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Construction and Operation of a 16-UNIT RAINULATOR

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CONTENTS

CONSTRUCTION AND OPERATION OF A 16-UNIT RAINULATOR[1]

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The "rainulator" is a portable rainfall simulator developed to serve as a tool for runoff and erosion research. It can greatly reduce the number of years required to evaluate the erosion-control effectiveness of specific management practices and cropping systems. Runoff and erosion data obtained with rainulators supplement other data obtained from plot studies under natural rain to provide needed information for improved conservation farm planning.

DESIGN

Development

Based on studies of natural rainfall and many previous rainfall simulators, the rainulator was designed with the following characteristics:[3]

1. Is completely portable.
2. Can cover plots of various sizes.
3. Can cover several plots simultaneously.
4. Applies drop-size distribution near that of natural rainfall.
5. Provides drop velocity of fall near that of natural rainfall.
6. Produces kinetic energy at impact approximately 80 percent that of corresponding natural rainfall.
7. Applies intensities in the range of storms that produce medium to high rates of runoff and erosion (1 1/4, 2 1/2, and 5 i.p.h.).
8. Uses standard runoff and soil loss measuring equipment.
9. Operates satisfactorily in wind velocities of less than 15 m.p.h.
10. Can reproduce specific simulated storms.

The nozzles that produce drop size, energy, and intensity characteristics near those of natural rainfall are an essential feature of the rainulator design.[4]

Capabilities

The rainulator is designed for rectangular plots that are 14 feet or less in width and have center to center distances of 18 feet. The first unit of the rainulator covers an effective plot length of 15 feet up the slope. Each additional unit covers 20 feet farther up the slope. Four units cover a 75-foot plot. Sixteen units are capable of simultaneously covering four plots with a maximum size of 14 feet wide by 75 feet long each. The same 16 units can also be used to cover eight plots which are 35 feet long.

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[1] Contribution from the Soil and Water Conservation Research Division, Agricultural Research Service, USDA, in cooperation with the Minnesota, Indiana, and Georgia Agricultural Experiment Stations.

[2] Agricultural Engineers, USDA, Morris, Minn., Lafayette, Ind., Watkinsville, Ga., and Morris, Minn., respectively.

[3] Meyer, L. D. Use of the Rainulator for Runoff Plot Research. Soil Sci. Soc. Proc. 24: 319-322. 1960.

[4] Meyer, L. D., and McCune, D. L. Rainfall Simulator for Runoff Plots. Agr. Engin. 39: 644-648. 1958.

General Description

The rainulator consists basically of a series of frames that support the carriages on which are mounted the nozzles (figs. 1 and 2). A small gasoline engine supplies the energy that drives the carriages in a controlled speed reciprocating motion through a belt, gear, and chain drive (fig. 3). Water is supplied to the nozzles through irrigation pipe, plastic pipe, rubber hose, and appropriate fittings. The spraying from the nozzles is controlled by electrical solenoid valves that are synchronized with the carriage cycles by means of switches and relays (figs. 4 and 5).

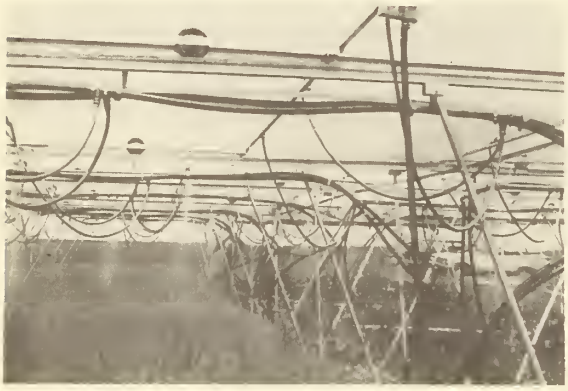


Figure 1.--Rainulator in operation.

Figure 2.--Top view of frame and carriage assembly.

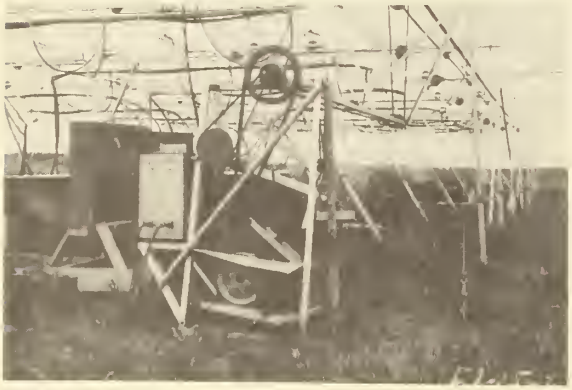


Figure 3.--Power and control units.

Figure 4.--Solenoid bank.

Figure 5.--Control box.

CONSTRUCTION

Procurement of Supplies

Almost all of the supplies and equipment for rainulators are commercially available. Auxiliary equipment and supplies are also included in the list given in table 3, Appendix. The aluminum parts are standard shapes and sizes. In most cases parts can be cut from standard lengths without waste. Aluminum with the number and temper shown is necessary to provide adequate strength, rigidity, and machinability. Trade names are listed where sources are very limited or description of parts is difficult. Hardware items can be obtained from local sources or from a hardware jobber.

Fabrication of Pieces

Cutting

Because of the large amount of cutting, a power hacksaw is recommended. Lengths of most pieces can vary 1/4 inch or so without trouble. For those parts where length is critical, a small "c" has been placed by the dimension figure in the drawings.

Drilling

Spacing of holes is very critical in nearly all cases. Location of holes should be carefully marked with a scratch awl and then punched before drilling. Paired pieces should be clamped back to back before drilling to insure perfectly mated holes. Two sizes of holes are most commonly used in the aluminum members. The larger is drilled with a 25/64-inch drill bit and is meant for the insertion of a 3/8-inch bolt. The smaller hole is drilled with a 20/64-inch drill bit and is then tapped with a 3/8 inch-16 tap. Accuracy in drilling holes of exact size is important. Tapped holes for threaded capscrews have proved satisfactory. If threads become stripped, nuts may be placed on the ends of the screws.

Machining

Very few machining operations are required for fabrication. Standard keyways are necessary for fastening sprockets and flexible joints to shafts. The small insets for the nozzle holders can be either machined or sawed.

Pairs

When it is indicated that parts are to be made in pairs, this means that two pieces are nearly alike in dimensions but are opposite in symmetry. For example, if a part is to be made from an angle in pairs, two angles should be clamped together and drilled. Then, if holes are required in both sides, the other sides of the angles should be clamped and drilled in the same manner. This procedure saves time and makes possible good alignment of similar parts on a unit. This procedure is not possible in drilling the I-beams, but it is still preferable to lay paired I-beams side by side and mark both at the same time. Most of the paired channel pieces should also be marked and drilled this way. In some instances, parts that are paired do not require the same number of holes. To reduce the number of drawings required, the part with the greatest number of holes is shown. The extra holes in the other part cause no difficulty.

Drawing Scales

Most parts of the rainfall simulator are very long in comparison to width or thickness. For this reason, a much reduced length scale was used to get proportioned drawings. The end-view sketches do not always adhere to the horizontal scale since they were intended only to show the relative position of the parts. The actual cross section of each part is specified in table 3, Appendix.

Coding Parts

A four-color code system for the main, right$_1$, left$_1$, and right$_2$ units makes assembly easier because there are only small differences in the parts of the different units in many cases. A permanent waterproof paint should be used.

Assembly

Initial Assembly

Although the rainulator has many parts, the assembly is not difficult. The numbers in the circles of Drawing 600--Over-All Assembly, indicate detailed subassembly drawings. A good method of assembly is to fabricate and assemble the frame and carriage for one unit before starting fabrication of parts for remaining units. One unit can be assembled in a shop area about 25 feet square. The parts for the remaining units are then fabricated and all 16 units assembled. After the frames and carriages are in place, the water and electrical systems are added. An area of 100 by 120 feet is required for a test site for 16 units.

Subassembly

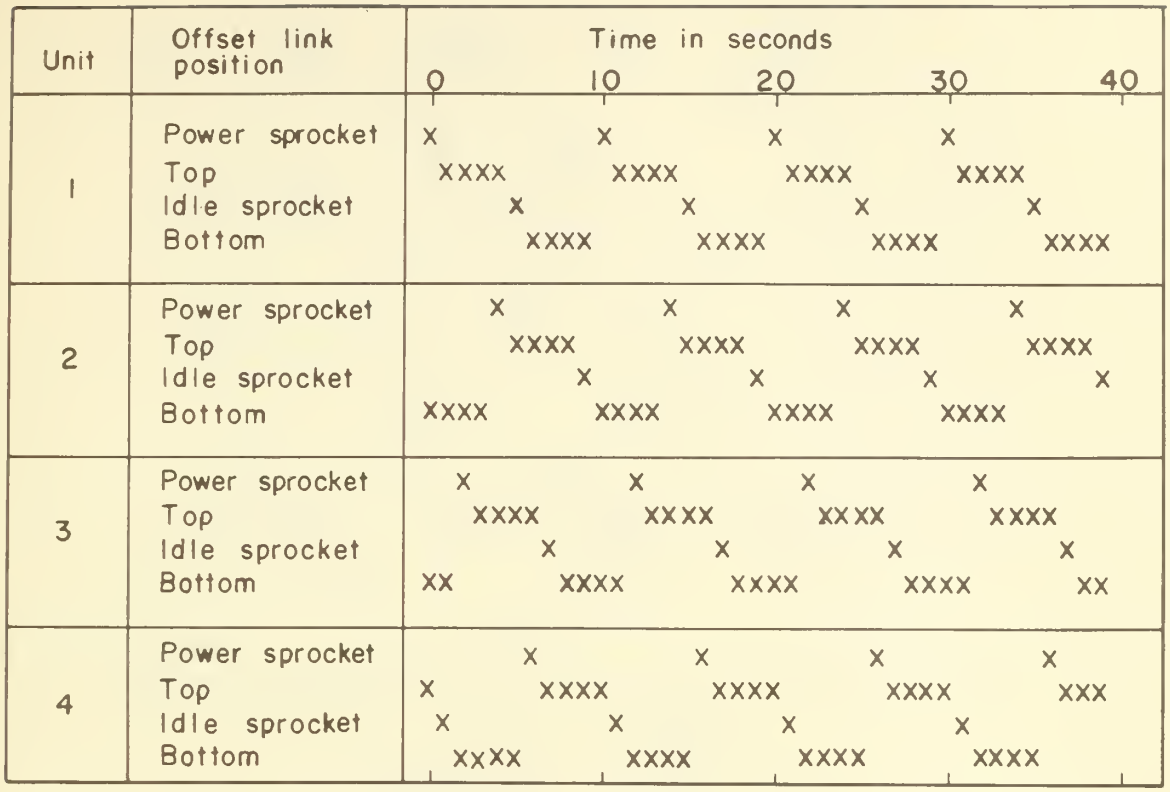
The following subassemblies made in the shop permit easier handling and erection in the field:

1. One side of frame.
2. One side of carriage.
3. Motor mount with motor.
4. Solenoid valve bank.
5. Switch and relay box.
6. Shafts, sprockets, and flexible joints.
7. Nozzles and channels.
8. Feet and receiver.
9. Drive shaft and mounting.

Subassemblies can be handled by one or two men and, with suitable handling and loading precautions, they can be transported intact between jobs without damage.

Adjusting and Timing

The rainulator is designed to produce a planned intensity of storm over a given plot area. Correct timing of the carriage movement and solenoid valves is very important for the proper operation of the rainulator. The carriages require approximately 10 seconds for a complete cycle. During this 10-second interval, the drive-rod driving the carriage will spend 4 seconds going along the top of the chain, 1 second going around the idler sprocket, 4 seconds returning along the bottom of the chain, and 1 second going around the power sprocket. The nozzles spray only during the 4 seconds while the drive rod is moving along the top of the chain and driving the carriage 6 feet towards the idler shaft. Carriages are numbered 1 through 4, beginning at the lower end of the plot. Timing for carriages 1 through 4 is staggered at 2-second intervals (fig. 6). Staggering the timing of

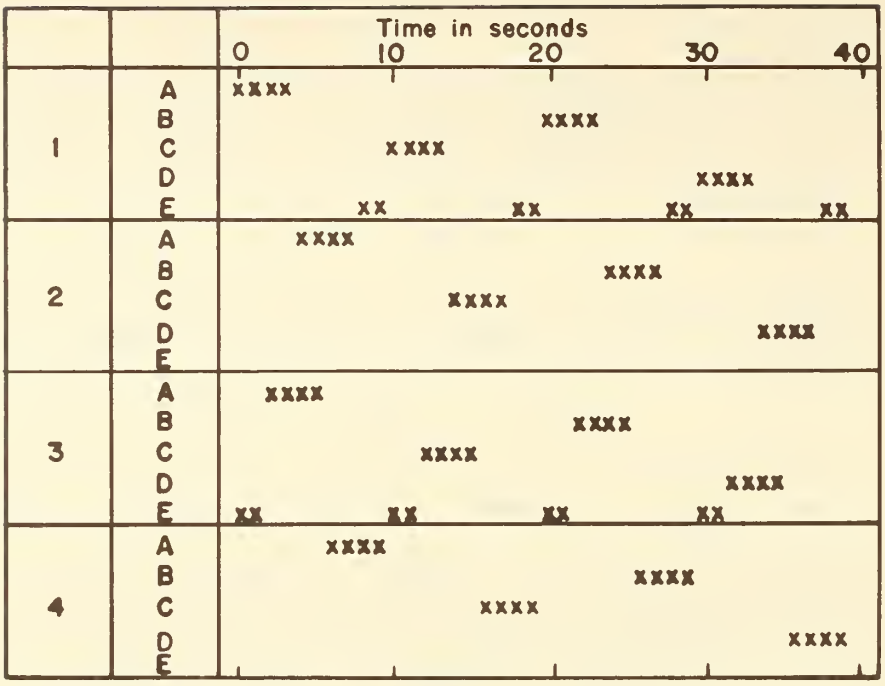


Note: X indicates position of drive rod.
Each X indicates time duration of 1 second.
36 chain links = 1 second time.

Figure 6.--Carriage timing (position of offset link).

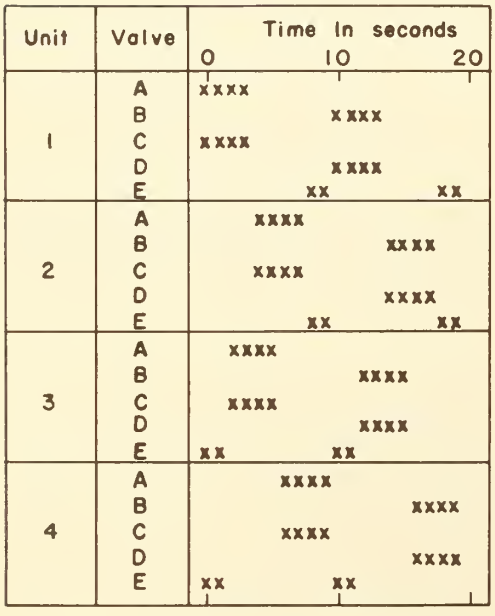
the carriages reduces the sideways impact on the rainulator frame caused by the sudden reversals in direction of the carriages, and also permits timing of the nozzles for most efficient use of water. Carriages for side units move with the corresponding main unit carriages to which they are attached.

The solenoid valves are timed with the carriage movement as shown in figures 7 through 9. The valves are timed to open during the 4-second period the carriage is moving away from the power shaft and remain closed during the remainder of the cycle. These valves have been lettered A through E. Valves A through D control the water flow to the four banks of three nozzles each, and E controls the bleed water flow. For the 5-i.p.h. intensity, all nozzles are operated in each cycle. For a 2 1/2-i.p.h. intensity, the A and C valves are operated together and the B and D valves are operated in alternate cycles. Two cycles of the carriage are necessary for all nozzles to operate. For the 1 1/4-i.p.h. intensity, one valve at a time operates in the order A, C, B, D. Four cycles of the carriage are required for all nozzles to operate. The bleed valves are adjusted to have 12-g.p.m. capacity (equal to three nozzles at 4 g.p.m.). The same number of valves are open at all times, which maintains a constant rate



Note: x indicates ON position
blank indicates OFF position.

Figure 7.--Solenoid timing diagram for rainfall simulator at 1 1/4-i.p.h. intensity.



Note: x indicates ON position,
blank indicates OFF position.

Figure 8.--Solenoid timing diagram for rainfall simulator at 2 1/2-i.p.h. intensity.

of water flow. For both the 1 1/4- and 2 1/2-i.p.h. intensities, the timing provides uniform water flow when either 4 or 2 units are used. However, when only 2 units are used up and down the slope with 5-i.p.h. intensity, an additional bleed valve must be added to each unit to have uniform flow.

The first step in timing consists of adjusting the carriages in relation to each other by moving either a flexible joint or a 45-tooth gear on a carriage shaft. The first carriage is moved to the position where the nozzles should begin to spray. The first unit carriage is moved by hand the equivalent of 4 seconds of time or 144 links (4 X 36). There are 360 links in the carriage chain so that 36 links are the equivalent of 1 second. The carriage of the No. 2 unit is then moved to the position where the nozzles should begin to spray, and the flexible joints and 45-tooth gear are tightened. This operation is continued for the No. 3 and No. 4 units. Figure 6 is used to determine the proper positioning of the carriages.

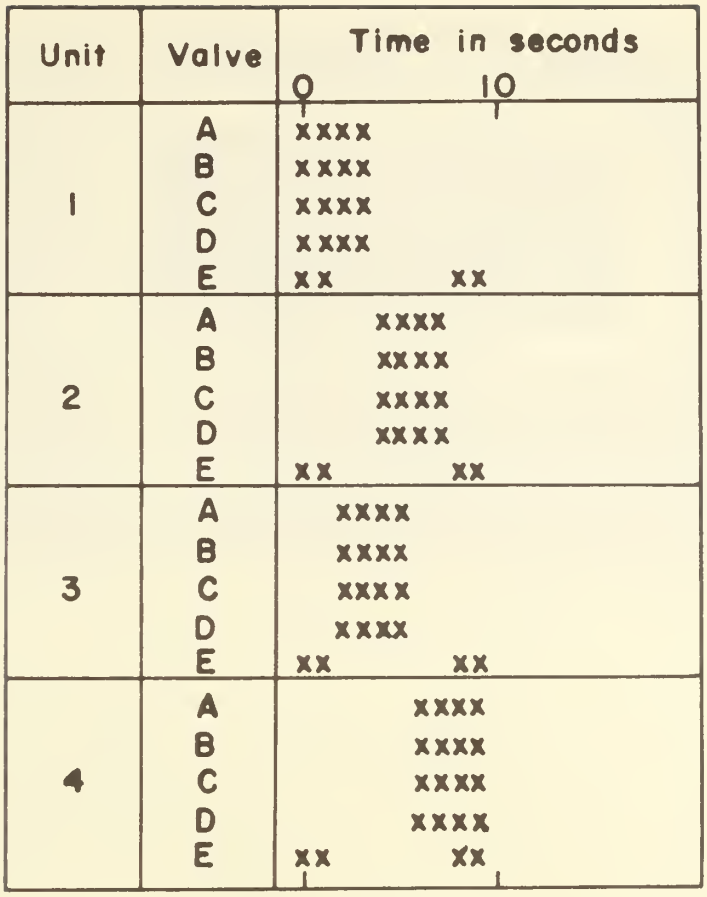


Figure 9.--Solenoid timing diagram for rainfall simulator at 5-i.p.h. intensity.

The second step is timing the leaf switches with each other and then with the carriages. Adjust the leaf switches with the holding screws until one is turned on just as the preceding switch is turned off by the rotation of the cam wheel. At the same time each switch must be adjusted so it remains turned on while the cam wheel rotates 36°, or 4 seconds of time (fig. 10). Leaf switches that control solenoids for units No. 1 and No. 2 are located on one side of the leaf switch box and are called bank A. The leaf switches that control solenoids for units No. 3 and No. 4 are located on the other side of the leaf switch box and are called bank B. The leaf switch for bank A of the first unit is adjusted by slipping the cam on its axle until it just closes when the carriage for No. 1 unit is in position for the nozzles to begin spraying. All other units are then synchronized with the leaf switches and the rainulator is timed. The leaf switches will seldom need retiming with each other, but the other timing operations must be repeated each time the rainulator is set up.

The gear ratios and speeds of the various units are shown in table 1. The speed of the power shaft is important but other motor speeds can be used with suitable speed reducer and sheave diameter ratios.

Figure 10.--Cam and leaf switch box.

TABLE 1.--Speed-reduction ratios for rainulator

Item	Reduction ratio	R.p.m.
Motor speed.....	--	2,820
Gear, V-belt, and sprocket power between--		
Motor and lower sheave.....	1:6	470
Lower sheave and power shaft.....	9:11	384
Power shaft and drive shaft.....	9:16	216
Drive shaft and carriage shaft.....	1:3	72
Carriage shaft and carriage.....	1:12	6
Timer drive between--		
Power shaft (384 r.p.m.) and reducer input....	3:16	72
Reducer input and reducer output.....	1:48	1 1/2
Reducer output and timer shaft.....	1:1	1 1/2

Calibration

Runoff and sediment measuring equipment should be calibrated in the laboratory before it is used with the rainulator. The flumes and sampling wheels may have different calibration curves. Calibration with the range of flow rates and type and quantity of sediment expected to be encountered in the test runs is desirable.

Replacement Parts

A number of parts of the rainulator sometimes need to be replaced because they are lost, broken, or do not function properly. The most common items needing replacement are bolts and nuts used in assembling the units. Spare

plastic fittings should be available for those broken. A solenoid valve or relay may require replacing. Aluminum members may become bent and require replacing; however, these can be straightened in many cases.

AUXILIARY EQUIPMENT

Water Supply

Source

Quantity.--The rainulator requires a source of clean water. A stream or natural lake may be most convenient. When a well or municipal supply is used, temporary storage will generally be required. The water requirements per plot are shown in table 2 for four plot lengths. The total rate depends on the intensity and the number of plots to which water is applied simultaneously. The total quantity of water required can be determined by multiplying the appropriate total rate by the number of plots and by the length of the runs. This quantity must be increased by 15 percent to allow for adjusting, leaks, and other uses prior to and after runs.

TABLE 2.--Water requirements per plot

Intensity (i.p.h.)	Length of plot			
	20 feet	35 feet	55 feet	75 feet
	G.p.m.	G.p.m.	G.p.m.	G.p.m.
1 1/4.....	6	12	18	24
2 1/2.....	12	24	36	48
5.....	24	48	72	96

Quality.--Foreign matter in the water supply can cause improper operation of the nozzles and the valves unless suitable strainers are inserted in the supply line. Salts, organic materials, and other dissolved solids in the water can affect infiltration rates and other test results.

Pump

A gasoline-engine-drive centrifugal-pump is best in most installations because of its portability. The pump must have sufficient capacity to provide the rate of flow required for the rainulator under the operating head. The operating head consists of static head from water source to rainulator, pump and supply line losses, and 30 p.s.i. at the solenoid valves. The pump listed in table 3, Appendix has sufficient capacity to handle four 75-foot plots at 5-i.p.h. intensity under normal operating conditions. In many cases, a smaller pump may be adequate and more desirable because of lower cost and greater ease in handling and transportation. The pump must operate under short periods of little or no flow and full pressure while the rainulator is checked.

Supply Line

Ordinary irrigation pipe is suitable for the supply line. When all 16 units are used, a 4-inch diameter supply line provides water with a reasonable amount of pressure loss. Flow or nondraining joint gaskets will lessen water losses. A surge tank of at least 20-gallon capacity in the supply line provides more uniform water pressure at the rainulator.

Plot Borders

The plot borders are made of 9-inch-wide strips of 16-gage galvanized sheet metal (fig. 11). Corrugations run across the width of the strips to provide rigidity in a vertical direction. Six to 12-foot lengths are satisfactory. Joints are made by overlapping the upper piece at least two corrugations, or about 4 inches, on the inside of the lower piece. Soil pushed up around the joints outside the plots will prevent leaks.

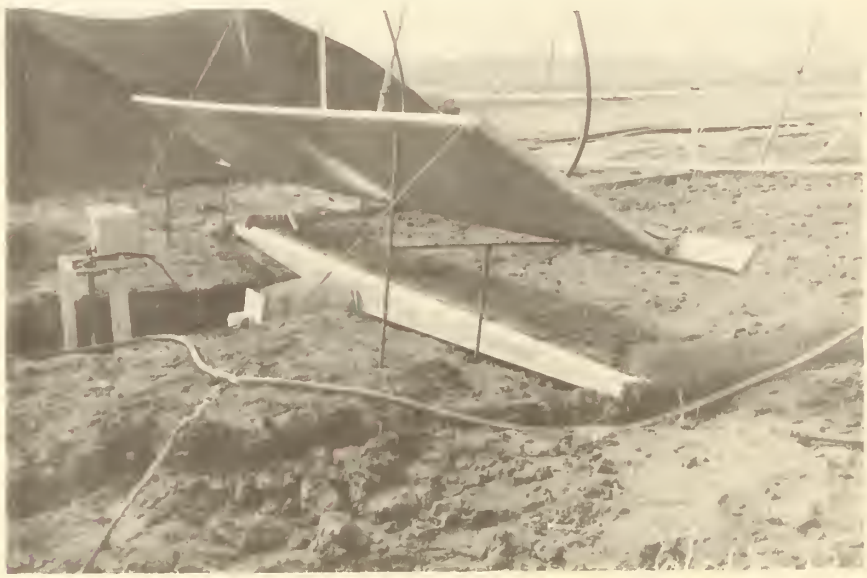


Figure 11.--Plot borders, collection trough.

Measuring Equipment

Runoff

Runoff can be measured with a standard 0.6-foot HS flume or other suitable flow meter. The runoff leaves the lower end of the plot over a sill plate and enters the collection trough where it runs toward the center of the plot, through the approach channel, to the measuring flume (fig. 12). A sampling wheel is located at the lower end of the approach channel. The flume approach channel and collection trough can be constructed of 22-gage galvanized sheet metal, but the sill plate should be constructed of 9-gage or thicker galvanized sheet metal for sufficient strength and rigidity. A 4- to 5-foot long approach channel permits the measuring flume to be placed at sufficient distance from the rainulator to avoid almost all spray from the nozzles. A canvas shield can be used over the flume

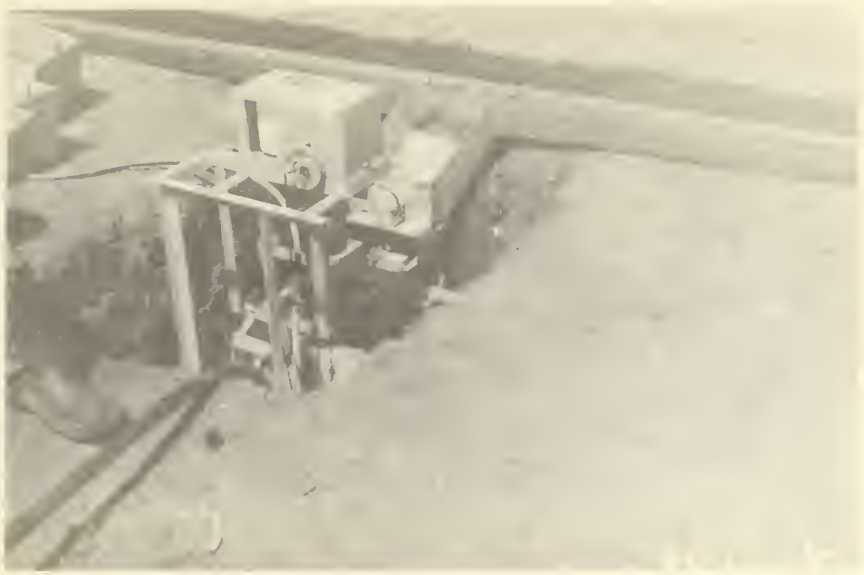


Figure 12.--Closeup of measuring flume.

to protect against the mist. A standard water-stage recorder is used to determine the depth of flow through the flume. As the depth of flow will not exceed 0.6 foot, gears for the recorder should be selected to provide approximately full chart width at this depth. The recorder clock should complete one revolution in 6 hours or less. Sediment in the runoff can interfere with the operation and accuracy of the flume.

A flushing device[5] that uses sprays of water to keep the sediment in suspension has proved very satisfactory for flows greater than 0.02 c.f.s. when operated at 10 p.s.i., and 0.04 c.f.s. when operated at 30 p.s.i. The effect of the flushing device should be considered when measuring outflow from the flume.

Sediment

Samples of the runoff are used to determine the sediment content. The sampling wheel collects approximately 1 percent of the runoff, which is carried through a hose and copper tube through the side of the flume. Prenumbered glass or plastic quart jars with screw lids are suitable for collecting samples. Simple wooden trays holding 12 jars each are convenient.

A jar is placed under the outlet from the sampler wheel at 3-minute intervals during the run and removed when a quart sample is obtained, or after 3 minutes, whichever is sooner. The time required to obtain the sample is recorded on the data sheet. For a 60-minute run, up to 24 jars are required per flume, up to 96 jars for 4 units. Time intervals are not critical, but equal intervals facilitate computations. Longer time intervals may be desirable during the period of low flow to obtain sufficient quantity of sample.

Water Application

Although the rainulator is designed to produce intensities of 1 1/4, 2 1/2, and 5 i.p.h., variations in water pressure, wind and other minor factors will

[5] Hermsmeier, L. F., and Young, R. A. Antisedimentation Device for Measuring Flumes. Agr. Engin. 43(11): 648-49. 1962.

result in intensity variations up to 10 percent. To measure the actual quantity of water applied during a run, a 16-foot length of 1 1/4- × 1 1/4- × 1/8-inch square-edge aluminum channel is supported on standards on a diagonal with the plot sides about 1 foot above the surface of the ground under each unit. The channel is placed with the open side up, and the water falling into the channel is collected at the lower end in a covered bucket placed just outside the plot border. The lower 0.4 foot of the channel is covered, which provides 15.6 feet collection length. A strip of wire screen is fitted into the opening of the channel to reduce splash. The effective width of this channel for collecting water is 1.05 inches. This value was obtained by experimental tests. The use of measuring channels does not provide an accurate method of measuring water application on plots where crops extend above channels.

Water meters in the supply line may measure the applied amount of water more accurately than the measuring troughs when vegetation on the plots has sufficient height and density to materially interfere with water entering the measuring troughs. However water meters are inherently much less accurate than measuring flumes and should be used only when necessary.

Associated Equipment

Standard equipment for measurements of wind velocity and direction, relative humidity, water and air temperatures, soil moisture, bulk density, texture, and other variables in connection with rainulator runs should be provided. Data on these concomitant variables add materially to the value of the runoff and soil-loss data.

Wind Shields

Moderate winds do not seriously affect the rainfall patterns on plots beneath the rainulator, because of the large downward velocity of the drops and the large border area that is sprayed beyond the plot area. However, if strong winds are encountered, a canvas sheet on the windward side can be used to reduce wind effect.

Transport

A bed length of 22 feet is required to transport the rainulator. The total weight of 16 units of the rainulator with runoff measuring equipment, but without pumps, is about 9,000 pounds. Since it is desirable to have the bed as near the ground as possible for ease in loading, a flatbed trailer is usually most convenient (fig. 13). The chassis for a house trailer with adequate load carrying capacity is satisfactory. The transport trailer or truck should be fitted with racks and bins to hold different parts. A trailer also provides a convenient place to store the rainulator when not in use.

Figure 13.--Rainulator loaded on trailer.

OPERATION

Plot Preparation

The rainulator can be used on plots laid out on an existing condition, or the plot area can be given particular treatments before the test is run. The plots should be accurately located before the rainulator is assembled at the site (fig. 14). When plots of less width are used, the centerline distance between

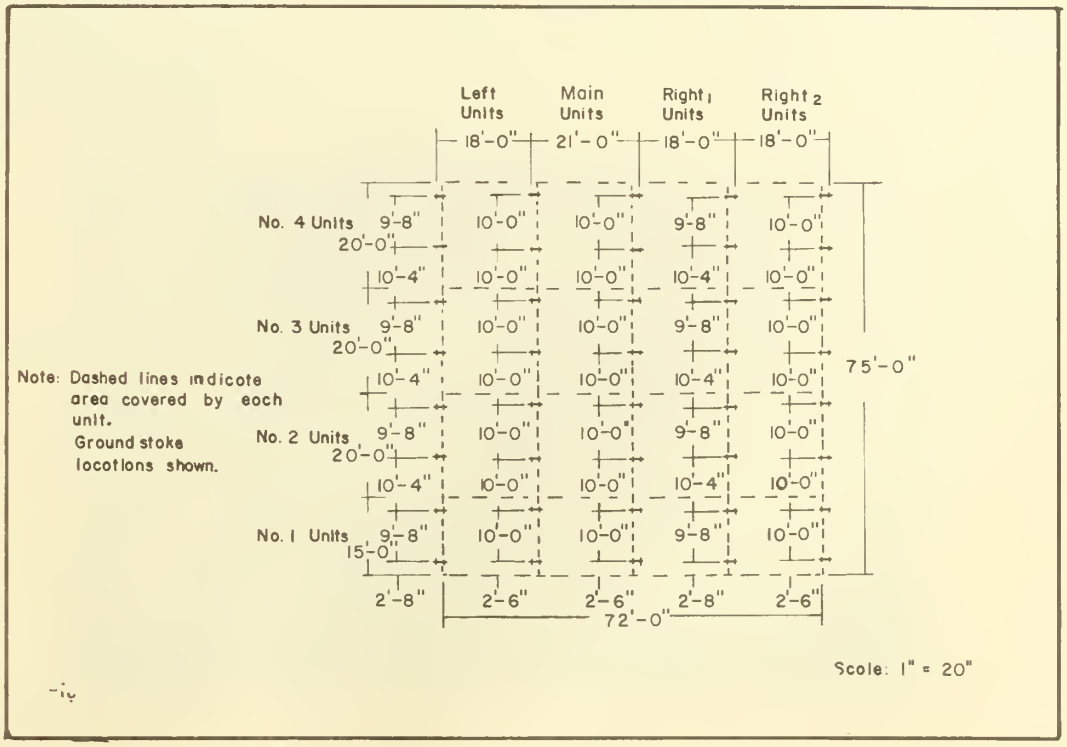


Figure 14.--Ground layout showing location of feet.

plots should remain the same as shown. While uniform plot slopes are usually desired, the rainulator has sufficient flexibility to operate over plots with slope variations up to 2 percent. Side slope on plots should be at a minimum in order to avoid concentration of the runoff along a plot border. It is particularly important that the lower edge of the plot and the sill plate have no side slope. The rainulator has been used on plot slopes up to 15 percent and, with adequate bracing, can be used on steeper slopes. The sheet-metal plot borders can be installed either before or after erection of the rainulator, but once installed they may interfere with cultivation and other plot treatments. In some cases the plot borders are removed for cultivation and then replaced. If plot borders are installed first, the possibility of plot disturbance is reduced during erection of the rainulator. The sill plate and runoff-measuring equipment can be installed at the same time as the plot borders.

Assembly and Erection

Follow these steps in assembling and erecting the rainulator and auxiliary equipment:

1.--Drive plot borders in place with maul and use a jig to maintain alignment.

2.--Drive sill plate into position at lower end of plot with maul and a jig to prevent damage to sill plate. Care should be taken that the sill plate is level across its length, that it is at the correct elevation, and that the plot is not disturbed during installation. In hard soils some excavation may be necessary.

3.--Excavate pit for flume on centerline of plot, beginning 4 feet downhill from sill plate. A minimum size of 2- × 3- × 2 1/2-feet deep is required, but a larger pit will provide more comfort for operator.

4.--Install flume, approach channel, and other measuring equipment.

5.--Provide drainage for pits. An open ditch or tile line can be used for gravity drainage in some cases. Other places a sump pump will work best (fig. 15).

Figure 15.--Sump pump with connections.

6.--Set out foot stakes and space accurately using a wooden template to improve accuracy and speed. In firm soil only one stake per foot is required.

7.--Set up main frame unit for top unit only. The permanent wire guys should be used on the upper side. A temporary brace can be used to prevent unit falling uphill when there is a strong wind.

8.--Set up remaining main frame units down the slope, depending on whether 35- or 75-foot plots are being used.

9.--Add left and right unit frames to main units. Always start from top unit and work down the slope. Either right or left units can be assembled first.

10.--Assemble carriage assembly for main unit and place on frame. Place carriages on all frames. Fasten left and right carriages to main unit carriages. Two men can lift assembled carriage onto frame, but it is much easier for three or four men. Some prefer to place carriage on main units before assembling frames of left and right units.

11.--Adjust legs for the proper height of I-beams. Except on very uneven slopes, the legs should be adjusted to provide a uniform nozzle height of 8 feet above the plot. On very uneven slopes the following procedure is best for fitting the rainulator to the ground surface:

a. Take readings on all outside feet.
b. Determine average slope up-slope.
c. Determine average slope across-plot.
d. Record reading values based on average slopes found above that best fit up-and-down slope values for each border. (These will be the same for all borders if there is no across-plot slope.)
e. Select one or more actual readings which are very near the corresponding average values found in (d).
f. Set one of the legs 7 1/2 feet from the base of the foot to the bottom of the I-beam.
g. Read rod as its top is against the bottom of the I-beam.
h. Use average slopes above to compute readings beneath all other I-beams.
i. Adjust legs to those readings.

12.--Install remaining guy wires around rainulator and adjust so units are aligned.

13.--Install motor assembly, shafts, and drive chains. Operate carriage by hand to check proper adjustment before running with motor.

14.--Install water-supply system. The 3-inch supply lines are run between the plots, and enter at the upper end of the plots. Supply hoses are installed on connections. Use plank set on two sawhorses for support when making hose connections over the plot area.

15.--Put electrical system in place. Electrical cables are placed on the ground or fastened to the legs between plots. Cover electrical connections subjected to spray with waterproof plastic.

16.--Check the electrical system. Operate each relay manually to see that it operates the correct solenoid valve.

17.--Time solenoid valves with carriages. Place main-unit carriage of lowest unit in position where nozzles should begin spraying. Tighten all sprockets and shafts in power train to motor. Adjust cam wheel until cam is just closing No. 1 leaf switch. Move first carriage accurately by noting number of links of drive chain passing a given point until time for No. 2 unit to spray is reached according to figure 1. Adjust No. 2 unit carriage by slipping connecting joint on

power shaft until carriage is in position for nozzles to begin spraying. Continue with remaining units up slope. Left and right units are in time when main units are timed.

18.--Check water supply. Start pump and get pressure in line. Bleed air from a high point in supply line. Open foot valves at lower end of 3-foot supply lines to remove any sediment. Operate each relay manually to check nozzle operation. Occasionally a check valve may stick. It can usually be freed by tapping with a wooden stick. Start motor and operate carriages. Turn on electrical system and operate several cycles to see that all is in order.

Labor Requirements for Assembly and Erection

A 3-man crew is best for assembly and erection. Five or six days are required for a skilled crew to assemble, erect, and prepare a 16-unit rainulator for operation. If the plot borders, sill plates, and runoff-measuring equipment are installed in advance, the same crew can assemble, erect, and prepare the rainulator for use in 3 days. Two 3-man crews can do the same jobs in a little more than half the time. A skilled crew is very important, and a crew not familiar with the rainulator may require two or three times longer to set it up.

Operation During Run

A supervisor, plus one man per plot, is the minimum crew required during operation. The supervisor is in charge of the operation, coordinates time, operates motor and switching unit, makes minor adjustments, and observes operation of units. One man is needed at each flume site to collect sediment samples and check operation of flume and stage recorder. The operation of the solenoid valves and nozzles requires careful attention during a run. In case of a malfunction, the rainulator should be stopped for a short time until proper operation is obtained. Each operator should be equipped with a stopwatch or a watch with a second hand, to coordinate measurements. Immediately before, and sometimes after the runs, soil moisture samples in the plots are obtained. During the run a continuous record of depth of flow in the flume is obtained by means of the automatic water level recorders. After completion of the run, the water collected in the covered buckets at the lower end of the measuring channels is weighed.

Disassembly and Loading

Crew-size requirements for disassembly and loading are the same as for assembly. The procedure for assembly is reversed. The electrical system is removed first and then the water-supply system. The carriages are then removed and disassembled, and finally, the frames are taken down. Because there is no need for adjustments or fitting pieces together, disassembly and loading require from one-third to one-half as much time as assembly and erection.

MEASUREMENTS AND ANALYSES

Determinations of the sediment content of samples and of soil-moisture content are the two major procedures requiring laboratory facilities. A drying oven with adequate capacity for the expected number of samples is required.

An automatic rapid-reading balance is desirable. The oven capacity helps determine how soon sample jars and cans may be used for another run. The following procedure can be used for determining sediment content of samples:

1.--Weigh sample and jar.
2.--Add measured quantity of flocculent.
3.--Leave for 4 hours.
4.--Decant clear liquid.
5.--Place in drying oven 24 hours.
6.--Weigh dried sample and the jar.
7.--Weigh jar if not previously tared.

Allowance should be made for sediment added with flocculent when determining sediment content of sample.

The three forms shown below, 16, 17, and 18, have been found to expedite the recording of the large amount of field data obtained with the rainulator. Additional columns will be needed for soil-moisture data when tared moisture cans are not used.

RAINULATOR
SOIL-MOISTURE DATA

Run number _____
Date _____
Plot number _____

A - Top third of plot
B - Middle third of plot
C - Bottom third of plot

Can number	Sample number	Depth (in.)	Wet weight (g.)	O.D. weight (g.)	Moisture (pct.)

RAINULATOR
RUNOFF DATA

Location _____
Run number _____
Date _____
Plot number _____

Treatment _____
Recorder number _____
Flume number _____

Jar number	Collection time start	Collection time period	Weight of jar + wet sample (g.)	Weight of jar (g.)	Weight of wet sample (g.)	Weight of water (g.)	Weight of container + dry sample (g.)	Weight of dry sample (g.)	Soil content (pct.)

RAINULATOR
WATER-APPLICATION DATA

Factors
1 min. × 8.4816
30 min. × 0.2827
60 min. × 0.1414
120 min. × 0.0707
(For 15.6' Channel Length)

Run number _____ Wind speed _____
Date _____ Wind direction _____
Location _____ Water temperature _____
Time _____ Air temperature _____
Length of run (min.) _____ Relative humidity _____
Type of run _____ Sky cover _____

Unit and code color	Plot number	Length of plot	Plot width	Soil type	Slope cover	Tillage practice
Left $_1$						
Main						
Right $_1$						
Right $_2$						

Bucket No.	Time of catch (min.)	Weight of water + bucket (lb.)	Weight of bucket (lb.)	Weight of water (lb.)	X factor	Application rate (i.p.h.)	Total applied (in.)
Left $_1$							
1(bottom)							
2							
3							
4 (top)							
Main							
1(bottom)							
2							
3							
4 (top)							
Right $_1$							
1(bottom)							
2							
3							
4 (top)							
Right $_2$							
1(bottom)							
2							
3							
4 (top)							

APPENDIX

TABLE 3.--Parts list[1]

Assembly	Part numbers
Framing assembly:	
I-beams and supports	1 - 39
Carriages	50 - 78
Power-unit mountings	100 - 122
Power assembly	200 - 233
Electrical-control system	300 - 367
Water-supply system	400 - 462
Auxiliary equipment	500 - 521, 611

See footnote at end of table.

