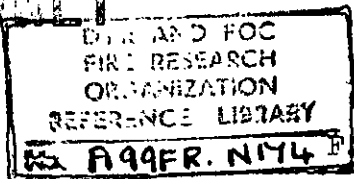


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TESTING OF FIREMENS' HELMETS

by

J. A. Gordon

Summary

This note describes the equipment and procedure for testing firemens' helmets, in accordance with Home Office Fire Service Department Specification No. 33 for Uniform and Personal Equipment.

March, 1955.

Fire Research Station,
Station Road,
Boreham Wood, Herts.

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Introduction

In 1943 a technical panel sponsored by the Ministry of Home Security was formed under the Chairmanship of Mr. A. Bailey, to reconsider the design of existing firemens' helmets, and to devise a programme of tests for the acceptance of new designs. These tests are described in this note.

Description of tests

1. Impact test

(a) A weight of 14 lb (Fig 5/3) is to be dropped centrally, four times in succession, from a height of 12 ft. onto a helmet supported on a dummy head of wood, without the helmet losing shape or serviceability, or permitting damage to the wooden supporting block.

(b) The above test is to be repeated in such a manner that the weight strikes the crown of the helmet near to but clear of the comb. The shell must not be penetrated in this test.

2. Penetration test

A conical 2 lb. weight (Fig 5/1) is to be dropped from a height of 12 ft. with the pointed end downwards; onto the crown of the helmet, near to, but clear of, the comb. The weight must not penetrate the shell.

3. Shear test

A 10 lb, steel plate (Fig 5/2) is to be dropped edgewise across the comb of the helmet from a height of 12 ft. There must be no fracture of the shell.

4. Electrical resistance

Metallic contact is to be made over the whole area normally in contact with the wearer's head; the external surface of the helmet excluding the brim, is to be wrapped in a wet cloth to give intimate electrical contact throughout; a variable A.C. voltage is to be applied as follows:

(a) With the head cradle dry, the voltage is to be increased to 10,000 volts.

(b) as for test (a), but with the head cradle made damp;

(c) as for test (a), but with both the head cradle and the inside of the crown made damp.

No breakdown or "brush effect" must occur during these tests.

5. Flame resistance

A coal-gas flame from $\frac{1}{2}$ in. bunsen burner is to be brought into contact with the outer surface of the helmet, whilst it is rotated steadily through one complete revolution in a period of 34 seconds. There must be no flaming of the material or surface finish of the helmet and no irreparable damage.

6. Water resistance test

The helmet shell is to be completely immersed in water for a period of 24 hours and the increase in weight, after wiping off the surface water is to be measured. It should not exceed 2 per cent of the original weight.

Description of apparatus used for impact tests

Photographs and drawings of the apparatus used for impact tests are shown in Figs. 1 to 5.

A wooden block, shaped to the form of a human head (Draft British Standard and C.V.(P.S.M.) 836) is mounted at the top of a steel plate having a central longitudinal slot; the plate is sandwiched between an angle iron column and an outer steel plate each faced with strips of brake lining material, by the pressure of six springs which may be adjusted by means of six bolts and nuts. In the tests, the adjustment was such as to give a maximum static load of 250 lb. and was obtained by tightening the six nuts against a stop and then slackening back $\frac{1}{6}$ th turn.

A steel spindle which is a finish fit in a fibre bush in the wooden head-block (Fig 4/7) is set to measure the amount of depression of the helmet relative to the head cradle, due to impact.

The whole assembly is mounted on a heavy cast-iron base for stability.

In the tests, the appropriate weight is suspended vertically above the helmet by a piece of string. The string is burned through by a lighted taper to prevent disturbance of the weight and the weight is allowed to drop on to the helmet.

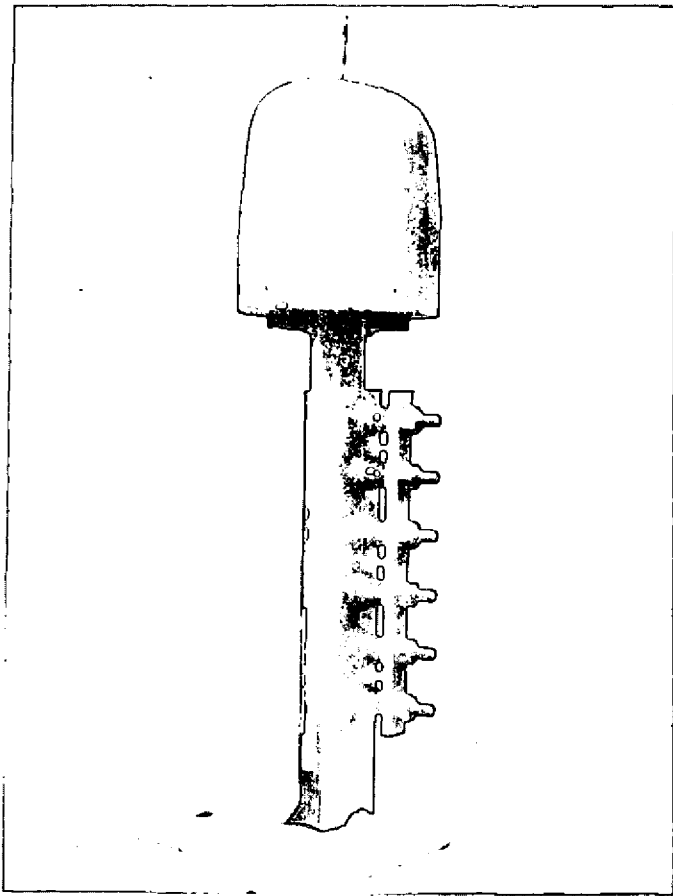


FIG. 1. HELMET TESTING APPARATUS.

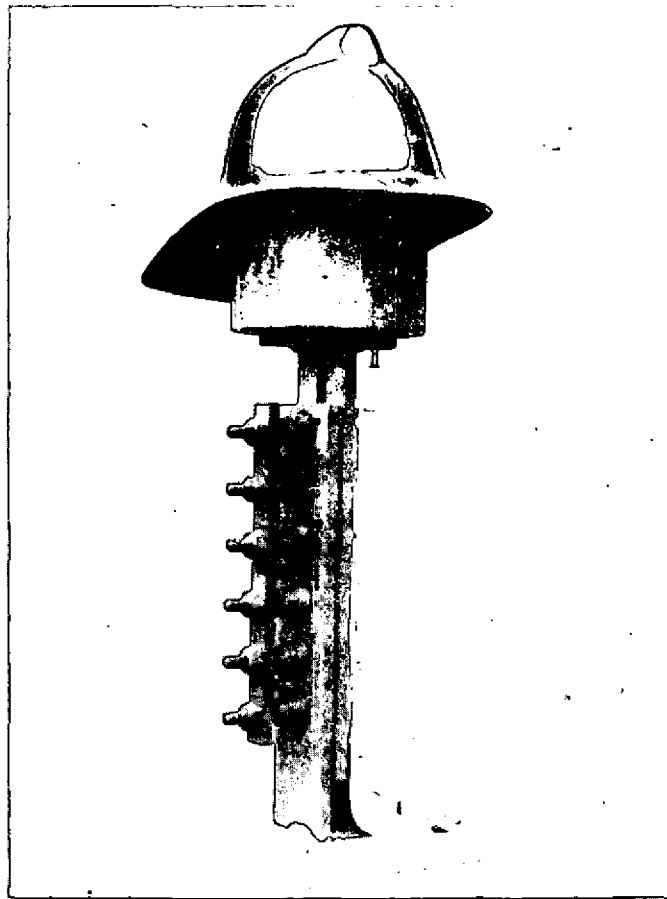


FIG. 2. APPARATUS WITH HELMET IN POSITION.

