



(22) Date de dépôt/Filing Date: 2006/01/30

(41) Mise à la disp. pub./Open to Public Insp.: 2007/07/30

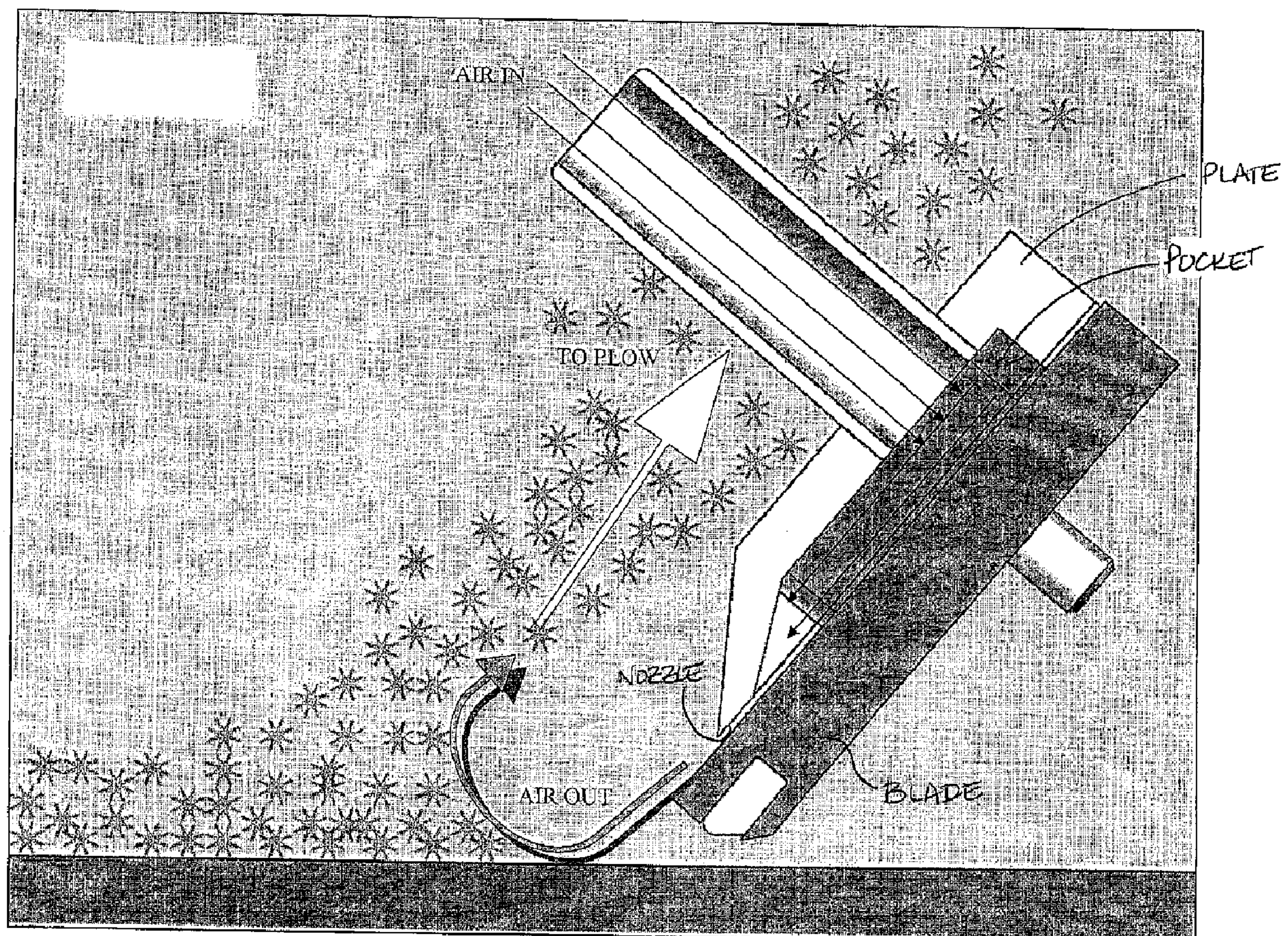
(51) Cl.Int./Int.Cl. *E01H 5/06* (2006.01),
E01H 5/07 (2006.01), *E01H 5/12* (2006.01)

(71) Demandeur/Applicant:
MSI MACHINEERING SOLUTIONS INC., TC

(72) Inventeurs/Inventors:
TESSIER, LYNN P., CA;
DOYLE, JOHN P., CA

(74) Agent: GOODWIN MCKAY

(54) Titre : APPAREIL DE DENEIGEMENT
(54) Title: SNOW REMOVAL APPARATUS



1 **“SNOW REMOVAL APPARATUS”**
2

3 **FIELD OF THE INVENTION**

4 Embodiments of the invention are related to apparatus used to
5 remove snow from roadways and the like and more particularly is directed
6 towards enhancements to blades used when plowing snow from roadways.
7

8 **BACKGROUND OF THE INVENTION**

9 Removal of snow and ice from roadways is of prime concern to
10 ensure optimum road safety under winter driving conditions. Further, surface
11 cleaning of airport runways, race tracks and the like to remove water, snow, ice
12 and debris, is a prime safety concern. Significant resources are expended by all
13 levels of government and others in order to achieve optimum road conditions.
14 Snow and ice removal however can be less than optimum due to the lack of high
15 efficiency snow removal apparatus or systems and the high cost associated with
16 more complex technologies to remove snow and ice or to reduce its
17 accumulation on roadways

18 In many jurisdictions roads are plowed using a variety of equipment
19 including, but not limited to, bulldozers equipped with scraper blades, graders,
20 front end loaders, sweepers and the like equipped with plow-shaped angled or
21 curved snow scrapers and snowplows having one or two-sided plow-shaped
22 blades which direct snow to a blower. Typically, a metal ground engagement tool
23 (GET) is affixed to a bottom edge of the blade and the GET engages the road
24 surface to scrape snow and ice. The accumulated snow and ice is usually
25 directed by the blade to be deposited along the side of the roadway.

1 Engagement between the blade and the pavement results in deterioration of
2 both the blade and the pavement necessitating replacement of the GET at
3 regular intervals to maintain optimum removal and may result in a deterioration
4 of the surface of the roadway over time.

5 Others have introduced rubber snowplow blades to provide a more
6 flexible blade which can more positively engage the road surface and increase
7 the removal of snow and ice therefrom while reducing damage to the road
8 surface.

9 It is well known to apply salt or a mixture of salt and an abrasive,
10 such as sand, to the surface of roadways to assist in melting snow and ice
11 accumulated thereon. The use of salt on the road surface acts to enhance
12 removal of snow and ice both by vehicular traffic and by clearing with the
13 snowplow blade. It is known to replace crystalline road salt with pre-wetted salt
14 which comprises a small amount of liquid de-icer added to the road salt. The pre-
15 wetted salt stays on the road better and works more quickly than dry salt.
16 Further, it is known to use a variety of deicing chemicals for reactive and
17 proactive deicing of road surfaces.

18 Use of chemical deicers and road salt can have serious detrimental
19 effects on air quality, surface and ground water, vegetation, soil, wildlife and can
20 enhance vehicle and structural corrosion. Thus, use of salt and other deicers has
21 come under strict review and legislation is being put into place to govern its use
22 and storage. One such legislation is the Code of Practice for the Environmental
23 Management of Road Salts of April 2004, Canadian Environmental Protection
24 Act, 1999 (CEPA 1999) which outlines the environmental indicators for road

1 salts, provides guidance for areas vulnerable to road salts, outlines a salt
2 management plan and a monitoring and measuring progress.

3 Others have attempted to use jets of pressurized air to assist in
4 removing snow plowed from the road surface. US Patent 4,885,852 to
5 Gudmundsson teaches a curved scraper blade having a passageway formed
6 behind the scraper for expelling air from an air supply therethrough to direct un-
7 compacted snow from hindrances along the roadside and compacted snow lifted
8 by the scraper through the passageway and directed outward to the side of the
9 road. Air acts to move snow which is lifted by the scraper.

10 German Patent application DE 103 04 443 A1 to Merlaku,
11 published August 19, 2004 teaches using a plurality of compressed air nozzles
12 directed toward the roadway and positioned immediately above the road surface
13 for removing compacted snow and ice therefrom. The nozzles can be tilted
14 electronically to adjust the angle of incidence of the air with the roadway. A
15 compressor mounted on a truck supplies the nozzles, which are mounted either
16 at a lower edge behind a front-mounted scraper blade or at the rear of a
17 snowplow, with compressed air. The force of the air is sufficient to disrupt the
18 snow and ice without direct contact of the blade with the road surface.

19 There is a need for systems and apparatus which assist in
20 optimizing snow and ice removal from roadways while minimizing the use of road
21 salt and other environmentally detrimental chemicals. Further there is a need for
22 apparatus which can be implemented without significant additional cost and
23 which are relative simple to manufacture and utilize.

24

1 Having reference to Fig. 37, the novel snowplow blade design
2 generates a substantially planar air jet from the nozzles which flows down the
3 leading surface of the plow blade to lift snow off the roadway and to deflect the
4 snow upwards into the plow. As the jet of air from the nozzle extends
5 substantially beyond the tip of the plow blade, snow is removed from the road
6 surface even when the plow blade is not in contact with the road surface. The
7 plate, which creates the nozzles, is positioned above the edge of the plow blade
8 and the road surface permitting higher plowing speeds and reduced wear on the
9 plow blade.

10 Having reference to Figs. 2, 5-6, 10, 13-15, 21, 23-26, 29, 32 and
11 33, a plurality of pockets are machined at intervals along an inner surface of the
12 longitudinally extending plate. Preferably, the pockets are generally triangular in
13 shape, having the broadest extent of the pocket at a lower discharge edge of the
14 plate. An air inlet is provided to the pocket adjacent the apex of the pocket near
15 the upper end of the plate. In one embodiment, the air inlet is connected to an air
16 hose extending from an air manifold, which is mounted on the scraper blade, for
17 example at a top of the scraper blade.

18 In one embodiment, the air manifold is bolted to a rubber skirt
19 found at the upper edge of a conventional curved scraper blade and the hoses
20 extend therefrom along the curve of the blade for attachment to the air inlets.

21 In another embodiment the manifold is mounted behind or
22 incorporated into a mold board of the scraper blade. Openings are machined
23 through the blade to conduct air to the pockets in the plate.

24 A lower edge of the longitudinally extending plate, typically, the
25 angled tip of the conventional blade which has been modified to act as the plate,

1 is angled to extend inwardly toward the scraper blade lying thereunder, at the
2 bottom of each pocket. The lower edge of the plate is preferably mounted about
3 1 to 1 ½ inches offset above the lower edge of the scraper blade. Preferably,
4 seals are positioned between the plate and the blade to prevent loss of air.

5 In a first embodiment, as shown in Figs. 2-8, the nozzle gaps are
6 formed by inserting a thin shim between the longitudinally extending plate and
7 the inner surface of the lower leading edge of the scraper blade. The shim acts
8 to create a plurality of laterally spaced discrete nozzle discharges and the nozzle
9 gaps at the bottom of the pockets which permits air to be directed outwards
10 therefrom.

11 In another embodiment, shown in Figs. 9-36, a nozzle gap is
12 machined as part of the base of each pocket and extending therefrom to a tip
13 edge of the longitudinally extending plate along the extent of the pocket and the
14 longitudinally extending plate is bolted directly to the scraper blade.

15 In a preferred embodiment, the pockets machined in the plate are
16 positioned between bolt holes formed in the plate, which are patterned for
17 alignment with the bolt hole pattern on the scraper blade. Small amounts of
18 plate material are left along the lower edge of the plate to create more than one
19 laterally spaced nozzle for each pocket to add structural rigidity to the plate and
20 to provide dimensional stability to the nozzle gaps.

21 The plate may be formed in one or more pieces. A center plate
22 (Figs. 13-22) is bolted to a center portion of the scraper blade and end section
23 plates (figs. 23-36) are bolted to the scraper blade on either side of the center
24 plate so as to create nozzles along a portion or along the full extent of the lower
25 leading edge of the scraper blade. As shown in Figs 32 and 33, in the preferred

1 embodiment, each end pocket of the end units are shaped so as to extend
2 outwards to an outer extent of each of the end units.

3 Compressed air is provided to the nozzles from a compressor
4 mounted to the vehicle on which the scraper blade is attached. Sufficient
5 compressed air is supplied to result in an optimum pressure exiting the nozzles
6 of approximately 30 psi, at an optimum flow rate of 1600 cfm. One of skill in the
7 art would understand that pressures, flow rates and gap sizing ranging about the
8 optimum would be operable in the system as described.

9 In order to achieve a range of optimum pressures and flow rates
10 without exceeding the ability of conventional vehicle-mountable compressors to
11 provide sufficient compressed air, the nozzle gap is preferably in a range of
12 about 0.020 to 0.060 inches. Most preferably, the nozzle gap is 0.020 inches
13 which provides a substantially planar flow of air therefrom. Nozzle gaps of
14 significantly smaller dimension are likely to result in turbulent air patterns which
15 are less efficient for removal of compacted snow and ice. Nozzle gaps of greater
16 than 0.060 inches would require prohibitively large compressors to achieve the
17 desired pressures and flow rates.