TABLE 3.--Parts list[1]--Continued

FRAMING ASSEMBLY--I-BEAMS AND SUPPORTS

Part number	Description	Number of pieces				
		Left$_1$ unit	Main unit	Right$_1$ unit	Right$_2$ unit	Total
	2"x2" I-beam:					
1.....	22'.....	--	8	--	--	8
1L$_1$.....	22'.....	8	--	--	--	8
1R$_1$.....	21'4".....	--	--	8	--	8
1R$_2$.....	22'.....	--	--	--	8	8
	1-7/16"x1/2"3/32" channel:					
2.....	20'.....	--	8	--	--	8
2L$_1$.....	20'.....	8	--	--	--	8
2R$_1$.....	20'.....	--	--	8	--	8
2R$_2$.....	20'.....	--	--	--	8	8
3.....	1 1/4"x1/4" rectangular bar, 2-5/8"	16	32	32	16	96
	2"x2"x1/4" channel:					
4.....	4".....	16	32	16	16	80
4A.....	4".....	1	2	1	1	5
	1" schedule 40 pipe:					
5.....	80".....	16	32	16	16	80
6.....	10'.....	2	4	2	2	10
	1"x3/4"x1/8" T-bar:					
7 and 7R$_2$..	16'.....	--	8	--	8	16
7L$_1$.....	16'.....	8	--	--	--	8
7R$_1$.....	14'.....	--	--	8	--	8
	1"x3/16" rectangular bar:					
8.....	3".....	16	16	16	16	64
9.....	4".....	16	16	16	16	64
	2"x1 1/2"x1/4" angle:					
10.....	32".....	16	32	16	16	80
11.....	15".....	4	8	4	4	20
	1 1/4" schedule 40 pipe:					
12.....	34".....	10	20	10	10	50
13.....	23-3/4".....	8	16	8	8	40
	1 1/4"x1 1/4"x1/8" angle:					
14.....	12'6".....	4	8	4	4	20
15.....	8'6".....	3	6	3	3	15
16.....	46".....	--	--	--	--	24
17.....	1-3/8" set collars, galv.....	18	36	18	18	90
18.....	3/8-16x1/2" thumb screws, malleable steel	18	36	18	18	90
19.....	3/4" perf. hanger strap, 8"....	32	32	32	32	128
20.....	1/4" dia. steel rod, 3-3/4"....	16	--	16	16	48
21.....	8-32x1/2" hex head brass screws	48	48	48	48	192
22.....	8-32x1/2" flat head brass screws	40	40	40	40	160
23.....	8-32 nuts, brass.....	48	48	48	48	192
24.....	3/8-16x1" galv. steel bolts....	11	32	11	11	65
25.....	3/8-16x1" alum. bolts.....	37	74	37	37	185
26.....	3/8-16 alum. nuts.....	84	168	100	84	436
27.....	3/8-16 wing nuts, galv. steel..	13	36	13	13	75
28.....	3/8-16x2 1/2" galv. steel bolts	2	4	2	2	10

TABLE 3.--Parts list[1]--Continued

Part number	Description	Number of pieces				
		Left$_1$ unit	Main unit	Right$_1$ unit	Right$_2$ unit	Total
FRAMING ASSEMBLY--I-BEAMS AND SUPPORTS--Continued						
29.....	3/8-16x2 1/2" galv. alum. bolts	34	68	34	34	170
30.....	3/8-16x3" alum. bolts.....	16	32	32	16	96
31.....	7/16" machine bolts, galv steel, 3".	--	16	--	--	16
32.....	1/4" stove bolts, 1/2".....	32	32	32	32	128
33.....	1/8" cable, 9'2" ea.....	--	--	--	--	26
34.....	Snap fastener with swivel, 4"..	--	--	--	--	26
35.....	1/8" cable clamp.....	--	--	--	--	52
36.....	1/8" cable thimble.....	--	--	--	--	52
37.....	Screw type soil anchor.....	--	--	--	--	26
38.....	1/4"x1 1/4"x1/8", channel, 16'.	4	4	4	4	16
39.....	Bracket for measuring channels.	12	12	12	12	48
FRAMING ASSEMBLY--CARRIAGE						
	1 1/4"x1 1/4"x1/8" angle:					
50-50R$_2$...	16'.....	--	4	--	4	8
50L-50R$_1$..	16'.....	4	--	4	--	8
51-51R$_2$...	16'.....	--	4	--	4	8
51L-51R$_1$..	16'.....	4	--	4	--	8
52.....	12' 2 1/4".....	4	4	4	4	16
53.....	12' 2 1/4".....	--	4	--	--	4
53L-53R$_1$.. 53R$_2$	12' 2 1/4".....	4	--	4	4	12
54-54R$_2$...	7 1/2".....	--	24	--	24	48
54L-54R$_1$..	6".....	24	--	24	--	48
55.....	9".....	--	16	--	--	16
56.....	1"x1"x1/8", channel, 16'.....	12	12	12	12	48
	1 1/4"x1/4" rectangular bar:					
57-57R$_2$...	9-5/8".....	--	8	--	8	16
57L-57R$_1$..	8 1/2".....	8	--	8	--	16
58.....	2-1/8".....	24	24	24	24	96
59.....	3".....	32	40	32	32	136
60.....	1 1/2".....	28	32	28	28	116
61.....	1 1/2".....	4	8	4	4	20
62.....	13".....	--	16	--	--	16
63.....	3 1/4".....	--	8	--	--	8
	1/2" alum. rod, bent:					
64-64R$_2$...	12 1/2".....	--	8	--	4	12
64L-64R$_1$..	11".....	4	--	4	--	8
65-65R$_2$...	7".....	--	12	--	12	24
65L-65R$_1$..	5 1/2".....	12	--	12	--	24
66.....	1/2" alum. rod, 9'5-3/4" for drive rod.	36	56	36	36	164
67.....	1/2" x 0.091 washer for drive rod and wheels.	36	56	36	36	164

See footnote at end of table.

TABLE 3.--Parts list[1]--Continued

FRAMING ASSEMBLY--CARRIAGE--Continued

Part number	Description	Number of pieces				
		Left$_1$ unit	Main unit	Right$_1$ unit	Right$_2$ unit	Total
68.....	3/32"xl 1/4" cotter keys to hold axles and drive rod.	40	48	40	40	168
69.....	8-32xl/2" hex head brass screws.	96	96	96	96	384
70.....	3/4"xl/2"xl" bushing, bronze, for drive rod.	--	8	--	--	8
71.....	6" dia. wheel.....	16	20	16	16	68
72.....	4-3/4" dia. wheel.....	4	8	4	4	20
73.....	1/4" galv. steel bolts, 1 1/2"	64	80	64	64	272
74.....	3/8-16xl" galv. steel bolts...	40	24	40	40	144
75.....	3/8-16xl" alum. bolts.....	88	168	104	88	448
76.....	3/8-16 galv. steel wing nuts.	40	24	40	40	144
77.....	3/8-16 alum. nuts.....	64	144	80	64	352
78.....	#9 galv. steel wire 10'.....	--	4	--	--	4

FRAMING ASSEMBLY--POWER-UNIT MOUNTINGS

Part number	Description	Total
	1 1/4"xl 1/4"xl/8" angle:	
100.....	49 1/2".....	2
101.....	49 1/2".....	2
102.....	12 1/2".....	2
103.....	19".....	2
104.....	7".....	2
105.....	112".....	2
106.....	45".....	2
107.....	8".....	1
	1"xl/4" bar:	
108.....	35".....	2
109.....	49 1/2".....	2
110.....	45 1/2".....	2
	1"xl"xl/8" channel:	
111.....	19".....	2
112.....	24".....	2
113.....	23".....	3
114.....	14".....	2
115.....	22".....	2
116.....	6"xll"xl/4" plate.....	1
117.....	3/8-16xl" galv. steel bolts.....	5
118.....	3/8-16xl" alum. bolts.....	41
119.....	3/8-16 galv. steel hex nuts.....	5
120.....	3/8-16 alum. nuts.....	41
121.....	3/16" dia. stove bolts 1/2".....	10
122.....	3" strap hinges.....	2

TABLE 3.--Parts list[1]--Continued

POWER ASSEMBLY--Continued

Part number	Description	Total
200.....	Gasoline engine.....	1
201.....	Safety clutch.....	1
202.....	9" sheave, C-size, 5/8" bore.....	1
203.....	114.9" V-belt.....	1
204.....	11" sheave, V-C-size.....	1
205.....	1" alum. rod, 10', motor to first unit.....	1
206.....	1" pillow block.....	3
207.....	#50 18-tooth sprocket, 1" bore.....	1
208.....	#50 chain with conn. link, 7'11".....	1
209.....	#50 32-tooth sprocket.....	1
210.....	1" alum. rod, 10'9" drive shaft.....	1
211.....	1" alum. rod, 10'9" drive shaft.....	3
212.....	1" alum. rod, 9'2".....	3
213.....	1" flexible coupling.....	6
214.....	1" pillow block.....	8
215.....	#40 15-tooth sprocket, 1" bore.....	8
216.....	#40 chain, 56 1/2" with conn. link.....	8
217.....	#40 45-tooth sprocket, 1" bore.....	8
218.....	1" alum. rod drive shaft, 9".....	8
219.....	#40 30-tooth sprocket, 1" bore.....	8
220.....	1" flanged bearings.....	16
221.....	#40 chain, 14'10 1/2" with 2 conn. links.....	8
222.....	#40 special link, double side conn.....	8
223.....	#40 30-tooth idler sprocket.....	8
224.....	1" I.D. X 1-3/16" O.D. x 1" long bushing.....	8
225.....	1" dia. steel rod, 4".....	8
226.....	1 1/2"x1/2" steel bar, 4".....	8
227.....	1/4" dia. steel rod, 4".....	8
228.....	1 1/4"x1 1/4"x1/8" angle, 1-5/8".....	8
229.....	3/8" dia. steel rod, 5".....	8
230.....	1/2" dia. steel rod, 1-5/8".....	8
231.....	1" set collars.....	16
232.....	1/4"x1/4" key stock, 2'.....	1
233.....	1/4" dia. steel rod, 2-3/4".....	16

ELECTRICAL-CONTROL SYSTEM

	DRIVE TO MICROSWITCHBOX:	
300.....	#41 9-tooth sprocket, 1/2" bore.....	1
301.....	#41 chain, 4'1 1/2", plus conn. link.....	1
302.....	#41 48-tooth sprocket, 1/2" bore.....	1
303.....	Gear reduction box, 48:1 ratio.....	1
304.....	#41 10-tooth sprocket, 1/2" bore.....	1
305.....	#41 chain, 1'9 1/2".....	1
306.....	#41 conn. link.....	1
307.....	#41 10-tooth sprocket, 1/2" bore.....	1

See footnote at end of table.

TABLE 3.--Parts list[1]--Continued

ELECTRICAL-CONTROL SYSTEM--Continued

Part number	Description	Total
	MICROSWITCHBOX:	
308.....	Sides, microswitchbox, 1/4" alum. plate.....	2
309.....	Ends, microswitchbox, 1/4" alum. plate.....	2
310.....	Bottom, microswitchbox, 1/4" alum. plate.....	2
311.....	Cover, microswitchbox, 1/4" alum. plate.....	2
312.....	Handle for cover.....	1
313.....	Corner braces, 1 1/4"x1 1/4"x1/8" angle, 18".....	4
314.....	Corner braces, 1 1/4"x1 1/4"x1/8" angle, 16".....	2
315.....	Corner braces, 1 1/4"x1 1/4"x1/8" angle, 12".....	2
316.....	1/2" alum. rod, axle.....	1
317.....	Sheave, pressed steel, 4" dia., 1/2" bore.....	2
318.....	1/4"x9" alum. disk with cam.....	2
319.....	Microswitches, BA-2RL2-A2.....	16
320.....	1/8" roundhead steel bolts, 1".....	32
321.....	#8-32x1/2" brass screws, hex head.....	64
322.....	Amphenol fittings, AN3106A-18-1S.....	2
	CABLE, MICROSWITCHBOX TO CONTROL BOX:	
323.....	Wire, 2-18-AWG, type S.P.-5 pr. 10', (2 cables).	100'
324.....	Amphenol AN-3102A-18-1P.....	4
325.....	Amphenol AN-3057-10 cable clamp.....	4
	CONTROL BOX:	
326.....	5/4x6"x12' pine.....	1
327.....	3/4" fir plywood.....	1
328.....	1/4" masonite, back and panels.....	1
329.....	Handle, cabinet.....	1
330.....	2 1/2" hinges, butt, brass, pr.....	2
331.....	Door pulls, pr.....	1
332.....	Friction catches, cabinet door, pr.....	1
333.....	Amphenol fitting, AN-3106A-18-1S.....	2
334.....	Switch, D.P., S.T. (125 V--6A).....	7
335.....	Switch, D.P., D.T. (125 V--6A).....	2
336.....	Circuit breaker, single pole, 5 amp., 125 V.....	6
337.....	Relay, PR5D, 12 V.....	4
338.....	Relay, PR7D, 12 V.....	16
339.....	Amphenol fittings, AN316A-14S-6S.....	16
340.....	Wire, electric, TW, #12, 6 colors, 40' ea., 240'.....	6
	CABLE, CONTROL BOX TO SOLENOIDS:	
341.....	Amphenol fittings, AN3102A-14S-6P plug.....	32
342.....	Amphenol fittings, AN3057-6 clamp.....	32
343.....	Wire 2-18 AWG, type S.P. 3 pr., 95' ea., 570'.....	2
344.....	Wire 2-18 AWG, type S.P. 3 pr., 85' ea., 510'.....	2
345.....	Wire 2-18 AWG, type S.P. 3 pr., 75' ea., 450'.....	2
346.....	Wire 2-18 AWG, type S.P. 3 pr., 65' ea., 390'.....	2
347.....	Wire 2-18 AWG, type S.P. 3 pr., 55' ea., 330'.....	2
348.....	Wire 2-18 AWG, type S.P. 3 pr., 45' ea., 270'.....	2

TABLE 3.--Parts list[1]--Continued

ELECTRICAL CONTROL SYSTEM--Continued

Part number	Description	Total
	CABLE, CONTROL BOX TO SOLENOIDS--Continued	
349.....	Wire 2-18 AWG, type S.P. 3 pr., 35' ea., 210'.....	2
350.....	Wire 2-18 AWG, type S.P. 3 pr., 25' ea., 150'.....	2
351.....	Amphenol, AN3106A-14S-6S.....	16
352.....	Bracket for fitting on solenoid.....	16
	BATTERY AND GENERATOR CIRCUITS:	
353.....	Amphenol, AN3102A-12S-3S socket.....	1
354.....	Amphenol, AN3102A-12S-3P plug.....	1
355.....	Amphenol, AN3057-4 clamp.....	1
356.....	Wire 2-18 AWG type S.P.,-10'.....	1
357.....	Battery clips, alligator, 3".....	2
358.....	Battery, 12 volt, auto type.....	1
359.....	Ammeter, 2" dia. + or - 30 amp.....	1
360.....	Voltage regulator, 12 volt, auto type.....	1
361.....	Amphenol, AN3102A-12S-3S socket.....	1
362.....	Amphenol, AN3102A-12S-3P plug.....	1
363.....	Amphenol, AN3057-4 clamp.....	1
364.....	Wire 2-18 AWG type S.P.-20'.....	1
365.....	Generator, auto type, 12 volt, 25 amp.....	1
366.....	V-belt, size A- 48".....	1
367.....	Sheave, 'A', 10", 1/2" bore, V-belt.....	1

WATER-SUPPLY SYSTEM

400.....	Pump, g.e.d., centrifugal.....	1
401.....	Suction line complete with strainer.....	1
402.....	Adapter, pump to irrigation pipe.....	1
403.....	Irrigation line, pump to unit.....	1
404.....	Valve, line irrigation, 4".....	1
405.....	Pipe Tee, 4"x4"x4".....	1
406.....	Pipe Tee, 4"x4"x3".....	3
407.....	Pipe elbow, 4"x3".....	1
408.....	Pipe, irrigation, 3", 4' lengths.....	16
409.....	Pipe, irrigation, 3", 16' lengths.....	16
410.....	Valve, irrigation line, 3".....	8
411.....	Valves, foot and cleanout, 3" end.....	4
412.....	Midpipe riser, 3".....	32
413.....	Nipple, close, 1" alum.....	32
414.....	Pipe Tee, 1/2"x1/2"x1".....	32
415.....	Nipple, pipe, 1/2" dia. x 1 1/2".....	64
416.....	Valve, 1/2" solenoid, NC, 12 V.....	64
417.....	Nipple, pipe, 1/2" dia. x 1 1/2".....	64
418.....	Bushing, 3/4"x1/2" dia. x 1 1/2".....	64
419.....	Elbow, 90°, plastic, 1" insert x 3/4" FPT.....	64
420.....	Plastic pipe, 1" dia., 4" long.....	64

See footnote at end of table.

TABLE 3.--Parts list[1]--Continued

WATER-SUPPLY SYSTEM--Continued

Part number	Description	Total
421.....	Coupling, hose, 1" size.....	64
422.....	Clamp, hose, 1", stainless steel.....	192
423.....	Plastic pipe, 1" dia., 12' long.....	32
424.....	Plastic pipe, 1" dia., 7' long.....	32
425.....	Coupling, hose, 1" size.....	64
426.....	Clamp, hose, 1", stainless steel.....	64
427.....	Plastic pipe, 1" dia., 4" long.....	64
428.....	Elbow, 90°, plastic, 1" insert.....	64
429.....	Clamp, hose, 1", stainless steel.....	128
430.....	Plastic pipe, 1" dia., 34".....	32
431.....	Plastic pipe, 1" dia., 25 1/2".....	32
432.....	Pipe Tee, plastic, 1" insert x 1" insert x 3/4 FPT.....	64
433.....	Clamp, hose, 1", stainless steel.....	128
434.....	Plastic pipe, 1" dia., 70".....	64
435.....	Pipe Tee, plastic, 1" insert x 1" insert x 3/4 FPT.....	64
436.....	Clamp, hose, 1", stainless steel.....	128
437.....	Plastic pipe, 1" dia., 70".....	64
438.....	Elbow, 90°, plastic, 1" insert x 3/4 FPT.....	64
439.....	Clamp, hose, 1", stainless steel.....	64
440.....	Adapter, brass, 3/4" MPT x 3/4" MHT.....	192
441.....	Coupling, hose, 1/2" size, female end only, without fingers.	192
442.....	Hose, all purpose, 1/2", 72".....	48
443.....	Hose, all purpose, 1/2", 66".....	144
444.....	Coupling, hose, 1/2" size, female end only, without fingers.	192
445.....	Adapters, brass, 3/4" MHT x 1/2" FPT.....	192
446.....	Nipple, pipe, 1/2" dia. x 1 1/2".....	192
447.....	Valve, check, brass, angle.....	192
448.....	Elbow, street, 1/2" alum.....	192
449.....	Pressure gage, type 100, 3 1/2" dia., 0-15 p.s.i.....	32
450.....	Pressure gage, type 100, 3 1/2" dia., 0-100 p.s.i.....	3
451.....	Nozzle, 1/2", 80100 vee jet.....	192
452.....	Nozzle holder.....	192
	BLEED LINE:	
453.....	Midpipe riser, 3".....	16
454.....	Nipple, close, 1".....	16
455.....	Elbow, pipe, 90°, 1" x 1/2".....	16
456.....	Nipple, 1/2" dia. x 1 1/2".....	16
457.....	Valve, solenoid, NC, 12 Volt, coil.....	16
458.....	Nipple, 1/2" dia., x 1 1/2".....	16
459.....	Discharge hose, 1", 10'.....	16
460.....	Clamp, hose, 1", stainless steel.....	16
461.....	Washers, hose, rubber, 1".....	128
462.....	Washers, hose, rubber, 3/4".....	384

TABLE 3.--Parts list[1]--Continued

AUXILIARY EQUIPMENT

Part number	Description	Total
500.....	Sill plate, 12 gage.....	4
501.....	Collection gutter, 18 gage.....	4
502.....	Gutter cover.....	8
503.....	Approach chute.....	4
504.....	Approach chute cover.....	4
505.....	0.6' HS flume with stilling well.....	4
506.....	Flume mounting 45".....	4
507.....	Flume mounting 31".....	4
508.....	Flume mounting 26 1/4".....	4
509.....	Leg clamp.....	12
510.....	Stage recorder.....	4
511.....	Stage recorder mounting, 19 1/4".....	4
512.....	Stage recorder mounting, 18".....	4
513.....	Stage recorder mounting, 13 1/2".....	8
514.....	Stage recorder mounting, 9 1/4".....	4
515.....	Stage recorder mounting, 13".....	4
516.....	Sampling wheel and mounting.....	4
517.....	Plot borders, 18 gage corr. metal, 8" wide.....	680'
518.....	Measuring troughs 1 1/4"x1 1/4"x1/8"x16', alum. channel, ea.	16
519.....	Bracket for measuring troughs, ea.....	48
520.....	Sump pump.....	1
521.....	Stopwatches.....	4
611.....	Border lineup device.....	1

[1] Mention in this publication of commercially manufactured equipment does not imply endorsement by the U.S. Department of Agriculture over similar equipment not mentioned.

TABLE 4.--Items required for rainulator and estimated cost (1962)

Type	Estimated cost
Aluminum shapes	$3,468.00
Sheet steel and steel pipe fittings	239.84
Hardware and lumber	214.59
Sprockets, chains, couplings, bearings, etc	809.56
Structural steel	19.04
Electrical	337.40
Irrigation equipment	1,762.80
Brass fittings, hose, gages, valves, etc	2,808.77
Plastic pipe and fittings	417.28
Gasoline engine and sump pump	327.00
Measuring equipment	1,210.00
Total	$11,614.28

ALUMINUM SHAPES AND FITTINGS

Description	Number	Unit	Unit cost	Total cost
Angle, 1 1/4"x1 1/4"x1/8", 6061-T6-16' sharp corner.	103	ea.	$9.40	$968.20
Angle, 2"x1 1/2"x1/4", 6061-T6-16' structural.	18	ea.	10.25	184.50
Bars, rectangular, 1/4"x1 1/4", 6063-T6-16'.	9	ea.	8.60	77.40
Bars, rectangular, 3/16"x1", 6061-T5-12'	4	ea.	4.50	18.00
Channel, 2"x2"x1/4", 6062-T6-22'	1	ea.	24.40	24.40
Channel, 2"x2"x1/4", 6062-T6-15'	1	ea.	16.60	16.60
Channel, 1"x1"x1/8", 6063-T5-16' sharp corner.	52	ea.	4.85	252.20
Channel, 1-7/16"x1/2"x3/32", 6063-T5-20'	32	ea.	3.25	104.00
Channel, 1 1/4"x1 1/4"x1/8", 6063-T5-16', sharp corner.	16	ea.	6.15	98.40
I-beam, 2"x2", 6062-T6-22' thickness 0.125".	32	ea.	11.30	361.60
Plate, 1/4", 2'x8' hardness 1100-F	16	sq. ft.	1.20	19.20
Pipe, schedule 40, 1"-20', 6063-T6	40	ea.	9.60	384.00
Pipe, schedule 40, 1 1/4"-20', 6063-T6	15	ea.	13.30	199.50
Rod, 1", 6061-T6-12'	8	ea.	11.00	88.00
Rod, 1/2", 6063-T5-12'	8	ea.	3.50	28.00
T-bar, 1"x3/4"x1/8", 6063-T5-16', sharp corner.	32	ea.	3.20	102.40
Bolts, 3/8-16x1"	7	C	9.40	65.80
Nuts, 3/8-16	9	C	4.90	44.10
Bolts, 3/8-16x2 1/2"	2	C	17.40	34.80
Bolts, 3/8-16x3"	1 1/2	C	21.40	32.10
Elbow, street, 90°, 1/2"	192	ea.	.90	172.80
Holder, nozzle, (According to plan.)	192	ea.	1.00	192.00
Grand total				$3,468.00

TABLE 4.--Items required for rainulator and estimated cost (1962)--Continued

SHEET STEEL AND STEEL PIPE FITTINGS

Description	Number	Unit	Unit cost	Total cost
Elbow, 90°, 1"x1/2", galv.	16	ea.	$0.39	$6.24
Nipple, pipe, 1/2"x1 1/2", length, galv.	352	ea.	.05	17.60
Nipple, pipe, 1" close, galv.	48	ea.	.11	5.28
Pipe tee, 1/2"x1/2"x1", galv.	32	ea.	.62	19.84
Sill Plate:				
Sheet steel, galv., 9 gage, 1'x14'.	4	ea.	8.00	32.00
Sheet steel, galv., 16 gage, 7'x36".	2	ea.	5.25	10.50
Sheet steel, galv., 16 gage, 7'x32".	1	ea.	4.00	4.00
Sheet steel, galv., 16 gage, 6'x24".	4	ea.	3.00	12.00
Sheet steel, galv., 16 gage, 6'x30".	2	ea.	3.75	7.50
Pipe tee, 3/8", galv.	12	ea.	.18	2.16
Pipe, 3/8", galv.	2	ft.	.16	.32
Sheet steel, galv., 12 gage, 12" width.	680	ft.	.18	122.40
Grand total.				$239.84

HARDWARE AND LUMBER ITEMS

Board, 5/4x6"x12'.	1	ea.	$1.80	$1.80
Board, 2"x4".	16	ft.	.15	2.40
Bolts, machine, 7/16" dia. x3".	1	box (25)	1.96	1.96
Bolts, machine, 1/4"x6".	4	ea.	.04	.16
Bolts, machine, 1/4"x1 1/2" galv.	11	pkg.(25)	.49	5.39
Bolts, machine, hex head, 3/8-16x1".	3	C	2.02	6.06
Bolts, machine, hex head, 3/8-16x2 1/2".	10	ea.	.05	.50
Bolts, stove, 1/8" dia. x 1" rh.	4	box (10)	.14	.56
Bolts, stove, 1/4" dia. x 1/2" rh.	2	C	1.34	2.68
Bolts, stove, 3/16" dia. x1/2" rh.	1	C	.86	.86
Cable, 1/8" dia., 7x7 galv., 1,500 lb. working strength.	300	ft.	.09	27.00
Cable clamp, 1/8" galv.	52	ea.	.12	6.24
Cotter pins, steel 3/32" dia. x1".	2	C	.60	1.20
Door pulls.	1	pr.	.30	.30
Friction catches.	1	pr.	.20	.20
Handle cabinet.	1	ea.	.60	.60
Hanger strap 3/4" perforated.	9	roll (10')	.30	2.70
Hinge strap, 3", galv.	1	pr.	.80	.80
Hinges, butt, 2 1/2" brass.	1	pr.	.60	.60
Key stock, 1/4"x1/4".	2	ft.	.45	.90
Masonite, 1/4" waterproof 24"x16".	1	ea.	.30	.30
Nuts, brass, 8-32.	3	gross	1.46	4.38
Plywood, 3/4", 24"x16".	1	ea.	.90	.90
Screws, brass, flathead, 8-32x1/2".	1 1/2	gross	2.06	3.09
Screws, brass, hex head, 8-32x1/2".	4	gross	2.06	8.24
Screws, wood, 1 1/2".	8	ea.	.01	.08
Set collar, 1" galv.	16	ea.	.30	4.80
Set collar, 1-3/8" galv.	90	ea.	.70	63.00

TABLE 4.--Items required for rainulator and estimated cost (1962)--Continued

HARDWARE AND LUMBER ITEMS--Continued

Description	Number	Unit	Unit cost	Total cost
Set screw, 3/16"x1/2".....	12	ea.	.02	.24
Snap fastener with swivel 5/8" galv.....	26	ea.	.30	7.80
Soil anchor, screw type, 30", 3" or 4" disk type.	26	ea.	1.50	39.00
Thimble, cable, 1/8" galv.....	52	ea.	.06	3.12
Thumb screws, malleable, 3/8-16x1/2".....	1	C	6.85	6.85
Washers, 1/2" x 12 gage.....	2	C	.80	1.60
Wing nuts, 3/8-16, galv.....	2	C	3.94	7.88
Wire, #9, galv.....	40	ft.	.01	.40
Grand total.....				$214.59

SPROCKETS, CHAINS, COUPLINGS, BEARINGS, BELTS, SHEAVES, CLUTCH, AND WHEELS

Sprocket; 45-tooth, #40, 1" bore, keyway..	8	ea.	$10.60	$84.80
Sprocket; 30-tooth, #40, 1" bore, keyway..	8	ea.	8.40	67.20
Sprocket; 30-tooth, #40, 1-3/16" bore.....	8	ea.	7.70	61.60
Sprocket; 15-tooth, #40, 1" bore, keyway..	8	ea.	2.35	18.80
Sprocket; 48-tooth, #41, 1/2" bore, set screw.	1	ea.	9.95	9.95
Sprocket; 32-tooth, #50, 1" bore, keyway..	1	ea.	11.30	11.30
Sprocket; 18-tooth, #50, 1" bore, keyway..	1	ea.	6.85	6.85
Sprocket; 9-tooth, #41, 1/2" bore, set screw.	1	ea.	1.70	1.70
Sprocket; 10-tooth, #41, 1/2" bore, set screw.	2	ea.	1.80	3.60
Bushing, bronze, 1" I.D.x1-3/16" O.D.x1" long.	8	ea.	1.00	8.00
Bearing, flange, 1" bore.....	16	ea.	5.00	80.00
Bearing, pillow block, 1" bore.....	11	ea.	5.00	55.00
Chain, roller, #40.....	160	ft.	1.15	184.00
Chain, roller, #40, special double side link.	8	ea.	.30	2.40
Chain, roller, #41.....	6	ft.	.60	3.60
Chain, roller, #41, conn. link.....	2	ea.	.10	.20
Chain, roller, #50.....	10	ft.	1.40	14.00
Wheel, 6" dia., rubber tire, 1/2" tread width, ballbearing.	68	ea.	.69	49.62
Wheel, 4 1/2" dia., rubber tire, 1" tread width, ballbearing.	20	ea.	.36	7.20
Slip clutch, centrifugal, 5 hp.....	1	ea.	16.00	16.00
Bushing, bronze, 3/4" O.D.x1/2" I.D.x1"...	8	ea.	.20	1.60
Sheave, V-belt, single, 'C', 9" dia., 3/4" bore with key seat.	1	ea.	15.85	15.85
Sheave, V-belt, single, 'C', 11", dia., 1" bore with key seat.	1	ea.	17.75	17.75
V-belt, 'C', 114.9" length.....	1	ea.	9.30	9.30

TABLE 4.--Items required for rainulator and estimated cost (1962)--Continued

SPROCKETS, CHAINS, COUPLINGS, BEARINGS, BELTS, SHEAVES, CLUTCH, AND WHEELS--Continued

Description	Number	Unit	Unit cost	Total cost
Coupling, flexible, 1" bore, separable....	6	ea.	$3.04	$18.24
Speed reducer, gear type, 48:1, 1/2" shaft, seminole type ACD.	1	ea.	54.00	54.00
Sheave, V-belt, 'A', 4" dia., 1/2" bore...	1	ea.	1.20	1.20
Sheave, V-belt, 'A', 10" dia., 1/2" bore..	1	ea.	3.00	3.00
V-belt, 'A', 48".....	1	ea.	2.80	2.80
Grand total.....				$809.56

STRUCTURAL STEEL

Bar, rectangular, 1 1/2"x1/2", mild.....	3	ft.	$0.85	$2.55
Bar, 1/8"x2", mild.....	6	ft.	.30	1.80
Channel, 9 gage, 1 1/4"x1/4".....	14	ft.	.16	2.24
Rod,1/4" dia., mild.....	18	ft.	.10	1.80
Rod, 1/2" dia., mild.....	48	ft.	.20	9.60
Rod, 1" dia., cold rolled.....	3	ft.	.35	1.05
Grand total.....				$19.04

ELECTRICAL ITEMS

Microswitch, BA-2RL2-A2.....	16	ea.	$2.35	$37.60
Relays, PR5D.....	4	ea.	4.00	16.00
Relays, PR7D.....	16	ea.	5.00	80.00
Switch, DPST, 125V, 6A.....	7	ea.	1.02	7.14
Switch, DPDT, 125V, 6A.....	2	ea.	1.18	2.36
Fitting, Amphenol, AN3102A-18-1P.....	4	ea.	1.20	4.80
Fitting, Amphenol, AN3057-10.....	4	ea.	.45	1.80
Fitting, Amphenol, AN3106A-18-1S.....	4	ea.	1.60	6.40
Fitting, Amphenol, AN3106A-14S-6S.....	32	ea.	1.15	36.80
Fitting, Amphenol, AN3102A-14S-6P.....	32	ea.	.85	27.20
Fitting, Amphenol, AN3157-6.....	32	ea.	.40	12.80
Fitting, Amphenol, AN3102A-12S-3S.....	2	ea.	.50	1.00
Fitting, Amphenol, AN3102A-12S-3P.....	2	ea.	.45	.90
Fitting, Amphenol, AN3057-4.....	2	ea.	.35	.70
Wire, 2 cond., 18 AWG, SP.....	6	spools(250')	6.25	37.50
Wire, 1 cond., 12 AWG, TW, 6 colors.....	240	ft.	.02	4.80
Circuit breaker, 5 amp., 125V, SP.....	6	ea.	1.60	9.60
Battery clips, 3".....	1	pr.	.60	.60
Battery, 12V, auto type.....	1	ea.	20.00	20.00
Generator, 12V, auto type, 25 amp.....	1	ea.	20.00	20.00
Voltage regulator, 12V, auto type.....	1	ea.	7.00	7.00
Ammeter, -30 to +30 amp. 12V, 2" dia.....	1	ea.	2.40	2.40
Grand total.....				$337.40

TABLE 4.--Items required for rainulator and estimated cost (1962)--Continued

IRRIGATION EQUIPMENT AND PUMP

Description	Number	Unit	Unit cost	Total cost
Midpipe riser, 3"	48	ea.	$3.00	$144.00
Pipe, irrigation, 4" med. wt	1,000	ft.	.40	400.00
Pipe, irrigation, 3", 20' length	20	ea.	6.40	128.00
Elbow, 90°, 4"x3"	1	ea.	7.20	7.20
Pipe tee, 4"x4"x4"	1	ea.	14.00	14.00
Pipe tee, 4"x4"x3"	3	ea.	12.00	36.00
Valve, line 3"	8	ea.	22.00	176.00
Valve, line 4"	1	ea.	33.00	33.00
Valve, foot, 3" with cleanout	4	ea.	6.90	27.60
Adapter, steel, 4" IPTx4" plain end with latch, with 1" plug.	1	ea.	7.00	7.00
Suction line complete with strainer	1	ea.	90.00	90.00
Pump, g.e.d. centrifugal, irrigation type, 500 g.p.m. @70 p.s.i.	1	ea.	700.00	700.00
Grand total				$1,762.80

BRASS FITTINGS AND HOSE, CLAMPS, GAGES, VALVES

Coupling, hose, 1", without fingers	128	pr.	$0.93	$119.04
Coupling, hose, 1/2", without fingers, female end only.	384	ea.	.17	65.28
Clamps, hose, 1" stainless steel	720	ea.	.20	144.00
Adapters, brass, 3/4" MHTx3/4" "MPT	192	ea.	.40	76.80
Adapters, brass, 3/4" MHTx1/2" FPT	192	ea.	.35	67.20
Washers, hose, rubber, 1"	1 1/2	C	1.10	1.65
Washers, hose, rubber, 3/4"	4	C	.50	2.00
Hose, all purpose, 1/2"	1,200	ft.	.13	156.00
Valves, solenoid, 12V, D.C., N.C.1/2"	80	ea.	19.15	1,532.00
Valves, angle check, 1/2", brass	192	ea.	2.15	412.80
Nozzle, 1/2", 80100 veejet	192	ea.	.75	144.00
Gage, pressure, type 100, 3 1/2" dia. 0-15 p.s.i.	32	ea.	2.40	76.80
Gage, pressure, type 100, 3 1/2" dia. 0-100 p.s.i.	3	ea.	2.40	7.20
Hose, 1", soft rubber	40	ft.	.10	4.00
Grand total				$2,808.77

PLASTIC PIPE AND FITTINGS

Pipe, plastic, flexible, 1" dia	1,600	ft.	$0.15	$240.00
Elbow, 90°, 1" insert	164	ea.	.29	18.56
Pipe tee, 1" insert x 1" insert x 3/4 FPT.	128	ea.	.69	88.32
Elbow, 90°, 1" insert x 3/4" FPT	128	ea.	.55	70.40
Grand total				$417.28

TABLE 4.--Items required for rainulator and estimated cost (1962)--Continued

GASOLINE ENGINE AND SUMP PUMP

Description	Number	Unit	Unit cost	Total cost
Engine, gasoline, 5 hp., air cooled alum. block, 4,000 r.p.m., W 1:6 gear, reduction, 3/4" shaft.	1	ea.	$87.00	$87.00
Pump, sump, 250 g.p.m.....	1	ea.	240.00	240.00
Grand total.....				$327.00

MEASURING EQUIPMENT

Recorders, stage.....	4	ea.	$222.50	$890.00
Flume, 0.6' HS with stilling well. (According to plan.)	4	ea.	40.00	160.00
Wheel, sampling and mounting. (According to plan.)	4	ea.	40.00	160.00
Grand total.....				$1,210.00

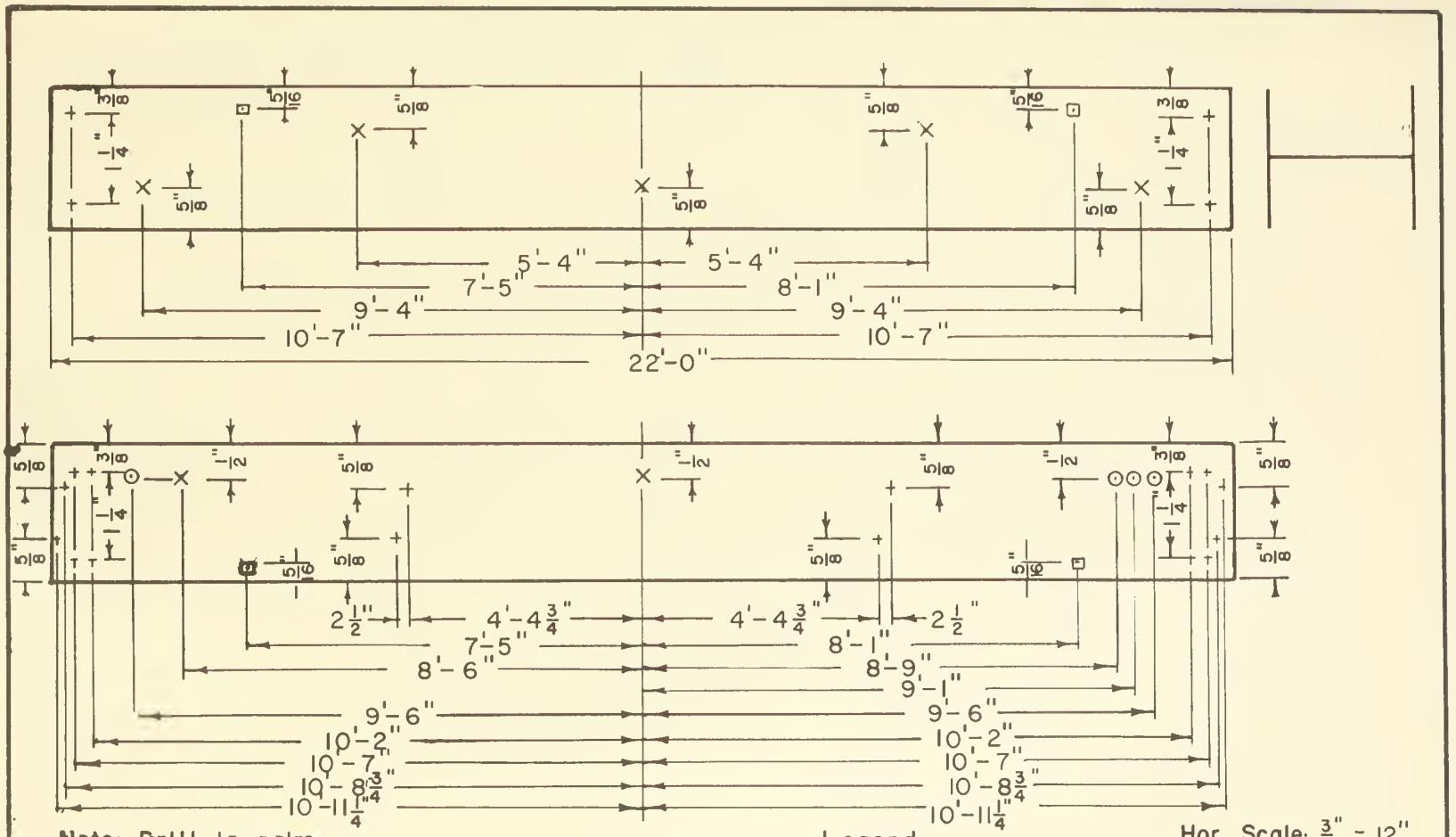
LIST OF DRAWINGS

Number	Item	Length of item
1 $1R_2$	I-Beam, Main and $Right_2$ Units	22'
1A	I-Beam, Main Unit, Side View	22'
$1L_1$	I-Beam, $Left_1$ Units	22'
$1R_1$	I-Beam, $Right_1$ Units	22'
2 $2R_2$	Wheel Track, Main and $Right_2$ Units	20'
$2L_1$	Wheel Track, $Left_1$ Units	20'
$2R_1$	Wheel Track, $Right_1$ Units	20'
3	I-Beam Connector	2 5/8"
4	Connector, Leg to I-Beam	4"
4A	Connector, Brace Leg to I-Beam	4"
5	Leg	6'-8"
6	Brace Leg	10'
7 $7R_2$	Plastic Pipe Support	16'
$7L_1$	Plastic Pipe Support	16'
$7R_1$	Plastic Pipe Support	14'
8	Connector, I-Beam to T-Bar	3"
9	Connector, I-Beam to T-Bar	4"
10	Foot	2'-8"
11	Brace Foot	15"
12	Leg Receiver	2'-10"
13	Leg Receiver	2'-0"
14	Spacer, I-Beam to I-Beam	12'-6"
15	Spacer Connector	8'-6"
16	Carriage Connector	3'-10"
20	Alignment Pin	4"
35	Measuring Channel Bracket	18"
50 $50R_2$	Lower Carriage Frame, Main and $Right_2$ Units	16'
$50L_1$ $50R_1$	Lower Carriage Frame, $Left_1$ and $Right_1$ Units	16'
51 $51R_2$	Upper Carriage Frame, Main and $Right_2$ Units	16'
$51L_1$ $51R_1$	Upper Carriage Frame, $Left_1$ and $Right_1$ Units	16'
52	Lower Carriage Frame, Main, $Left_1$, $Right_1$ and $Right_2$ Units	12'-2 1/4"
53 $53R_2$	Upper Carriage Frame, Main and $Right_2$ Units	12'-2 1/4"
$53L_1$ $53R_1$	Upper Carriage Frame, $Left_1$ and $Right_1$ Units	12'-2 1/4"
54 $54R_2$	Carriage Spacer, Main, $Right_2$ Units	7 1/2"
$54L_1$ $54R_1$	Carriage Spacer, $Left_1$ and $Right_1$ Units	6"
55	Carriage Drive Slot, Main Units	9"
56	Nozzle Frame	16'
57 $57R_2$	Carriage Brace, Main and $Right_2$ Units	9 5/8"
$57L_1$ $57R_1$	Carriage Brace, $Left_1$ and $Right_1$ Units	8 1/2"
58	Connector, Carriage to Nozzle Frame	2 1/8"
59	Axle Support	3"
60	Axle Support	1 1/2"
61	Axle Support, for Bent Axle	1 1/2"
62	Drive Slot Brace, Main Carriage	13"
63	Drive Slot Spacer	3 1/4"
64 $64R_2$	Axle, Main and $Right_2$ Units	12 1/2"
$64L_1$ $64R_1$	Axle, $Left_1$ and $Right_1$ Units	11"
65 $65R_2$	Axle, Main and $Right_2$ Units	7"
$65L_1$ $65R_1$	Axle, $Left_1$ and $Right_1$ Units	5 1/2"
66	Drive Rod	9'-5 3/4"
100	Leg, Motor Mounting	49 1/2"
101	Leg, Motor Mounting	49 1/2"

Number	Item	Length of item
102	Motor Mounting, Leaf Switch Box Support	12 1/2"
103	Motor Mounting Brace	19"
104	Motor Mounting Spacer	7"
105	Power Shaft Frame	9'-4"
106	Power Shaft Frame Support	3'-9"
107	Power Shaft Frame Spacer	8"
108	Motor Mounting, Brace	35"
109	Motor Mounting, Brace	49 1/2"
110	Power Shaft Brace	45 1/2"
111	Motor Mounting Brace	19"
112	Motor Support	24"
113	Motor Mounting Brace	23"
114	Motor Mounting, Leaf Switch Box Support	14"
115	Drive Shaft Support	22"
116	Speed Reducer Bracket	11"
205	Power Shaft, Motor to First Unit	11'
210	Drive Shaft, First and Third Units	10'-9"
211	Drive Shaft, Second and Fourth Units	10'-9"
212	Drive Shaft, Between Units	9'-2"
218	Drive Shaft	9"
453	Nozzle Holder Bracket	4"
453A	Nozzle Holder	--
500	Sill Plate	13'-4"
501	Collection Gutter	6'-5 1/2"
502	Gutter Cover	83 1/2"
503	Approach Chute	60"
504	Approach Chute Cover	60"
506	Flume Mounting	45"
507	Flume Mounting	31"
508	Flume Mounting	30-3/4"
509	Leg Clamp, Flume Mounting	--
510	Stage Recorder Mounting	26 1/4"
511	Stage Recorder Mounting	19 1/4"
512	Stage Recorder Mounting	18"
513	Stage Recorder Mounting	13 1/2"
514	Stage Recorder Mounting	9 1/4"
515	Stage Recorder Mounting	13"
516	Collection Funnel	--
516A	Collection Funnel	--
517	Funnel Spout and Grid	--
518	Funnel and Motor Mounting	--
519	Funnel and Motor Mounting	--
520	Funnel and Motor Mounting Assembly	--
521	Measuring Wheel	--
521A	Measuring Wheel Details	--
522	Measuring Wheel Receptacle	--
523	Measuring Wheel Support Bracket	--
600	Over All Assembly	--
601	I-Beam Detail	--
602	T-Bar Assembly	--
603	Carriage Frame Assembly	--
604	Unit Drive Shaft Assembly	--
605	Motor Mount Assembly	--

LIST OF DRAWINGS--Continued

Number	Item	Length of item
606	Up Slope Wheel Assembly	--
607	Chain Tightener Assembly	--
607A	Chain Tightener Assembly	--
608	Leafswitch Spacing	--
609	Control Panel	--
610	Wiring & Switching Diagram	--
611	Border Line-Up Device	--
612	Flume Mount Assembly	--



Note: Drill in pairs.

