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(54) Multi-component shipping container system for the transportation of organic matter, with water pumping system, variable payload, and active thermal regulator

(57) The multi-component shipping container system for the transportation of organic matter with water pumping system, variable payload, active thermal regulator, is an invention representing a revolutionary new method to transport all kind products requiring a thermal factor for its transportation and preservation. The invention not only is a novelty, but it also provides the special feature of improving the preservation conditions of the products by allowing that even after extensive exposure to adverse external temperature conditions during transportation, the product is not damaged; likewise, it guarantees a significant cost reduction of the final product due to the savings originated by using more economic and developed means to be able to reach the consumer more effectively and cheaper.

How did the invention come about? Very simple, nowadays, the Tropical Flower industry faces the problem of an extremely expensive transportation system that does not allow direct transportation of the product to the wholesaler, thus preventing the expansion of the market and increasing its final costs, this is because of the special needs of the product, particularly the need of a temperature higher than 8.9°C for its adequate preservation. The transportation system of the Tropical Flowers has not developed by function of its needs mainly because the market is rather small and does not represent a "grosso modo" an important group of economic interest in order to develop container trucks that would transport the refrigerated product. To the contrary, the Tropical Flower Industry enjoys a technologically advanced transport infrastructure causing its market to expand at very convenient prices. The problem solved with this invention is the use of the Transporting Industry developed depending on the needs of the Traditional Flower Industry in favor of the Tropical Flower Industry. From now on, a product (Tropical Flowers) can be transported in refrigerated trucks without damaging its quality, but to the contrary, improving its preservation because of the adequate conditions provided by the system.

This multi-component shipping container system for the transportation of organic matter, with water pumping system, variable payload, active thermal regulator, consists of using a group of three basic elements, which are: insulated chassis, water storage reservoir tanks and the water pumping unit. The mentioned system maintains the temperature of the payload inside the chassis within a maximum temperature range when exposed to changing temperatures; as a thermal agent, it uses either hot or cold water pumped by the pumping unit towards the storage tanks specially designed to adapt to the requirements of the volume, space and type of payload contained in the chassis. The chassis groups consists, for the time being, of four different chassis and its payload support groups with different sizes and features. Each individual chassis integrates the thermal tanks, the payload support group, and the corresponding top cover for each one. The top covers of the chassis are the covers matching the four types of chassis. Each cover matches the corresponding chas-

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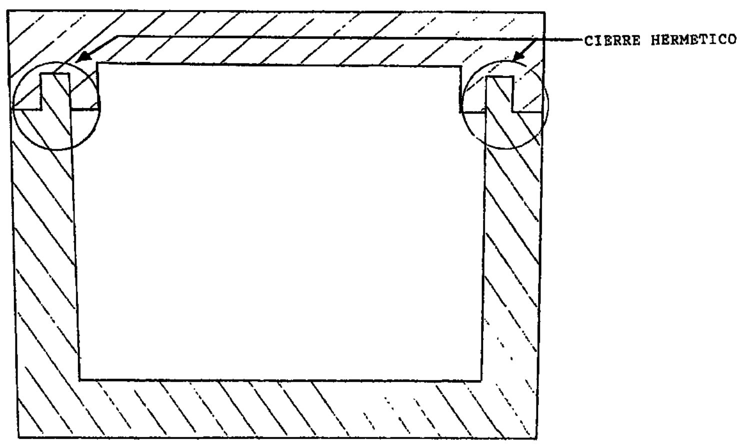
sis, thus locking up the upper part. The thermal tank group matches inside the different chassis. When the thermal tanks are loaded with any of the different liquids, they perform as a thermal battery for the system. Depending on the kind, shape or payload demand, one or several kinds of tanks can be used interchangeably in any of the chassis. The payload support group keeps the products in position and secure inside the chassis. An internal structure combined with the chassis offers payload support. The payload support group is formed by three different kinds of components. The last one is the water pumping unit which depending on a specific application heats up the incoming water at the desired temperature and injects the liquid into the thermal tank group. We must bear in mind that this invention will be primarily used for the transportation of Tropical Flowers, however, the system is adequate to preserve any kind of organic matter, such as foliage, protein, lipids, carbohydrate compounds, etc.

The invention includes standardization and compatibility characteristics that make all the components of the systems compatible and interchangeable with one another, allowing for several combinations between tanks and chassis, depending on the characteristics and needs of the payload.

In order to manufacture the multi-component, shipping container system for the transportation of organic matter, with water pumping system, variable payload, active thermal regulator, it is necessary to cast wooden molds for the chassis and the top covers which must strictly abide by the specifications shown in the schematics attached hereto. Once the molds are ready they are used to make the ceramics ones, which at the same time will serve as basis for the definite aluminum ones. Once the aluminum ones are ready, the insulating material is poured into them. The chassis and the top covers must be free of cracks, otherwise the thermal factor would escape, which is why this a very delicate procedure. The storage tanks basically follow the same manufacturing pattern, however, in order for the tanks to get their final shape, they are prepared using the blown method inside the mold and not the dripping method as the chassis.

The last thing is the water pump which in spite of being a completely new unit, only requires for its manufacturing the assembling of the parts that form it, as previously illustrated.

FIGURA 28: VISTA EN CORTE DEL ACOPLE DE LA CUBIERTA CON EL CONTENEDOR (SELLO HERMETICO)



Description

I.- STATUS OF THE TROPICAL FLOWER MARKET

We will now refer to the tropical flower market divided into its two main groups: 1.- Tropical Flowers and; 2.- Traditional Flowers.

Tropical flowers, in Costa Rica, are grown in the Atlantic Zone. They are mostly field crops such as helicons, gingers, ornamental bananas, cordyline and palm leaves. Presently around the world they are packed in all sizes of cardboard boxes.

The optimal temperature for their preservation is 14°C and will suffer damage at a prolonged temperature of 9°C or lower. They are packed at the farm, then exported via cargo aircraft to the importing distributors in Miami. The large importing distributor picks them up without delays at the Miami airport. The flowers are held in their Tropical cooler (14°C) for several days while telephone negotiations are finalized to sell them to the wholesalers throughout the United States. The flowers are then shipped by commercial aircraft to the purchasing wholesaler's AIRPORT.

The wholesaler must then drive to the AIRPORT to pick up the product. The air cargo cost from the Miami airport to the wholesaler's airport is approximately $10.50/box, plus additional costs incurred for transporting them from the Airport to the Warehouse. The wholesaler then distributes/sells the product to florist shops in the area.