Fig. 1

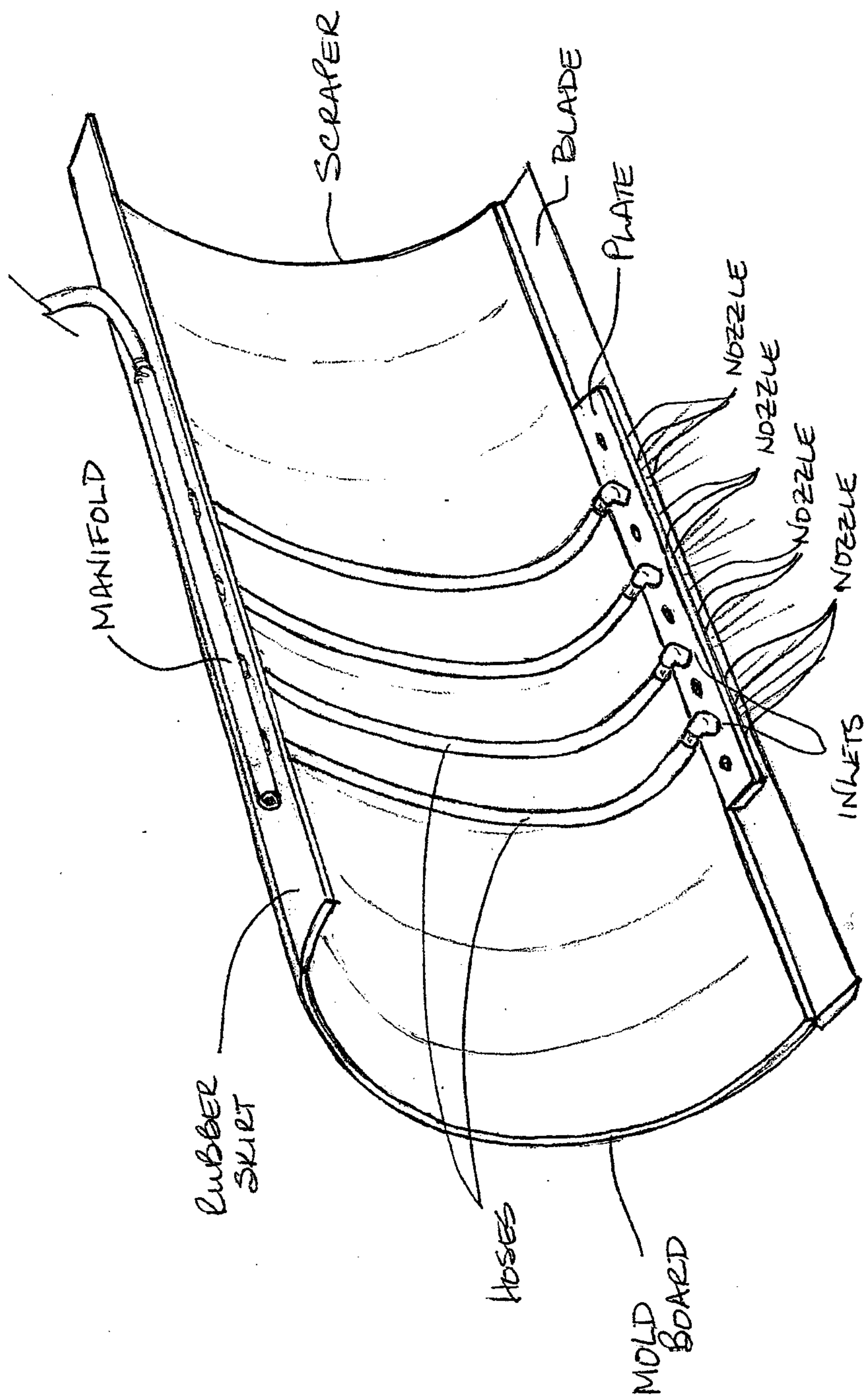


Fig. 5

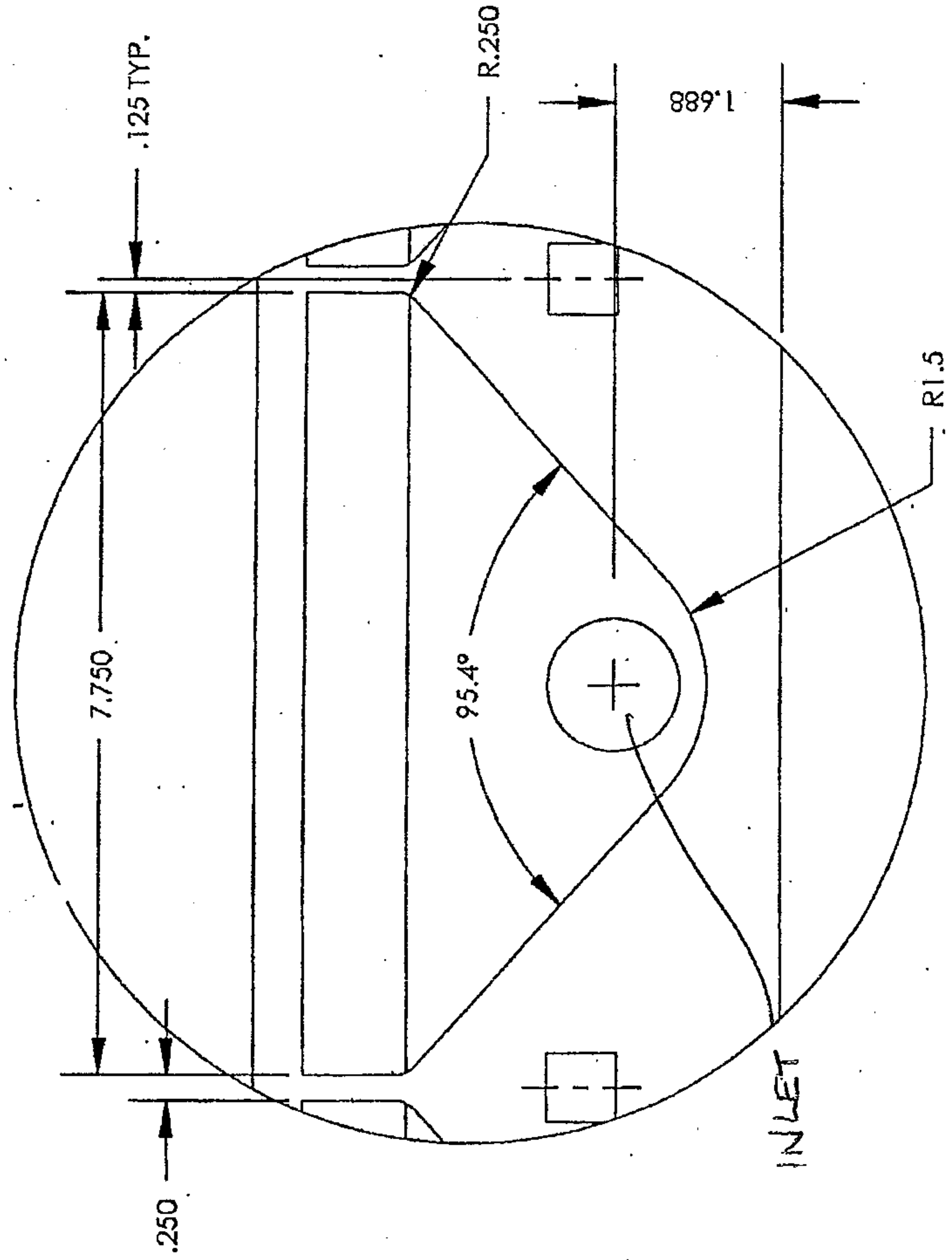
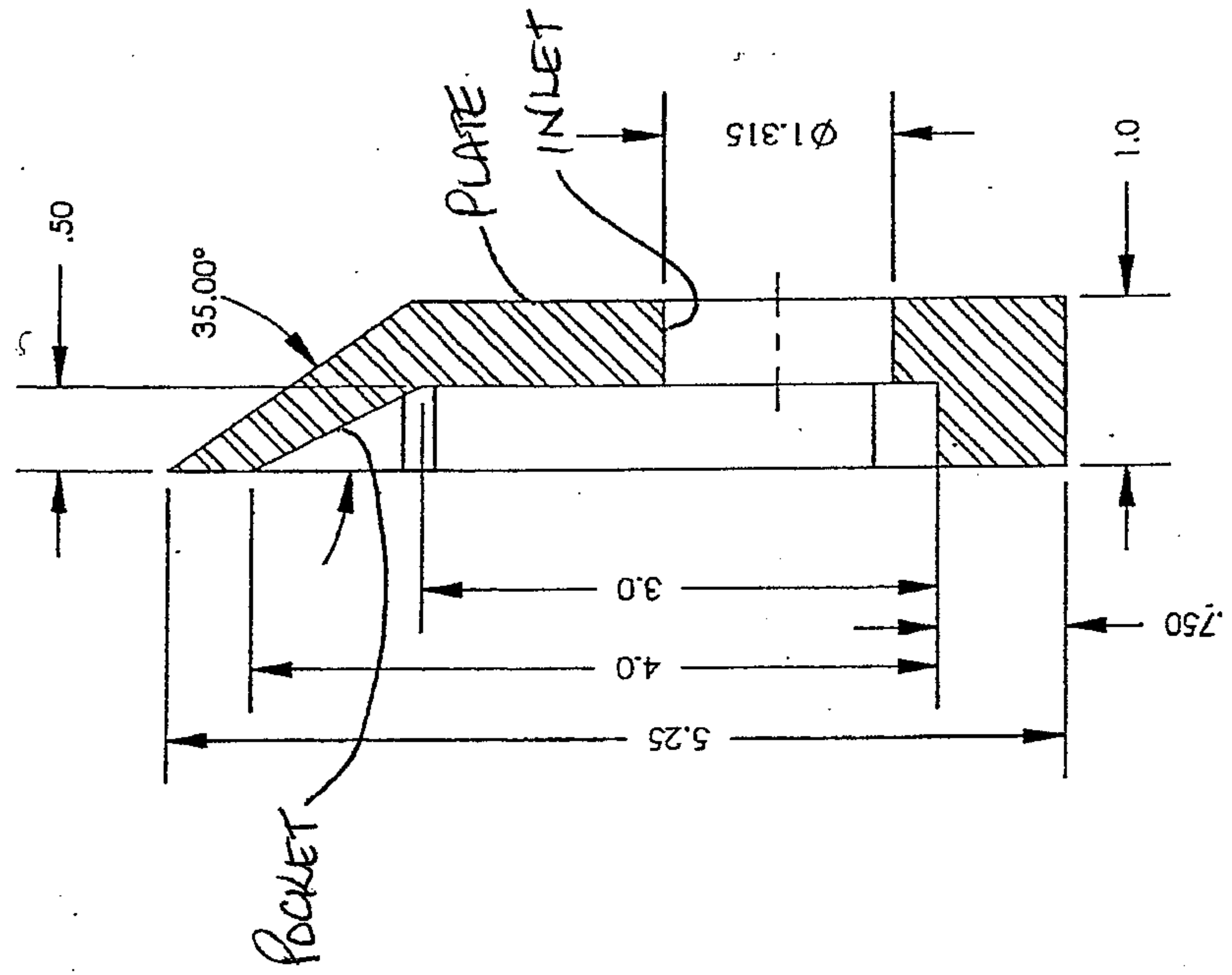
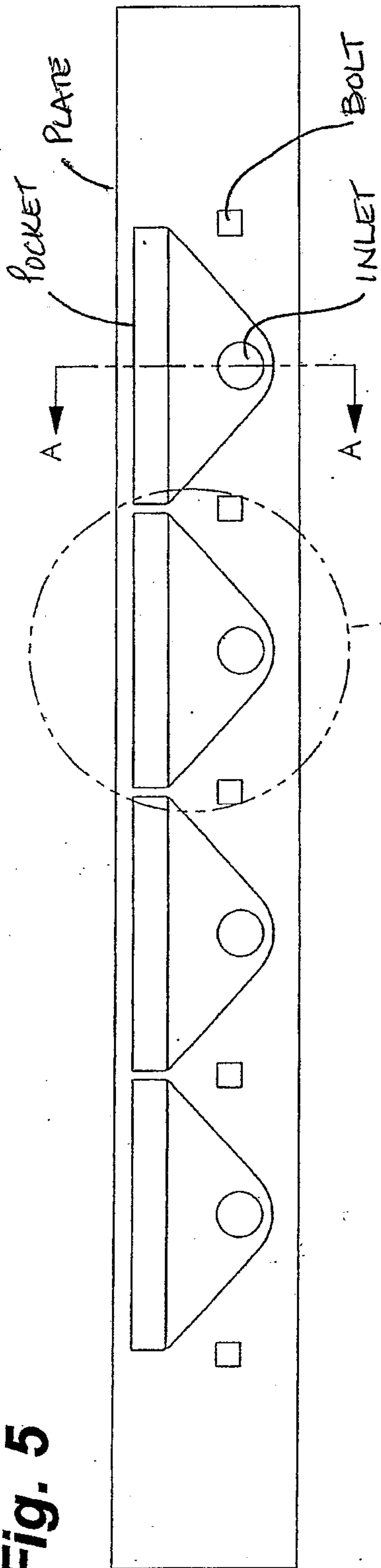