2" X 2" X $\frac{1}{8}$" thick - I-beam.

See drawing 1A for side view.

Legend

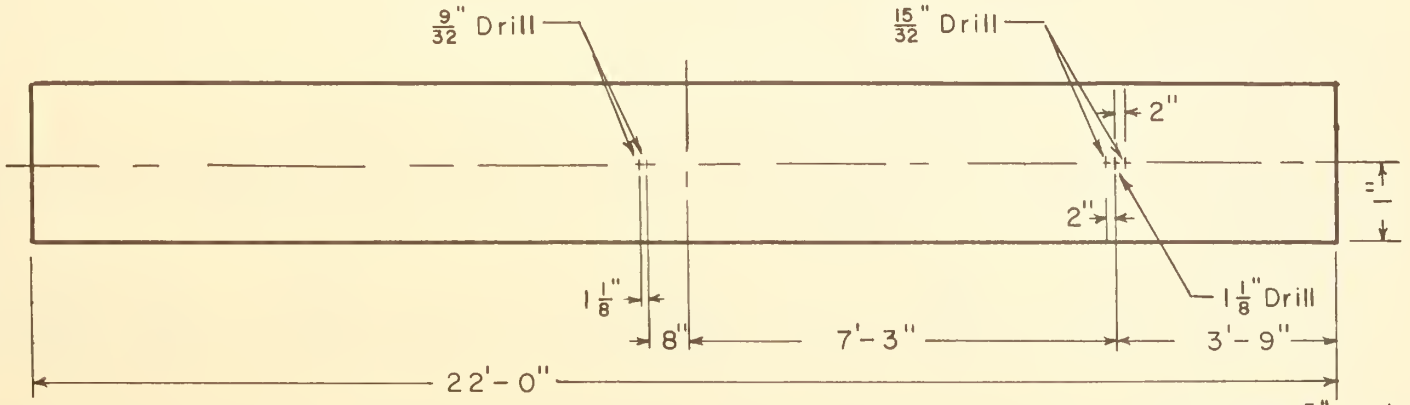
+ $\frac{25}{64}$" Drill X $\frac{11}{64}$" Drill

⊡ $\frac{9}{32}$" Drill ⊙ $\frac{3}{8}$"-16 Tap

Hor. Scale: $\frac{3}{8}$" = 12"

Ver. Scale: 1" = 2"

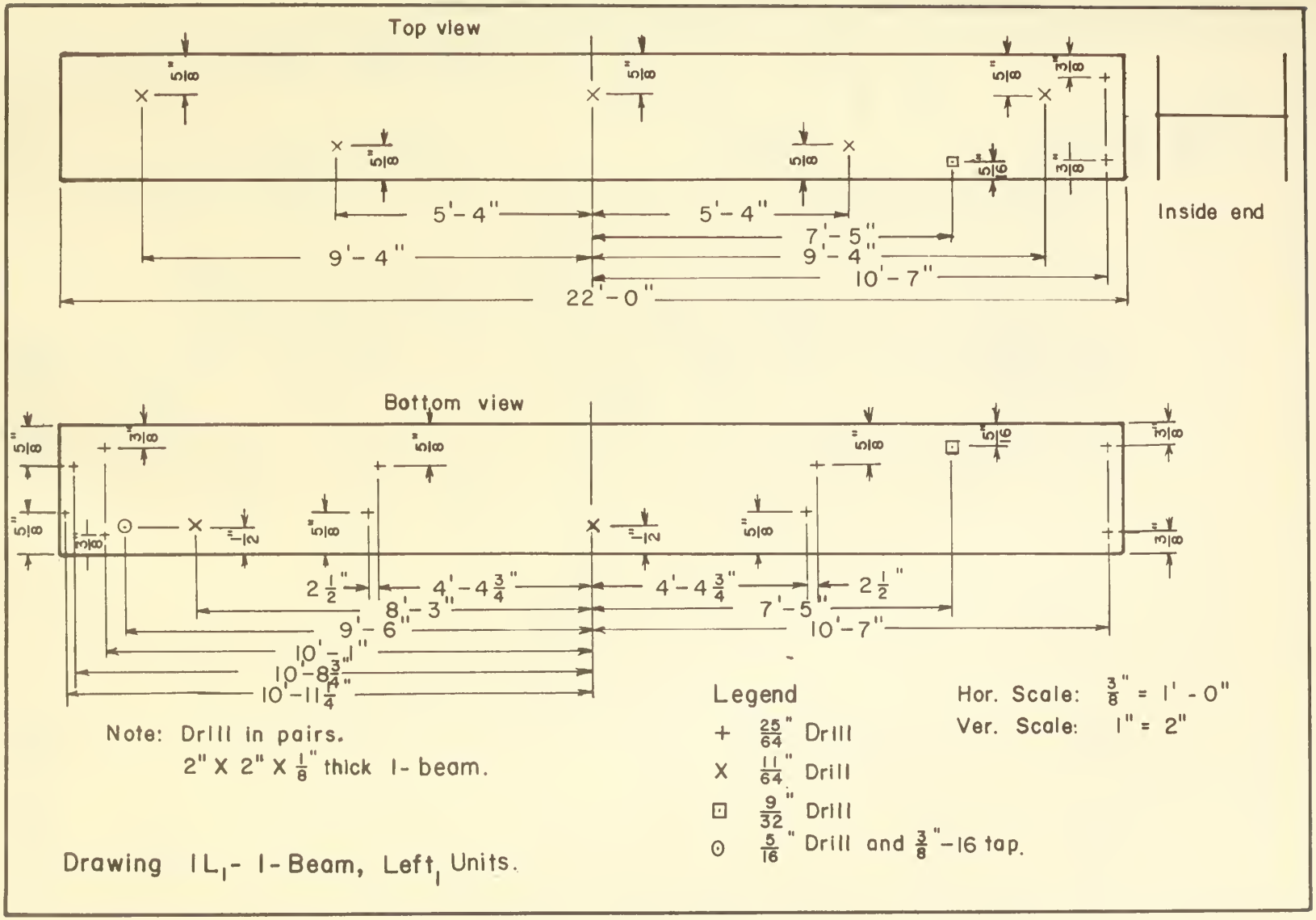
Drawing 1 $1R_2$ – I-Beam, Main and $Right_2$ Units.

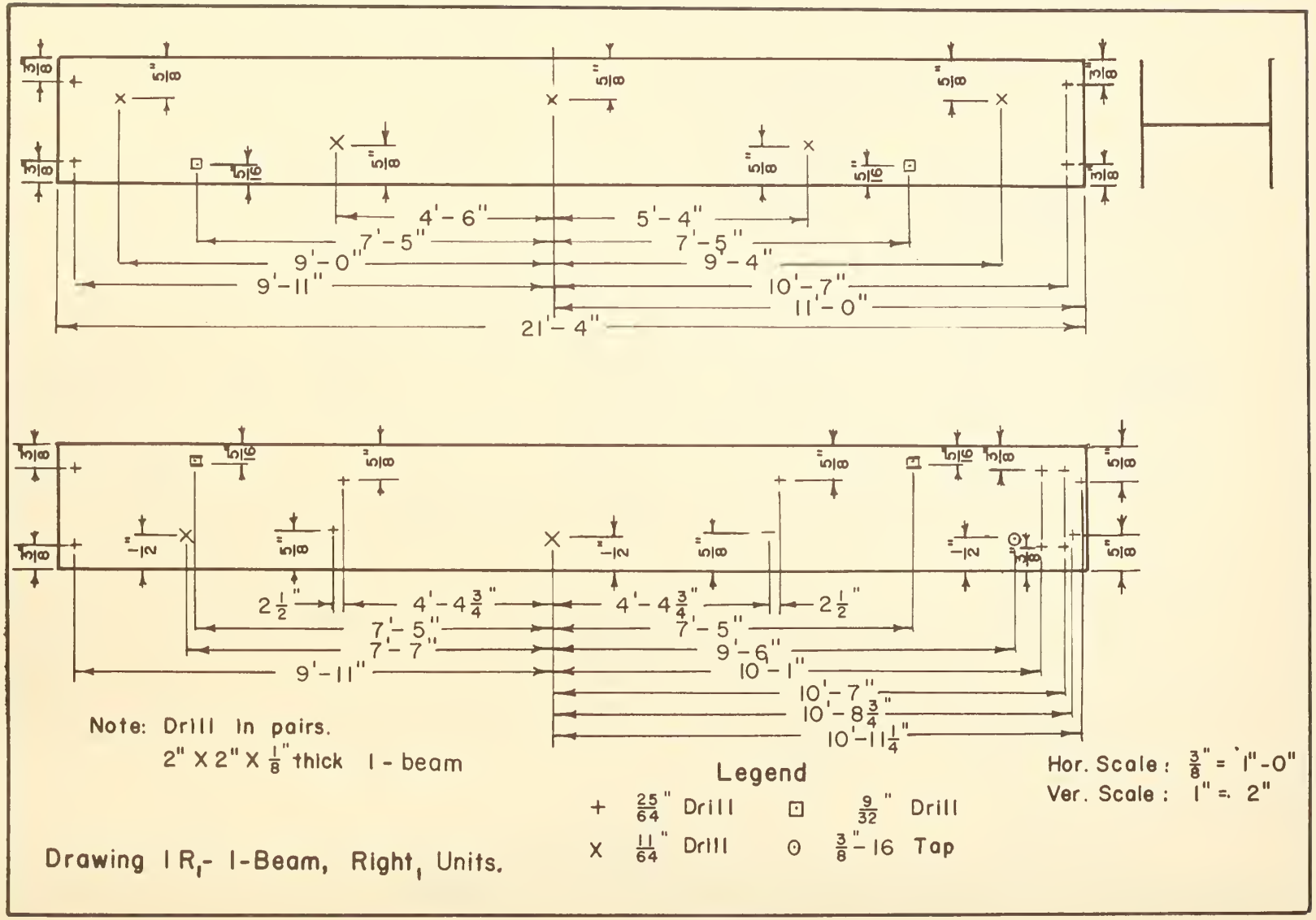


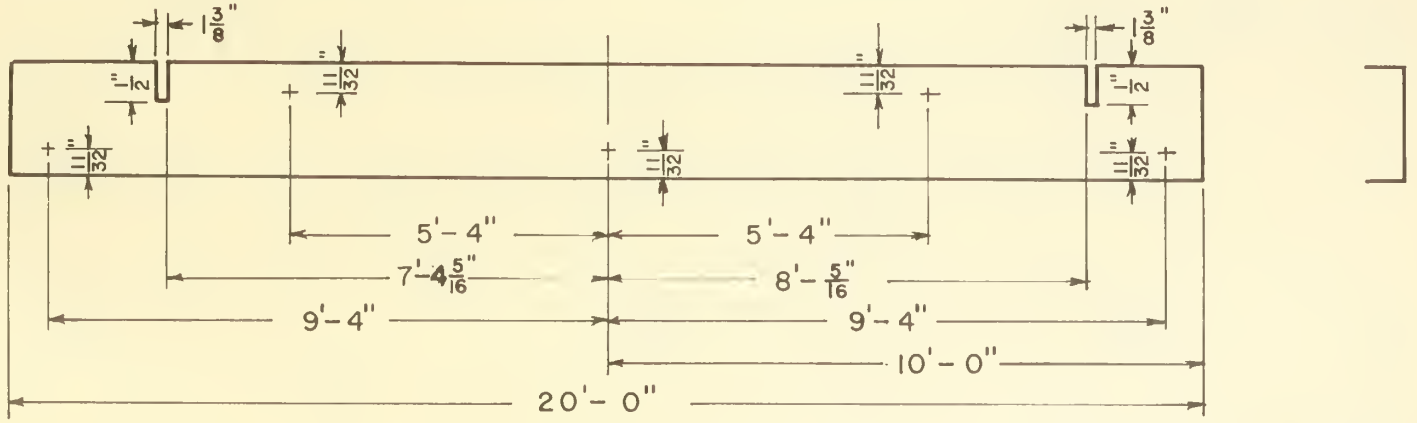
Hor. Scale: 3/8" = 1'-0"
Ver. Scale: 1" = 2"

Note: Side view holes are used only on main unit.

Drawing 1A – I-Beam Main Unit, Side View.


Top view
Inside end
5'-4"
5'-4"
7'-5"
9'-4"
10'-7"
22'-0"
9'-4"
Bottom view
2 1/2"
4'-4 3/4"
4'-4 3/4"
2 1/2"
8'-3"
7'-5"
9'-6"
10'-7"
10'-1"
10'-8 3/4"
10'-11 1/4"
Note: Drill in pairs.
2" X 2" X 1/8" thick I-beam.
Legend
+ 25/64" Drill
X 11/64" Drill
⊡ 9/32" Drill
⊙ 5/16" Drill and 3/8"-16 tap.
Hor. Scale: 3/8" = 1'-0"
Ver. Scale: 1" = 2"
Drawing 1L1- I-Beam, Left1 Units.

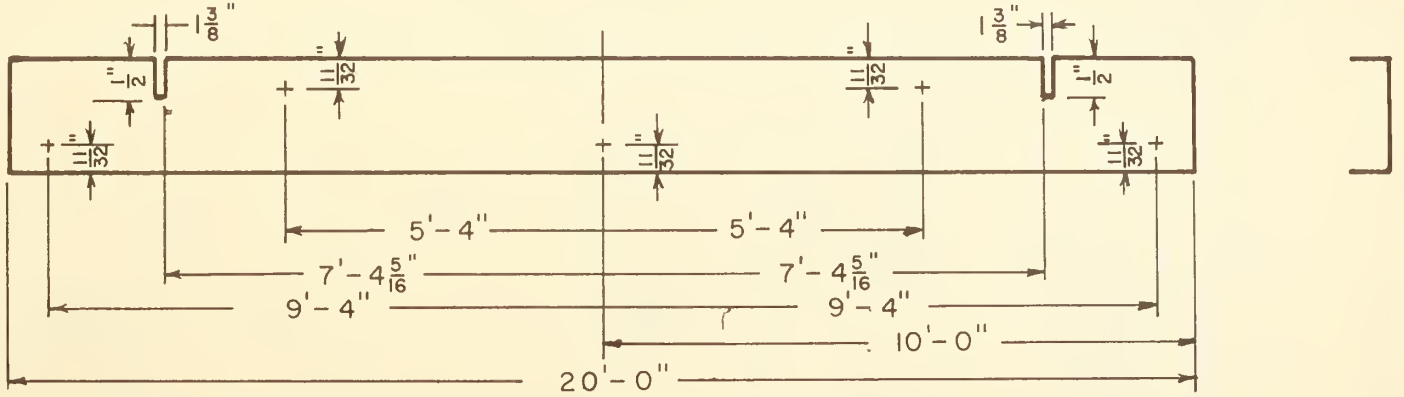

4'-6"
5'-4"
7'-5"
7'-5"
9'-0"
9'-4"
9'-11"
10'-7"
11'-0"
21'-4"
2½"
4'-4¾"
4'-4¾"
2½"
7'-5"
7'-5"
7'-7"
9'-6"
9'-11"
10'-1"
10'-7"
10'-8¾"
10'-11¼"
Note: Drill in pairs.
2" X 2" X ⅛" thick I - beam
Legend
+ 25/64" Drill
⊡ 9/32" Drill
X 11/64" Drill
⊙ ⅜"-16 Tap
Hor. Scale: ⅜" = 1"-0"
Ver. Scale: 1" = 2"
Drawing 1 R1- I-Beam, Right, Units.



Hor. Scale: $\frac{3}{4}$" = 2'-0"
Ver. Scale: 1" = 2"

Note: Drill in pairs for upper and lower.
All holes $\frac{11}{64}$" drill and countersink inside channel.
$\frac{1}{2}$" X $1\frac{7}{16}$" X $\frac{3}{32}$" channel.

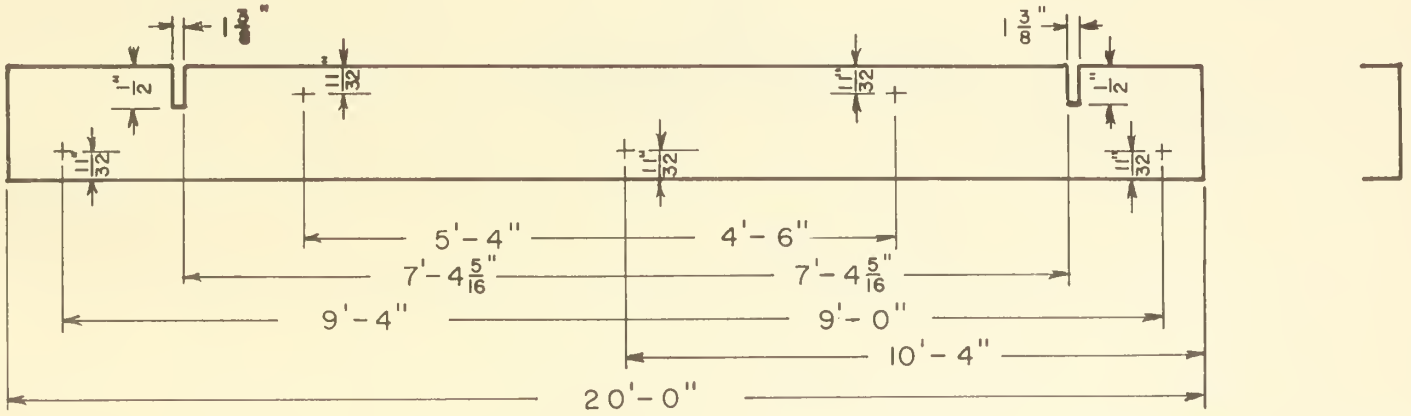
Drawina 2 $2R_2$ – Wheel Track - Main and $Right_2$ Units.



Hor. Scale: $\frac{3}{4}$" = 2'-0"
Ver. Scale: 1" = 2"

Note: All holes $\frac{11}{64}$" drill and counter sink inside channel.
Drill upper and lower parts in pairs.
$\frac{1}{2}$" X 1 $\frac{7}{16}$" X $\frac{3}{32}$" thick channel.

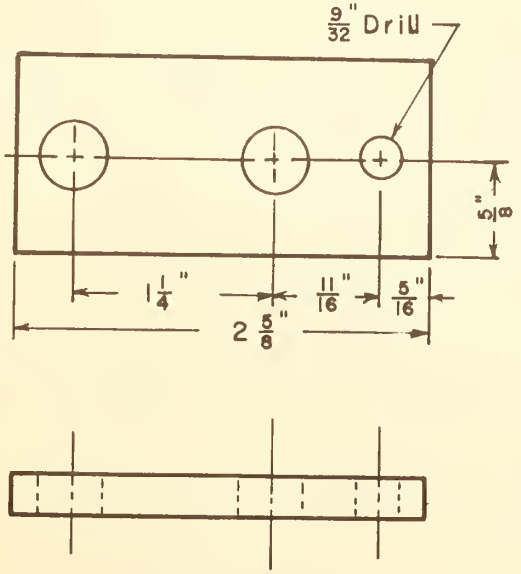
Drawing $2L_1$- Wheel Track, Left, Units.



Note: All holes $\frac{11}{64}$" drill and counter sink inside channel.
Drill upper and lower parts in pairs.
$\frac{1}{2}$" X $1\frac{7}{16}$" X $\frac{3}{32}$" thick channel.

Hor. Scale: $\frac{3}{4}$" = 2'-0"
Ver. Scale: 1" = 2"

Drawing $2R_1$ – Wheel Track, Right$_1$ Units.

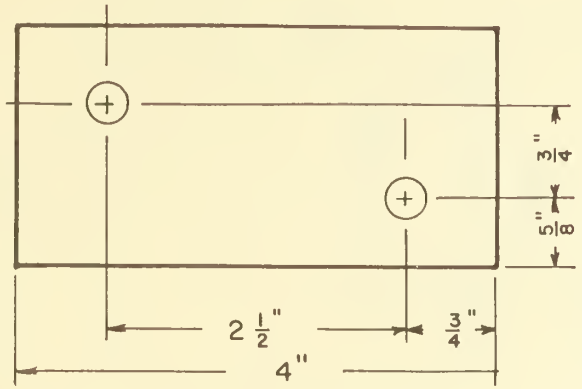


Scale: 1" = 1"

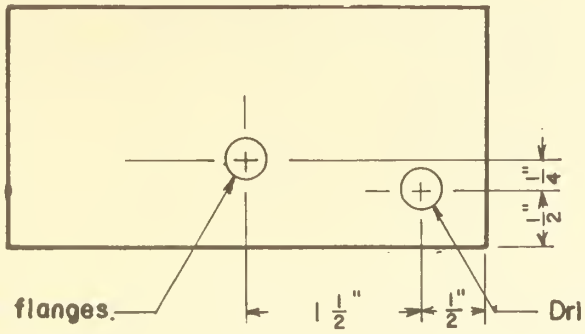
Note: Drill $\frac{25}{64}$" except as noted.

$1\frac{1}{4}$" X $\frac{1}{4}$" bar.

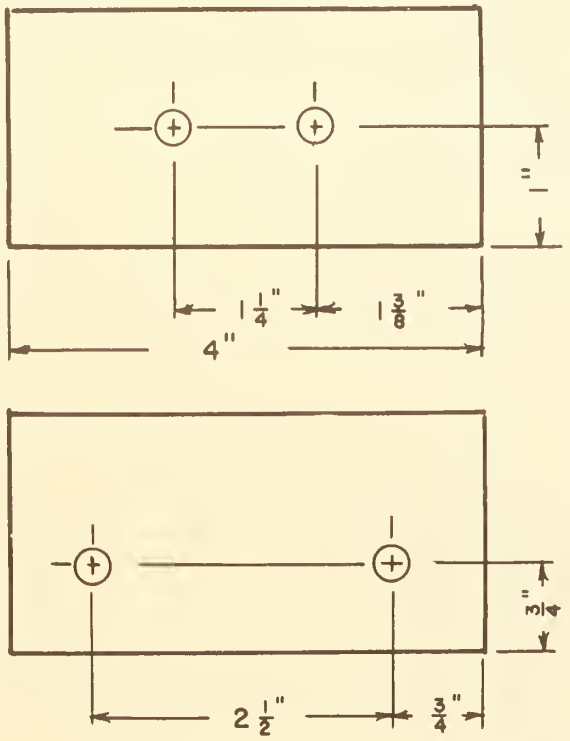
Drawing 3 - I-Beam Connector.



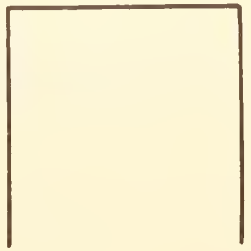
Note: All holes $\frac{25}{64}$" drill.
2" X 2" X $\frac{1}{4}$" channel.



Drawing 4 - Connector, Leg to I-Beam.

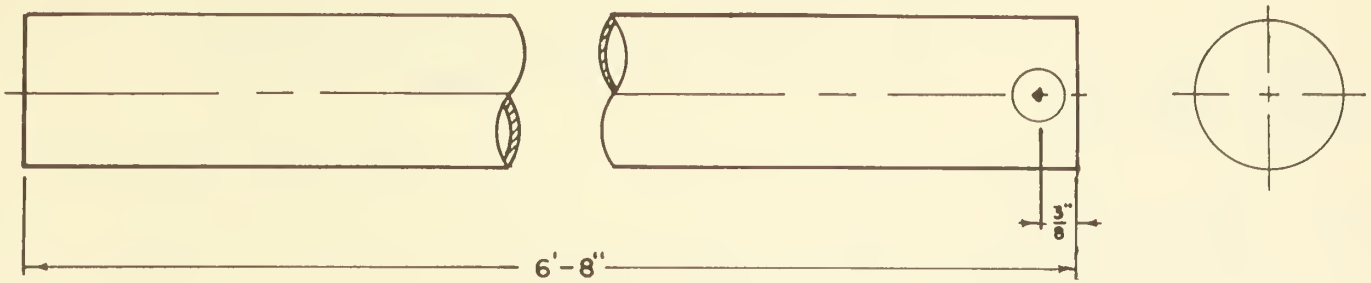


Note: All holes $\frac{25}{64}$" drill.
2" X 2" X $\frac{1}{4}$" channel.

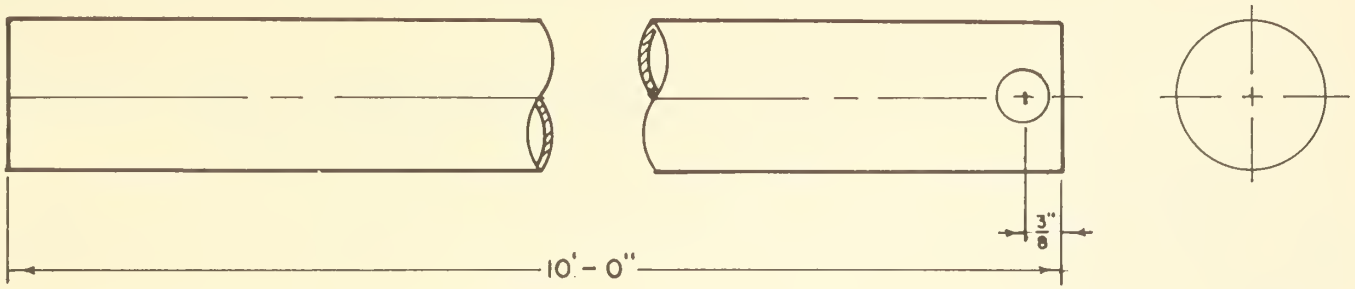


Scale: $\frac{3}{4}$" = 1"

Drawing 4A - Connector, Brace Leg to I-Beam.



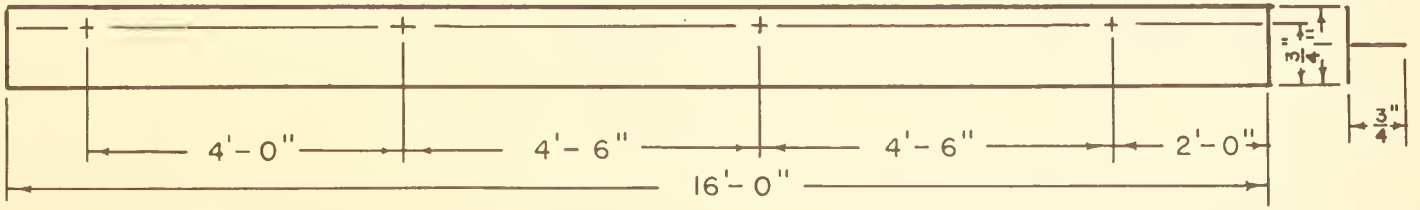
Drawing 5- Leg.



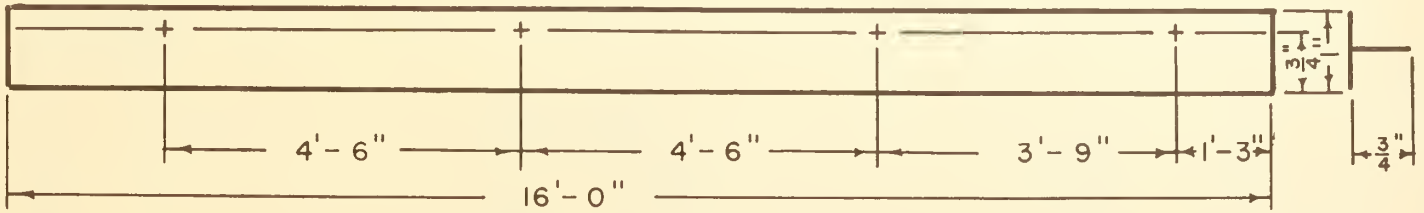
Hor. Scale: $\frac{3}{4}$" = 1"
Ver. Scale: 1" = 1"

Note: 1" schedule 40 pipe. Both drawings.
Both holes $\frac{25}{64}$" drill.

Drawing 6 - Brace Leg.



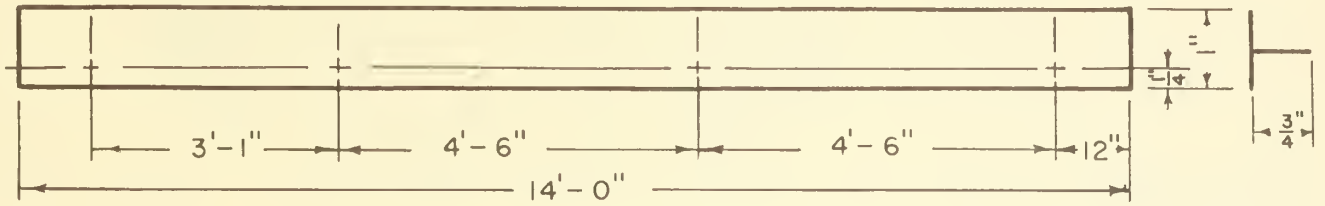
Drawing 7 $7R_2$ - Plastic Pipe Support.



Hor. Scale: 1" = 2'-0"
Ver. Scale: 1" = 2"

Note: Both drawings.
Drill upper and lower parts in pairs. Upper is shown.
All holes $\frac{11}{64}$" drill.

Drawing $7L_1$ - Plastic Pipe Support.

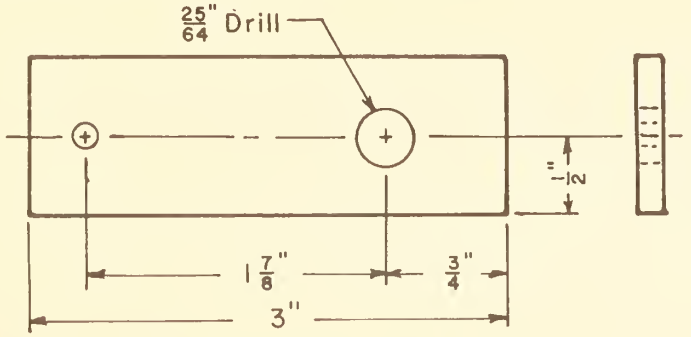


Note: Drill upper and lower in pairs. Upper shown.
All holes $\frac{11}{64}$" drill.

Hor. Scale: 1" = 2'-0"

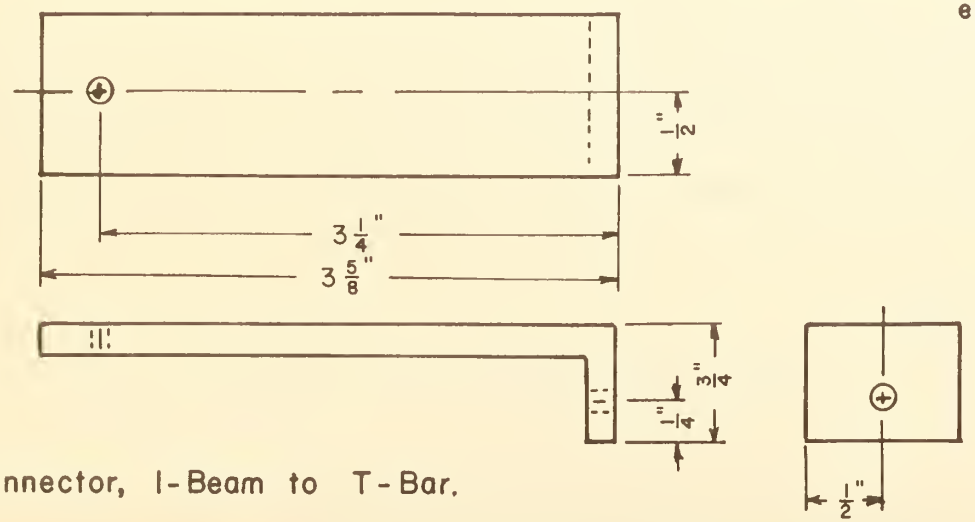
Ver. Scale: 1" = 2"

Drawing $7R_1$ - Plastic Pipe Support.



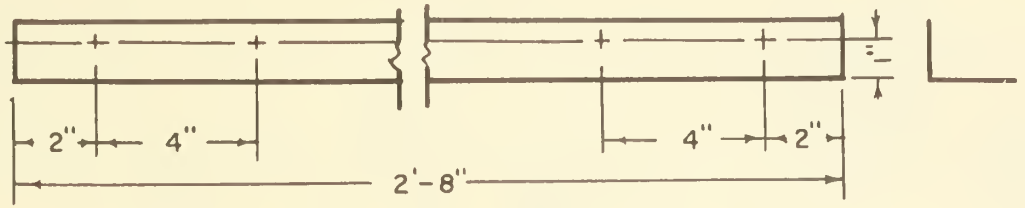
Drawing 8- Connector, I-Beam to T-Bar.

Note: 3/16" X 1" bar
All holes 11/64" drill
except as noted.



Scale: 1" = 1"

Drawing 9 - Connector, I-Beam to T-Bar.

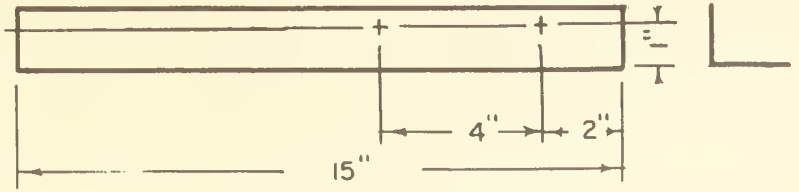


Note: All holes $\frac{25}{64}$" drill. Drill in pairs.

$1\frac{1}{2}$" X 2" angle 1/8" thick.

Scale: 1" = 4"

Drawing 10 - Foot.

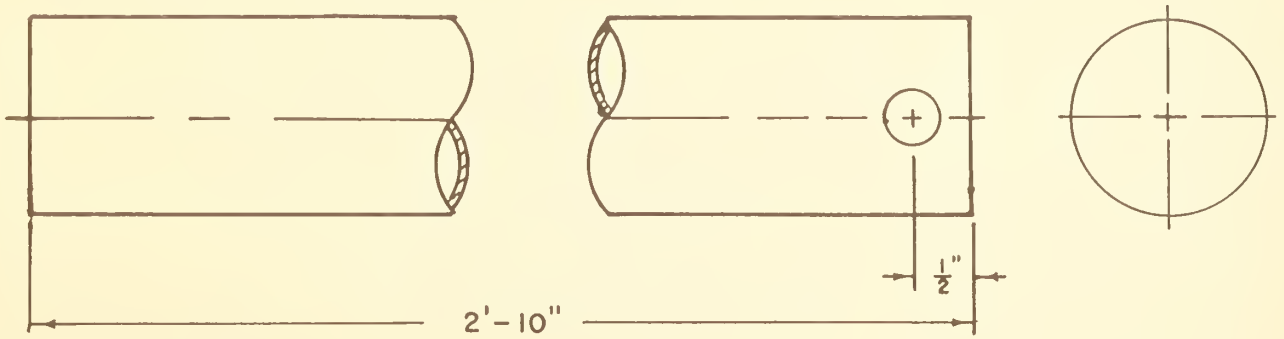


Note: All holes $\frac{25}{64}$" drill. Drill in pairs.

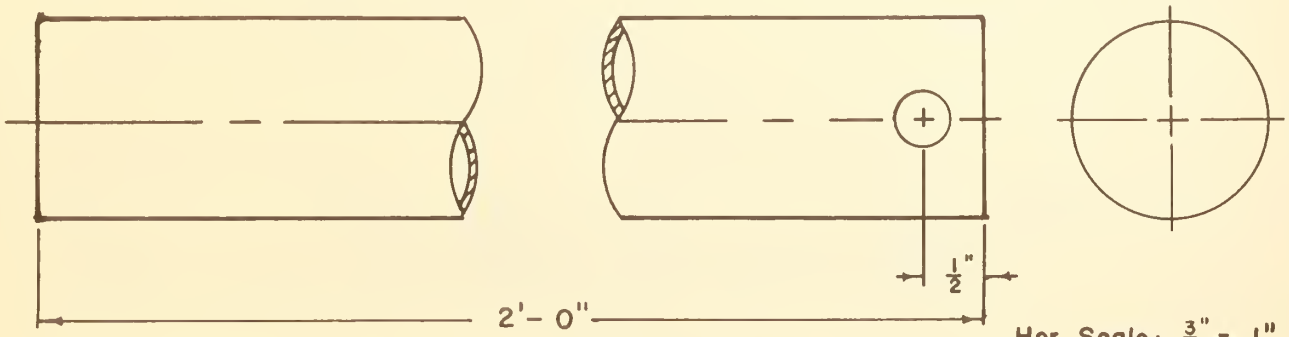
$1\frac{1}{2}$" X 2" angle 1/8" thick.

Scale: 1" = 4"

Drawing 11 - Brace Foot.



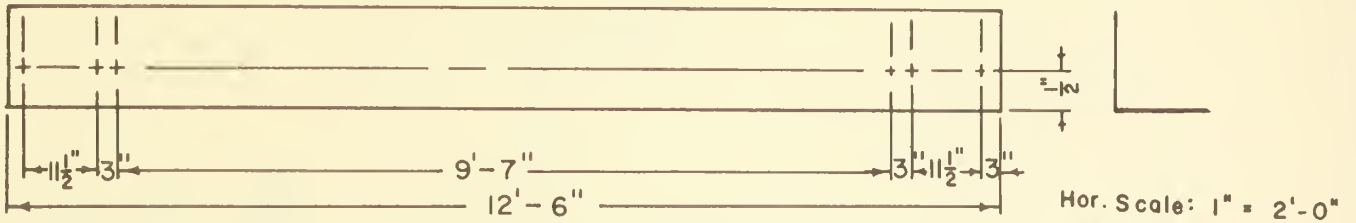
Drawing 12- Leg Receiver



Hor. Scale: $\frac{3}{4}$" = 1"
Ver. Scale: 1" = 1"

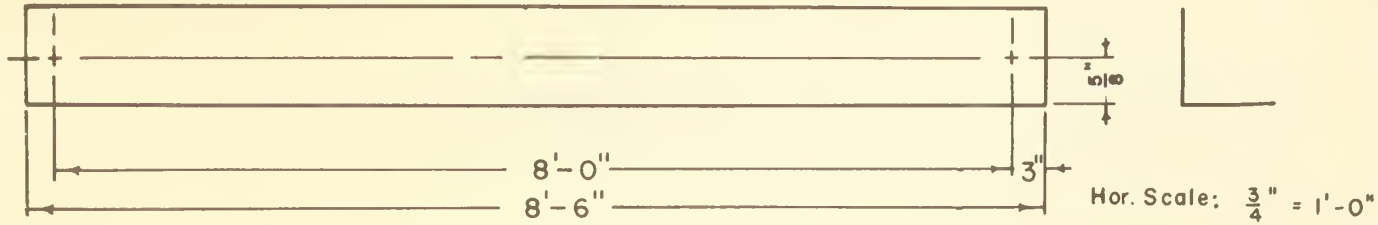
Note: Schedule 40 pipe. Both drawings.
Both holes $\frac{25}{64}$ drill.

Drawing 13 - Leg Receiver.