Transportation from the importing distributor to the wholesaler is our point of focus. This is where the invention is used. There is a cheaper, more effective transportation method than air freight, which until this invention, could not be used by the Tropical Flower Industry.

It is the refrigerated trucking system that during the course of the years has been developed for Traditional Flowers. The Tropical Flower Industry cannot use this system because the trucks are refrigerated at 3°C. Tropicals cannot remain at these low temperatures without wilting. Transportation within the United States represents approximately 25% of the cost of the final product. We are dealing here with large savings able of determining success or failure in a competitive market.

We can say that Tropical Flowers started approximately 40 years ago with the introduction of two of the old Tropicals, Birds of Paradise and Antheriums. Today there are available many new Tropical flowers and foliage. The new Tropical flower market started in earnest around 1983. A Hawaiian named Howard Cooper began shipping Tropicals such as helicons, bananas, ti leaves and gingers from his large garden in Maui. Its final destination was Los Angeles.

In 1985, our company, Costa Flores S.A., began exporting, via cargo aircraft, to Europe and the United States. Because of our large start-up volume we were exporting at the time 50% of the newer Tropicals on the market. Over the years with the maturing of the market, this advantage has declined. The first few years were largely promotional. Afterwards prices were high. Costa Flores was the dominating force of the new Tropicals for the first five or six years. The business has now spread over a number of farms. Tropicals are now a major export of Costa Rica. The United States is the major destination.

The Carli's have always been good pioneers and problem solvers. The objective now was the U.S. market. How could we get an edge on the rest of this market? We have relied on the European market for too long. Costa Rican production cannot compete in a market as mature as the European market. There are too many Tropical countries that are closer and have better air freight rates. Transportation is 50% of the final product costs. The long standing market for Costs Rica is the United States. Costs Rica is one of the closest tropical countries to this huge market.

The solution reached to strongly penetrate this market was: to take advantage of the tremendously developed and economic refrigerated land transportation system using a completely new method to keep the flowers under better conditions while riding long distances in the refrigerated container system.

Until now, the Tropical flowers industry could not use this transportation means mainly because of the conditions which made impossible the preservation, in this case, of the Tropicals. This invention solves this technical problem. Our system will be able to maintain any organic matter contained inside at a certain temperature range, for the length of time required to reach its destination or time duration. Payload is not restricted to Tropicals since it can be any kind of matter requiring a thermal factor to keep it in optimum conditions while being transported.

Our invention can be applied to many situations requiring a MULTI-COMPONENT SHIPPING CONTAINER SYSTEM FOR THE TRANSPORTATION OF ORGANIC MATTER, WITH WATER PUMPING SYSTEM, VARIABLE PAYLOAD AND ACTIVE THERMAL REGULATOR, however, our intention is that in the future, this will be the standard way of packing and shipping Tropicals throughout the world.

Thanks to this invention, from now on, whenever it is required to transport a certain product which during this process may be exposed to thermal conditions that could damage its preservation, the invention could be used to maintain the product between critical preservation temperatures according to its essential characteristics and requirements.

In spite of being needed by the Tropical Flower Industry, no one in this industry or in any other related industry has come up with a packing system with thermal battery. This system, as we will see, can also aid in the preservation of Tropicals during their transportation in refrigerated containers, it could be used to maintain within a critical temperature range any organic or inorganic matter, such as proteins, carbohydrates, flammable and of course all kinds of Tropical Flowers.

II- STATUS OF THE TRADITIONAL FLOWER MARKET

Traditional flowers in Costs Rica are grown in the highlands, such as on the slopes of Poas. Unlike Tropical field cropping, Traditionals are grown in high intensity conditions under hard roof or shade cloth. They include flowers such as roses, aster, lilies, and chrysanthemum. Unlike the large array of box sizes used for Tropicals, Traditionals are packed at the farm in standard size cardboard boxes of 106 cm x 26 cm x 10 cm. Tropicals and Traditionals are then exported via cargo aircraft to the Miami Airport. The large importing distributor in Miami picks up them up within the next few hours. The flowers are held in their Traditional flower cooler (3C) for a few days. They are right next to the Tropical cooler but at a different temperature, 14C. Meanwhile, flowers of all kinds are being sold by telephone to the wholesalers throughout the United States. At this point Tropicals and Traditionals usually take different routes to the wholesaler.

Traditionals are sent in a sophisticated, refrigerated trucking system directly to the DOOR of the wholesaler for only $3.50/box, and it is not necessary to pick them up at the airport because they are delivered at the DOOR of the store. The wholesaler then sells the product to florist shops in the area. Remember, the transport from the importing distributor, to the wholesaler is our point of focus.

Tropicals on the contrary are sent via aircraft and the wholesaler must pick up the product at the Airport at a much higher price.

Let us review once more, but slower, the whole importing, exporting and transporting process to the wholesaler. At the farm, harvested Traditional flowers are quickly bundled and transported to the post harvest facilities where they are sorted and bundled together by color, grade, and quality. The best quality flowers are selected for export and the others are typically sold nationally. Each Traditional flower bundle is sleeved and placed in a preservative solution to condition the flowers and improve longevity. The components of the solution are based on the flower's needs and thus vary by flower type.

The Traditional flower bundles are then packed in standard size cardboard boxes inside the cooler, and pre-cooled at an optimum temperature (3°C). The boxes are palletized (placed on wooden platforms), transported to the airport in refrigerated trucks, and loaded in commercial cargo aircraft to be transported to the importing distributor in Miami.

Miami is the port of entry of most of Central and South America's cut flower production. Here, Traditional Flowers are immediately transferred from the aircraft to coolers at 3C and 90% relative humidity. Tropicals, on the other hand, are placed at the airport in shaded but non-refrigerated warehouses, because they don't need it. At each location, the U.S. Department of Agriculture makes random inspections. After clearing customs and agriculture all flowers are brought to the importing distributor's warehouse, more or less four hours after the aircraft has landed. Tropicals and Traditionals are placed in their respective refrigerators, 3°C for Traditionals and 14°C for Tropicals. Each box goes through an X-ray machine inside the cooler, and is scanned and sorted by bar code. Flower boxes, depending on flower type are automatically sorted for quality inspections. After passing inspection, they are placed in the designated locations inside the cooler. Inventory is computerized. As orders are taken, invoices are simultaneously printed in the distribution department and customer's orders are assembled.

