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(19) (CA) **APPLICATION FOR CANADIAN PATENT** (12)

(54) Blind Ice Dams

(72) Hoyeck, Ralph H. - Canada ;

(73) Same as inventor

(57) 6 Claims

ABSTRACT:

The present invention deals with insulated ice dams, with makeup cooling facilities, applicable to cool, short summer nordic countries; for river dams, for dams harnessing the sea tidal power etc., using: a) ice dams processed and frozen during the cold winter months, making use of the sub-zero atmospheric air temperature to freeze an isolated mass of water, section by section, leaving cooling agent conduits/tunnels, across the ice dam, accessible to man and to robots, b) a layer of ice/frozen wood pulp mixture known to have a higher melting temperature than the pure ice alone, to cover the exposed surface of the ice dam all around serving as a primary insulation skin covering the ice dam, c) an additional ice dome over the water level increasing the weight of the ice dam to counterbalance the uplifting forces acting on it, d) an insulation cover over the whole surface of the ice dam, e) cold water sprinkling system over the exposed insulation cover, when the atmospheric temperature rises over the melting point, causing the sprinkled water to evaporate and cool down the insulation cover, f) a cooling process of the ice dam during the summer season using, generally, the method of compressed and decompressed gases, to cool the gases to sub-zero temperature, to be circulated through the cooling agent conduits provided across the ice dam, to maintain the said ice dam in its frozen state, g) a heat exchanging process between the warm cooling gases in summer and the natural cold water accumulating behind the dam to lower the temperature of the cooling gases prior and during the compression and decompression operation, so transferring the cold water temperature to the cooling gases; air or other cooling agents, and in turn, to the ice dam to maintain the ice at sub-zero temperature during summer season, resulting in an ice dam using material (water) supplied and delivered on site by nature, frozen by nature in winter and partly maintained in its frozen state in summer by nature as well.

1- Title of the invention

The present invention is titled ice dams, abbreviated as ID, and being here developed by a legally blind person, with the main proceeds oriented for medical eye research, the full title would then be the blind ice dams, abbreviated as BID.

2- Comparison with the Prior Art

2-1- The comparison with the prior art revealed no substantial prior art in that field that could replace the present invention.

2-2- Concerning the use of ice as a structural material, some efforts were made during the second world war, to build a large ice platform to be used as a floating airfield amid the Atlantic, for military purposes, under the name of the Habbakuk project, using a mixture of ice with some ten percent of frozen wood pulp.

Such mixture was found to produce bullet proof, hard ice with some higher melting point than the pure ice alone. Little data is available regarding this project, apparently the frozen wood pulp would produce an extremely hard mixture, however, it seems there is not much gain in the attempt to raise the melting point of the frozen wood pulp mixture.

The main documents available from the National Research Council of Canada, Canada Institute for Scientific and Technical Information, regarding what was called the Habbakuk Project were:

A) Perutz, M.F. "A description of the iceberg aircraft carrier and the bearing of the mechanical properties of frozen wood pulp upon some problems of glacial flow" Journal of Glaciology 1(3): 95-104, 1948.

B) Physical properties of frozen wood pulp, by G.M. Williams s. 3t, 21, s 57tp. Ottawa: National Research Council of Canada, Division of Building Research, 1972.

2-3 With reference to non conventional dams in the Prior Art, my latest application titled Self Supporting Flexible Dams (SSFD), U.S. patent No: 4,906,134, issued March 6, 1990, deals with flexible wall dams using reinforced, flexible walls, supported by the pressure of the water that they retain, which is totally different concept than the present invention that deals with insulated ice dams and cooling makeup facilities.

3- Field of the Invention

The so described ice dam could be economically feasible in nordic countries, with cool, short summer, using:

(A) An ice block processed to freeze in place in the winter months by means of atmospheric cold air at sub-zero temperature.

(B) Cooling agent conduits provided through the said ice block.

(C) A layer of ice/frozen wood pulp mixture covering the ice dam all around.

(D) An additional mass of ice extending over the water level to give the ice dam an additional weight.

(E) Makeup cooling facilities by pumping cooling agents through the conduits created across the ice dam.

(F) With continuous spraying of cold water over the exposed insulation cover, during summer season.

(G) A heat exchanging process in summer between the warm cooling agent; air or other agent and the water accumulating behind the dam as a first step in lowering the temperature of the cooling agent prior to cooling such agent to sub-zero temperature.

4- Prior Art

4-1 The prior art uses mainly concrete dams for high waterheads and lately, flexible wall dams are being used on a small scale.

4-2 The concrete dams are very costly and time consuming, many large scale projects requiring high waterhead dams; like the Fundy Bay Tidal Power Project and the Grand Canal Project in Canada, and other major projects in the world had to be postponed indefinitely due to the prohibitive high cost of the conventional concrete dams.

4-3 On the other hand, the flexible wall dams require:

A) Continuous cross reinforced rubber membrane walls.

B) Field splicing and vulcanizing operations to join the rubber walls side by side, and other related operations.

Neither the technology of the transversal reinforcement, nor the technology of the splicing and vulcanizing are developed yet to satisfy the requirement of a continuous flexible membrane dam.

4-4 On the contrary, the present invention uses, a process, 60% accomplished by nature, and tries to maintain it for the remaining 40% of the operation. The proposed ice dam, for nordic countries, could be created and maintained by nature for the seven winter months and the present invention would follow-up to maintain the said ice dam, in its solid state, for the remaining five months of the year, through efficient insulation and by means of continuous cooling processes.

5- Summary

5-1 The present invention takes advantage of the sub-zero temperature prevailing through the long winter months in nordic countries and tries to manipulate and maintain an operation basically processed by nature, through insulation and continuous cooling processes, using hydro energy generated by the waterhead created behind the said ice dam, to maintain the said ice dam through the summer months until the natural cold cycle is back at work.

5-2 The building of ice dams on a dry base is usually carried on in winter by spraying cold water at sub-zero atmospheric temperature, over a cold pre-prepared surface where the sprayed water would freeze on contact and by continuing the spraying operation, gradually, a massive solid ice block would build upto the required height and form a solid ice dam that could support high waterheads, the same as the conventional concrete dams.

5-3 For dams across rivers or across sea water, sections of water across the water course are isolated and allowed to freeze section by section.

