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Telegraph Key and Sounder"

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THE MAKING OF A TELEGRAPH KEY AND SOUNDER

ARTHUR G. HAMILTON

LOWELL SCHOOL, BOSTON, MASS.

THE problem of a telegraph key and sounder shown in the following drawings was worked out under the author's direction in the Lowell School in Boston, Mass. It is not offered as a new model but is submitted as an improvement on an old idea. The following is a material list of the parts needed for each model:

1 pc. ¾"x5"x8" gum wood.
1 pc. ⅞"x1 1/16"x1⅜" gum wood.
1 pc. ⅜"x1⅛"x2⅜" brass.
1 pc. ⅜"x1⅞"—21 gage strap iron.
1 pc. ⅜"x2⅝"—21 gage strap iron.
1 pc. ⅜"x2"—21 gage strap iron.
2 pcs. ⅜"x1 3/16"—21 gage strap iron.
1 pc. ⅛"x⅜"x1⅞" soft iron.
3—⅜"—6 round head blued wood screws.
1—⅝"—6 round head blued screw.
1—¾"—6 wood screw.
1—1" drawer knob.
1 pc. ⅜" wood dowel ½" long.
1—⅜"—4 wood screw.
2—1⅛"—8 wood screws.
1—⅞"—8-32 round head machine screw.
6—¾"—8-32 round head machine screws.
1—¾"—4-32 round head machine screw.
5—8-32 hexagonal nuts.
2—4-32 hexagonal nuts.
4—¾"—5/32" round head stove bolts.
4—5/32" stove bolt nuts.
17—3/16" iron washers (or burs).
1—3/16" machine nut.
2—¼" machine nuts.
1—¾"—3/16" tire bolt.
2—1¾"—¼" tire bolts.
1 ft. No. 22 brass spring wire.
1 solid head thumb tack.
140 ft. No. 25 S.C.C. copper wire.
1 pc. ½"x3/32" round iron (driving fit).
2 pcs. ⅜"x3/32" round brass (driving fit).
2 pcs. ¼" red fibre tubing 1⅛" long.
4 pcs. 3/32" red fibre sheet ⅞" dia.
1 pc. ¼"x5/16"x4¼" soft iron.
1 pc. ¼"x5/16"x3⅜" soft iron.
3 brass upholstering tacks.

The *assembly* drawing is on sheet No. 22.

The *base-board* drawing is on sheet No. 23, and the *pivot block* drawing is on sheet No. 24. These two parts should be made first, finished all over, and the various holes laid out with the point of a scratch awl, keeping strictly to dimensions. Do not drill the holes until the polishing of these two parts has been completed. While waiting for the various coats of oil and shellac to dry the rest of the model can be made.

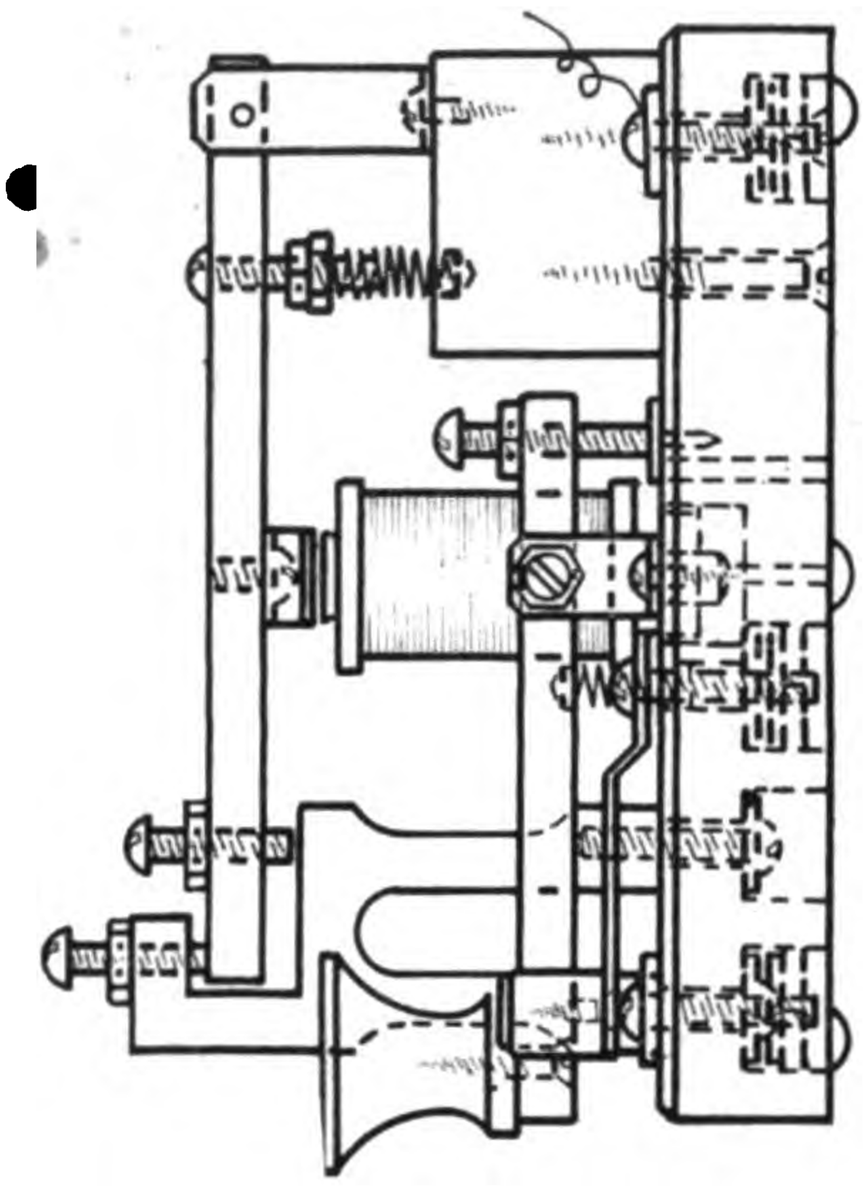
The *anvil* drawing is on sheet No. 23. This can be laid out on a piece of bar brass and cut out with a fine hack-saw, or made from a brass casting, snagging with a coarse file. In either case it should be finished with a smooth file and emery cloth. The three holes shown are drilled with a No. 31 twist drill and tapped with an 8-32 machine tap. Adjust in the top of the anvil a ¾"—8-32 round headed machine screw and a hexagonal nut, to be used as a lock nut. Fasten the anvil to the base-board with two similar screws, and washers. While being drilled the anvil can be held in the jaws of a wooden handscrew.