Fig. 6

Fig. 7

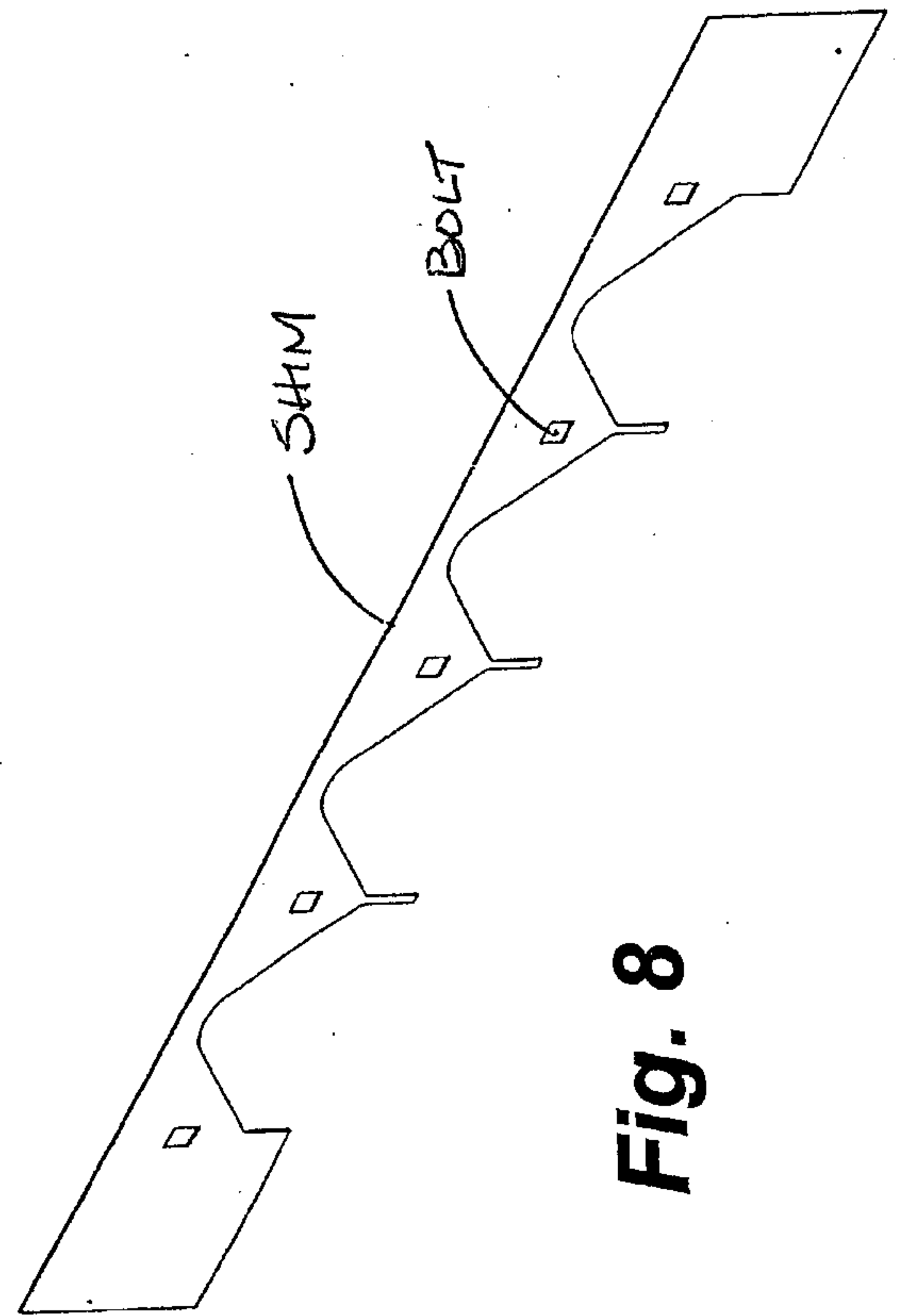
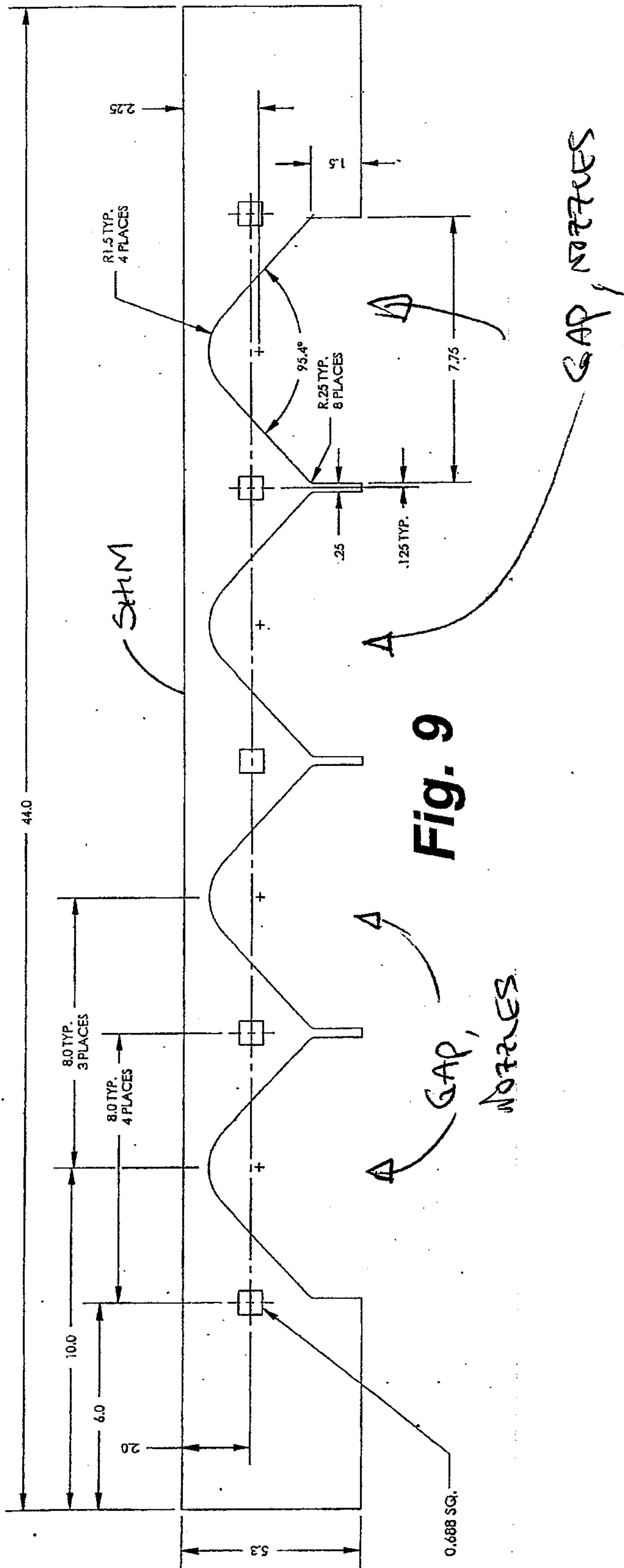