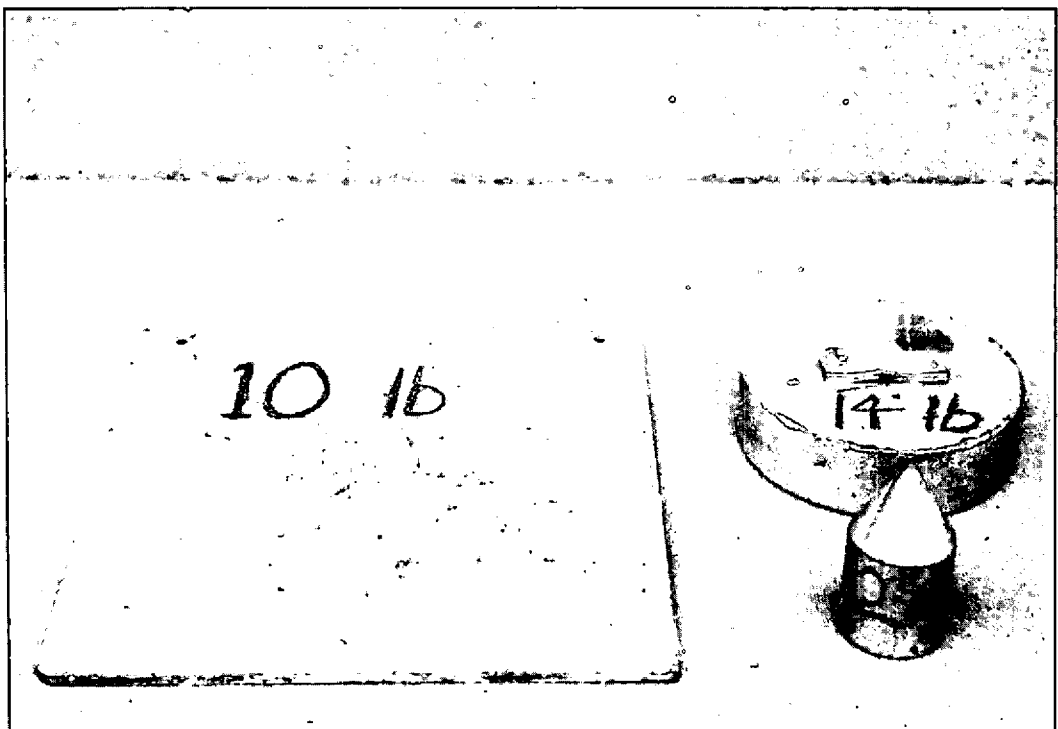


FIG. 3. TEST WEIGHTS.