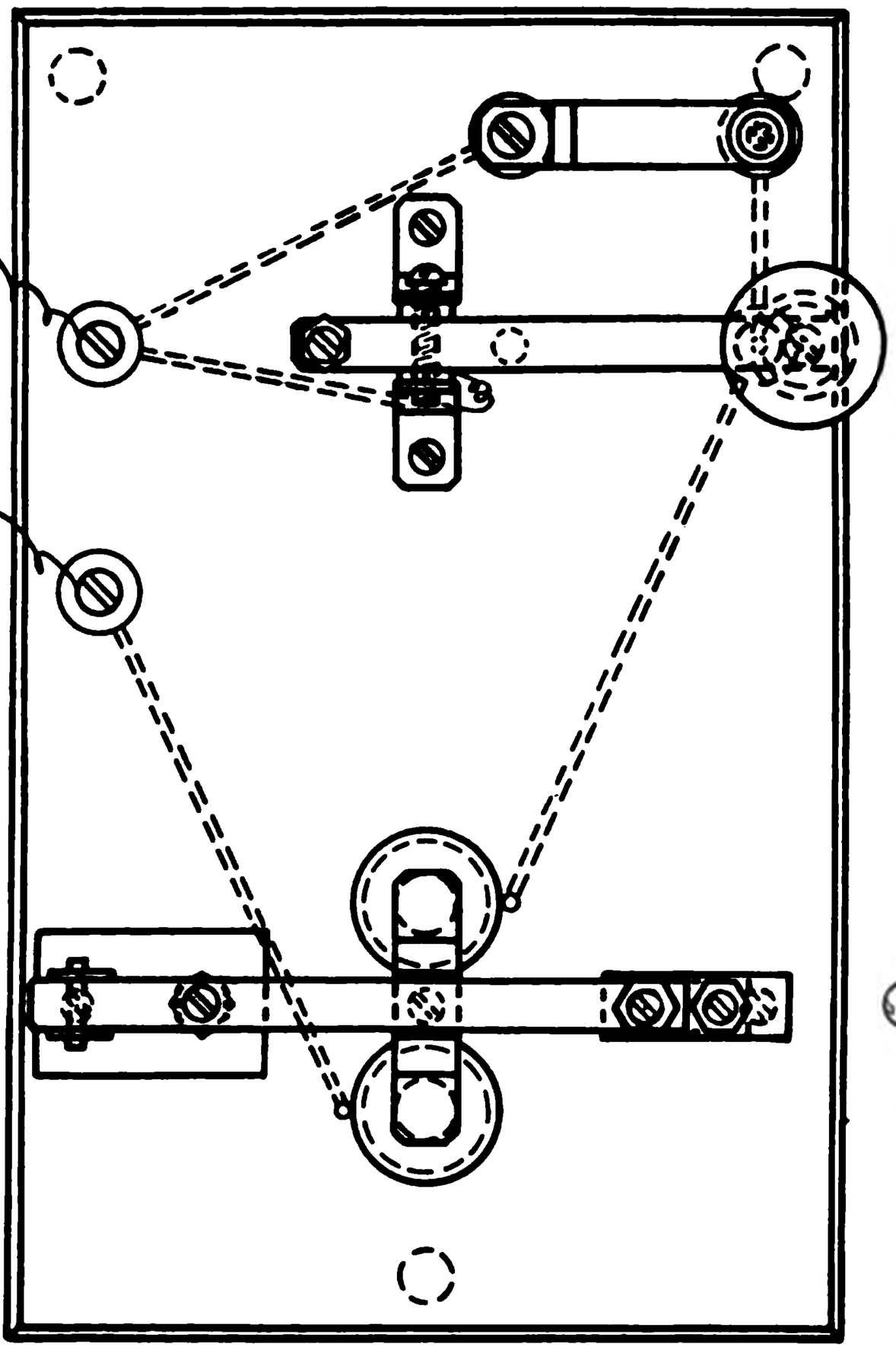
The *magnet* drawing is on sheet No. 24. The cores *A* are two tire bolts. The top