Fig. 8

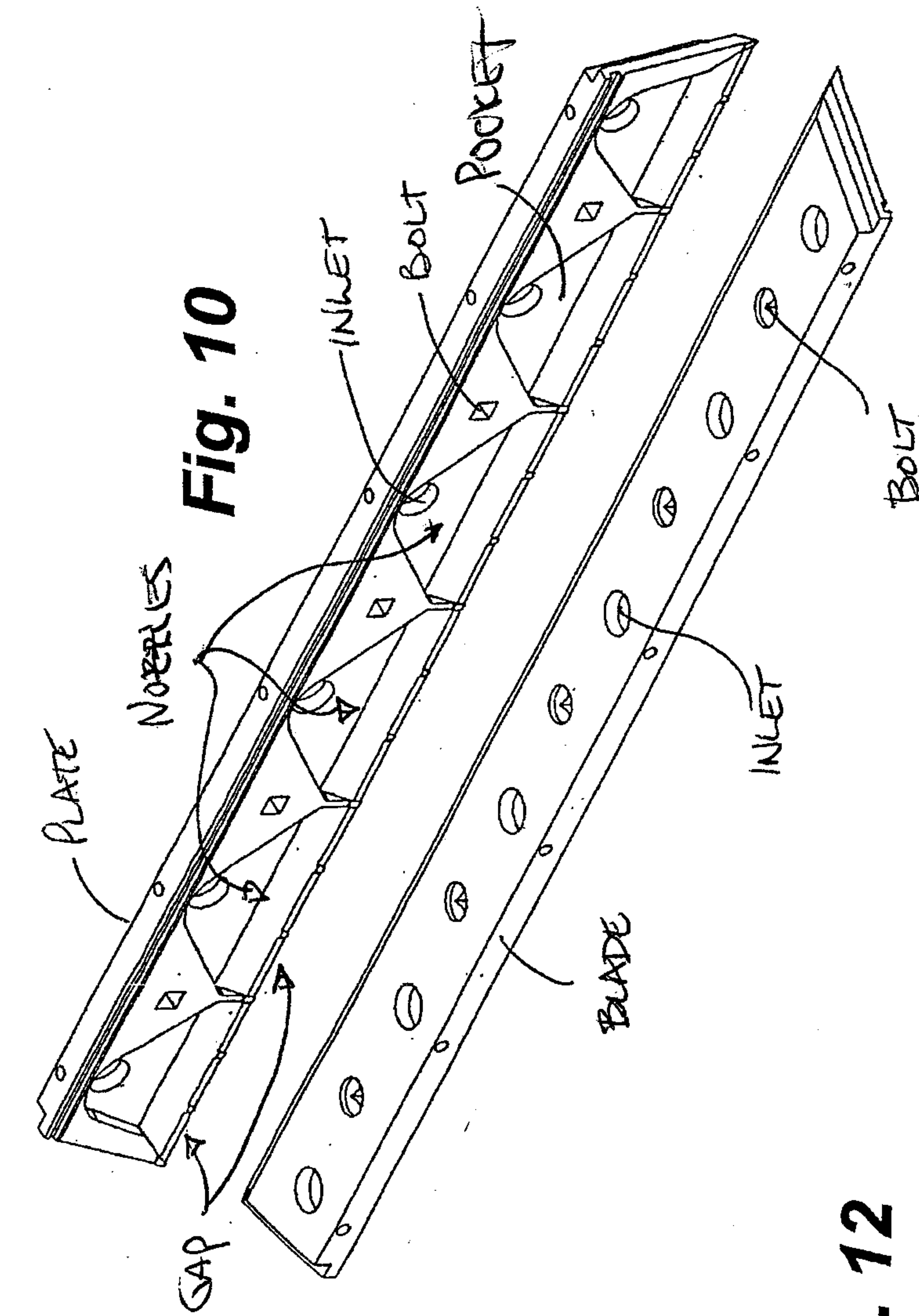


Fig. 10

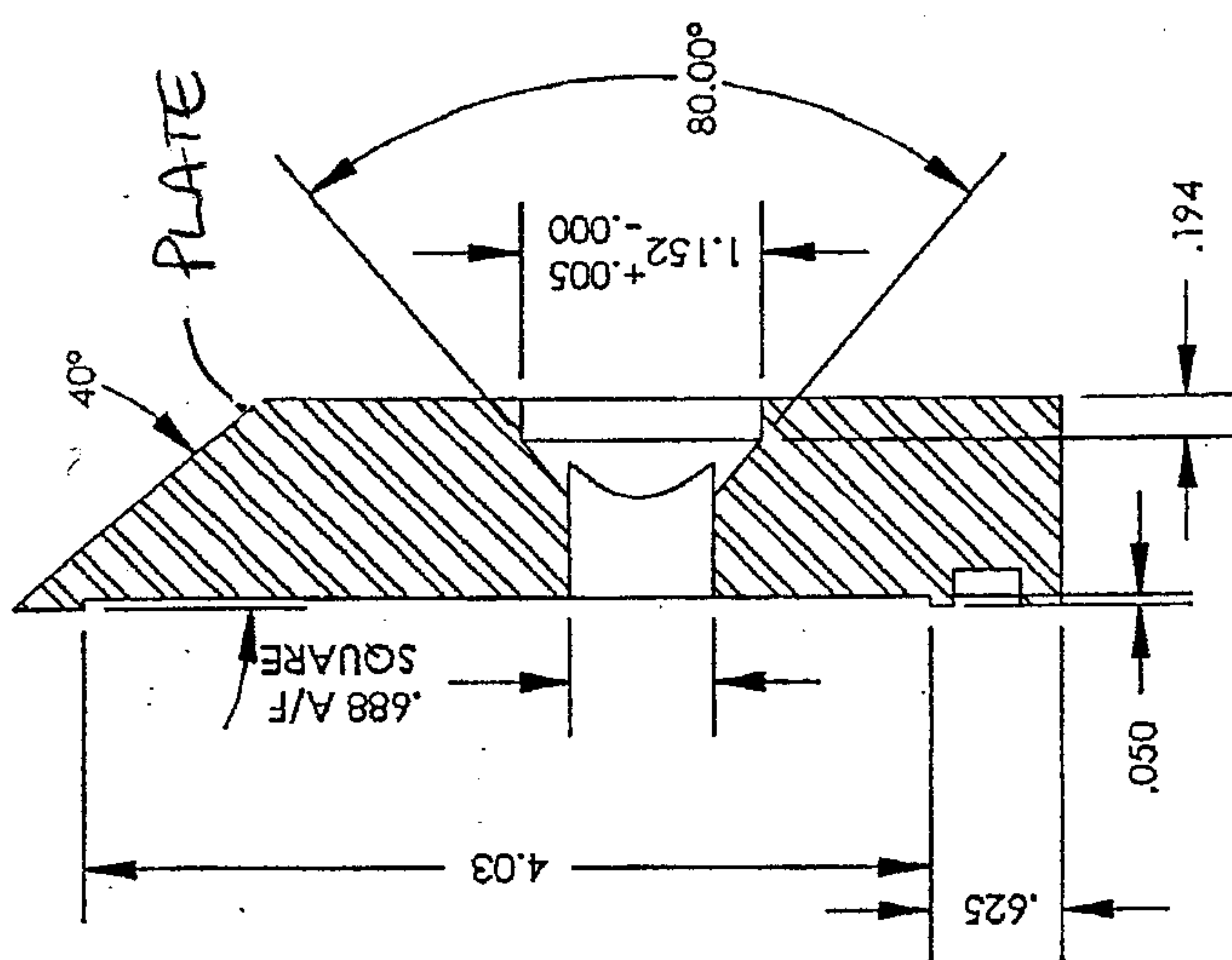


Fig. 12

SECTION D-D
PLOW BOLT DETAILS
TYP. 5 PLACES
SCALE 1:2

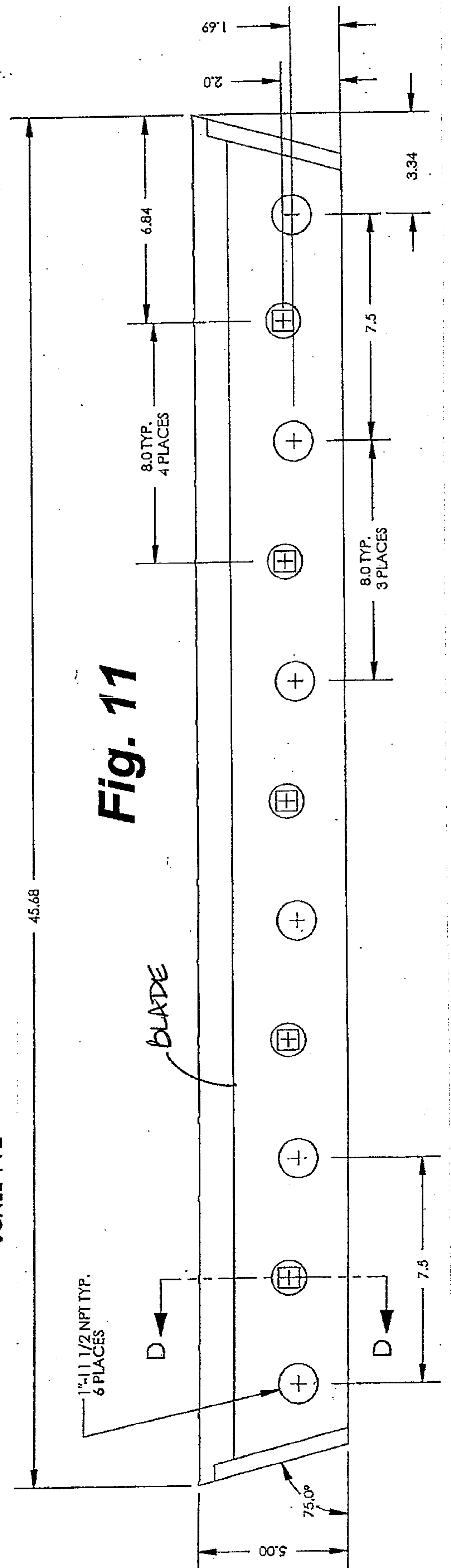


Fig. 11

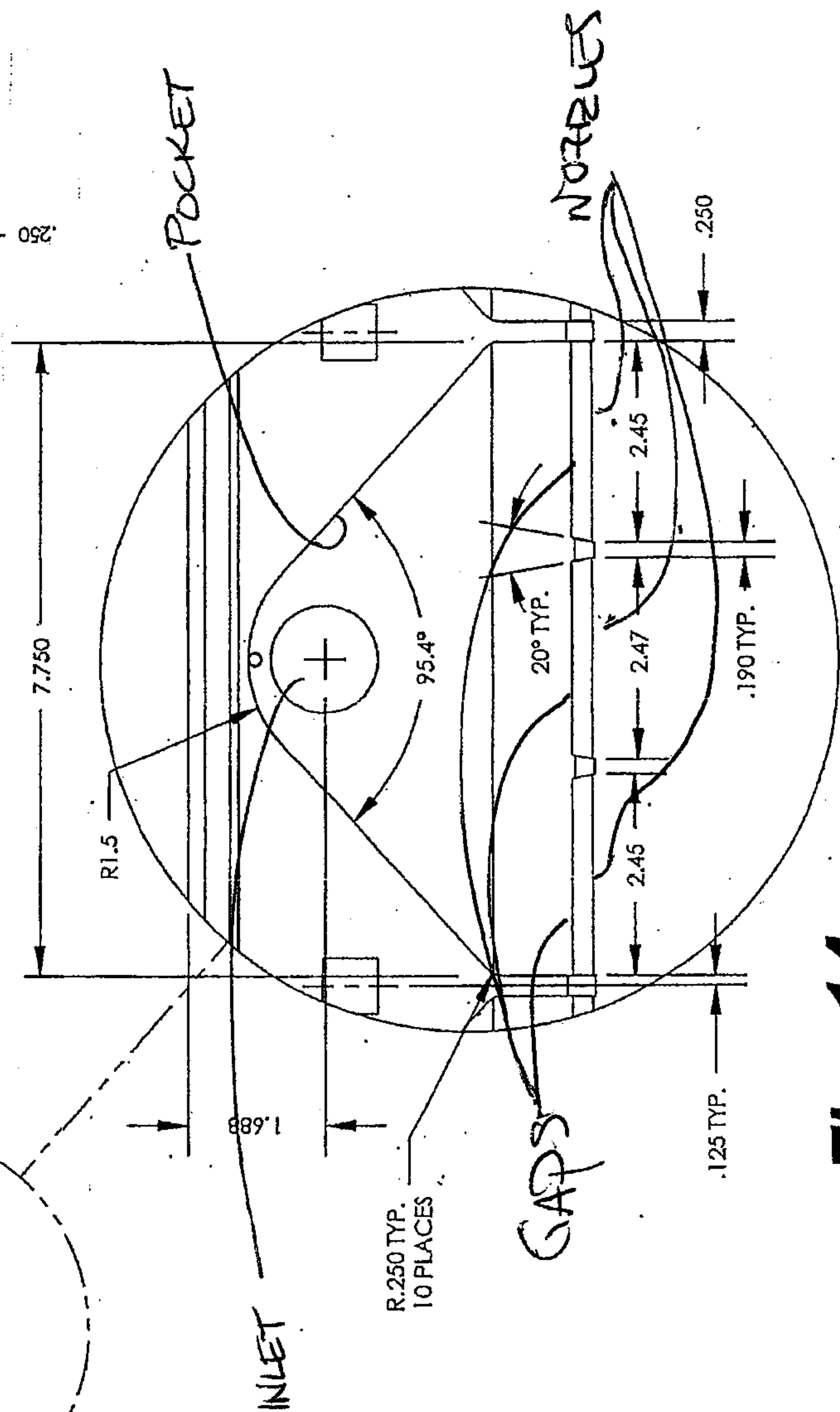
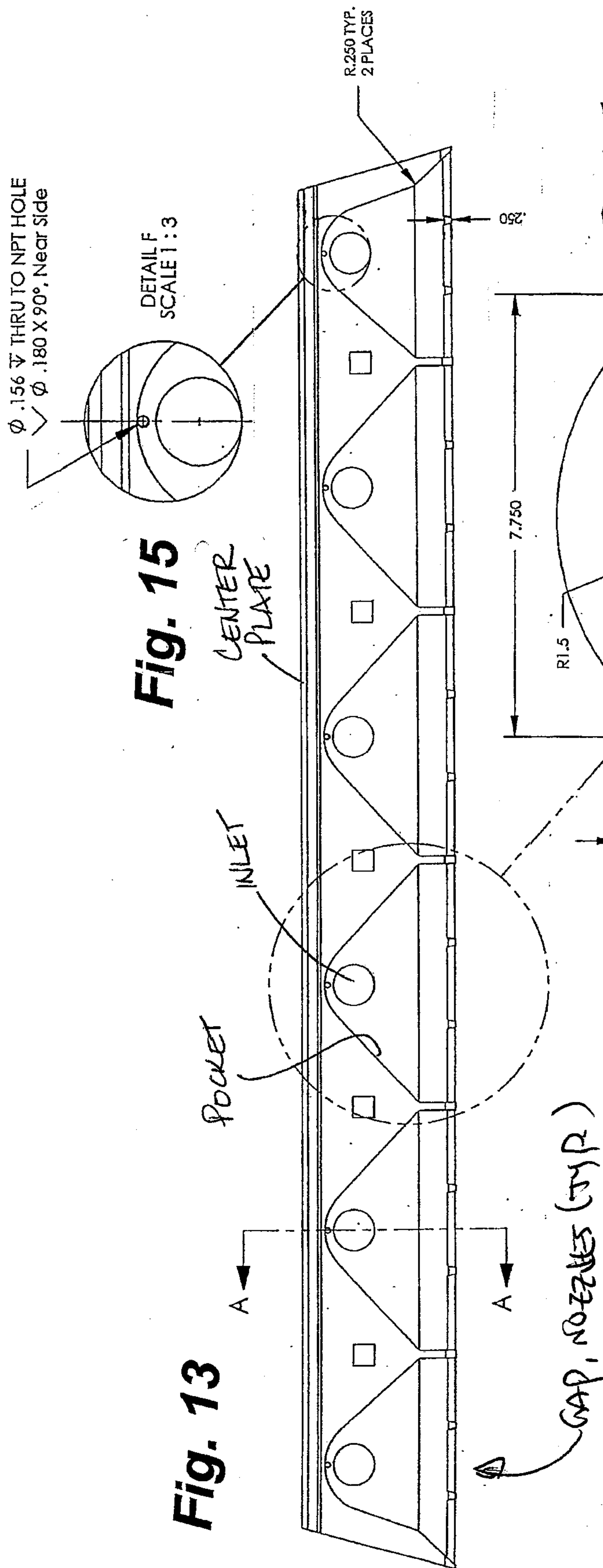