The highest percentage of flowers are United States bound. All of Costs Rica Traditional flowers and the $157,217,000 worth of Traditionals imported into the United States from all over the world, will be riding the refrigerated trucking system from the importing distributor to the wholesaler. The main U.S. market is designed and developed according to the needs of the Traditional Flowers, the whole system is based upon them.

III.- STATUS OF THE U.S. WHOLESALE MARKET

After the Traditional flowers arrive at the DOOR of the wholesaler, they are immediately placed in a 3°C cooler. Normally, they are unpacked from the boxes and held in preservative solutions until sold to retail customers or consumers. Consumers can reasonably expect a packet of floral preservative to accompany their purchase of Traditional flowers. When used according to directions, floral preservative will improve longevity and vase life performance of most Traditional flowers.

Tropical flowers do not arrive at the DOOR of the wholesaler. The wholesalers have to pick them at the AIRPORT. This entails money, time and organization most wholesalers do not have. The 15% for the wholesalers that will go to the airport, return to their store and only unpack enough Tropicals for display. The others are placed in the Tropical cooler (14°C) inside the box. Tropicals stay fresher in the humidity of the box than they do in a bucket of water. Tropical flower vase life CANNOT be extended once they are harvested.

Wholesale florists in the 1920's sold 99% of hard goods, and only a few fresh flowers that were grown locally. In those days, growers were located near retail florists in large cities, as there was little refrigeration available to hold flowers while travelling long distances. At this point Tropical Flowers were unknown.

In those days transporting Flowers from grower to retail florists took a day or two - otherwise they were worthless. Therefore, during 20's, 30's and even into the 40's wholesalers were not much of a player in the fresh flower. Indeed, it was not until the advent of inexpensive refrigerated truck transportation in the 1950's that the structure of the floral industry allowed wholesalers to enter the midst of the grower-to-retailer stream of fresh products. Cheap refrigerated truck transport brought us centralized growing (in warm areas), and centralized distribution through wholesalers in the major cities. Local growers either went bankrupt or became retail oriented by opening their own consumer outlet. A few innovators still survived and served both retail and wholesale outlets for many years.

Wholesalers played an important economic role during the 50's. They bought large quantities of each flower type (800 red roses per box) and broke them into smaller units (25 red roses) for resale to the retail florist. This allowed growers to do what they do best - grow, and retailers to do what they do best - design and sell to the public. Wholesalers did the locating and warehousing of the product and for a small fee, handled the hassles of dealing with unknown growers.

IV.- STATUS OF LAND TRANSPORTATION

Wholesalers also enjoyed a transportation-related advantage- the big refrigerated trucks refused to drop flowers off at retail locations because it was (and still is nowadays) uneconomical for a 45' truck to stop along a city street to deliver one or two flower boxes. The economics of transportation and communication definitely benefited the wholesaler.

Presently, customers in most major cities may order their imported or Florida grown flowers during 5-7 days per week, cutting down on speculative buying that was necessary having only a few days to buy. Most trucks are outfitted with satellite technology to track shipments. A transmitting unit that periodically transmits the location of the vehicles to the home base is installed. This provides instant communication between the dispatcher and the drivers, allowing for quick response to road side emergencies, traffic, weather or delivery problems that might cause delays.

With the bar coding systems, it is possible to trace the product from the time it enters the truck until it reaches the customer's cooler. Through the use of Electronic Data Exchange (EDE), truck companies are able to receive large amounts of information from shippers and to process this information from one computer to another. This process generally eliminates input errors and can be done in a one - one thousandth of the time it took a manual system. EDE works hand on hand with bar coding by facilitating tracing of product on a 24 hours basis. ***All of the above is support infrastructure and cannot be used by the Tropical Flower Industry mainly because of the low 3°C temperature used for Traditionals Flowers.***

V.- HOW WILL THE SYSTEM AFFECT THE MARKET

The multi-component shipping container system for the transportation of organic matter, with water pumping system, variable payload and active thermal regulator was born out of relationship and need. The relationship was between the "Traditional" versus the "Tropical" flower industries.

In order to confront this industry, so developed and benefited by modern infrastructure as the Traditional Flower Industry, as part of the Tropical Flower Industry we have to be able to penetrate the U.S. market with equally competitive prices. The only possible way of doing so is by taking advantage of the existing transportation System of Traditional Flowers in refrigerated trucks. This perspective arises from the close relationship we have with Costa Flores, S.A., Costa Rica's main grower of Tropical Flowers.

The exhaustion of the European market caused this need.

A.- TRANSPORTATION FLOW CHART FOR TROPICAL FLOWERS

Present scheme.

FARM --via aircraft-- IMPORTING DISTRIBUTOR--via aircraft--WHOLESALER

Since the beginning of the Tropical Flower industry, some 14 years ago, Tropicals have been confined to use an expensive transportation means, air. The product is delivered at the customer's AIRPORT, not at the DOOR, a three times the cost. Over the last 50 years, large refrigerated trucking companies have emerged in Miami, servicing Traditional Flowers conveniently and effectively.

Why has not a transportation industry been built around Tropicals according to its their 14°C temperature needs? The answer is relations. In relation to Traditional Flowers Tropicals mean only 2% of sales. With our new invention we hope to increase sales to the U.S. market by 10%. We know that the United States is by far, the major market for Costa Rican flowers. Another aspect worth noticing is the relative size of Tropical exports in Costa Rica nowadays. Ten years Costa Rica did not export Tropical Flowers. Nowadays they add up to 23% of all flowers exported from Costa Rica. With our new invention we hope to raise to 50% the total of exported flowers from Costa Rica.

Suggested scheme:

FARM—by air—DISTRIBUTOR IMPORTER—by land--WHOLESALER

The Tropical flower industry is relatively small but not so young. As in all maturing markets, a growing competition exists, smaller margins and lower prices through time. Tropicals are only sold to customers whose schedule and budget allows them to go to the airport.

More than 85% of the flower industry customers will NOT go to the airport. Therefore, shipping by truck would open the Tropical markets manifold by bringing the flowers directly to the door of the customers, saving at least two thirds in transportation costs. At this point in time Costa Flores S.A. needs this competitive edge to increase its customer base in the United States and to keep up with the maturing market.

David and Adrian Carli, besides being father and son are inventors, so there is a long history between them, but the working relationship between the two inventors began five or six years ago at the farms of Costa Flores S.A. During the summer months, while Adrian was away in college, both of them worked on farm projects. These projects would include everything related from flower growing to flower vase life preservation techniques. There was even a time when they consulted on the refrigerated trucking problem. They bought a hand warmer, and even developed a chemical reaction, with the intention of using it as a warmer for the Tropical Flower box. However, its 500 calorie output was not enough heat to make a difference. There was not much of an economic need at the time so the project was set aside.