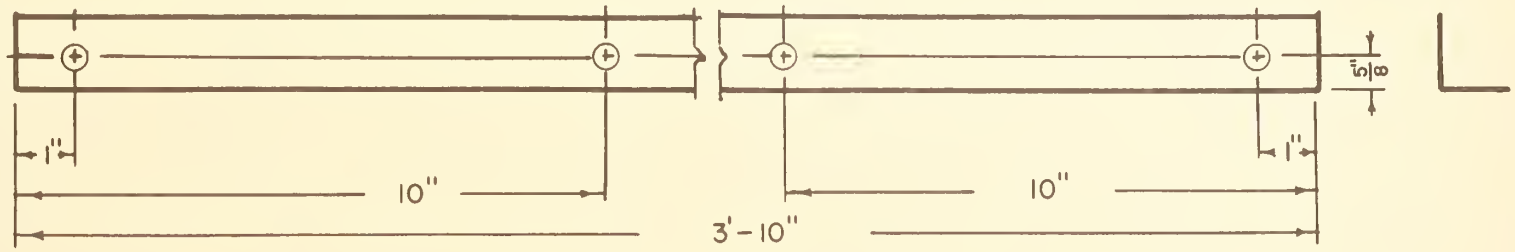
Note: All holes $\frac{25}{64}$" drill. Drill in pairs. $1\frac{1}{4}$" X $1\frac{1}{4}$" angle $\frac{1}{8}$" thick.

Drawing 14 - Spacer, I-Beam to I-Beam.



Note: All holes $\frac{25}{64}$" drill. Drill in pairs. $1\frac{1}{4}$" X $1\frac{1}{4}$" angle $\frac{1}{8}$" thick.

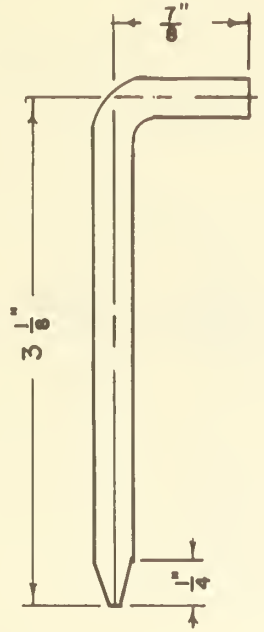
Drawing 15 - Spacer Connector.



Scale: $\frac{3}{8}$" = 1"

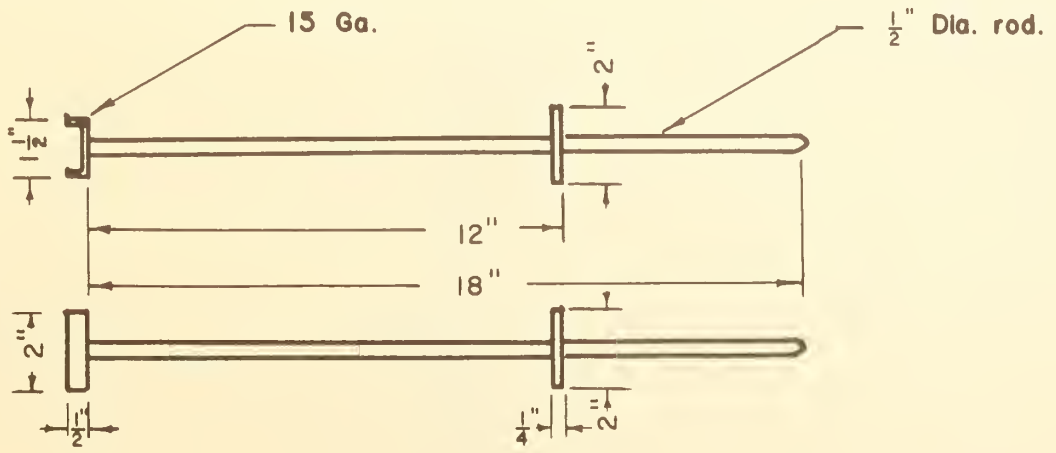
All holes $\frac{25}{64}$" drill.
$1\frac{1}{4}$" X $1\frac{1}{4}$" X $\frac{1}{8}$" thick angle.

Drawing 16 - Carriage Connector.



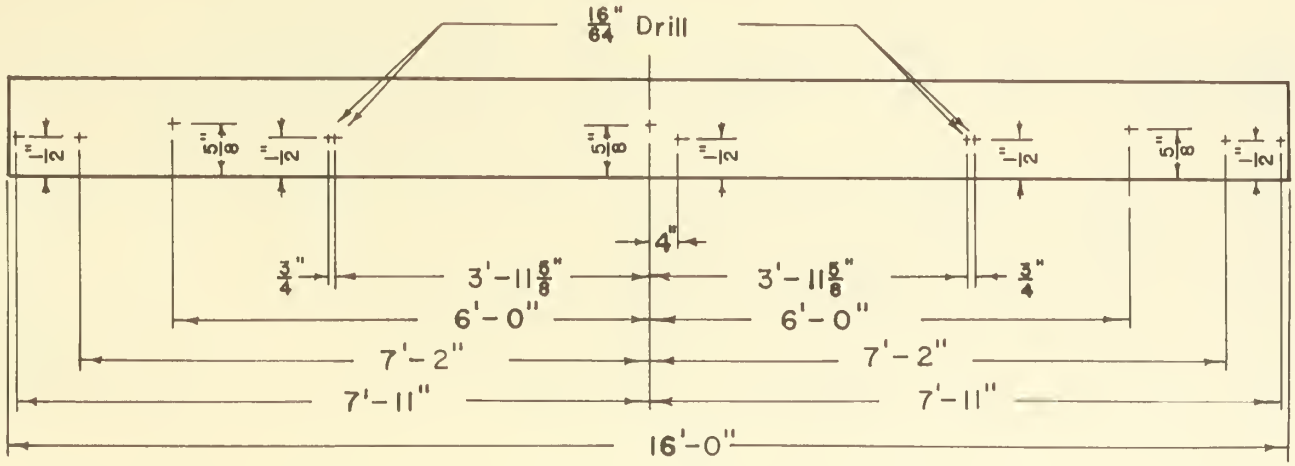
Note: $\frac{1}{4}$" steel rod - dimensions not critical.

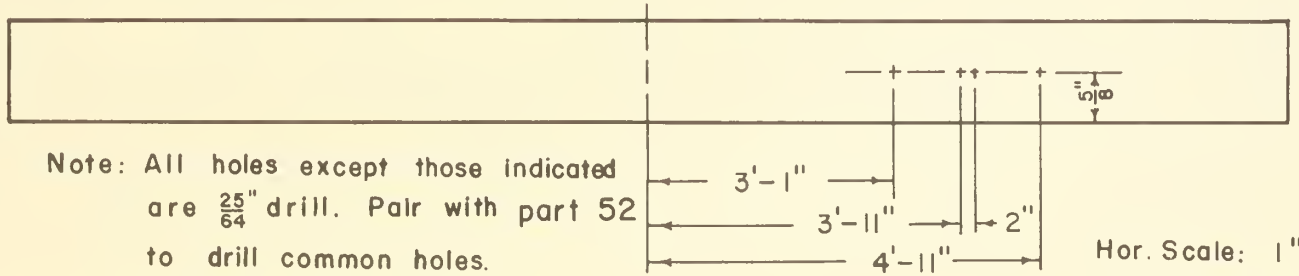
Drawing 20 - Alignment Pin.



Scale: 1" = 4"

Drawing 35 - Measuring Channel Bracket.



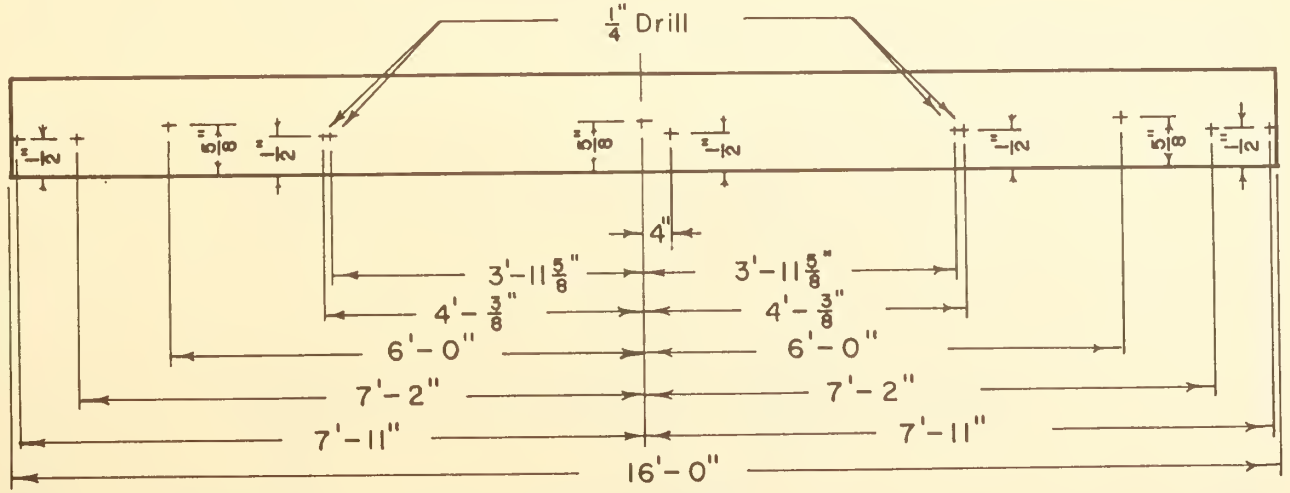


Note: All holes except those indicated are 25/64" drill. Pair with part 52 to drill common holes.
1 1/4" X 1 1/4" X 1/8" angle.

Hor. Scale: 1" = 2'-0"

Ver. Scale: 1" = 2"

Drawing 50 $50R_2$ - Lower Carriage Frame, Main and $Right_2$ Units.



Note: Holes not otherwise marked drill $\frac{25}{64}$".

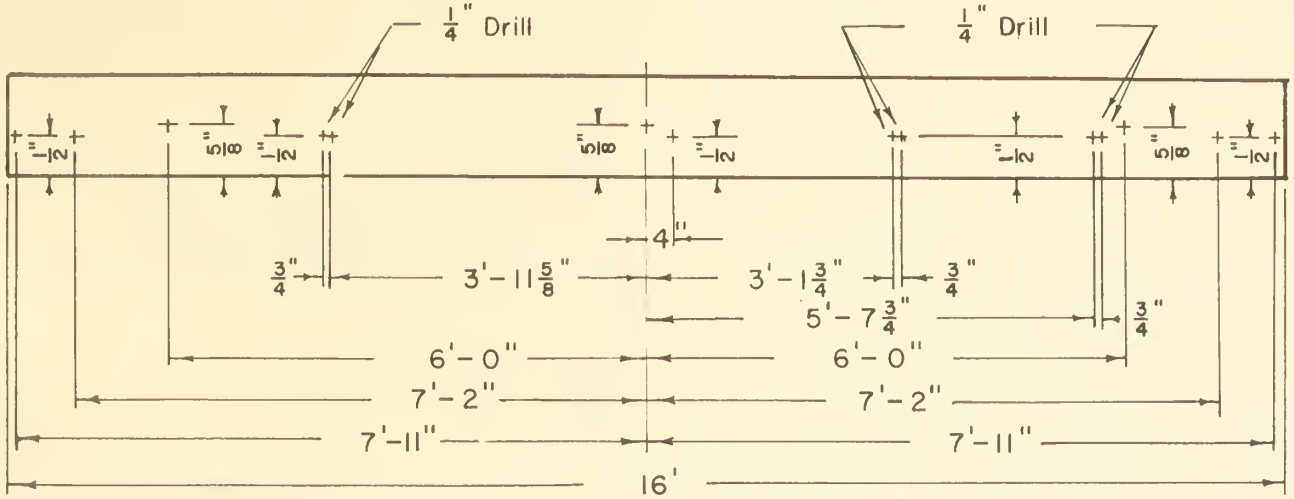
Pair with part 52 to drill common holes.

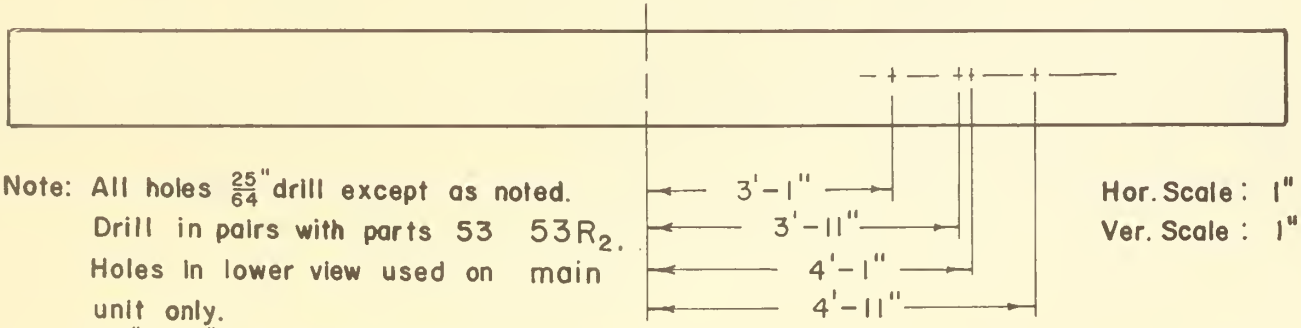
$1\frac{1}{4}$" X $1\frac{1}{4}$" X $\frac{1}{8}$" angle.

Hor. Scale: 1" = 2'-0"

Ver. Scale: 1" = 2"

Drawing 50L, 50R – Lower Carriage Frame, Left, and Right, Units.

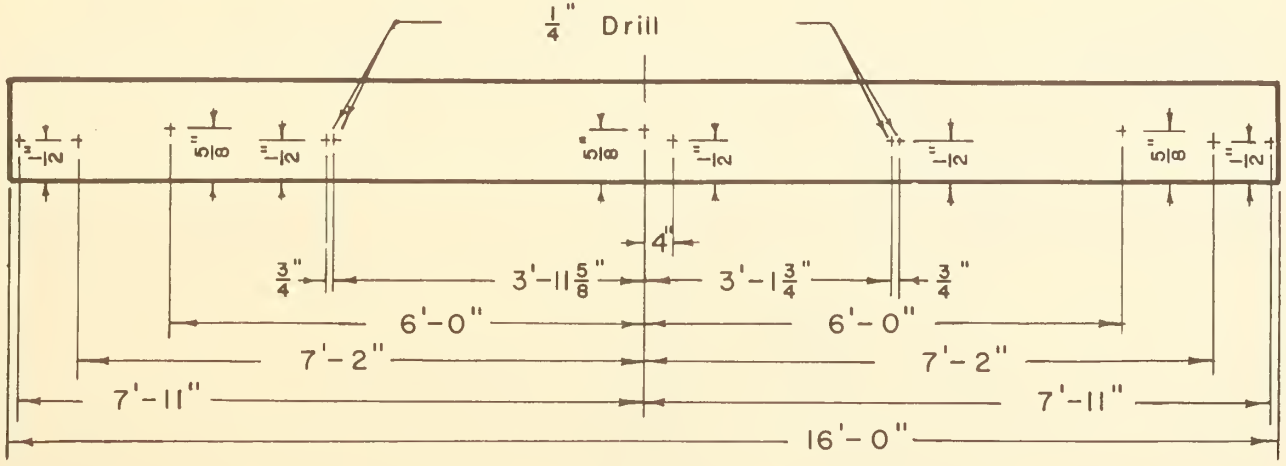




Note: All holes $\frac{25}{64}$" drill except as noted.
Drill in pairs with parts 53 $53R_2$.
Holes in lower view used on main unit only.
$1\frac{1}{4}$" X $1\frac{1}{4}$" X $\frac{1}{8}$" thick angle.

Hor. Scale: 1" = 2'-0"
Ver. Scale: 1" = 2"

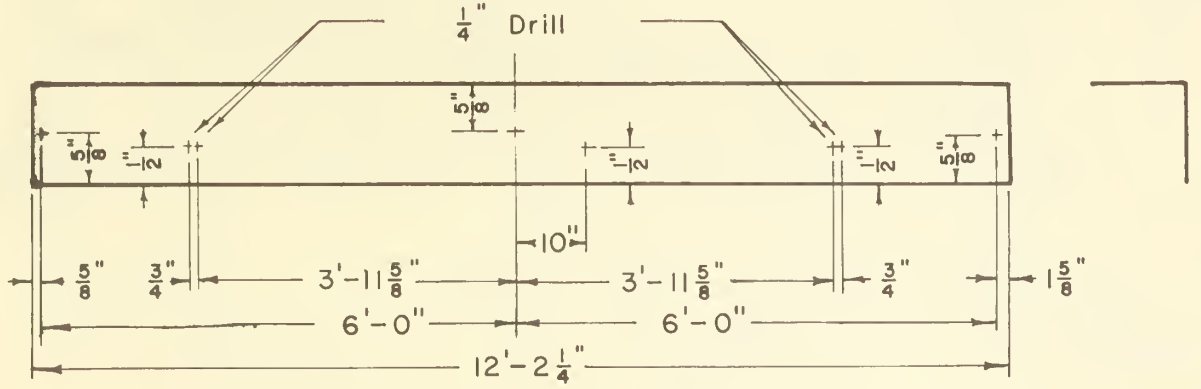
Drawing 51 $51R_2$ – Upper Carriage Frame, Main and $Right_2$ Units.



Hor. Scale: 1" = 2'-0"
Ver. Scale: 1" = 2"

Note: All holes $\frac{25}{64}$" drill except as noted.
Drill in pairs with parts 53 L 53R.
$1\frac{1}{4}$" X $1\frac{1}{4}$" X $\frac{1}{8}$" thick angle.

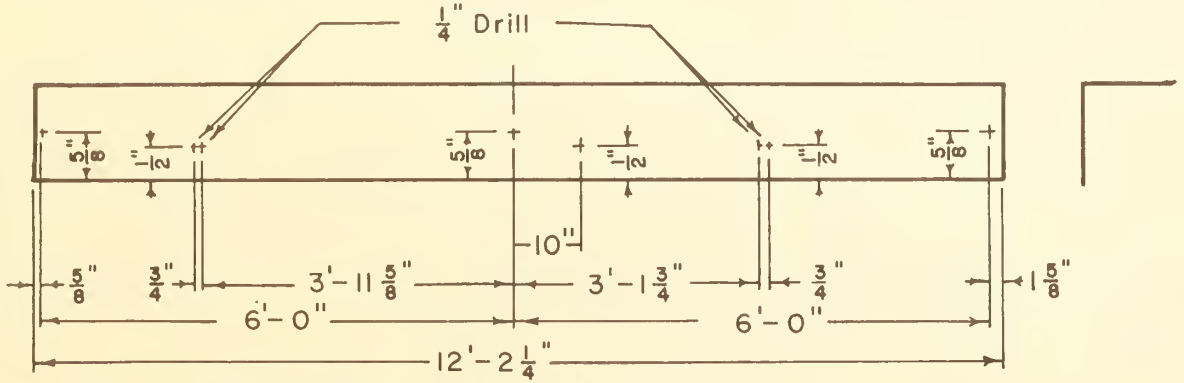
Drawing 51L, 51R, – Upper Carriage Frame, Left, and Right, Units.



Note: All holes $\frac{25}{64}$" drill except as noted.
Drill common holes in pairs with parts
50, $50R_2$ $50L_1$ $50R_1$
$1\frac{1}{4}$" X $1\frac{1}{4}$" X $\frac{1}{8}$" thick angle.

Hor. Scale: 1" = 2'-0"
Ver. Scale: 1" = 2"

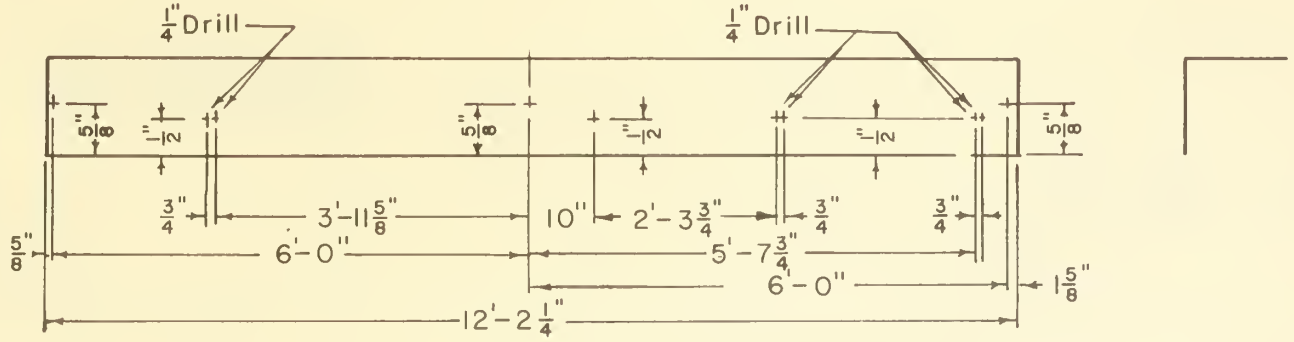
Drawing 52 - Lower Carriage Frame, Main, $Left_1$ $Right_1$ and $Right_2$ Units.



Note: All holes $\frac{25}{64}$" drill except as noted.
Pair with parts 51R$_1$ 51L$_1$.
$1\frac{1}{4}$" X $1\frac{1}{4}$" X $\frac{1}{8}$" thick angle.

Hor. Scale: 1" = 2'- 0"
Ver Scale: 1" = 2"

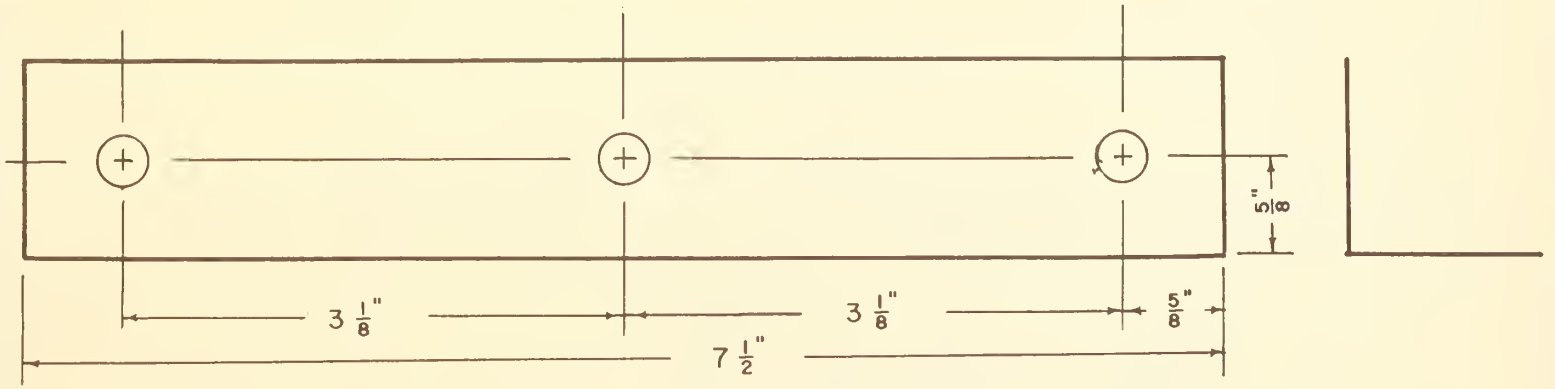
Drawing 53 53R$_2$ – Upper Carriage Frame, Main and Right$_2$ Units.



Note: Pair with part 51 $51R_2$ to drill common holes.
$1\frac{1}{4}$" X $1\frac{1}{4}$" X $\frac{1}{8}$" angle.
Drill all holes $\frac{25}{64}$" except as shown.

Hor. Scale: 1" = 2'-0"
Ver. Scale: 1" = 2"

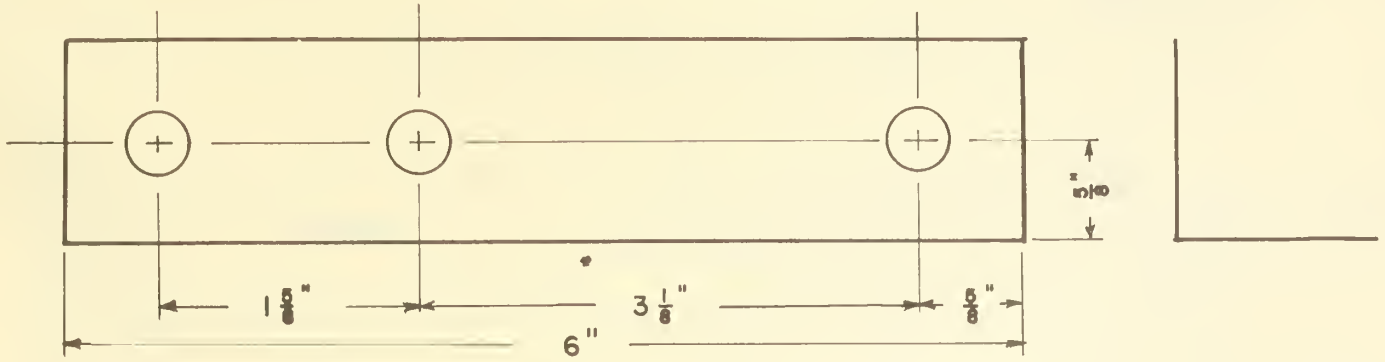
Drawing $53L_1$ $53R_1$ – Upper Carriage Frame, $Left_1$ and $Right_1$ Units.



Hor. Scale: 1" = 1"
Ver. Scale: 1" = 1"

Note: Holes $\frac{25}{64}$" drill.
$1\frac{1}{4}$" X $1\frac{1}{4}$" X $\frac{1}{8}$" angle.

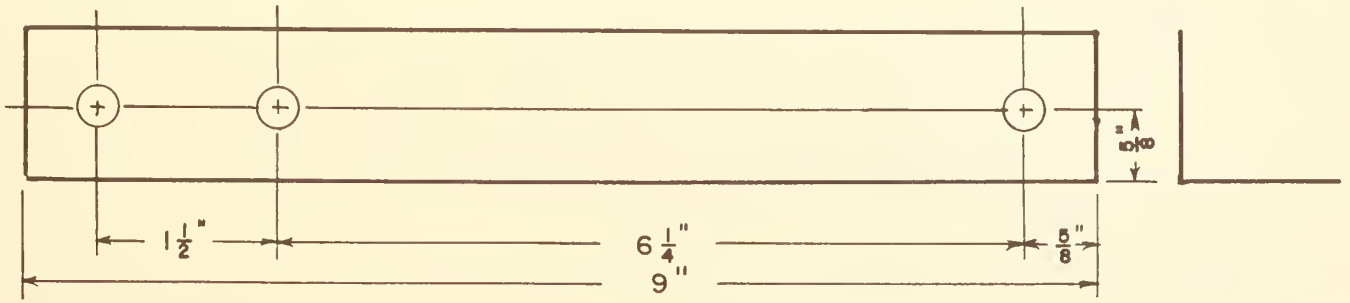
Drawing 54 $54R_2$ Carriage Spacer, Main, $Right_2$ Units.



Scale: 1" = 1"

Note: Holes $\frac{25}{64}$" drill.
Drill Right$_1$ and Left$_1$ parts in pairs.
$1\frac{1}{4}$" X $1\frac{1}{4}$" X $\frac{1}{8}$" thick angle.

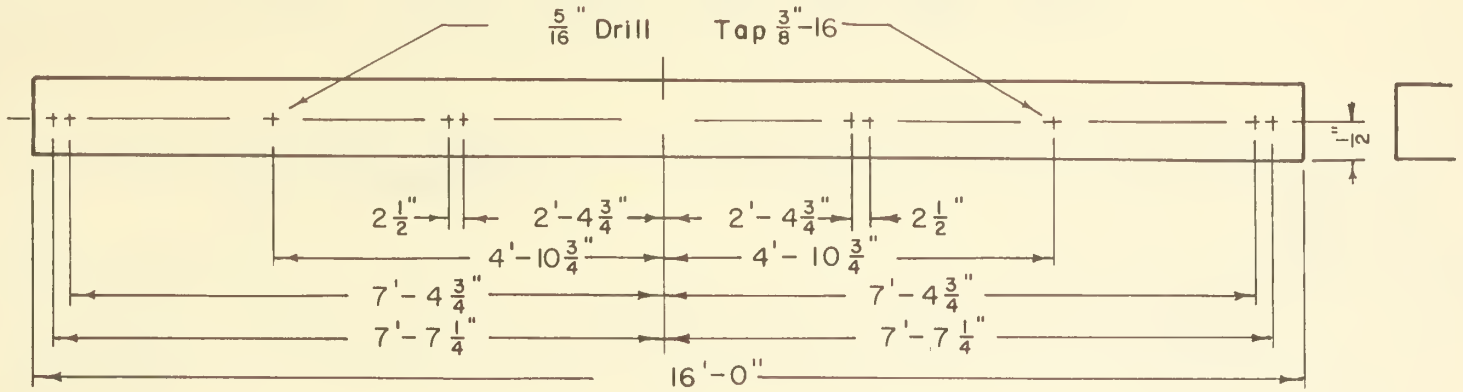
Drawing 54L$_1$ 54R$_1$ – Carriage Spacer, Left$_1$ and Right$_1$ Units.



Scale: $\frac{3}{4}$" = 1"

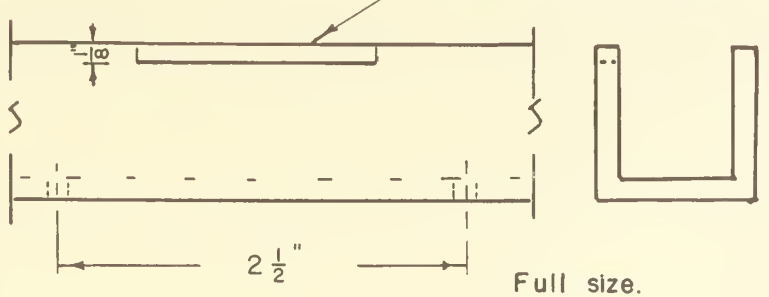
Note: Drill in pairs.
$1\frac{1}{4}$" X $1\frac{1}{4}$" X $\frac{1}{8}$" thick angle.

Drawing 55 - Carriage Drive Slot, Main Units.



Note: All holes 8-32 tap.
1" X 1" X 1/8" channel.

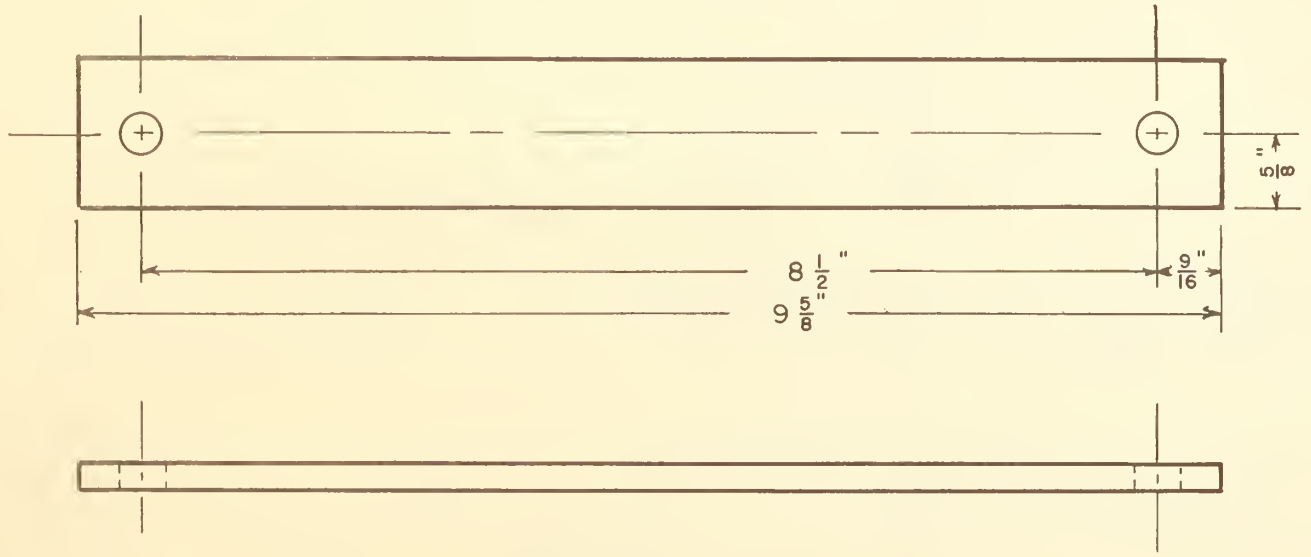
Hor. Scale: 1" = 2'-0"
Ver. Scale: 1" = 2"



Full size.

Detail

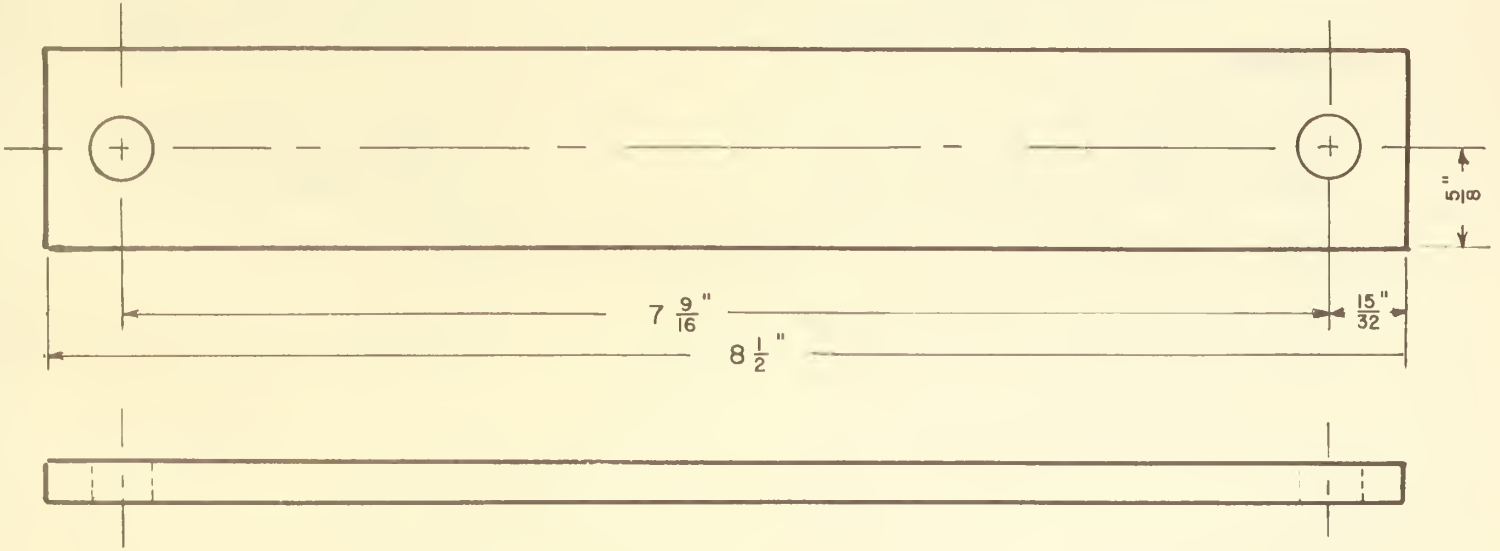
Drawing 56 - Nozzle Frame.



Scale: $\frac{3}{4}" = 1"$

Note: All holes $\frac{25}{64}"$ drill.
$1\frac{1}{4}"$ X $\frac{1}{4}"$ bar.

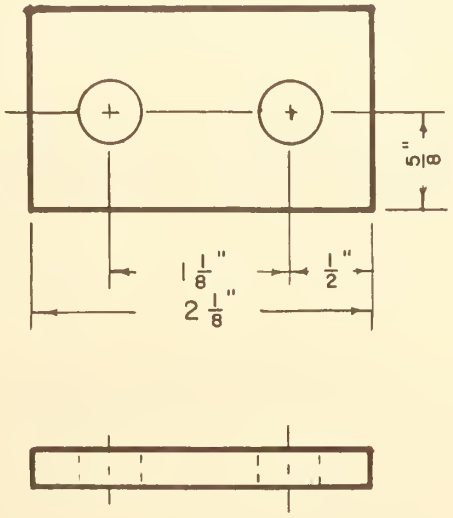
Drawing 57 $57R_2$ – Carriage Brace, Main and $Right_2$ Units.



Scale: 1" = 1"

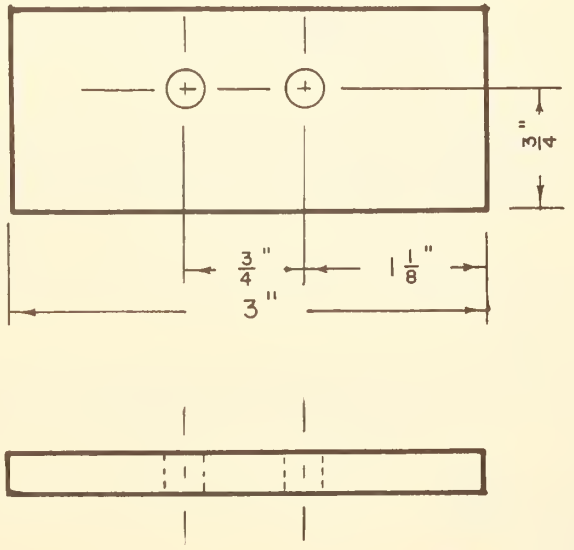
Note: All holes $\frac{25}{64}$" drill.
$1\frac{1}{4}$" X $\frac{1}{4}$" bar.

Drawing $57L_1$ $57R_1$ – Carriage Brace, $Left_1$ and $Right_1$ Units.



Note: $1\frac{1}{4}$" X $\frac{1}{4}$" bar.
Both holes $\frac{25}{64}$" drill.

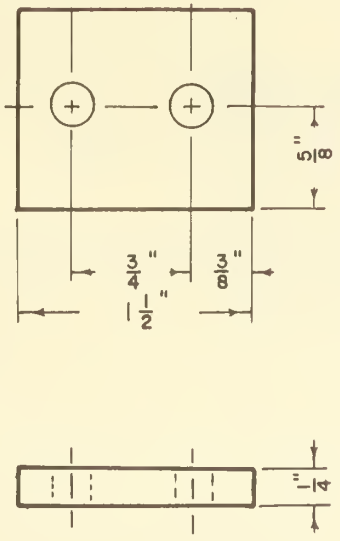
Drawing 58- Connector, Carriage to Nozzle Frame.

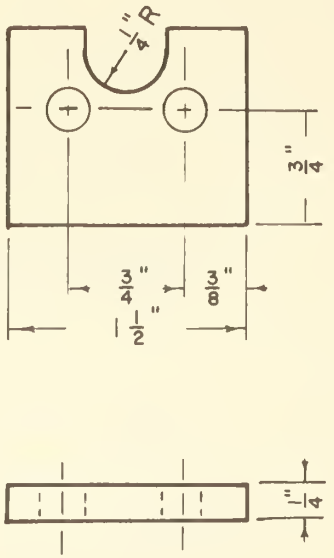


Scale: 1" = 1"

Note: $1\frac{1}{4}$" X $\frac{1}{4}$" bar.
Both holes $\frac{9}{32}$" drill.

Drawing 59- Axle support.



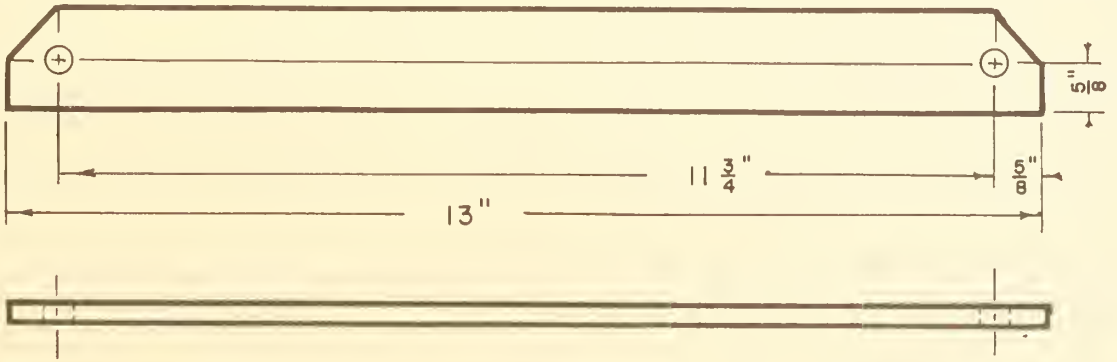


Scale: 1" = 1"

Note: All holes $\frac{9}{32}$" drill. Both drawings.

Drawing 60- Axle Support.

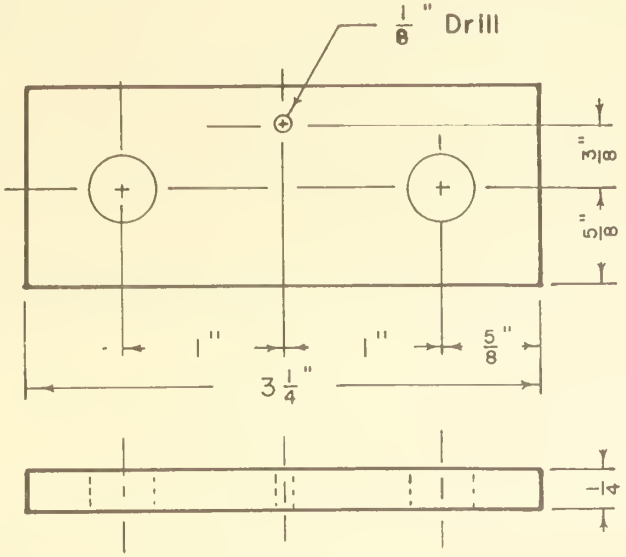
Drawing 61 - Axle Support, for Bent Axle.



Note: Both holes $\frac{25}{64}$" drill.
$1\frac{1}{4}$" X $\frac{1}{4}$" bar.