5-4 The so described ice dam comprises mainly:

A) An ice block in between two opposite piers, with internal conduits/tunnels, used as cooling agent conduits.

B) Piles driven in the ground and extending through the ice block to be used as ties bonding the ice block to the ground.

(C) A layer of ice/frozen wood pulp mixture covering the ice block all around, raising slightly the melting point of the outer surface of the ice dam.

(D) Insulation/isolation water barriers covering the exposed faces of the ice dam.

(E) An additional ice dome extending above the water level to give the ice dam an additional weight to counter balance the uplifting forces acting on the said ice dam, said ice dome is covered with an insulation all around.

(F) Makeup cooling facilities, using conventional methods or with cold air circulation system, through the internal conduits and when feasible, through separate cold air hoses injected through the mass of water, prior to freezing.

(G) And with continuous spraying of the exposed insulation surface, when the outside temperature rises over the freezing point, with cold water which evaporates and keeps the exposed insulation cover at low temperature.

(H) A heat exchanging process in summer between the warm cooling agent, atmospheric air or other cooling agent and the mass of water created behind the ice dam as a first step to lower the temperature of the cooling agent from the atmospheric temperature to the temperature of the water prior to cooling such agent to sub-zero temperature and circulating such agent through the cooling conduits provided through the ice dam block, resulting in a very low cost ice dam, replacing cost prohibitive concrete dams.

5A- Feasibility and justification

5A-1 The so described ice dams would be economically justifiable and technically feasible in the following circumstances:

A- In cool, short summer nordic countries.

B - With efficient all around insulation.

C - With efficient makeup cooling facilities through accessible passes across and underneath the mass of the ice dam.

D - If the overall output of energy from the project, after comparison with the prior art, justifies the investment in the cooling equipment and in the sacrifice of a certain percentage of energy generated, to be put back in the makeup cooling facilities to maintain the ice dam during the summer season.

E- In operations like harnessing the Fundy Bay tidal power in Canada, and in similar situations, where the dam could be 100 feet deep or more, while the profitable waterhead of the high tide is only about 35 feet and where the costs of a conventional dam using the prior art technology proves to be prohibitive.

F- In areas where there is abundant idle manpower and no sources of energy to put the manpower at work.

G- In circumstances where there is no large capital available for initial investment in a colossal, cost prohibitive, conventional concrete dam.

5A-2 A rough estimate suggests:

I- That, in winter, 5 to 15% of the energy generated by the dam would be reused in cooling makeup facilities to keep the ice dam at the required sub-zero temperature, using the compressed and the decompressed air method or other conventional technology, to produce chilled air to be circulated through the different tunnels inside the ice dam to maintain the ice at the required sub-zero temperature.

II- That in summer, 25 to 45% of the energy generated by the dam is reused in the makeup cooling facilities to maintain the ice dam at the required sub-zero temperature.

5A-3 In the case of dams to harness the tidal power, to have a continuous flow of energy, it is believed, that building 2 or 3 dams in different areas to create different basins, would allow the manipulation and control of the water flow, in and out of such basins, in a way to have constant flow of water, in one direction or the other with reversible turbines, to keep a constant flow of energy at all times.

5A-4 On the other hand, unlike the river dams where the flow of water diminishes by 33% or more during summer, in the case of the Fundy Bay tidal power or the like, the quantity of the tidal water is constant all through the year.

5A-5 Conclusion

Weighing the positive and the negative points and comparing with other technologies would give the following result:

A- The negative points of the ice dams are:

I- The high cost of the cooling equipment.

II- The sacrifice of energy that is to be put back in the makeup cooling operation.

III- The lack of experience in the use of ice as a structural material.

IV- In the case of ice dams to harness the tidal power, the intermittence of flow of the tidal water which means the intermittence of the energy flow.

B- The positive points of the ice dams are:

I- That the ice, the material in use, is free of charge and at the same time is delivered on sight, free of charge, i.e., free material and free delivery.

II- The project is based on dams built in the cold winter season with the freezing process carried on by nature without the use of cooling equipment, i.e., free material, free delivery and free freezing by nature.

The main task in the project is to maintain an ice dam delivered to man by nature at the end of winter and to maintain it in its frozen state during the summer months and to hand it back to nature at the end of summer.

III- Unlike the water flow on the rivers that diminish by 33% or more during summer, in the case of ice dams to harness the tidal power, the flow of tidal water is constant all year around.

IV- That the cooling equipment are not required of a large capacity to create a massive ice block dam but to maintain an ice dam already frozen by nature.

V- In the case of dams to harness the tidal power, it is believed that the building of 2 or 3 ice dams would create 3 basins and in such case it would be possible to manipulate the flow of water in and out of these basins using reversible turbines to keep a constant flow of energy at all times.

VI- The project uses a heat exchanging process between the warm cooling gases and the natural cold water behind the dam so transferring the natural cold temperature of the water to the cooling gases and in turn to the ice dam, using the help of nature in the maintenance of the ice dam.

C) Comparison with other facilities in the present day technology:

If we look at the transportation field and consider the positive and the negative points of the motorcar for example, one would find out that:

I- Eighty percent of the time there is one passenger in the car weighing about 70 kilos, the weight of the average car is usually about 800 kilos or over ten times the weight of the passenger.

II- The efficiency of the car engine is about 20%.

It means that 2% of the precious nonrenewable energy consumed in the motor car is used to move passengers while the remaining 98% of the energy is wasted, through the low efficiency of the car engine, and to move the bulky dead weight of the car itself and this is after 140 years of continuous improvement in the car system.

D) In view of the fore-mentioned factors in (A), (B) and (C), and taking into consideration the idle manpower, in the vicinity of large, dormant hydro energy power in the world and especially in the Canadian Maritimes, with the large idle manpower, relying on unreliable subsidies from the government, and facing them, millions of idle horsepowers of tidal energy, swinging back and forth, one would not hesitate to conclude, that, in the absence of a viable alternative, even with the negative factors, the so described ice dams, with the prescribed circumstances, are believed to be well justifiable.

However, due to the lack of reliable data on the behaviour of ice as a structural material, it would be necessary to build a miniature pilot project prior to engaging in the so described ice dams, to determine the real gap between the theory and the practice.

