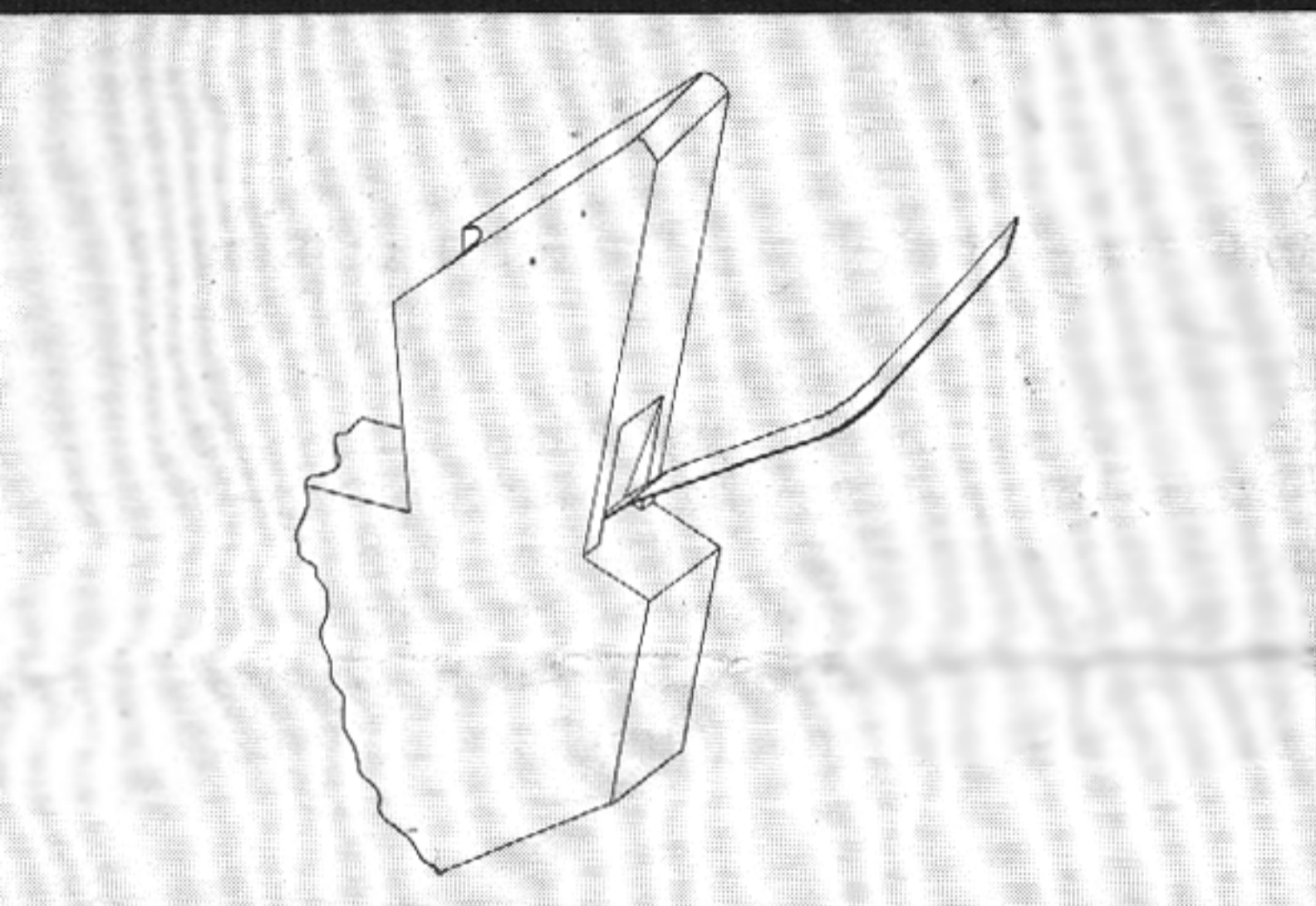
### STEP 15

Height of the Record or Reproduce heads is determined by the Allen screw nearest the front of each head cup as illustrated. Any tilting of the head face is corrected by adjusting the Allen screw nearest the rear of the head cup. Once the front screw is adjusted so the height of the head is correct, the rear one must also be adjusted so the head block will be firmly contacted by both screws. The rear screw is then adjusted slightly while actually recording or playing a tape to correct whatever minor tilt of the head face might exist. Refer now to the section on Alignment Hints — Mechanical for more information on these adjustments before proceeding to Step 16.