Fig. 14

DETAIL B
POCKET DETAILS
TYP. 4 PLACES
SEE SHT. 2 FOR END POCKET DETAILS

Fig. 17

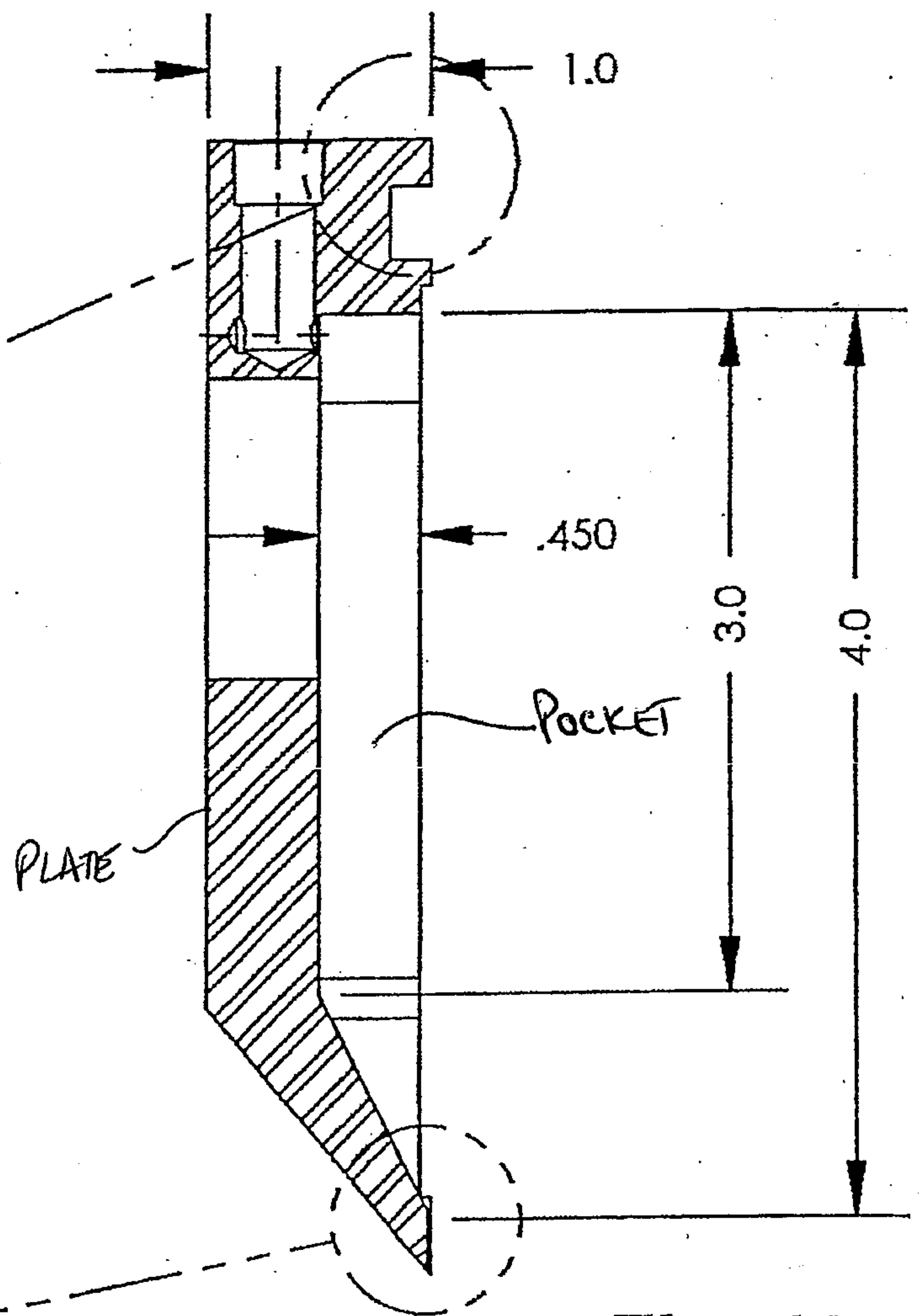
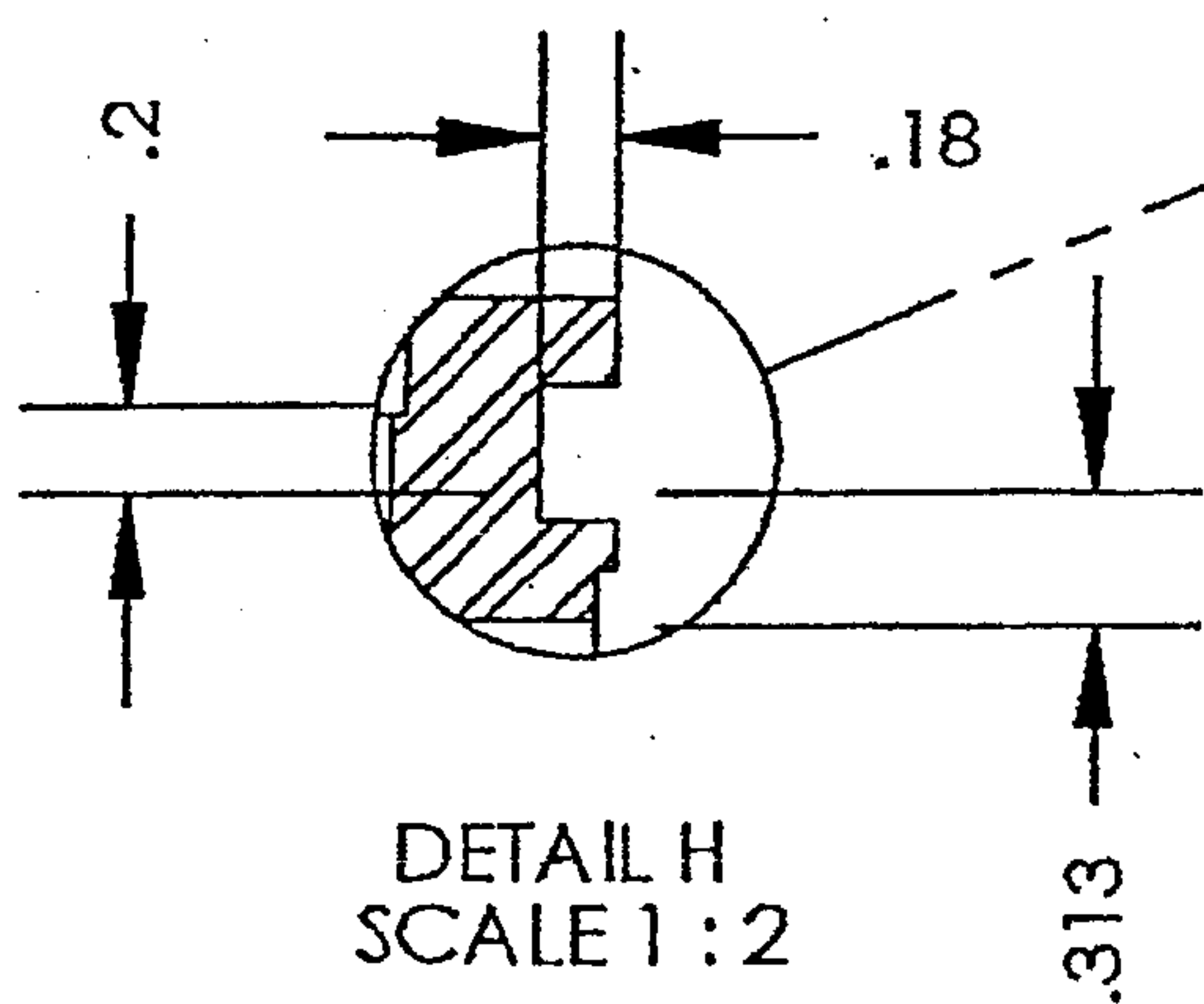


Fig. 16

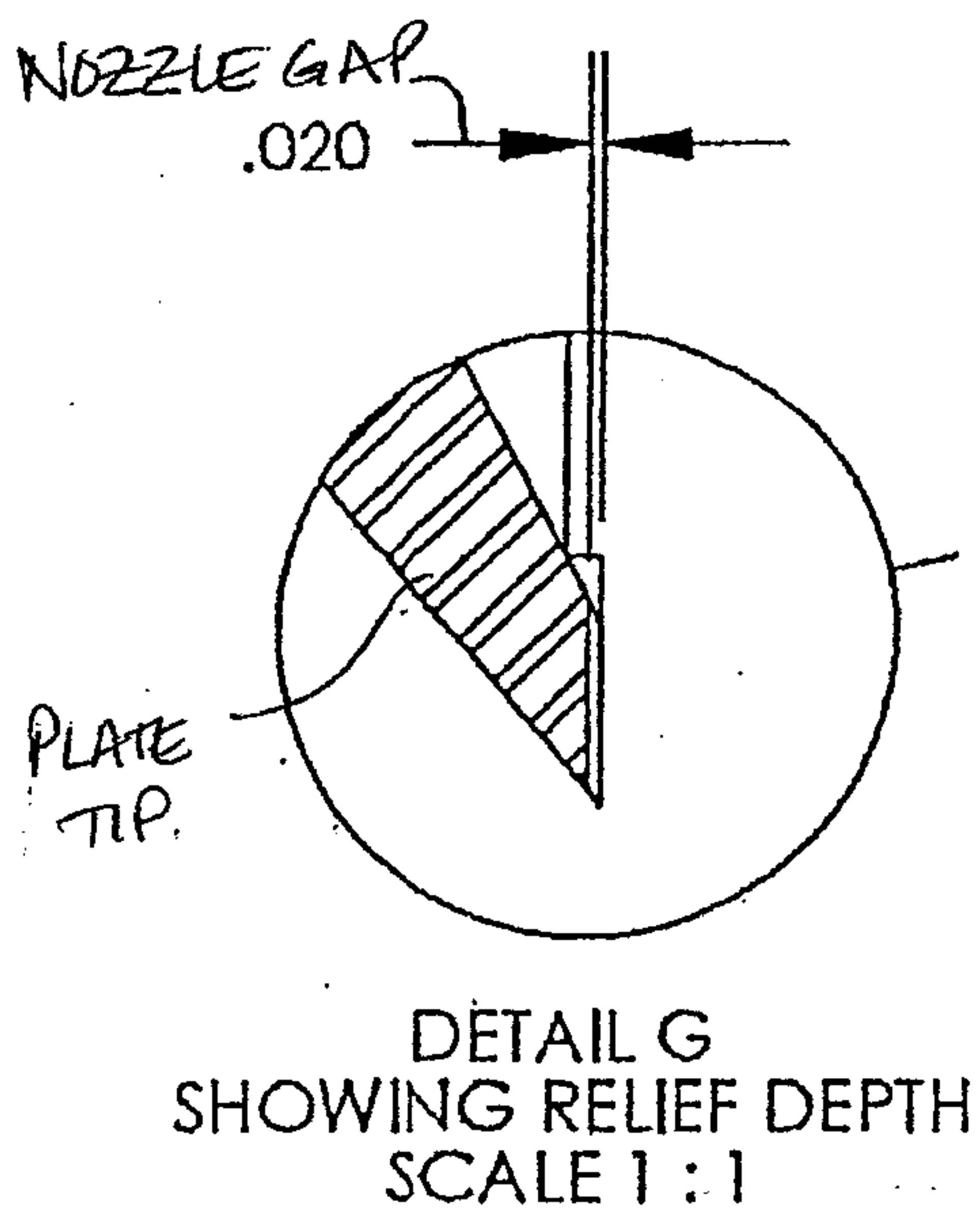
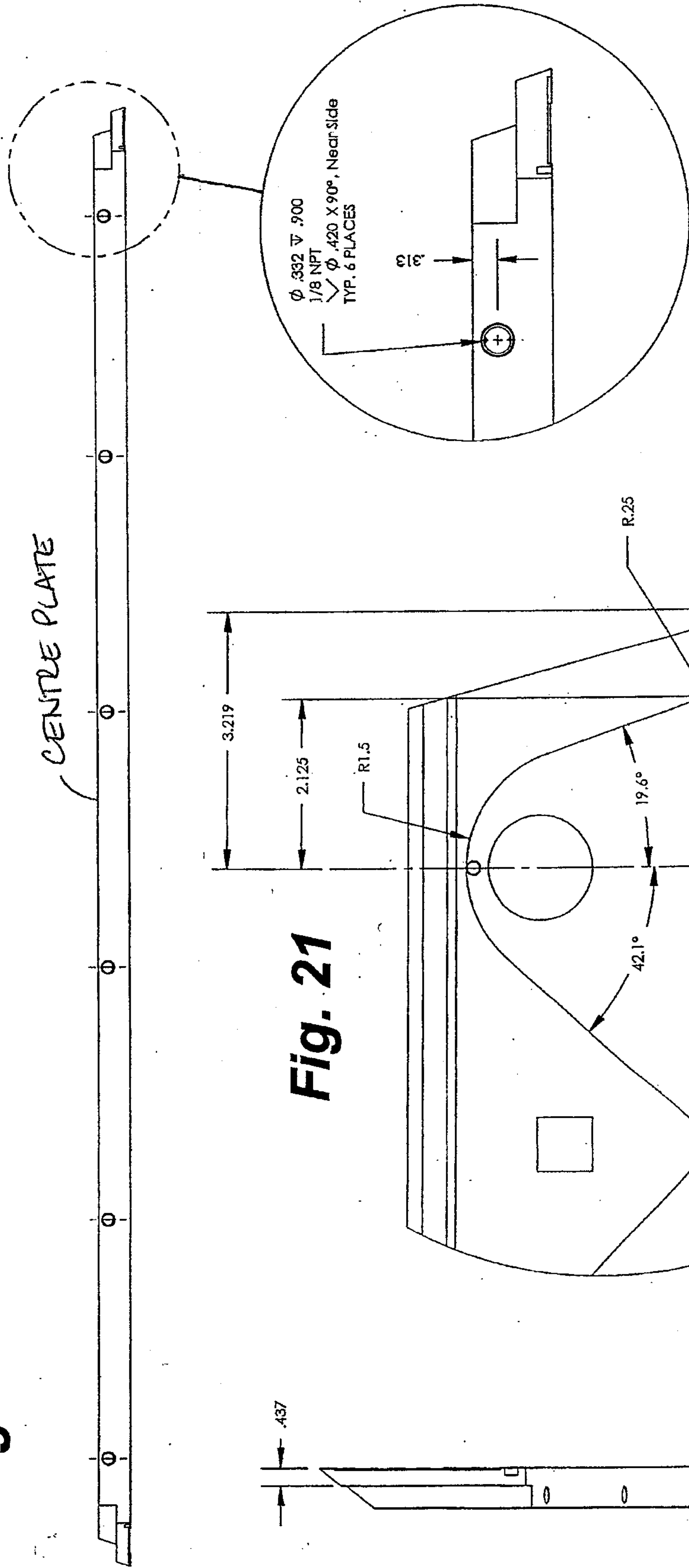


