



(22) Date de dépôt/Filing Date: 2000/05/09

(41) Mise à la disp. pub./Open to Public Insp.: 2001/11/09

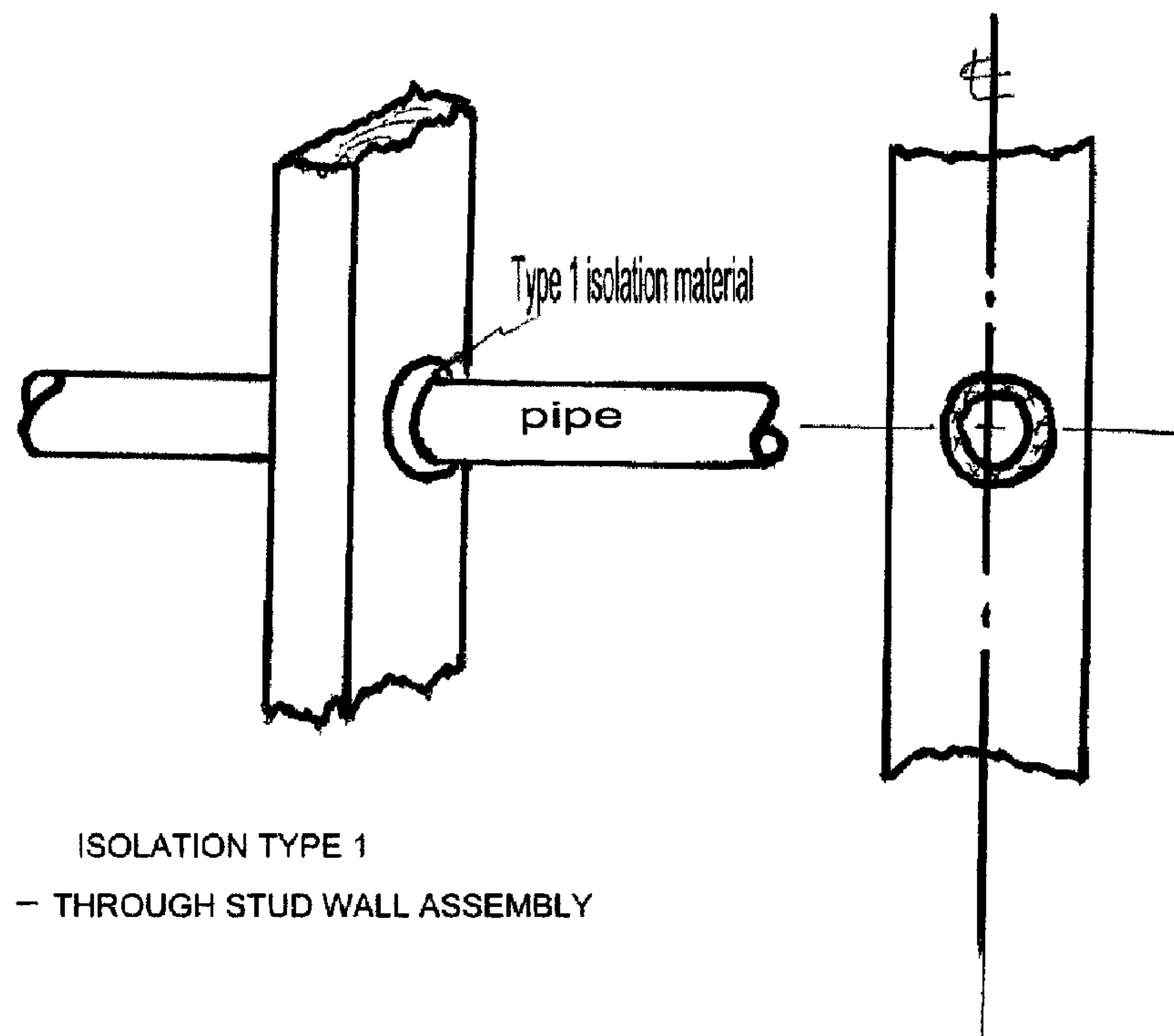
(51) Cl.Int.⁷/Int.Cl.⁷ F16L 55/035

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(54) Titre : ATTENUATION DES BRUITS DES EQUIPEMENTS SANITAIRES

(54) Title: SOUNDTRAP PLUMBING NOISE REDUCTION



(57) Abrégé/Abstract:

The invention provides improved plumbing noise containment in new home and retrofit construction without dramatically increasing the width of the wall/floor assemblies. The invention dramatically reduces the unwanted noises transmitted from the pipes to the living areas of the home; thus greatly improving the quality of construction and lifestyle for the homeowners. To achieve noise containment in the plumbing four processes must be applied. All the pipes are isolated from the structure. All the pipes have a sound absorption material wrapped around them. The wall and floor cavities that contain pipes are treated with sound absorptive insulation. Wall and floor cavities that contain pipes are covered with a barrier material and/or acoustic wallboard. All four processes are applied before conventional wall/ceiling coverings are installed.

SOUNDTRAP PLUMBING NOISE REDUCTION

ABSTRACT

The invention provides improved plumbing noise containment in new home and retrofit construction without dramatically increasing the width of the wall/floor assemblies. The invention dramatically reduces the unwanted noises transmitted from the pipes to the living areas of the home; thus greatly improving the quality of construction and lifestyle for the homeowners. To achieve noise containment in the plumbing four processes must be applied. All the pipes are isolated from the structure. All the pipes have a sound absorption material wrapped around them. The wall and floor cavities that contain pipes are treated with sound absorptive insulation. Wall and floor cavities that contain pipes are covered with a barrier material and/or acoustic wallboard. All four processes are applied before conventional wall/ceiling coverings are installed.

Summary

SOUNDTRAP PLUMBING NOISE REDUCTION

When conventional noise control techniques are performed only a small portion of the required noise reduction is obtainable. Using additional conventional noise reduction techniques i.e. resilient channels, in conjunction with double drywall increases the wall/floor assembly by over 25 mm. (1"). This increase in wall thickness makes it difficult for the electricians who have installed electrical boxes and also the finish carpenters who have to accommodate door frames and trim to walls and floors / ceiling assemblies of a non standard thickness.

This invention provides a better family living environment and reduces the amount of noise heard in a home. Particularly the noises made by liquids and solids as they pass through the hot and cold water supply pipes and the drains waste and vent pipes, without significantly increasing the width of the interior wall of floor assemblies.

THE SOUNDTRAP PLUMBING NOISE CONTROL SYSTEM

BACKGROUND TO THE INVENTION

Plumbing noise has long been known to annoy homeowners. Homebuilders have had a problem identifying how noisy the plumbing would be after construction. Trades people install the plumbing according to the building code. Unfortunately none of the building codes apply to noise problems generated from the mechanical installation work of the pipes. These installations hard fastened the pipes to the building structure and pass pipes through hollow joist and wall cavities. These hollow cavities amplify the noises made by the fluids and solids as they pass through the pipes. The hard fastening of the pipes directly transmits noises in the pipes and does not allow for normal expansion and contraction of these pipes; thus, generating unwanted noise throughout the home.

Conventional plumbing installed to code is functional but noisy.

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Fig 22	Pipes resting on the building structure, isolation, pipe wrap, insulation and barrier material with sound deadening board.

SOUNDTRAP PLUMBING NOISE REDUCTION

DESCRIPTION

Research and testing established that plumbing noise is annoying and the loudest and most annoying household plumbing noise is the flushing of the toilet.

According to ASHREA 'The American Society of Heating and Refrigeration Engineers' the living area's in an average North American home is considered quiet at NC30, and bedrooms NC 25. Our testing showed that noise generated by flushing the average home toilet to be 60+dB.

Therefore no known single noise reduction technique was capable of removing enough noise from the plumbing system to make the noise unobtrusive to the people living in the home.

The 'SOUNDTRAP PLUMBING NOISE REDUCTION' achieves the required noise reduction by performing the described processes prior to the installation of the wall/ceiling finishes.

- Isolating all the pipes from the structure of the home with any kind of vibration isolation /damping material, reduces plumbing noise by up to 15dB.
- Wrapping all the pipes with any kind of sound absorptive pipe wrap, reduces plumbing noise by up to 5dB.
- Filling the walls, floors and joist cavities with any kind of sound absorptive insulation, reduces plumbing noise by up to 3 dB.
- Covering the floor or wall cavity or any par thereof that contain pipes with a limp sound absorptive barrier material and or acoustic sound deadening board, reduces the noise by up to an additional 10dB.

This work is performed prior to the installation of conventional construction wall/floor coverings

Product description:**Type 1 isolation material**

Polyethylene foam

Typical properties: - Compressive strength	ASTM D3575 at 5%	2.5
Tensile strength (psi)	ASTM D3575 test E	60 (4.22Kg / cm)
Tear strength (lb./in)	ASTM D3575 test D	19 (8.6Kg / 25.4cm)
Density Range	ASTMD3575 test C	2.3-3.3
Nominal Thickness	6.2mm.	(1/4")

Type 2 isolation material.

Re-enforced rough ribbed neoprene sheet

Typical properties:- Duro Range A scale	50-60
Specific Gravity	1.23 approx.
Tensile strength	Mpa 5.2-9.6
	PSI 3000-8000
Elongation %	250 - 800
Nominal Thickness	6.2mm (1/4")

Type 3 isolation material.

Neoprene sheet

Typical properties:- Duro Range A scale	50-60
Specific Gravity	1.23 approx.
Tensile strength	Mpa 5.2-9.6
	PSI 3000-8000
Elongation %	250 - 800
Nominal Thickness	6.2mm (1/4")

Pipe wrap

Closed cell polyolefin tube

Typical properties:- Density	2 LBS/CU.FT. (.90Kg / 0.92m ³)	Nominal
Thickness	12.5mm. (1/2")	

Insulation:F/glass, Mineral Fibre or Celulose. Density 1-3 LBS/CU.FT. (0.45 - 1.36 Kg / 0.092 m³)

Barrier Material

A thin, limp, dense noise barrier material

Typical properties:- Specific gravity

2.5

Performance Data: ASTM E 90-90.

Frequency (hz)

Transmission loss (dB)

80	17
100	14
125	13
250	16
500	20
1000	24
2000	29
4000	35

STC= 24

Nominal Thickness 1.6 mm. (0.070")

Sound Deadening Board

Sound Deadening Wood Fibreboard

Typical properties:-

Density	14.5 LBS.CU.FT	(6.57Kg / 0.092m ³)
Traverse Loads at Rupture	10.5 LBS	(4.76 Kg)
Linear Expansion	0.3%	
Thermal Resistance	R 1.5	
Compression Strength @ 10% Deformation	20-25 psi	(1.41 - 1.76 Kg/cm)

Performance Data:

Frequency (hz)

Absorption Coefficient

100	0.09
125	0.13
250	0.21
500	0.37
1000	0.30
2000	0.29
4000	0.34

NRC = 0.30

Description of the drawings

1. Fig 1. Shows a typical water supply or drains, waste or vent pipe centred in a joist or stud. The hole drilled to accommodate the plumbing pipe is increases by 12mm. In order to accommodate the vibration isolation material.

2. Fig 2. Shows a typical water supply or drains, waste or vent pipe centred in a wall or floor assembly. The holes drilled to accommodate the plumbing pipes are increased by 12mm. In order to accommodate the vibration isolation materials
3. Fig 3. Shows a typical plumbing pipe supported by a structural member. Vibration isolation material is installed between the pipe and structure.
4. Fig 4. Shows a typical plumbing pipe supported by a hanger strap. Vibration isolation material is installed between the pipe and hanger at the point of contact.
5. Fig 5. Shows a typical vertical pipe that is supported by a mechanical clamp. Vibration isolation material is installed between the clamp and structure and there is no contact between the pipe and structure.
6. Fig 6. Shows a typical plumbing pipe resting on the building structure. Vibration isolation material is installed in between the pipe and structure.
7. Fig 7. Shows a typical water supply or drains, waste or vent pipe centred in a joist or stud. The hole drilled to accommodate the plumbing pipe is increases by 12mm. In order to accommodate the vibration isolation material. Pipe wrap is closely fitted to pipe.
8. Fig 8. Shows a typical water supply or drains, waste or vent pipe centred in a wall or floor assembly. The holes drilled to accommodate the plumbing pipes are increased by 12mm. In order to accommodate the vibration isolation materials. Pipe wrap is closely fitted to pipe.
9. Fig 9. Shows a typical plumbing pipe supported by a structural member. Vibration isolation material is installed between the pipe and structure. Pipe wrap is closely fitted to pipe.
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12. Fig 12. Shows a typical plumbing pipe resting on the building structure. Vibration isolation material is installed in between the pipe and structure. Pipe wrap is closely fitted to pipe.

13. Fig 13. Shows a typical water supply or drains, waste or vent pipe centred in a wall or floor assembly. The holes drilled to accommodate the plumbing pipes are increased by 12mm. In order to accommodate the vibration isolation materials. Pipe wrap is closely fitted to pipe. The wall and joist cavities that contain pipes are filled with insulation.
14. Fig 14. Shows a typical plumbing pipe supported by a structural member. Vibration isolation material is installed between the pipe and structure. Pipe wrap is closely fitted to pipe. The wall and joist cavities that contain pipes are filled with insulation.
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16. Fig 16. Shows a typical vertical pipe that is supported by a mechanical clamp. Vibration isolation material is installed between the clamp and structure and there is no contact between the pipe and structure. Pipe wrap is closely fitted to pipe. The wall and joist cavities that contain pipes are filled with insulation. Wall and floor cavities adjacent to the pipes are also filled with insulation for an additional 1 m.
17. Fig 17. Shows a typical plumbing pipe resting on the building structure. Vibration isolation material is installed in between the pipe and structure. Pipe wrap is closely fitted to pipe. The wall and joist cavities that contain pipes are filled with insulation. Wall and floor cavities adjacent to the pipes are also filled with insulation for an additional 1 m.
18. Fig 18. Shows a typical water supply or drains, waste or vent pipe centred in a wall or floor assembly. The holes drilled to accommodate the plumbing pipes are increased by 12mm. In order to accommodate the vibration isolation materials. Pipe wrap is closely fitted to pipe. The wall and joist cavities that contain pipes are filled with insulation. Sound barrier material is mechanically fastened or glued to the exterior faces of the joists or studs over wall and floor cavities that contain plumbing pipes.
19. Fig 19. Shows a typical plumbing pipe supported by a structural member. Vibration isolation material is installed between the pipe and structure. Pipe wrap is closely fitted to pipe. The wall and joist cavities that contain pipes are filled with insulation. The wall and joist cavities are filled with insulation. Sound barrier material is mechanically fastened or glued to the exterior faces of the joists or studs over wall and floor cavities that contain plumbing pipes. In addition inside these cavities strapping is installed to the edges of these studs/joists and sound deadening board is fastened to these straps. The board is fitted so that the facing of the board is flush with the facing edge of the wall / joist member.