6- A brief description of the drawings

Fig. 1 - is a longitudinal section 1-1 of the dam, showing:

A) Different levels of cooling agent conduits/tunnels

B) Piles tying the ice dam to the waterbed

C) Wire ropes across the ice dam anchored at opposite ends to the two piers bordering the dam.

D) Inclined long posts across the ice dam connected to the wire ropes and used as reinforcement to the ice block.

E) A suspended bridge over the dam, supporting an overhead crane, a bridge deck, a sprinkler system etc.

Fig. 2 - is a plan view 2-2 of the upper part of the dam showing the position of cooling agent conduits etc.

Fig. 3 - is a sectional plan view 3-3 over the waterbed showing mainly the piles tying the dam to the waterbed.

Fig. 4 - is a sectional plan view 4-4 under the waterbed showing the underground cooling agent conduits.

Fig. 5 - is a transversal cross section 5-5 of the dam.

7- Preferred embodiments

The present invention deals with insulated ice dams, with makeup cooling facilities, supported by the Hydro energy generated by the waterhead, created behind the said ice dam, as it is illustrated in the attached drawings and described hereinafter:

7-1- (See Figs. 1, 2, 3, 4, 5)

7-1-1 Fig. 1 to 5 show an ice dam 1, built in between two concrete piers 2, 3, over a concrete waterbed 4, provided with concrete walls 5, protruding over the concrete waterbed 4, to serve as keys, preventing the ice dam block 1, from sliding over the waterbed. Said concrete piers, 2, 3 are provided with walls 2A, 3A, extending inwardly joining the floor walls 5 to serve, as well as keys to prevent the ice dams from sliding.

At the same time the piers 2, 3 are lined with a thick rubber lining to absorb the expansion of the ice dam.

An insulated flexible barrier 22, bridges in between the front ends of the piers 2, 3 isolating and insulating the front side of the ice dam.

A similar insulated, flexible barrier 23, bridges in between the back ends of the piers 2, 3 isolating and insulating the back side of the ice dam.

7-1-2 An underground transversal concrete wall 6, is built across the dam to prevent the water from seeping under the concrete waterbed.

7-1-3 A net of conduits/tunnels 7, accessible to man or to robots is provided under the surface of the concrete floor 4, with inlet and outlet shafts 8, is used as conduits for cooling agents, like circulating cold air at sub-zero temperature or other cooling agents.

7-1-4 Different nets of conduits/tunnels 9, 12 equally accessible to man or to robots at different levels of the ice dam with common inlets outlets 10, and with individual inlets outlets 11, 13, used in conjunction with mobile fly valves or plugs 11A, 13A and a waterproof curtain 20 to isolate the transversal conduits one by one, pump cooling agents through them to freeze the ice block, section by section. Additional small diameter tubular conduits 30, are installed mainly towards the outer surface of the dam and used as well as cooling agent conduits to keep the outer skin of the ice dam well frozen at all times.

7-1-5 A variety of piles 14 is driven into the waterbed and left to protrude out through the ice block to serve as ties connecting the ice block to the waterbed.

Said piles 14 could be driven at an angle giving them higher resistance to pullout forces.

At the same time said piles 14 are interconnected with posts 15, to increase the tying capacity of said piles to the ice blocks.

7-1-6 Upright long posts 26, are installed all across the ice dam connected at their upper and lower ends to wire ropes 25, stretched across the dam and connected at their opposite ends to the opposite piers 2, 3 bordering the ice dam.

Both the upright posts and the wire ropes are used jointly as means of reinforcement to the ice dam.

7-1-7 The outer surface of the ice dam is covered all around with a mixture of ice and frozen wood pulp, which mixture is supposed to have a higher melting temperature than the pure ice alone resulting in an ice dam with a protective ice cover having a higher melting temperature than the pure ice alone.

7-1-8 Four pillars 16, are erected at the four corners of the bordering piers 2, 3 to serve as corner supports for a suspended bridge with its cables 17, suspended bridge deck 18, with a mobile overhead crane 19, supported by the said suspended bridge.

7-1-9 Thin water barriers 27, 28, are attached all along the suspended bridge and stretched down to the waterbed, parallel to the isolating insulating water barriers 22, 23 and at short distances from them, to allow the separation of sections of water at the outer surfaces of the dam and to inject wood pulp into these isolated sections prior to freezing, creating an ice/frozen wood pulp mixture at the outer skin of the dam to raise its melting temperature.

7-1-10 An impermeable curtain 20, unrolls down from a drum 21 carried by the mobile crane 19.

Said curtain 20, unfolds down in between the transversal conduits 9, 12 to isolate sections of the water and by pumping cooling agents through the conduits inlets 11, 13, the isolated sections of the dam would freeze and develop its resistance to a waterhead as a solid concrete dam.

Gradually the mass of water would be isolated section by section, which isolated sections would be cooled down below 0 temperature to freeze and develop its strength.

7-1-11 A number of wire ropes 25, are installed all along the dam, anchored at opposite ends to the opposite piers 2, 3 to be used in conjunction with long upright random posts 26, as means of reinforcement to the ice block dam .

The posts 26, are connected at both ends to the wire ropes 25.

7-1-12 The construction of the ice dams could be made in steps as follows:

I- For dams built over dry land:

A- By preparing; the underground concrete work, the side piers, the piles driven through the ground, the reinforcing posts, etc., in the known conventional methods.

B- By cooling the concrete waterbed to a below 0 temperature, either by means of cooling agents, through conduits 7, or that the floor would be cooled by nature at below 0 atmospheric temperature.

C- By installing inflated conduits positioned in the location of the cooling agent conduits 9, 12, said inflated conduits being lightweight could be suspended from a temporary structure or a permanent suspended bridge installation.

D- By sprinkling cold water at sub-zero atmospheric temperature over the cold concrete floor of the dam where the sprayed water would freeze on contact and build up gradually into a mass of ice until it reaches the required height.

II- For dams planned to be built across a flowing river, across a gulf like the Fundy Bay project, the James Bay Grand Canal project, in Canada or similar projects elsewhere, further steps would be required like:

A- Preparing the underground concrete work and a series of pillars 2, 3 in the conventional methods used for underwater operations.

B- Erecting the suspended bridge with its accessories 16, 17, 18, 19, 20 and 21.

C- Installing transversal insulated water barriers 22, 23 bridging in between the opposite ends of the concrete piers 2, 3 to isolate the water in between the concrete piers and the transversal insulated water barriers prior to freezing.