Fig. 18

SECTION A-A
TYP. 6 PLACES
SCALE 1:2

Fig. 19



DETAIL
SCALE 1:2

Fig. 22

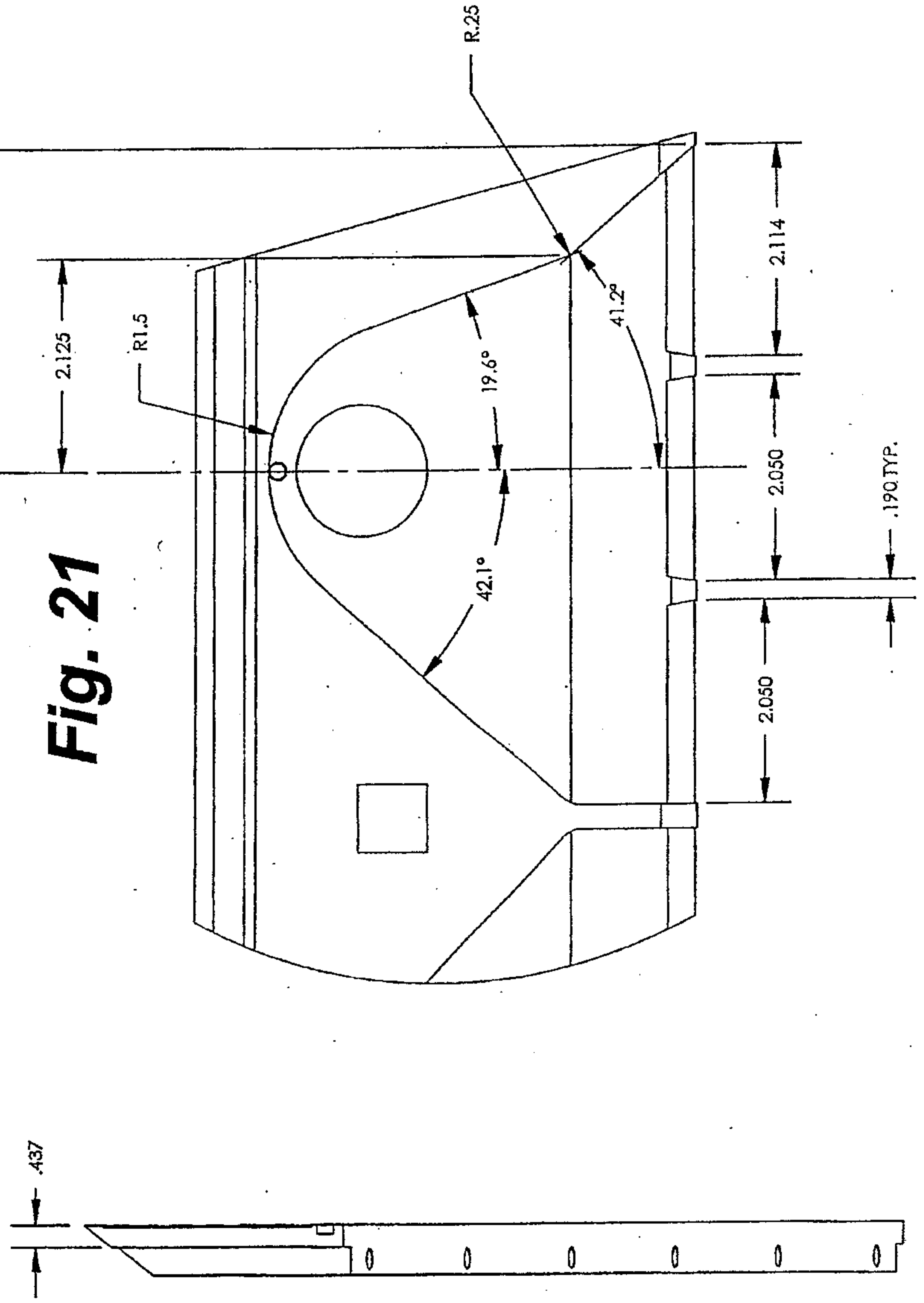


Fig. 20

5X ϕ .156 ∇ THRU TO NPT HOLE
 ∇ ϕ .180 X 90°, Near Side

Fig. 28

DETAIL D
SCALE 1:3

END PLATE

Fig. 23

A

A

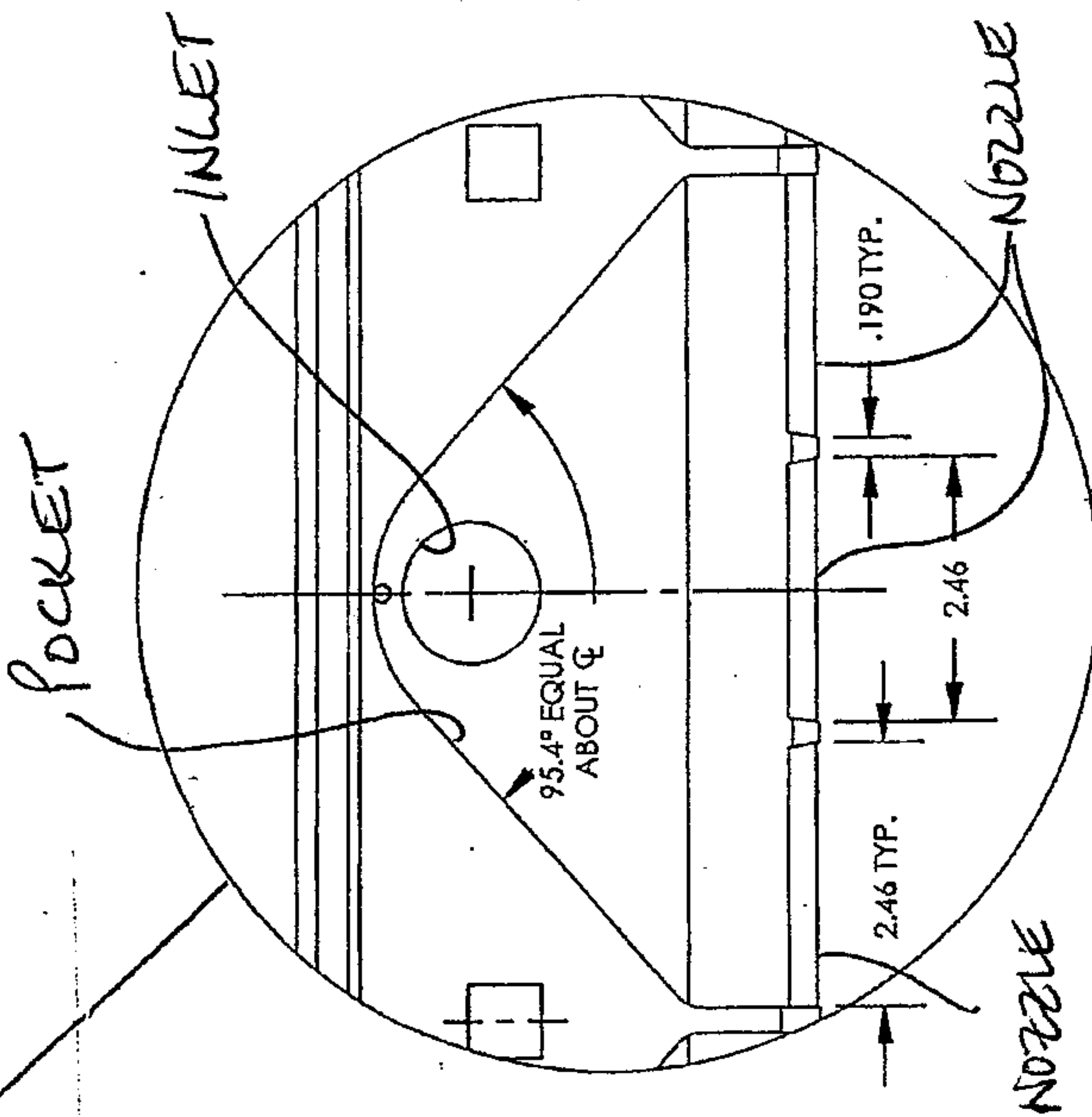


Fig. 24

DETAIL B
POCKET DETAILS
TYP. 3 PLACES
SEE SHT. 2 FOR END POCKETS DETAILS