Scale: 1" = 2"

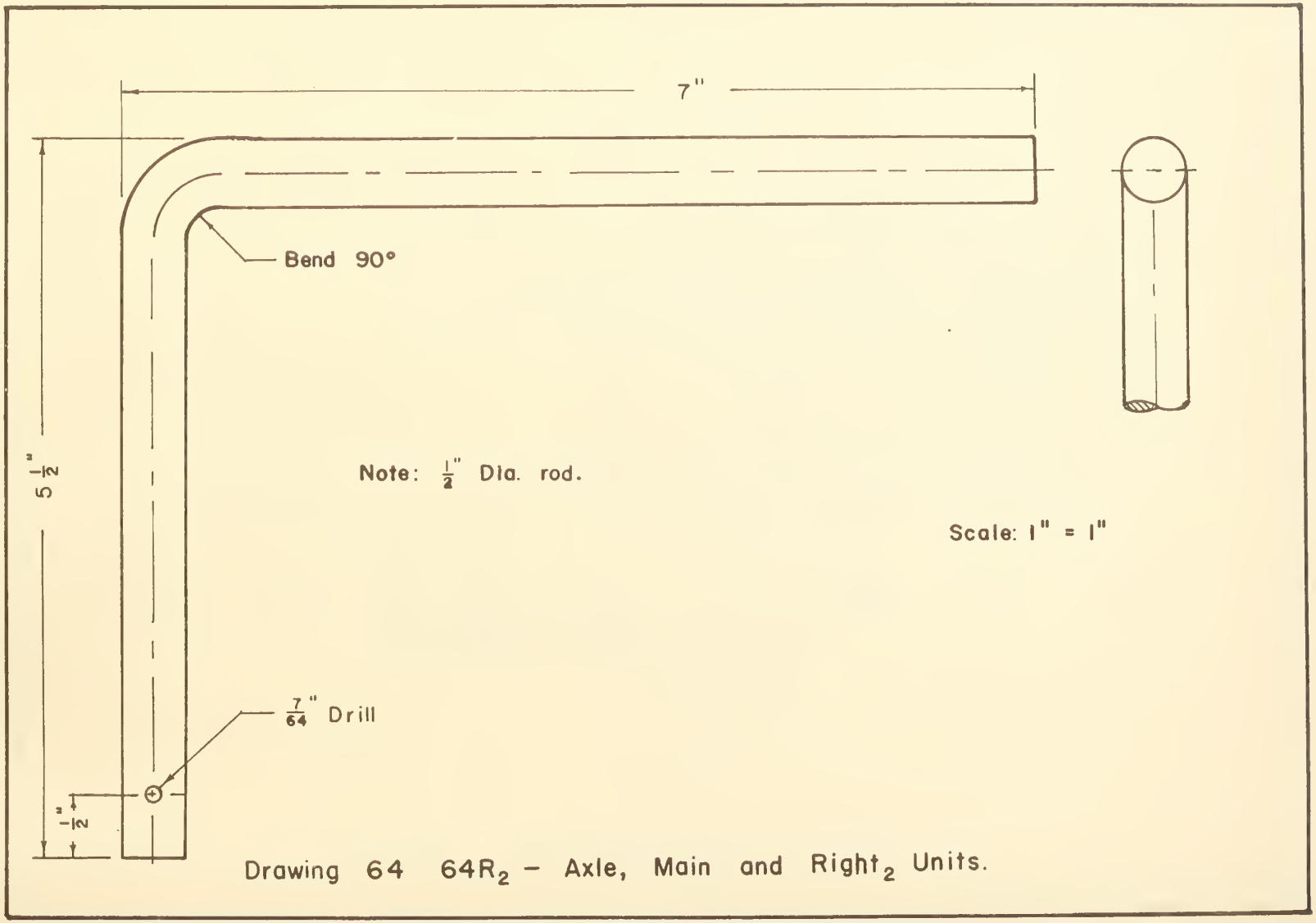
Drawing 62 - Drive Slot Brace, Main Carriage.



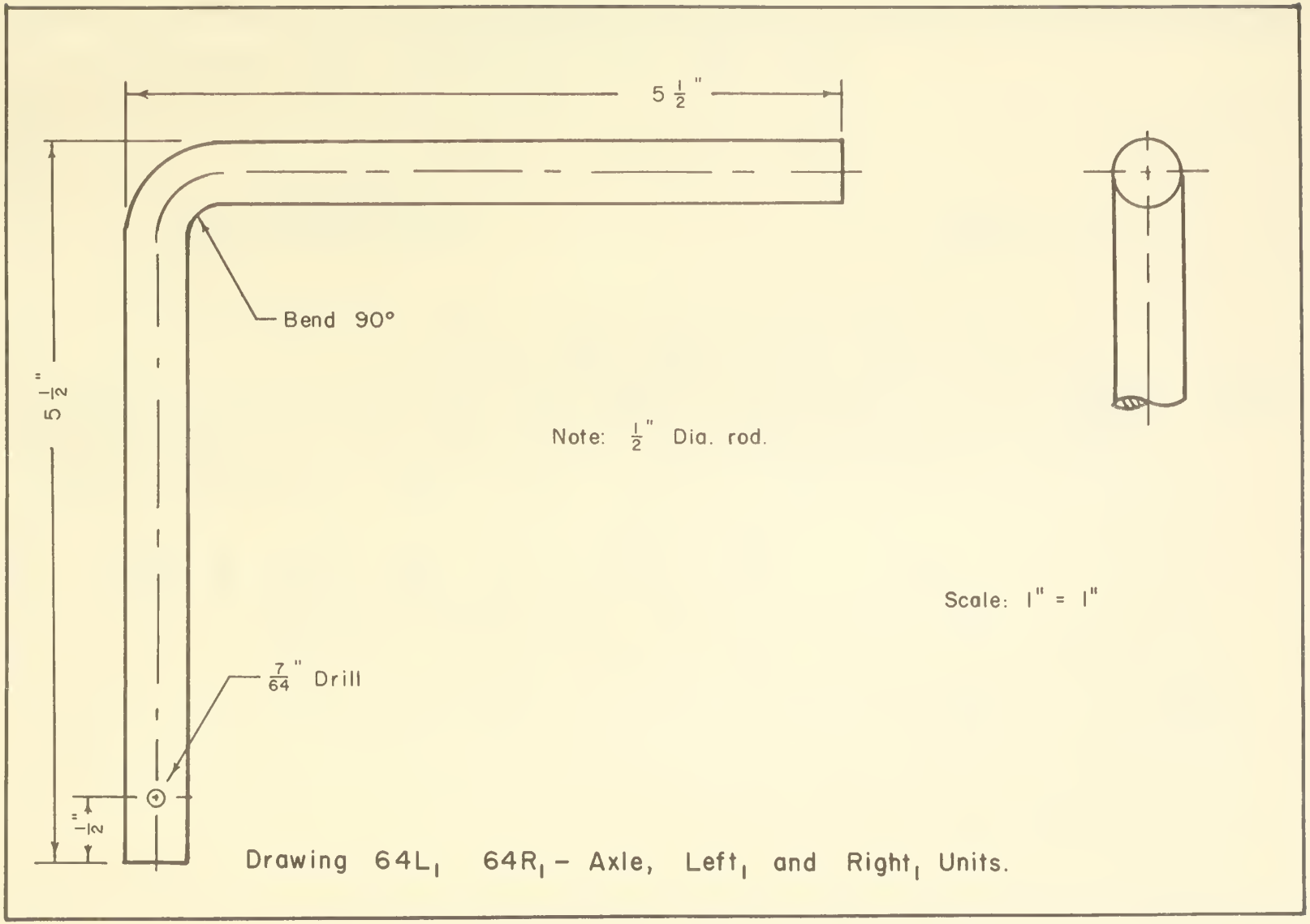
Scale: 1" = 1"

Note: Both holes $\frac{25}{64}$" drill.
$1\frac{1}{4}$" X $\frac{1}{4}$" bar.

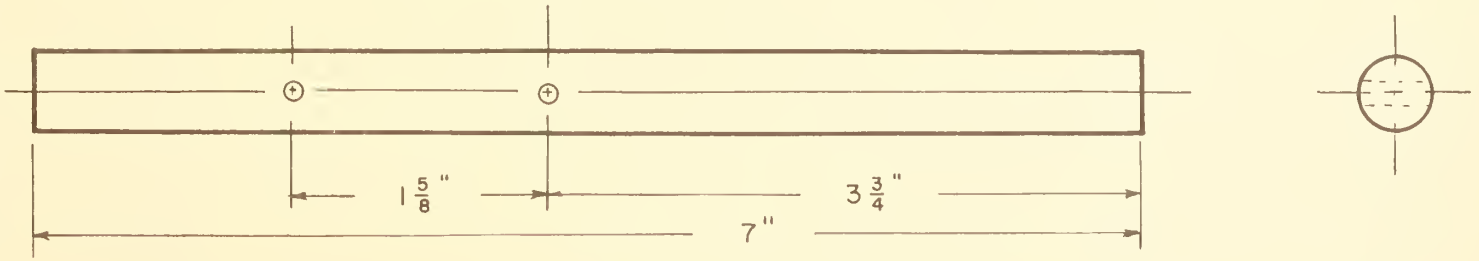
Drawing 63 - Drive Slot Spacer.



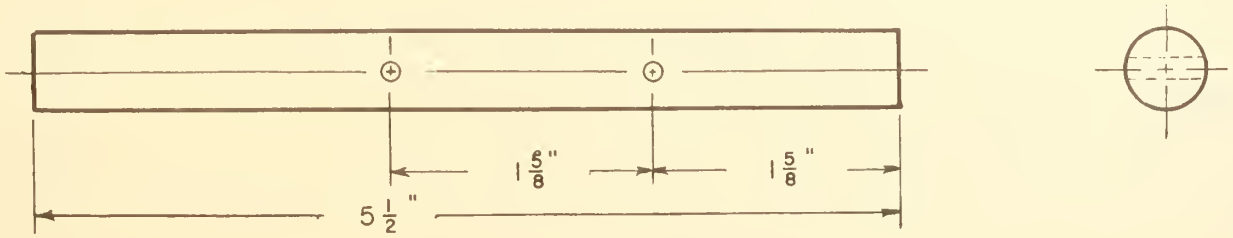
Drawing 64 $64R_2$ – Axle, Main and $Right_2$ Units.



Drawing $64L_1$ $64R_1$ – Axle, $Left_1$ and $Right_1$ Units.



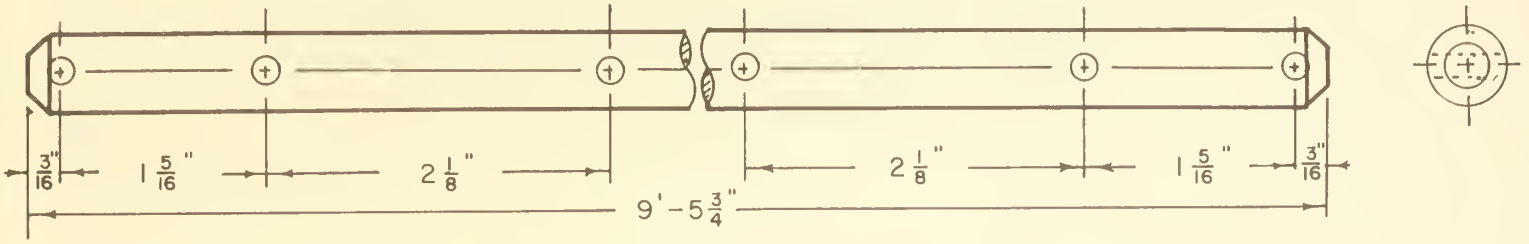
Drawing 65 $65R_2$ -- Axle, Main and $Right_2$ Units.



Note: All holes $\frac{7}{64}$" drill.
$\frac{1}{2}$" Dia. rod.

Scale: 1" = 1"

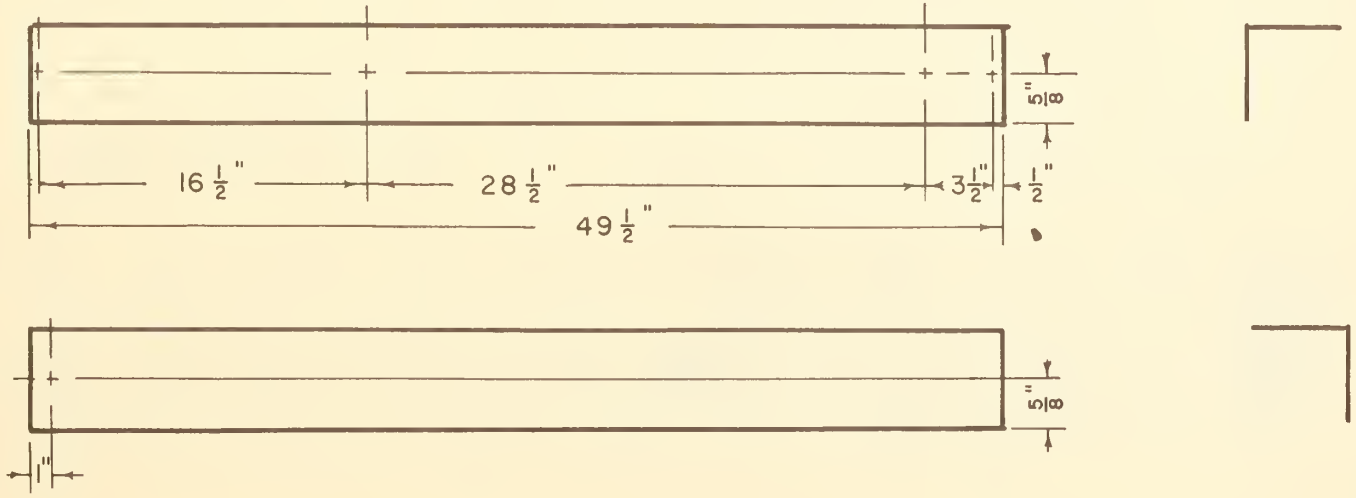
Drawing $65L_1$ $65R_1$ – Axle, $Left_1$ and $Right_1$ Units.



Note: All holes $\frac{1}{8}$" drill.
$\frac{1}{8}$" Bevel, 45°, both ends.
$\frac{1}{2}$" Dia. rod.

Scale: 1" = 1"

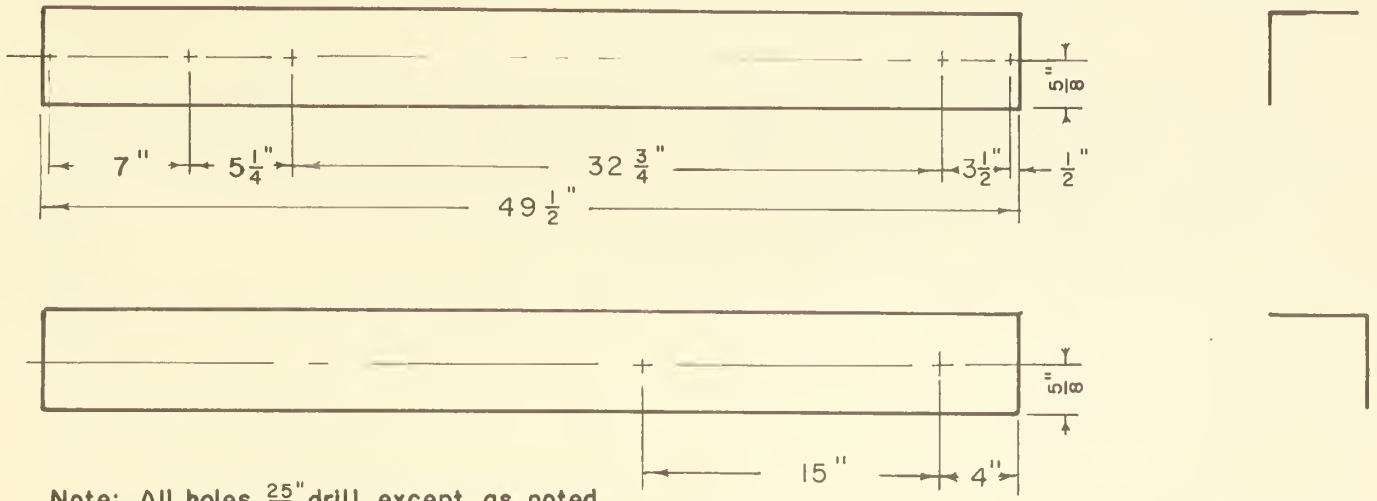
Drawing 66 - Drive Rod



Note: All holes $\frac{25}{64}$" drill.
$1\frac{1}{4}$" X $1\frac{1}{4}$" X $\frac{1}{8}$" thick angle.

Hor. Scale: 1" = 8"
Ver. Scale: 1" = 2"

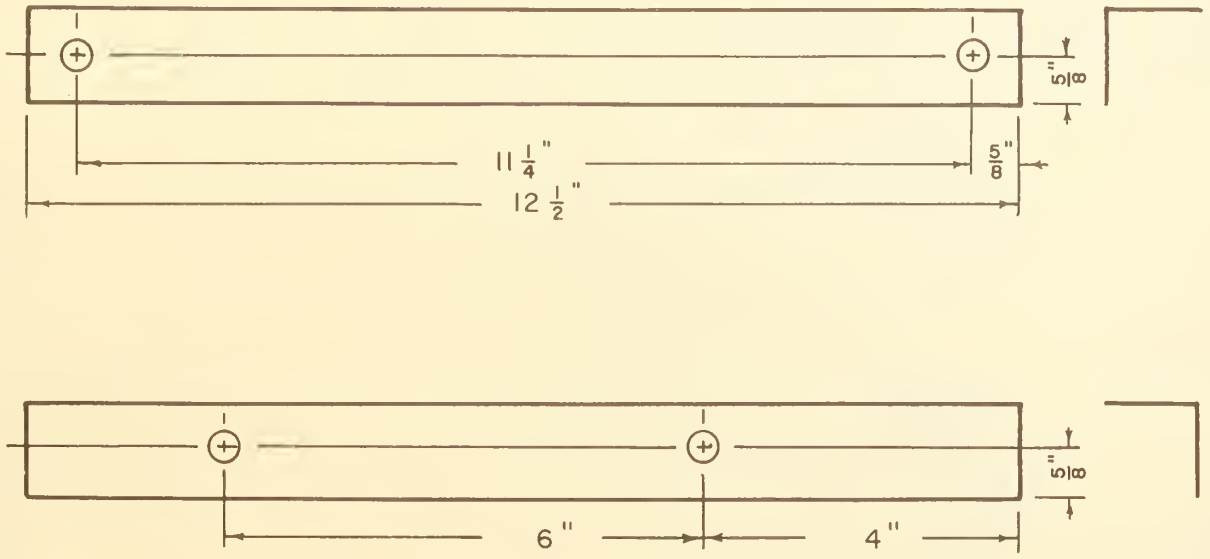
Drawing 100 - Leg, Motor Mounting.



Note: All holes $\frac{25}{64}$" drill except as noted.
Drill in pairs.
$1\frac{1}{4}$" X $1\frac{1}{4}$" X $\frac{1}{8}$" thick angle.

Hor. Scale: 1" = 8"
Ver. Scale: 1" = 2"

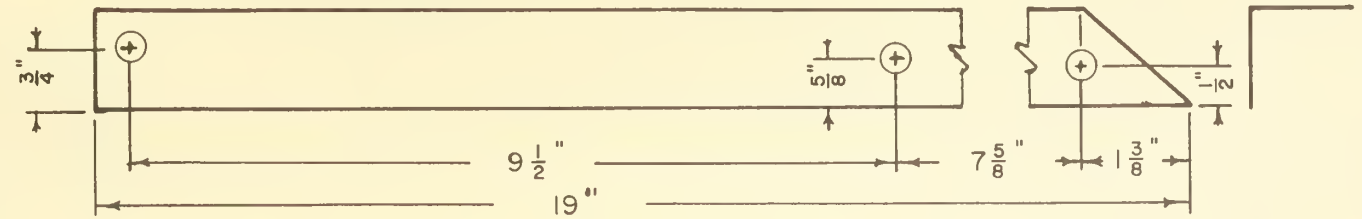
Drawing 101 - Leg, Motor Mounting.



Note: All holes $\frac{25}{64}$" drill.
Drill in pairs.
$1\frac{1}{4}$" X $1\frac{1}{4}$" X $\frac{1}{8}$" thick angle.

Scale: 1" = 2"

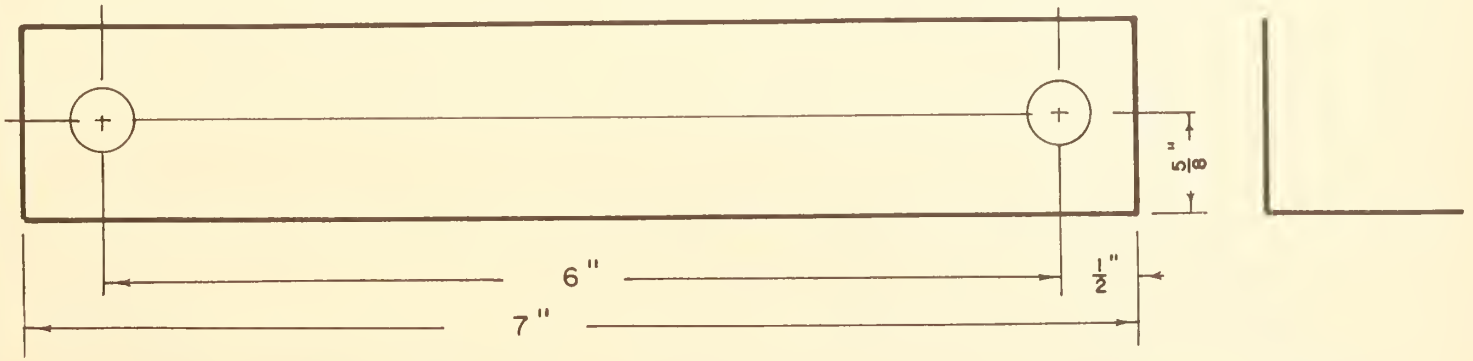
Drawing 102 - Motor Mounting, Leaf Switch Box Support.



Scale: 1" = 2"

Note: All holes $\frac{25}{64}$" drill.
Drill in pairs.
$1\frac{1}{4}$" X $1\frac{1}{4}$" X $\frac{1}{8}$" thick angle.

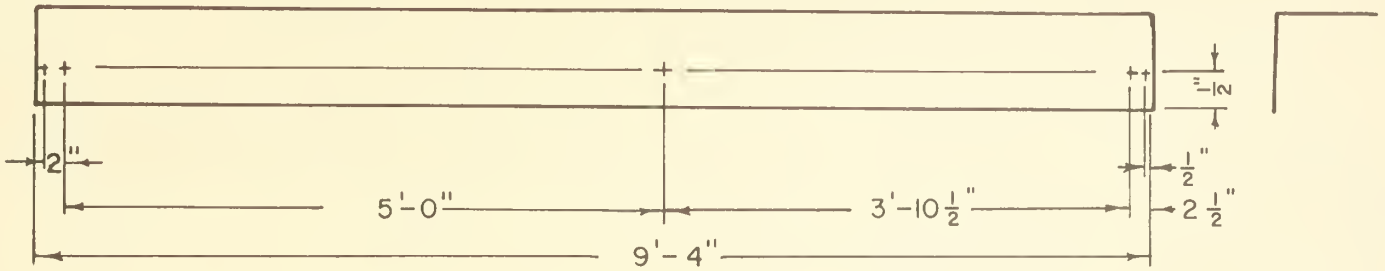
Drawing 103 - Motor Mounting Brace.



Note: Both holes $\frac{25}{64}$" drill.
$1\frac{1}{4}$" X $1\frac{1}{4}$" X $\frac{1}{8}$" thick angle.

Scale: 1" = 1"

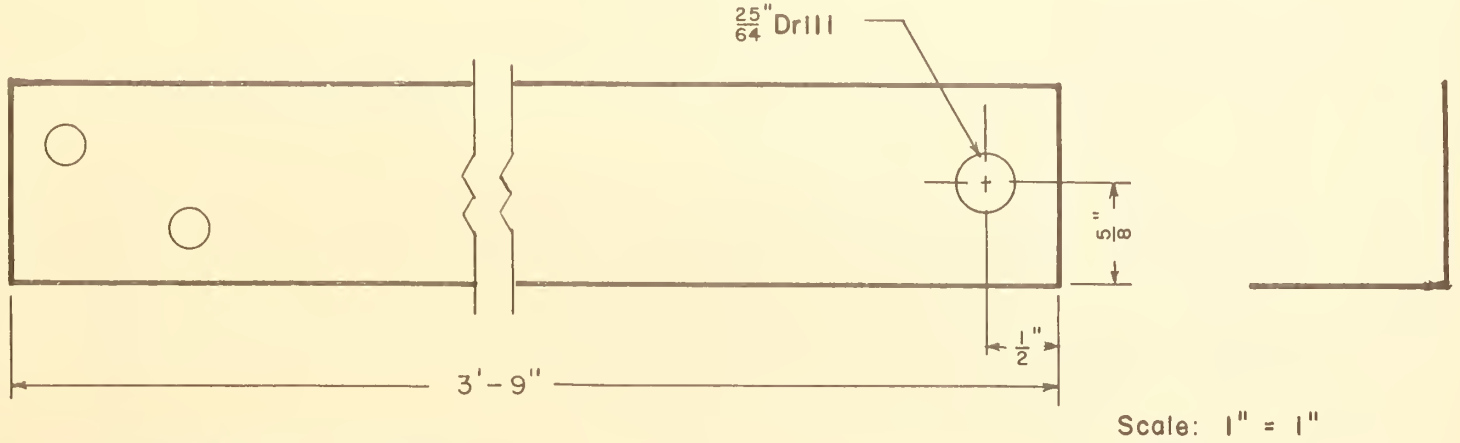
Drawing 104 - Motor Mounting Spacer.



Note: All holes $\frac{25}{64}$" drill.
Drill in pairs.
$1\frac{1}{4}$" X $1\frac{1}{4}$" X $\frac{1}{8}$" thick angle

Hor. Scale: $\frac{3}{4}$" = 1'-0"
Ver. Scale: 1" = 2"

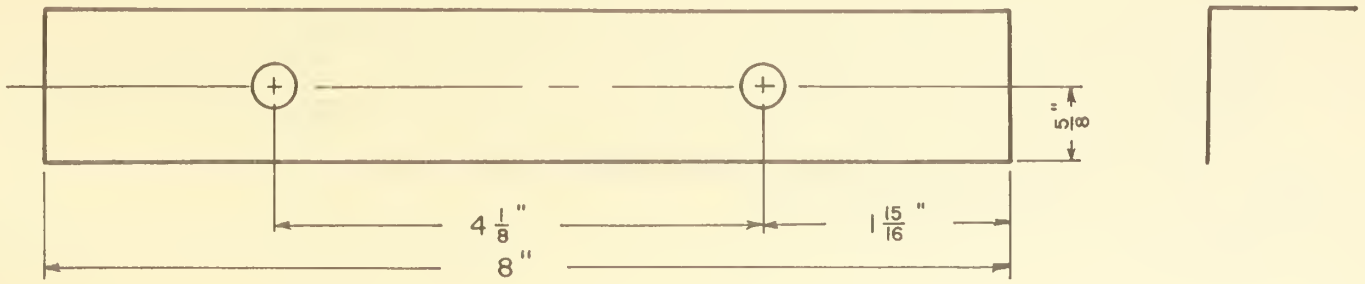
Drawing 105 - Power Shaft Frame.



Scale: 1" = 1"

Note: Hole size and locations
to fit hinges.
$1\frac{1}{4}$" X $1\frac{1}{4}$" X $\frac{1}{8}$" thick angle.

Drawing 106 - Power Shaft Frame Support.

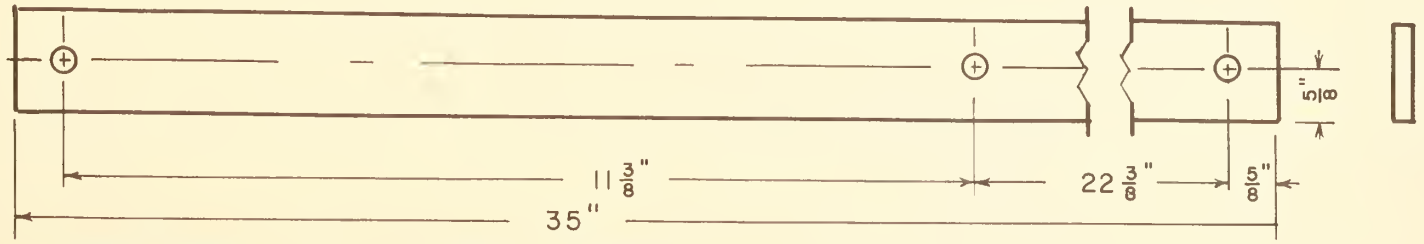


Note: Both holes $\frac{25}{64}$" drill in above view.

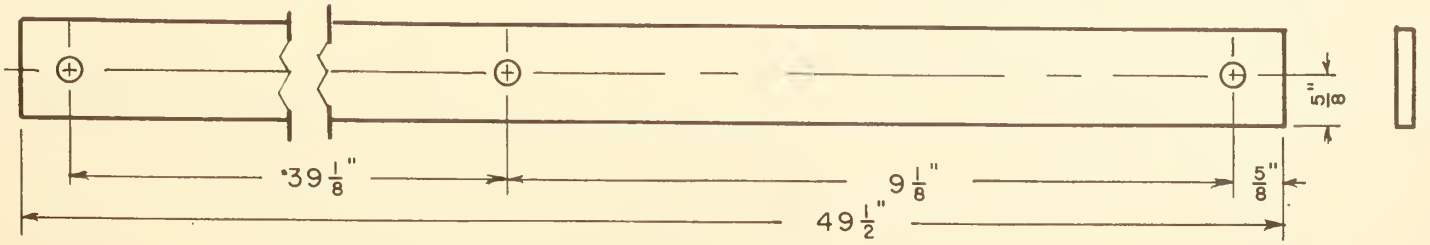
Note: Hole size and locations to fit hinges.
$1\frac{1}{4}$" X $1\frac{1}{4}$ X $\frac{1}{8}$" thick angle.

Scale: $\frac{3}{4}$" = 1"

Drawing 107 - Power Shaft Frame Spacer.



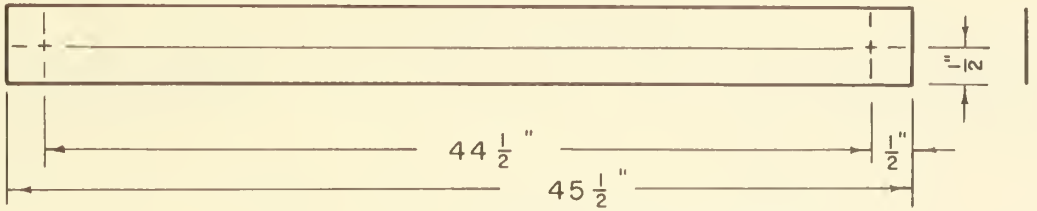
Drawing 108 - Motor Mounting, Brace.



Note: All holes $\frac{25}{64}$" drill.
$1\frac{1}{4}$" X $\frac{1}{4}$" bar.

Scale: 1" = 2"

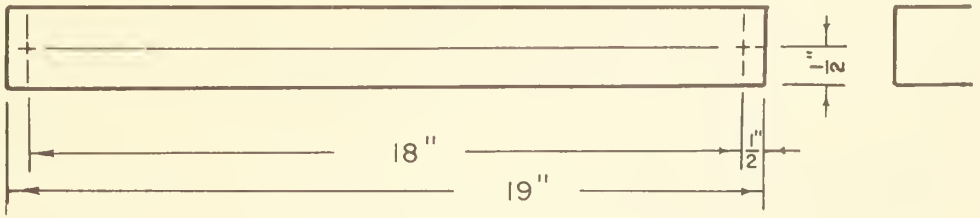
Drawing 109 - Motor Mounting, Brace.



Note: Both holes $\frac{25}{64}$" drill.
1" X $\frac{3}{16}$" bar.

Hor. Scale: 1" = 8"
Ver. Scale: 1" = 2"

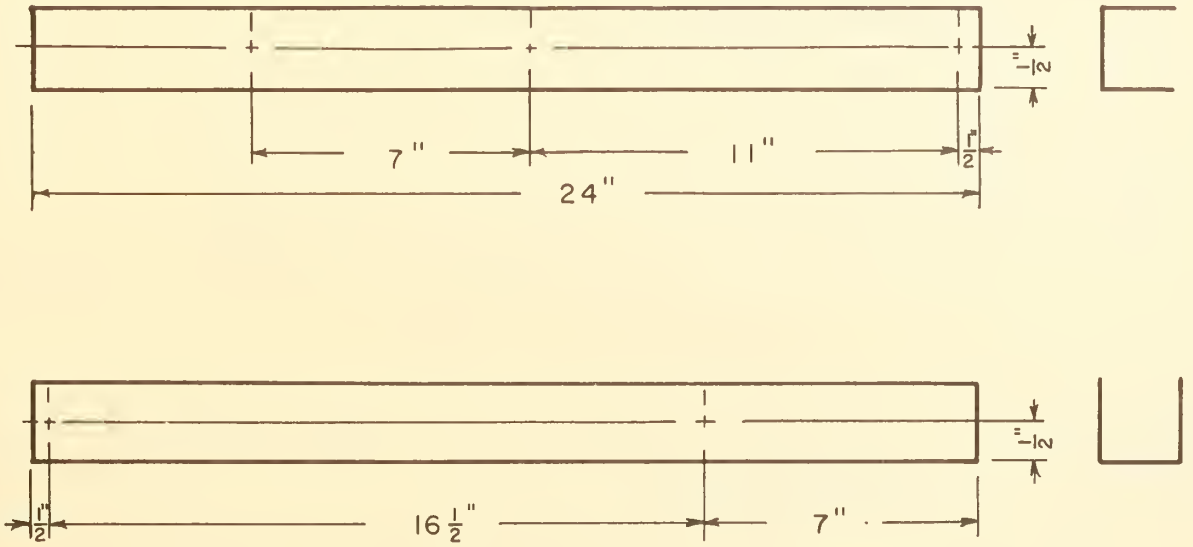
Drawing 110 - Power Shaft Brace.



Note: Both holes $\frac{25}{64}$" drill.
1" X 1" X $\frac{1}{8}$" channel.

Hor. Scale: 1" = 4"
Ver. Scale: 1" = 2"

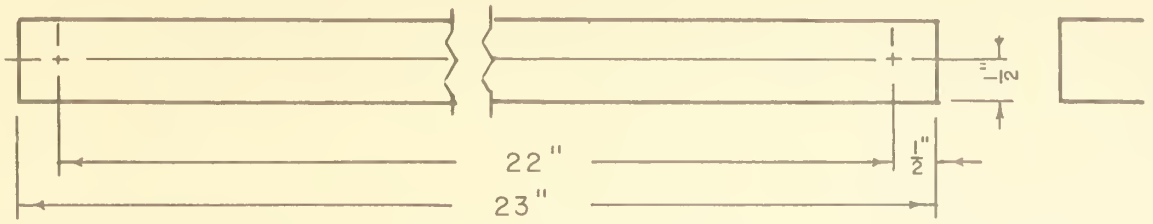
Drawing 111 - Motor Mounting Brace.



Note: All holes $\frac{25}{64}$" drill.
1" X 1" X $\frac{1}{8}$" channel.

Hor. Scale: 1" = 4"
Ver. Scale: 1" = 2"

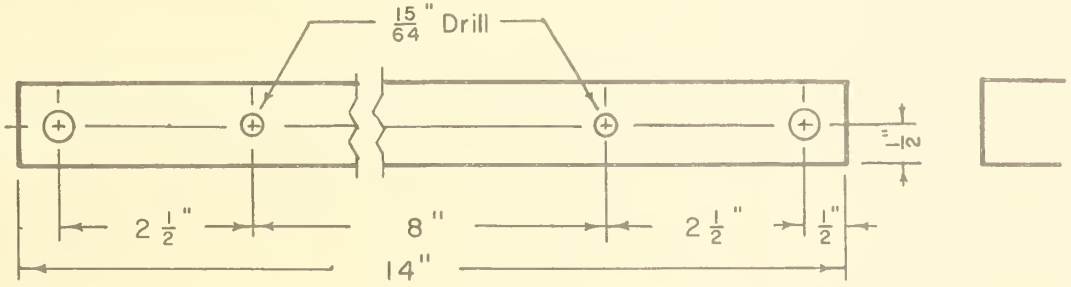
Drawing 112 - Motor Support.



Note: Both holes $\frac{25}{64}$" drill.
1" X 1" X $\frac{1}{8}$" thick channel.

Hor. Scale: 1" = 4"
Ver. Scale: 1" = 2"

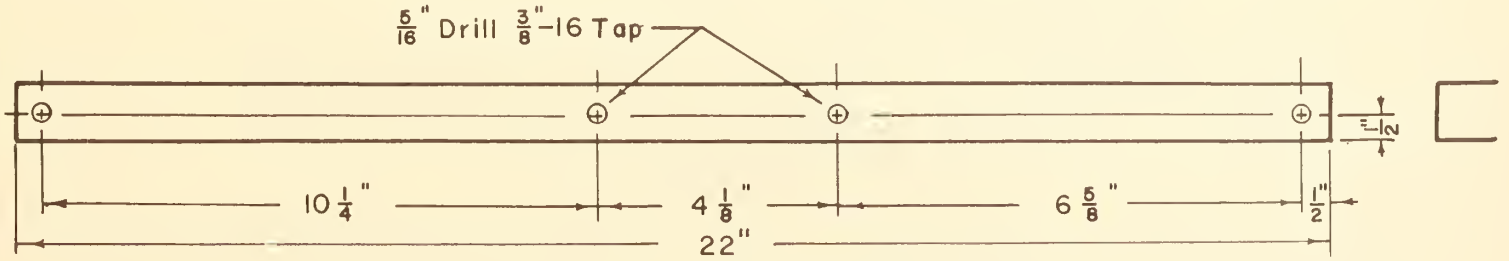
Drawing 113- Motor Mounting Brace.



Note: All holes $\frac{25}{64}$" drill except as shown.
1" X 1" X $\frac{1}{8}$" thick channel.

Scale: 1" = 2"

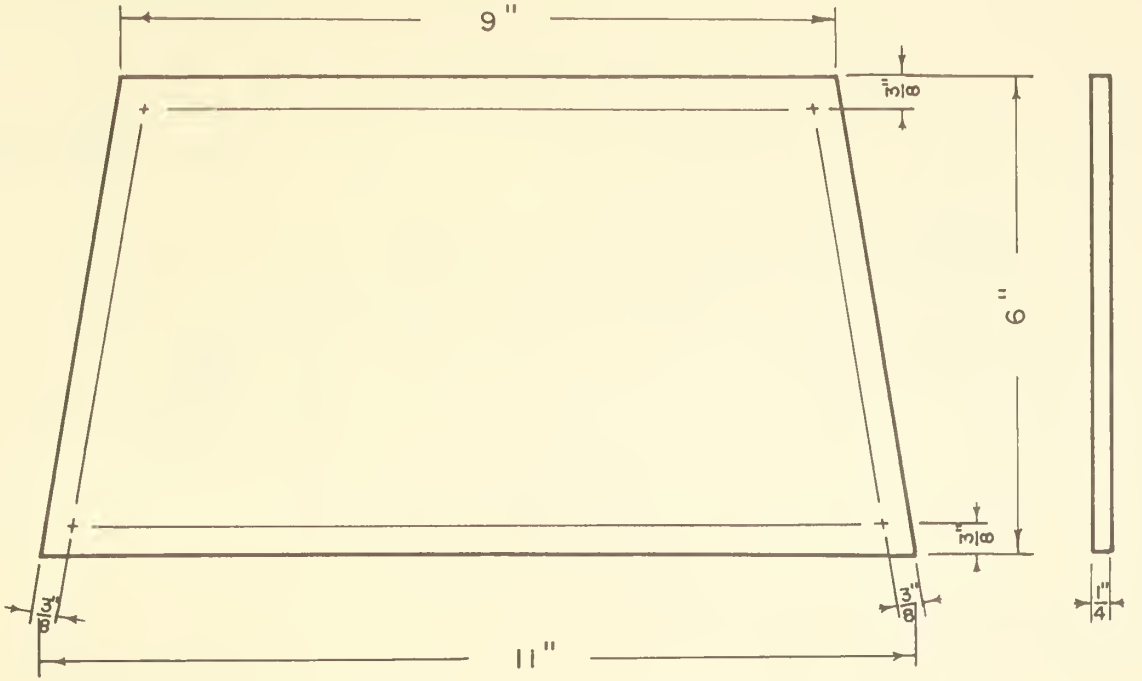
Drawing 114 - Motor Mounting, Leaf Switch Box Support.



Note: All holes $\frac{25}{64}$" drill except as noted.
1" X 1" X $\frac{1}{8}$" channel.

Scale: $\frac{3}{8}$" = 1"

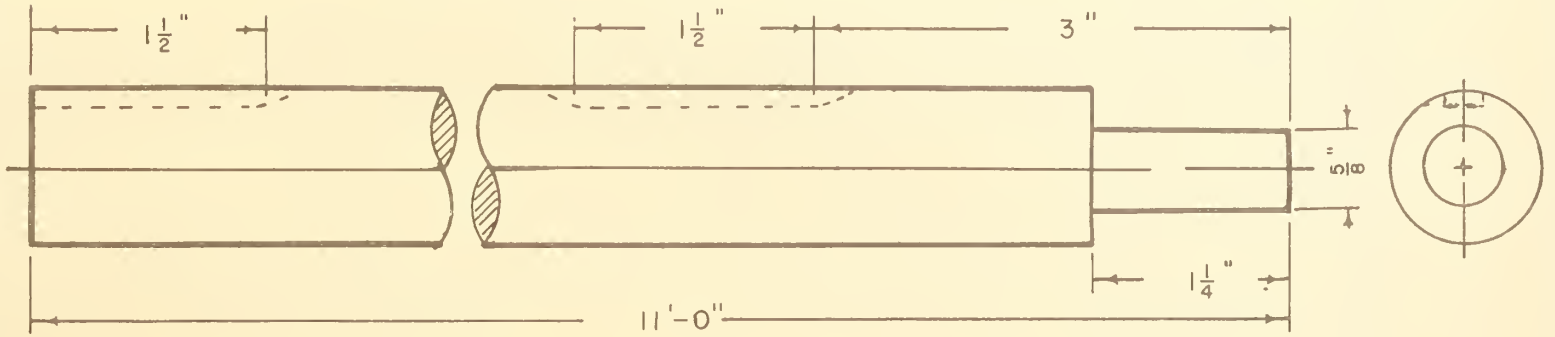
Drawing 115 - Drive Shaft Support.



Scale: 1" = 2"

Note: All holes $\frac{15}{64}$" drill.
Drill additional holes to fit reduction box.

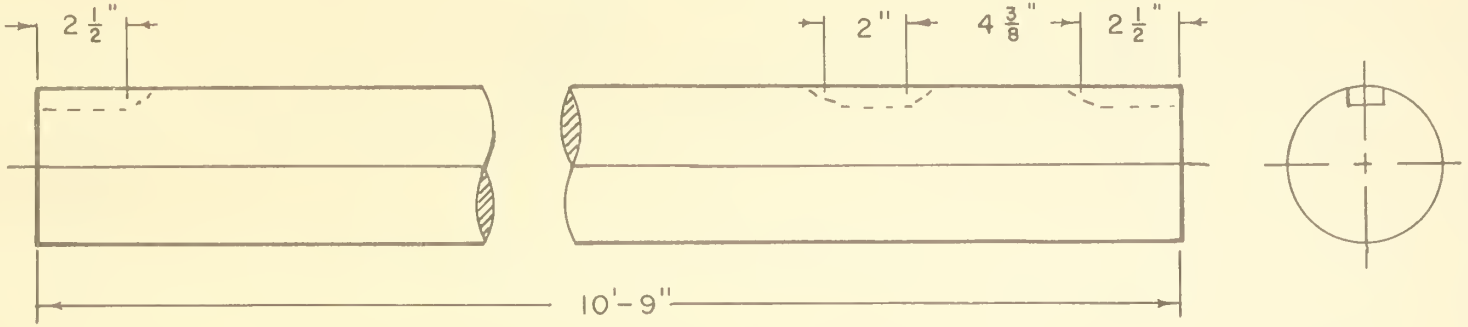
Drawing 116 - Speed Reducer Bracket.



Note: Use standard keyways.
1" Dia. rod.