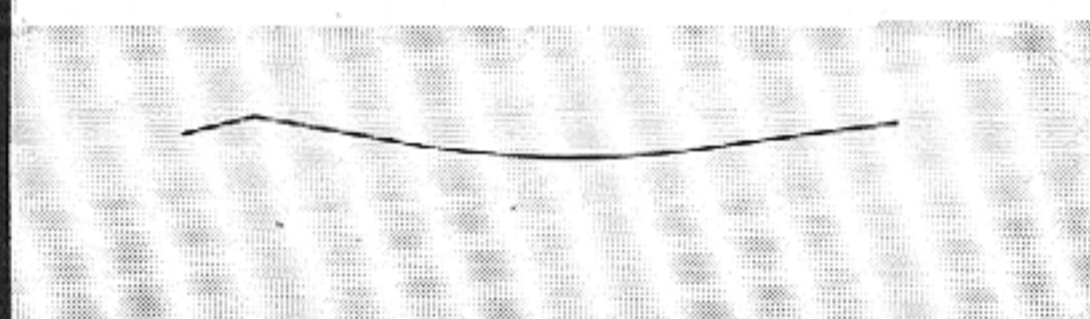
## STEP 16

Replace the gate on the assembly in the closed position. Remove one of the uprights used to mount the black cover casting. Check the gate springs in your nest against the scale profile drawing given and pre-shape the spring to its proper slight bend. Nearly all complaints of gate springs that won't stay in place are caused by an excessive bend in the spring which has the practical effect of shortening its length so it can easily pop out. After forming the springs to the correct shape, place one against the back of the tape lifter bar as shown in the photo and drawing.