SCALE 1:3

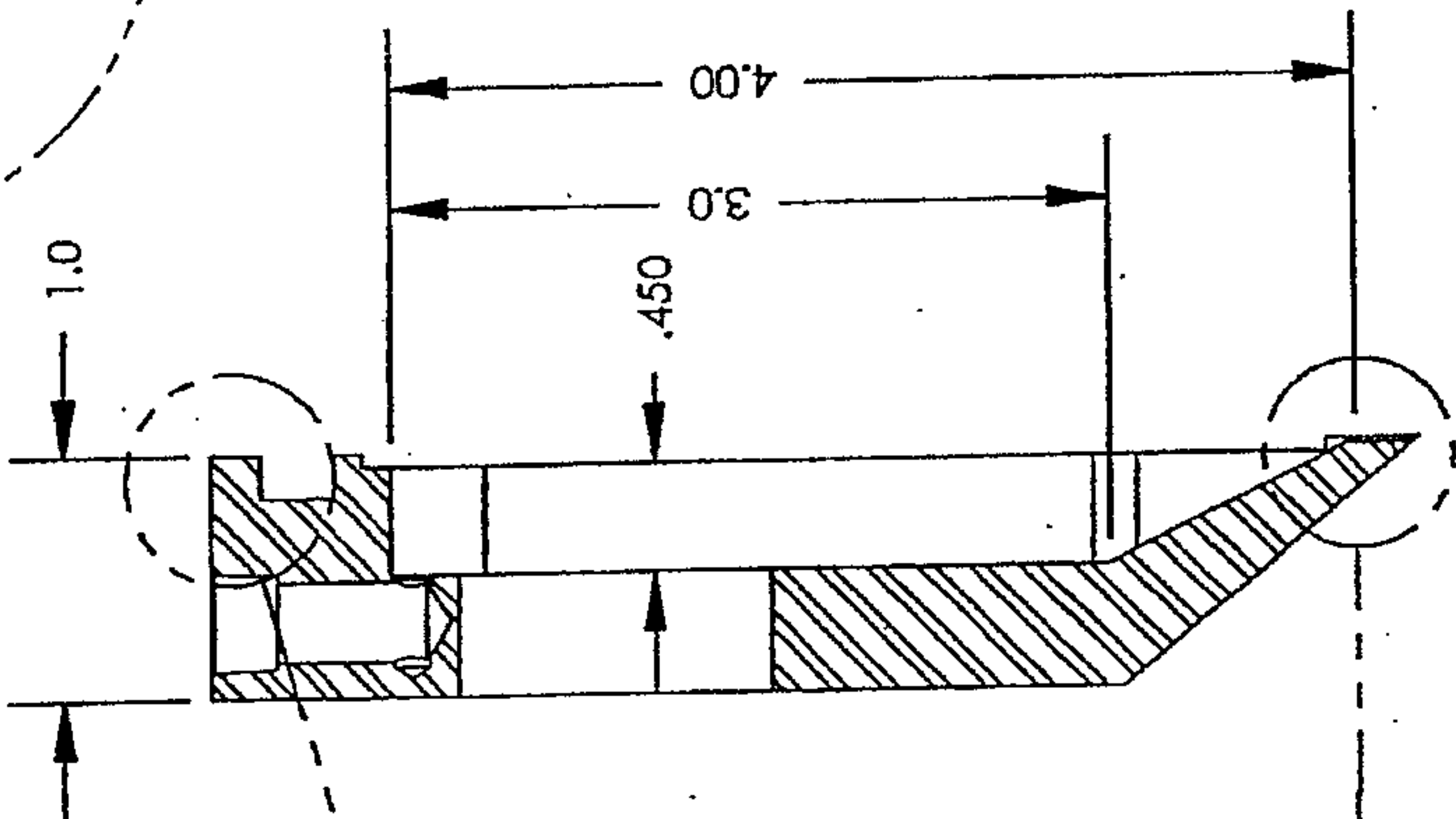


Fig. 25

SECTION A-A
SCALE 1:2

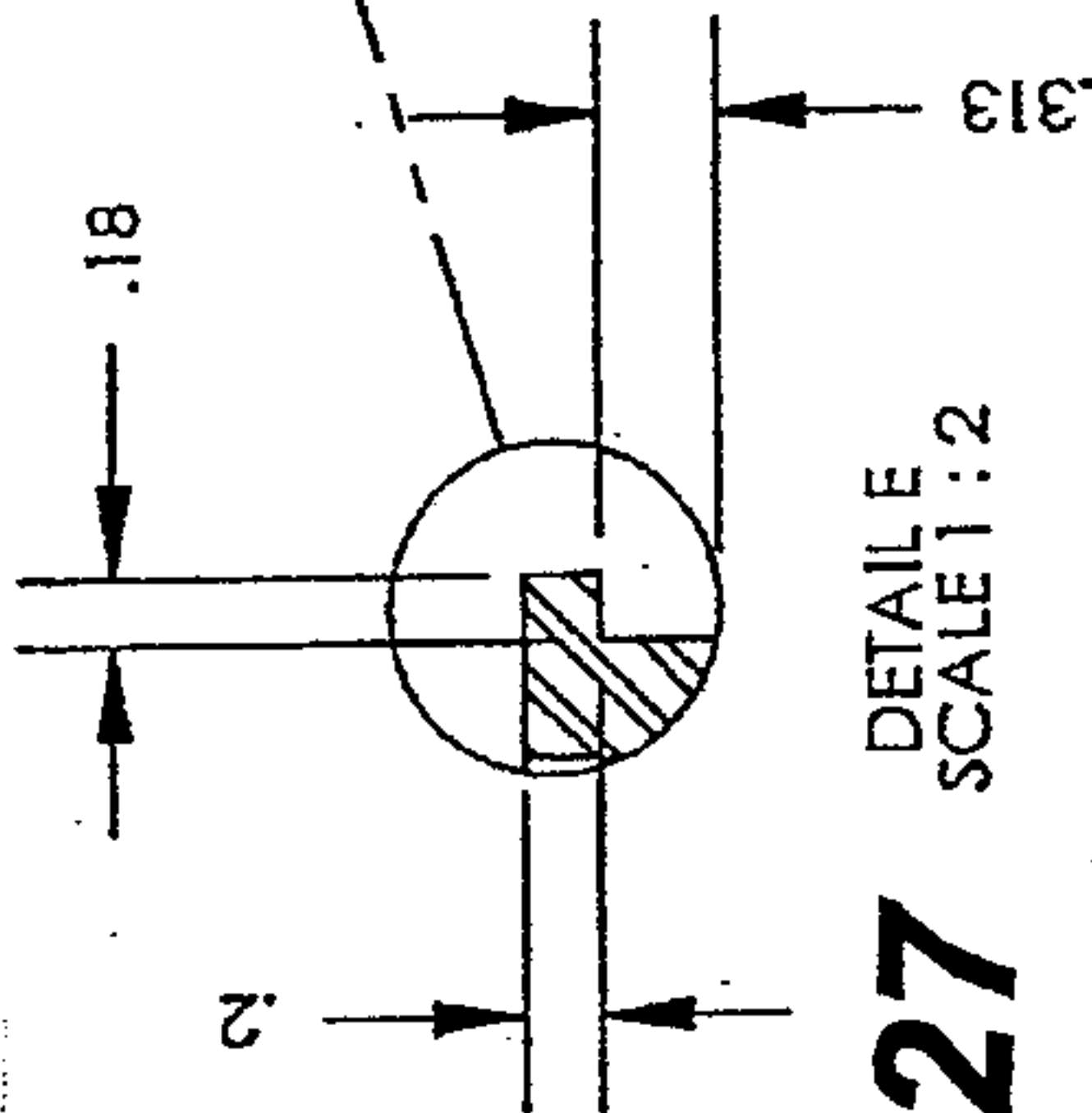


Fig. 27

DETAIL E
SCALE 1:2

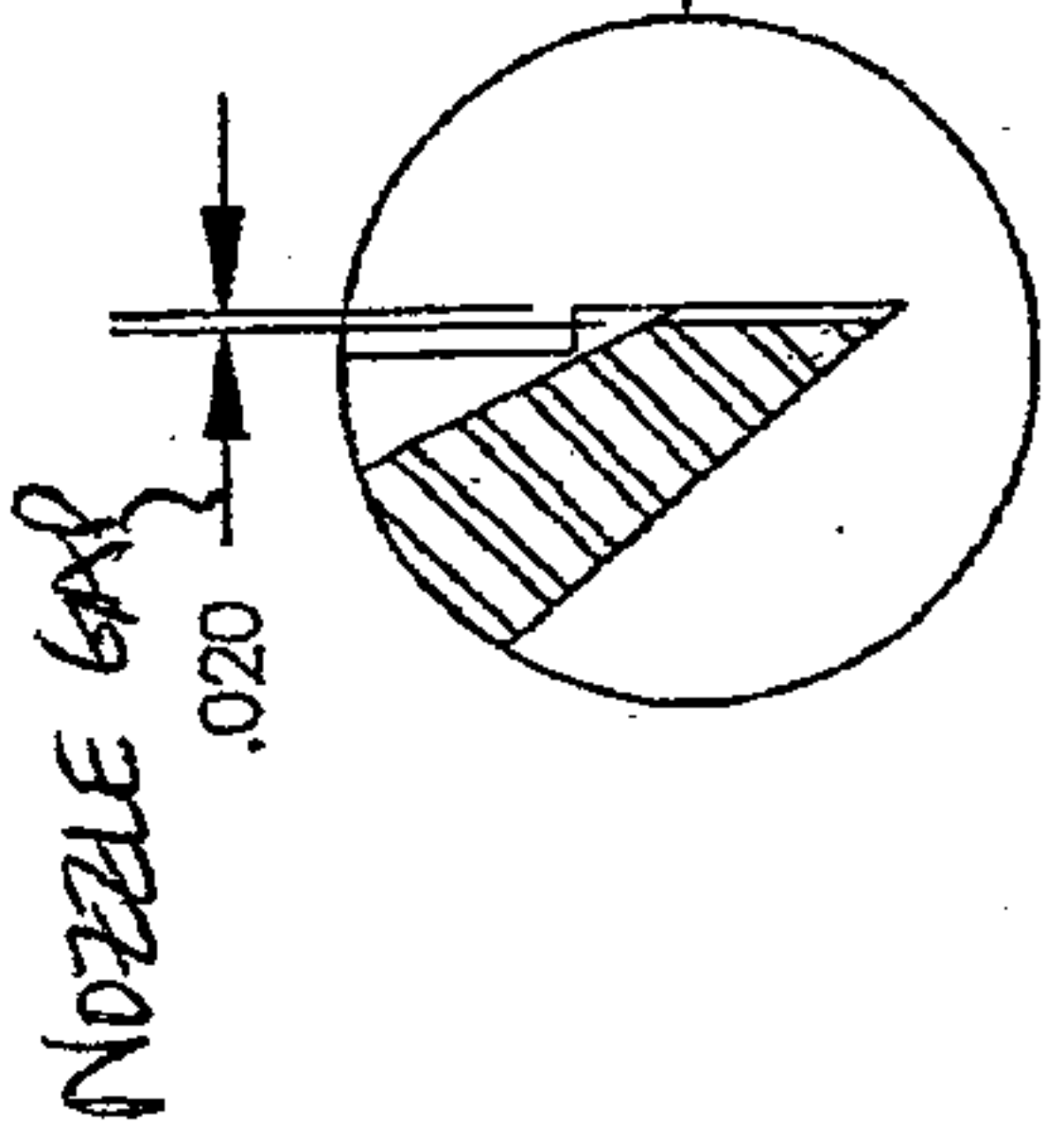


Fig. 26

DETAIL F
SHOWING NOZZLE CUTOUT
SCALE 1:1

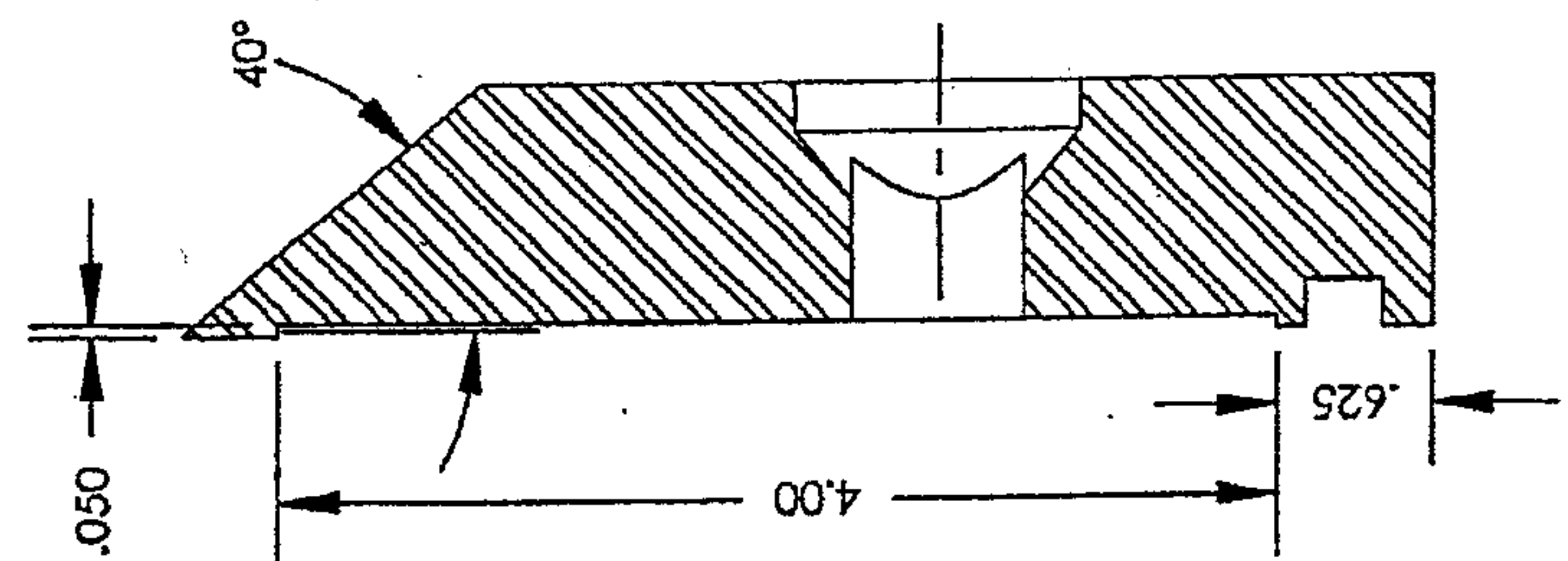
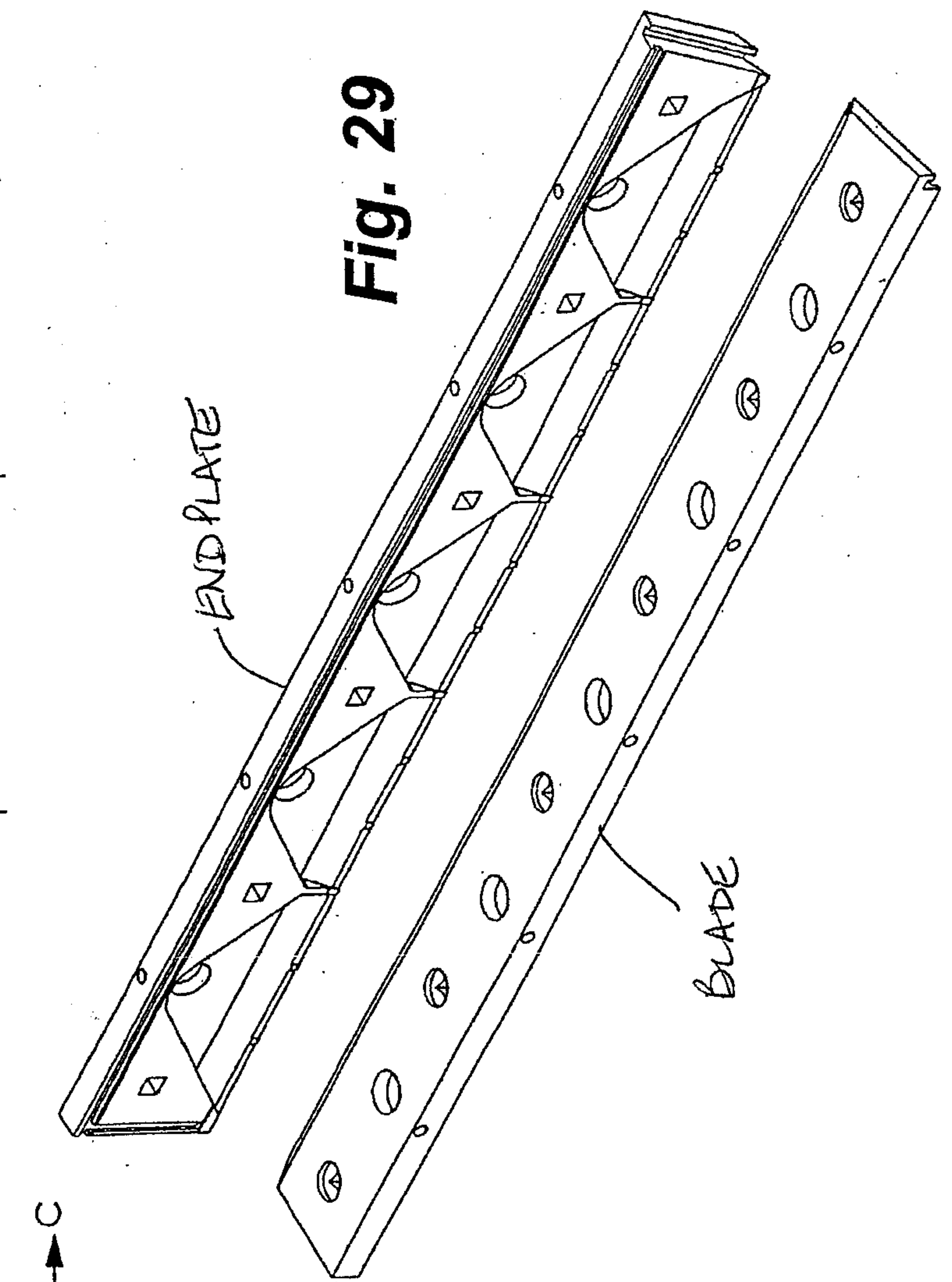
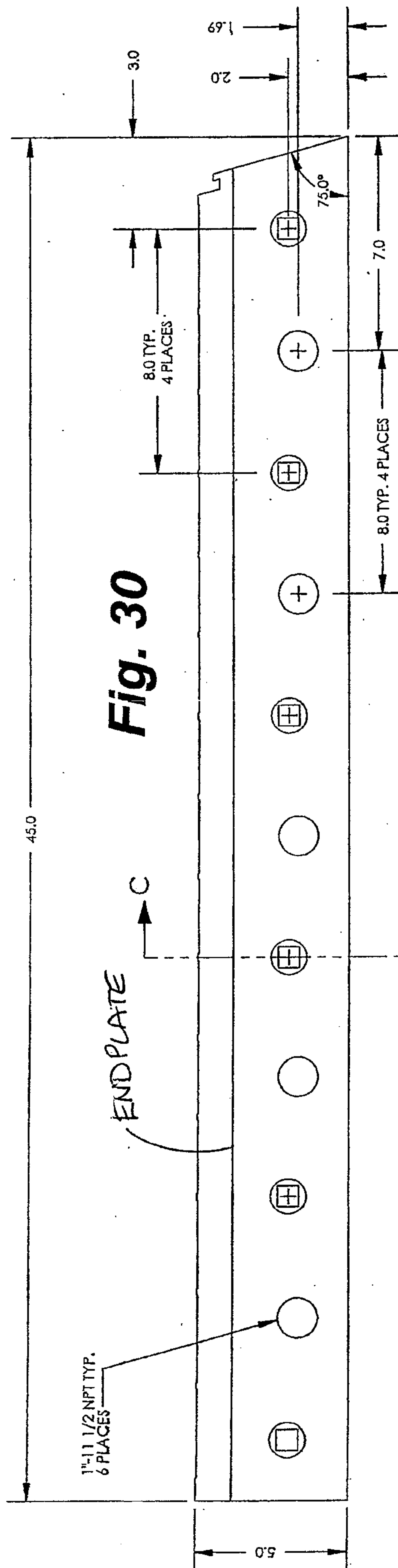