It was not until a year ago that the company's economic outlook felt threatened, for which reason it was necessary to start thinking about possibilities on how to increase sales. The idea to continue trying materials to be used in the refrigerated truck took shape, and until then, did not have any financial meaning. No one in the Tropical Flower industry and in general transportation had done any thing similar, but wrap extra insulation on the outside of the box in feeble attempts to use the trucking system. So Adrian and David started working on the project. They discussed the possibility of using acid-base chemical reactions as a heat generator but discarded the idea, not only because of its high costs, but because of its environmentally unfriendly by-products. The next solution discussed was using of a hot iron bar as a heat reservoir to warm up the box. Adrian quickly observed that water holds ten times as much the amount of heat as the same weight of iron. Water is one of the best heat retainers of all elements. Water was the solution, not only because of its availability and environmentally nourishing characteristics, but because of its cost.

Then in a very simple way, the idea is to begin with an insulated box. A specially shaped plastic bottle filled with hot water is placed inside the box. The water bottle is our thermal heater or water reservoir. It will contain enough hot water, at the right starting temperature, to keep the Tropical Flowers warm while remaining in the refrigerated truck system between the importing distributor and the wholesaler. This would lower the cost of the final product and make it more convenient for the wholesaler to buy Tropical Flowers. The result would be an increase in Tropical Flower sales in the United States.

B.- THE PROBLEM OF THE PRESENT TECNIQUE

The technical problems encountered were the conditions that were specially created for the shipping and distribution of Traditional Flowers that had been in the market four times longer than Tropical Flowers with a market 50 times bigger. Those are the conditions used in all the studies and estimates, hereinafter referred to as "The Conditions":

Tropical Flowers boxes leave Miami at a temperature of 22°C. We wish to maintain them above 9°C in a 3°C refrigerated truck. The trucks must reach the most outlying markets, such as Chicago and New York, 40 hours away.

The fact of keeping the box warm while exposed to such temperatures, is typically a matter of how thick should the polystyrene insulated walls be. The thicker the insulation, the less heat will escape. However, in a trucking transport situation we are charged per volume of space occupied. Therefore, blindly increasing the thickness of the walls would make boxes too large and transportation too costly. The question arose: how much room would the insulation occupy to meet The Conditions, when relying only on wall insulation? Figure 41 is a graph of a computer simulation showing four different wall thickness and the time the flowers were kept above the critical 9°C temperature during 40 hours.

The conclusion is that we cannot depend on insulation alone to do the job effectively. As shown in figure 41, top curve, it would take an 8cm wall thickness, which is 90% of volume, to maintain The Conditions using just insulation. Obviously, this is too much space used up by the insulation materials. At a wall thickness of 2.5cm, 43% of the volume would be insulation. This is the maximum thickness a polystyrene box can have, and still withstand the harsh shipping handling. This maximum thickness of polystyrene was chosen because of polystyrene costs versus the thermal reservoir. With a 2.5cm thick wall , the box will cost $2.50. The bottle and hot water only cost $.35 and would be doing the job of one of 5.5cm, equal to $5 worth of insulation. This is just one of the important economic (financial) aspects to remember. If it were not for this fact, the invention would not be of interest.

The insulated walls occupy 43% of the volume of the single box. Does this loss in volume make the system financially unattractive?

In order to be able to answer this question, let us look at the savings in air freight compared to loss in space. A cardboard box occupies 13% of volume. So in an insulated a 2.5cm thickness polystyrene box would use only 30% more volume than cardboard. This is the "extra" lost space.

Truck freight = $3.50/box + (extra lost space) = $4.55/box

Air Freight = $10.50/box

Therefore, we are still saving more than 50% in freight when considering volume lost to insulation.

The next doubt was how much space would be available in between the Tropical Flowers boxes to place a thermal reservoir. We looked at all our Tropical packing configurations. We noticed that 90% of the flower types had an empty space in the center of the packed product, more than 4000 cubic cm. long. This is because Tropical Flowers have big rigid heads.

The next doubt was how much extra heat, calories, would be necessary to maintain the box of Tropical Flowers warm under Conditions, with a wall thickness of 2.5cm polystyrene. Figure 42 is a graph of the conclusion by computer simulation. We programmed the computer with the physical laws of convection and conduction as related to the amount of water, flowers and insulated walls. Maintaining The Conditions, we saw what the graph would look like, using different starting water temperatures, with different amounts of water. As figure 42 shows we need 3.7 liters of water with a starting temperature of 60°C. Actual refrigeration tests showed computer simulations to be accurate in ± 5%. Figures 39 and 40 show the correct information for a "Fish Box" (SIMPLE STYROFOAM TEST BOX USED TO TRANSPORT FISH) with tank scenario and no tank scenario, respectively, verifying the accuracy of the rank within ± 5%.

Once in Miami, the process of heat injection must be simple and cost effective. There was no time or nor budget to open the boxes and insert the heated object, nor to make any cumbersome movement of the boxes. The heat needed would be too strong to be stored in a small solid object driven through a slot in the box. The profile that seemed feasible was the hot liquid water, injected through the front of the box. The front part is from where all the boxes can be accessed and all are facing one way. For instance it would not be convenient to inject water through the top lid. The top boxes on the pallet, would be accessible but in order to reach the lids of the lower ones, it would be necessary to remove the boxes from the pallet. This would increase costs and cause confusion. Side injection would have similar drawbacks as top injection. Front injection on the other hand can be accomplished without moving the boxes. It is only necessary to walk around the pallet to be able access all fronts. It was necessary to invent a whole new system. Including boxes and bottles of different sizes to meet all packing requirements. We chose four box sizes. The "full" size is the standard size of Traditional flower chassis. All the others are increments of it.

half	106 x 26.5 x 19
half-long	159 x 26.5 x 19
full	106 x 53.0 x 19
full-long	159 x 53.0 x 19

The larger chassis worked out particularly well. This is because the percentage of space occupied by the bottle is less and because of box mass versus surface area ratio, discussed in the following paragraph. This happens also because we were able to recover 6cm of wall space by not having two interior walls in a full size chassis. For example, in the full-long chassis, the 6 liter, 7cm wide bottle can be placed in the center where the two of its sides come together. The bottles occupy the space of the walls. This leaves both sides of the full-long chassis open. Each side is as big as a half chassis WITHOUT a bottle. This makes the double width of the full chassis more effective for bulky products without any unused space such as the spaces left by bouquets. Heat requirements for the different box sizes were worked out by computer simulation. See figures 37 and 38.