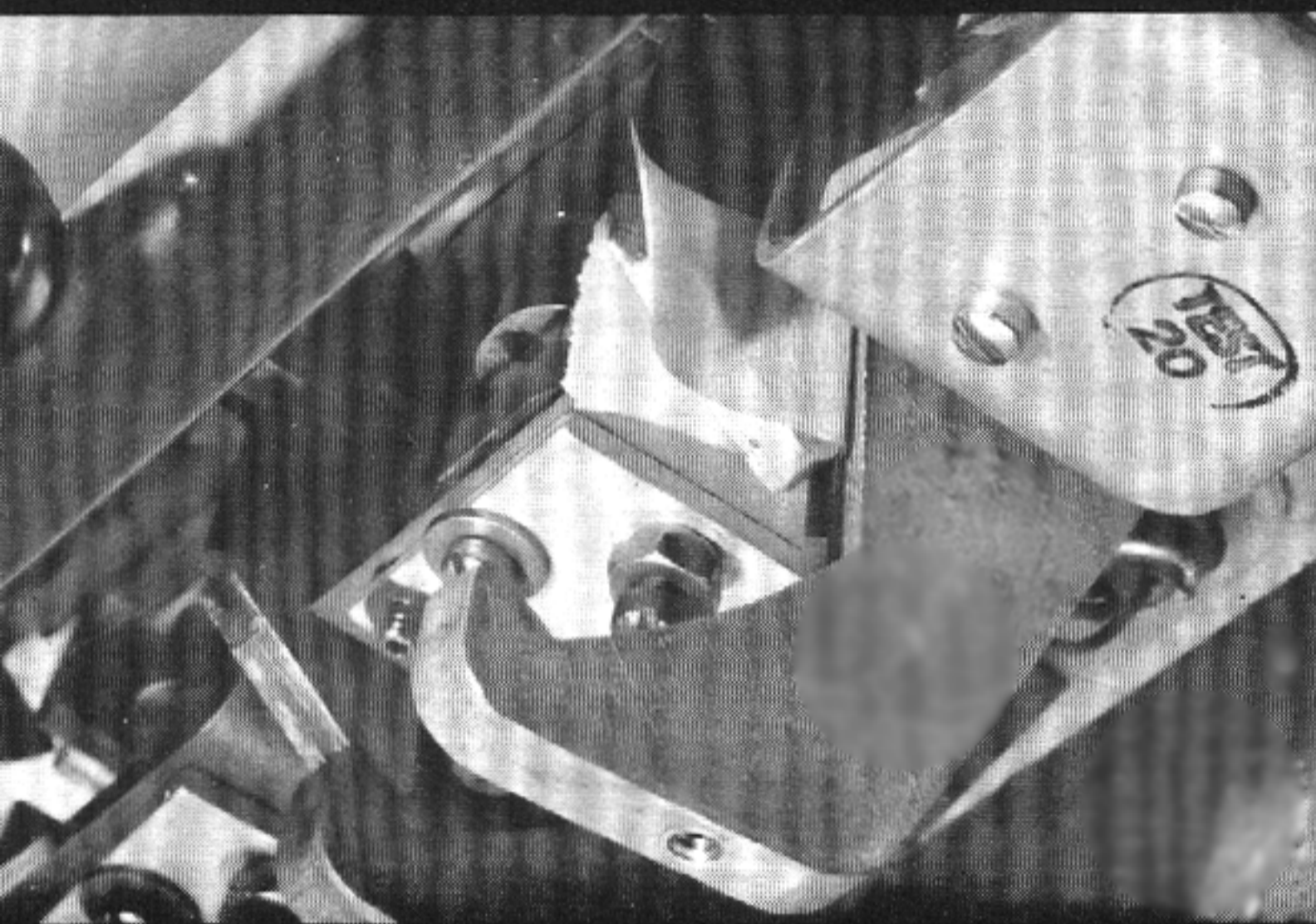


## STEP 16A and 16B

← Inserting gate spring against back of tape lifter bar.