Scale: 1" = 1"

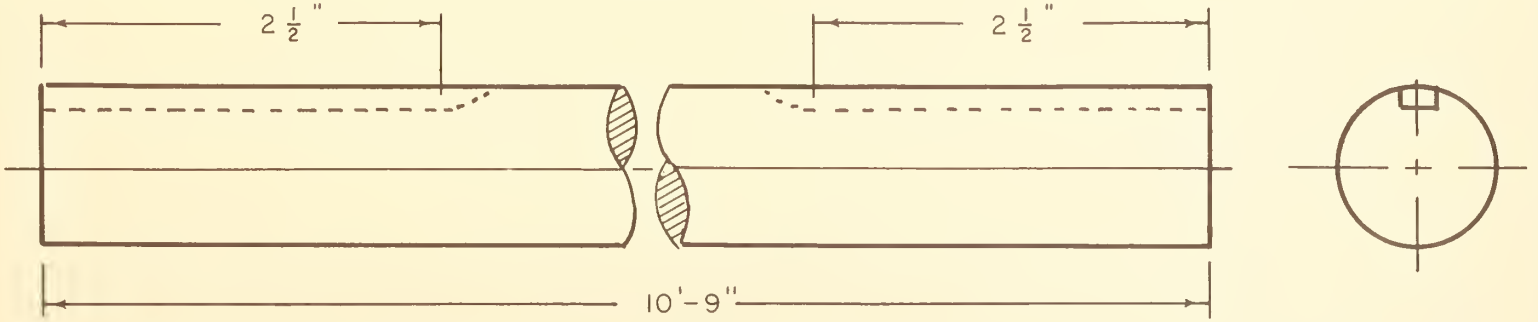
Drawing 205 - Power Shaft, Motor to First Unit.



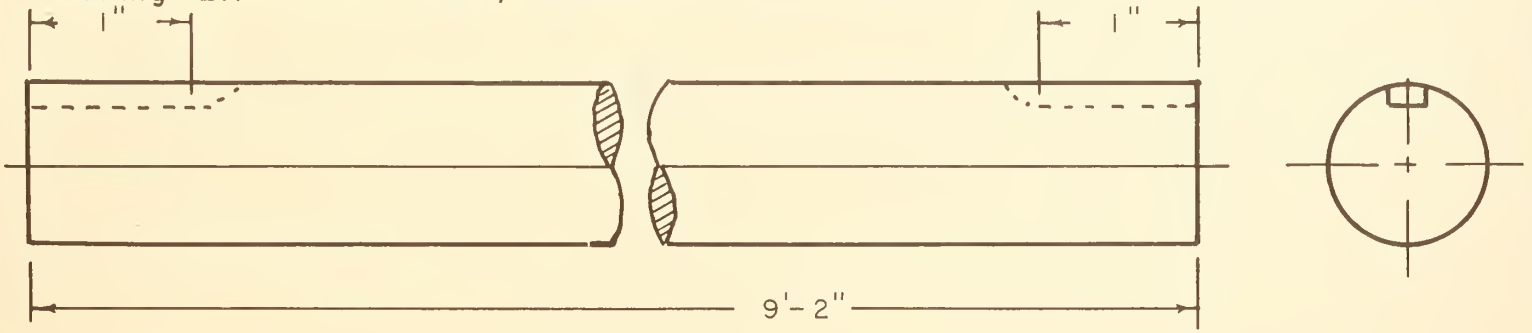
Note: Use standard keyways.
1" Dia. rod.

Hor. Scale : 1" = 4"
Ver. Scale : 1" = 1"

Drawing 210 - Drive Shaft, First and Third Units.



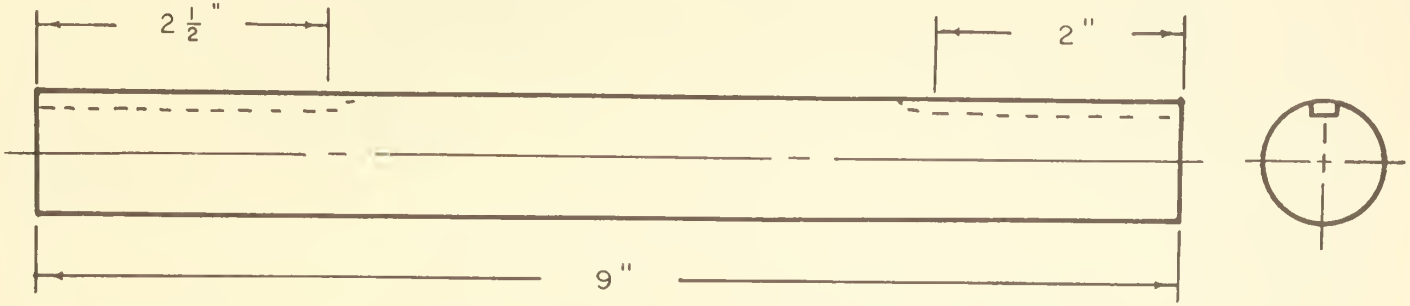
Drawing 211 - Drive Shaft, Second and Fourth Units.



Note: Use standard keyways. Both drawings.
1" Dia. rod.

Scale: 1" = 1"

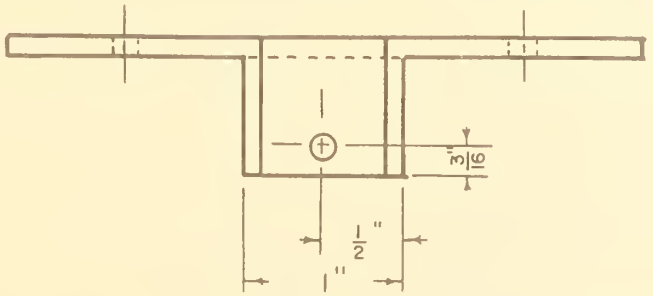
Drawing 212 - Drive Shaft, Between Units.



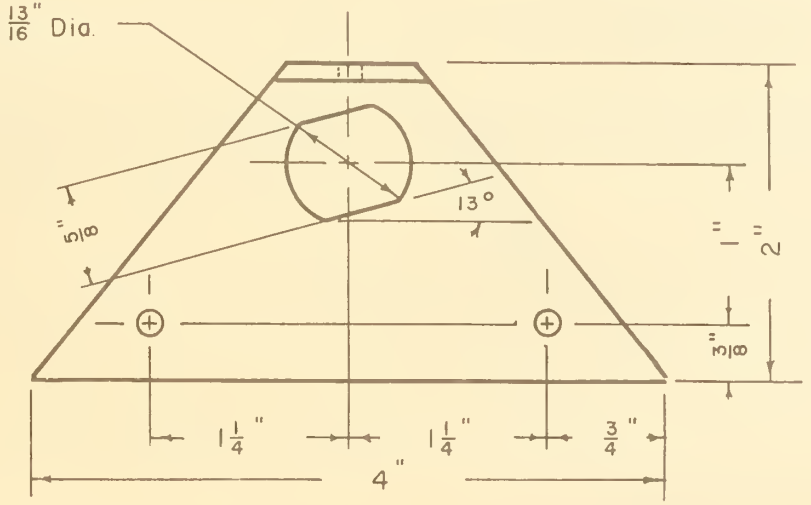
Note: Use standard keyways.
1" Dia. rod.

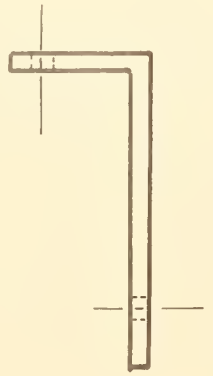
Scale: 3/4" = 1"

Drawing 218 - Drive Shaft.



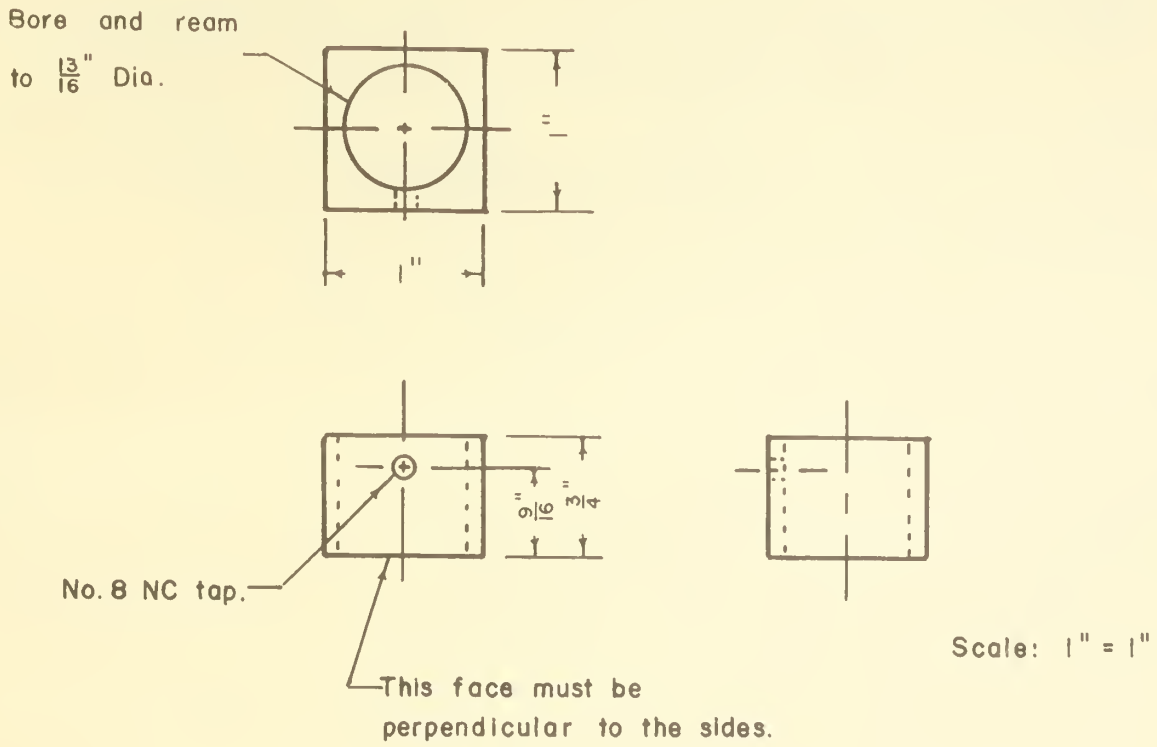
Note: All holes 11/64" drill.
2" X 7/8" X 1/8" thick angle.



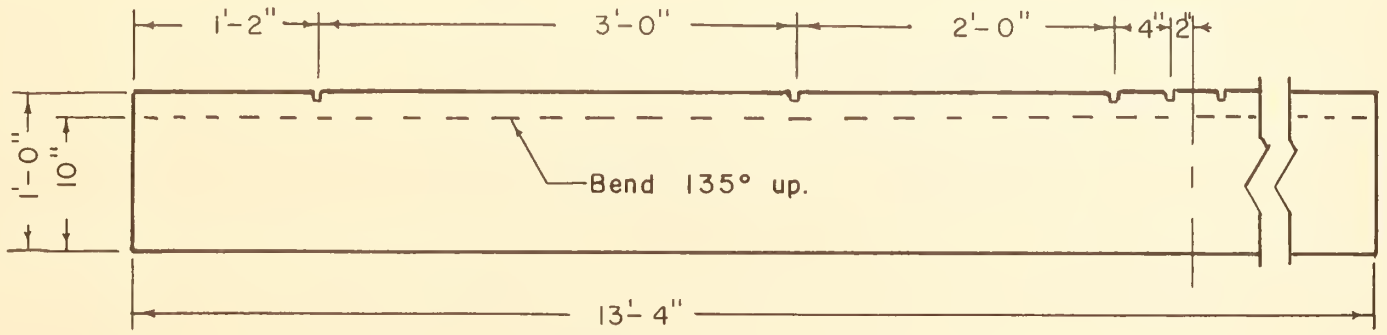


Scale: 1" = 1"

Drawing 453 - Nozzle Holder Bracket.



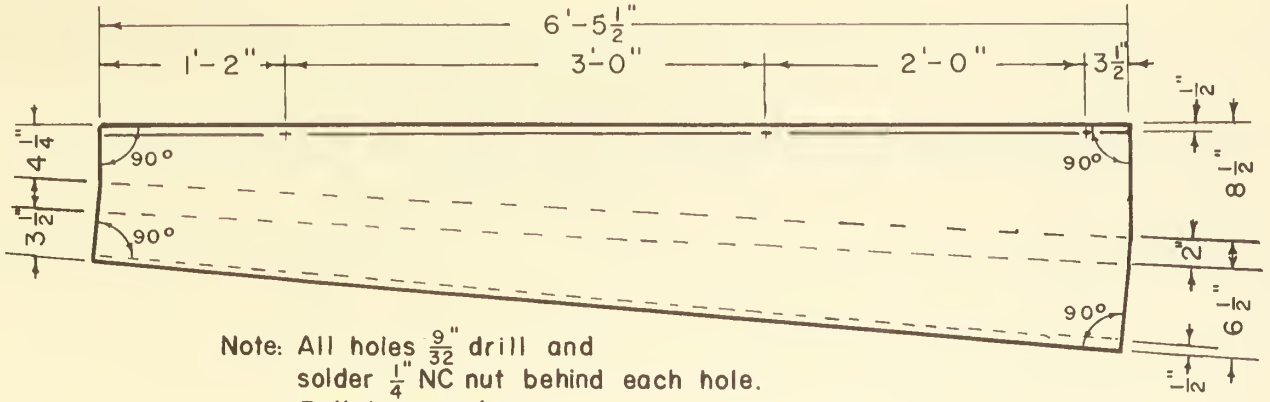
Drawing 453A - Nozzle Holder.



Note: Dimensions of other half same as shown.
9 gage galvanized steel.
Length can be varied to fit plot width.
Spacing of notches to fit bolts on collection gutter.
Sharpen lower edge.

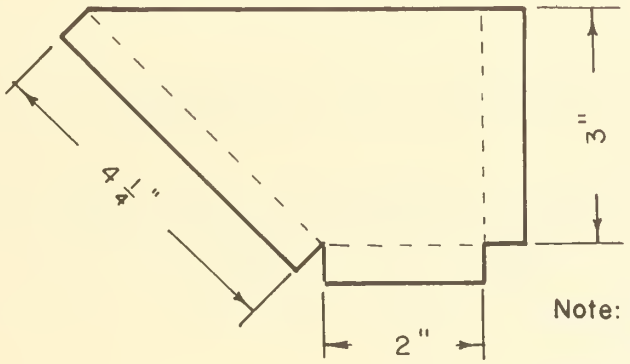
Scale: 1" = 1'-0"

Drawing 500 - Sill Plate.



Note: All holes $\frac{9}{32}$" drill and
solder $\frac{1}{4}$" NC nut behind each hole.
Roll lower edge.
22 gage galvanized steel.
Length can be varied to fit plot width.

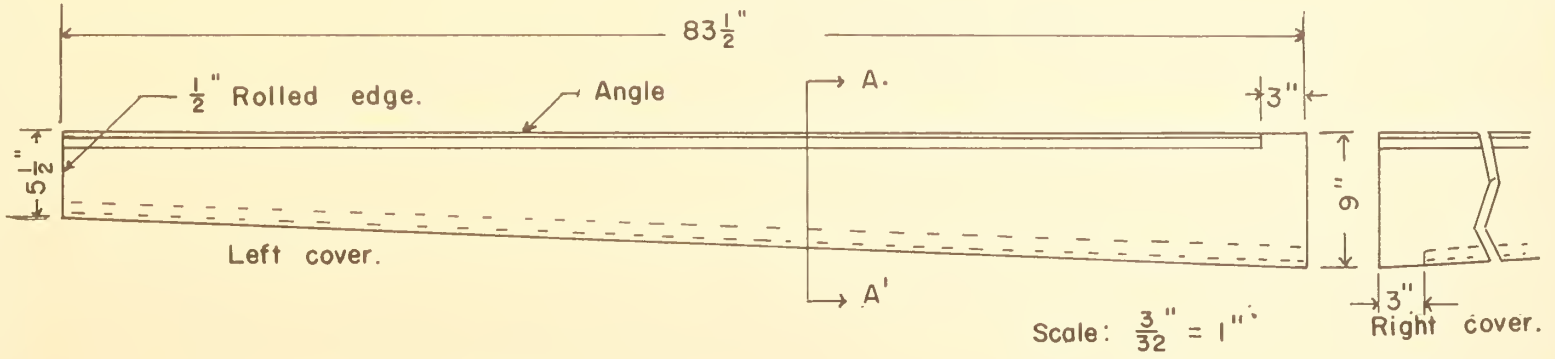
Scale: 1" = 1'-0"

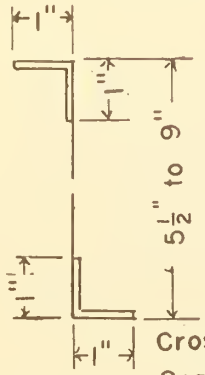


Note: Bend tabs 90°
Up for right side, down for left side.

Scale: 1" = 2"

Drawing 501 - Collection Gutter.



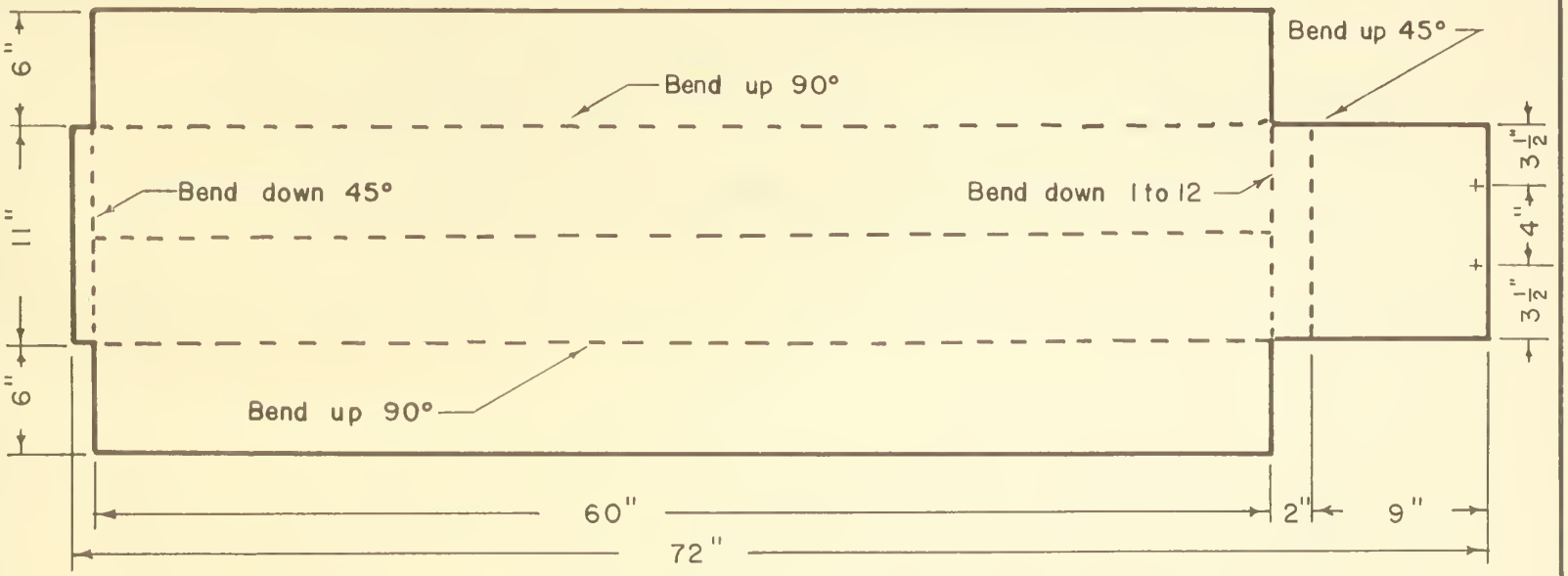


Cross section at A–A'
Scale: ⅜" = 1"

Material: 22 ga. galv. sheet iron.

1" x 1" x ⅛" angle.

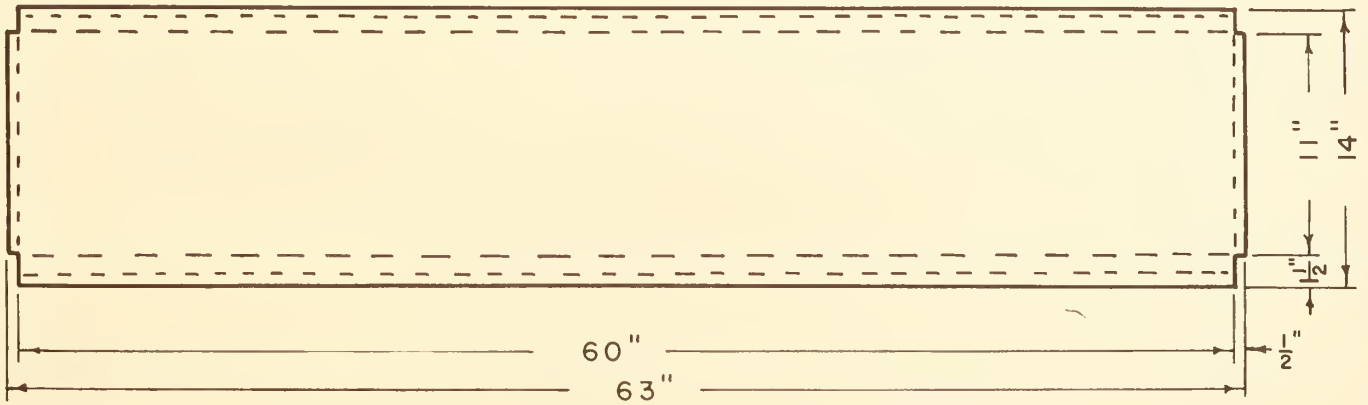
Drawing 502 – Gutter Cover.



Note: Bend up along centerline so center of chute is 1" or more lower than the edges.
22 ga. galv. sheet steel.
Both holes drill and solder. NC nut behind each hole.

Scale: 1" = 8"

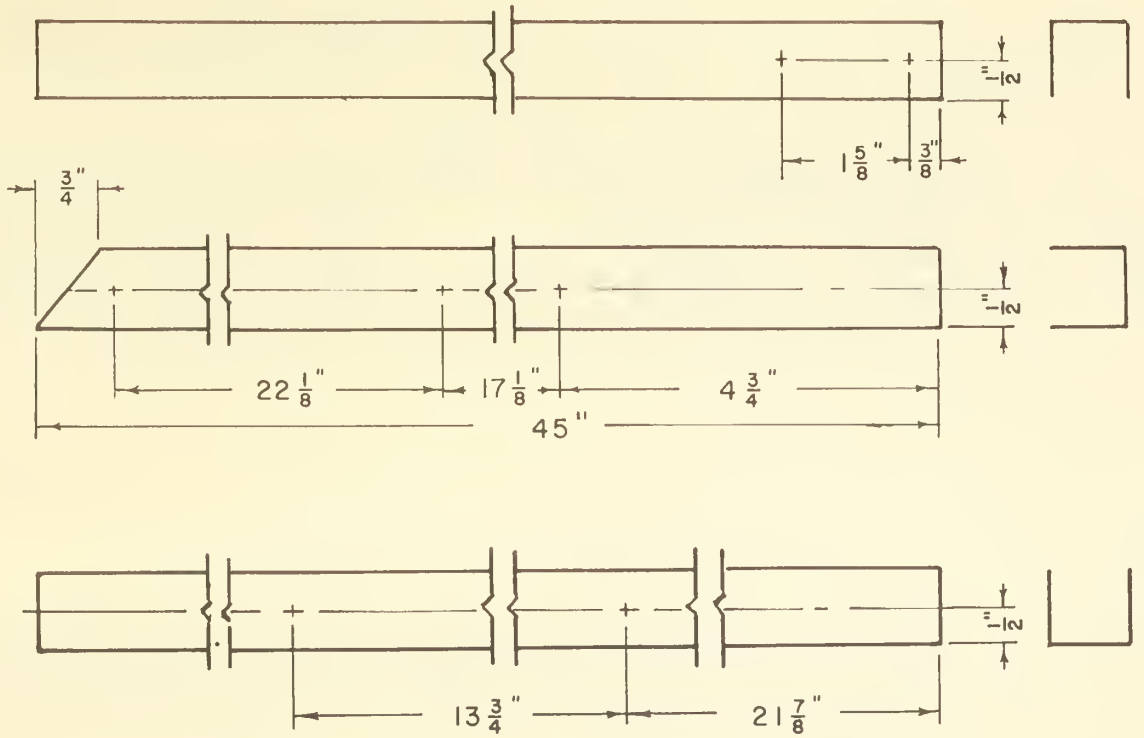
Drawing 503 - Approach Chute.



Note: Roll out all edges.
Bend tabs on both sides down 90°.
22 ga. galv. sheet steel.

Scale: 1" = 8"

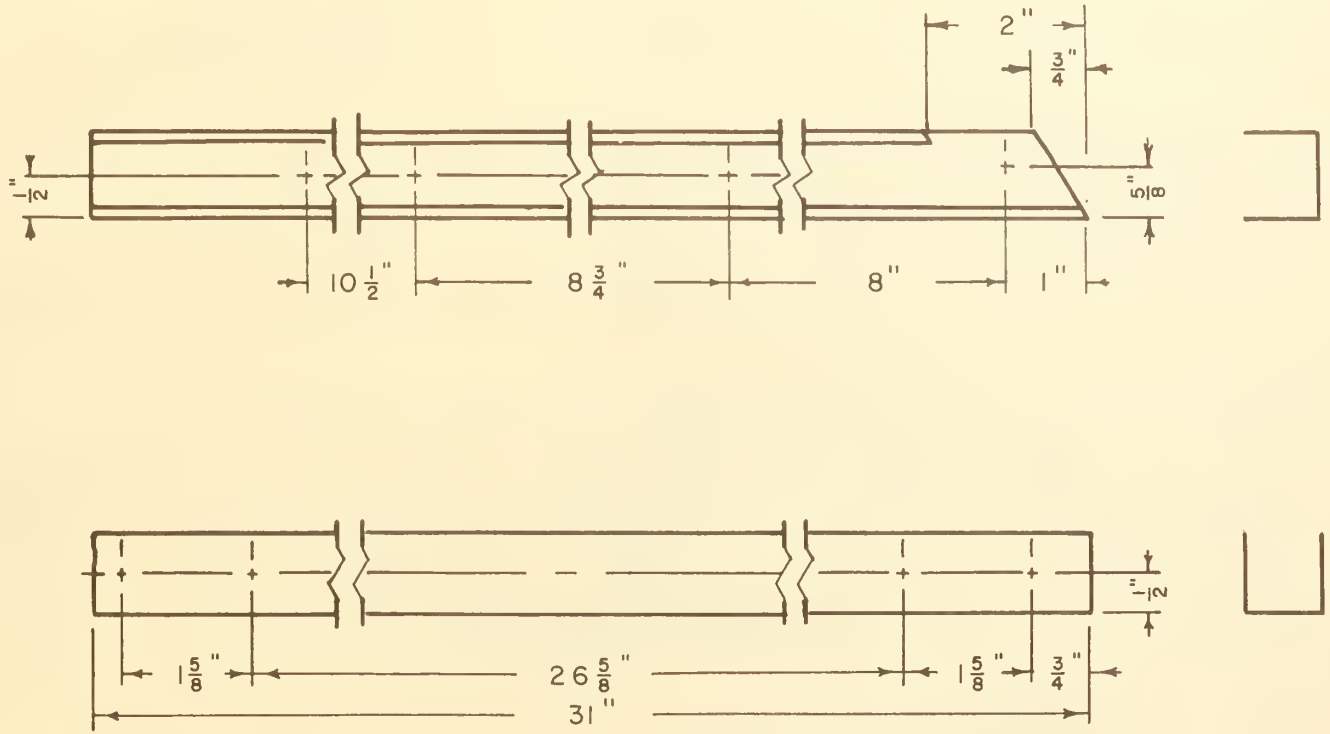
Drawing 504 - Approach Chute Cover.



Note: All holes $\frac{9}{32}$" drill.
1" X 1" X $\frac{1}{8}$" channel.

Scale: 1" = 2"

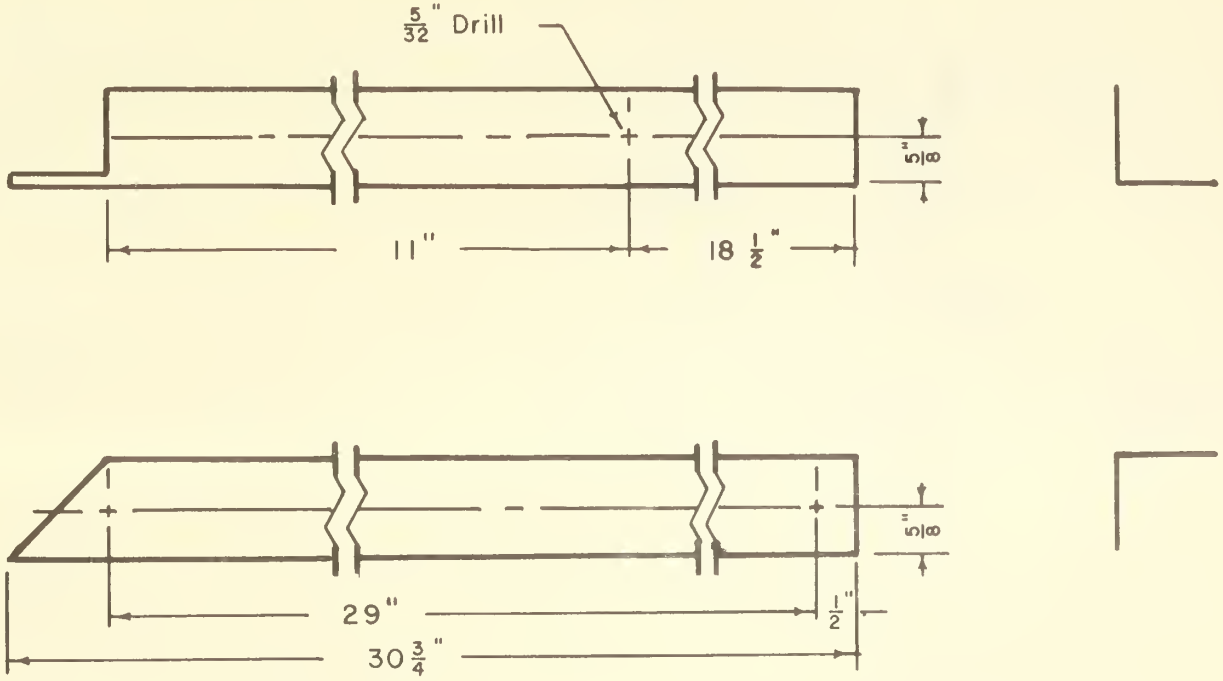
Drawing 506 - Flume Mounting



Note: All holes $\frac{9}{32}$" drill.
1" X 1" X $\frac{1}{8}$" channel.

Scale: 1" = 2"

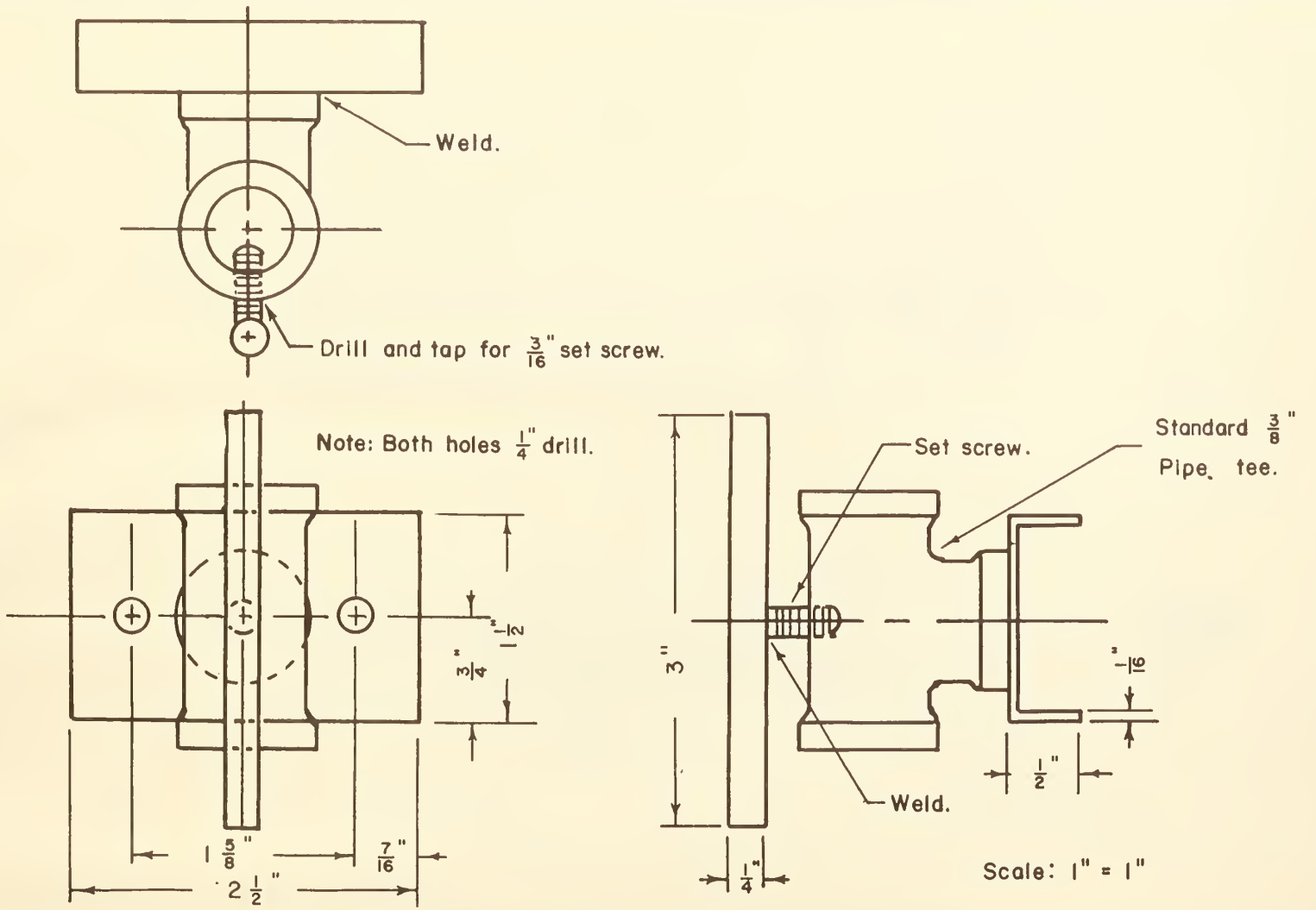
Drawing 507 - Flume Mounting.



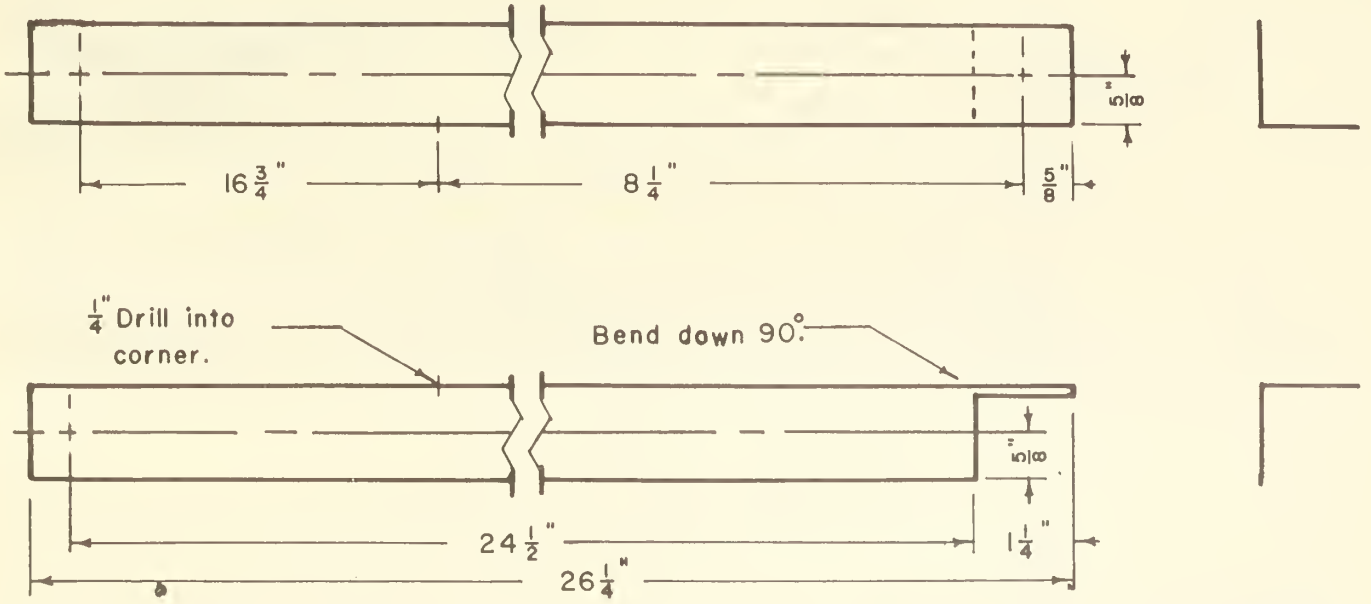
Note: Both holes $\frac{9}{32}$" drill.
$1\frac{1}{4}$" X $1\frac{1}{4}$" X $\frac{1}{8}$" thick angle.

Scale: 1" = 2"

Drawing 508- Flume Mounting.



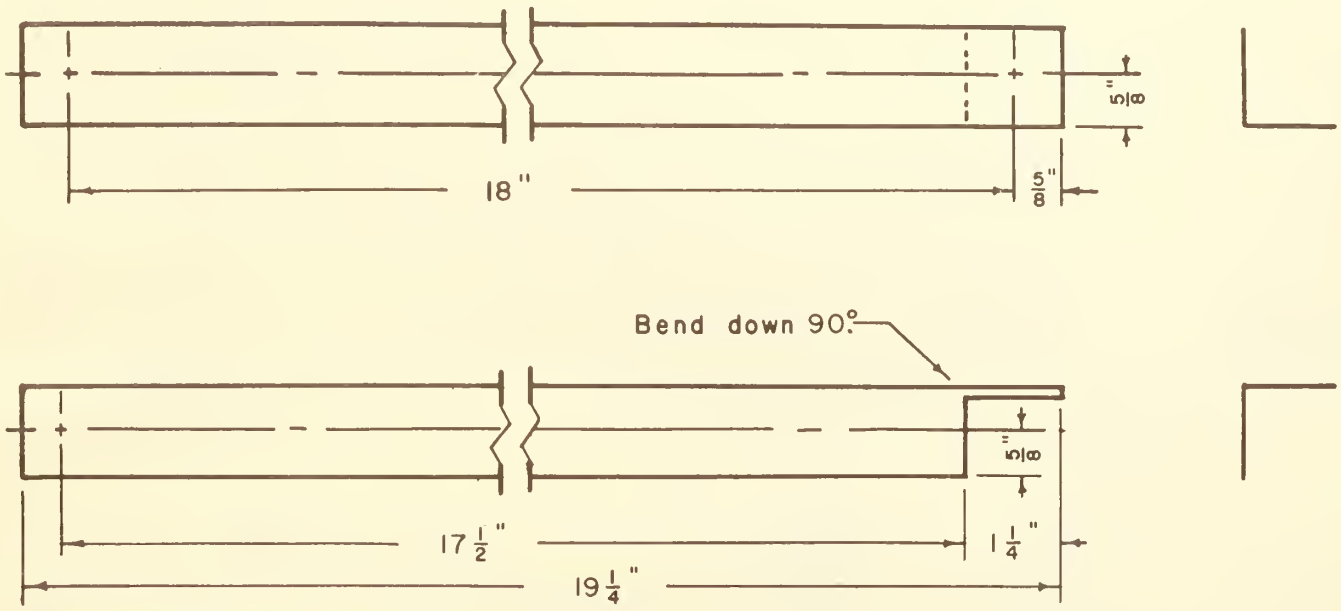
Drawing 509 – Leg Clamp, Flume Mounting.



Note: All holes $\frac{3}{16}$" drill except as noted.
$1\frac{1}{4}$" X $1\frac{1}{4}$" X $\frac{1}{8}$" thick angle.

Scale: 1" = 2"

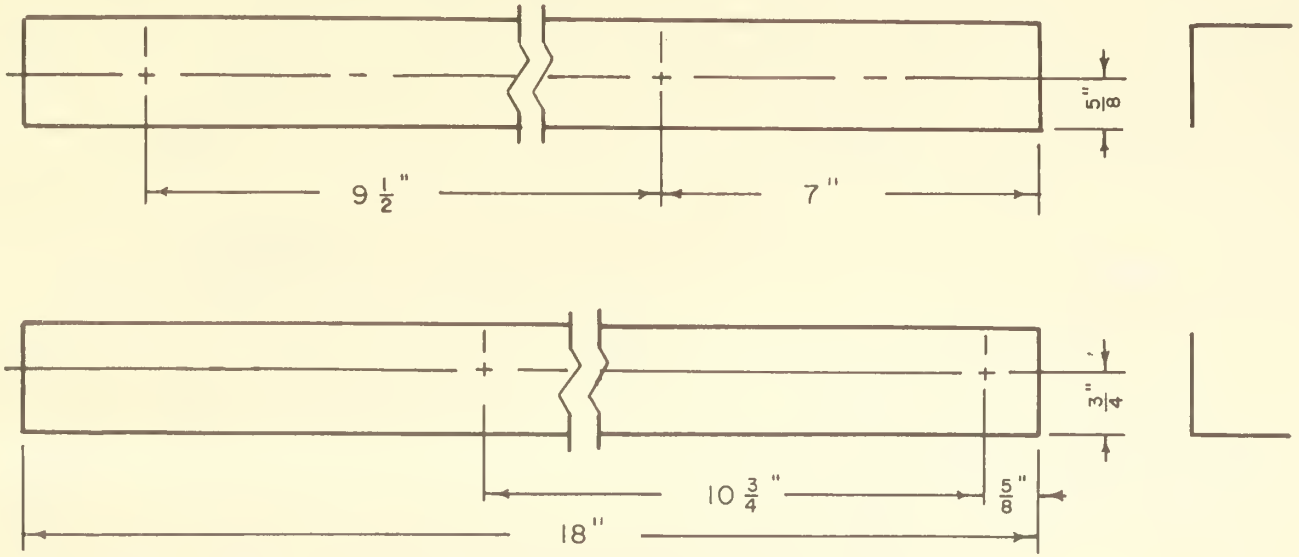
Drawing 510 - Stage Recorder Mounting.



Note: All holes $\frac{3}{16}$" drill.
$1\frac{1}{4}$" X $1\frac{1}{4}$" X $\frac{1}{8}$" thick angle.

Scale: 1" = 2"

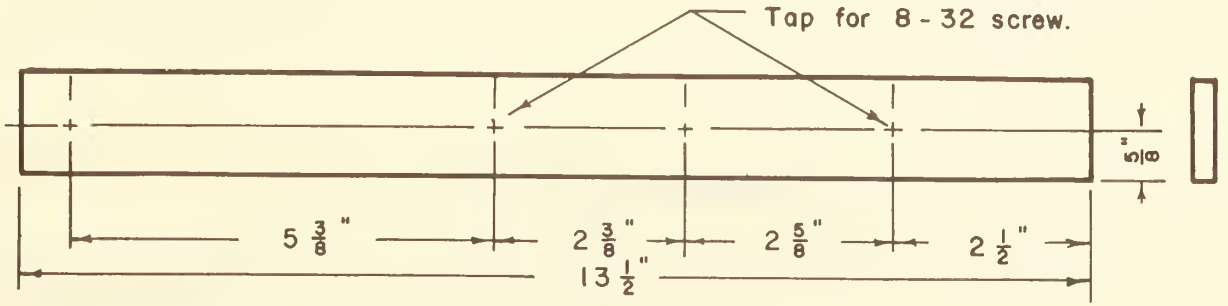
Drawing 511 - Stage Recorder Mounting.