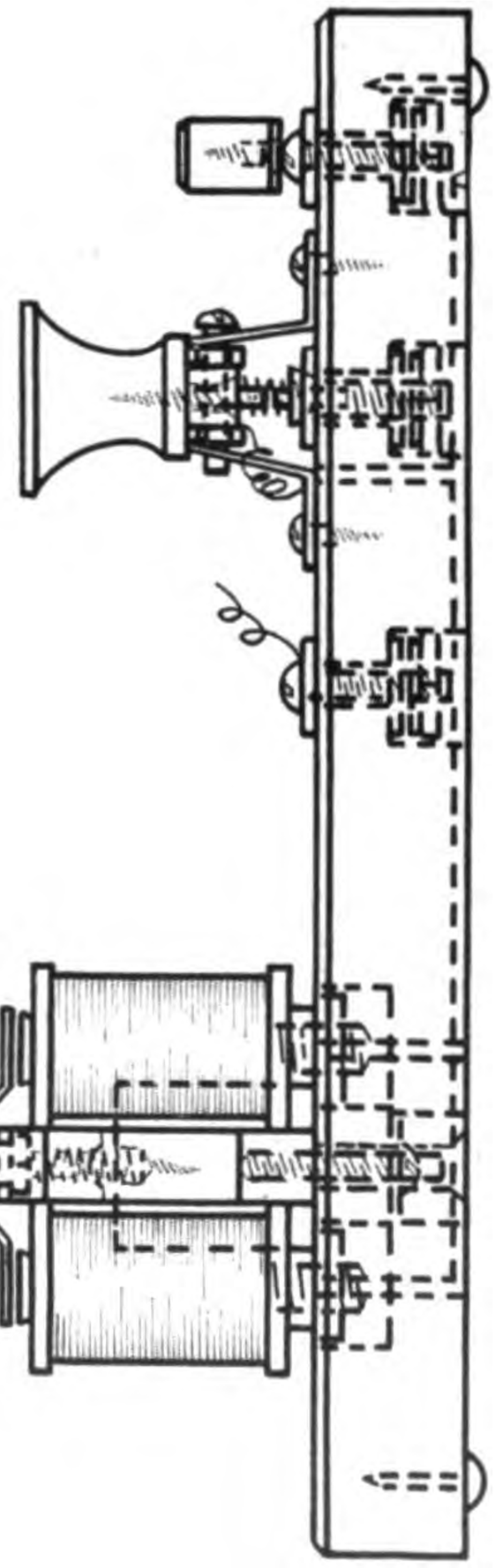
TELEGRAPH KEY and SOUNDER

Scale 6"=1'-0"

For measurements see detail sheets 23, 24 and 25







SHEET NO. 22.

and bottom heads *B* and *D* can be cut from sheet fibre with a ¾" bung cutter, or ¾" fibre faucet washers can be used. The top heads *B* are counter-sunk so that the iron cores *A* project 1/16". The bottom heads *D* are tapped and screwed on the ends of the cores *A* hard up against the ends of the barrels *C*, which are pieces of red fibre tubing cut in the mitre-saw box to insure square ends. This makes a firm spool on which to wind the wire. Adjust the gears of a hand drill until they are tight and fasten the drill frame horizontally in a vice. Hold the threaded end of one of the magnet cores *A* in the jaws of the drill chuck. If the chuck is too small, drill and tap a ¼" hole ⅜" deep in the end of a ½" round soft steel rod and file off the other end to fit the chuck. This will take the threaded end of the tire bolt. To wind the magnet, hold the spool of wire in the left hand and turn the handle of the drill with the other hand. Allow 6" of wire to stick thru the small hole in the bottom head *D* and start close up to the right hand side and wind on a layer of wire. Care should be taken to see that each turn is as close as possible to the one preceding it, and that the wire does not slip, for any irregularity in any layer will destroy the smoothness and appearance of the outside layer. When the winding is completed hold the wire from slipping and cut 6" from spool. The last three turns are lifted and the end of the wire pulled thru underneath. Push the threaded ends of the magnet cores *A* thru the holes in the ends of the magnet yoke *E* and screw on tight the nuts *F*. Care should be taken to turn the magnet heads *D* so that the small holes in them will clear the yoke *E*. The end of the outside layer of wire of one spool must be bared and tightly twisted with the bared end of the inside layer of the other spool close up to the spool. Cut off the surplus wire. Fasten the magnet to the base-board with a ⅝"—6 round headed screw, the two nuts *F*, the corners of which must be filed off, fitting into the two ⅝" holes. The two loose ends of wire are passed down thru the two small holes, one front and one back of the magnet, and run in the grooves in the under side of the base-board to either the left binding post, or the key contact point. The connections are to be made later.