Heat requirement is a function of the flower mass inside the chassis versus the box's surface area. Therefore, if some chassis are heavier than others, proportionately less heat would be required. This is because of the holding capacity of the chassis with a higher mass to surface area ratio. They are able to retain heat longer, therefore require less amount of hot water per chassis volume. Therefore, a direct proportion with the size of the chassis and the size of the bottle does not exist. We discovered that a six liter bottle is best for all chassis except for the "half chassis". A variety of bottle shapes were invented to accommodate the different packing configurations of the varieties.

37cm x 11cm x 12.75cm	4 liters
53cm x 10cm x 12.75cm	6 liters
62cm x 8.5cm x 12.75cm	6 liters
72cm x 7 cm x 12.75	6 liters

The most affected market would be the United States Tropical Flower market. With this invention, we would expect gingers to make larger headway than helicons. This is because they are more traditional. You may notice this trend in the above mentioned statistics on "Costa Rican Cut Flower Exports". Four times as much ginger is exported to the United States than helicons. We estimate a 2-4 fold ginger export increase, during the first year, for companies using the new system. The multi-component, shipping container system for the transportation of organic matter, with water pumping system, variable payload and active thermal regulator will make Tropical Flowers accessible to small and large wholesalers.

For the first time, the high tech trucking system developed for cold requiring Traditional Flowers, can be used as well by Tropical Flowers requiring warmer temperatures. Wholesalers can now order Tropical and Traditional Flowers at the same time, not as it is now done, where Tropicals are only sold to wholesalers whose schedule and budget enables them to go to the airport.

According to this invention, there would be a wider market for Tropical Flowers, by bringing them directly to wholesalers, at half their transportation cost. If we consider that typically U.S. internal transportation costs are 25% of the overall Tropical Flower cost, it is possible to estimate the savings. Two thirds of 25% means 16.5% of the overall price savings. These are profit earnings that either maintain or send our companies bankrupt. There would be a thinner dividing line between Traditional and Tropical Flowers.

No system has ever existed addressing this problem as of our multi-component shipping container system for the transportation of organic matter, with water pumping system, variable payload and active thermal regulator, with the intention of eliminating The Conditions for the Tropical Flower Industry.

The only technical solution that improves the quality and delivery conditions of the flowers while developing a new and radical transportation means for Tropical Flowers is our multi-component shipping container system for the transportation of organic matter, with water pumping system, variable payload and active thermal regulator, which makes possible delivering the flowers at the door, at half the cost. We hope that in the long run the effect will be that the Tropical Flower Market reaches 10% sharing in the U.S. market within the next 5 years, thus replacing its present 2%.

C.- STATE OF THE DESIGN

The purpose of the system is to maintain the temperature of organic matter or any other payload (flowers...foliage...protein...lipid...carbohydrate compounds, etc.) within a maximum temperature range when exposed to variable temperatures. For the specific case of Tropical Flowers, this invention keeps the payload warm in a cold environment but the system is designed in such a way that it could perfectly function otherwise, keeping the payload cold in a warm environment.

The specific application used to assess the system is the following scenario: several specified *tropical flowers* at an initial temperature of 22.2C are exposed to an average cold storage temperature of 3.3°C. Tropical Flowers cannot endure temperatures of less than 8.9°C. without suffering damage.

This *INVENTION* is formed by six components or groups: (1) The **chassis group**, consisting of four different chassis and their corresponding top covers of different sizes and features. Figure 19 shows a three dimensional perspective of the smallest "half" chassis. The "half-long" chassis measures 53 cm more than the "half" chassis The "full" chassis is same length as the "half" chassis but twice as wide. The "full-long" chassis is twice as wide as the "half" chassis and 53 cm longer. The schematics for the "half", "half-long", "full", "full-long" chassis are found in Figures 1,3,5,7, respectively. Each individual chassis integrates the thermal tank group, the payload group, and the corresponding top cover for each individual chassis (top cover group). Each chassis provides a large thermal resistance between the outside and the interior sections. The chassis and their covers are made of insulated material. (2) The **top cover group** (Figure 19) consists of the matching tops for the four different types of chassis. Each top cover matches the corresponding chassis, thereby locking the open top. The schematics for each of the top covers for the "half', "half-long", "full", "full-long" chassis are found in Figures 2,4,6,8, respectively.(3) The **thermal tank group**. There are ten different tanks that fit inside the chassis; Baby Borg 2 and 4 Liter (Figure/Schematic 9), Big Borg 4 Liter (Figure/Schematic 10), Big Borg 8 Liter (Figure/Schematic 11), BOQX (Figure/Schematic 12), ROX (Figure/Schematic 13), TANK#40 (Figure/Schematic 17), TANK#50 (Figure/Schematic 16), TANK #60 (Figure/Schematic 15), and TANK #70 (Figure/Schematic 14). When charged with a variety of liquids the thermal tanks act as a thermal battery for the system. Depending on the type, form, or payload demand, one or several tanks can be used interchangeably in any of the chassis. The invention includes a standardization and compatibility characteristics thus making all the system's components compatible and interchangeable, allowing for diverse combinations among the tanks and the chassis, depending on the characteristics and needs of the payload. Water was used as charging liquid when assessing the *Invention*. (4) **Payload support group** (Figure/Schematic 18). An internal infrastructure combined with the chassis provides payload support. Three different types of components form the payload support group. These include anchor support "A", anchor support "B", and the stabilizing bar. (5) The water pumping unit (Figure 20) which depending on its specific application heats up the incoming water at the desired temperature and injects the liquid into the thermal tank group. (6) Payload. Organic matters, such as flowers, foliage, protein, lipids, carbohydrate components, etc.

The success of the system is determined by how long the system can keep the temperature inside the chassis above this critical temperature. In this case the *Invention* extended the viable storage of the flowers by 177%, when compared to the same insulated container before charging The exact thermal performance of the *Invention* is analyzed and discussed in detail in the THERMAL PERFORMANCE section.