- 20.** Fig 20. Shows a typical plumbing pipe supported by a hanger strap. Vibration isolation material is installed between the pipe and hanger at the point of contact. Pipe wrap is closely fitted to pipe. The wall and joist cavities that contain pipes are filled with insulation. Sound barrier material is mechanically fastened or glued to the exterior faces of the joists or studs over wall and floor cavities that contain plumbing pipes. In addition inside these cavities strapping is installed to the edges of these studs/joists and sound deadening board is fastened to these straps. The board is fitted so that the facing of the board is flush with the facing edge of the wall / joist member.
- 21.** Fig 21. Shows a typical vertical pipe that is supported by a mechanical clamp. Vibration isolation material is installed between the clamp and structure and there is no contact between the pipe and structure. Pipe wrap is closely fitted to pipe. The wall and joist cavities that contain pipes are filled with insulation. Sound barrier material is mechanically fastened or glued to the exterior faces of the joists or studs over wall and floor cavities that contain plumbing pipes.
- 22.** Fig 17. Shows a typical plumbing pipe resting on the building structure. Vibration isolation material is installed in between the pipe and structure. Pipe wrap is closely fitted to pipe. The wall and joist cavities that contain pipes are filled with insulation. Wall and floor cavities adjacent to the pipes are also filled with insulation for an additional 1 m. Sound barrier material is mechanically fastened or glued to the exterior faces of the joists or studs over wall and floor cavities that contain plumbing pipes. In addition inside these cavities strapping is installed to the edges of these studs/joists and sound deadening board is fastened to these straps. The board is fitted to the wall or so that the facing of the board is flush with the facing edge of the wall / joist member.

Claims

1. A 1990 study 'ON PLUMBING NOISE IN MULTI - DWELLING BUILDING' performed by MJM ACOUSTICAL CONSULTANTS inc., 655, Cote des Neiges, Burea 440, Montreal, Quebec, H3S-2A6. And published by the CMHC. Identified pipe isolation as being very important when containing noise in multi family dwelling units. The materials used to isolate water supply pipes only were:

Armstrong A.P. Armaflex Foam Pipe Insulation, nominal thickness 13 mm.
Acousto-Plumb System Acousto-Clamp pipe supports manufactured by Ancon Inc.

Double layer of cork with total thickness of 3 mm.

13 mm hair and fabric felt

My invention applies to single family homes and the thin foam material used in the process provides better vibration isolation than materials tested that are twice as thick.

2. Standard practice in the building industry is to install pipe wrap on water supply pipes only. My noise reduction process adds 12 mm. pipe insulation (wrap) to the supply water pipes as well as every drain, waste and vent pipe in the home.
3. The building industry often adds sound absorption to the wall / ceiling cavities that contain pipes. Unfortunately, this alone can do little to abate the noise generated by the plumbing system. My noise control process also adds sound absorption to these areas.
4. The 1990 study 'ON PLUMBING NOISE IN MULTI - DWELLING BUILDING' performed by MJM ACOUSTICAL CONSULTANTS inc., 655, Cote des Neiges, Burea 440, Montreal, Quebec, H3S-2A6. And published by the CMHC. Identified an improved wall construction to be: (resilient channels, in conjunction with double drywall).

Wall Construction Materials as tested:

13 mm drywall 7.8 kg/m²

16 mm drywall 10.2 kg/m²

25 mm gypsum coreboard 19.5 kg/m²

38 x 89 mm wood studs at 600 mm o.c.

90 mm steel studs

Resilient metal channels, type RCA by Canadian Gypsum Corporation at 600 mm o.c.

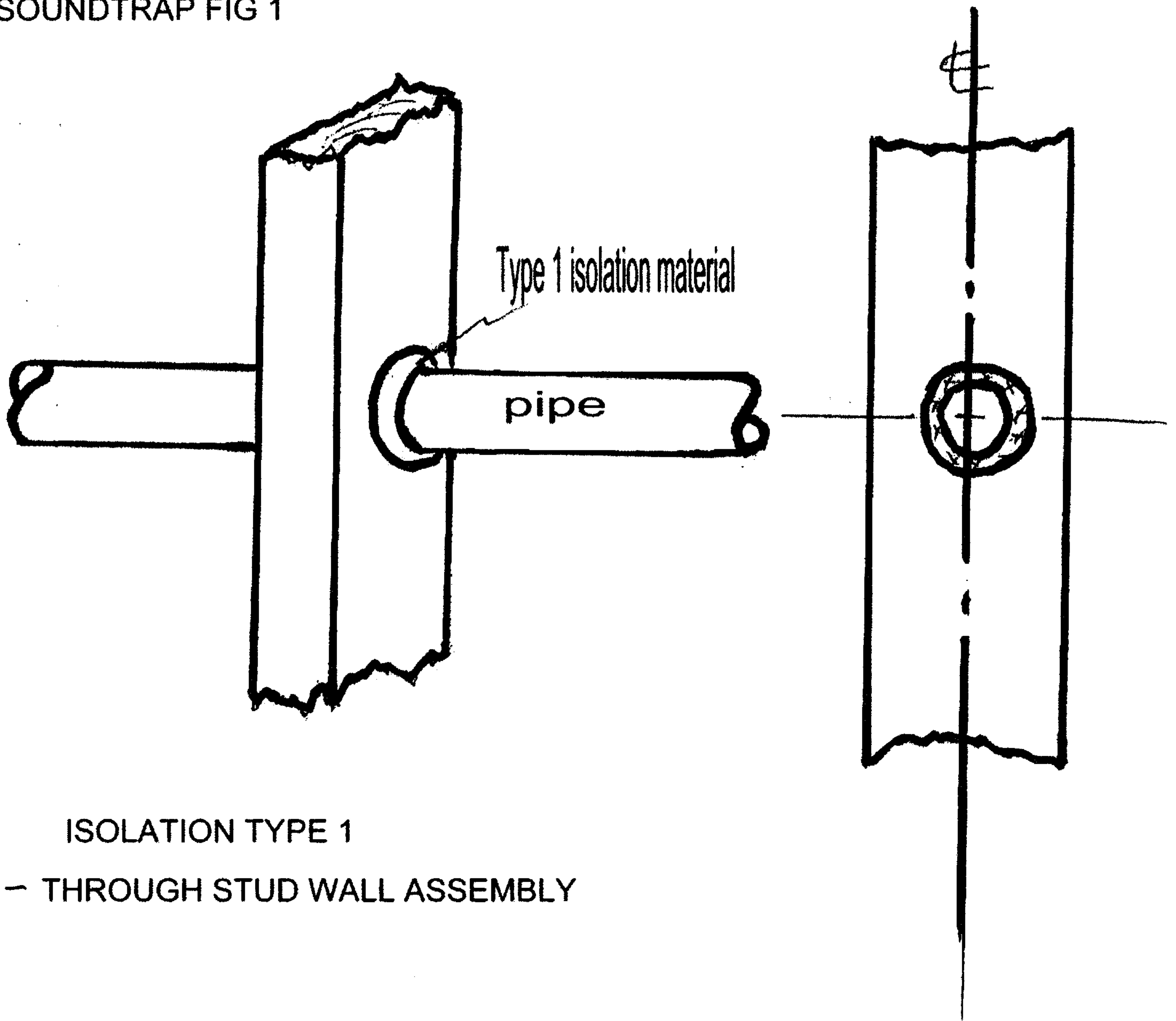
90 mm glass fibre batts.' Type R-12 Home Insulation, 1.2 kg/m².

Thermocell cellulose fibre: to install this material, 6 mm polythene sheet was attached to the studs leaving an opening at the top of each stud space. The cellulose fibre was then poured into the cavity through the opening. The opening at the top was gradually closed and the cavity filled completely. Drywall was then attached to the studs applied over the polythene sheet

This recommended wall improvement increased the assembly thickness by over 25mm.

My process installs an acoustic sound deadening board inside the wall or floor assembly and covers the floor or wall cavities that contain pipes with a limp sound absorptive barrier material. This is an increase in wall thickness of only 1.6 mm.

