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54 Fluid power pressure supply manifold.

57 A fluid power supply header or manifold system adapted to mount a plurality of individual valve means in parallel and/or series to a common supply pressure and tank return utilizing a dramatically reduced amount of material for any equivalent flow path and system flow capacity requirement. The manifold block (20) is characterized by a novel structure wherein the planar surface (34) of the manifold adapted to receive the valve means (51) is disposed at an angular disposition relative to two opposing surfaces which is less than ninety degrees. A cross-sectional plane taken perpendicular to the main pressure and tank duct passages (28) provided in the block defines a substantially triangular configuration between these three major planar surfaces. Valve access ports (40-50) are provided on the valve mounting surface and communicate by internal passages with the pressure and tank ducts and with outlet ports (52, 54) provided on one of the surfaces opposing the angularly inclined valve mounting surface for connection to external fluid control functions or fluid actuator means.

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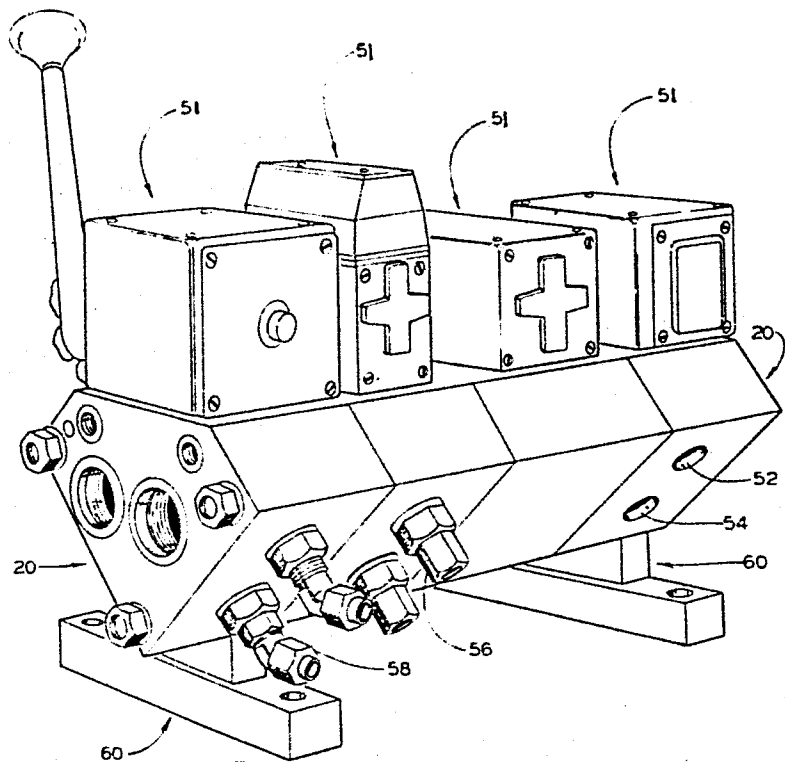


FIG. 2

MANIFOLD SYSTEM

Many different fluid power manifold systems have been available for many years. Most of these systems are designed to accommodate both the parallel connection of a plurality of individual valve means to a common source of pressure and tank and also to form more complex inter-connecting circuitry between the valve means to accomplish various fluid power control functions.

For a variety of reasons, these prior manifold systems have not met with widespread industry acceptance and conventional piping still represents the major vehicle for interconnecting fluid power elements in a control circuit.

One of the most basic forms of a fluid power manifold is referred to as a "drilled block". This is merely a rectangular solid block which is provided with a series of drilled passages to accommodate either a supply heater or "bus" function and/or to interconnect valve means. As the circuit connection between different valves becomes even routinely complex, the drilled block manifold requires relatively tortious cross-drilling techniques and quickly becomes expensive and generally unsatisfactory for widespread industry acceptance.

However, as a relatively simple supply header for mounting a plurality of individual valve means for parallel or series communication to a common pressure supply and tank, it has satisfactory utility and is moderately acceptable to the industry in those applications.

The primary disadvantage of the conventional drilled rectangular block is the very significant cost factor of the material required to accommodate even the minimum spacial requirements of the internal passages necessary to accommodate a simple supply header system having no complex control functions interconnecting the valves mounted thereon. It is believed that this cost factor is one of the major reasons thwarting truly widespread industry acceptance and use of such a concept.

The minimum spacial requirements of such a supply header manifold are dictated by a plurality of factors generally accepted in the industry and by the functional requirements of the system.

First, the flow capacity of the header or bus system dictates the size of the main pressure supply and return ducts. The various size of the valve means to be mounted on the manifold and the porting arrangement for such standard valves dictate the required size of the internal passages communicating with the valve means. As a practical manner, a

four-way valve function must be accommodated.

Industry practices for satisfactory acceptance require that all major ports enter or exit at a ninety degree angle on the surface of the manifold.

5 These factors dictate the size of the block and therefore the amount of metal required to accommodate the minimum necessary flow paths and any other desirable qualities, such as pilot valve passages, in a reasonably practical and economical
10 manner.

 The present invention relates generally to fluid power manifold systems and particularly to a novel and improved construction of a fluid pressure supply manifold or bus system specifically applicable
15 for mounting a plurality of individual valve means in parallel or series communication with a common pressure duct and tank return duct and to external control or actuating functions.