The *sounder lever* drawing is shown on sheet No. 25. The lever is made from a piece of ¼"x5/16" soft iron, filed smooth. The three tapped holes are drilled with a No. 31 twist drill, and tapped with an 8-32 machine tap at right angles to the 5/16" face. An iron rod is driven into the 3/32" hole in the end of the lever, cut off to ½" in length, and the ends filed to fit the two 3/32" holes in the top of the pivot bracket of the sounder lever shown on sheet No. 24, or the two holes may be reamed with tang of a file. This pin can be made from a wire brad. Chamfer the end of the lever a little for finish.

The *armature* drawing is shown on sheet No. 25 attached to the lever. The armature is made from a piece of ⅜" strap iron. A hole is made in the center with a 3/16" twist drill. The iron is then bent into shape and fastened to the sounder lever with a ¾"—8-32 round headed machine screw. The projecting end is cut off a short distance from the bar and then filed down smooth. Adjust two other similar screws and hexagonal nuts in the lever as shown on the drawing.

The *pivot block* drawing is on sheet No. 24. The pivot block has a hole laid out on the top face near one end. This is drilled a little larger than the outside diameter of the compression spring shown on sheet No. 25.

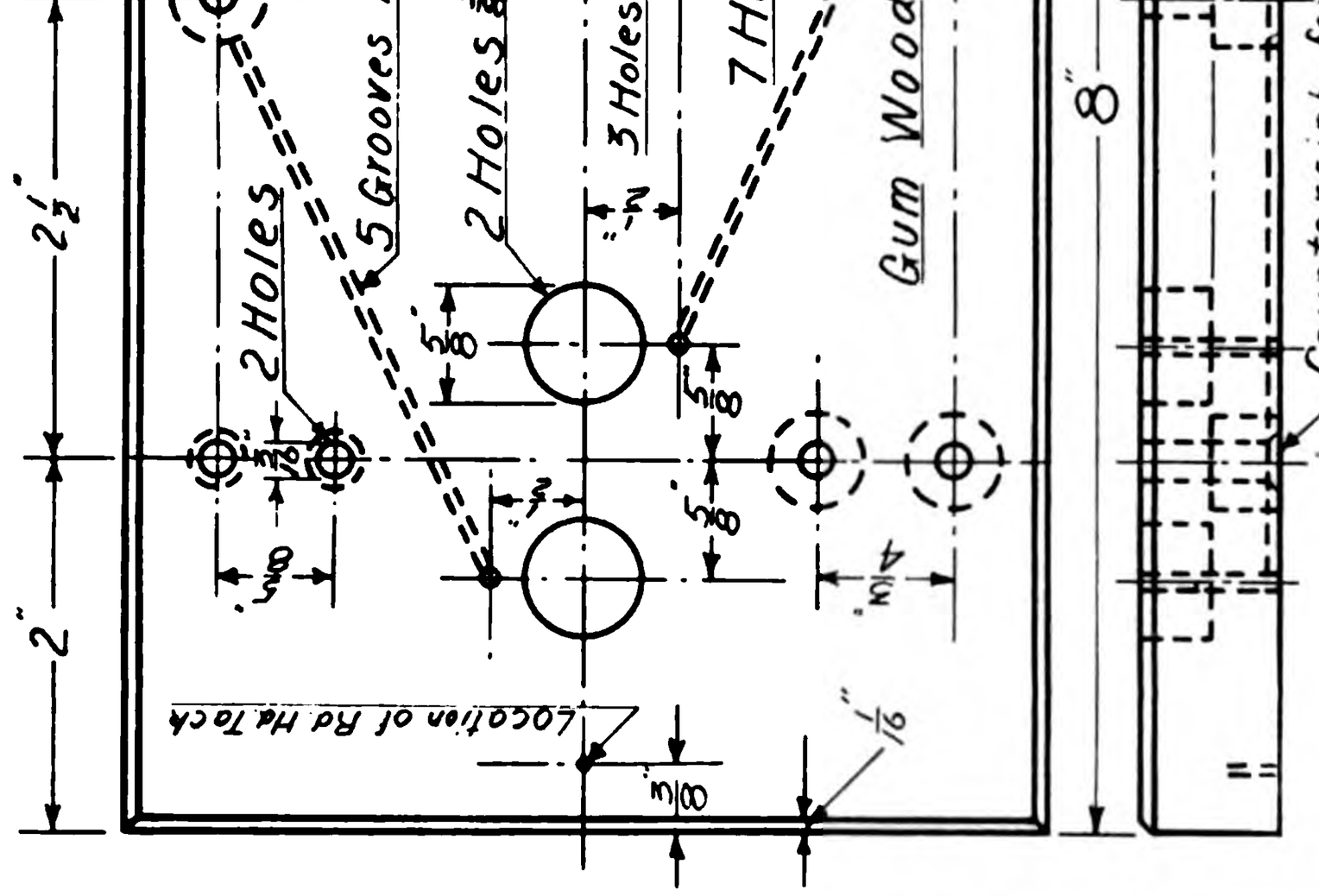
The *pivot bracket* for the sounder lever as shown on sheet No. 24, is attached to the pivot block. The bracket is made from a piece of ⅜" strap iron. A ⅛" hole