Fig. 31

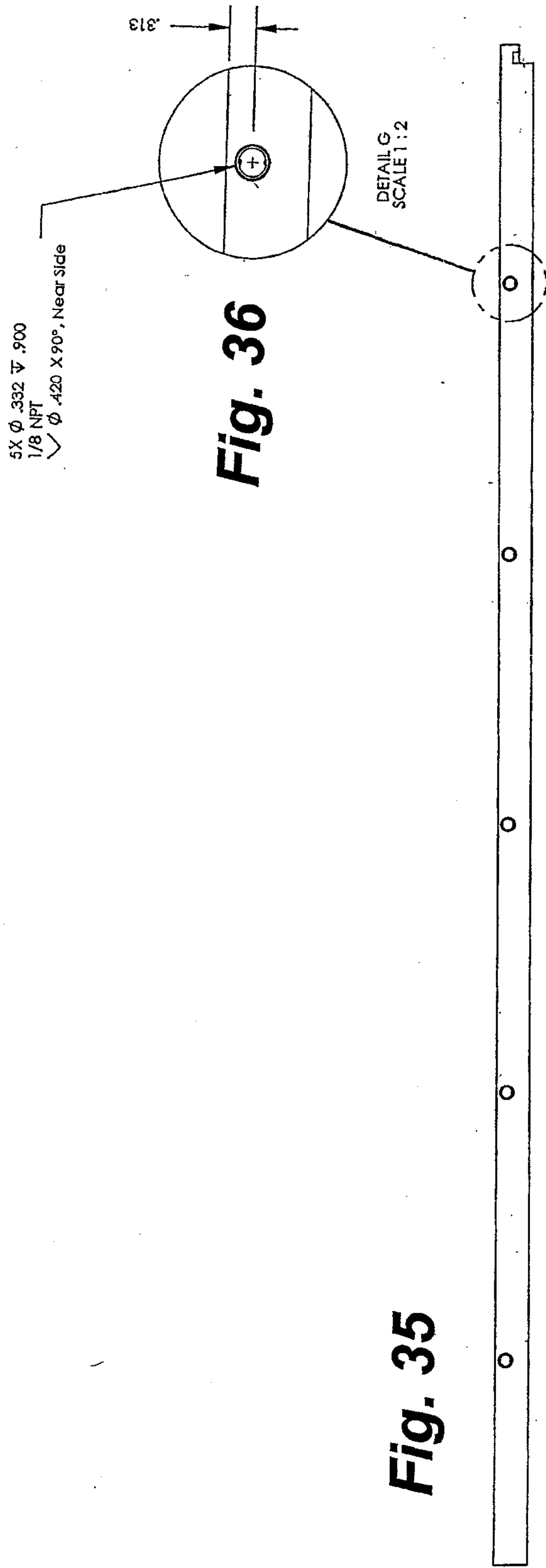


Fig. 36

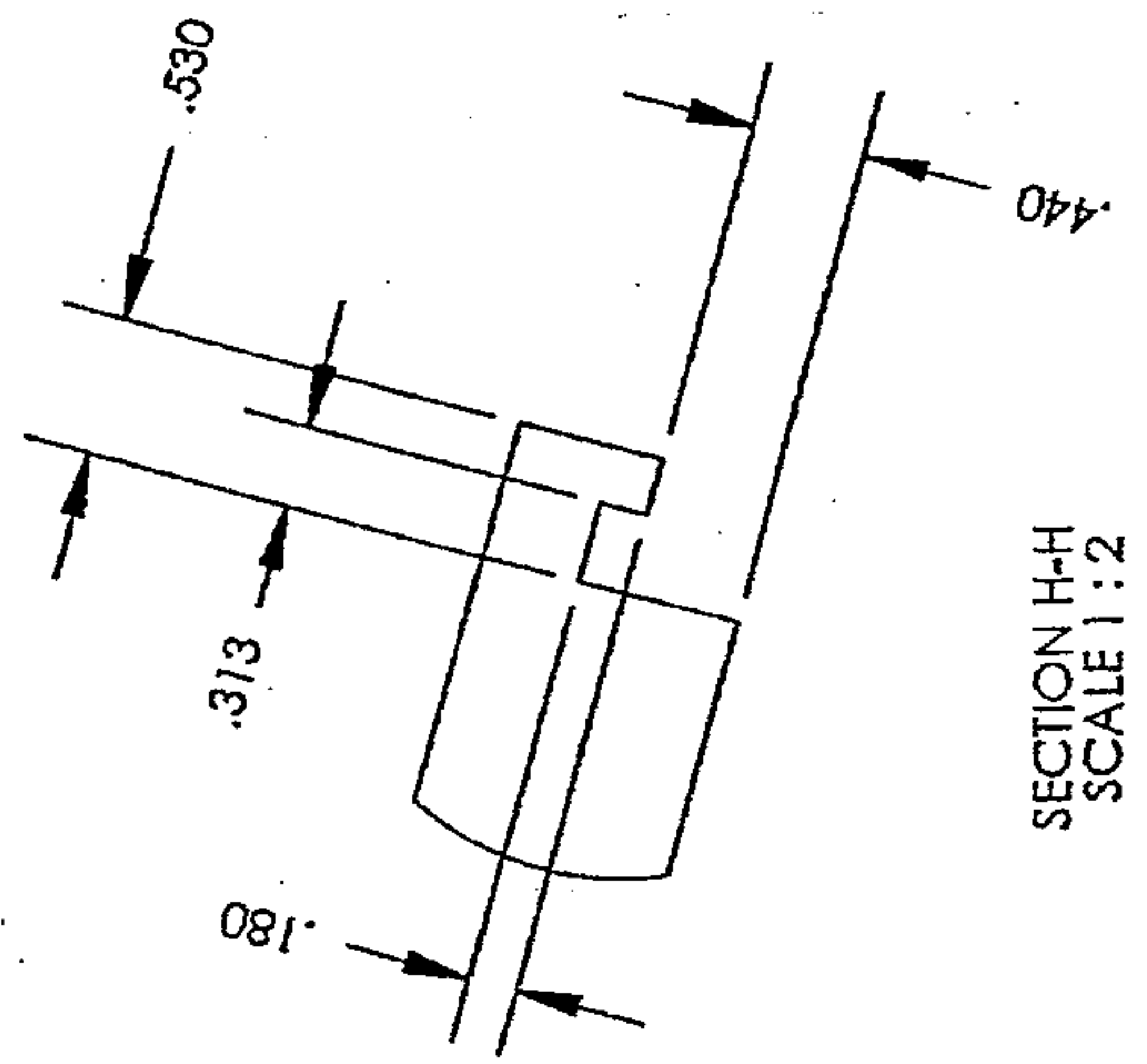
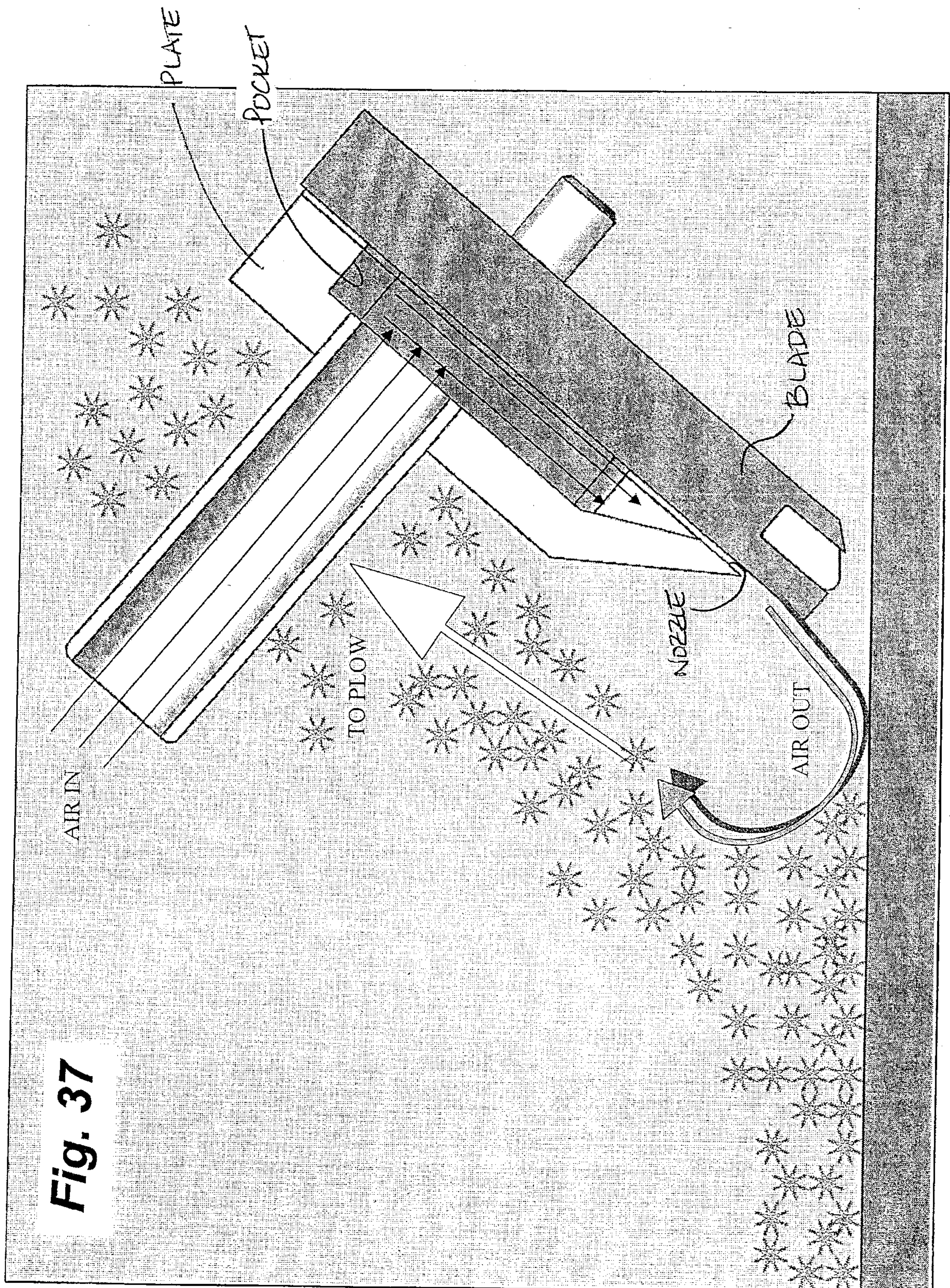


Fig. 34

Fig. 35



AIR IN

PLATE

POCKET

TO FLOW

NOZZLE

AIR OUT

BLADE