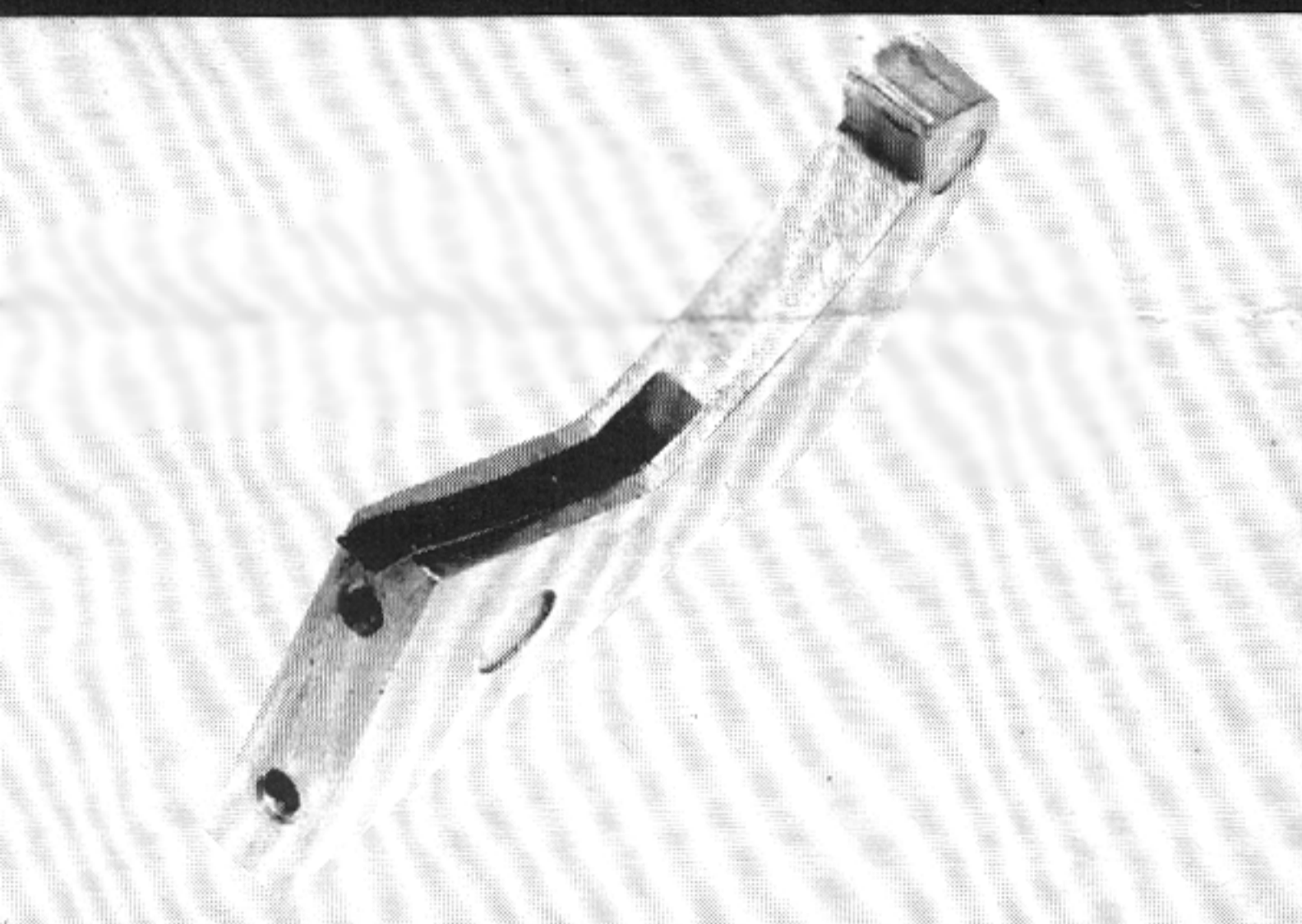


Profile drawing (to scale) — correctly shaped gate spring.