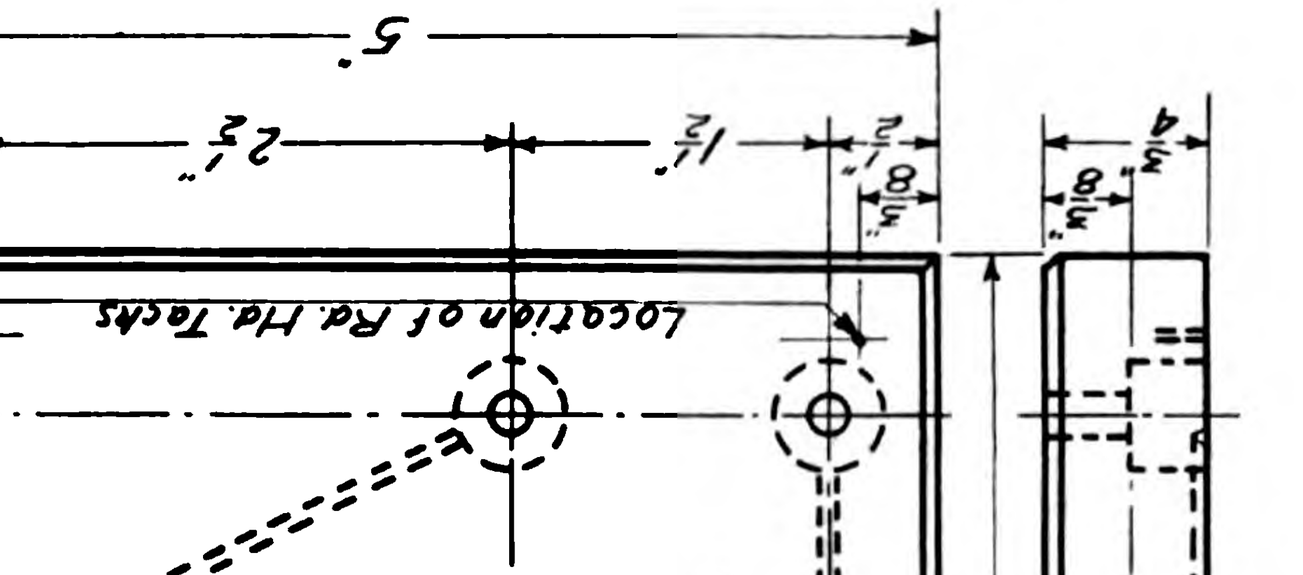
TELEGRAPH KEY and SOUNDER DETAILS

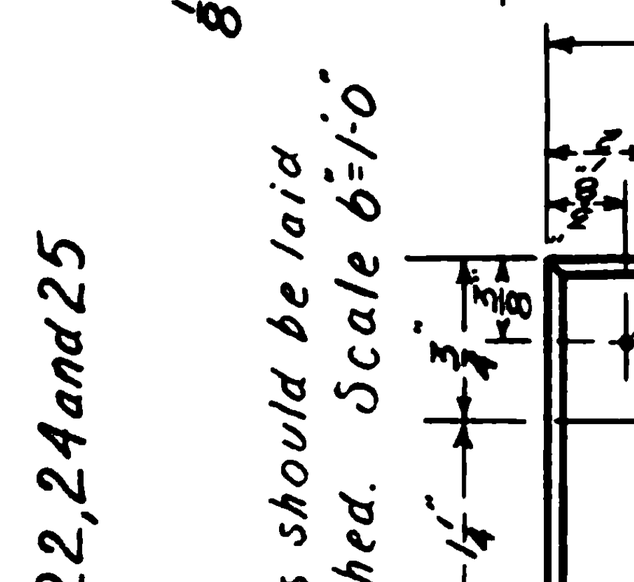
See sheets 22, 24 and 25

BASEBOARD

Each boy should make his own baseboard. Holes should be laid out but not cut until the baseboard has been polished. Scale 6"=1'-0"