1.- SYSTEM DESIGN FEATURES

The *INVENTION* is formed by five components or groups having specific features that contribute to the success of the system: (1) Chassis group, (2) Top Cover group, (3) Thermal tank group, (4) Payload supports, and (5) Water heating unit.

a.- CHASSIS GROUP

a.1.- HALF CHASSIS

Figure/Schematic 1 shows the detailed dimensions and the different characteristics included in the half chassis The following are some of the features that have been integrated into the design:

Thermal resistance.

- Extruded pattern XX and cylinders on inside bottom to register tanks. (Figure 21).
- Channels on inside walls and bottom for payload pieces (Half chassis only, Figure 22).
- Pattern of extruded cylinders on outside bottom matching the extruded patterns on top cover. This feature allows the boxes to stack in a four by four arrangement. (Figure 23).

The fluid reservoir on both ends are non-symmetrical (See manufacturing designs for top cover and chassis). When placing the lid on the chassis in one of its two possible positions, the front inlet opens up. When the lid is facing the other way, both inlets are sealed. This feature occurs due to the symmetry of the inlets on either end and the matching built in plugs on the far side top cover and chassis. (Figure 24). This feature is not available for the "full" and "full-long" chassis due to the lack of symmetry of the number of fluid reservoir openings on each side.
Tanks BOQX, ROX, #40, BORGS 2L, BORGS 4L can be used interchangeably with this chassis.

a.2.- HALF-LONG CHASSIS

Figure/Schematic 3 shows the detailed dimensions and the different characteristics included in the views of the "medium long" chassis. The following are some of the features that have been integrated into the design:

Thermal resistance.

- Cylinders on inside bottom to register tanks. (No XX Pattern, Figure 21).
- One extruded channel on inside walls for anchor support "a" and four bottom extrusions for payload pieces anchor support "b". (Figure 22).
- Pattern of extruded cylinders on outside bottom matching extruded conic patterns on the top cover. This feature allows the chassis to stack in a six by six arrangement. (Figure 23).

Fluid reservoir on both ends are non-symmetrical (See manufacturing designs for top cover and chassis). When the lid is placed on the chassis in one of the two possible positions, the front inlet opens up. When the lid is in the other position, both inlets are sealed. This is because of the symmetry of the inlets on either end and the matching built in plugs on the far side top cover and chassis. (Figure 24).
Tanks BOQX, ROX, #40, BORGS 2L, BORGS 4L can be interchangeably used in this chassis.

a.3.- FULL CHASSIS

Figure/Schematic 5 shows the detailed dimensions of the "full" chassis and the different characteristics included in the views of the "full" chassis. The following are some of the features that have been integrated into the design:

Thermal resistance.

- Cylinders on inside bottom to register tanks. (No XX Pattern, Figure 21).
- Four bottom extrusions for payload pieces anchor support "b". (Figure 22). (No side wall extrusions for anchor support "a"), therefore they are not used.
- Pattern of extruded cylinders on outside bottom matching extruded patterns on top cover. This feature allows the chassis to stack in a two by two arrangement. (Figure 23).
- Three fluid reservoir openings on one end and one on the rear end. (See manufacturing designs for exact dimensions). A sample of a receiver opening is found in Figure 25.

Tanks #40, #50, #60, #70, BABY BORGS 2L, BABY BORGS 4L, and BIG BORGS 8L, and can be used in this chassis.

a.4.- FULL-LONG CHASSIS

Figure/Schematic 7 shows the detailed dimensions as well as the different characteristics included in the "full-long chassis". The following are some of the features that have been integrated into the design:

Thermal resistance.

- Cylinders on inside bottom to register tanks. (No XX Pattern, Figure 21).
- Four bottom extrusions for payload pieces anchor support "b". (Figure 22). (No side wall extrusions for anchor support "a"), therefore they are not used.
- Pattern of extruded cylinders on outside bottom matching the extruded patterns on top cover. This feature allows the boxes to stack in a three by three arrangement. (Figure 23).
- Three half circle fluid reservoir openings on one end and one on the rear end. (See manufacturing designs for exact dimensions). A sample of a receiver opening is found in Figure 25.

Tanks #40, #50, #60, #70, BABY BORGS 2L, BABY BORGS 4L, BIG BORGS 4L, and BIG BORGS 8L can be used interchangeably in this chassis.

b.- CHASSIS TOP COVER GROUP

b.1.- HALF CHASSIS TOP COVER

Figure/Schematic 2 shows the detailed dimensions well as the different characteristics included in the views of the top cover. The following are some of the features that have been integrated into the design:

Thermal resistance.

- Extruded spheres on inside top to register tanks. (Figure 26 & 27).
- Extruded channels on inside top for payload support pieces. (Figure 27 & 29).
- Pattern of extruded cylinders on outside top. (Figure 23). Allows stacking in a four by four arrangement.
- Fluid reservoirs nets at both ends (Figure 24 & 27). Complimentary lip matches the chassis to provide two sealed ends or only one. (Figure 24).
- Extruded channels for tank neck clearance. (Figure 27).
- An additional lip around inside top perimeter to provide a locking action when closed. (Figure 28).
- Additional lip removed at critical areas. (See View D in Schematic 2).

b.2.- HALF-LONG CHASSIS TOP COVER

Figure/Schematic 4 shows the detailed dimensions and the different characteristics contained in the views of the top cover. The following are some of the features that have been integrated into the design:

Thermal resistance.

- Extruded spheres on inside top to register tanks. (Figure 26 & 27).
- Extruded channels on inside top for payload support pieces. (Figure 27 & 29).
- Pattern of extruded cylinders on outside top. (Figure 23). Allows stacking in a six by six arrangement.
- Fluid reservoir inlets on both ends (Figure 24 & 27) Complimentary lip matches the chassis to provide two

sealed ends or only one. (Figure 24).

- Extruded channels for tank neck clearance. (Figure 27).
- Additional lip around inside top perimeter to provide a locking action when closed. (Figure 28). Additional lip removed at critical points (See Figure J in Schematic 4).

b.3.- FULL CHASSIS TOP COVER

Figure/Schematic 6 shows the detailed dimensions well as the different characteristics contained in the figures of the top cover. The following are some of the features that have been integrated into the design:

Thermal resistance.