 The manifold system in accordance with the
20 present invention provides a feeder supply header or bus constructed to accommodate the required bus flow capacity while minimizing the amount of material necessary to accommodate all necessary spacial requirements for the valve means mounted thereon.

25 Comparable prior art rectangular block manifolds having equivalent flow paths and supply duct flow capacity requires at least thirty-three percent more material than the present invention in its

preferred embodiment.

The dramatic reduction of material is accomplished by providing a block having essentially a triangular cross-sectional configuration wherein the individual valve means are mounted on the face of the manifold, in its preferred form, which defines the hypotenuse of the triangle formed between the valve mounting face and the two opposing sides defining the major angle of the triangle.

The supply pressure and tank ducts extend through the manifold perpendicularly to the plane of the substantially triangular cross section. The various internal passages required to communicate each valve means to the pressure and tank duct and to the valve access and outlet ports are provided using standard and economical manufacturing techniques.

Industry standard porting and mounting requirements, and the accepted practice of providing major ports which exit at right angles to the face of the manifold, can be easily accomplished with a beneficial reduction of labour cost.

Further, in a preferred embodiment, a simple mounting bracket is supplied which orients the valves at two ninety degree opposite positions to more easily accommodate spacial positioning in the field. In one of these positions, a single

standard forty-five degree fitting may be employed to provide the desired ninety degree exit angle in either a horizontal or vertical direction.

5 The supply manifold design may easily accommodate various modular forms to add flexibility of application and permit standardized manufacturing of module units for convenient and economical marketing requirements.

10 An example of the invention will now be described with reference to the accompanying drawings, in which:-

 Figure 1 is a perspective view of a plurality of manifold module units shown in pre-assembled relationship and constructed in
15 accordance with the present invention;

 Figure 2 is a perspective view of a manifold comprising a plurality of module units such as shown in Figure 1 shown in assembled relationship
20 with a plurality of valve means mounted thereon;

 Figure 3 is an end elevational view of a typical manifold module unit constructed in accordance with the present invention for accommodating a conventional four-way valve;

25 Figure 4 is a top plan view of the module unit shown in Figure 3;

Figure 5 is an end elevational sectional view of the module unit shown in Figure 3, the section being taken along line 5-5 in Figure 4;

5 Figure 6 is an end elevational sectional view of the module unit shown in Figure 3, the section being taken along line 6-6 in Figure 4; and

Figure 7 is an end elevational view of the module unit shown in Figure 3, the section being taken along line 7-7 in Figure 4.

10 A fluid power supply manifold system constructed in accordance with the present invention is illustrated in Figures 1, 2 and 3. The preferred embodiment shown by way of example, is a modular or building block arrangement wherein each module unit
15 is designed to accommodate a single valve function and its body. However, it should be understood that other modular arrangements designed to accommodate two or more valve means thereon or a single manifold section to accommodate any number
20 of valve means may be used incorporating the concept and principles of the present invention.

The supply manifold system shown in Figure 1 includes a plurality of individual module units, indicated generally at 20, shown in exploded
25 relationship for purposes of description. Each of the modules 20 are basically of identical

construction with respect to the concept of
the present invention. In the modular
embodiment shown, the modules 20 are assembled
in force-transmitting and sealed relationship
5 by means of three tie rods 22 extending through
all the modules 20 and fixed conventionally by
nuts 24. A functionally equivalent construction
would consist of a single manifold base block
which would render the tie rods unnecessary but
10 lack a certain degree of flexibility to meet
given field applications while standardizing
manufacturing processes.

A main pressure supply duct 26 and tank
return duct 28 are extended through each module
15 and aligned with one another to communicate each
module to a common supply source of fluid
pressure, not shown. For simplicity of
manufacturing, the last module of any given
modular set has a conventional threaded plug in
20 the threaded bore of ducts 26 and 28.
Alternatively, a sealed end module unit having a
blind hole could be used if desired.

Parallel to the main ducts 26 and 28, a
pair of pilot pressure and tank return ducts 30
25 and 32 are optionally provided to permit pilot
signals to be accommodated and associated with
a corresponding primary valve means mounted on

each module.

5 An O-ring seal is mounted in surrounding relationship to each opening of the ducts 26, 28, 30 and 32 to provide a sealed relationship when the modules are assembled as a unit upon tightening the nuts 24 on the tie rods 22.

10 Each module 20 possesses the same cross-sectional dimensions along a plane perpendicular to the axis of the ducts 26 and 28 and presents an essentially triangular configuration formed between the three major planar surfaces 32, 34 and 36. The preferred embodiment utilize an angular orientation of surface 34 relative to surfaces 32 and 36 of forty-five degrees which provides a symmetrical arrangement and represents the minimum amount of material required to provide sufficient space for all necessary flow paths for a given valve arrangement and header supply capacity.

20 As an example of a typical system, the valve mounting face 34 of the first module 20 is angularly disposed relative to faces 32 and 36 as previously described and is provided with valve access ports 40 and 42 to accommodate a two-way valve function. The remaining modules are provided with valve access ports 44, 46, 48 and 50 to accommodate a four-way valve function.

The porting is dictated by standard valve porting arrangements and appropriate bolt holes are provided to accept the valve body.

5 Now referring to Figure 2, the representative valve mounting arrangement shown, has the four individual valve means, indicated generally at 51, mounted on four assembled manifold modules 20.