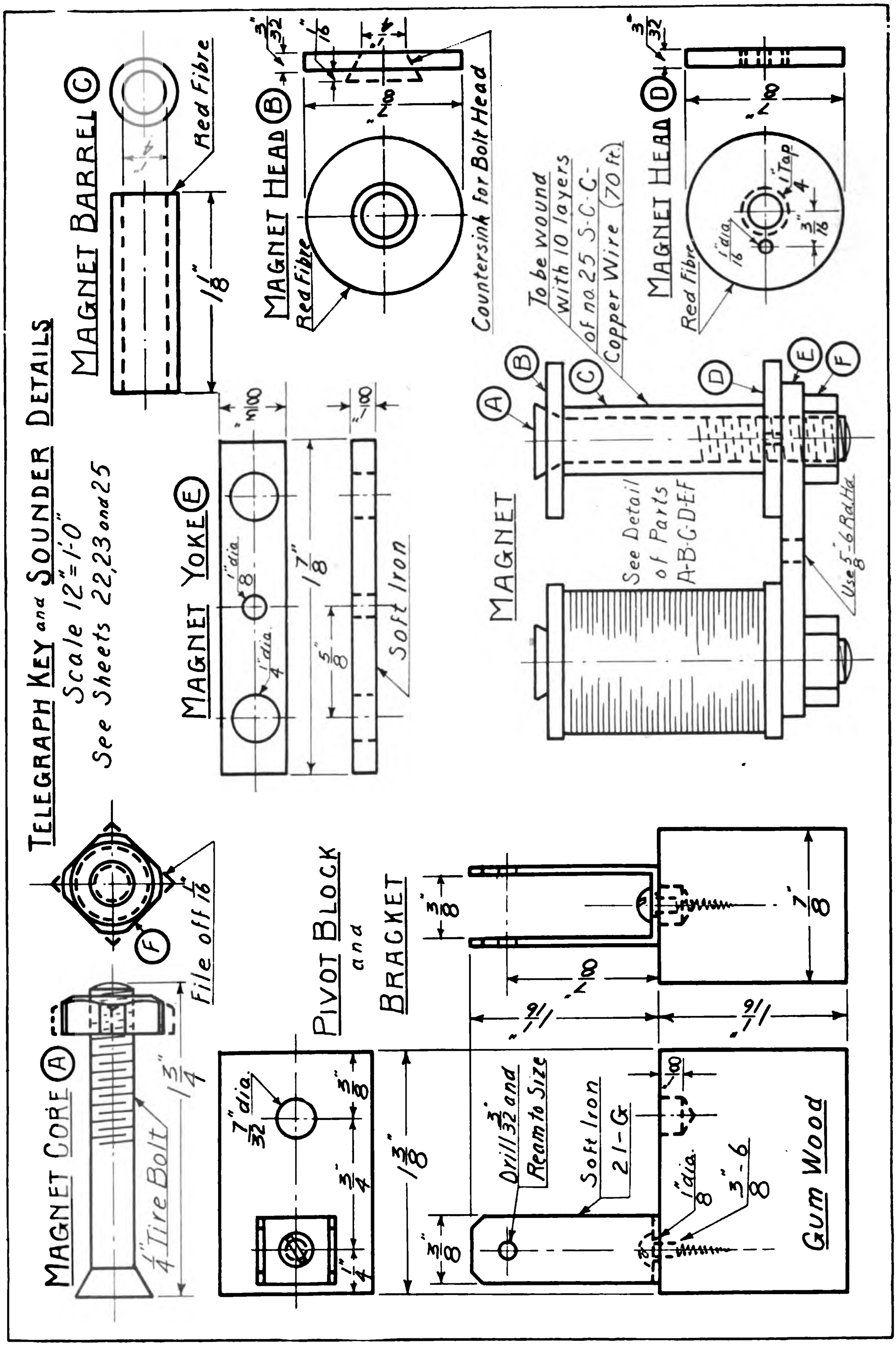




TELEGRAPH KEY and SOUNDER DETAILS

Scale 12"=1'-0"

See Sheets 22, 23 and 25



SHEET NO. 24.

is drilled in the center and the arms are bent up into shape. The two pivot holes are laid out from the base of the bracket with a pair of dividers while holding the bracket down on a flat surface. In drilling the pivot holes a piece of hard wood 3/8" long is placed between the two sides. Locate the position of the bracket on the pivot block by measuring from the center of the compression spring socket to a perpendicular line dropped from the center of the pivot holes, and fasten to the block with a round headed screw. Mount the sounder lever in the bracket and adjust a compression spring in the socket.