- Extruded spheres on inside top to match and position the extruded spheres of the tanks. (Figures 26 & 27).
- Extruded channels on inside top for payload support pieces. (Figure 27 & 29).
- Pattern of extruded cylinders on outside top. (Figure 23). Allows stacking in a two by two arrangement.
- Three half sphere fluid reservoir inlets on the front with complimentary lip matching the chassis to provide sealed ends. If a hole is needed the material surrounding the receiver end can be removed.
- Extruded channels for tank neck clearance. (Figure 27).
- Complimentary lip around inside top perimeter to provide a locking action when closed. (Figure 28). Complimentary lip eliminated at critical points (See View J in Schematic 4).

b.4.- FULL-LONG CHASSIS TOP COVER

Figure/Schematic 8 shows the detailed dimensions as well as the different characteristics integrated in the views of top cover. The following are some of the features that have been integrated into the design:

Hermetic locking of the contents.

- Thermal resistance
- Extruded spheres on inside top to match and position the extruded spheres of the tanks. (Figures 26 and 27).
- Extruded spheres on the inside top to give support to the payload pieces. (Figures 27 and 29).
- Pattern of extruded cylinders on outside top. (Figure 23). Allows stacking in a two by two arrangement.
- Three half sphere fluid reservoir inlets at the front with complimentary lip matching the chassis to provide two locked ends. If a hole is needed the material surrounding the receiver end can be removed.
- Three extruded channels for tank neck clearance. (Figure 27).
- Additional lip surrounding the interior top perimeter for the chassis to provide a locking action when closed. (Figure 28). Complimentary lip eliminated at critical points. (See view J in Schematic 4).

c.- THERMAL TANK GROUP

c.1.-TANK No. 1 - BOQX

Figure/Schematic 12 shows the detailed dimensions, as well as some of the features that have been integrated to the views of the reservoir BOQX 4 Liter tank. The following are some of the features that have been integrated into the design.

Approximate 4 liter capacity.

- Protruded spheres on top to match the protruded spheres of the top covers in order to provide support and position the tanks inside the chassis. (ALL DETAILS CAN BE SEEN IN FIGURE/SCHEMATIC 12).
- Extended channel on top for clearance for payload support structure.
- Extended neck at the upper top to allow access to the tank from one end of the chassis.
- Shape designed to allow space for specific payloads, while maintaining the highest possible storage capacity.
- Tank charging and encampment occur from outside closed assembly. Once the tank is loaded, its neck is filled with an aerosol self-expanding hardener insulating material that sprays and seals the tank.
- Protruded side slot to match the walls of the "half' and the "half-long" chassis. (Figure 35).
- This tank can be used interchangeably in the "half' and "half-long" chassis.

c.2.-TANK No.2 - ROX

Figure/Schematic 13 shows the detailed dimensions, as well as some of the features that have been integrated to the views of the ROX reservoir 4 Liter tank. The following are some of the features that have been integrated into the design.

Approximate 4 liter capacity.

- Protruded spheres on top to match the protruded spheres of the top covers in order to provide support and position the tanks inside the chassis. (ALL DETAILS CAN BE SEEN IN FIGURE/SCHEMATIC 13).
- Cone shaped extrusions at the base to match the cone shaped extrusions at the base of the chassis.
- Extended channel on top for clearance for payload support structure.
- Extended neck to allow inlet to be on the chassis end.
- Shape designed to allow space for specific payloads, while maintaining the highest possible storage capacity.
- Tank charging and encampment occurs from outside assembly. Once the tank is loaded its neck is filled with a self-expanding hardening insulating material that seals the tank.
- This tank can only be used in the "Half Chassis".

c.3.- TANK No. 3 - TANK #40

Figure/Schematic 17 shows the detailed dimensions, as well as the different characteristics integrated to the views of the Tank#40, 4 liter reservoir tank. The following are some of the features that have been integrated into the design:

Approximate 4 liter capacity.
Protruded spheres on top to match the sphere perforations of the top cover in order to provide support and position the tanks inside the chassis. (ALL DETAILS CAN BE SEEN IN FIGURE/SCHEMATIC 17).

- Cone shaped extrusions at bottom to adjust to the cone shaped extrusions at the bottom of the chassis.
- Extended channel on top for clearance for payload support structure.
- Extended neck to allow inlet to be on the chassis end.
- Cone shaped extrusions at the base to match cone shaped design at the base of the chassis.
- Extended channel at the cop to allow clearance for the payload support structure.
- Extended tube to allow that access to the tank from one end of the chassis.
- The design of the shape allows clearance for specific payloads, while it maintains the highest possible storage capacity.
- Tank charging and encampment occur from outside assembly. Once the tank is loaded its neck is filled with a self-expanding hardening insulating material that seals the tank.
- This tank can only be used in the Half Chassis.
- This tank can be used interchangeably in the Half, Half-Long, Full and Full-Long Chassis group.

c.4.- TANK No. 4 - BABY BORG 2L

Figure/Schematic 9 shows the detailed dimensions as well as the different characteristics integrated to the views of the BABY BORG 2L reservoir tank. This tank like tanks 2 and 3 can be used interchangeably depending on the payload demand and the environment. The following are some of the features that have been integrated into the design:

Approximate 2 liter capacity.

- Protruded spheres on top to match the sphere extrusions of the top covers in order to give support and position the tanks inside the chassis. (ALL DETAILS CAN BE SEEN IN FIGURE/SCHEMATIC 9).
- Cone shaped extrusions at the base to match cone shaped design at the base of the chassis.
- Extended channel (tube) on the top section to allow clearance for the payload support structure.

Extended neck to allow that access to the tank be placed at the end of the chassis.

- The design of the shape allows space for specific payloads, while maintaining the highest capacity as possible.

Tank loading and encampment occurs from outside closed assembly. When the tank is loaded its neck is filled with a self-expanding hardening insulating spray that seals and insulates the tank.

- This tank can be used interchangeably in the Half, Half-Long, Full and Full-Long Chassis group.

c.5.- TANK No. 5 - BABY BORG 4L

Figure/Schematic 9 shows the detailed dimensions as well as the different characteristics integrated to the views of the BABY BORG 4 liter reservoir tank. The following are some of the features that have been integrated into the design:

Approximate 4 liter capacity.

- Protruded spheres on top to match with the protruded spheres of the top covers in order to give support and position the tanks inside the chassis. (ALL DETAILS CAN BE SEEN IN FIGURE/SCHEMATIC 9).
- Extended channel on top to leave clearance for payload support structure.
- Extended neck to allow access to the tank from the end of the chassis.
- Shape designed to allow clearance for specific payloads, while maintaining the highest possible storage capacity.
- Tank loading and encampment occur from outside closed assembly. Once the tank is loaded its neck is filled with a self-expanding hardening insulation spray that seals and insulates the tank.