D- Installing the cooling agent conduits 9, 10, 11, 12, 13 as follows:

D1- Preparing the conduits/tunnels to the required size and shape, using the right piping material.

D2- By tying these conduits to buoys floating on the surface of the water.

D3- By filling these conduits with water and leaving them to sink to the required position.

D4- By anchoring these conduits to the concrete waterbed.

D5- By pumping out the water filling said conduits, leaving them held in place by the anchoring ties, connected to the concrete waterbed.

D6- By proceeding in pumping cold air through section by section to freeze the water surrounding said conduits, with external cold air injected through separate mobile hoses 29, used where it is necessary.

7-1-13- The building of the so described ice dams is carried on in winter, where the freezing process would be accomplished by nature and by blowing atmospheric air at sub-zero through the cooling conduits/tunnels to help the freezing process, leaving the use of artificial facilities to summer months.

7-1-14 For large dams, different spans of the so described ice dam are erected next to each other.

7-1-15 In summer, a heat exchanging process is used between the natural cold water accumulating behind the dam, and the warm cooling agent, the atmospheric air or other cooling agents, as a pre-cooling operation, lowering the temperature of the cooling gases, from the atmospheric temperature to the natural cold temperature of the water, prior to cooling said agent to sub-zero temperature, and pumping it through the cooling conduits provided below and across the ice dam.

7-1-16 A second heat exchange operation is made by cooling the compressed air using the water accumulated behind the dam during the gas compression and decompression operation made to lower the temperature of the cooling gases to sub-zero temperature.

These heat exchange operations transferred the natural cold temperature of the water to the cooling gases, and in turn to the ice dam itself so using a free natural phenomena to keep the ice dam in its frozen state and so reducing the cost of maintaining the ice dam in its frozen state during the summer season.

Details of the different components

1 - Ice dam.

2 - Concrete pier at the left end of the ice dam.

2A - Walls extending inwardly outside the left pier,

3 - Concrete pier at the right end of the ice dam.

3A - Walls extending inwardly outside the right pier.

4 - Concrete floor of the dam.

5 - Concrete edges protruding over the concrete floor of the dam to serve as keys preventing the base of the ice dam from sliding over the concrete base.

6 - Transversal concrete wall extending deep below the concrete floor to prevent the water from seeping under the concrete base of the dam.

7 - Continuous tunnels under the concrete floor to be used as conduits for the cooling agent.

8 - Open shafts at opposite ends of tunnels.

9 - Lower layer of continuous tunnels through the ice dam, used as conduits to the cooling agents.

10 - Shafts, serving as inlet/outlets at the opposite sides of tunnels (9, 12).

11 - Small tubes at opposite ends of each tunnel (9) to serve as individual inlet/outlet conduits for the cooling agents.

(11A)- Fly valve blocking the tunnel to keep the cooling agent in an isolated part of conduits.

12 - Upper layer of continuous tunnels inside the ice dam used as conduits for the cooling agents.and as access lanes for the control of the ice dam.

13 - Small tubes at opposite ends of each tunnel (similar to 11) used as individual cooling agent conduits for tunnels.

13A - Fly valve

14 - Piles driven through the ground and left protruding over the surface of the waterbed to serve as bonding ties to hold the ice dams block to the ground.

15 - Inclined posts connecting the piles(14) to each other and used as well as bonds between the ice dam and the waterbed.

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16 - Four pillars at the opposite ends of the concrete piers (2, 3) used as supports to the cables of a suspended bridge over the ice dam.

17 - Cables of the suspended bridges.

18 - Deck of the suspended bridge.

19 - Mobile overhead crane.

20 - Transversal waterproof separation curtain used to isolate the water of the dam prior to freezing.

21 - Transversal roller drum around which the curtain is rolled up.

22,23- Longitudinal insulated water barriers spread in between the concrete piers (2, 3) at the opposite sides of the dam and used as insulation barriers extending to cover the whole ice dam.

24 - Sprinklers.

25 - Wire ropes across the dam, connected to left pier 2 on one end and to right pier 3 at the opposite end and used to hold random long posts 26 across the ice block designed as reinforcement and means of bond through the ice block.

26 - Random upright posts across the ice block dam connected to the wire ropes 25 and used as means of reinforcement all through the ice dam, said posts are provided with steel spikes all along to provide a better grip between the said post and the ice dam.

27,28-Thin water barriers stretched parallel to the insulating/ isolating water barriers 22, 23 and at short distance from them to isolate outer sections of the dam and inject the wood pulp prior to freezing.

29 - Separate mobile hoses used to inject cold air through the water, prior to freezing.

30 - Small diameter tubular conduits installed mainly towards the outer surface of the ice dam and wherever necessary, and used as additional cooling agent conduits.

8- Claims

What I claim is:

1- An insulated ice dam with makeup cooling facilities, having a first part, a second part, a third part, a fourth part and a fifth part, said first part comprises a concrete floor, used as the waterbed, said second part comprises a left pier and a right pier at the opposite ends of the said ice dam, said third part comprises; a) a front insulating and isolating water barrier bridging between the front ends of the said left pier and the said right pier, tightly connected at its lower end to the concrete floor of the said first part and extending upward to cover the front half of the said ice dam, b) a rear insulating and isolating water barrier bridging between the rear ends of the said left pier and the said right pier, tightly connected at its lower end to the concrete floor of the said first part and extending upward to cover the rear half of the said ice dam, said fourth part comprises an ice block forming a continuous dam over the concrete floor of the said first part and filling the space in between the said left pier, the said right pier, the said front insulating water barrier and the said rear insulating water barrier, said fifth part comprises pillars positioned over the corners of the said left pier and the said right pier, supporting a suspended bridge over the said ice dam, said suspended bridge in turn supports; a bridge deck, a travelling crane, a roller drum etc., with additional facilities used in the maintenance of the said ice dam.