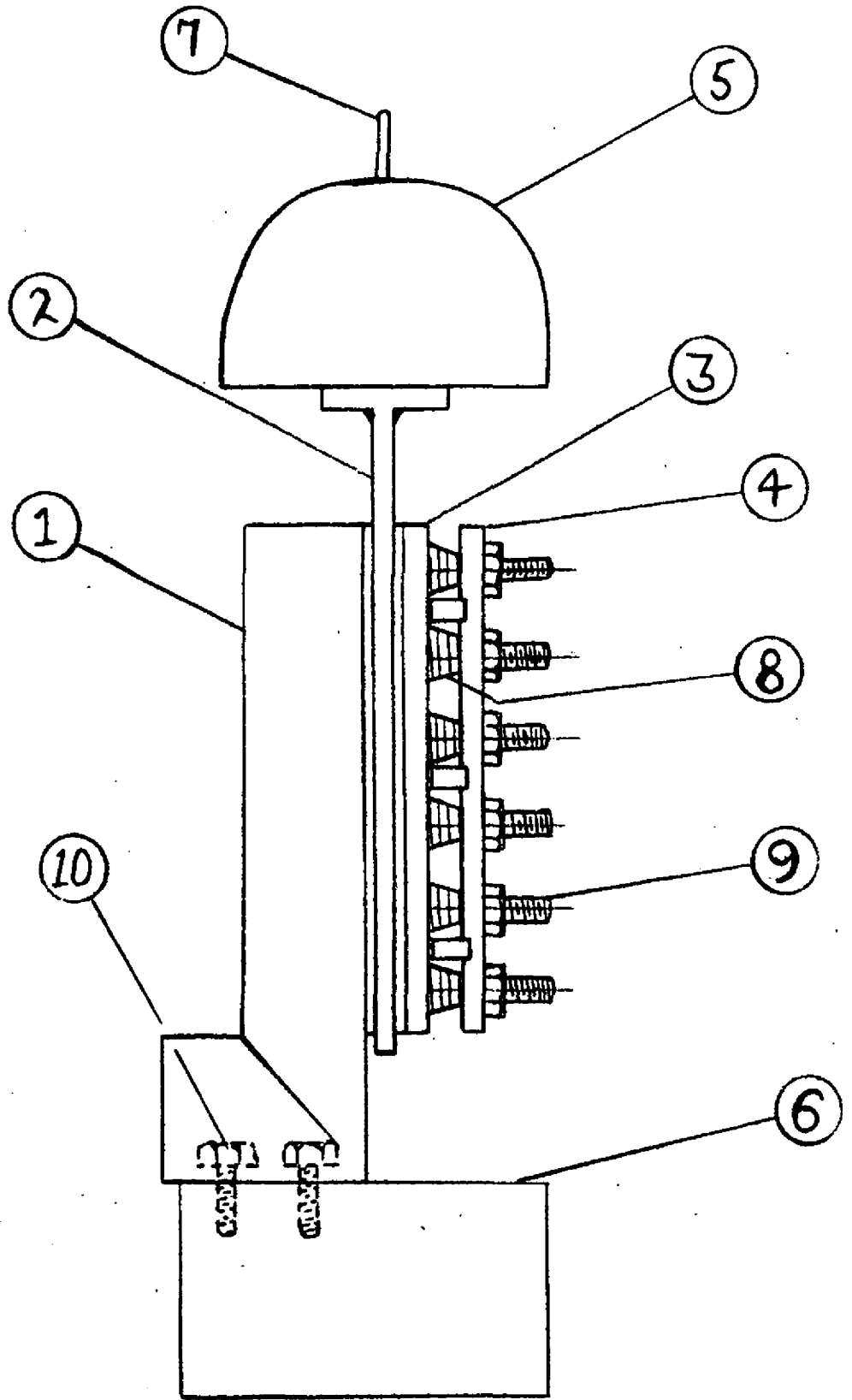


FIG 4 G.A. OF HELMET TESTING DEVICE

SCALE: 1/4

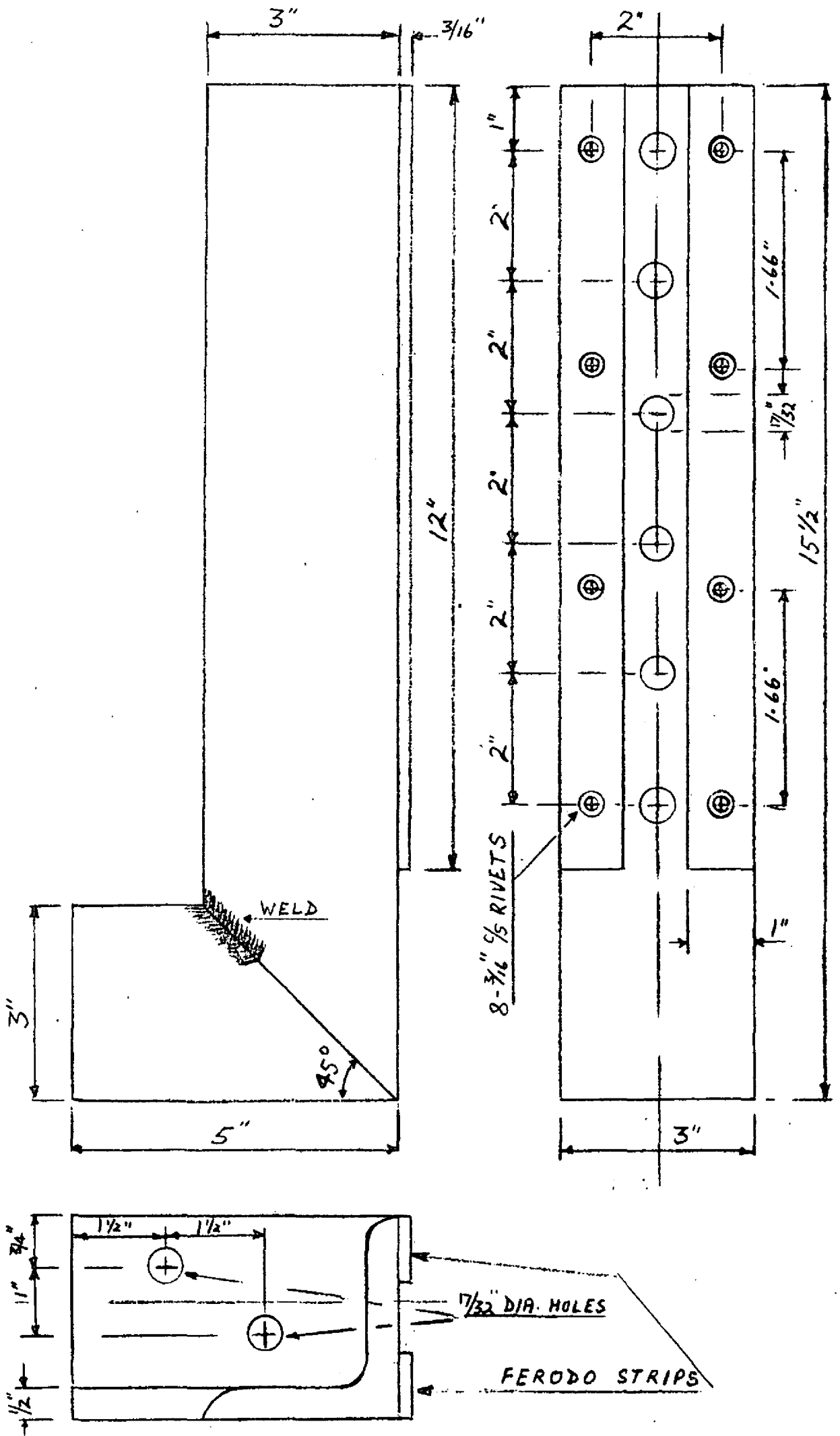


FIG. 4/1 PILLAR - 3" x 3" x 1/2" ANGLE IRON

SCALE 1/2

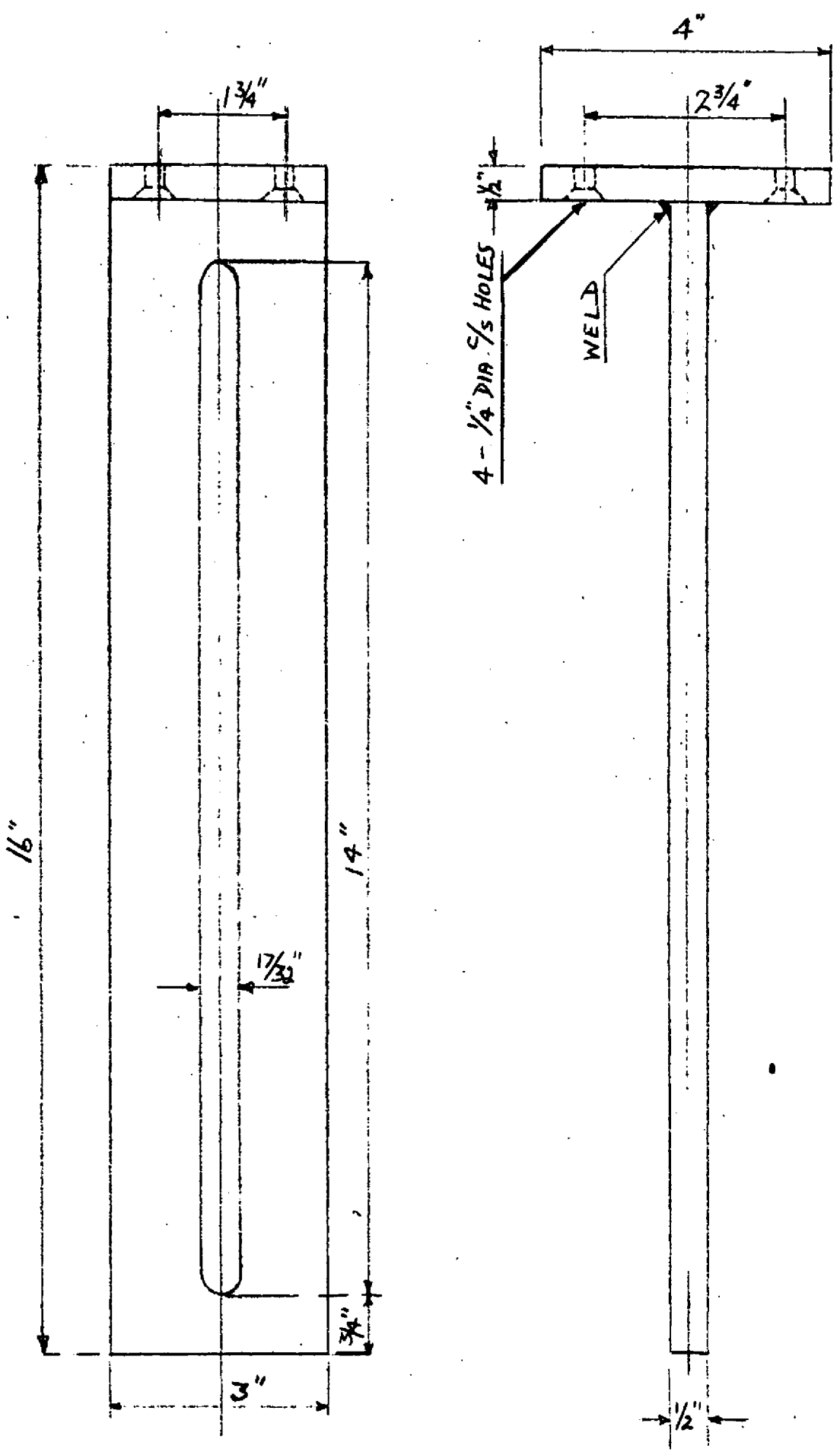