10 The modules 20 upon which a four-way valve is mounted are provided with outlet ports, such as at 52 and 54, for communication to external fluid power operative elements. Such elements typically consist of power cylinders or a control circuit inter-connecting a plurality of valve functions which are then conventionally connected to a power element or
15 the like.

Conventional fittings such as straight fittings 56 or forty-five degree fittings 58 may be employed to provide two different angular disposition for the connecting piping as desired.

20 In the embodiment shown, the outlet ports are provided in face 36 which is disposed at approximately a forty-five degree angle to the horizontal by use of a mounting bracket assembly indicated generally at 60. In this configuration, the valve mounting
25 face 34 is horizontally disposed. Alternative arrangements are possible to select a different

orientation in the field. The angular disposition of the valve mounting face and hence the valves, as well as the face provided with the outlet ports to external elements permit very flexible arrangements.

5 For example, the forty-five degree fittings are shown disposed at a ninety degree exit angle for connective piping. Merely rotating these fittings also provides a ninety degree vertically downward piping angle to be utilized as well as a horizontal

10 disposition angled forty-five degrees away from the disposition shown in Figure 2.

In a similar fashion, the manifold assembly may be rotated forty-five degrees, absent angled mounting bracket 60 to dispose face 36 carrying outlet ports

15 52 and 54 at a vertical disposition at right angles to the horizontal.

This flexibility of valve and outlet port arrangement is a significant additional advantage of the manifold construction which so dramatically

20 reduces the amount of material required as well as provides a saving in labour costs.

Now specifically referring to Figures 3-7, a typical unit module 20 is shown. For descriptive purposes, the manifold unit module 20 shown is

25 provided with a standard four-way valve porting arrangement. Preferably, provision is made for

pilot pressure and drain passages to accommodate this feature as needed.

5 The main supply ducts 26 and 28, commonly referred to as bus ducts, extend through the manifold module 20 and are provided with standard straight threads 62 and a recess for a conventional O-ring seal 64.

Valve access ports are provided in a standard pattern on face 34 at 44, 46, 48 and 50.

10 Port 44 communicates with pressure supply duct 26 via internal passage 66. Port 48 communicates with tank return duct 28 via internal passage 68. Port 46 communicates with an actuator outlet port 52 and port 50 communicates
15 with outlet port 54 via angular passages 70 and 72 respectively.

20 Ports 52 and 54 are commonly referred to as cylinder ports in the industry since these ports are commonly connected to external fluid power cylinders by conventional piping or other means of interconnection to perform their conventional control function. These ports also could be connected in various manners to an externally located control circuit having a plurality of
25 interconnected valve functions to obtain more complex control features without departing from

the invention or sacrificing the primary advantages thereof.

5 A plurality of drilled and threaded holes are conventionally provided in a standard pattern to acceptably mount the desired valve means upon face 34 and are indicated at 74. Drilled holes 76 are provided to accept conventional dowel pins typically provided in standard valve bodies to facilitate the mounting procedure.

10 Pilot pressure and tank return bus ducts 78 and 80 are extended parallel to ducts 26 and 28 through the module 20. In instances wherein a pilot signal is desired to monitor the primary valve, pilot ducts 78 and 80 communicate via
15 internal passages 86 and 88, which in turn communicates with pilot valve access ports 90 and 92 located on face 34. Construction ports 82 and 84 necessary to provide passages 86 and 88 are simply plugged and therefore are provided
20 with conventional threads and O-ring seals. Pilot ducts 78 and 80 are also provided with straight threads and appropriate O-ring seals in the same manner as bus ducts 26 and 28.

25 A pair of dowel pins 92 are provided on the outer face of the module which are adapted to

fit in aligned bores, not shown, in an adjacent module 20 to facilitate alignment and assembly.

5 It should be readily understood that the material savings resulting from the manifold system constructed in accordance with the present invention are equally applicable if the module concept is not employed as described herein. That is, a single base manifold block of greater length may be employed to form an
10 equivalent system and no tie rods need be employed.

Also it should be pointed out that the essentially triangular cross-sectional configuration results in much more efficient use of the space required to provide the desired flow
15 paths and bus duct flow capacity than the typical rectangular mode of the prior art.

A forty-five degree angular relationship between the valve mounting face and the other two major planar surfaces represent the optimum
20 savings by providing the optimum in minimizing the material required and further provides a symmetrical configuration more convenient to design and locate the required flow paths and porting arrangements.

25 The significant 25 to 30 percent material saving is occasioned by the more efficient pathway resulting when the access port passages

approach the outlet port face at an angle less than ninety degrees. The closer one approaches the forty-five degree relationship, the more material saving is realized.

5 Another advantage of the present invention is presented in connection with using the angular bracket 60 to orient the valve mounting face in a given disposition.

10 Bracket 60 includes a horizontal foot 61 and an angular brace member 63. In the embodiment shown, brace member 63 is provided with an inclined surface upon which the face 32 of a module unit 20 is conventionally attached by threaded fasteners or the like to dispose the manifold assembly in a
15 given orientation. As seen in Figures 2 and 3, the valve mounting face 34 is disposed in a horizontal disposition with the other faces 32 and 36 disposed forty-five degrees relative to face 34 as mounted on bracket 60.