2- An insulated ice dam as in claim 1, wherein the first part forming the concrete floor of the dam, is provided; a) with concrete walls extending upward and serving as keys interlocking with the ice block of the said fourth part, b) with a concrete wall all along the dam, extending downward through the ground, serving as a barrier preventing the water seepage underneath the concrete water bed, c) with a net of accessible conduits/tunnels below the concrete floor of the said waterbed serving as cooling agent conduits to keep the waterbed at sub-zero temperature, said second part comprises outer walls extending inwardly to serve as keys engaging the ice block of the said fourth part, with rubber lining covering the whole surface of the said second part and used to absorb the expansion of the ice block of the said fourth part, said fourth part is provided with accessible nets of conduits/tunnels at different levels, and the tubular coils, mainly towards the outer skin of the dam used altogether as cooling agent conduits serving to keep the ice block of the said fourth part at sub-zero temperature.

3- An insulated ice dam as in claim 2, using piles driven into the ground and extending upward across the concrete floor of the said waterbed and through the ice block of the said fourth part to serve as bonding ties tying the ice block of the said fourth part to the ground, with additional posts bridging in between the said piles serving as additional tying means connecting the ice block of the said fourth part to the ground, and wherein the said fourth part is provided with reinforcing wire ropes across the ice block connected at their both ends to the said left pier and the said right pier and holding among them random long posts used as well as reinforcement to the ice block of the said fourth part.

4- An insulated ice dam as in claim 3, for dams over dry land, built in the following methods: a) by preparing the first part, the said second part, and the said third part in the known conventional methods, b) by preparing the said piles and the ice reinforcing posts and wire ropes in the known conventional methods, c) by cooling the concrete waterbed to a sub-zero temperature, either by means of cooling agents, through the said cooling agent conduits or that the floor would be cooled by nature at below 0 atmospheric temperature, d) by installing inflated conduits positioned in the location of the said cooling agent conduits, e) by sprinkling cold water at sub-zero atmospheric temperature over the cold concrete floor of the dam, where the sprayed water would freeze on contact and build up gradually into a mass of ice until it reaches the required height, f) By spraying, over the ice block already formed, a mixture of water and wood pulp, which mixture would freeze upon contact with the ice block and build up into a layer of ice/frozen wood pulp mixture, creating a layer known to be of higher melting point than the pure ice alone, g) by covering the resultant ice dam with an insulation cover all around the ice dam, h) by sprinkling cold water over the exposed insulation cover, when the atmospheric temperature rises over the melting point.

5- An insulated ice dam as in claim 3, used for dams across water courses, built in the following methods; a) by preparing the said first part, the said second part and the said third part in the conventional known methods, b) by preparing the said piles and the ice reinforcing posts and wire ropes in the known conventional methods, c) by installing the cooling agent conduits, that are prepared of the right size and shape and of the right piping material, and put to float on the surface of the water of the dam prior to freezing, connected to buoys floating on the surface of the water, filled with water and allowed to sink to the required position, anchored by means of separate ties to the waterbed, emptied from the water, and then filled with cold air at sub-zero temperature or other cooling agent, causing the water around the said conduits to freeze gradually until the whole mass of water is converted into ice, d) additional cold air or other cooling agent, at sub-zero temperature is injected through the mass of water by means of mobile hoses used wherever the necessity requires, e) a transversal water barrier is lowered down through the mass of water from a mobile support, supported by the said suspended bridge and used to isolate sections of water to facilitate the freezing of the mass of water, section by section, f) a mobile plug, a fly valve or the like are installed inside the cooling agent conduit and pulled in coordination with the said transversal water barrier to isolate the cooling agent conduits, section by section, during the cooling process, g) longitudinal thin water barriers are installed parallel to the said insulating water barriers of the said third part and at a short distance from them, used to isolate the exposed skin of the said ice dam and to allow the injection of a certain percentage of wood pulp in that isolated section of water prior to freezing, producing an outer layer of ice/frozen wood pulp mixture, known to have a higher melting temperature than the pure ice alone, resulting in an ice dam with its outer surface covered with a layer having a higher melting temperature than the core of the ice block itself, h) cold water would be sprinkled over the frozen ice dam at sub-zero atmospheric temperature and allowed to freeze and build up a dome over the waterbed behind the dam, giving the ice dam an additional weight to counterbalance the uplifting forces acting on the said ice dam, i) a mixture of water and wood pulp is sprinkled over the said ice dome at sub-zero atmospheric temperature where the sprayed mixture would freeze on contact and create an outer skin covering the exposed surface of the ice dome with a layer having a higher melting temperature than the pure ice dome alone, j) an insulation cover is spread all over the exposed surface of the resulting ice dome, k) cold water is sprinkled over the said insulation cover when the atmospheric temperature rises over the melting point, where the sprinkled water would evaporate and cool down the insulation surface.

6- An insulated ice dam as in claim 5, built in the winter months, using mainly atmospheric air at sub-zero temperature to help processing the freezing of the mass of water to form the core of the said ice dam, and when the atmospheric temperature rises, artificial means are used to maintain the ice dam at the required sub-zero temperature, using; a) a heat exchanging process, between the warm gases; atmospheric air or other cooling agents, and the massive water behind the dam, by circulating the warm gases through tubular coils submerged under the water to pre-cool the warm gases to the water temperature prior to the compression and decompression operation or similar cooling processes, b) the method of compressed and decompressed gases, making use of the massive water created behind the dam, to cool the compressed gases, giving a higher efficient cooling process to the warm gases producing a mass of gases at sub-zero temperature, which cold gases are circulated through the cooling conduits, provided, below the waterbed and across the said ice dam, c) any conventional method that could make use of the massive water created behind the dam to cool the processing equipment and produce a higher efficiency cooling process to the ice dam, profiting of the natural low temperature of the mass of water created behind the dam, resulting in a process transferring the cooling factor of the water to the cooling gases and in turn, to maintain the ice dam at sub-zero temperature.