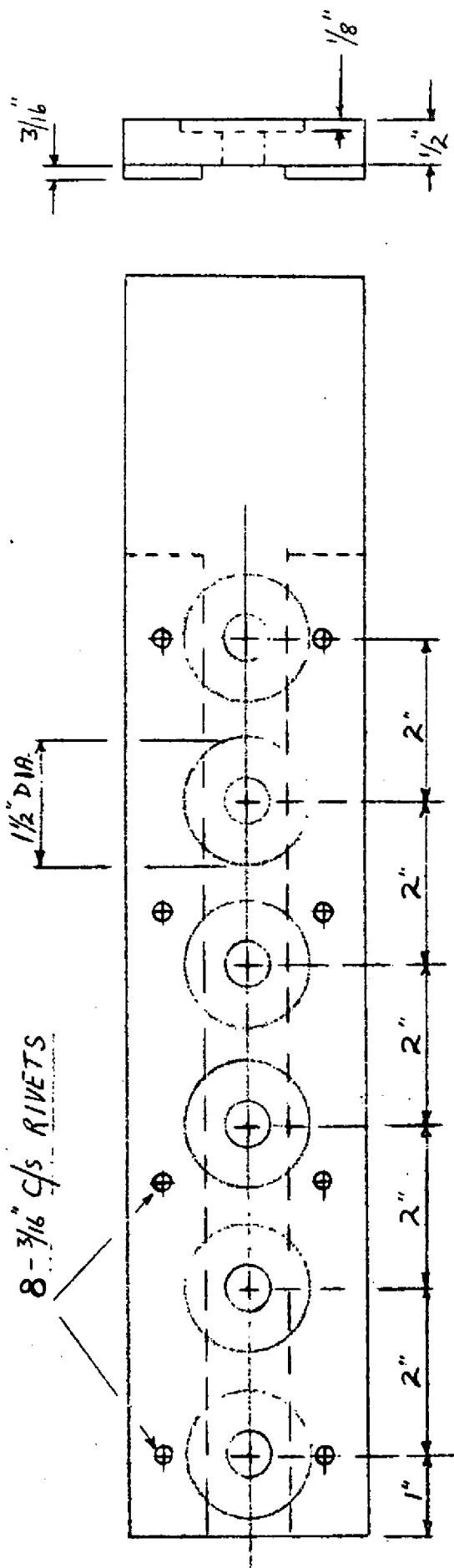
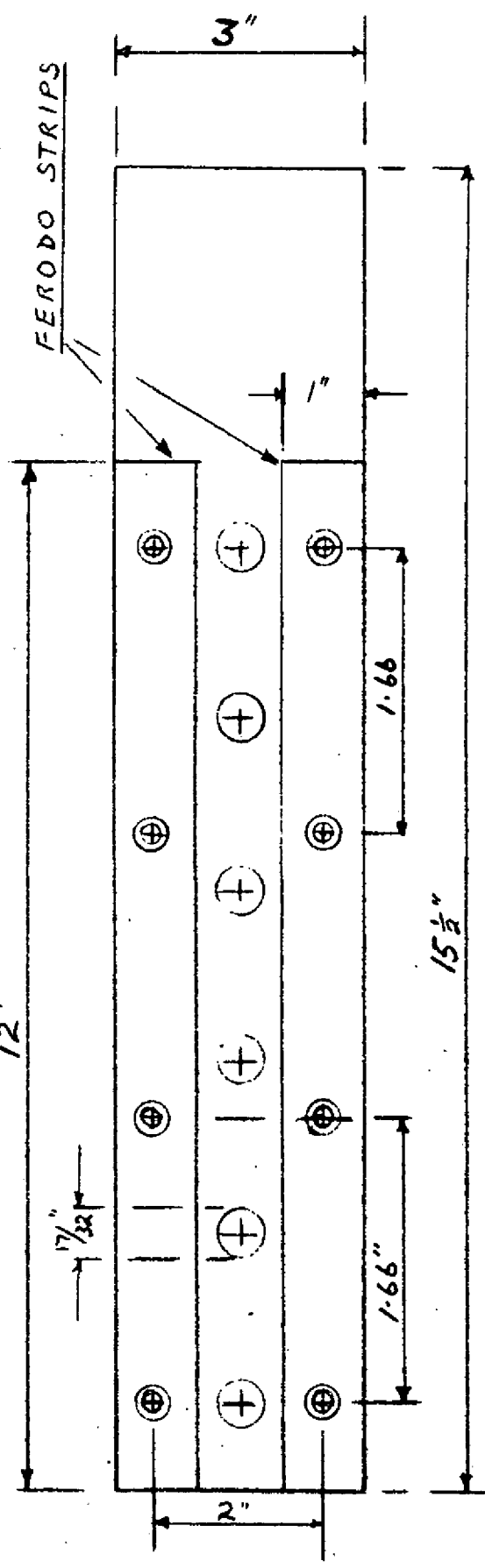


FIG 4/2 SLIDE M/S

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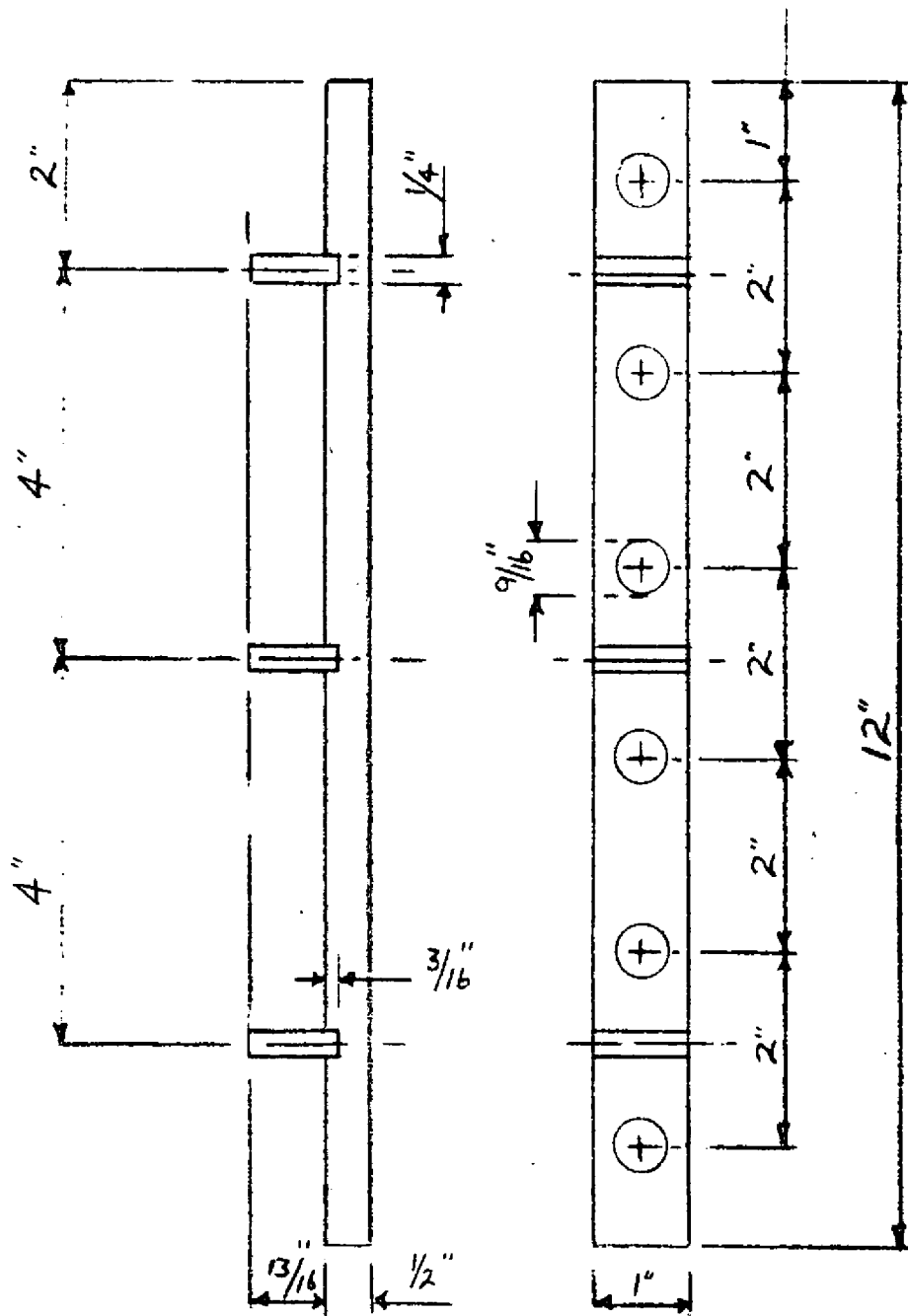
FRONT VIEW