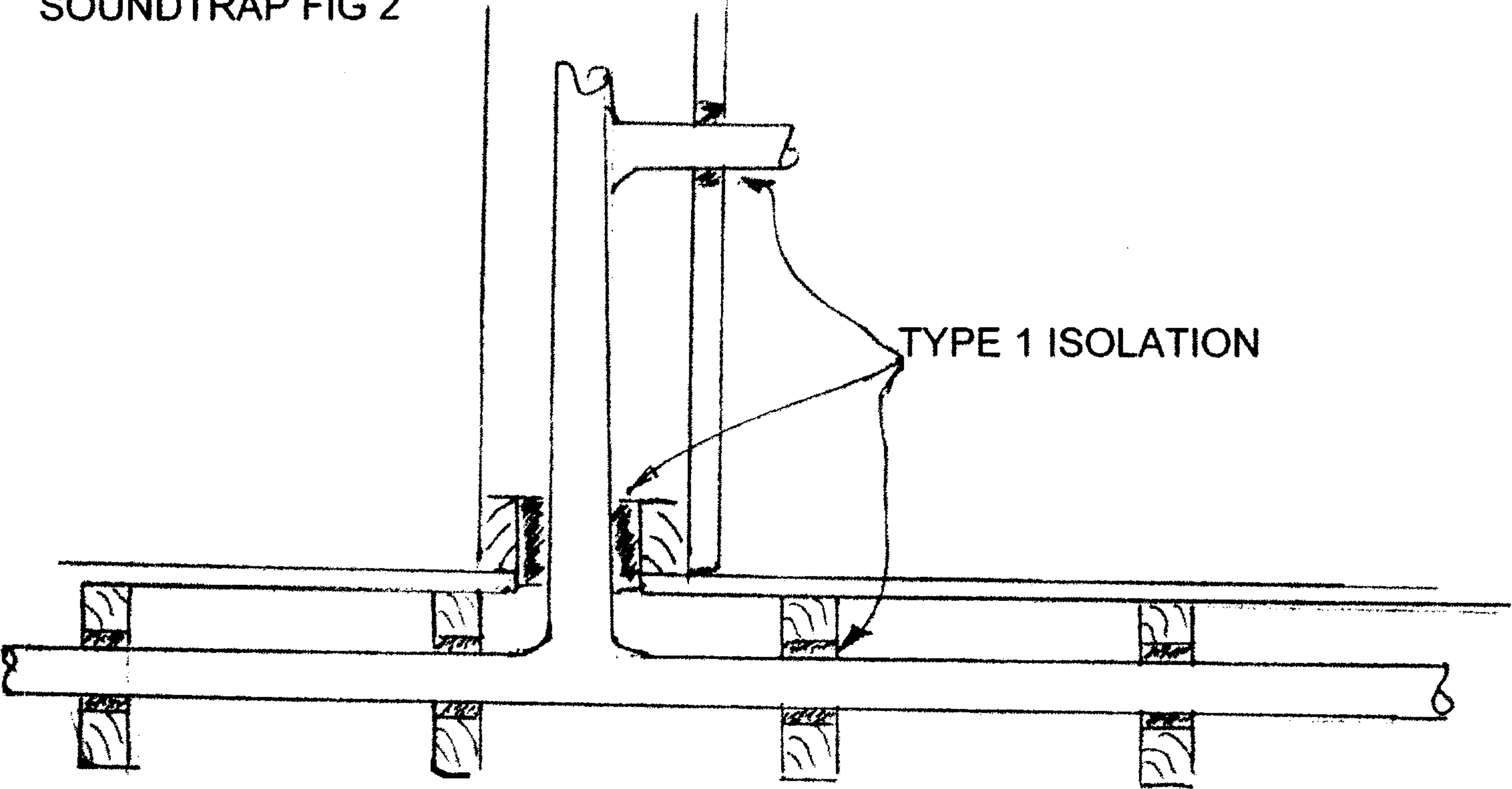
SOUNDTRAP FIG 1



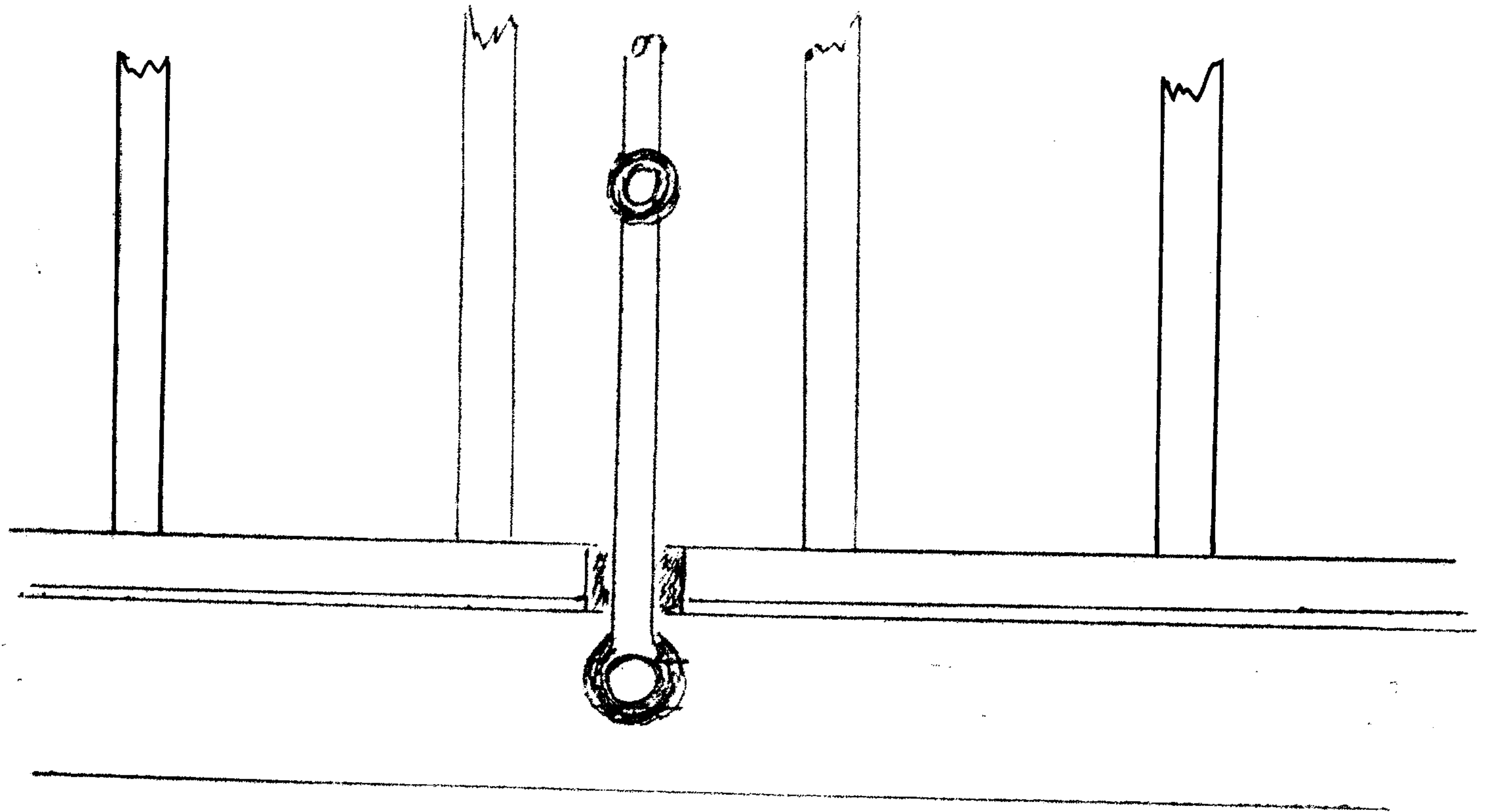
ISOLATION TYPE 1

- THROUGH STUD WALL ASSEMBLY

SOUNDTRAP FIG 2

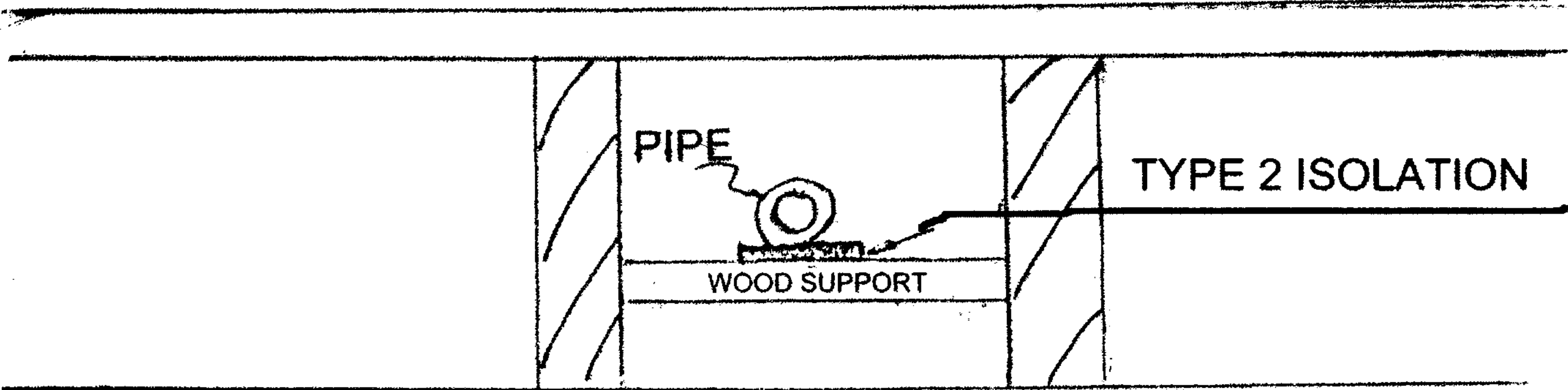


WALL/FLOOR ASSEMBLY

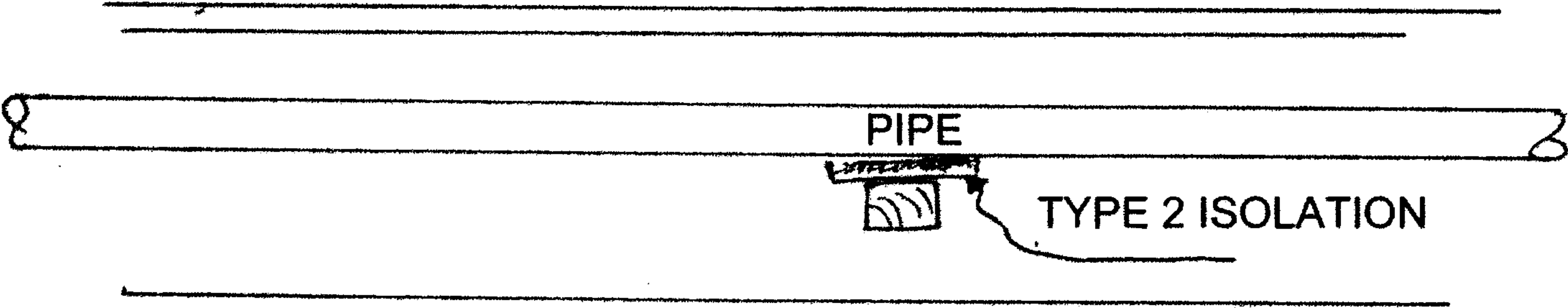


SOUNDTRAP FIG 3

FLOOR ASSEMBLY

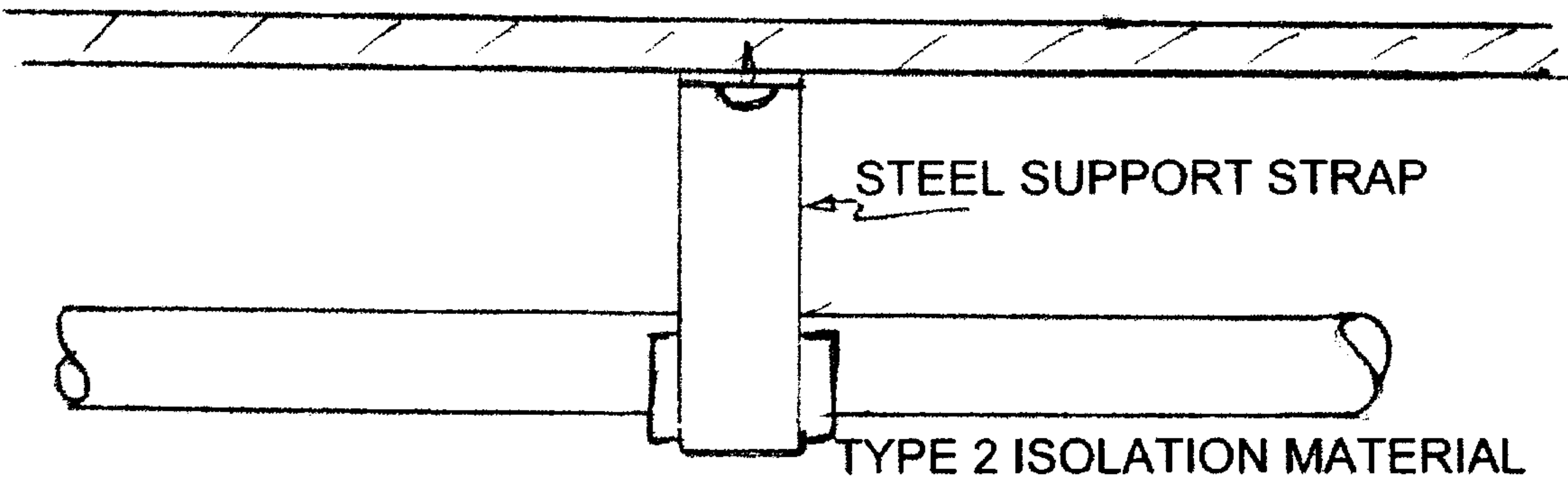
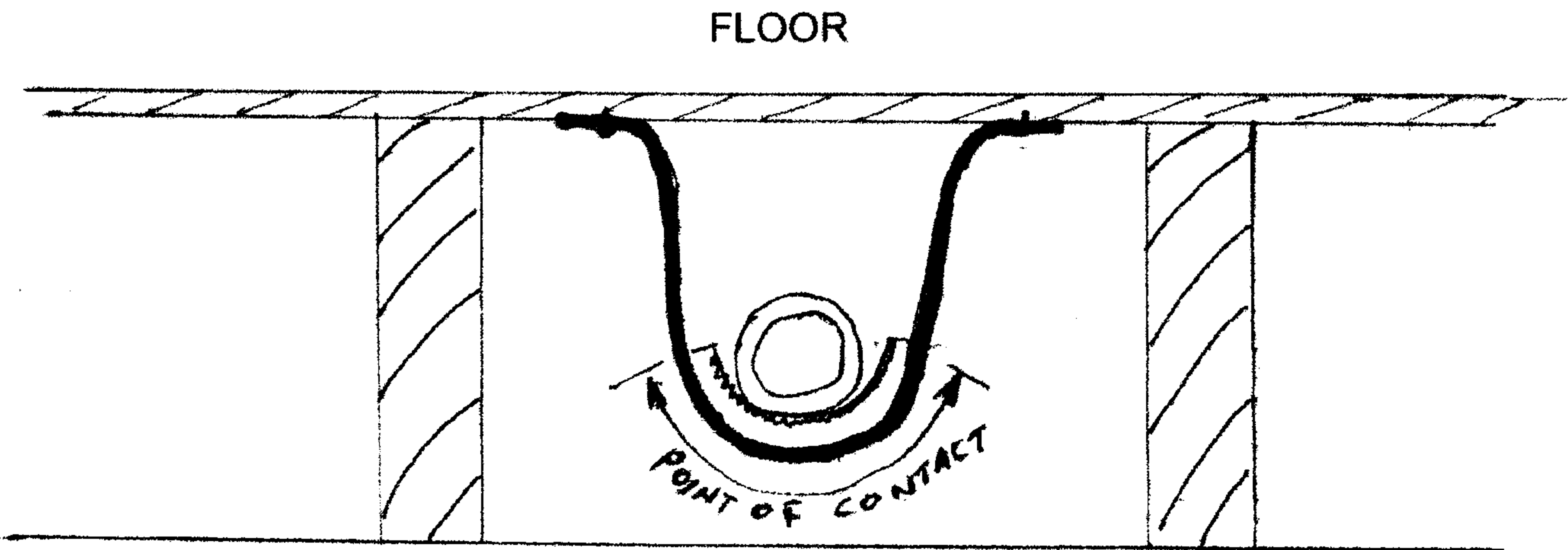


PIPES SUPPORTED BY WOODEN SUPPORTS



TYPE 2 ISOLATION

SOUNDTRAP FIG 4



PIPES SUPPORTED BY HANGERS

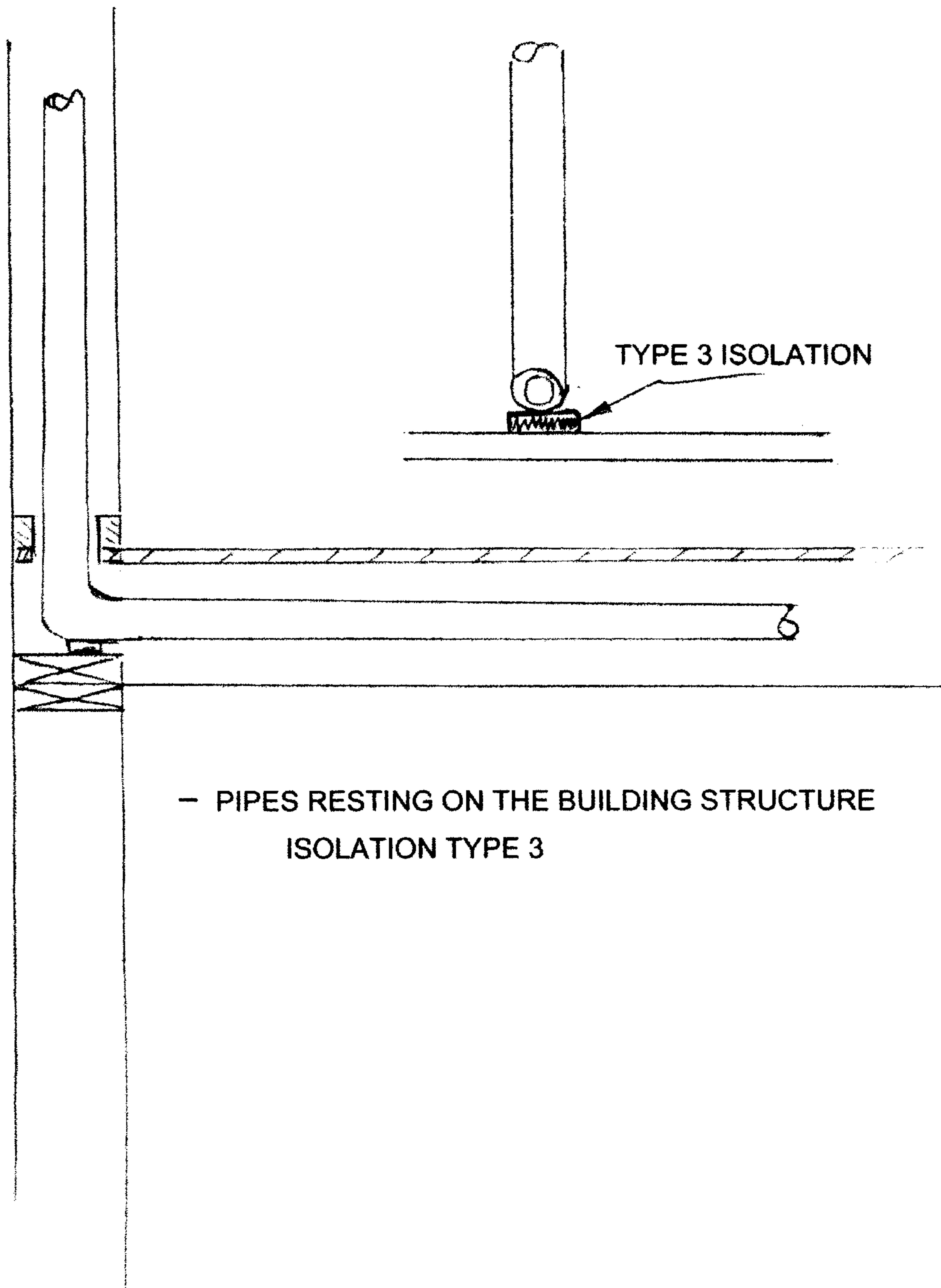
ISOLATION TYPE 2

The diagram illustrates a cross-section of a vertical stack assembly. A central vertical pipe is supported by a horizontal clamp. This clamp is connected to a larger horizontal support structure, which is shown with hatching to indicate it is a separate component. The support structure is labeled "TYPE 3 ISOLATION". Below the support structure, a horizontal line with arrows pointing outwards is labeled "CLEARANCE". The entire assembly is shown in a cross-sectional view, with the stack pipe and support structure clearly defined.