Note: All holes $\frac{3}{16}$" drill.
$1\frac{1}{4}$" X $1\frac{1}{4}$" X $\frac{1}{8}$" thick angle.

Scale: 1" = 2"

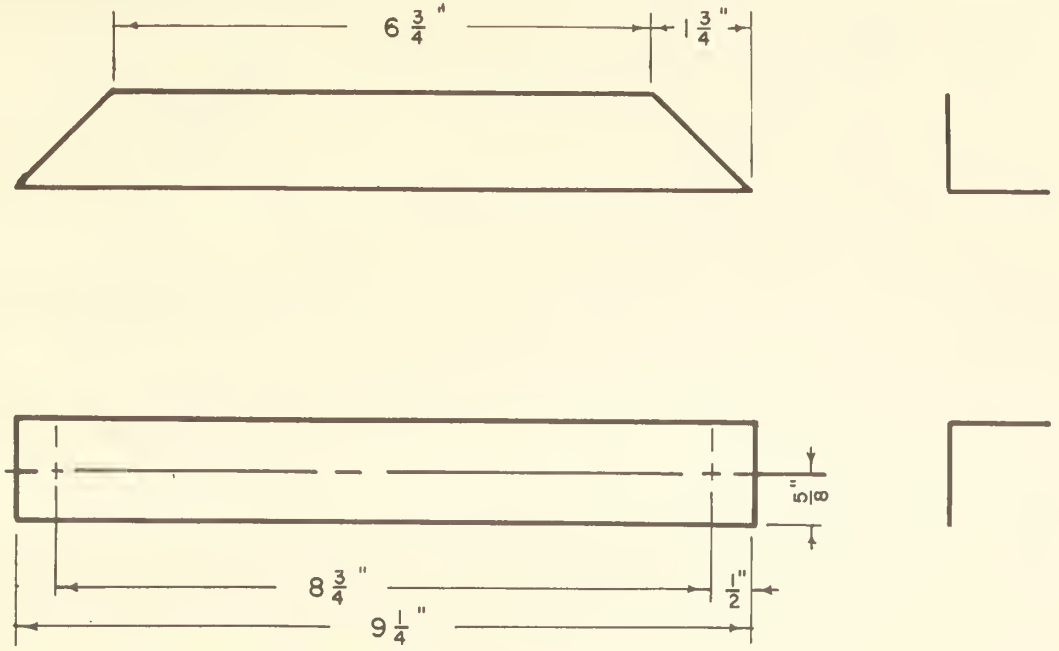
Drawing 512 - Stage Recorder Mounting.



Note: All holes $\frac{3}{16}$" drill except as noted.
$1\frac{1}{4}$" X $\frac{1}{4}$" bar.

Scale: 1" = 2"

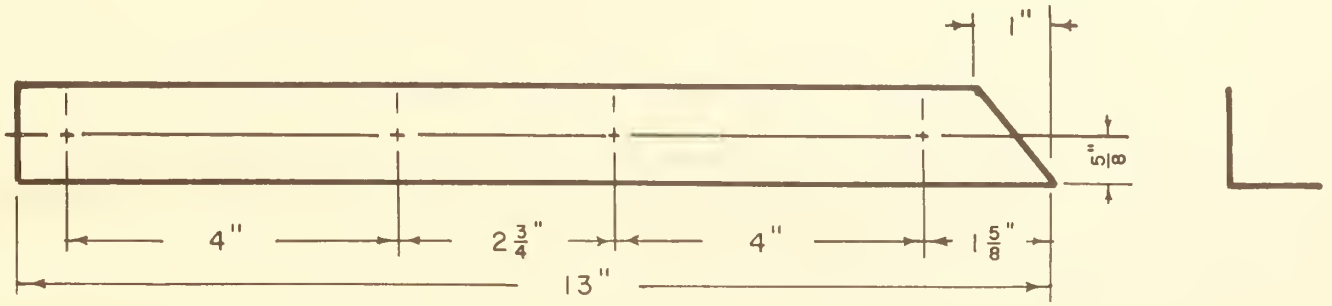
Drawing 513 - Stage Recorder Mounting.



Note: Both holes $\frac{3}{16}$" drill.
$1\frac{1}{4}$" X $1\frac{1}{4}$" X $\frac{1}{8}$" thick angle.

Scale: 1" = 2"

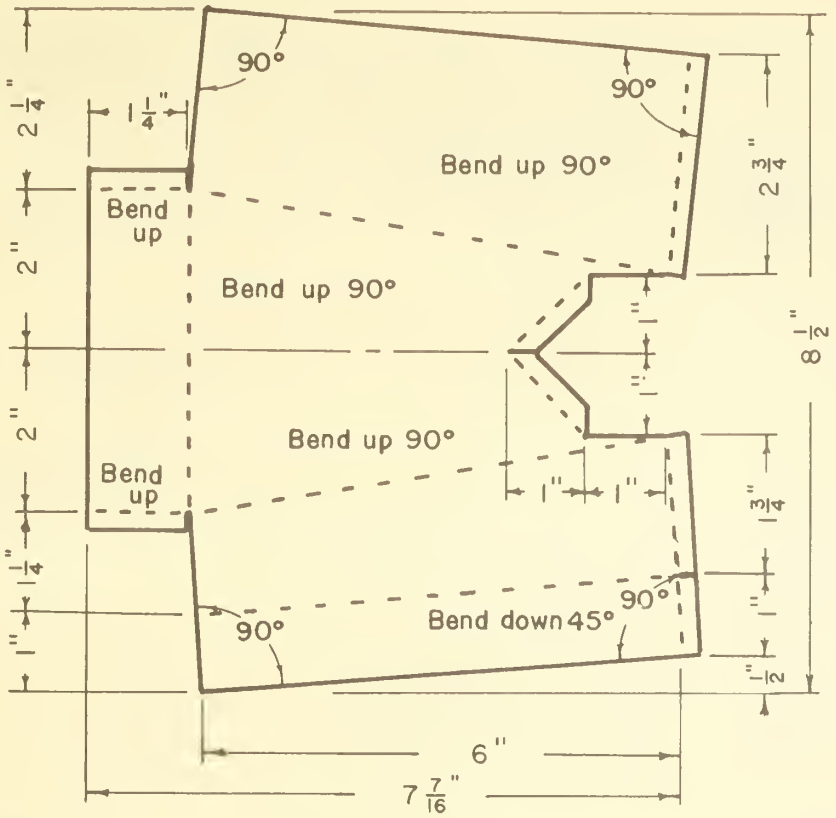
Drawing 514 - Stage Recorder Mounting.



Note: All holes $\frac{3}{16}$" drill.
$1\frac{1}{4}$" X $1\frac{1}{4}$" X $\frac{1}{8}$" thick angle.

Scale: 1" = 2"

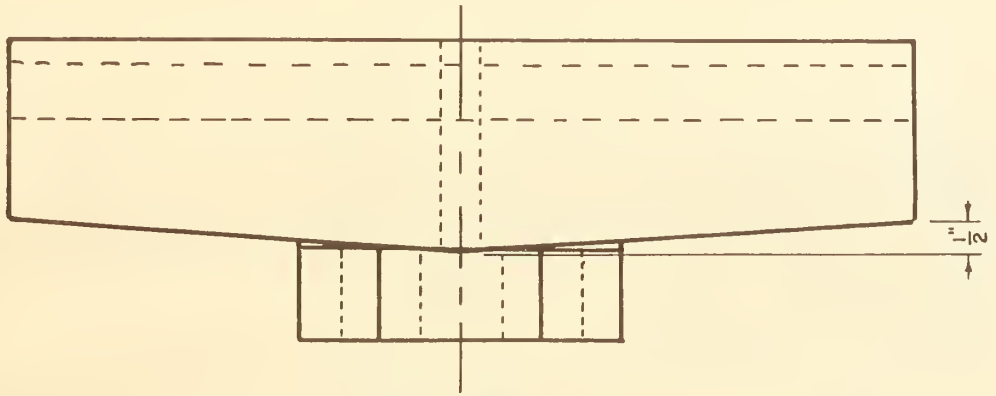
Drawing 515 - Stage Recorder Mounting.



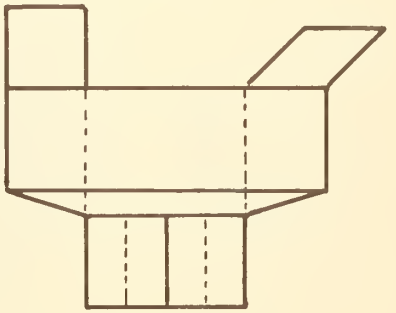
Note: 22 ga. galv. sheet steel.

Scale: 1" = 2"

Drawing 516 - Collection Funnel.



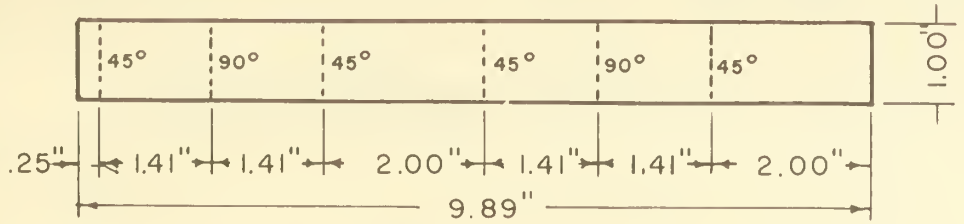
Front view.



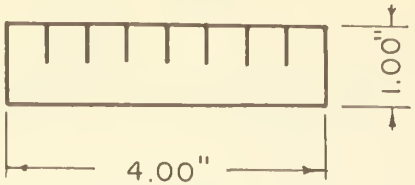
Side view.

Scale: 1" = 2"

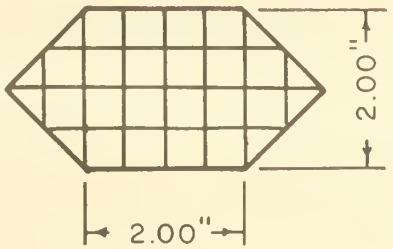
Drawing 516 A - Collection Funnel.

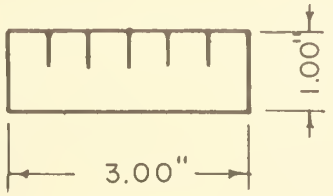


1 each.

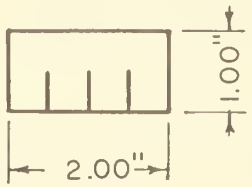


1 each.

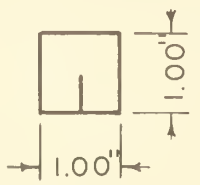




2 each.



5 each.

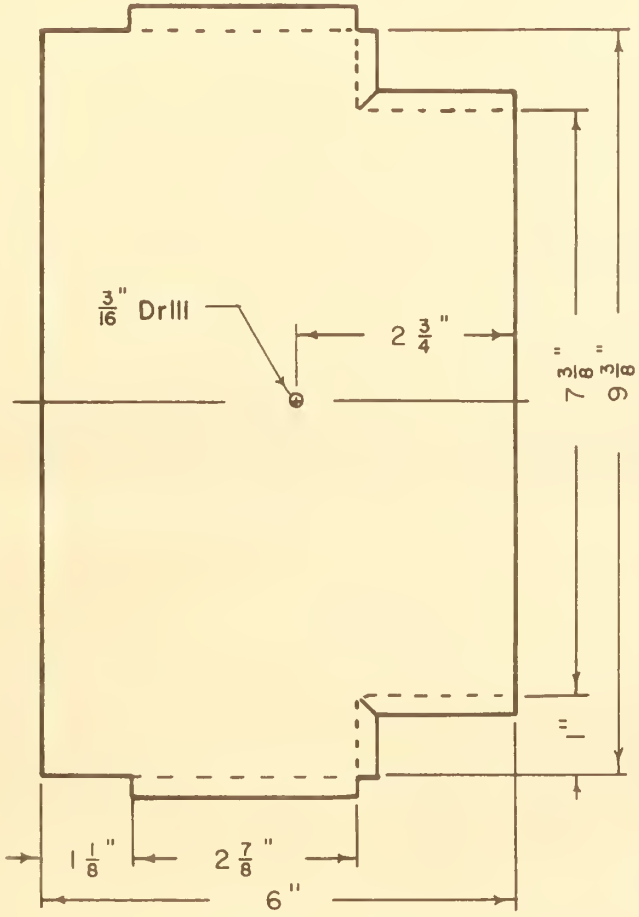


2 each.

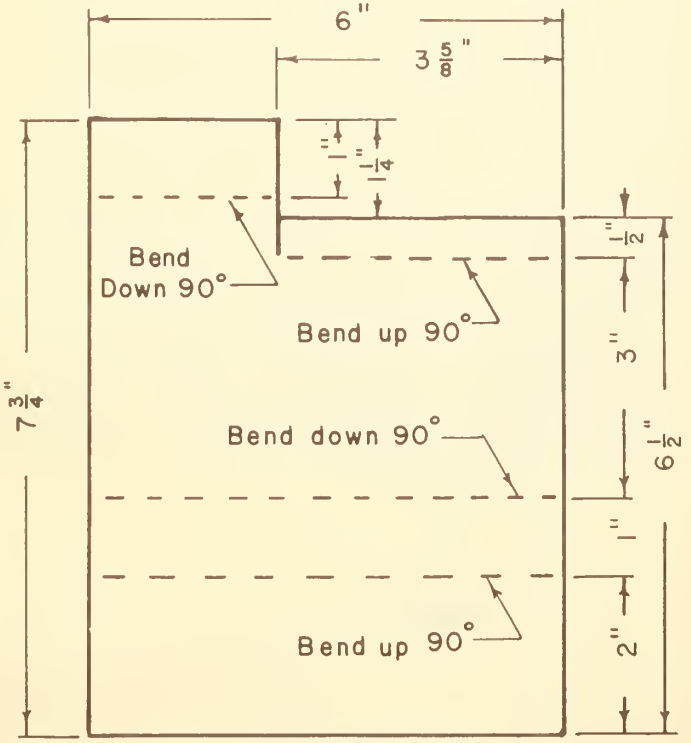
Note: 22 ga. galv. sheet steel.

Drawing 517 - Funnel Spout and Grid.

Scale: 1" = 2"



Top.



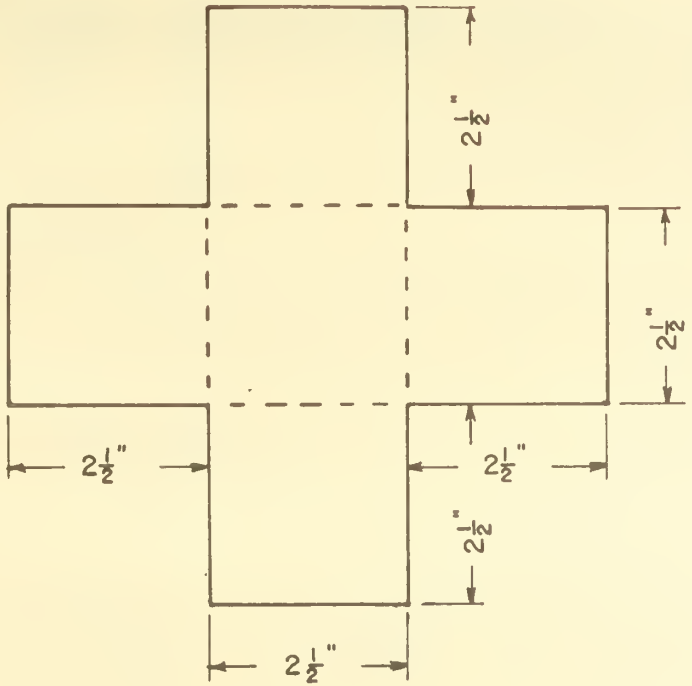
Side.

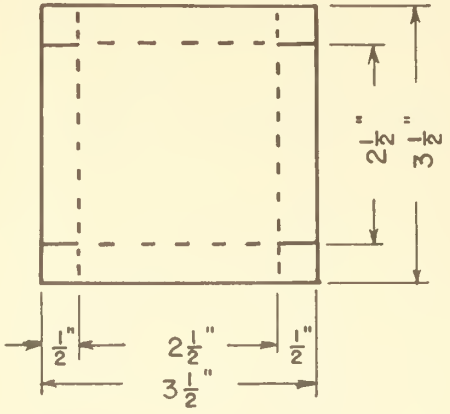
Both pieces 22 ga. galv. sheet steel.

Note: Bend tabs down 90°
1/4" Width tabs.

Scale: 1" = 2"

Drawing 518 — Funnel and Motor Mounting.

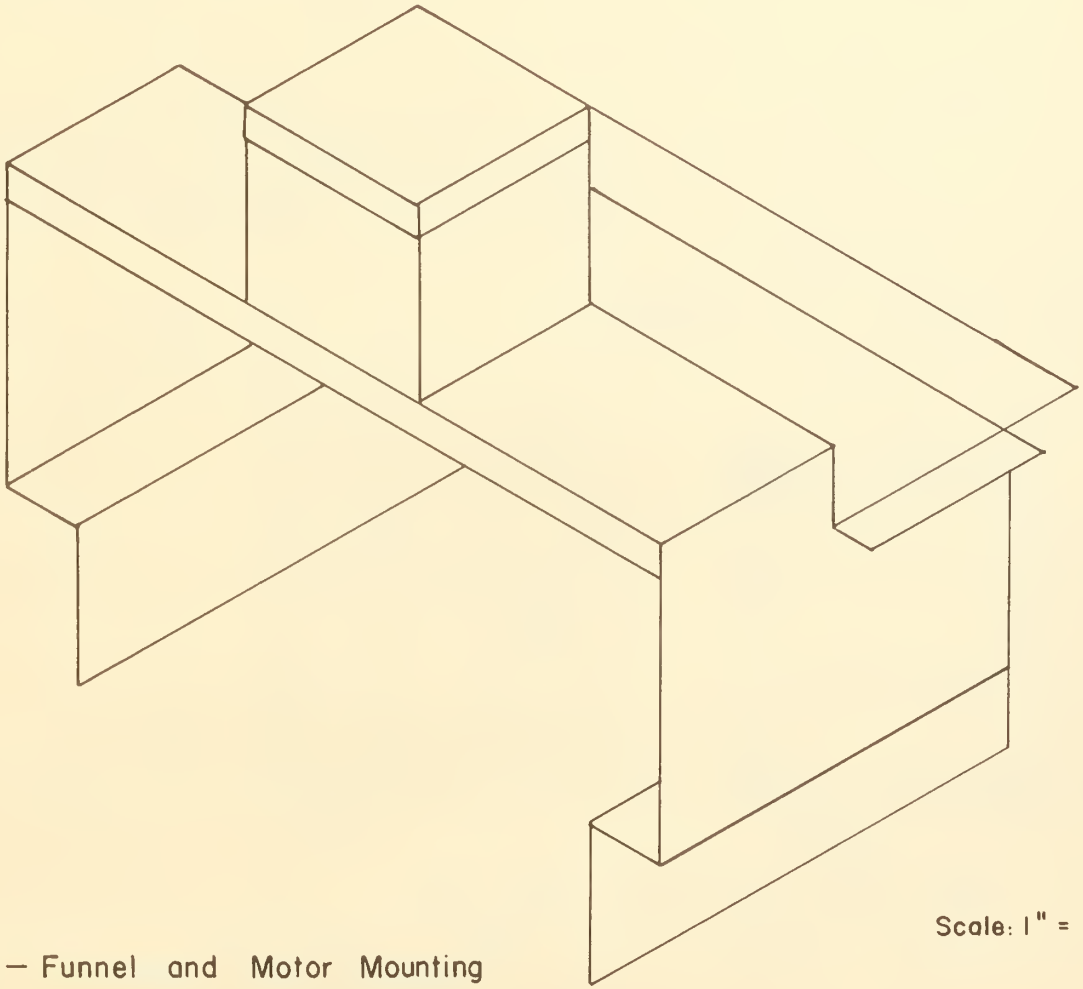




Scale: 1" = 2"

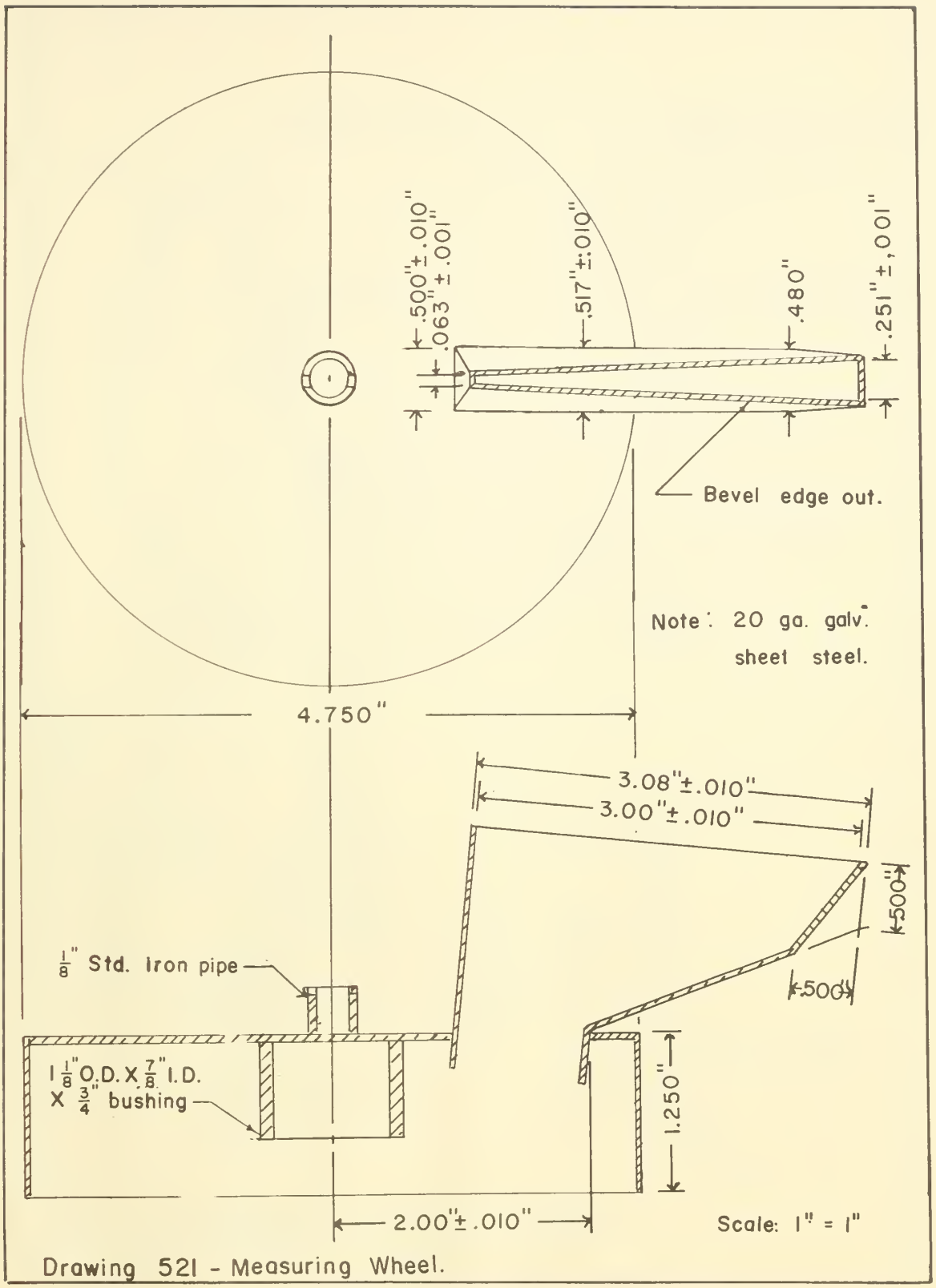
Note: Bend up 90° on dotted lines.
Dimensions will depend on size of motor selected.
Motor requirements: 30 to 60 r.p.m.
12 inch ounce torque.
22 ga. galv. sheet steel.

Drawing 519 - Funnel and Motor Mounting.

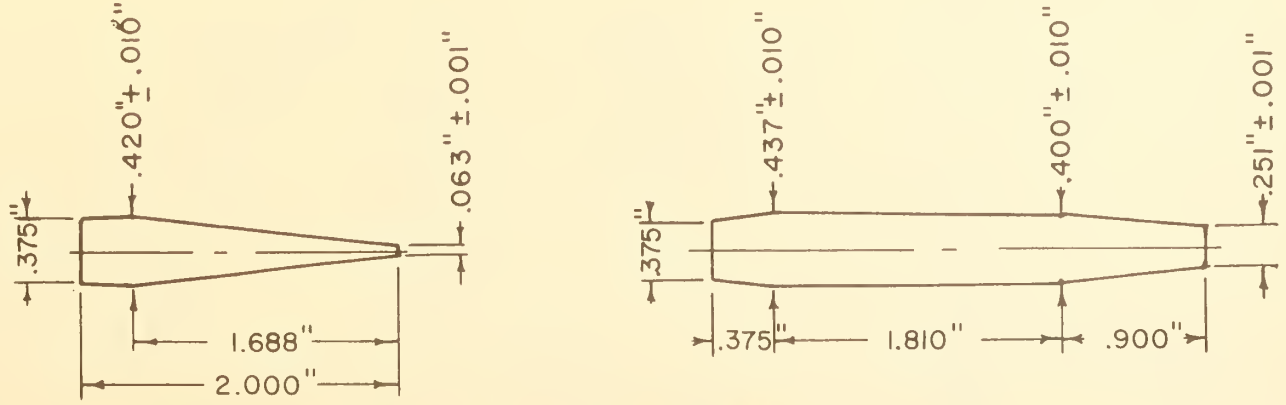


Scale: 1" = 2"

Drawing 520 — Funnel and Motor Mounting Assembly.



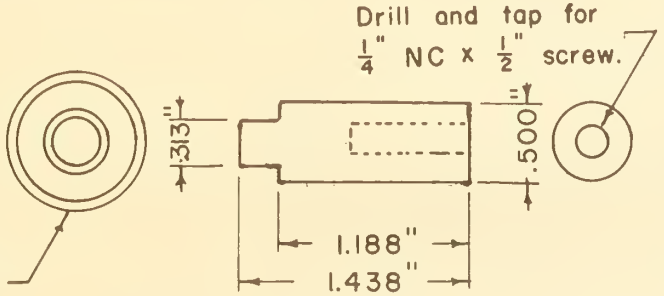
Drawing 521 - Measuring Wheel.



20 ga. galv. sheet steel.

Spout front.

Spout back.



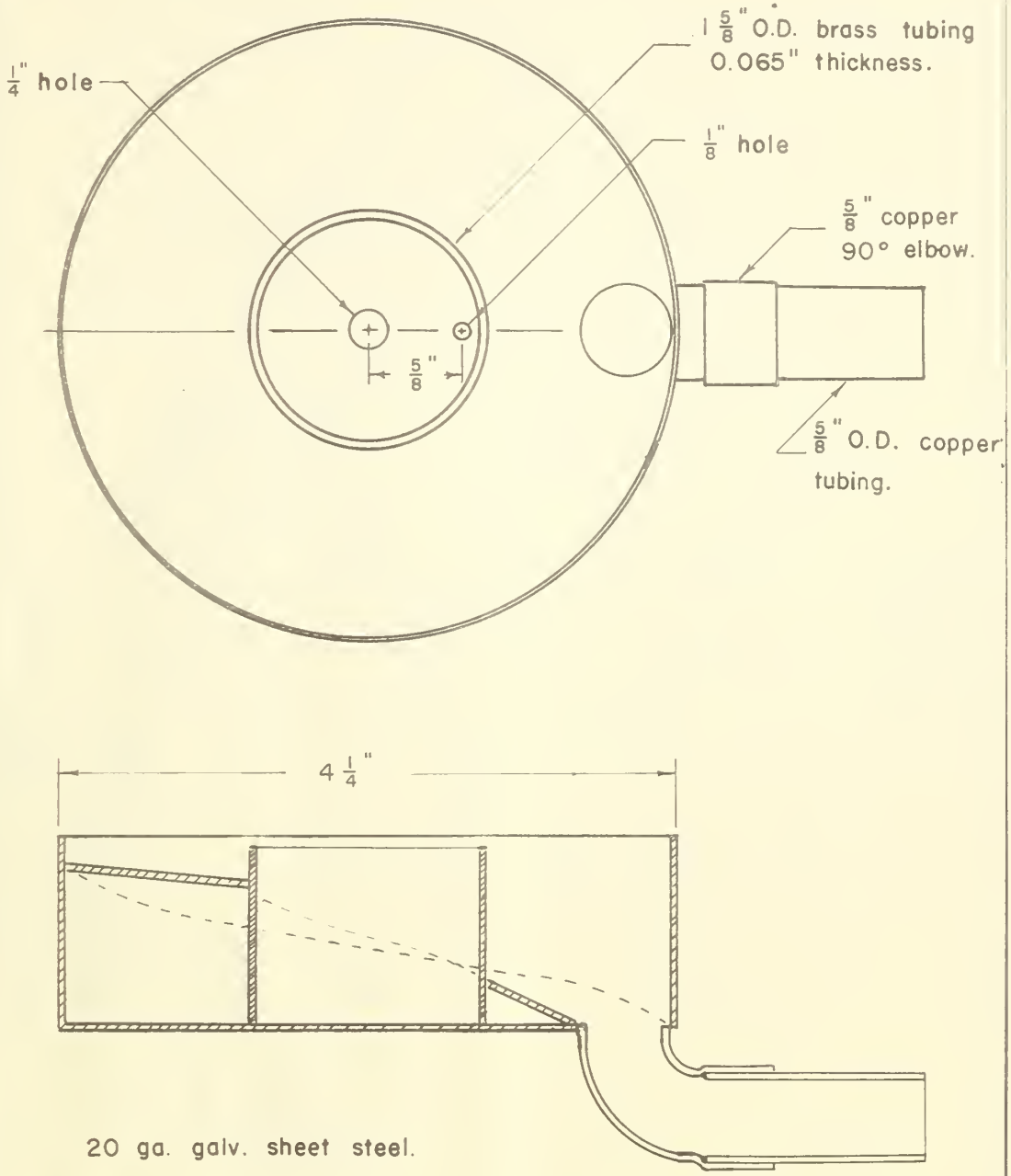
7/8" O.D. x 5/16" bore 1/4" width light duty ball bearing.

1/2" Dia. brass rod.

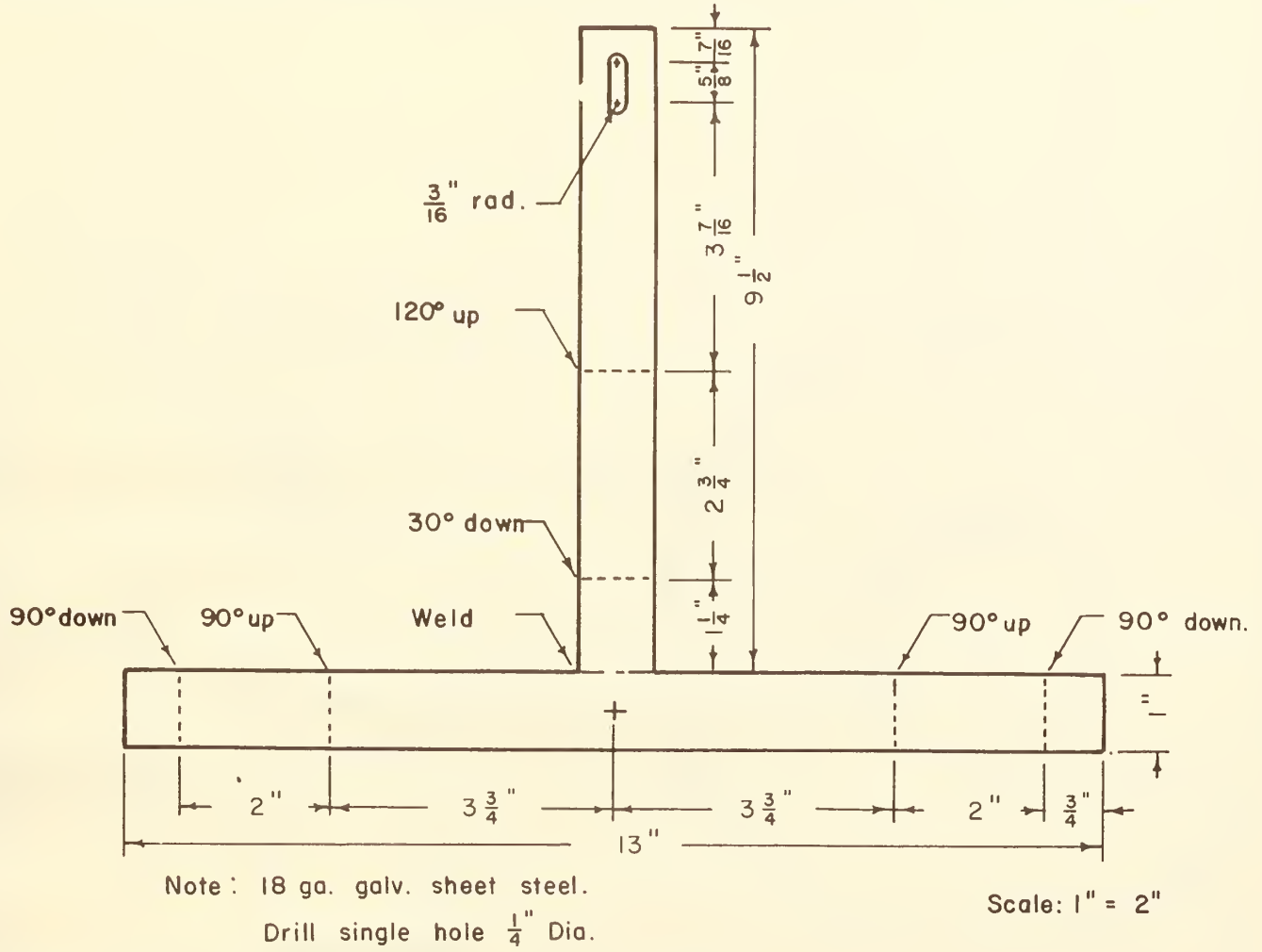
Bearing and shaft.

Scale: 1" = 1"

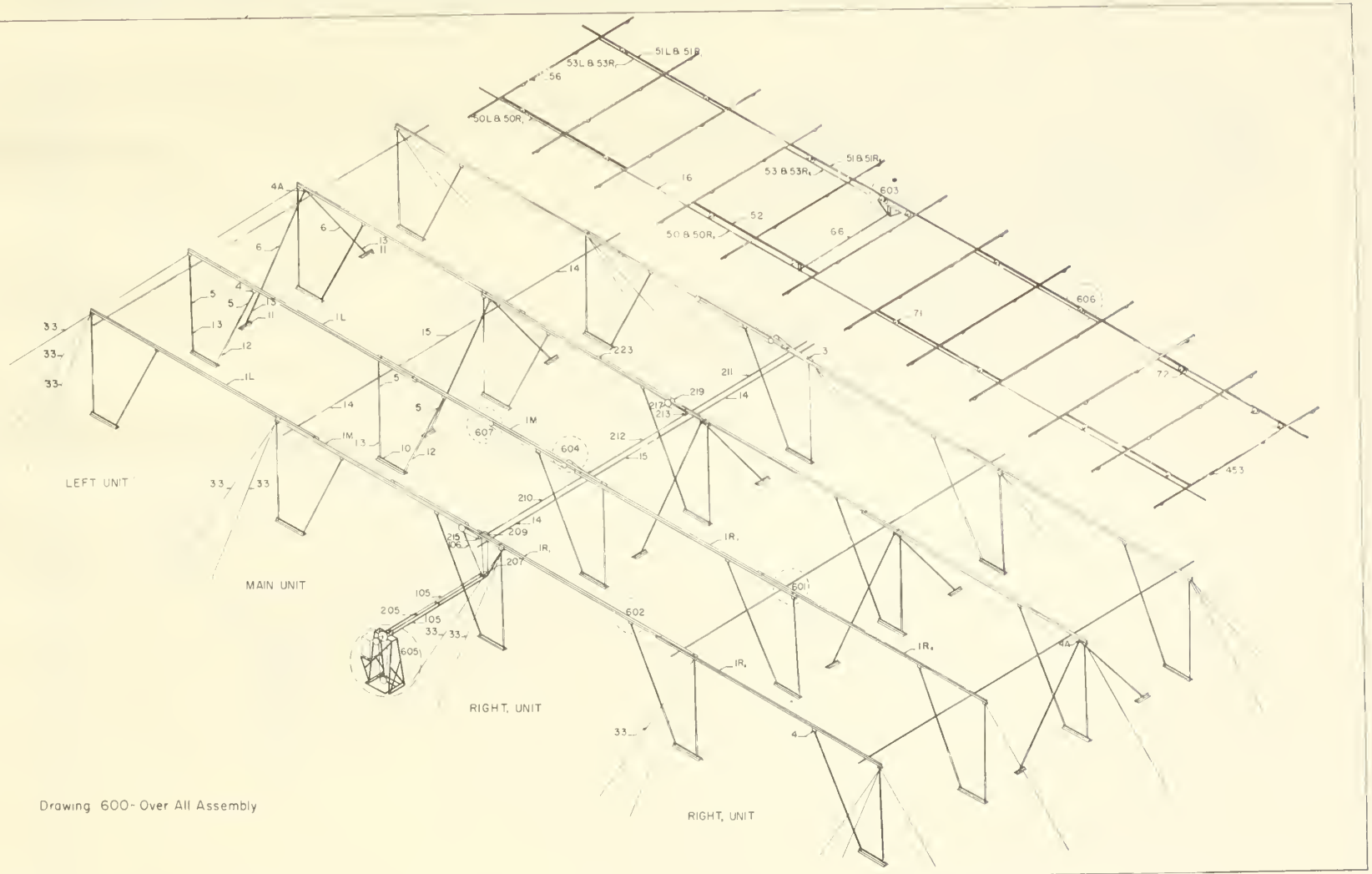
Drawing 521A - Measuring Wheel Details.

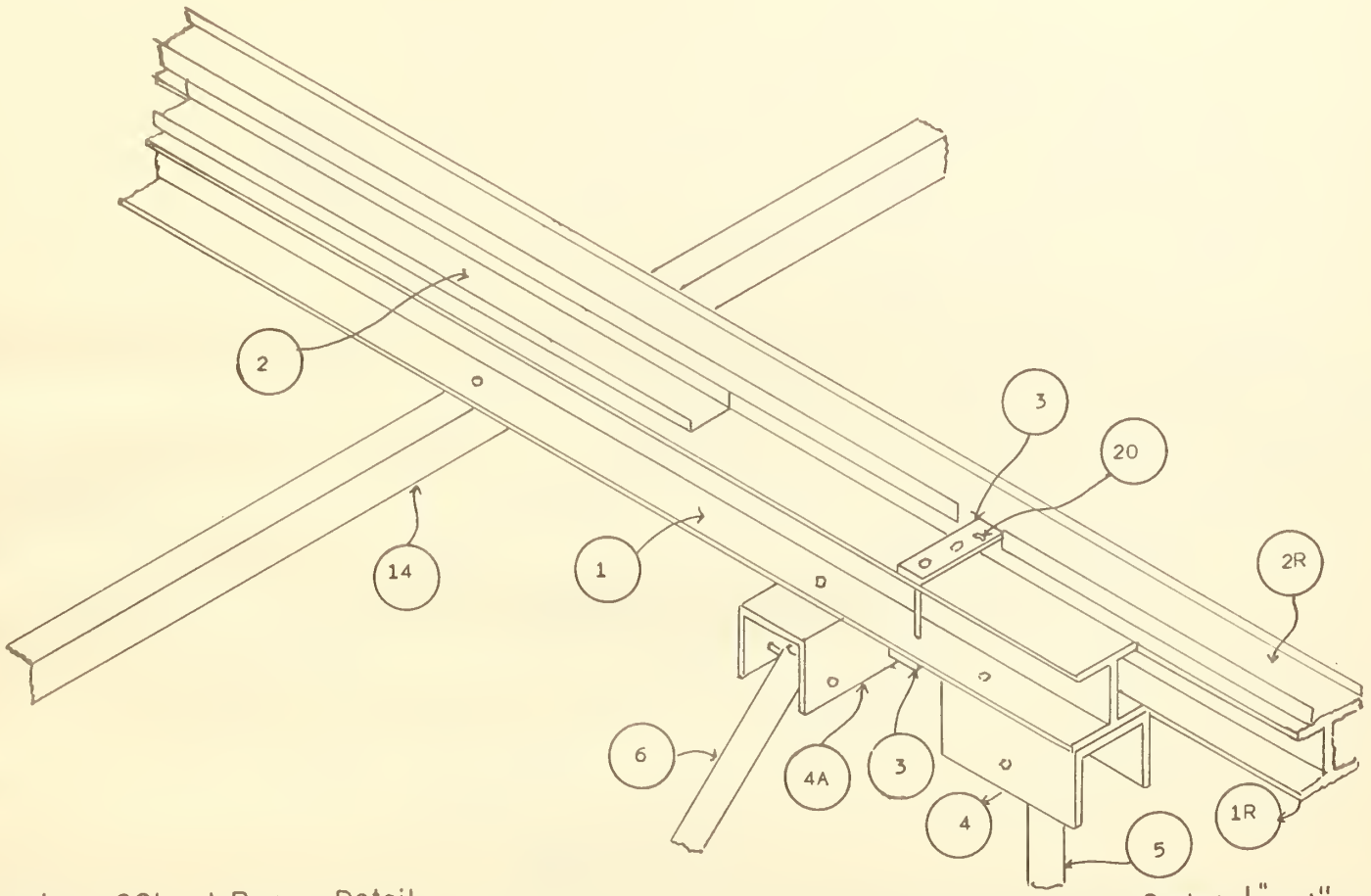


Drawing 522 - Measuring Wheel Receptacle.