BACK VIEW

SCALE: 1/2

FIG 4/3 OUTER STEEL PLATE M/S



SCALE: 1/2

FIG. 4/4 DISTANCE PIECE M/S

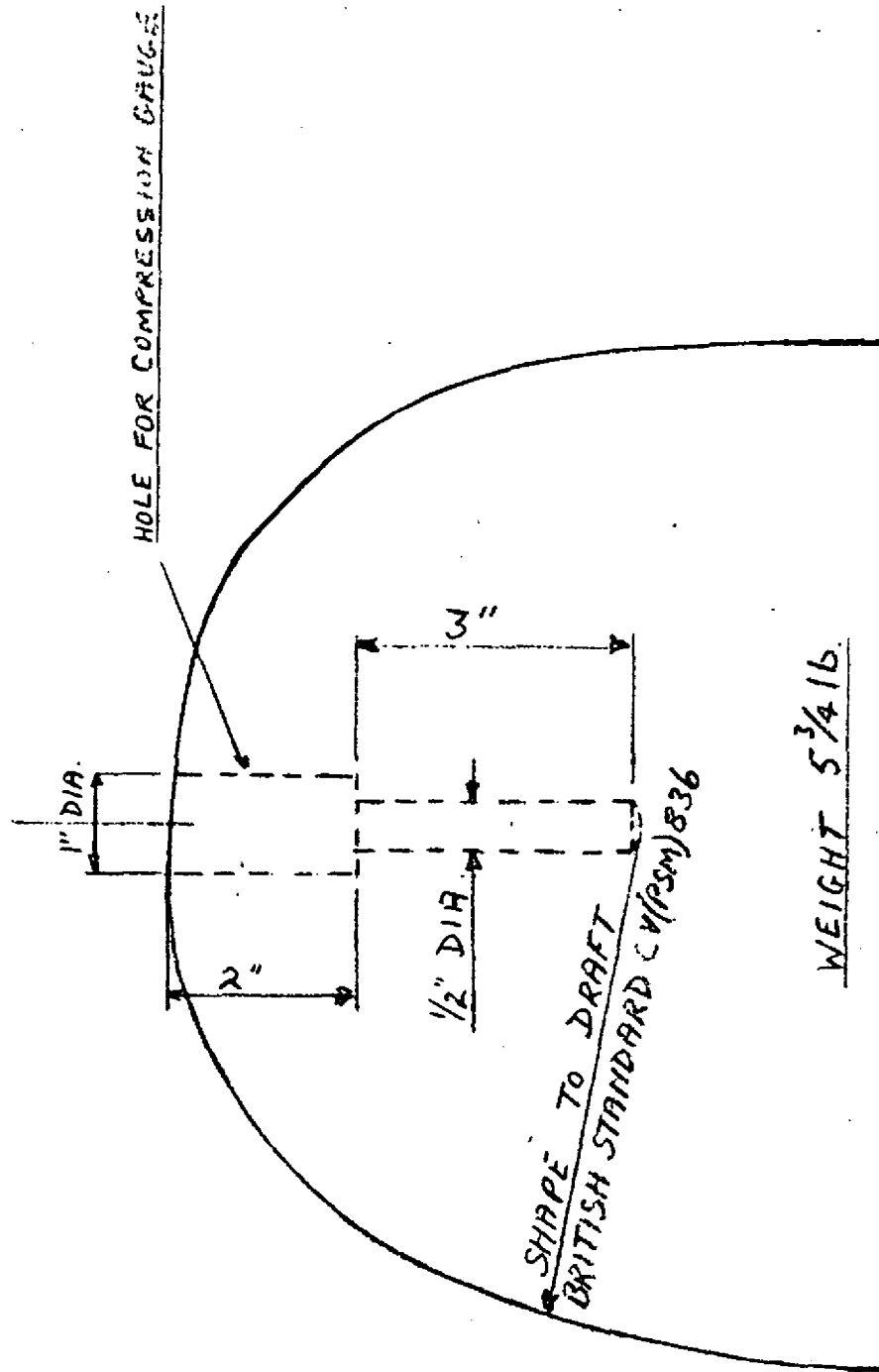
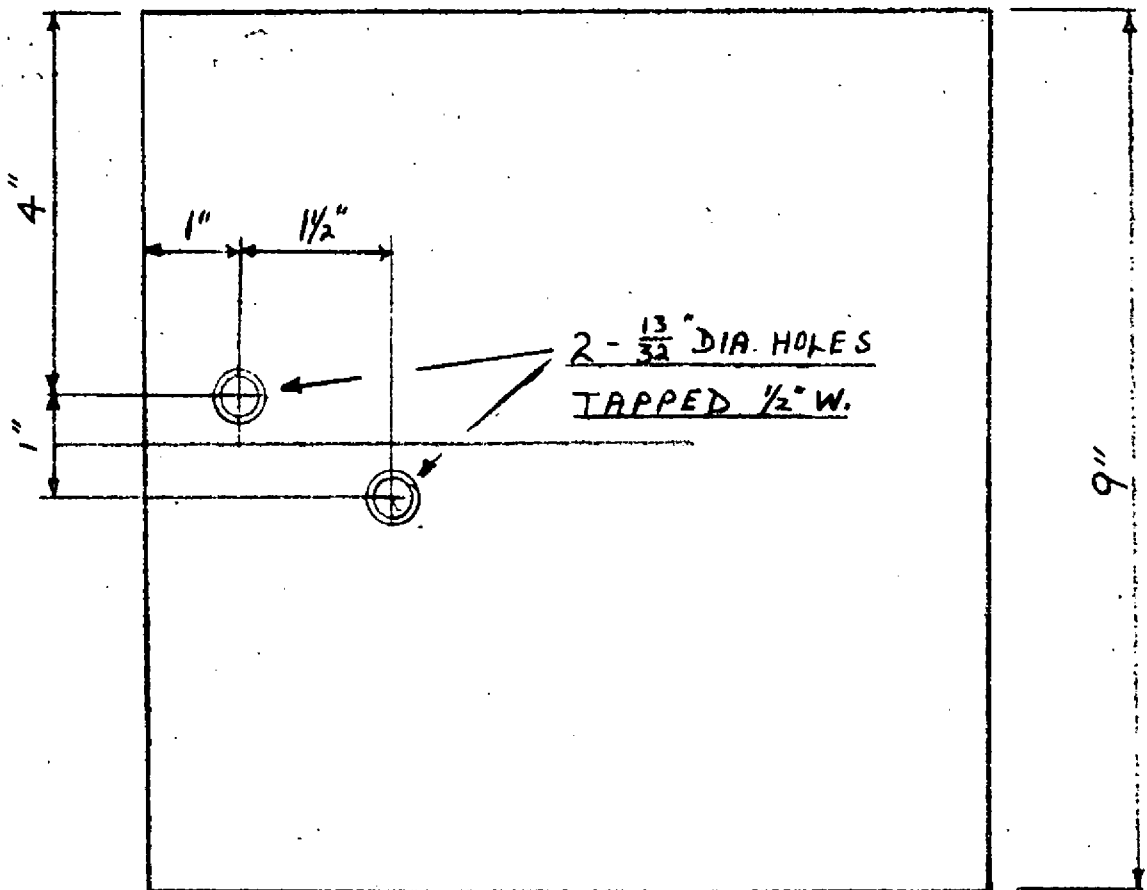
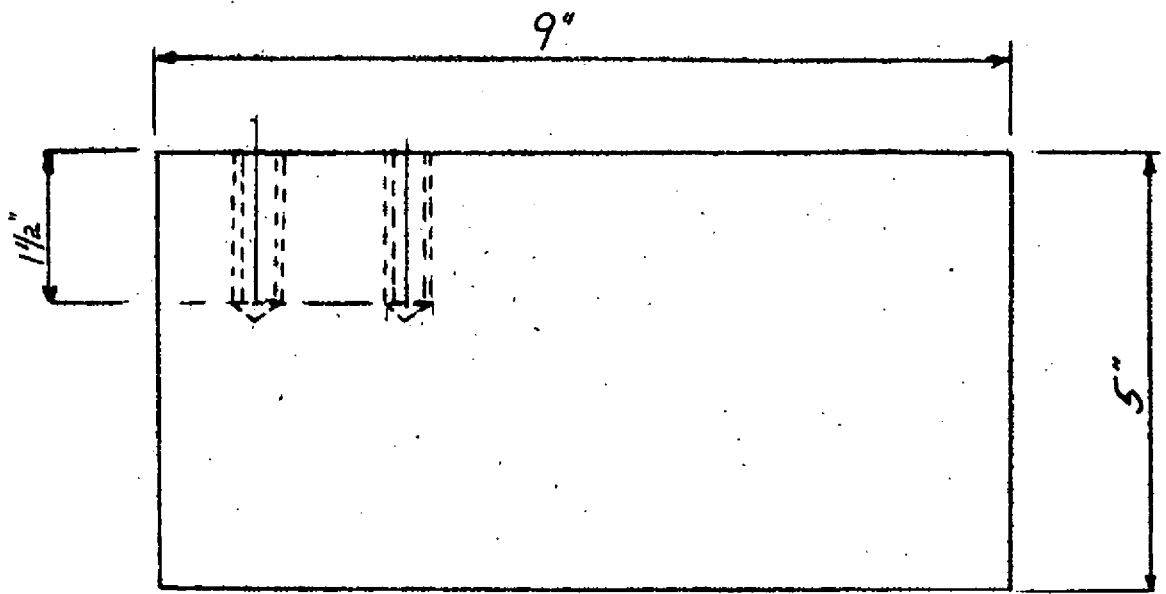