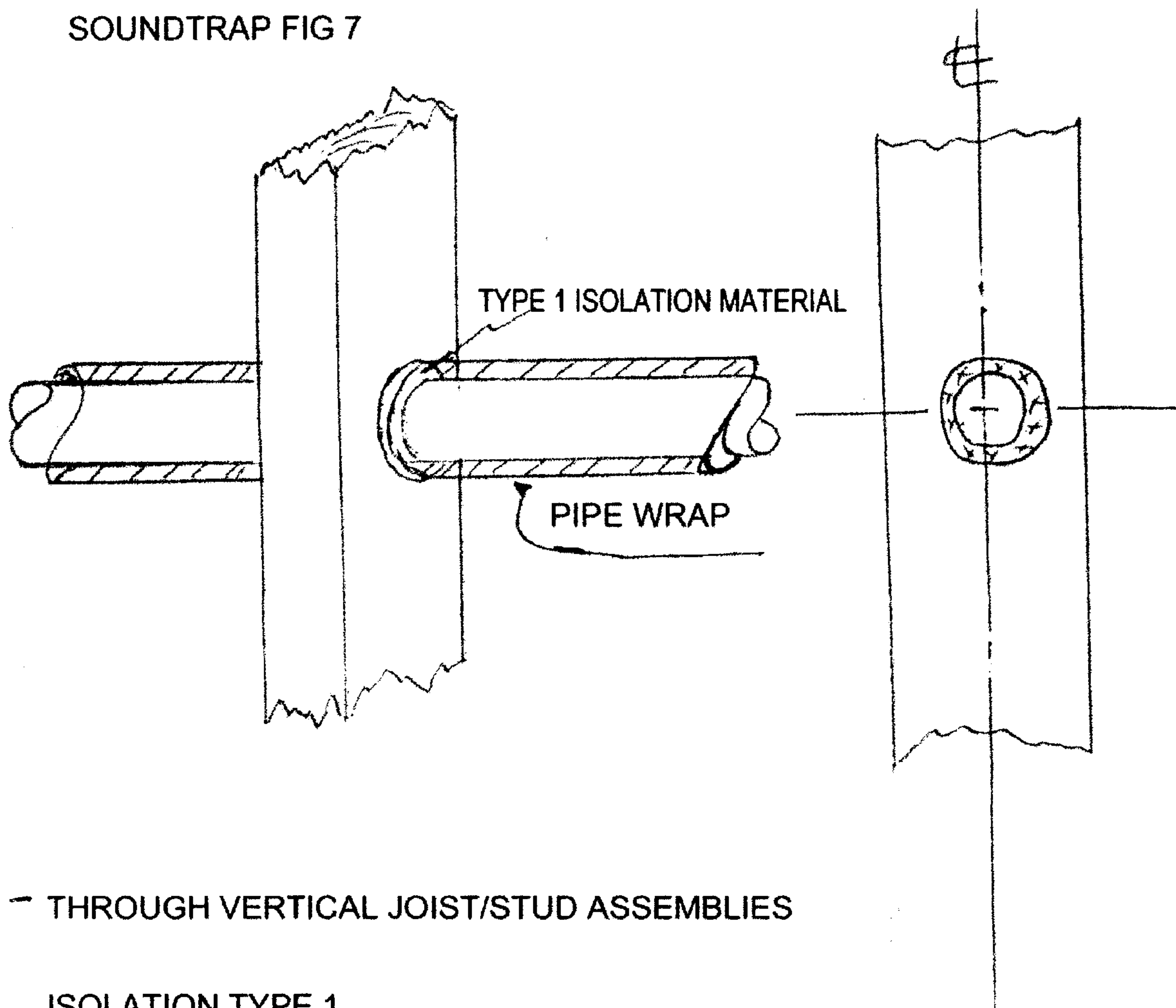
— STACKS SUPPORTED BY MECHANICAL CLAMPS

ISOLATION TYPE 3

SOUNDTRAP FIG 6



SOUNDTRAP FIG 7

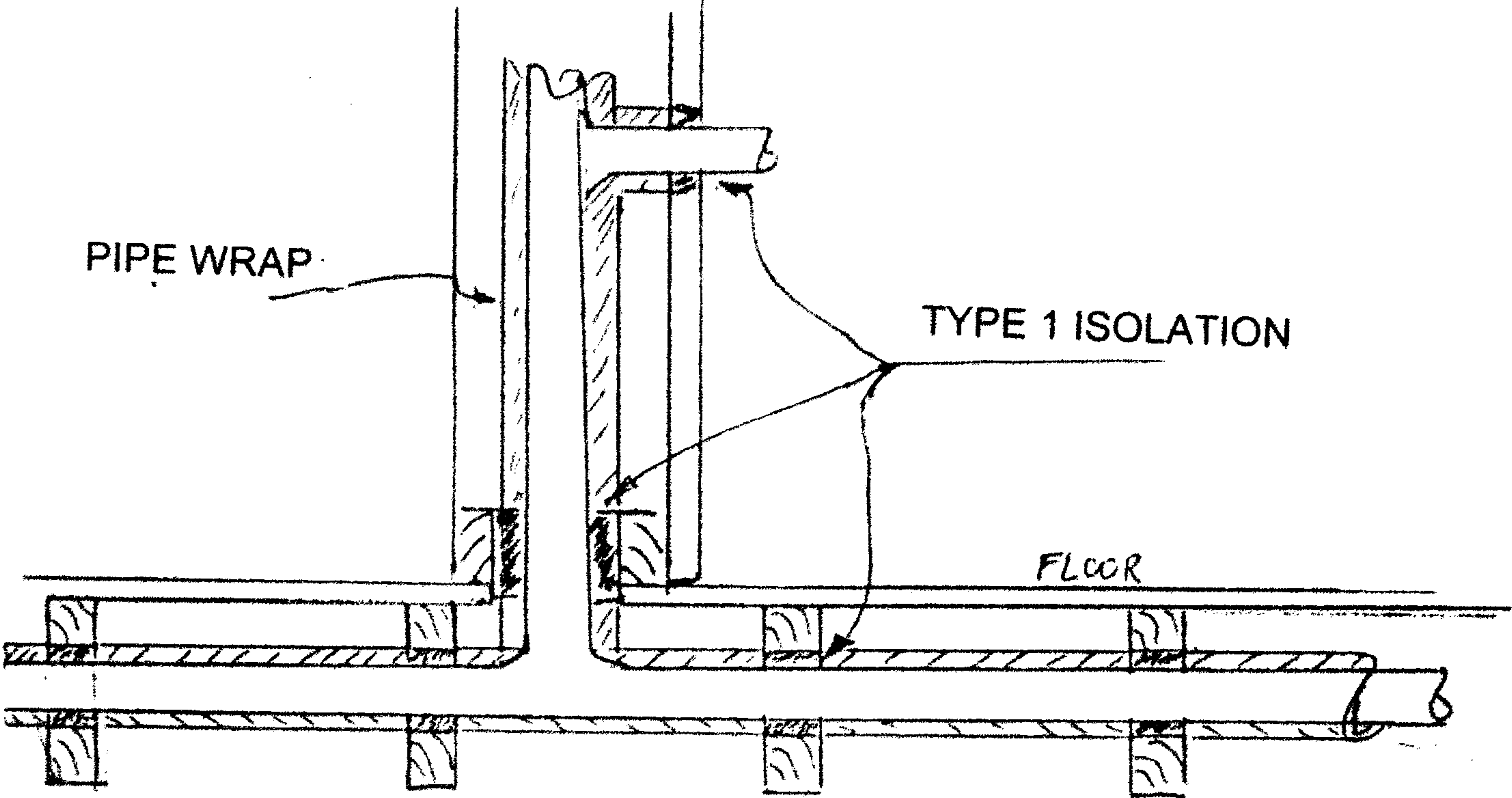


THROUGH VERTICAL JOIST/STUD ASSEMBLIES

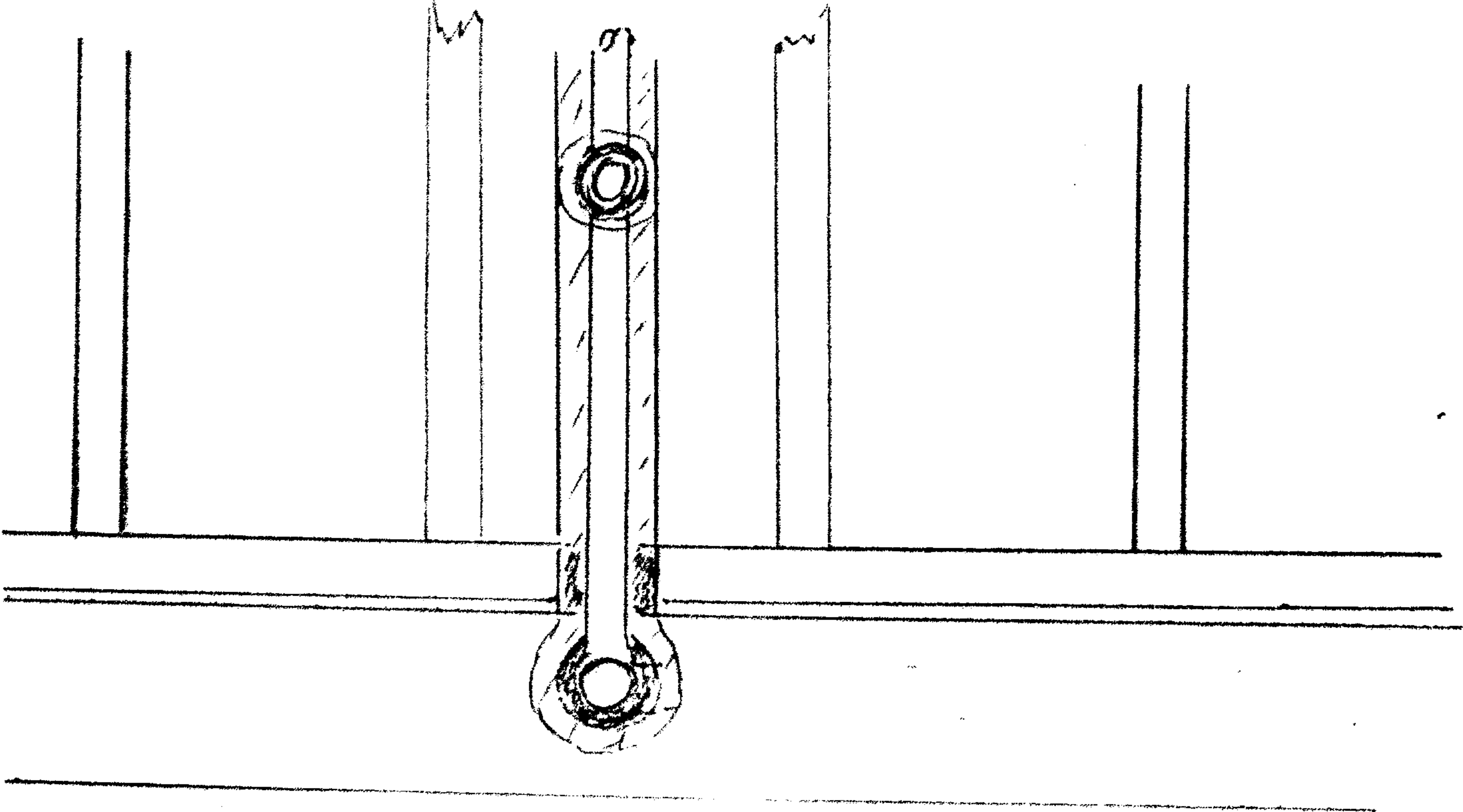
ISOLATION TYPE 1

PIPE WRAP

SOUNDTRAP FIG 8

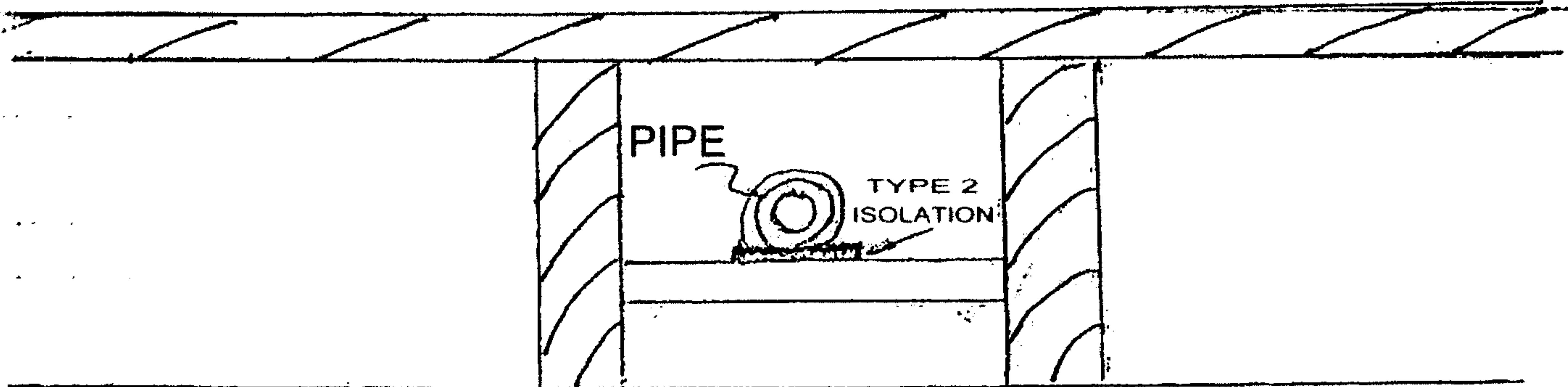


- ISOLATION TYPE 1
- PIPE WRAP

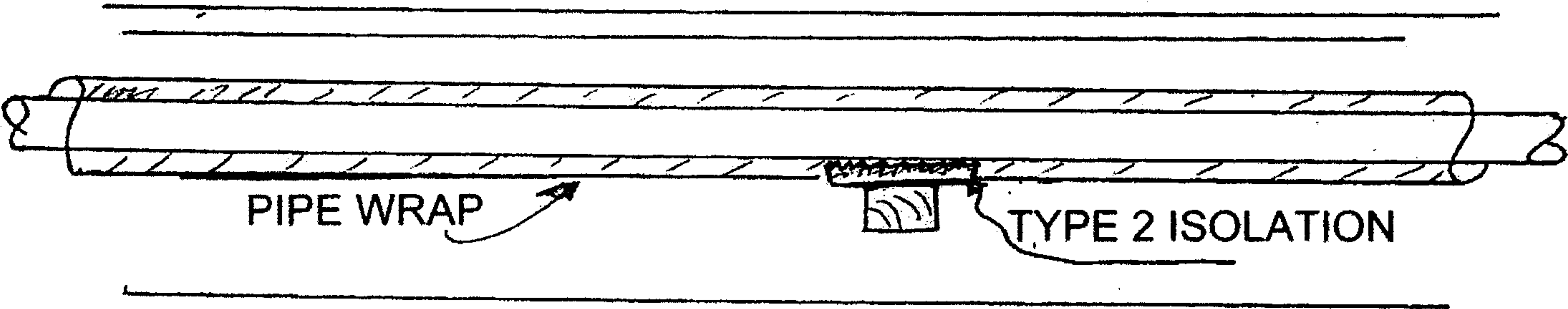


SOUNDTRAP FIG 9

FLOOR ASSEMBLY



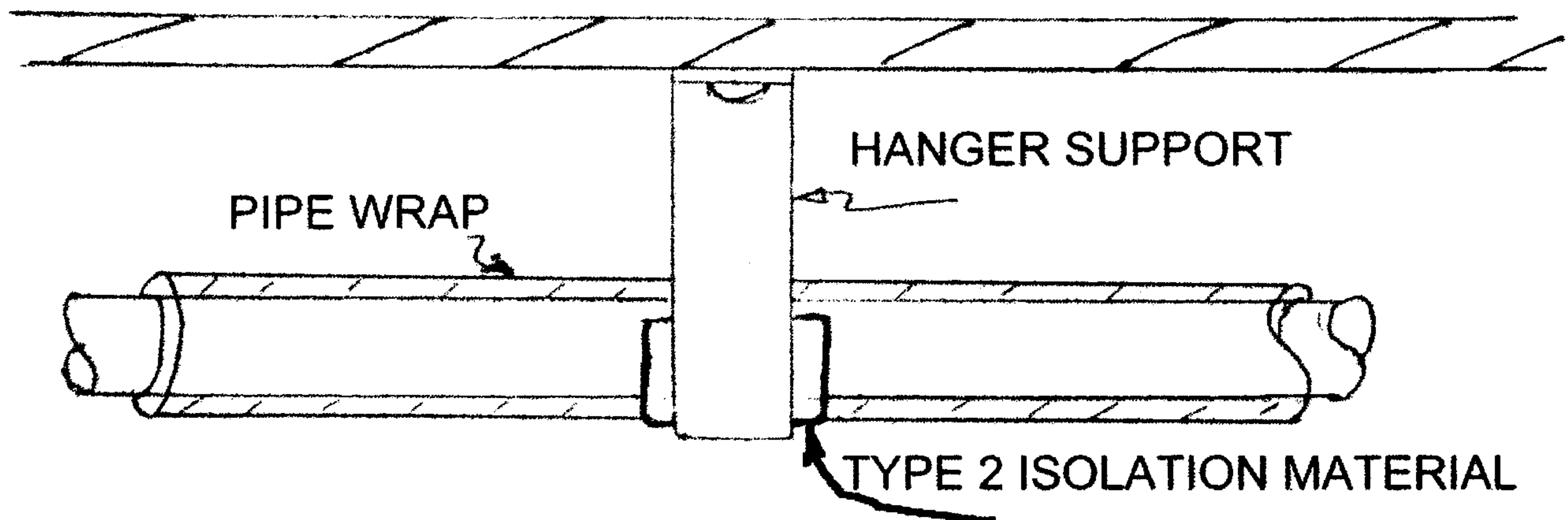
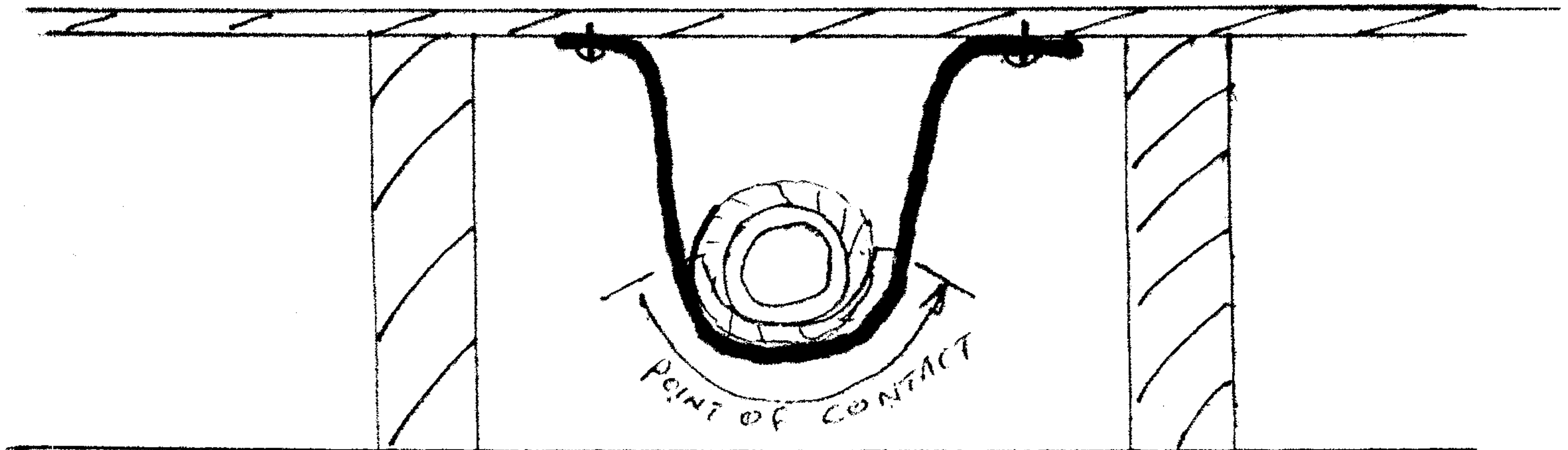
PIPES SUPPORTED BY HORIZONTAL STRUCTURES