20 Referring to Figure 3, a pair of drilled and threaded holes 94 are provided in face 32 which are adapted to receive a threaded fastener extended through bracket 60.

25 An alternative orientation of the manifold using a different mounting plate or bracket involves rotation of the manifold assembly forty-five degrees to dispose face 32 in a horizontal

position with the valve mounting face 34 inclined at a forty-five degree angle and face 34 disposed in a vertical position.

5 This feature provides a significant degree of flexibility in field applications when spacial requirements and arrangements of the manifold assembly and associated valves and connecting piping are limited.

10 Further, it is readily seen that employing the concept and principles of the present invention do not require any particularly complex manufacturing technique. All major drilled holes and passages enter and exit a manifold face at right angles to the face. The shorter distance
15 required to construct the major passages also leads to a reduction of machine time and a resultant labour savings.

The present invention provides a supply manifold system for parallel and/or series
20 communication of a plurality of valve means to a common pressure duct which possesses all the advantages of the prior art "drilled" rectangular block manifold and yet dramatically reduces the cost of an equivalent system. Further advantages
25 related to flexibility of orientation in the field and economical manufacturing procedures are additionally realized.

CLAIMS:

1. A fluid power supply manifold system for mounting a plurality of individual valve means in parallel and/or series communication to a common fluid pressure source and tank return and to
5 externally disposed fluid power control or actuator means, the system composing a base provided with a pair of parallel extending major ducts adapted for operatively communication with a fluid pressure source and a return to tank, said base having a
10 plurality of planar surfaces and an essentially triangular cross-sectional configuration along a plane perpendicular to the longitudinal axis of said pair of major ducts.
2. The manifold system defined in Claim 1
15 wherein one of said surfaces of said base means forming one of the sides of the essentially triangular cross-sectional configuration being provided with a plurality of valve access ports adapted to operatively communicate with a
20 respective one of a plurality of individual valve means spaced from one another essentially in a parallel direction to the longitudinal axis of said major ducts and defining a valve mounting surface, at least one of the two remaining surfaces defining
25 the sides of said triangular cross-sectional configuration provided with outlet ports adapted to

communicate with external fluid power operative elements; and passages internally disposed in said base means to connect certain of said valve access ports to said major ducts and other of said valve access ports to said outlet ports.

3. A manifold system defined in claim 1, wherein said triangular cross-sectional configuration defines substantially a right-angled triangle.

4. The manifold system defined in claim 1 wherein said triangular cross-sectional configuration defines substantially a forty-five degree triangle.

5. The manifold defined in claim 1 including a pair of mounting brackets, one connected to opposing ends of said manifold base, each of said brackets including a horizontally disposed foot and an inclined supporting brace member, each of said brace members being fixed to said manifold base and disposed at an angular orientation related to the angular orientation of said valve mounting face to dispose said mounting face in a horizontal disposition.

6. A fluid power supply manifold system for mounting a plurality of individual valve means in operative communication with a common supply

source of pressure and tank return the system
comprising a manifold base having a cross-
sectional configuration having at least three
sides defining major planar faces, one of said
5 faces being disposed at an angular orientation
less than ninety degrees relative to the other
two major faces and defining a valve mounting
face; a pair of ducts longitudinally extended
through said manifold means perpendicularly to
10 the plane of said cross-sectional configuration,
one for communication to a source of supply
pressure and the other for communication to a
return to tank; a plurality of valve access
ports and valve mounting holes provided on said
15 valve mounting face and aligned to receive a
plurality of individual valve means spaced from
one another along said face, certain of said
ports communicating with said pressure or tank
ducts and others operatively communicating with
20 outlet ports provided on at least one of said
other major faces for communication to externally
disposed fluid power operative elements.

7. The manifold system defined in claim 6
wherein said angular orientation of said valve
25 mounting face to each of said other major faces
is approximately forty-five degrees.