FIG. 4/5 WOOD HEAD BLOCK - BEECH



SCALE : 1/2

FIG. 4/6 BASE - CAST IRON

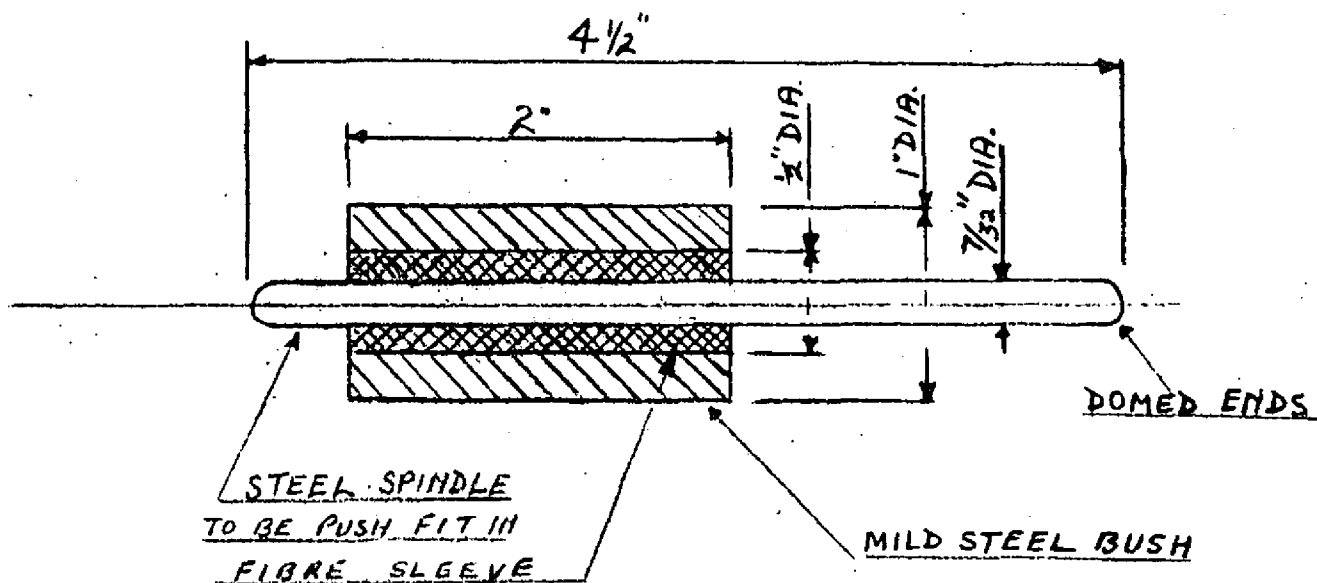
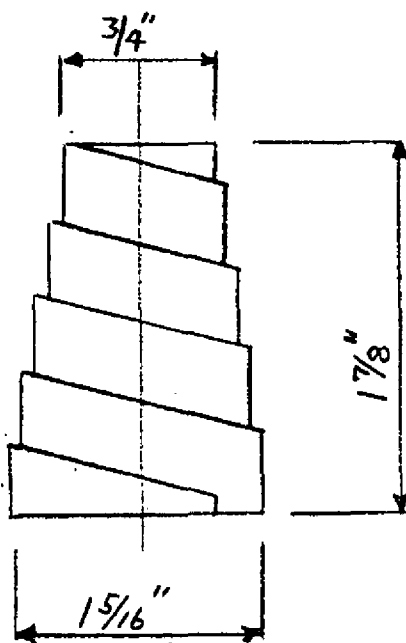