The *compression spring* drawing is on sheet No. 25. The spring is made by winding a piece of spring wire around a large wire brad. It is best to separate each turn of wire as it is being wound. If this is not possible, wind the turns close together and separate after the spring is made by pulling on each end of the spring. This spring and the spring in the key lever must be 3/16" across the outside diameter.

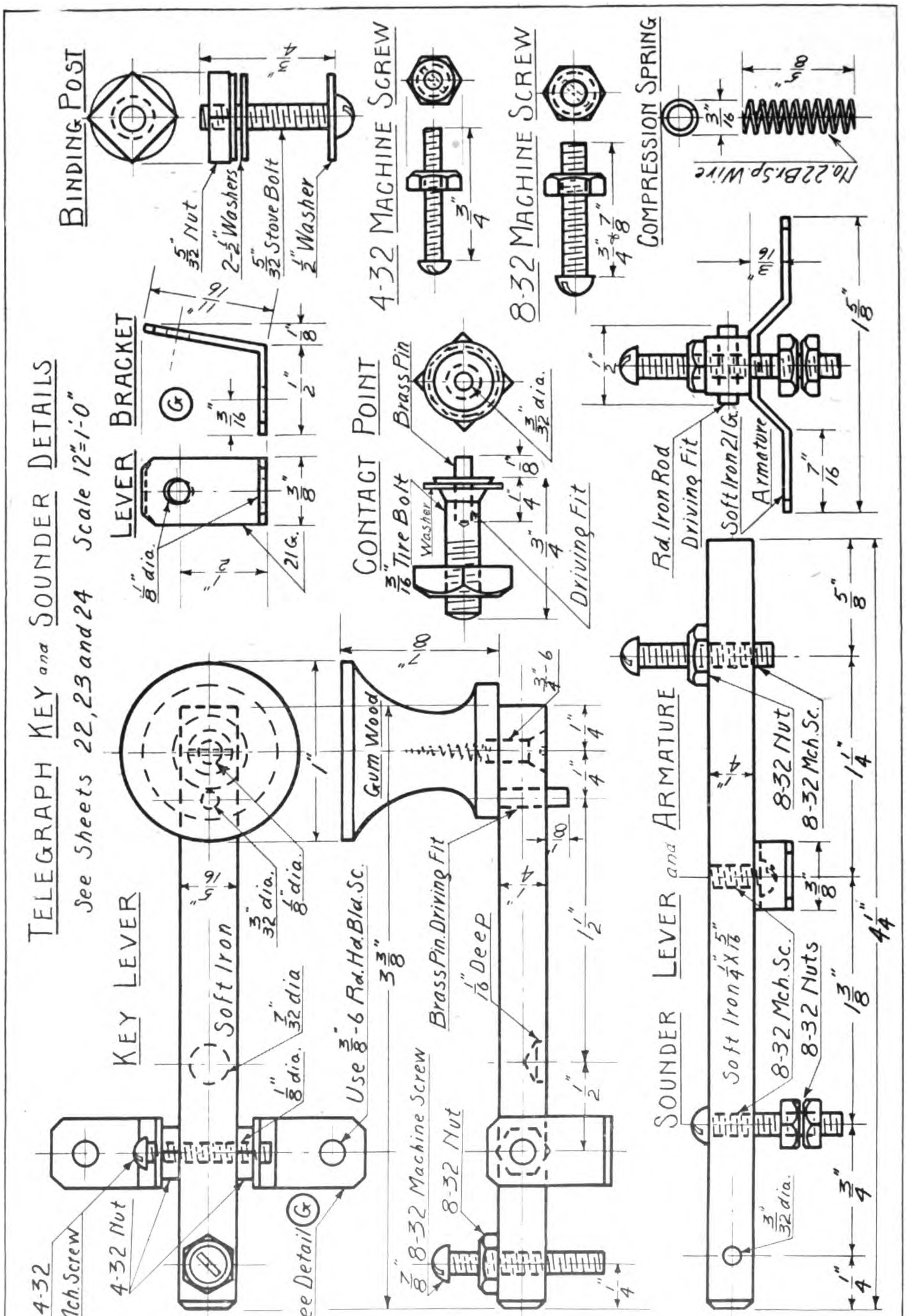
Place the pivot block on the base-board and line up the sounder lever so that the ends of the armature come squarely over the ends of the magnet cores, and the end of the lever swings clear in the anvil. Mark thru the screw holes in the base-board and fasten in place.