- ISOLATION TYPE 2
- PIPE WRAP

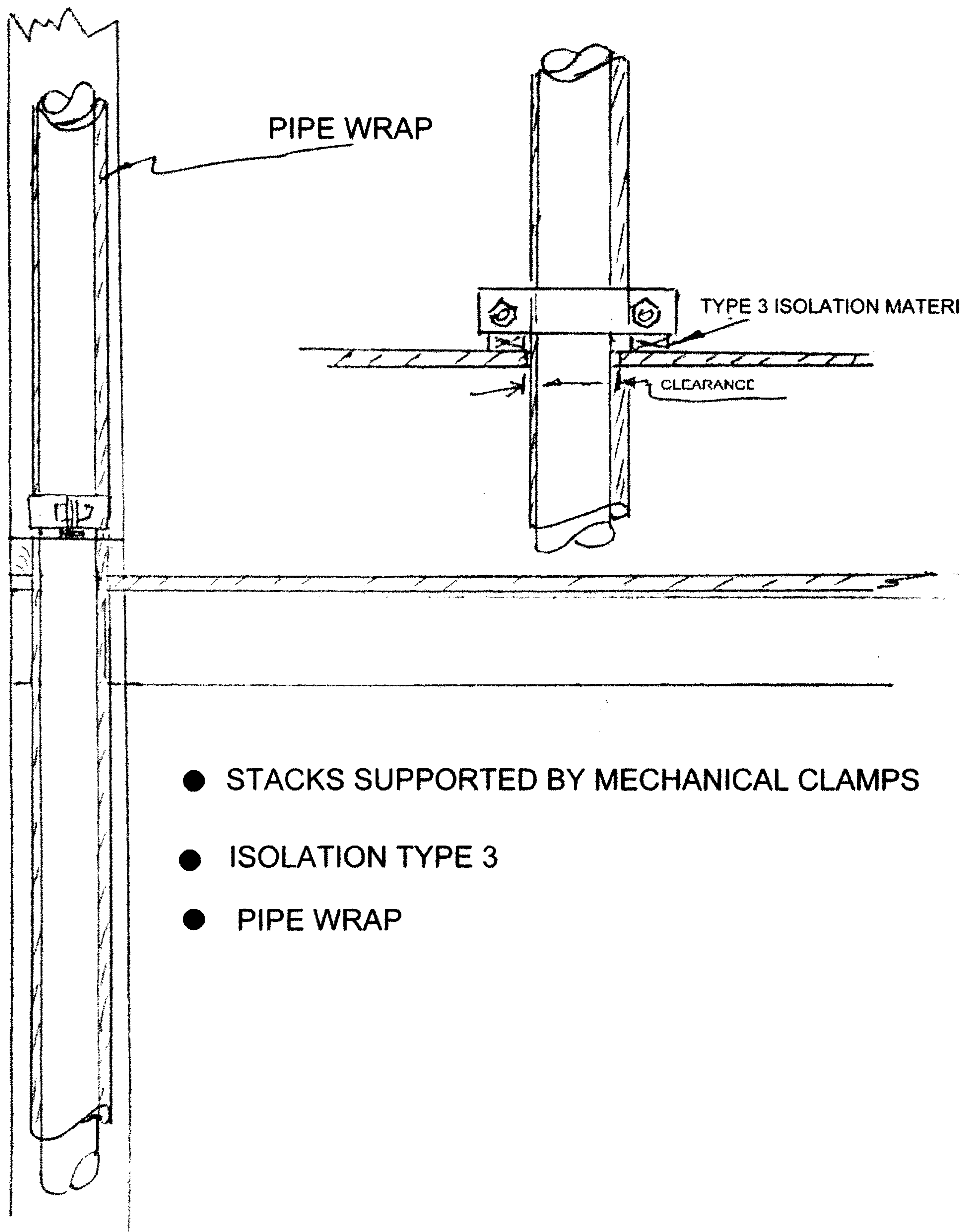
SOUNDTRAP FIG 10

FLOOR ASSEMBLY

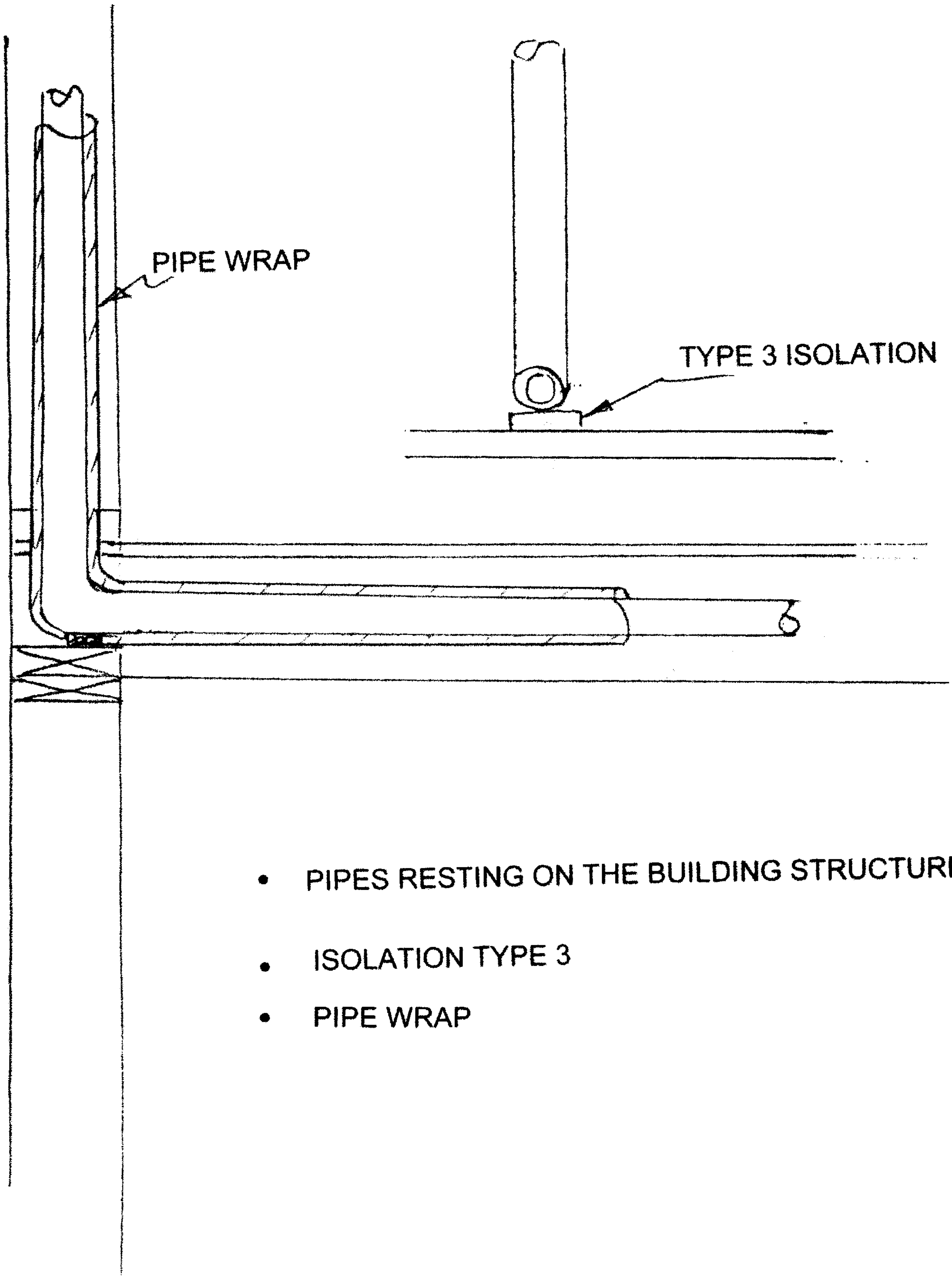


- PIPES SUPPORTED BY HANGER STRAPS
- ISOLATION TYPE 2
- PIPE WRAP

SOUNDTRAP FIG 11

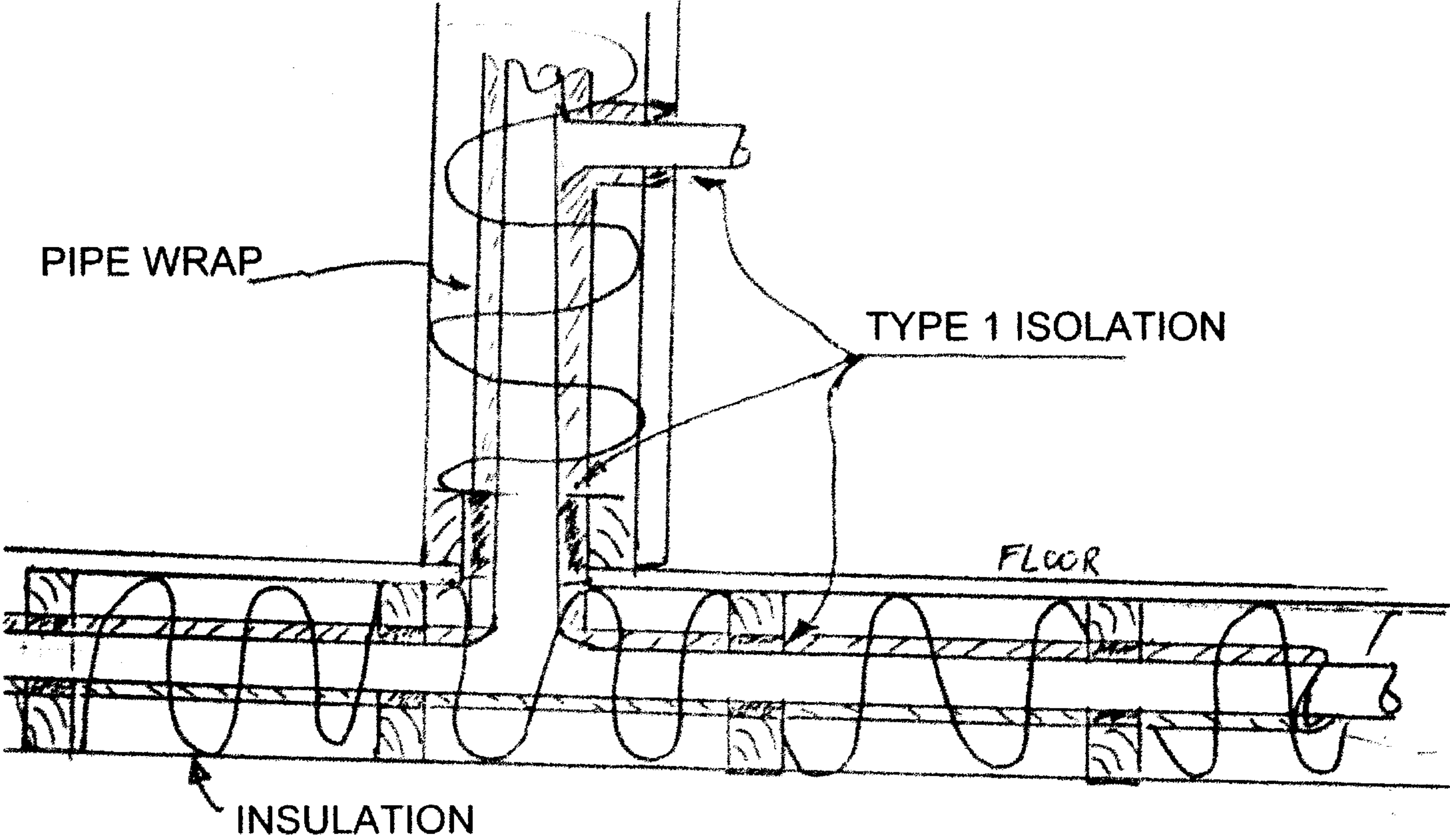


SOUNDTRAP FIG 12

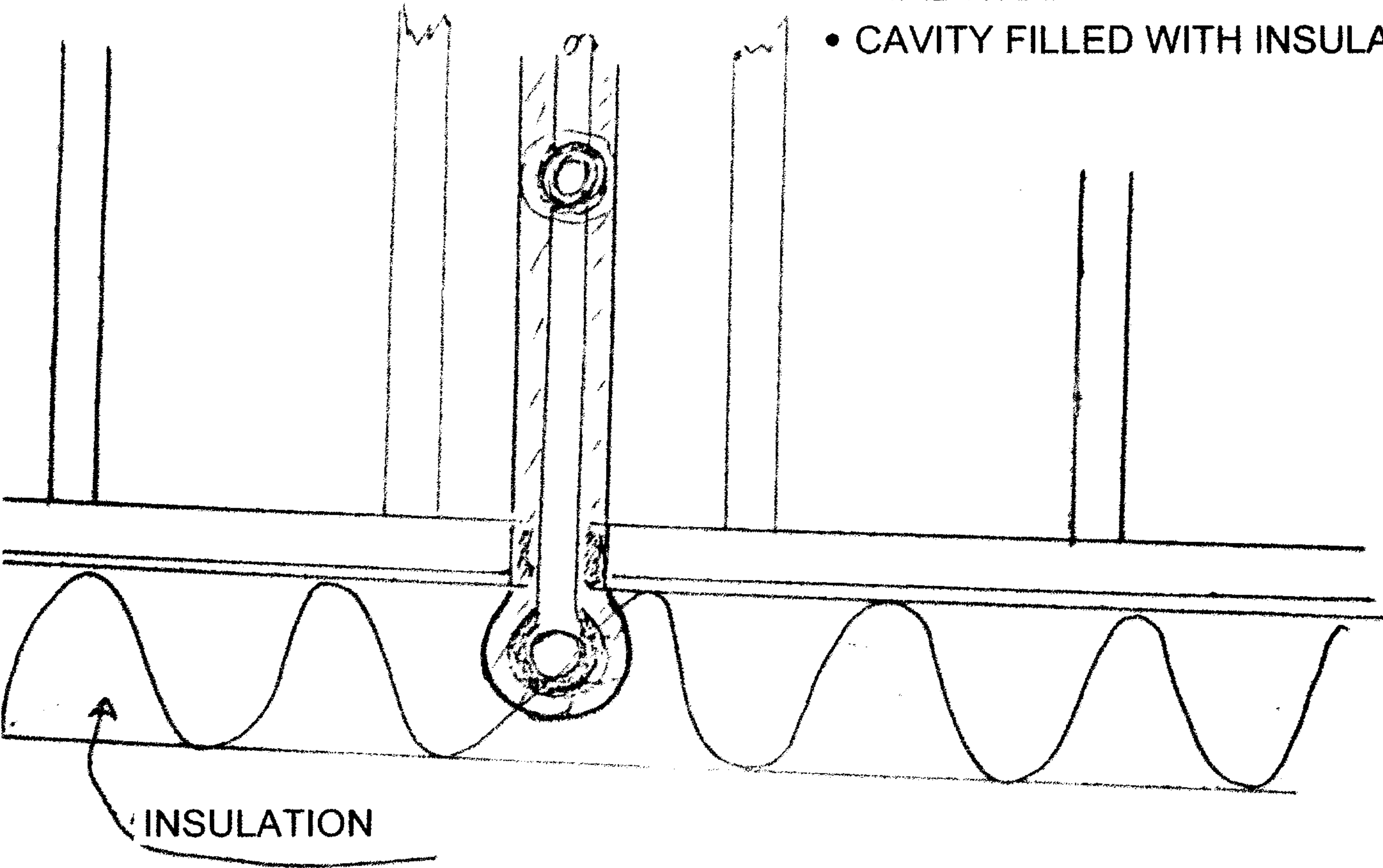