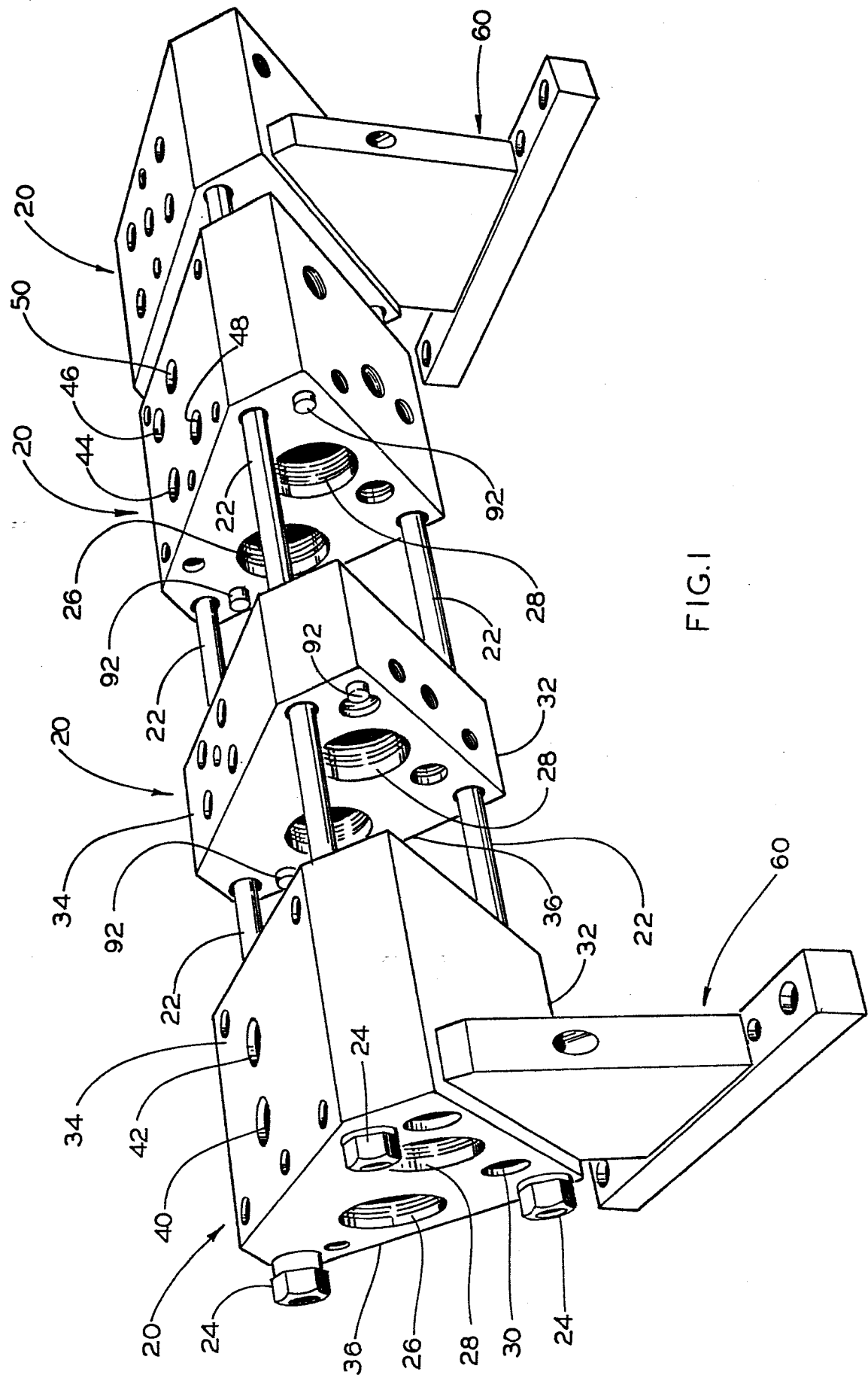


FIG.1

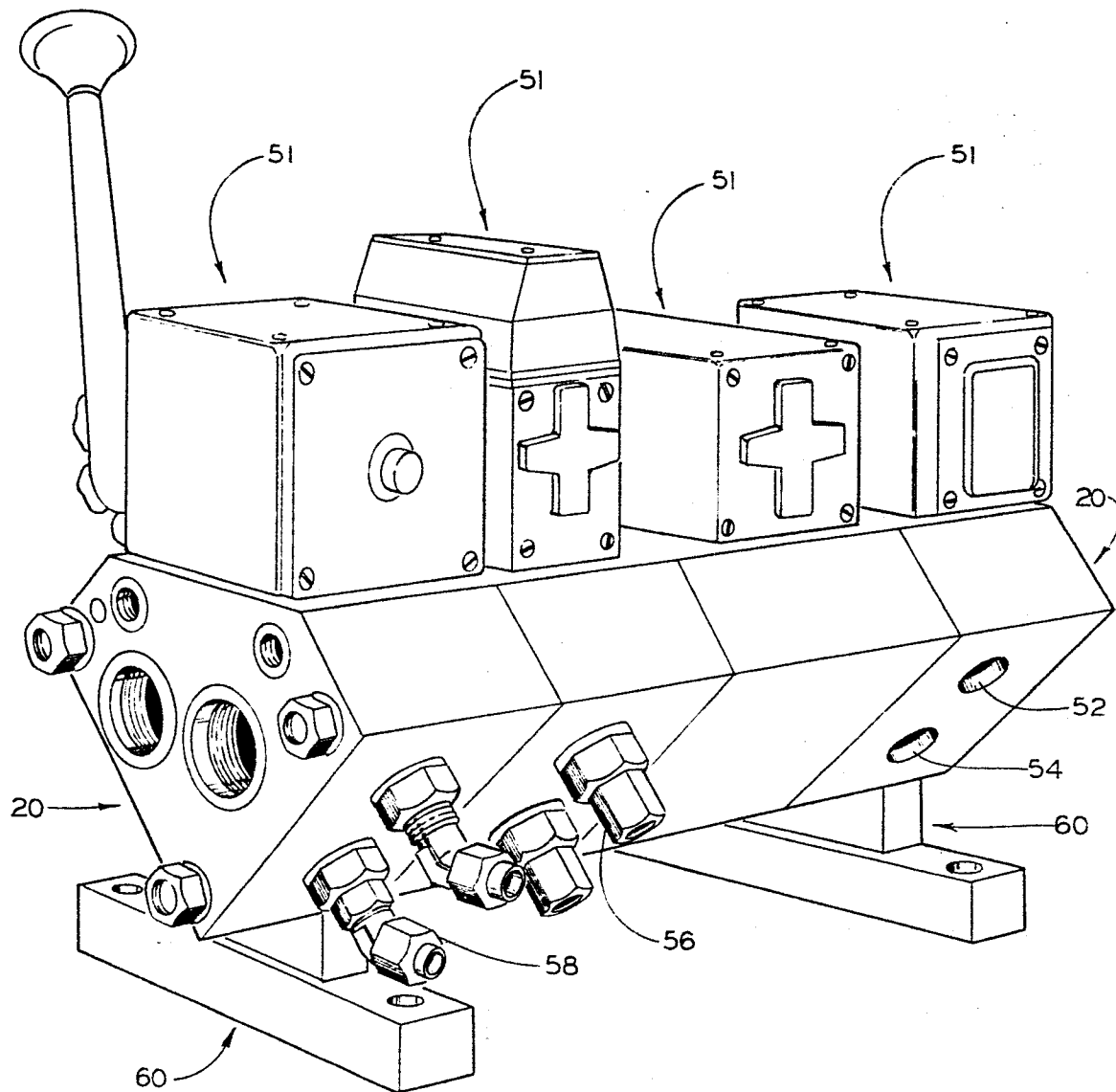


FIG. 2

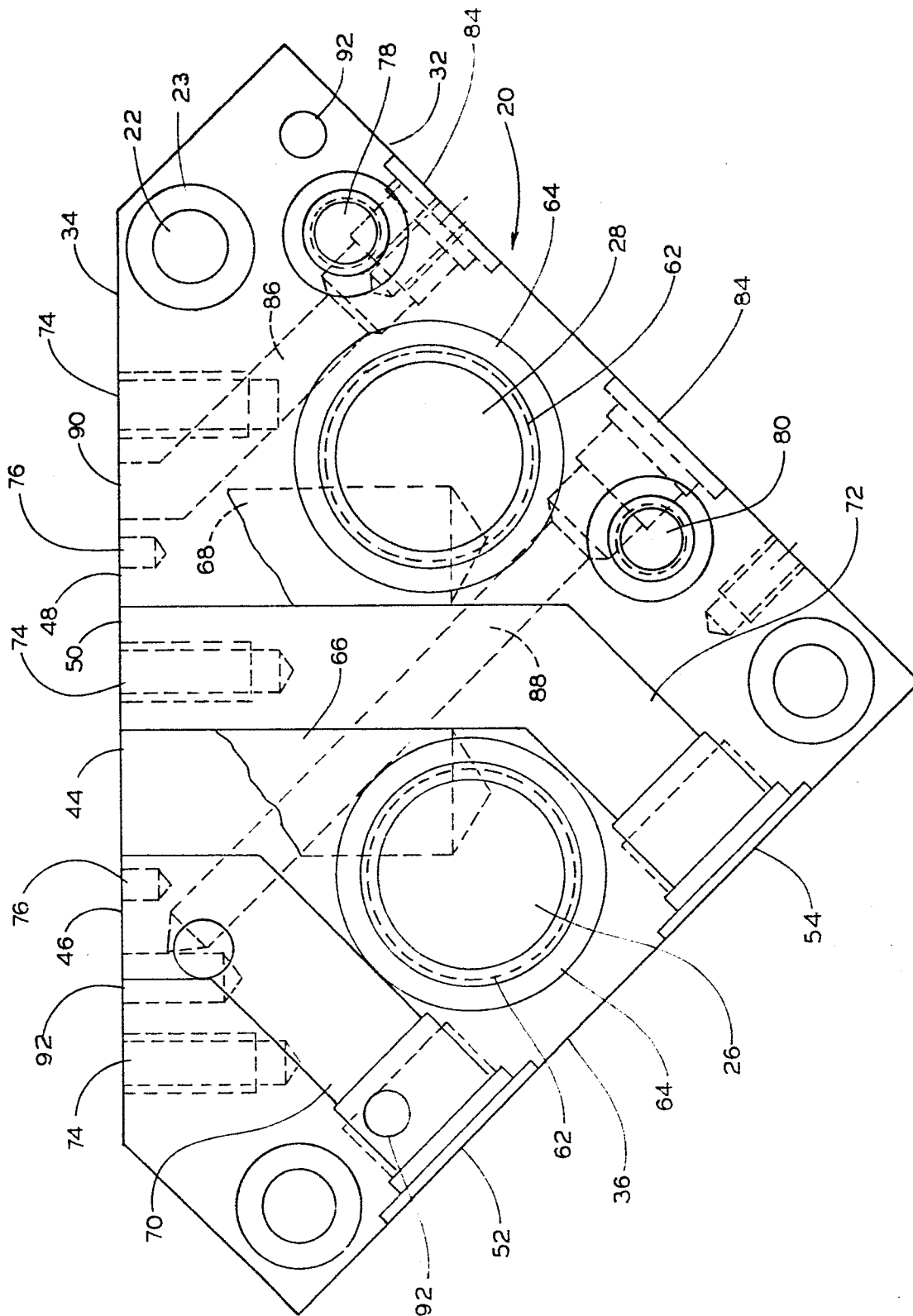


FIG. 3

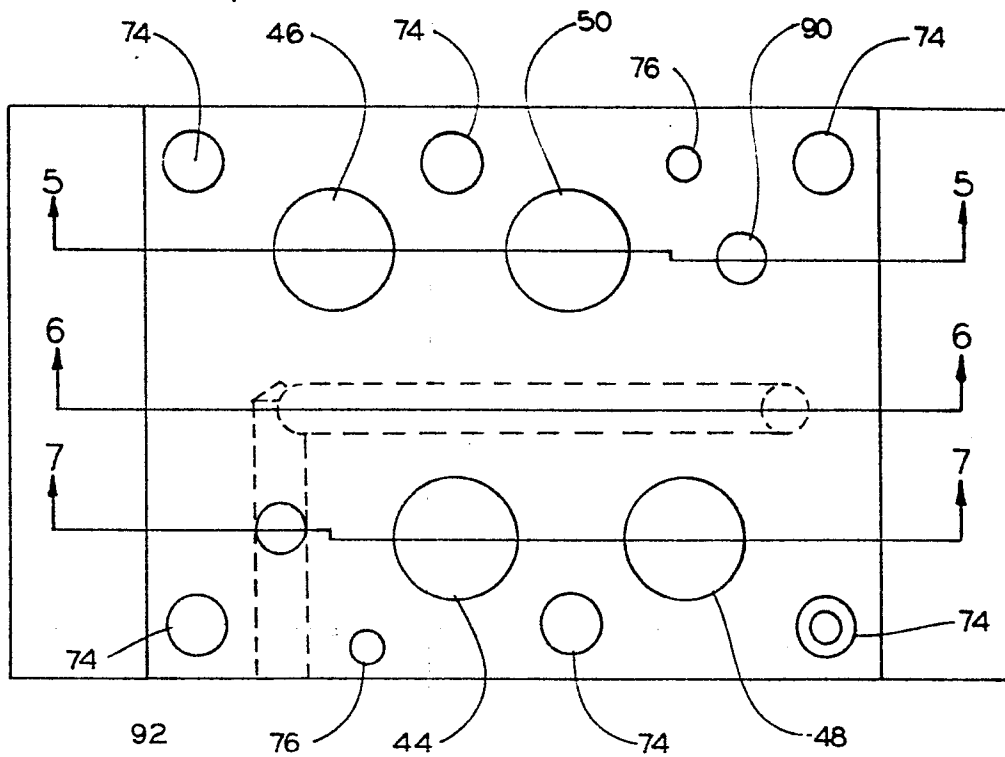


FIG. 4