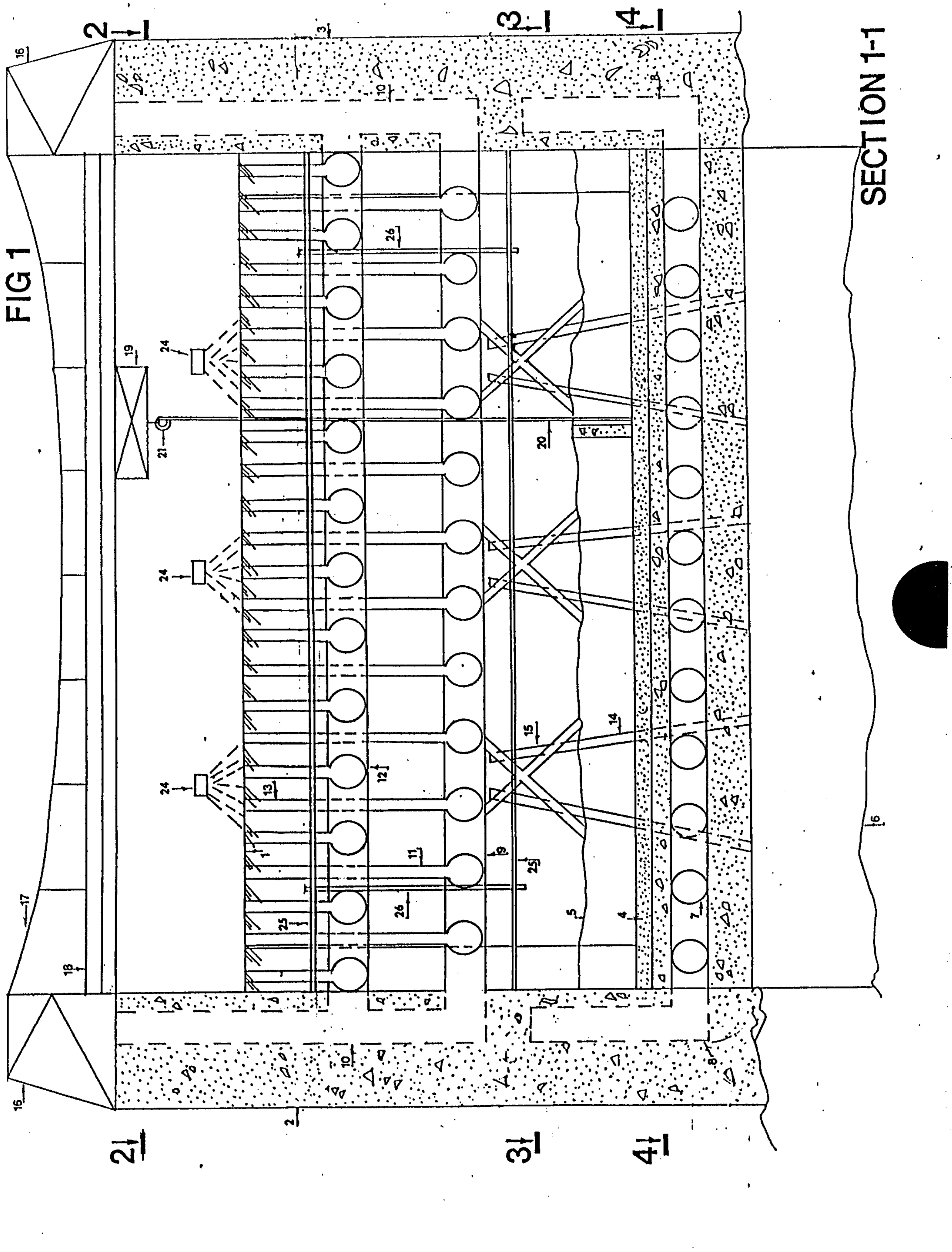
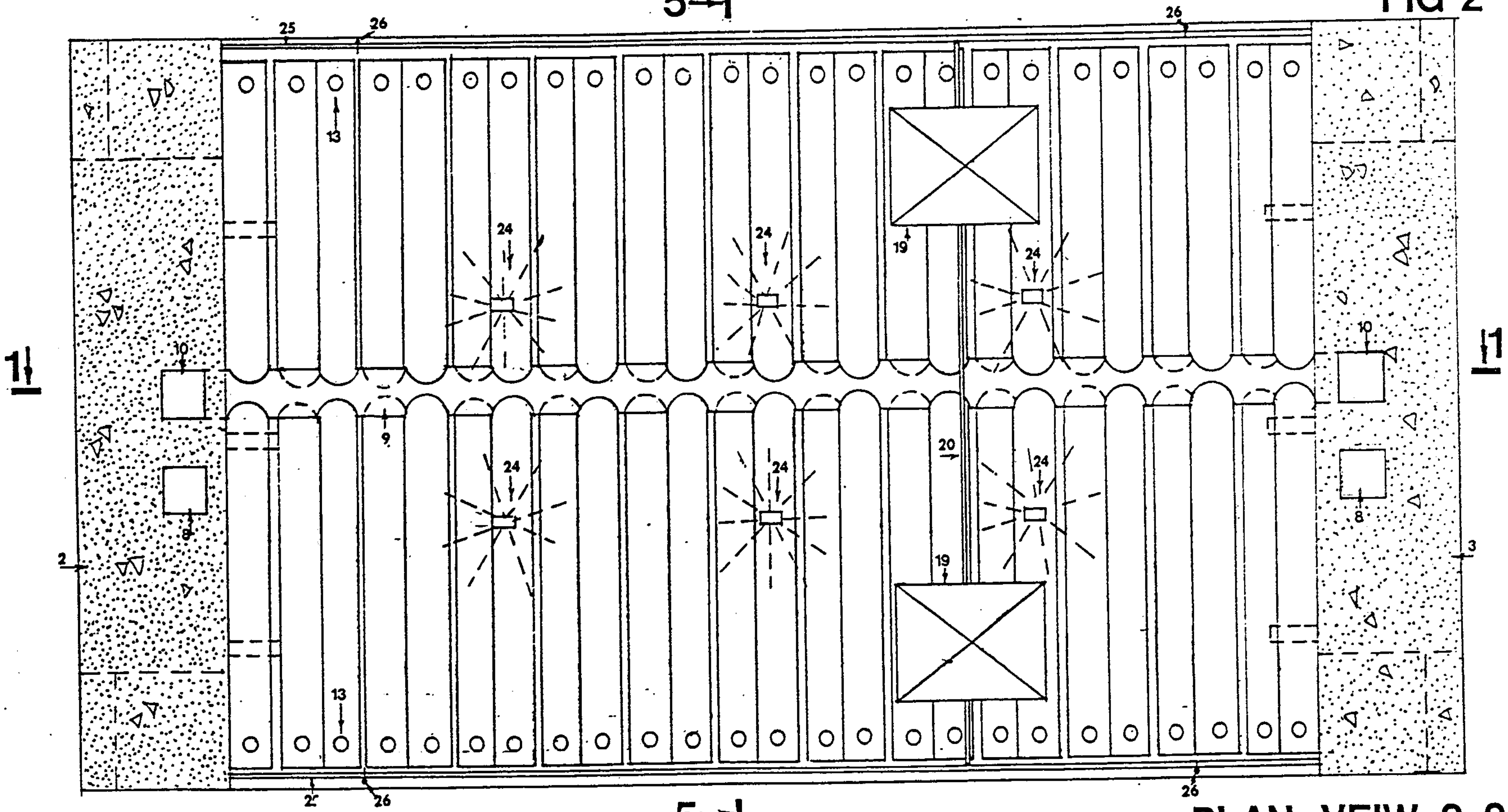