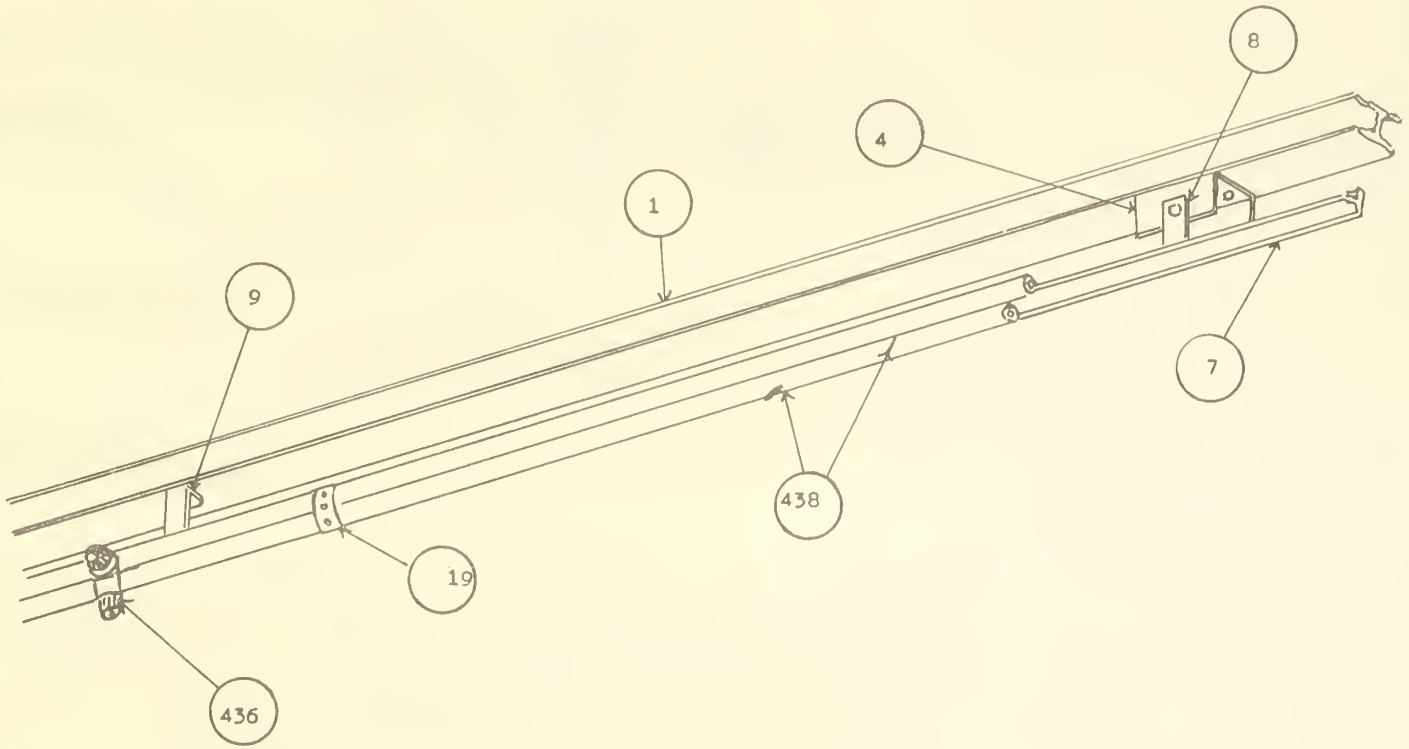
Drawing 523 - Measuring Wheel Support Bracket.


51L & 51R
53L & 53R
56
50L & 50R
51 & 51R
53 & 53R
16
603
52
66
50 & 50R
606
71
72
453
4A
6
13
11
4
5
3
33
1L
12
15
223
211
219
14
212
607
1M
604
10
LEFT UNIT
MAIN UNIT
RIGHT, UNIT
210
209
215
606
207
1R
105
205
602
601
605
4
Drawing 600- Over All Assembly
RIGHT, UNIT



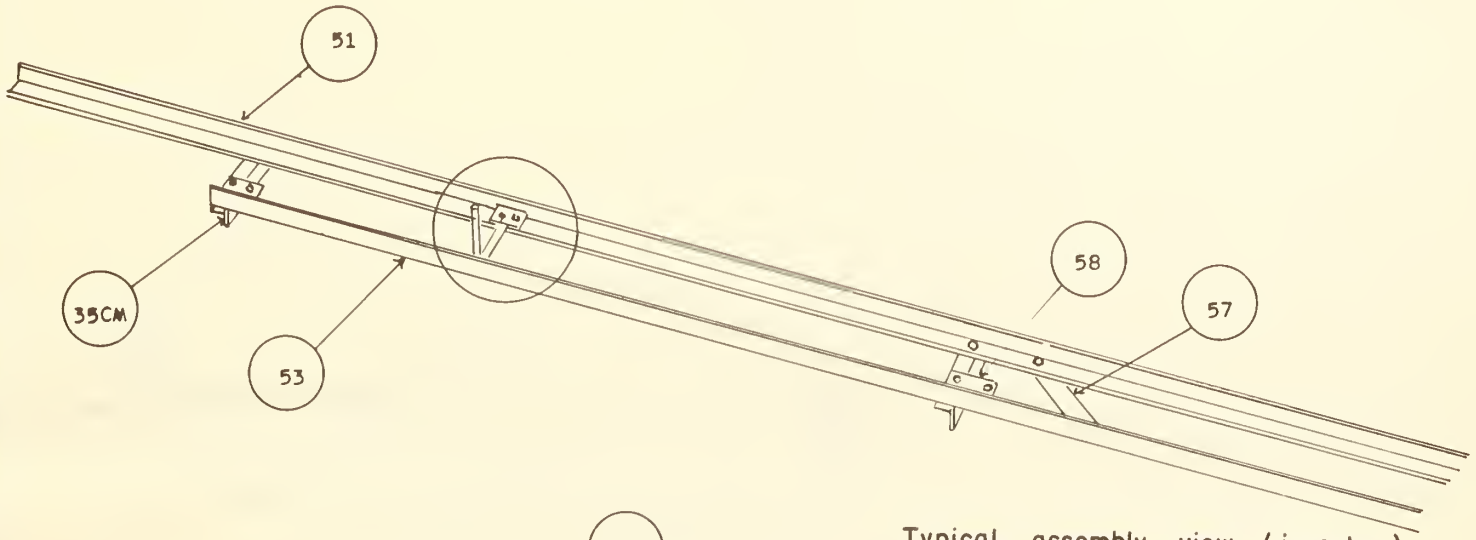
Drawing 601 — I-Beam Detail

Scale: $\frac{1}{4}$" = 1"

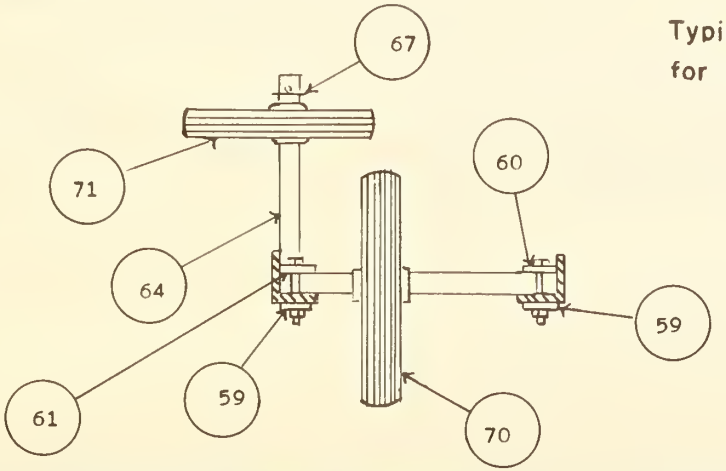


Drawing 602 — T-Bar Assembly.

Scale; $\frac{1}{8}$" = 1"

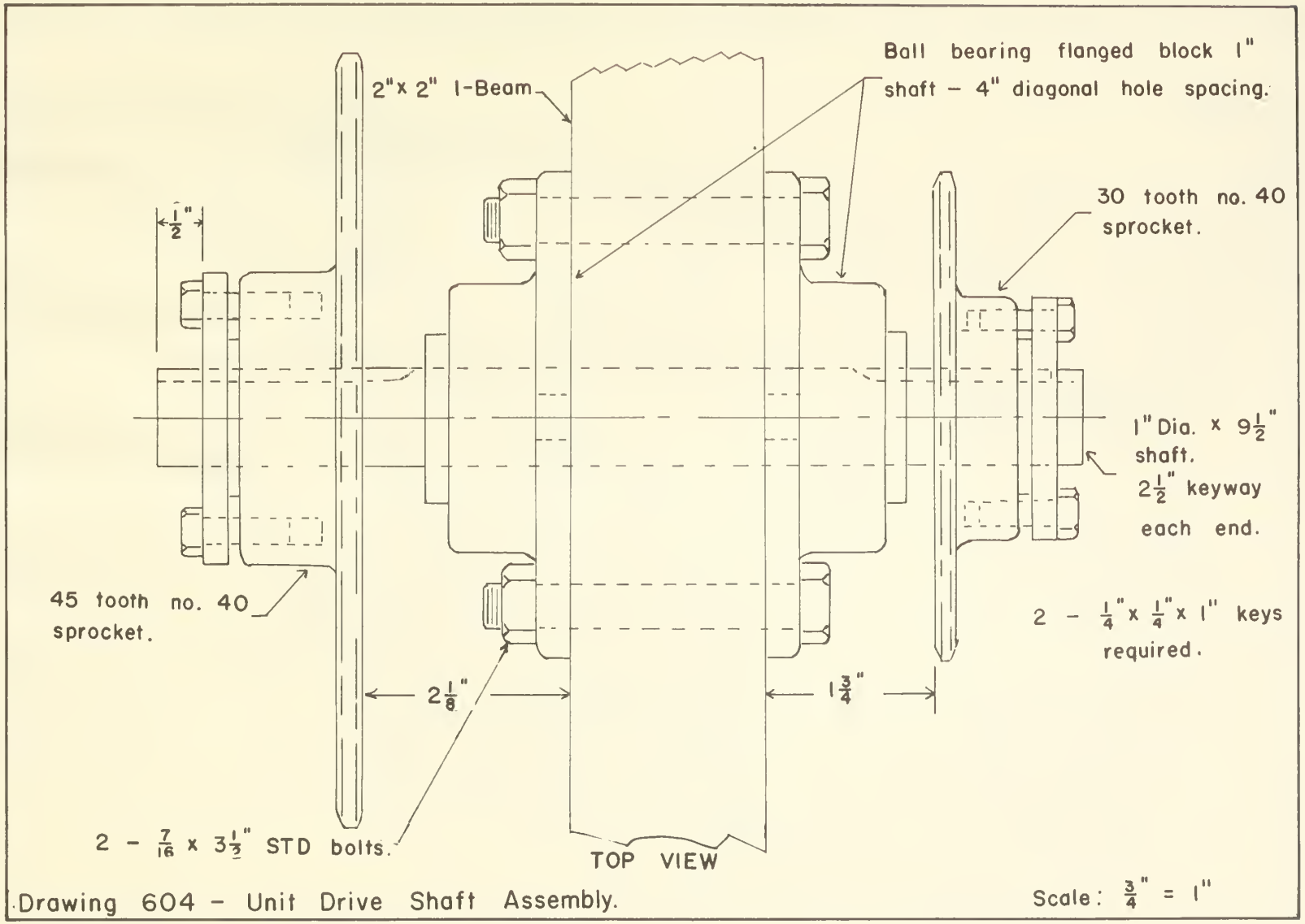


Typical assembly view (inverter) for all carriages.



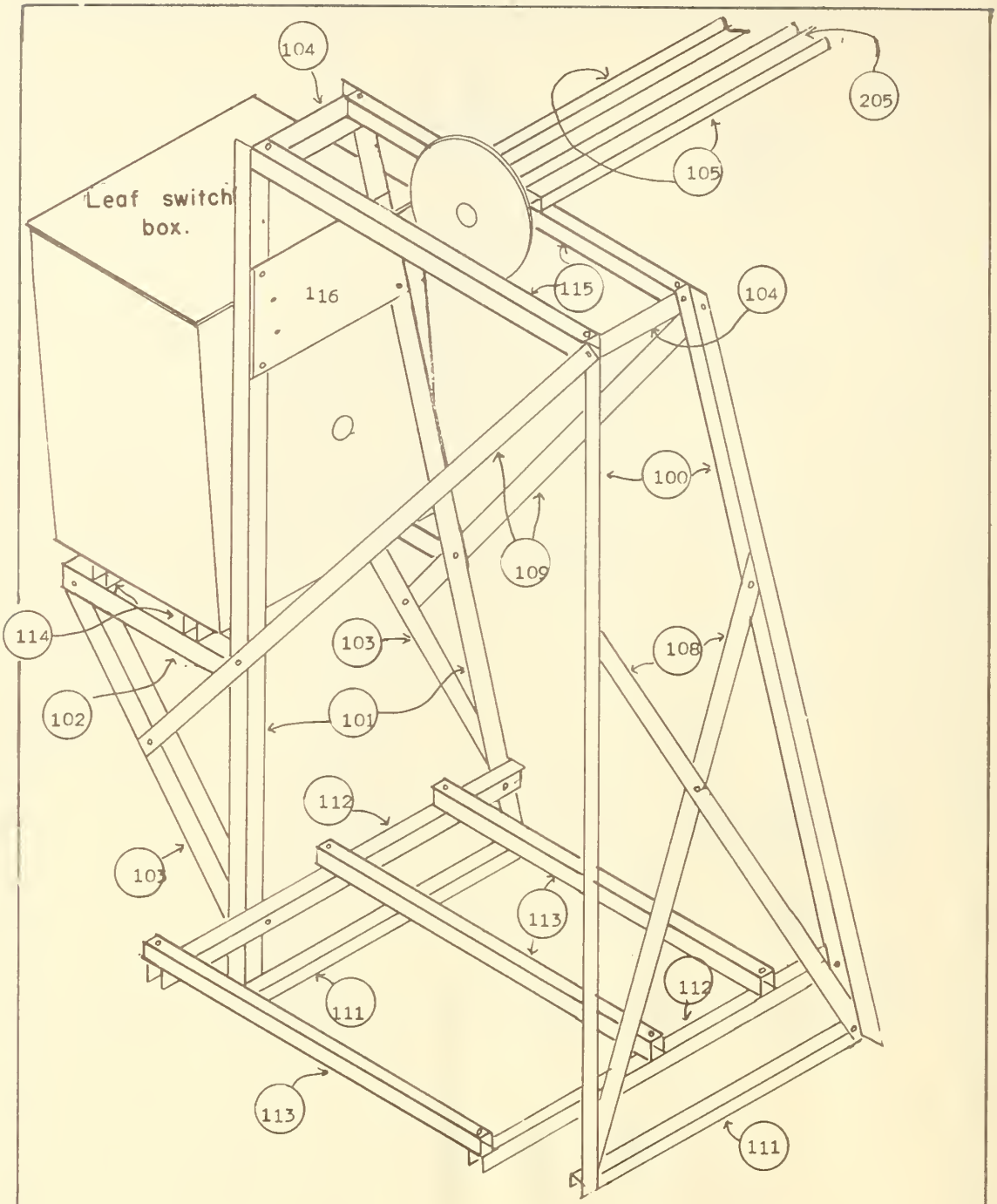
Drawing 603 — Carriage Frame Assembly.

Scale: $\frac{1}{4}$" = 1"

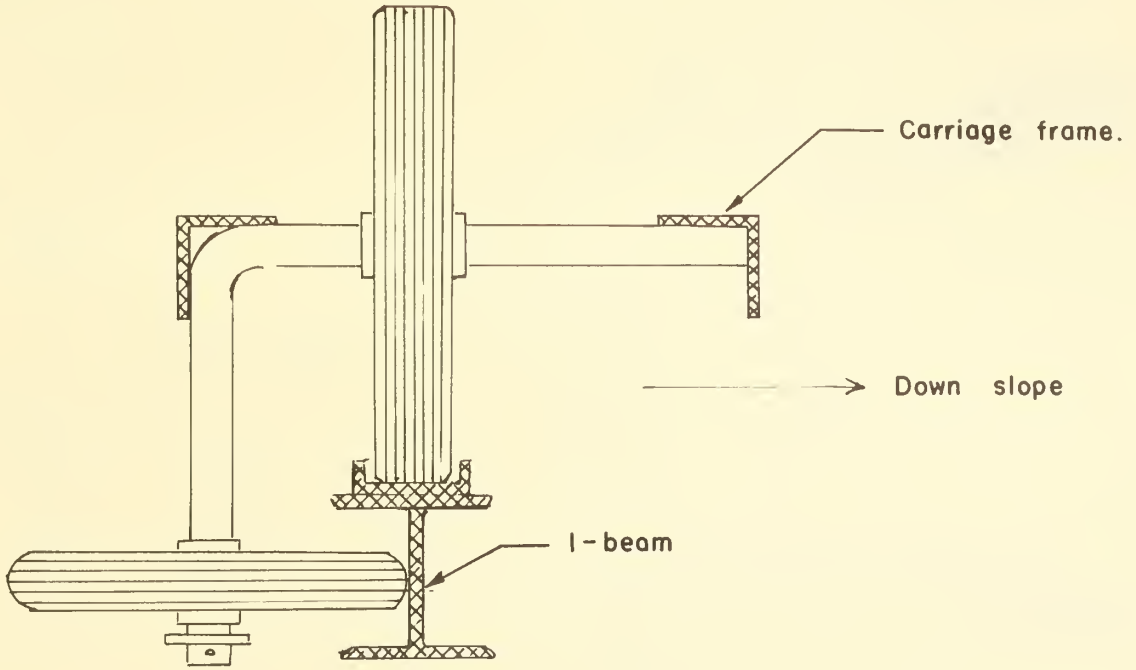


Drawing 604 – Unit Drive Shaft Assembly.

Scale: 3/4" = 1"

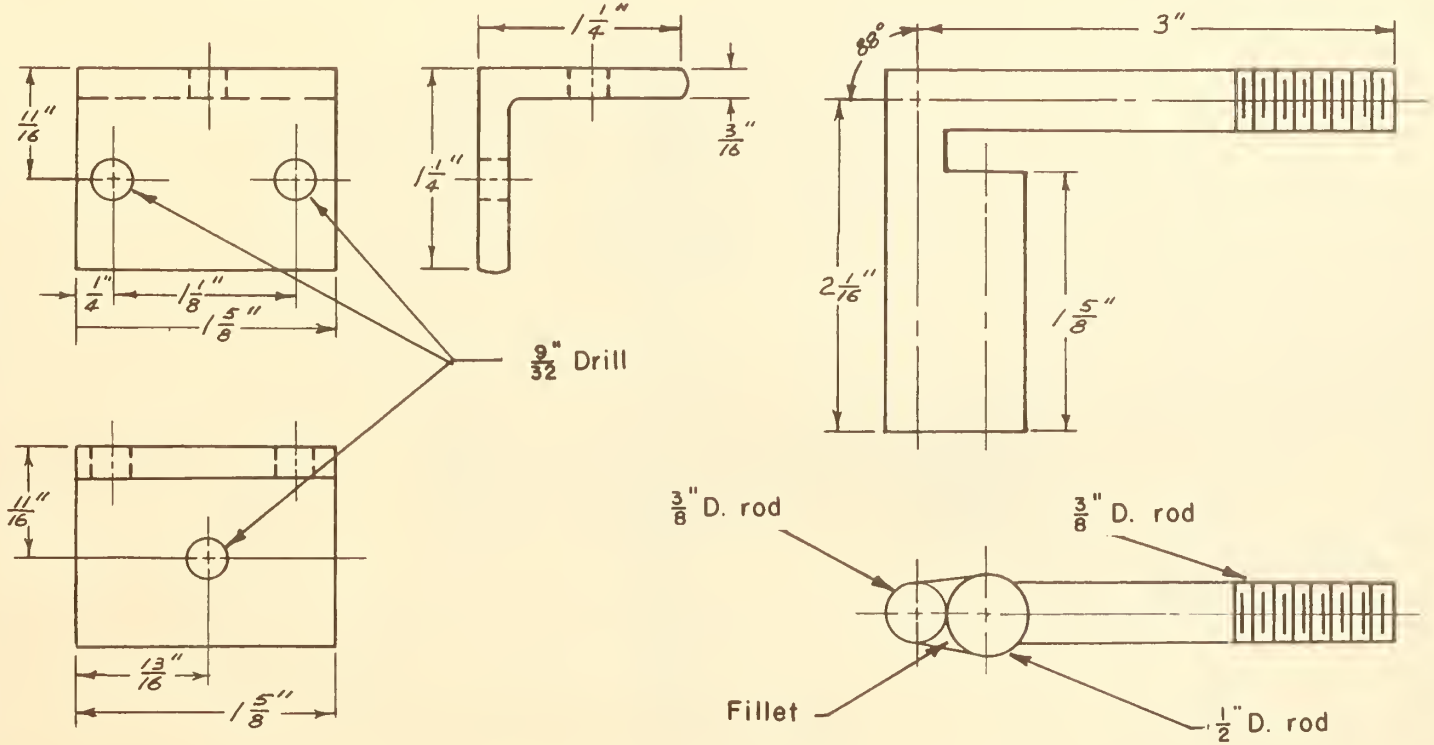


Drawing 605 — Motor Mount Assembly. Scale: $\frac{1}{8}$" = 1"



Drawing 606 — Up Slope Wheel Assembly.

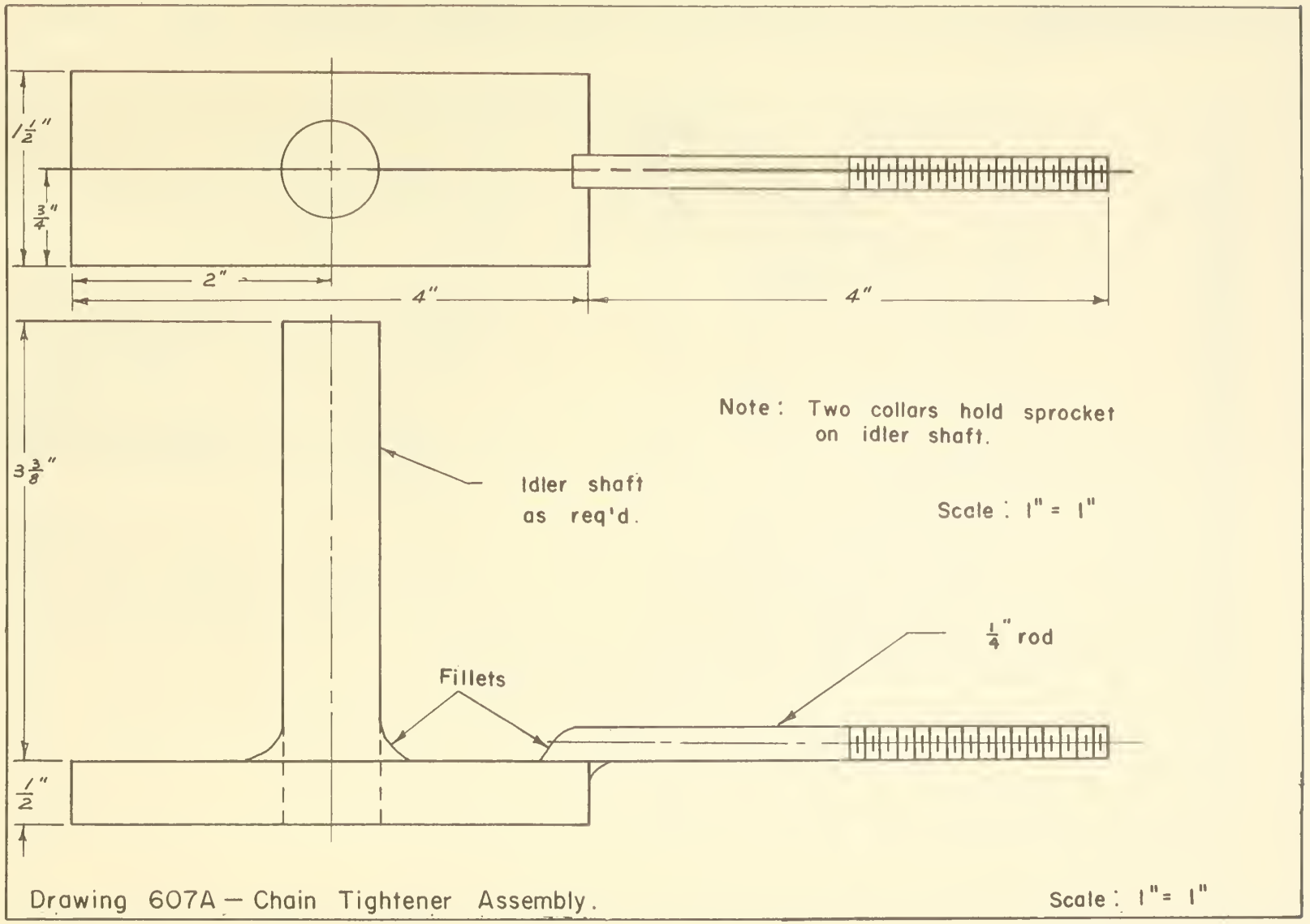
Scale: $\frac{1}{2}$" = 1"



Note: Fastener is held by two bolts through web of I-beam at desired location.

Drawing 607 – Chain Tightener Assembly.

Scale: 1" = 1"

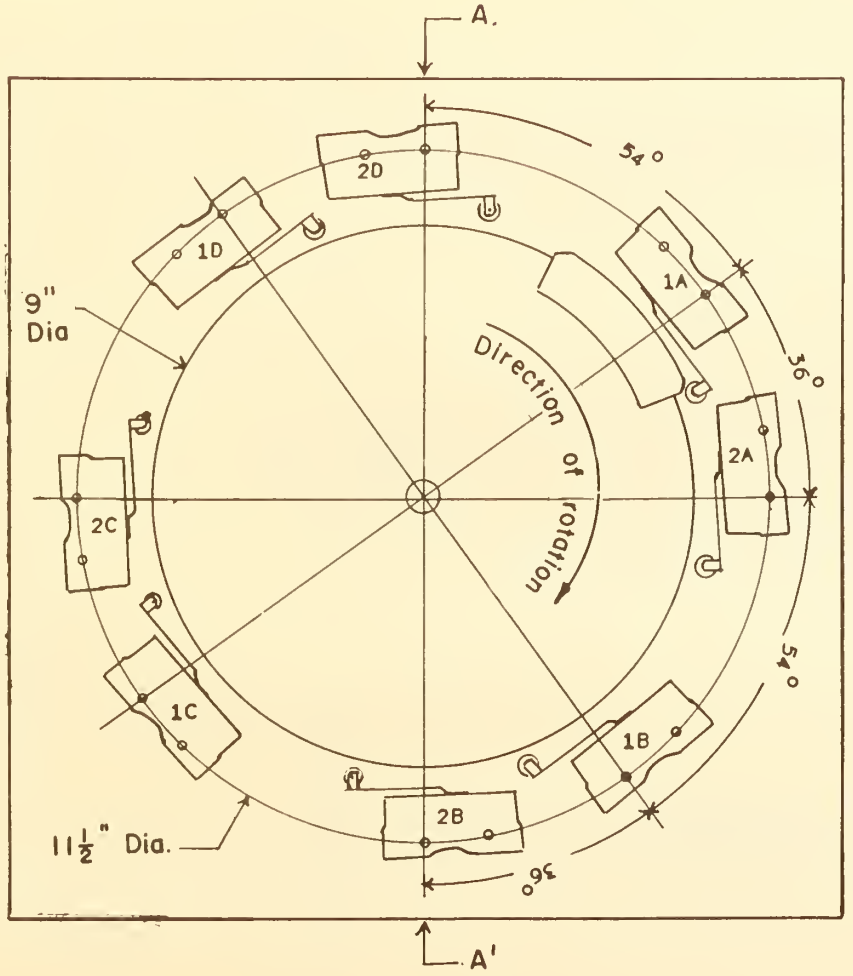


Drawing 607A — Chain Tightener Assembly.

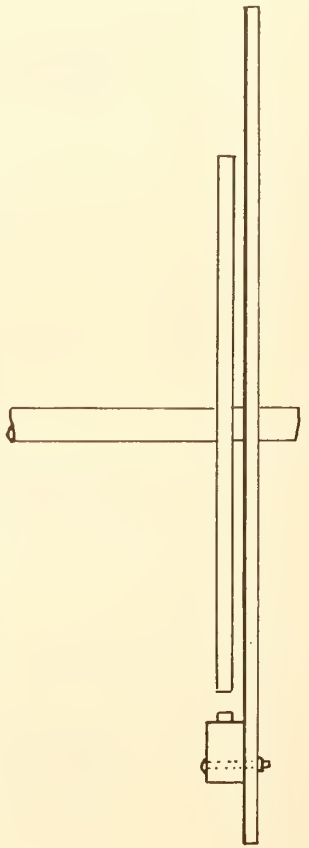
Scale: 1" = 1"

Note: Accurate switch spacing is necessary for correct nozzle timing.

Cam to control units 3 and 4 rotates on same shaft at other side of box.

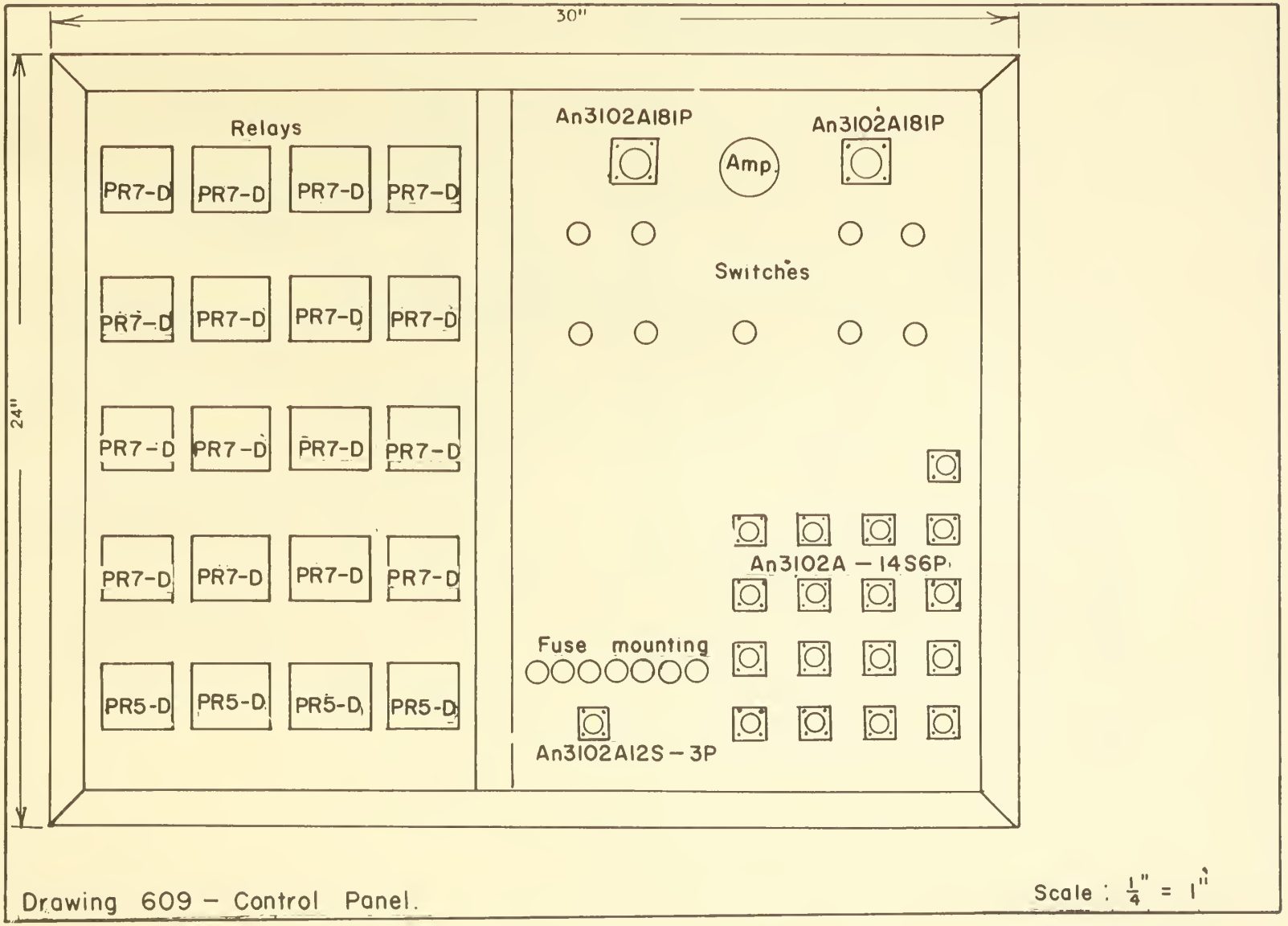


Sec. A–A'



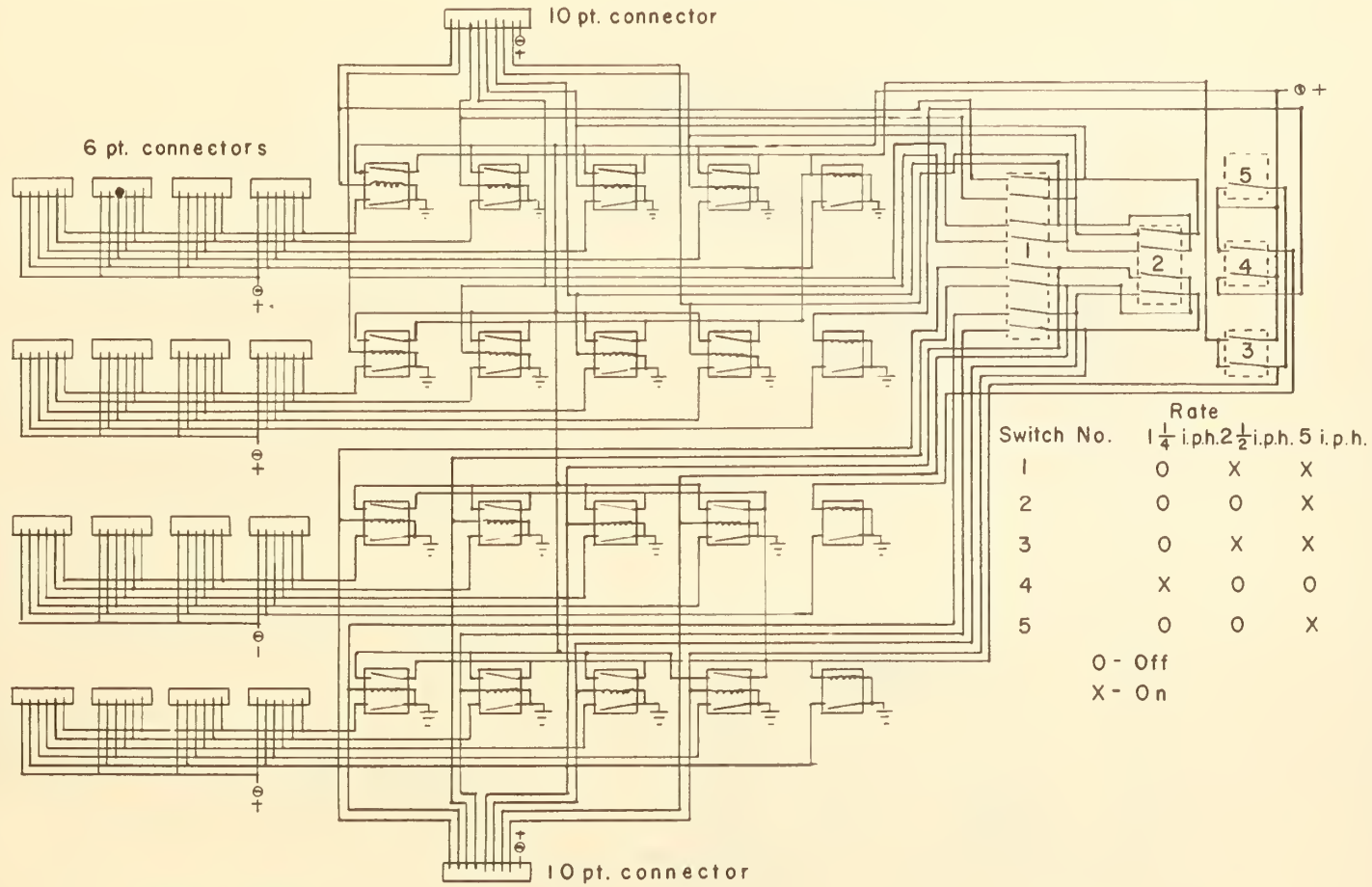
Drawing 608 – Leafswitch Spacing.

Scale : $\frac{3}{8}$" = 1"

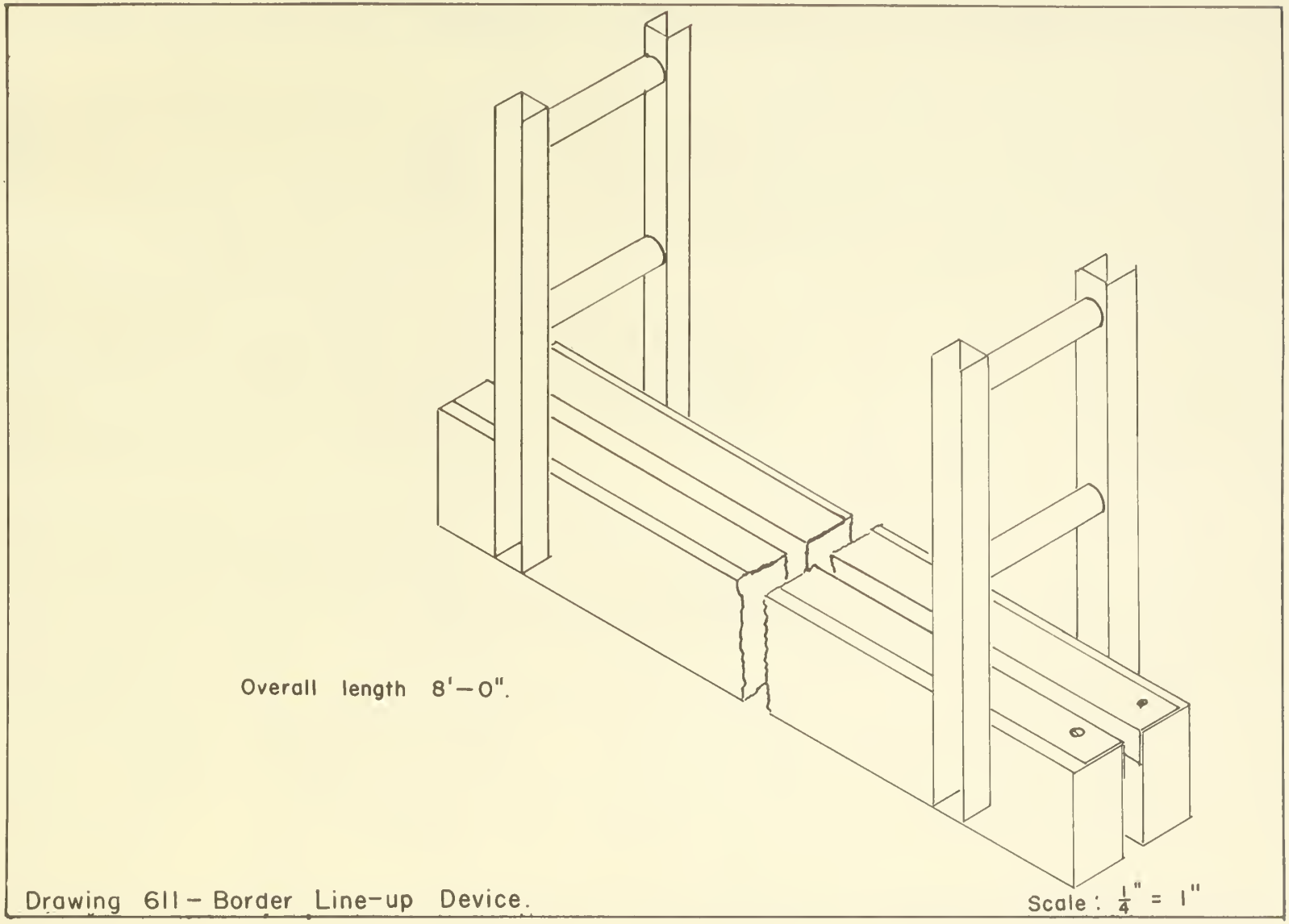


Drawing 609 – Control Panel.

Scale : $\frac{1}{4}$" = 1"

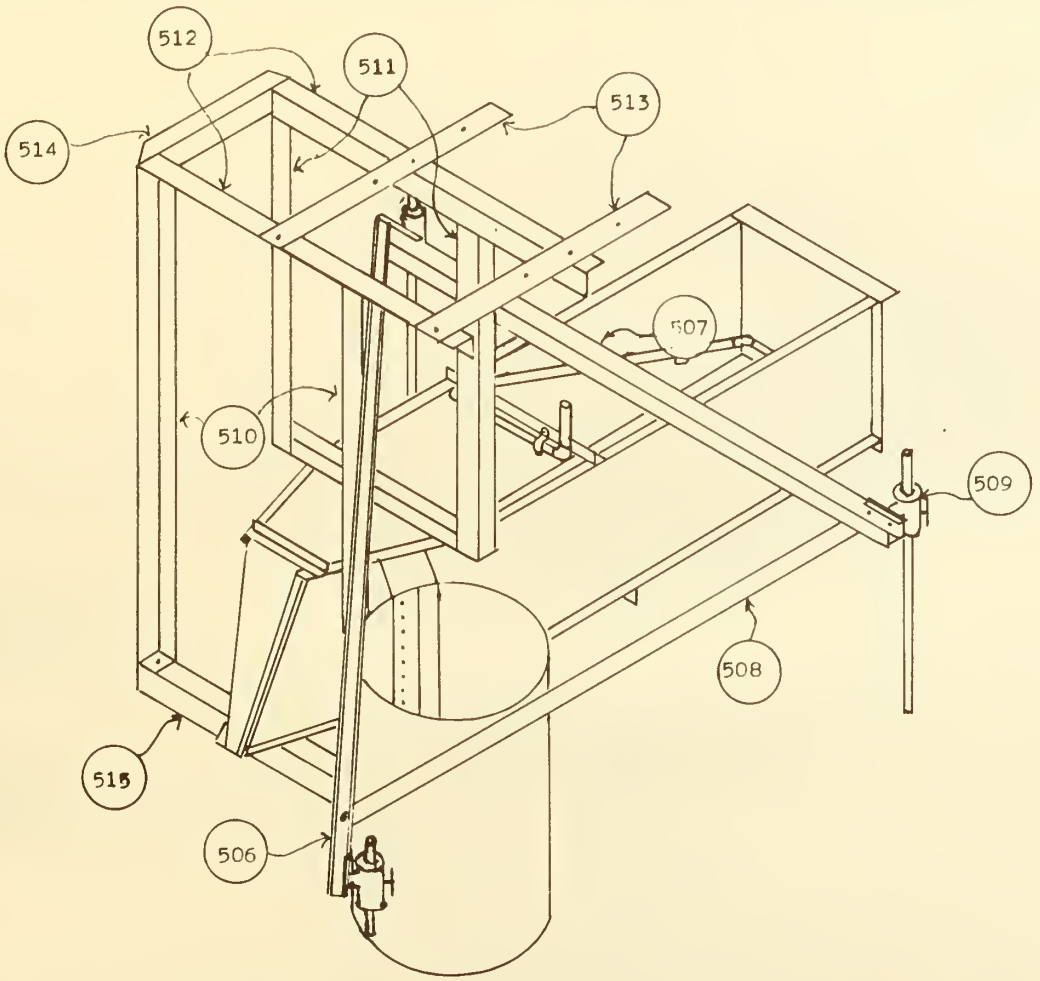


Dwg. 610 Wiring & Switching Diagram



Drawing 611 – Border Line-up Device.

Scale : $\frac{1}{4}$" = 1"



Drawing 612—Flume Mount Assembly.

Scale: $1\frac{1}{2}$" = 1'