- PIPES RESTING ON THE BUILDING STRUCTURE
- ISOLATION TYPE 3
- PIPE WRAP

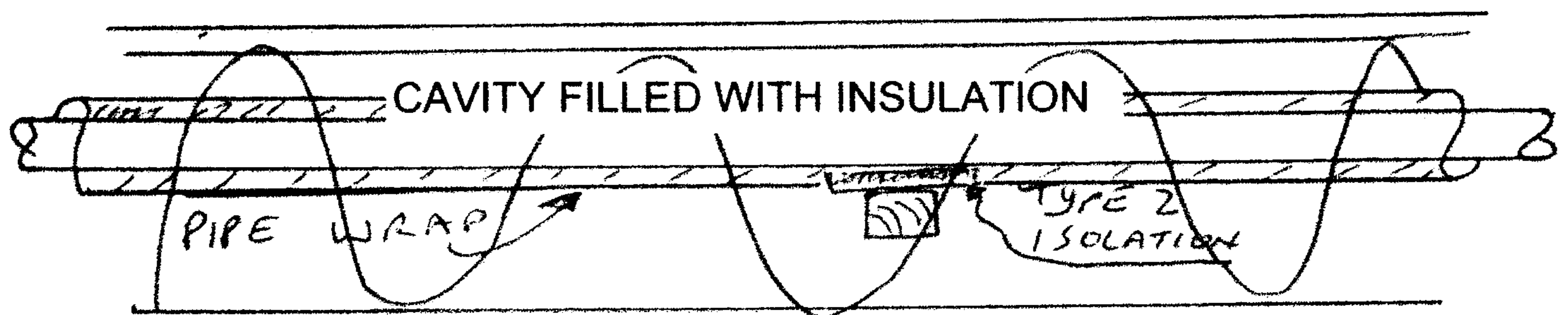
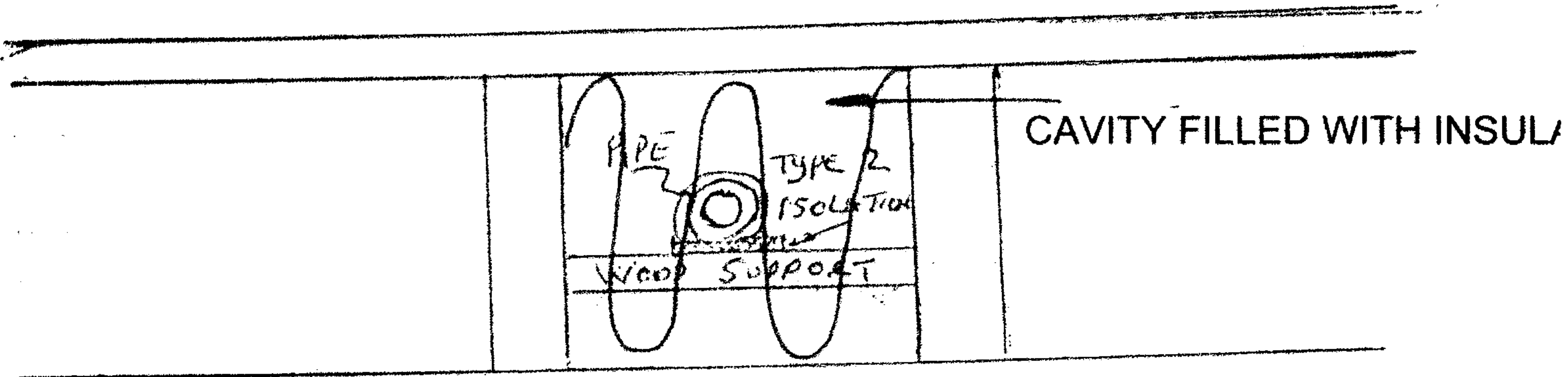
SOUNDTRAP FIG 13



- ISOLATION TYPE 1
- PIPE WRAP
- CAVITY FILLED WITH INSULA



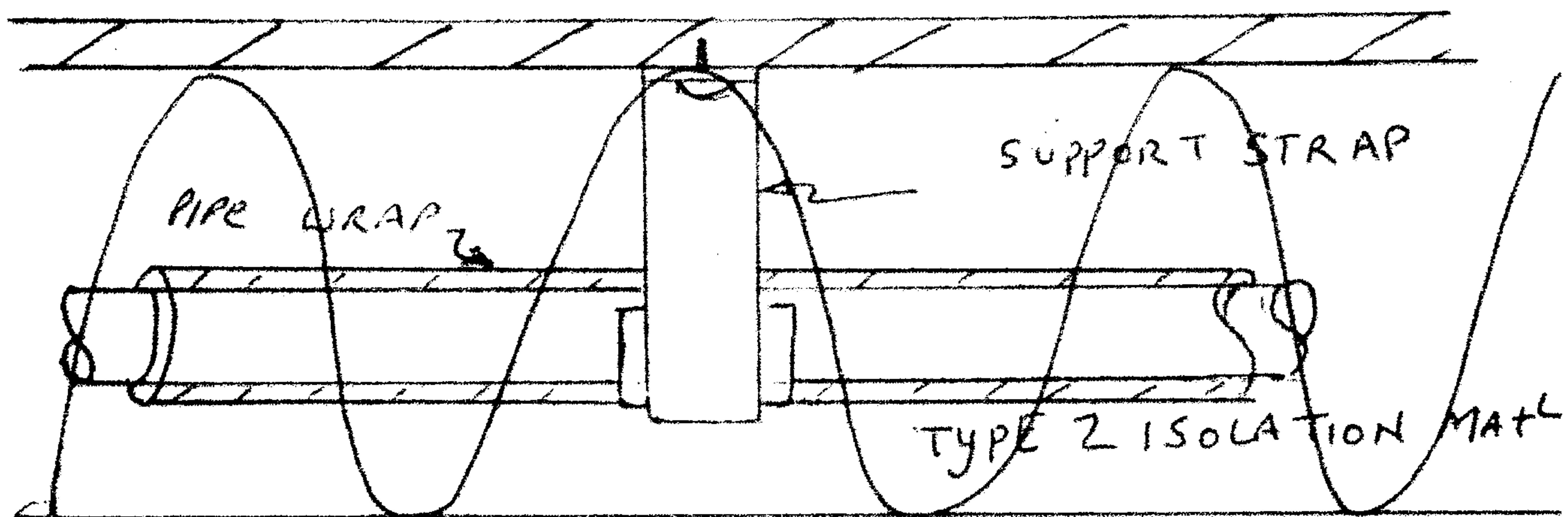
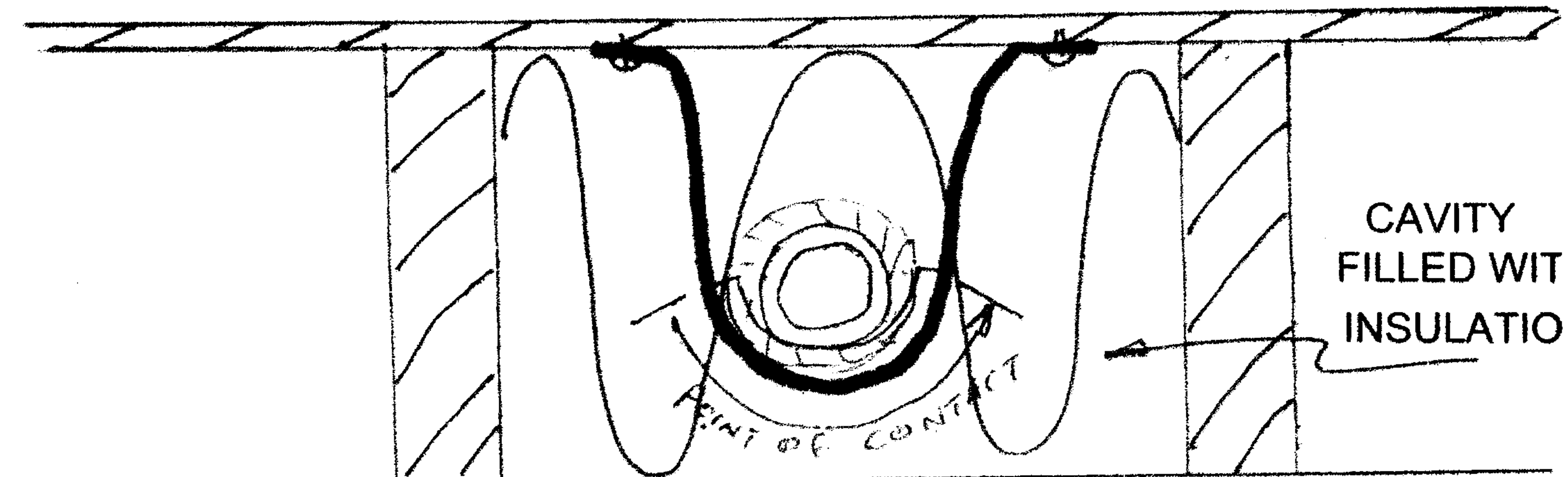
SOUNDTRAP FIG 14