FIG 1

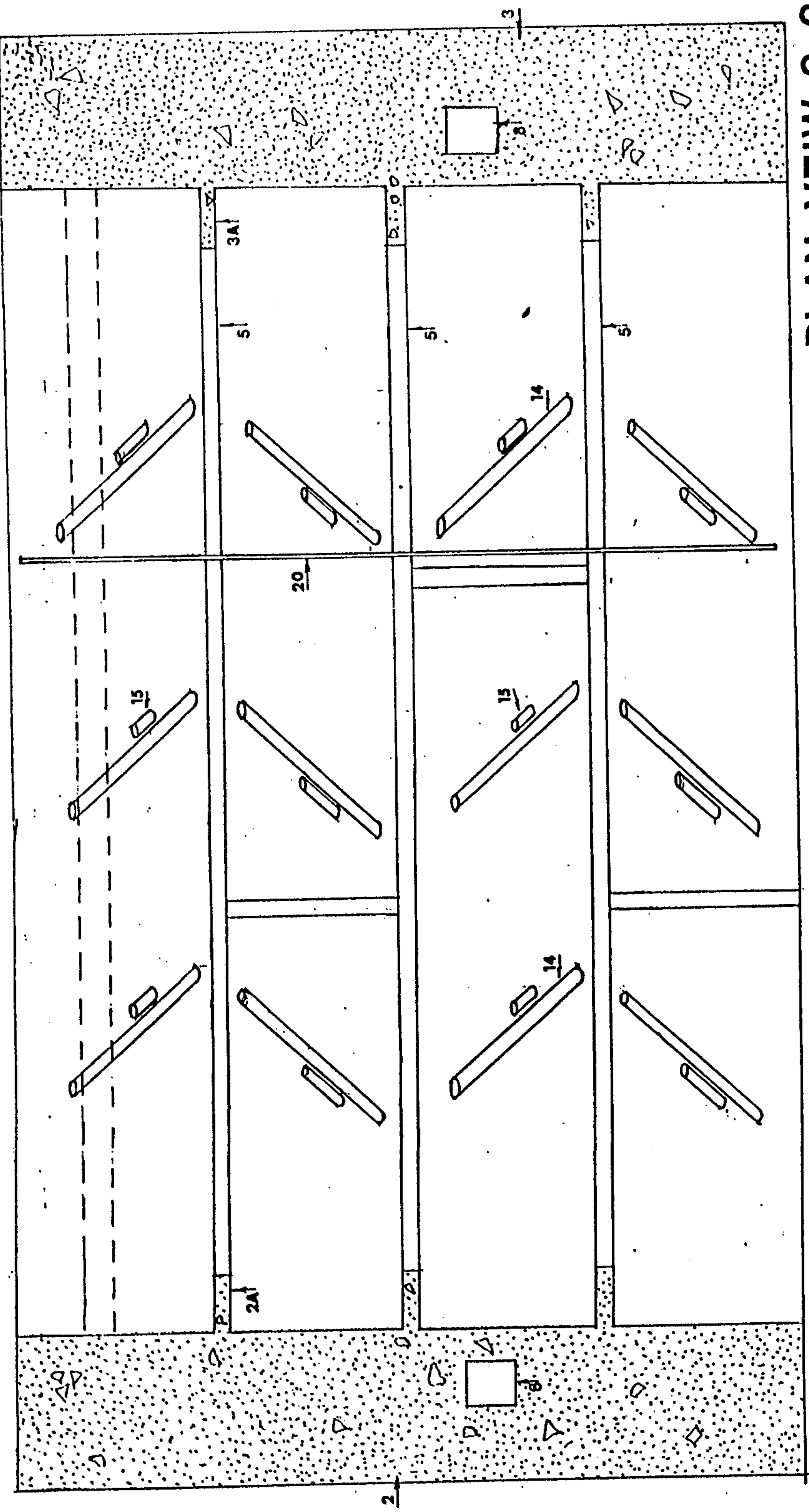
SECTION 1-1

FIG 2



PLAN VEIW 2-2

FIG 3



PLAN VEIW 3-3

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