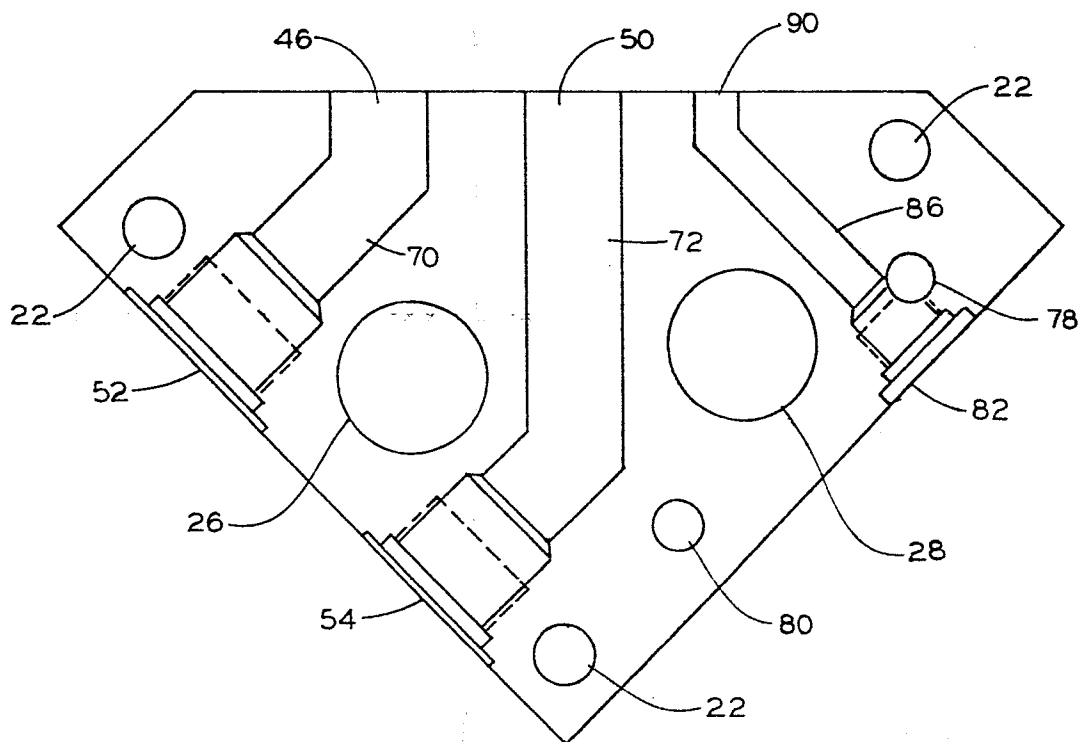


FIG. 5

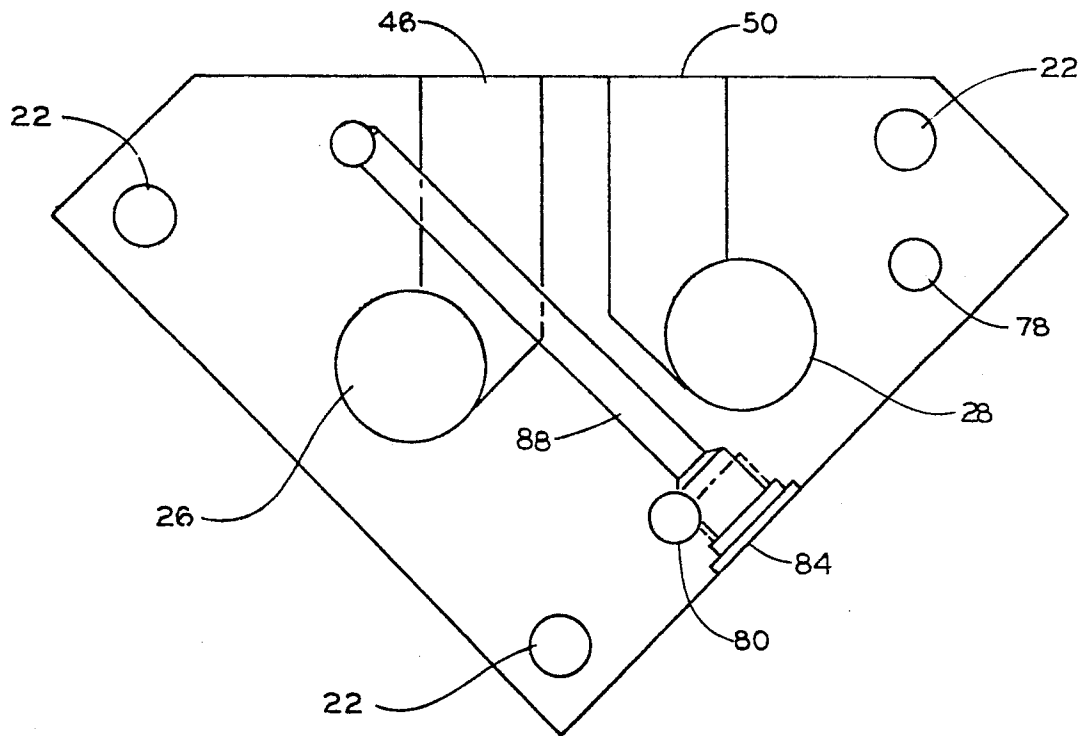


FIG. 6

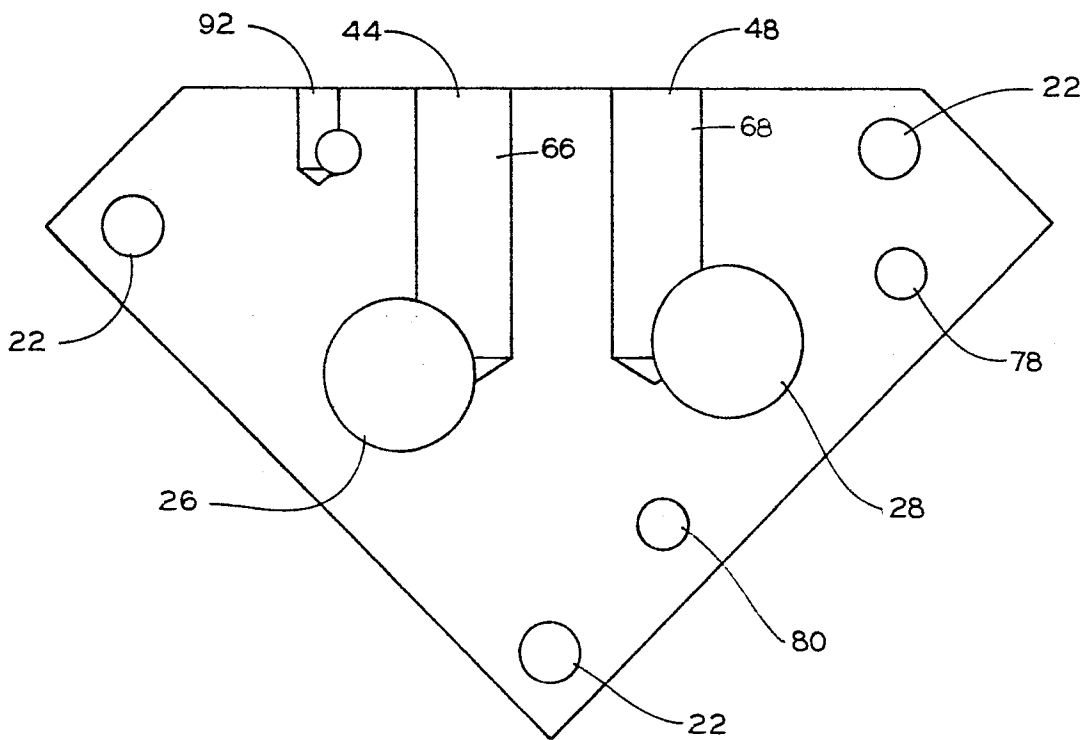


FIG. 7



European Patent
Office

EUROPEAN SEARCH REPORT

0142281
Application number

EP 84 30 7059

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
A	US-A-4 082 324 (R.E. OBRECHT) * Column 3, lines 14-42; figure 1 * -----	1	F 15 B 13/00 F 16 K 27/00
			TECHNICAL FIELDS SEARCHED (Int. Cl. 4)
			F 15 B 13/00 F 16 K 27/00
The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 03-01-1985	Examiner LEMBLE Y.A.F.M.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			