FIG 4/7 COMPRESSION GAUGE

SCALE: 1/1



SPRING

FIG 4/8 1/2" x 0.048" FLAT SPIRAL - 5 COILS

LOAD FOR 1" DEFLECTION - 60 LB

6 OFF

SCALE: 1/1

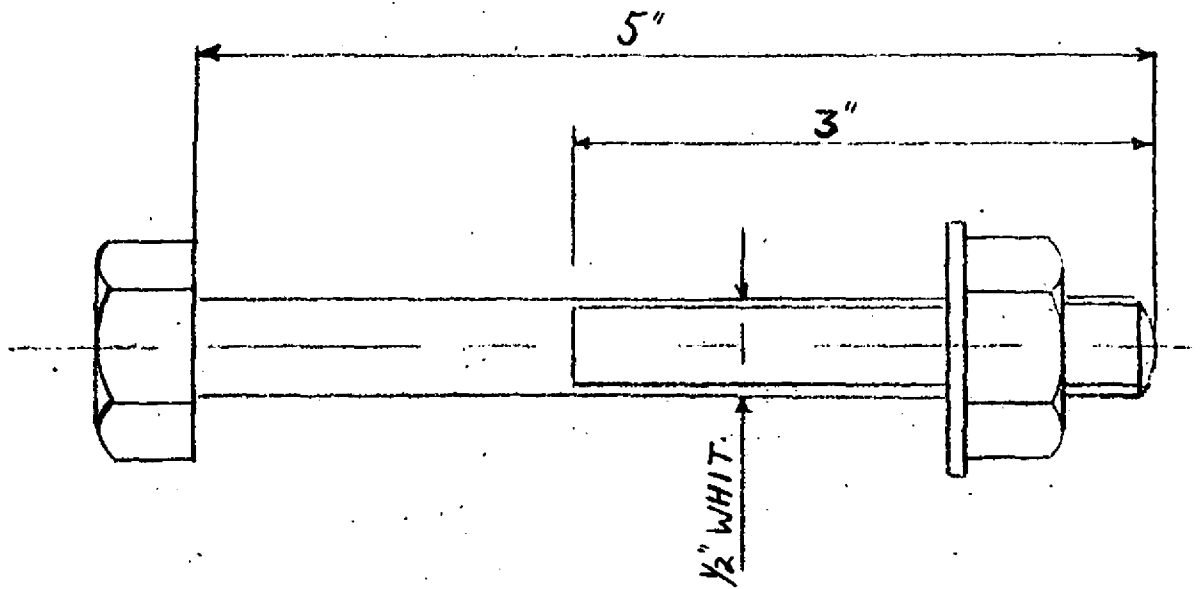


FIG. 4/9 1/2" WHIT. BOLT, NUT & WASHER

6 OFF EACH

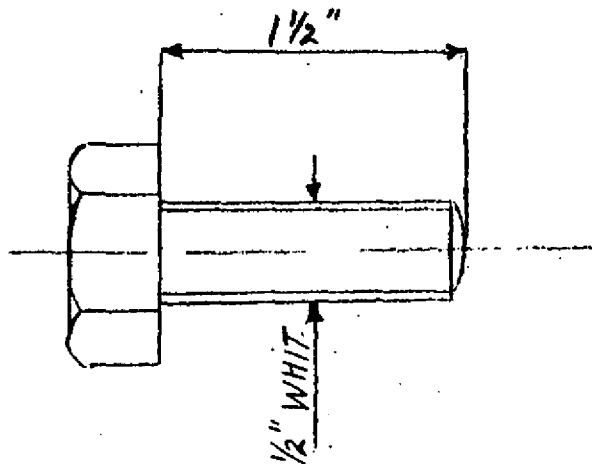