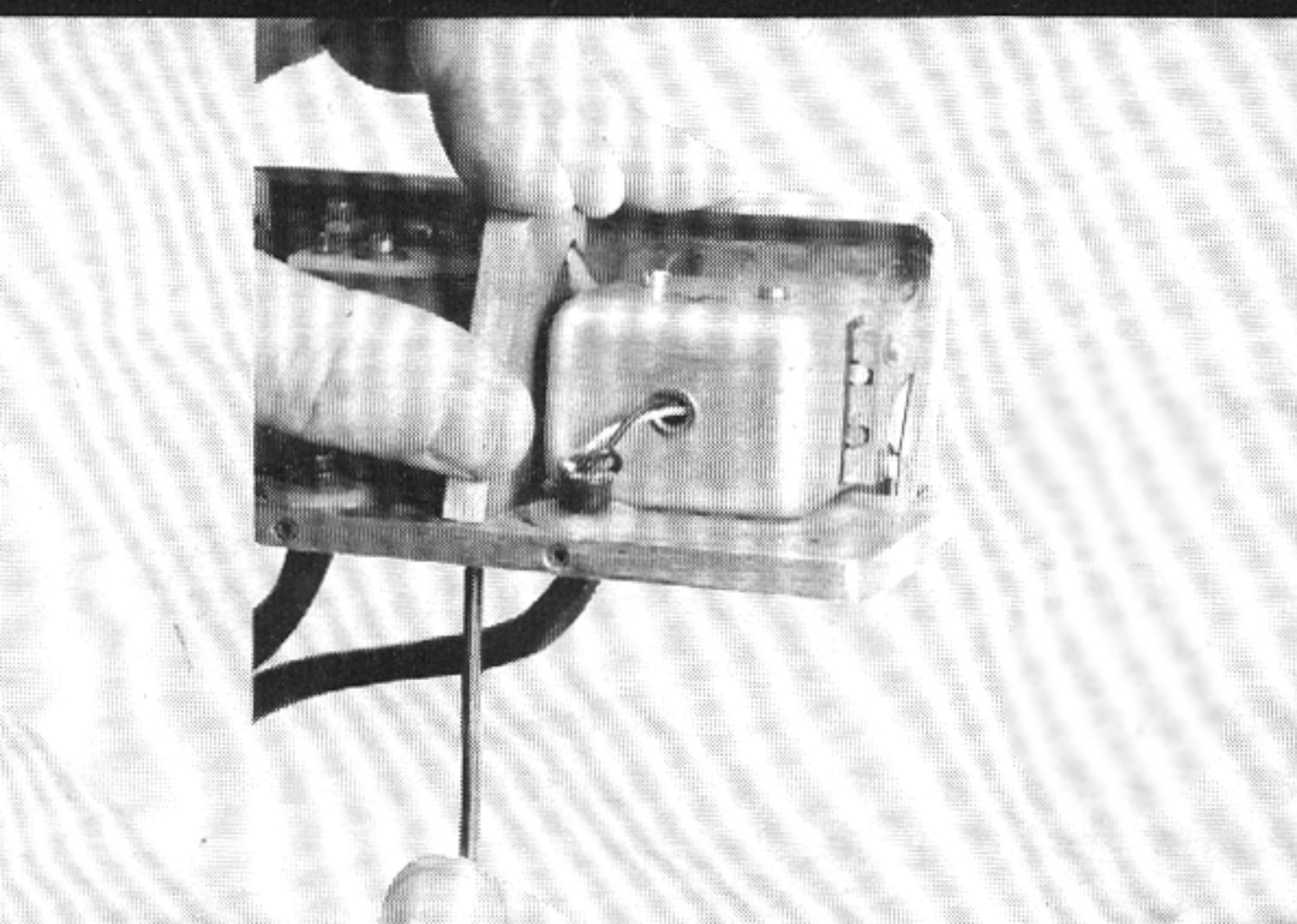
## STEP 17

Hold the spring in place with masking tape as shown. Don't apply the tape too tightly as you want it to pull away when you bring the upright down against the base to fasten it with its mounting screws. Fit the free end of the spring into the pocket of the upright as shown in the next photo. While holding the gate open (the other upright will serve as a stop), swing the upright down against the base and install one of its mounting screws. Tighten this one securely, then install the other mounting screw. Fish out the masking tape . . . gently.



## STEP 18

This view shows how the spring fits into the pocket provided for it on the front side of the upright. Note carefully the angled free end of the spring and the direction it points. This is the end that fits into the back of the tape lifter bar and it is imperative it be placed properly. If it is reversed, the spring will either pop out or will bind up the gate so it won't operate correctly.



## STEP 19

Place the assembly near the edge of a table so the cables will hang over and permit you to reach beneath the mounting plate to install screws in the upright. Position it as shown, insert one screw and tighten securely. Test the gate for opening and closing properly. When satisfied it works correctly, remove the other upright and install the second gate spring exactly as you did the first. These uprights can be moved forward and backward on the mounting plate. Since the black cover casting is screwed to the top of each upright, their correct location on the mounting plate is that spot where the tapped holes in the top of the uprights are centered under the mounting holes of the cover when it is put in place.

# ALIGNMENT HINTS

## MECHANICAL

To check final alignment of the new heads for height, install the assembly on the transport. Leave the gate and black cover casting off and do not connect the cables. Thread a blank tape on the recorder and put the transport in the Play mode. Look at the face of all three heads with tape running over them and after backing off the nut on the spring-loaded head mounting screw one full turn, adjust the height of the Record and Reproduce heads by turning the Allen head set screw nearest the front of each head cup until you can see an equal amount of the head stack above and below the tape edges. This will center the tape on both heads. Adjustments to the height of the Erase head must be made by inserting or removing brass shims. If no shim stock is available, heavy wrapping paper will make a suitable substitute. It should be pre-cut to the same length and width as the shims found when the head was removed.

When the height of all three heads is correct, remove the assembly. Sight across the head faces from one end of the assembly and correct any tilting of the head faces by adjusting the Allen head screw nearest the back of the Record and Reproduce head cups. Check the visual azimuth alignment of both heads and adjust the azimuth nut to square up the head in each cup. If you make any adjustments at all to the Height adjusting Allen head screw, you will have disturbed the previous visual azimuth setting you made. Erase heads do not require any adjustment for azimuth but the head should obviously not be cocked to either side. Now refer to Step 16 and proceed.

Final alignment for azimuth and tilt of the Record and Reproduce heads must be done during the electronic alignment, even though it is actually a mechanical adjustment. The gate may now be replaced, the gate springs installed and the assembly again mounted on the transport for final electronic alignment.