The *contact point* drawing is on sheet No. 25. The contact point is made by drilling a hole in the head of a tire bolt, driving in a brass pin and filing it off to length. While being drilled the bolt is held in the jaws of a wooden handscrew.

The *key lever* drawing is on sheet No. 25. The lever is made from a piece of 1/4"x 5/16" soft iron, filed smooth. Four holes are drilled at right angles to the 5/16" face, and the other hole is drilled parallel to it. The pivot is a 4-32 round headed machine screw in a 1/8" hole with two hexagonal nuts holding it in place. It would be better if this hole were tapped with a 4-32 machine tap. When the ability warrants it, it should be tried. The adjusting screw in the end is a 7/8"—8-32 round headed machine screw. All other 8-32 screws are 3/4" long. Do not try to use stove bolts in a threaded hole. The diameter of the hole that serves as a socket for the upper end of the compression spring should be a little larger than the spring. The contact point can be made by driving into the 9/32" hole a piece of round brass rod and cutting it off to the required length with a file. The key knob can be turned from a piece of gum wood, or a 1" drawer knob can be used.

The *lever bracket* for the key is on sheet No. 25. The bracket *G* is made from a piece of 3/8" strap iron. The holes in the base are drilled, and the iron bent into shape. Then the pivot holes are laid out by scribing from the base a perpendicular height with a pair of dividers while holding the bracket down on a flat surface.

The end of a short piece of wire, similar to that used for the magnet, is bared and wound around the pivot screw of the key lever between the nut and the lever bar, and the nut is screwed on tight. (It is a good plan to make a U-shaped wrench out of a piece of 3/32" flat steel with which to tighten the nuts.) The other end of the wire is run down thru the 1/16" hole under the bracket and along the groove in the underside of the base-board to the binding post and back through the other groove to the end of the switch. Adjust a compression spring in the 7/32" hole in the lever and base-board, and fasten the lever in place with 3/8"—6 round headed screws. Care should be taken to see that the contact points are in line before the lever is permanently fastened down. Where the adjusting screw in the end of the lever strikes the base-board, a solid head thumb tack, the head of which is filed flat, is driven into the base to receive the screw.



SHEET NO. 25.

The *switch* shown on sheet No. 23 is made from a piece of strap iron, drilled and bent into shape. The knob is a piece of a wood dowel chamfered around the top. Fasten the switch to the base-board with a 5/32" round headed stove bolt with a washer between the switch and the base-board and two washers at the lower end of the bolt. In a similar manner washers are to be placed on the two binding posts and the key and switch contact points. It is between the two washers at the lower end of the bolts that the bared ends of the connecting wires are clamped. The assembly drawing, sheet No. 22, shows how the five different wires are connected.

To level the key and sounder, drive 3 brass headed upholstering tacks into the holes located in the under side of the base-board, being sure to put 2 tacks on the key end.

To adjust the key and sounder connect the two binding posts with the poles of a battery by taking a turn of No. 22 bell wire around the binding posts between the heads and the washers and tightening the nuts with a screwdriver. When the switch is closed a current of electricity will pass through the magnet, drawing down the armature. If the switch is properly wired a distinct click of the screw in the end of the lever striking the anvil will be heard. To accomplish this, adjust this screw so that it will come in contact with the anvil before the armature touches the magnet. It may be necessary to bend the armature a little. The adjusting of the screw in the top of the anvil and the adjusting of the compression spring will depend upon the strength of the current used. The lock-nuts on the compression spring must be screwed down on the spring so that the lever will rebound when the current is cut off. Adjust the key lever by means of the screw in its end so that there will be a space of about 1/16", or less, between the two contact points. The compression spring will keep the points apart. Throw open the switch and press down on the key lever bringing the two contact points together. A current of electricity will flow from the battery thru the key lever to the magnet and back to the battery, causing the magnet to pull the sounder lever down suddenly, the screw in its end striking the anvil. Release the pressure on the key lever and the compression spring under the sounder lever will force that lever up suddenly against the screw in the top of the anvil. Thus, every time, the key lever is pressed down and released two distinct clicks are made by the sounder lever upon the anvil. Adjust the instrument until this result is obtained.

To send a message, the switch is thrown open and the key lever is pressed down. The current of electricity passes from the battery to the key, thru the key to the magnet and along the wire to the closed switch of the other instrument in the line, thru this closed switch to the magnet, which pulls down the sounder lever and clicks out the message.

A closed circuit battery should be used. If an open circuit battery is used the switch must not be left closed for any length of time. Dry cells make an open circuit battery.

When one is not limited in regards to price, brass may be substituted for all metal parts except the magnet cores, yoke and armature. Brass adjusting screws with knurled heads and knurled lock nuts and regular brass binding posts may also be substituted. Also, two small platinum contact points can be supplied.