- PIPES SUPPORTED BY HORIZONTAL STRUCTURES
- ISOLATION TYPE 2
- PIPE WRAP
- CAVITY FILLED WITH INSULATION

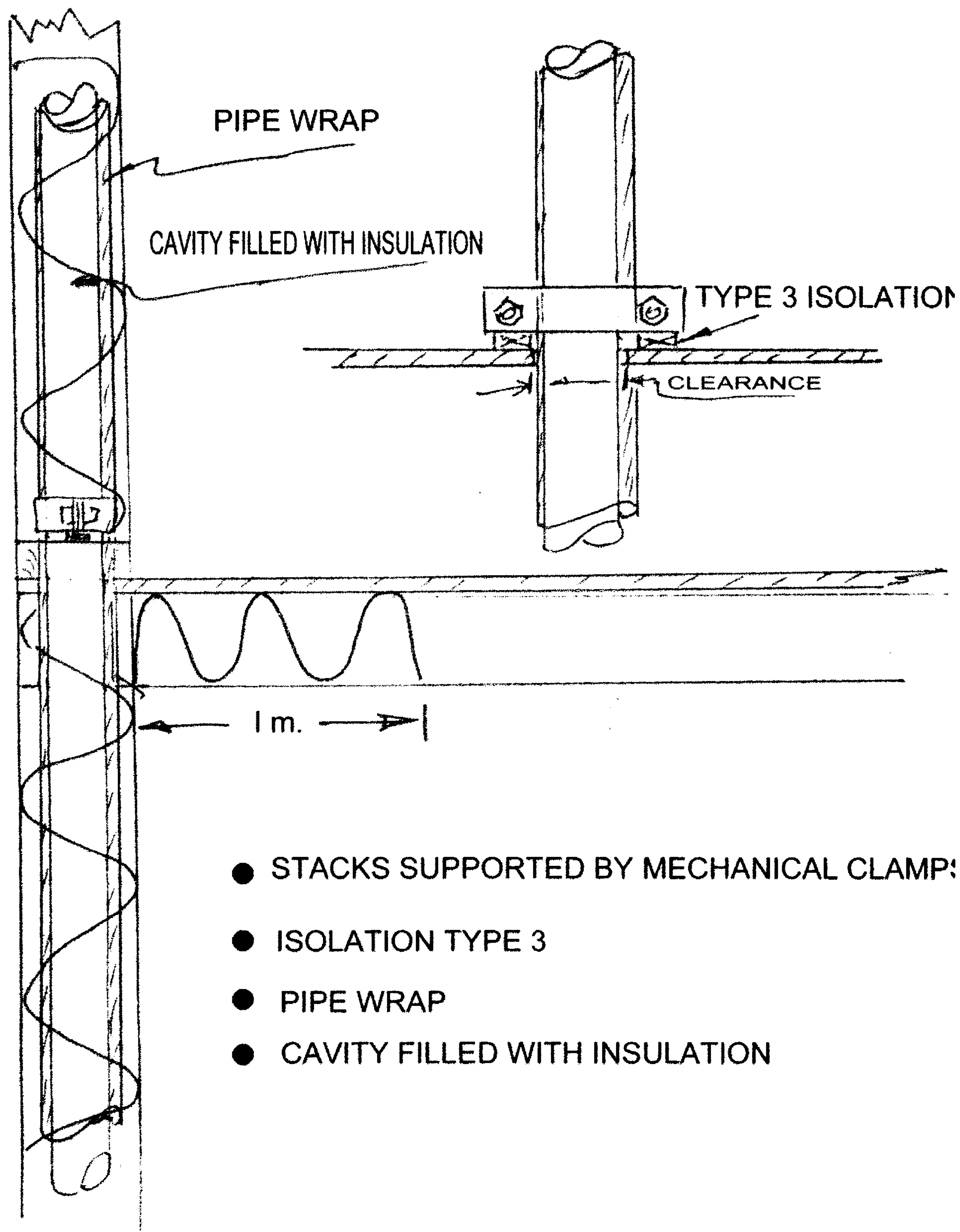
SOUNDTRAP FIG15

FLOOR ASSEMBLY

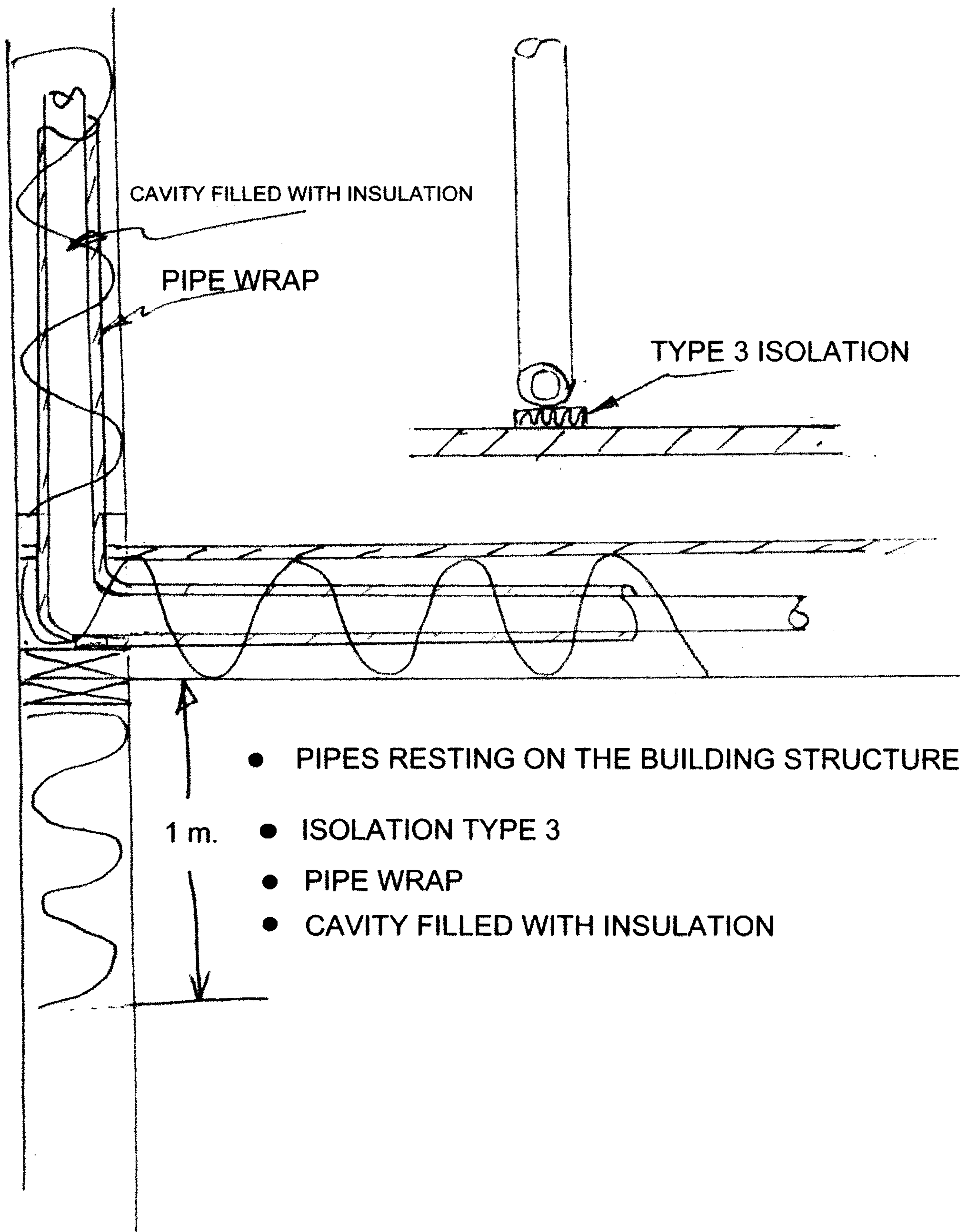


- PIPES SUPPORTED BY HANGER STRAPS
- ISOLATION TYPE 2
- PIPE WRAP
- CAVITY FILLED WITH INSULATION

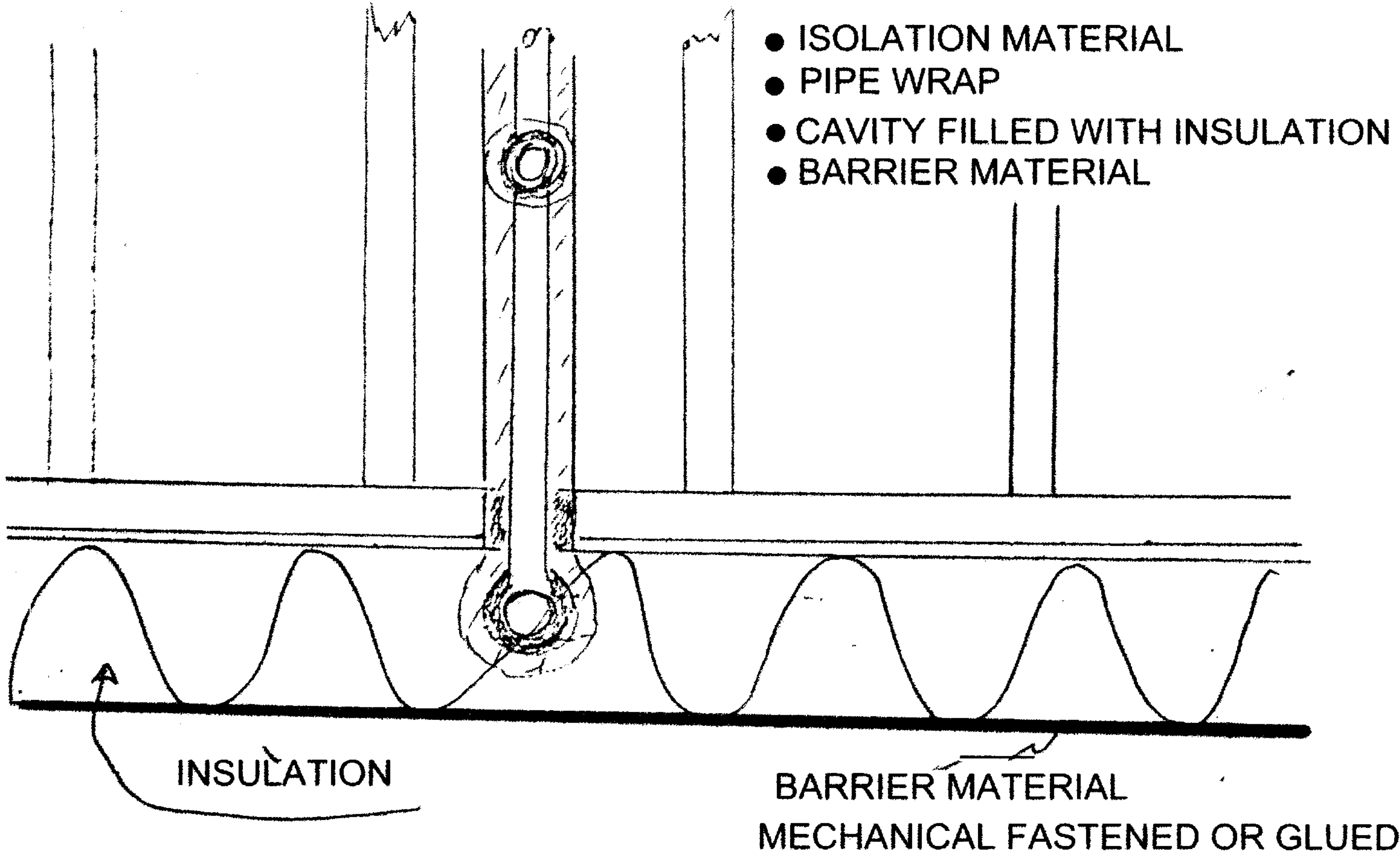
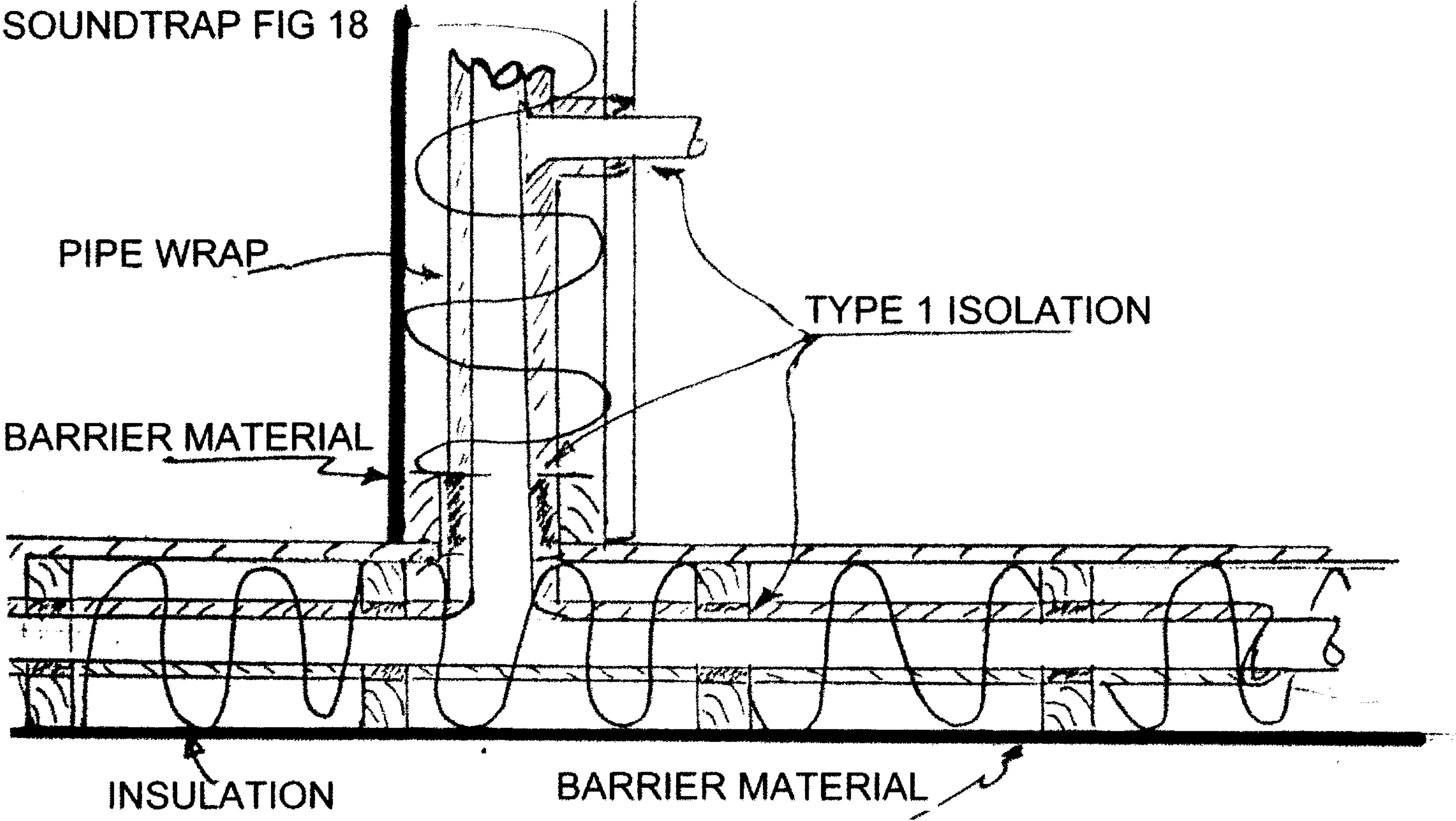
SOUNDTRAP FIG 16