## ELECTRICAL

Detailed procedure for aligning the electronics for use with the new heads is given in the operating manual which accompanies each recorder. Because these instructions vary considerably from model to model, the user should refer to them and perform them in the order recommended by Ampex. Basically, this consists of demagnetizing the heads (this can be done before final installation of the head assembly) and then playing a standard NAB alignment tape having a frequency range of 50 to 15,000 Hertz at a speed of 7.5 ips. To insure best results, no tape is recommended for azimuth alignment of the Reproduce head which does not provide at least a 12,000 Hz tone for this purpose.

The Reproduce head is adjusted for maximum output with the azimuth frequency, then the run of tones from 50 to 15,000 Hz is made and the playback equalization adjusted to give flat response within the specifications for the recorder. Finally, the operating level is set using the tone provided (usually 700, sometimes 1,000 Hz).

Once the playback circuits are aligned, the Reproduce head and playback circuit are used as a standard reference. The Record head and its associated circuitry are adjusted to the same performance level.

Before attempting any adjustments to the Record circuitry, the Erase current trimmer should first be adjusted for proper operation of the Erase head, as instructed in the manual. In most models, the Bias current adjust is taken off the Erase current trimmer. If insufficient Erase current exists, it is highly likely there won't be enough Bias current either. Therefore, adjust the Erase current first, then proceed to peak the Bias current, then azimuth the Record head and finally, use an audio oscillator to make a response run and adjust the Record equalization to obtain as flat a response as possible. Don't overlook adjusting the calibration controls for the VU meter on those models equipped with such controls.

## LITTLE THINGS TO KEEP IN MIND

Running a response check on any magnetic tape recorder used in professional work can yield some pretty weird results if the tones from an audio oscillator are not recorded at least 10 db below operating level and preferably even lower. The pre-emphasis of high frequencies during recording does not show up on the VU meter or at the output jack but the Record head gets this boost just the same. You can check the amount of boost at a given frequency by referring to the Record Equalization Curve supplied in the manual for each model.

When azimuthing the Record head don't overlook the slight time delay between the Record and Reproduce heads. While recording a 15,000 Hz tone at least 10 db below operating level and monitoring this recording with the Reproduce head, adjust the Record head azimuth nut for maximum output from the Reproduce head. When this point is reached, the gaps of the Record and Reproduce heads are in mutual alignment.

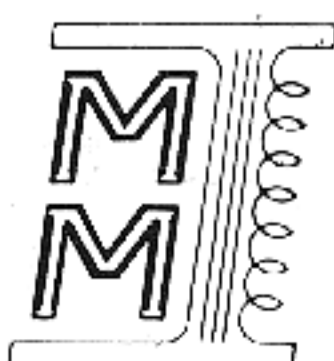
Fine adjustment of the brass Allen head screw nearest the rear of the Record and Reproduce cups should be made to peak up the face or tilt alignment of these heads. Once the Reproduce head is azimuthed, while playing the 15,000 Hz tone on the standard alignment tape, slowly turn the rear Allen head screw a quarter turn clockwise, then back where it was, then a quarter turn counter-clockwise. Within this range, the meter pointer will waver and vary several db. The proper setting for this screw is when the tone is steadiest as seen on the meter. Re-check the azimuth setting to make certain it hasn't shifted a bit, then snug down the spring-loaded nut on the head mounting screw . . . don't wham it down until the threads are stripped. Excess nut pressure against the spring under it will simply force the points of the Allen screws to dig themselves into the head block, thereby upsetting all the adjustments you just made for height, tilt and azimuth! The same procedure applies to the Record head except you record the 15,000 Hz tone. This completes all adjustments and the recorder is now ready to be placed in active service.

HERE IS THE **MMI WARRANTY** THERE JUST ISN'T ANY BETTER.

Except for wear (which is inevitable) and abuse (which seldom occurs when handled by competent professionals), the very simplicity of the installation permits MMI to extend the most liberal warranty in the industry:

**MINNEAPOLIS MAGNETICS, INC.**

**UNCONDITIONALLY GUARANTEES THESE PRODUCTS.**



**MMI**

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