FIG. 4/10 1/2" WHIT. BOLT

2 OFF

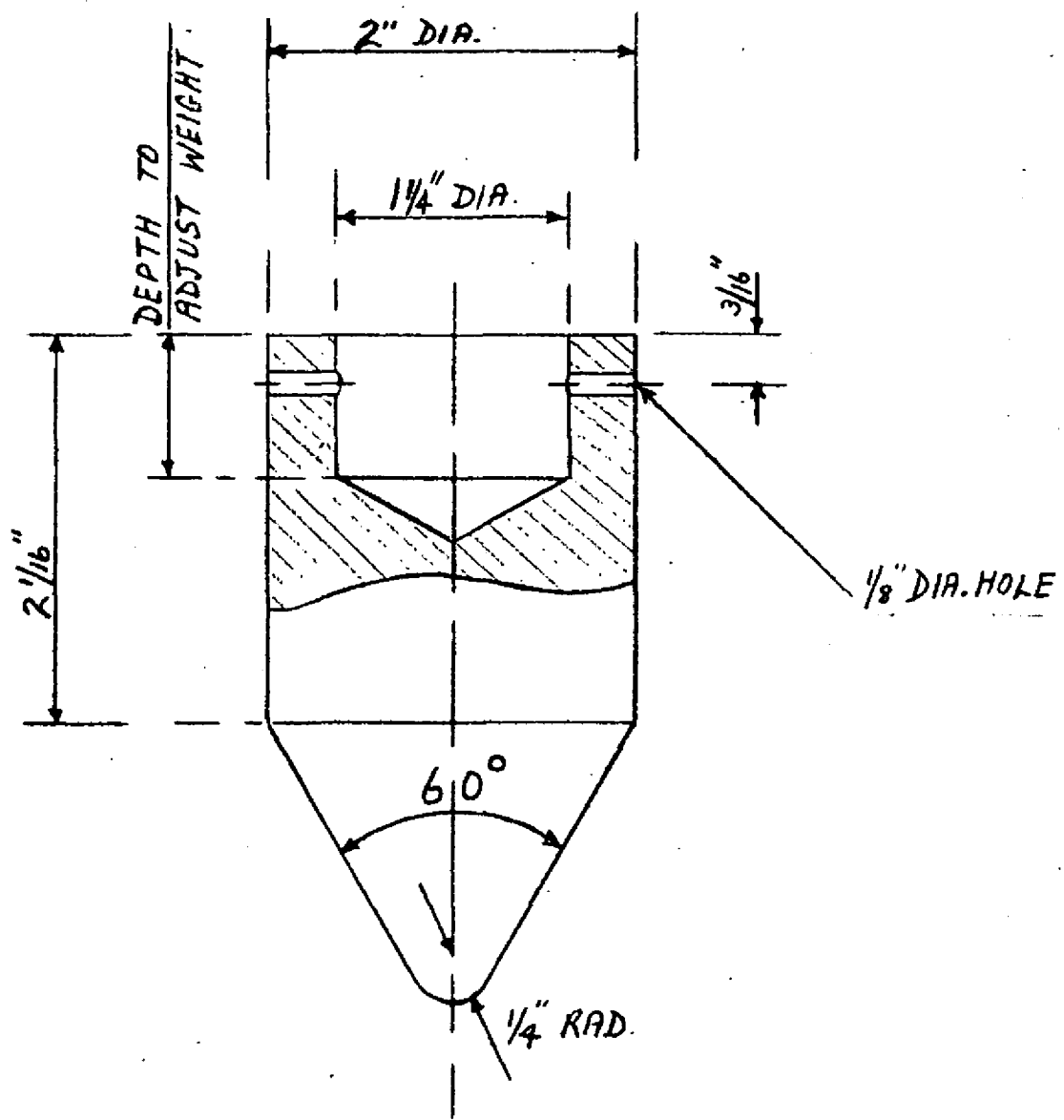
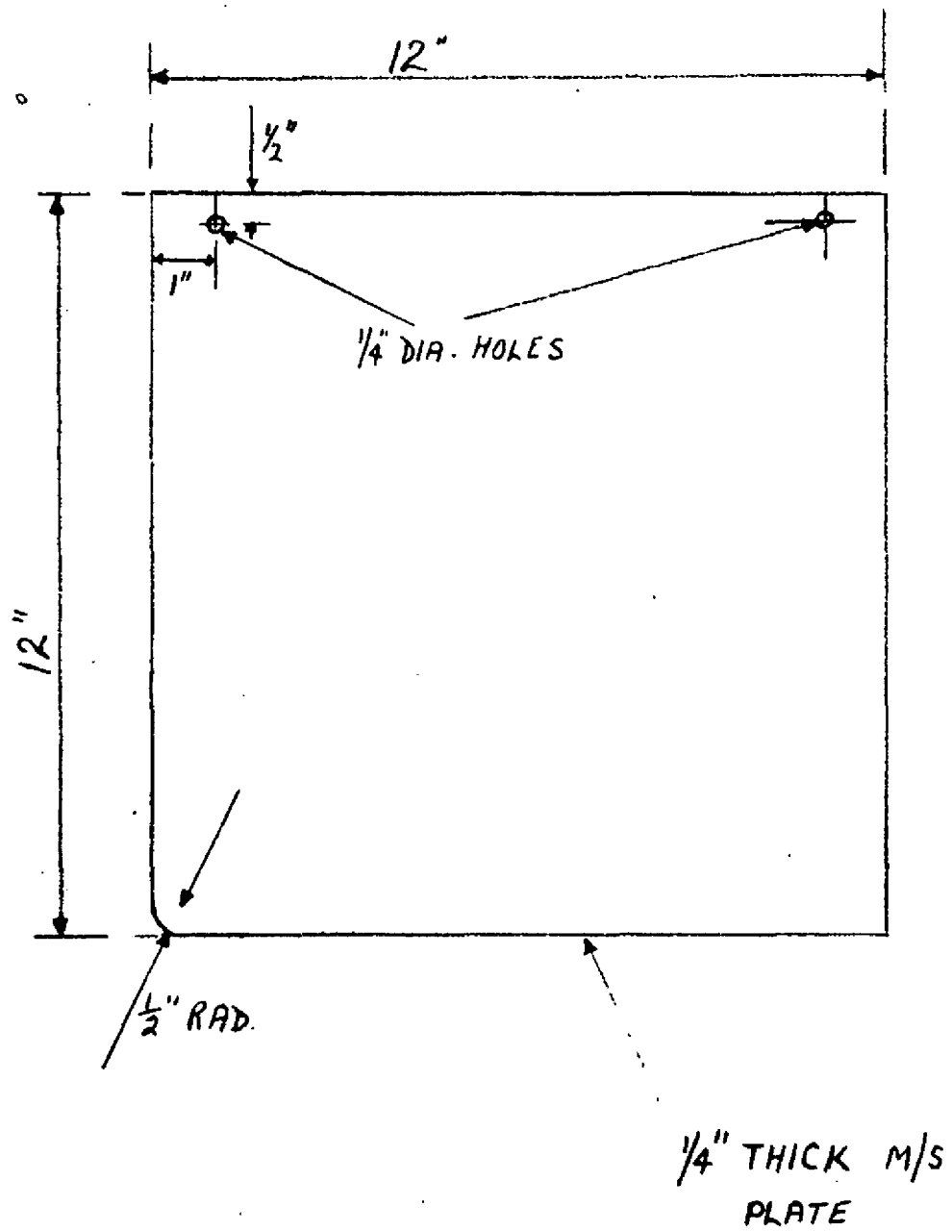


FIG. 5/1 PENETRATION TEST (216 M/S WEIGHT)



SCALE: 1/3

FIG. 5/2 SHEAR TEST (1016 WEIGHT)

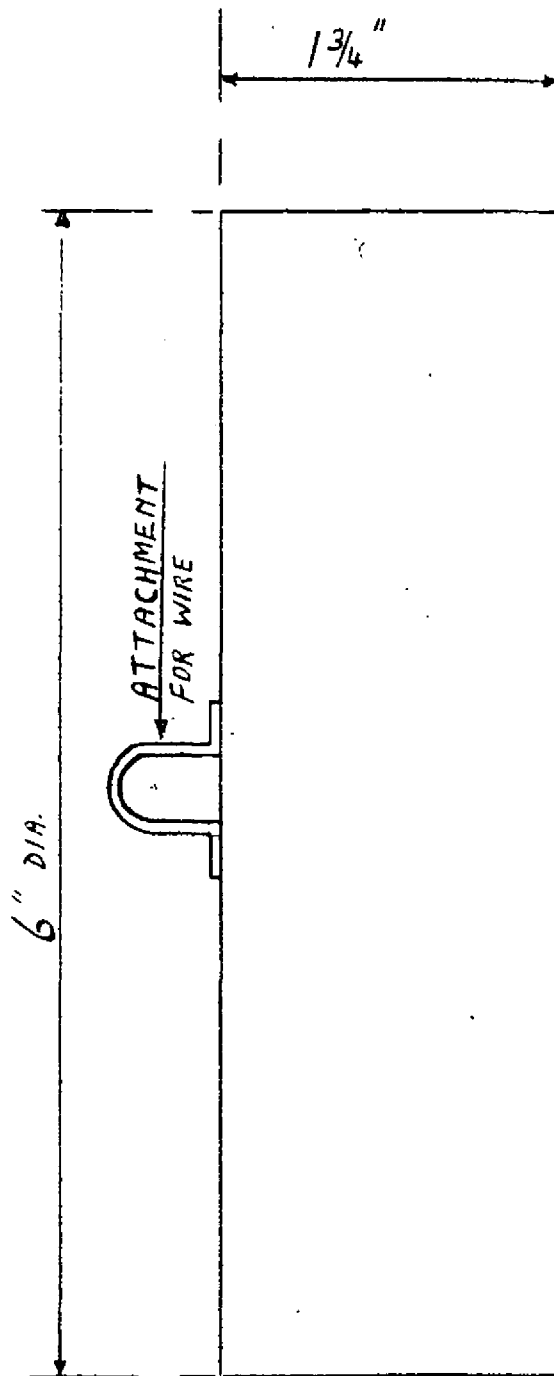


FIG. 5/3 IMPACT TEST (14 LB. M/S WEIGHT)