SOUNDTRAP FIG 17

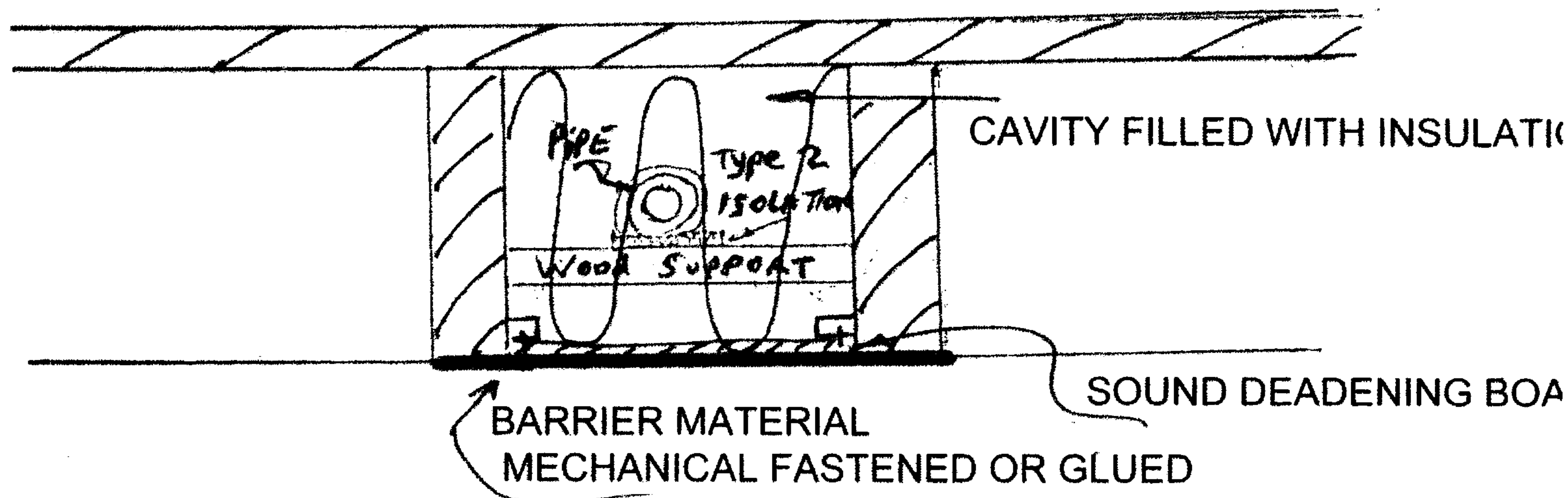


SOUNDTRAP FIG 18

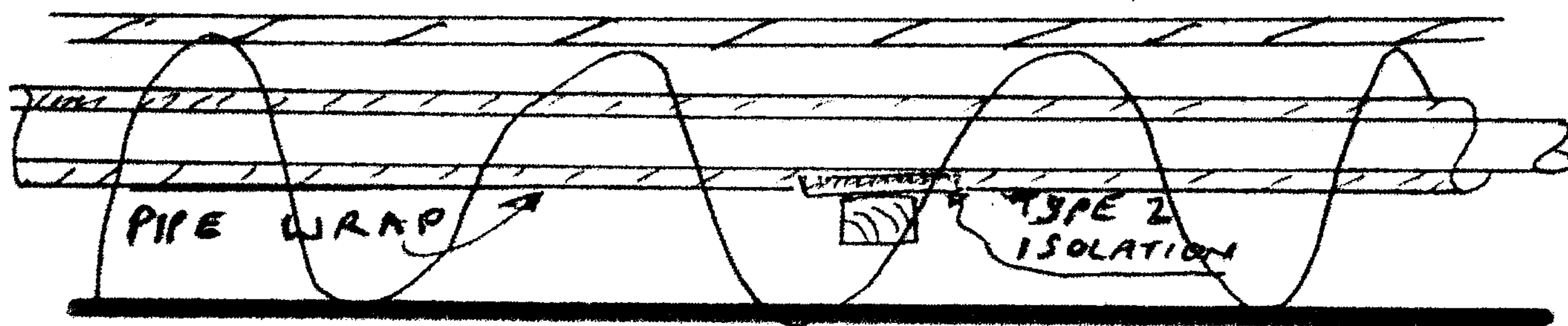


SOUNDTRAP FIG 19

FLOOR ASSEMBLY

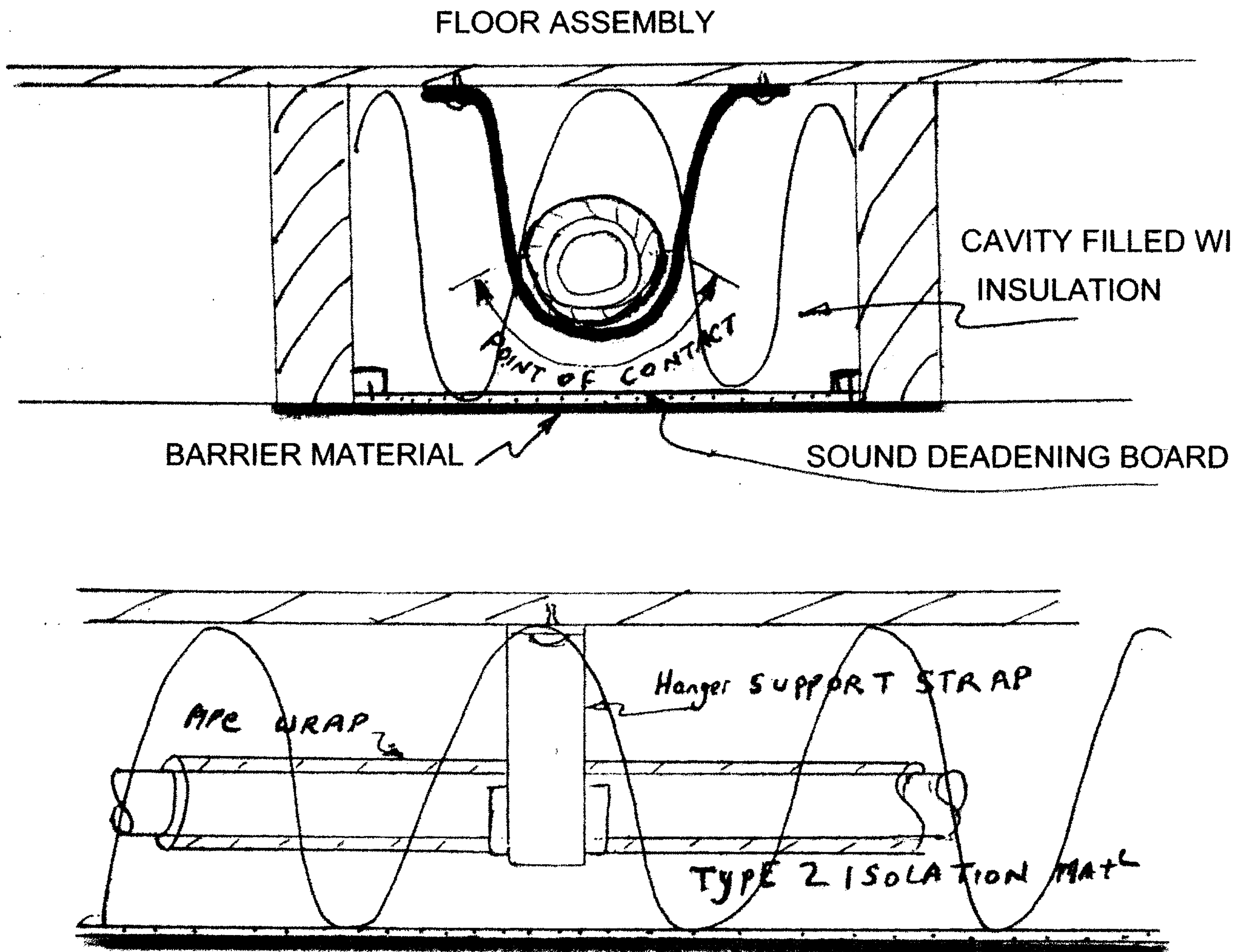


PIPES SUPPORTED BY STRUCTURAL SUPPORTS



- ISOLATION MATERIAL
- PIPE WRAP
- CAVITY FILLED WITH INSULATION
- BARRIER MATERIAL WITH SOUND DEADENING BOARD

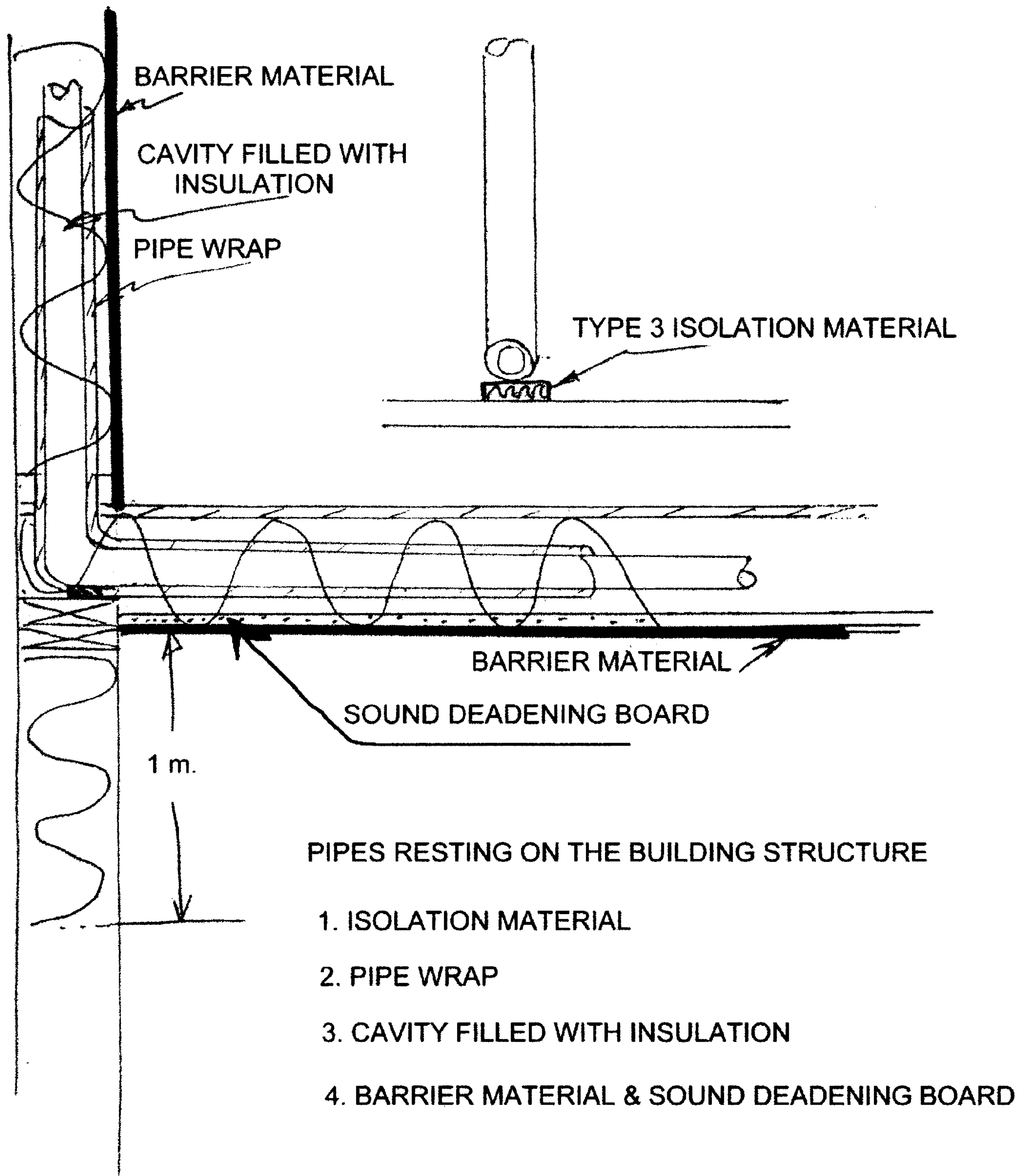
SOUNDTRAP FIG 20

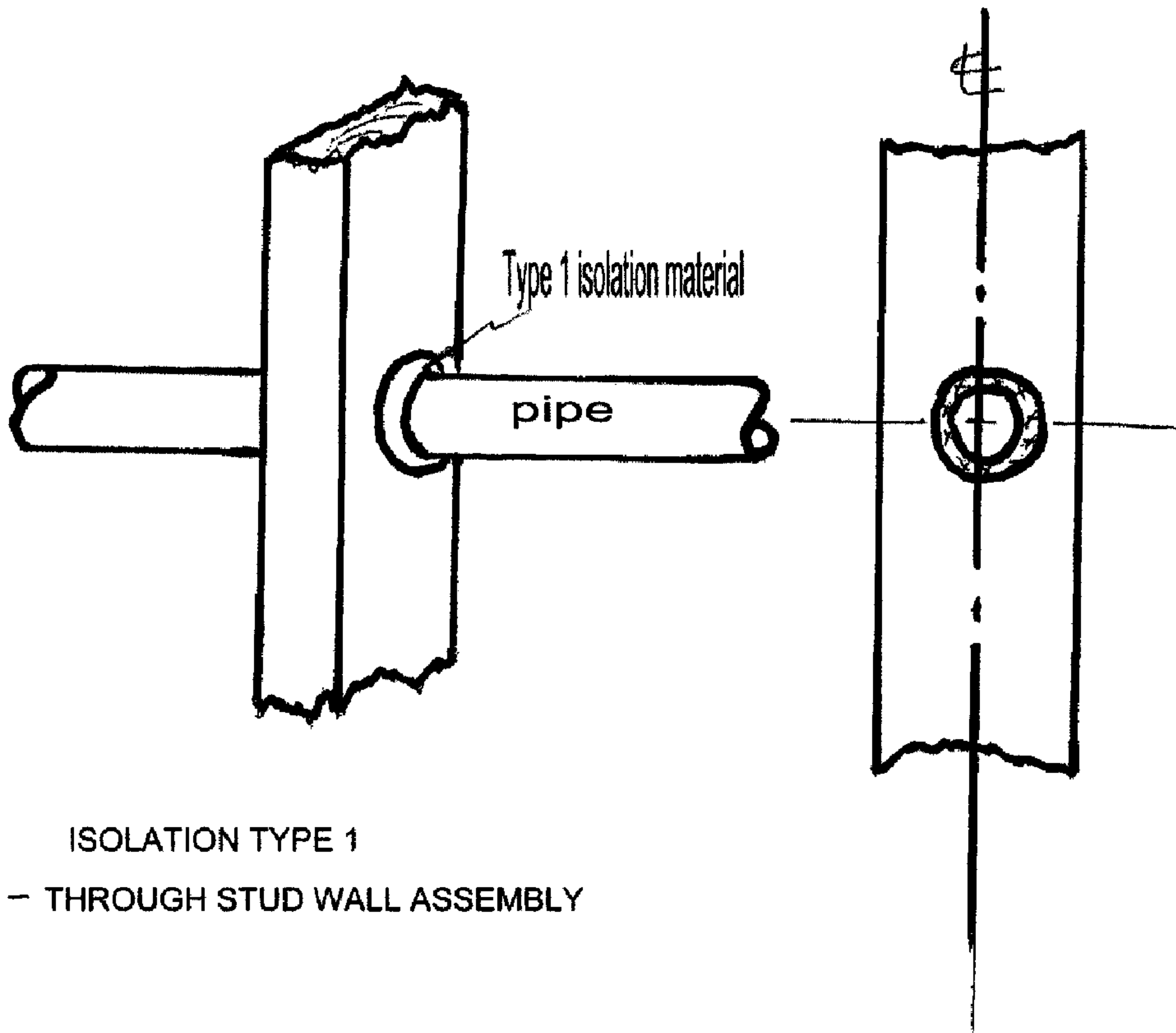


- PIPES SUPPORTED BY HANGER STRAPS
- ISOLATION MATERIAL
- PIPE WRAP
- CAVITY FILLED WITH INSULATION
- BARRIER MATERIAL WITH SOUND DEADENING BOARD



SOUNDTRAP FIG 22





ISOLATION TYPE 1

— THROUGH STUD WALL ASSEMBLY