FIG 4

PLAN VIEW 4-4

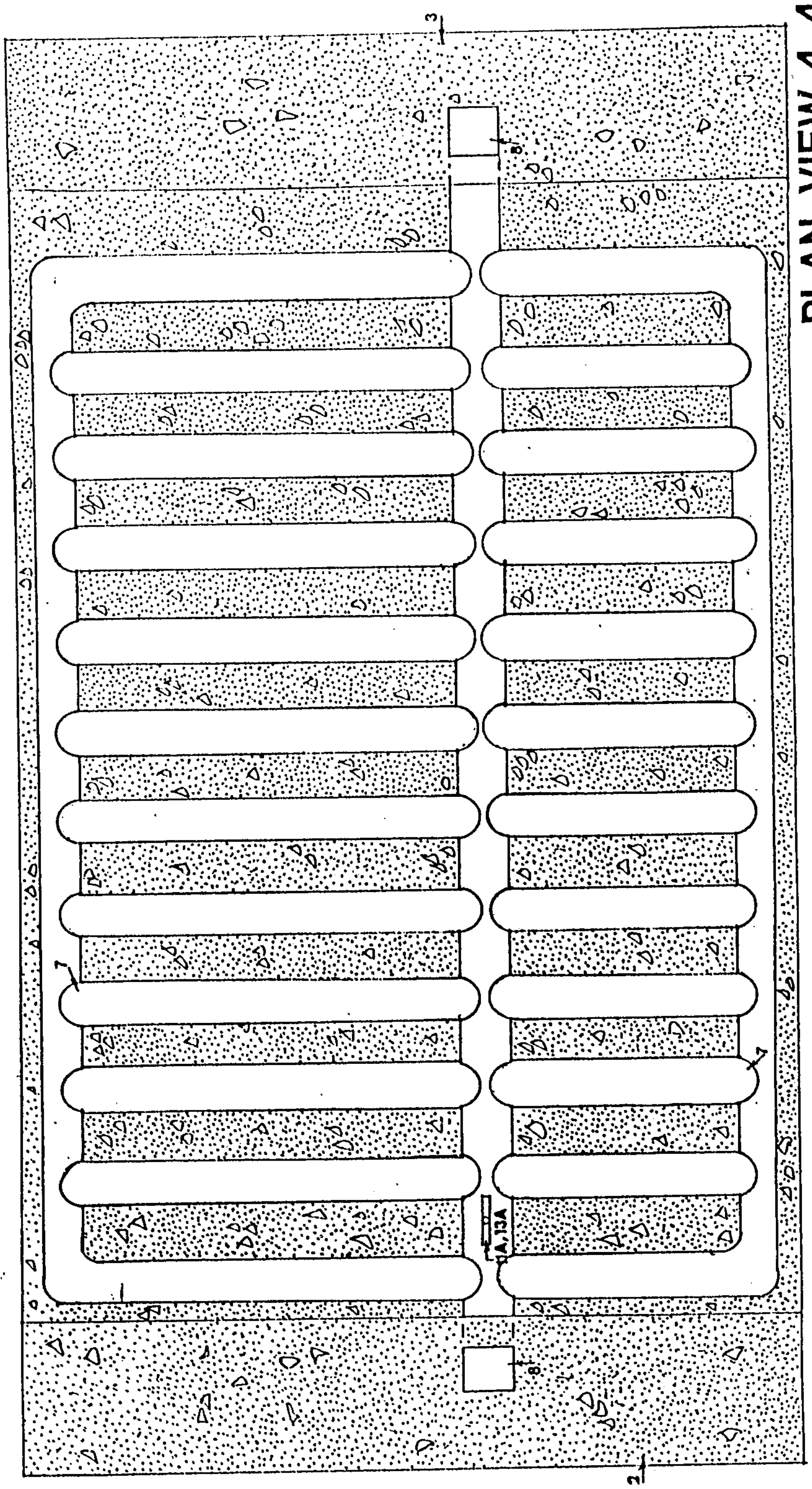
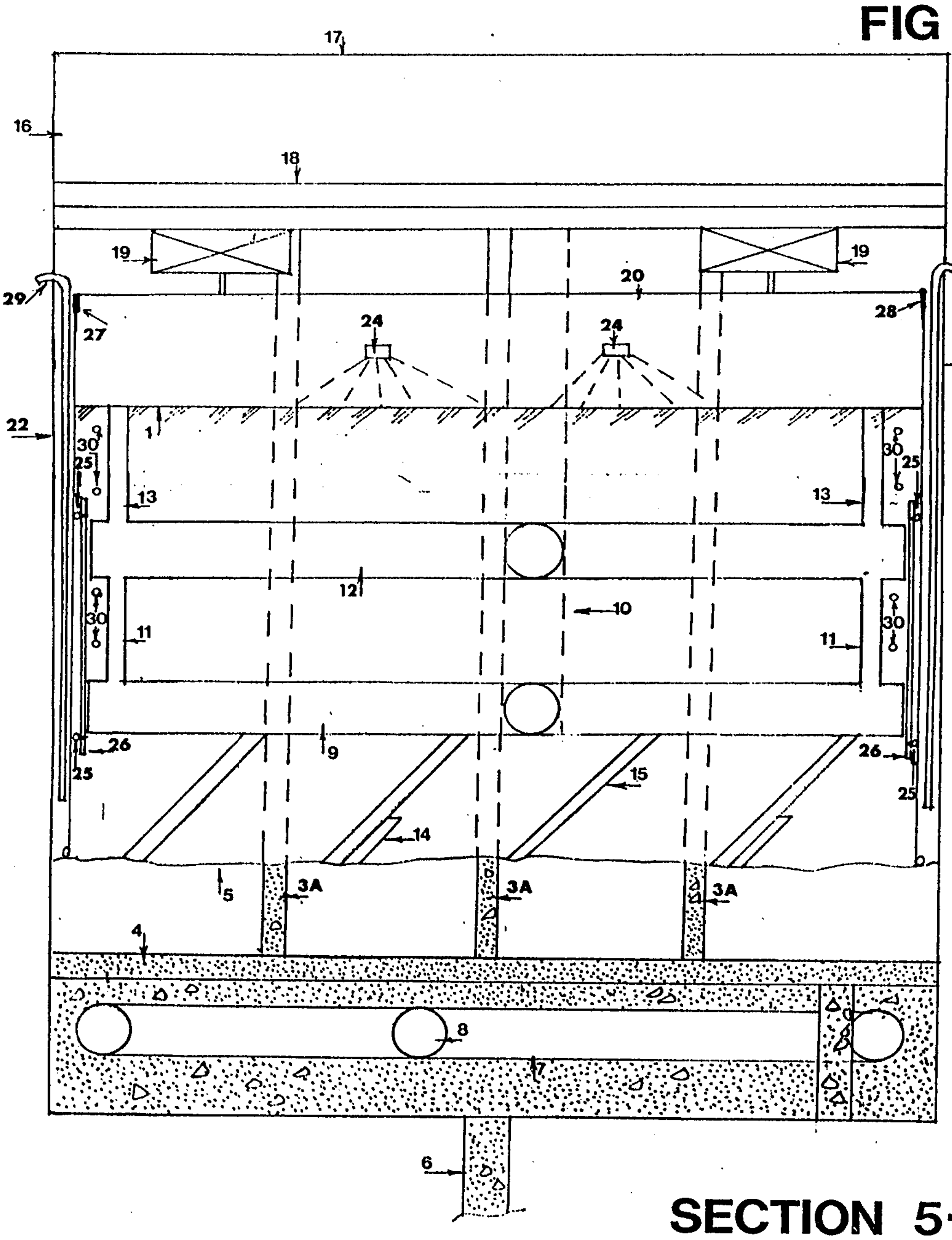


FIG 5



SECTION 5-5