This tank can be used interchangeably in the Half, Half-Long, Full and Full-Long Chassis group.

c.6.- TANK No. 6 - TANK #50

Figure/Schematic 16 shows the detailed dimensions as well as the different characteristics integrated to TANK# 50, 4 liter reservoir tank. The following are some of the features that have been integrated into the design:

Approximate 6 liter capacity.
Protruded spheres on top to match with the protruded spheres of the top covers in order to give support and position the tanks inside the chassis. (ALL DETAILS CAN BE SEEN IN FIGURE/SCHEMATIC 16).

- Cone shaped extrusions at the bottom to match the cone shaped perforations at the bottom of the chassis.
- Extended channel on top to leave clearance for payload support structure.
- Extended neck to allow access to the tank from the end of the chassis.
- Shape designed to allow clearance for specific payloads, while maintaining the highest possible storage capacity.
- Tank loading and encampment occur from outside closed assembly. Once the tank is loaded its neck is filled with a self-expanding hardening insulation spray that seals and insulates the tank.

This tank can be used in the Half-Long, Full and Full-Long Chassis group.

c.7.- TANK No. 7 - TANK #60

Figure/Schematic 15 shows the detailed dimensions as well as the different characteristics of TANK#60, 6 liter reservoir tank. The following are some of the features that have been integrated into the design :

Approximate 6 liter capacity.

- Protruded spheres on top to match with the protruded spheres of the top covers in order to give support and position the tanks inside the chassis. (ALL DETAILS CAN BE SEEN IN FIGURE/SCHEMATIC 15).
- Cone shaped extrusions at the bottom to match the cone shaped perforations at the bottom of the chassis.
- Extended channel on top to leave clearance for payload support structure.
- Extended neck to allow access to the tank from the end of the chassis.
- Shape designed to allow space for specific payloads, while maintaining the highest storage capacity possible.
- Tank loading and encampment occur from outside closed assembly. Once the tank is loaded its neck is filled with a self-expanding hardening insulating spray that seals and insulates the tank.

This tank can be used interchangeably in the Half-Long, Full and Full-Long Chassis group.

c.8.- TANK No. 8 - TANK#70

Figure/Schematic 14 shows the detailed dimensions as well as the different characteristics integrated in the views of TANK#70, 6 liter reservoir tank. The following are some of the features that have been integrated into the design:

Approximate 6 liter capacity.

- Protruded spheres on top to match with the protruded spheres of the top covers in order to give support and position the tanks inside the chassis. (ALL DETAILS CAN BE SEEN IN FIGURE/SCHEMATIC 14).
- Cone shaped extrusions at the bottom to match the cone shaped perforations at the bottom of the chassis.
- Extended channel on top to leave clearance for payload support structure.
- Extended neck to allow access to the tank from the end of the chassis.
- Shape designed to allow space for specific payloads, while maintaining the highest capacity as possible.
- Tank loading and encampment occur from outside closed assembly. Once the tank is loaded the tank neck is filled with a self-expanding hardening insulation spray that seals and insulates the tank.

This tank can be used interchangeably in the Half-Long, Full and Full-Long Chassis group.

c.9.-TANK No. 9 - BIG BORG 4L

Figure/Schematic 10 shows the detailed dimensions as well as the different characteristics of the BIG BORG 4L, 4 liter reservoir tank. The following are some of the features that have been integrated into the design:

Approximate 4 liter capacity.

- Protruded spheres on top to match with the protruded spheres of the top covers in order to give support and position the tanks inside the chassis. (ALL DETAILS CAN BE SEEN IN FIGURE/SCHEMATIC 14).
- Cone shaped extrusions at the bottom to match the cone shaped perforations at the bottom of the chassis.
- Extended channel on top to leave clearance for payload support structure.
- Extended neck to allow access to the tank from the end of the chassis.
- Shape designed to allow space for specific payloads, while maintaining the highest capacity as possible.
- Tank loading and encampment occur from outside closed assembly. Once the tank is loaded its neck is filled with a self-expanding hardening insulation spray that seals and insulates the tank.

This tank can be used in the Full and Full-Long Chassis group.

c.10.-TANK No. 10 - BIG BORG 8 L

Figure/Schematic 11 shows the detailed dimensions as well as the different characteristics of the BIG BORG 8L, 8 liter reservoir tank. This tank as well as the other tanks can be used interchangeably depending on payload demand and environment. The following are some of the features that have been integrated into the design:

Approximate 8 liter capacity.

- Protruded spheres on top to match with the protruded spheres of the top covers in order to give support and position the tanks inside the chassis. (ALL DETAILS CAN BE SEEN IN FIGURE/SCHEMATIC 11).
- Cone shaped extrusions at the bottom to match the cone shaped perforations at the bottom of the chassis.
- Extended channel on top to allow clearance for payload support structure.
- Extended neck to allow access to the tank from the end of the chassis.
- Shape designed to allow space for specific payloads, while maintaining the highest possible storage capacity.
- Tank loading and encampment occur from outside closed assembly. Once the tank is loaded its neck is filled with a self-expanding hardening insulation spray that seals and insulates the tank.

This tank can be used in the Full and Full-Long Chassis group.

d.- PAYLOAD SUPPORT GROUP

Figure/Schematic 18 shows the dimensions as well as the different characteristics of the components that form the *structure support group*. There are several components that form the *payload support group: anchor supports "A", anchor supports "B"*, and *stabilizing bar*. A*nchor supports "A", "B", and "C"* consist of a flat rigid bar and flexible strap The following are some of the features that have been integrated into the design:

Anchor supports "A", "B", and "C" group the flowers into a shaped bundle according to the shape of the payload section and prevent the payload from shifting within the chassis. (Figure 34).
Anchor support "B" is only used in the "half' and "half-long" chassis. The flower bundle (payload) is strapped to *anchor support "B"*. The supports are then either placed in the extruded slot in the center of the "half" chassis (Figure 30) or in one of the four extruded slots in the "half-long" chassis.
A*nchor support "C"* is only used in the "full" and "full-long" chassis. The flower bundle (payload) is strapped to *anchor support "C",* exactly like anchor support "B" but it is longer.
A*nchor support "A"* is only used in the "half" and "half-long" chassis. The flower bundle (payload) is strapped to *anchor support "A".* The assembly is placed in the extruded slot in the center of the chassis. (Figure 32 & 33).
The *stabilizing bar* interconnects with *anchor support "A"* , (Figure 31)
The *stabilizing bar* supports *anchor supports "A"* from shifting within the chassis. (Figure 32). Again, *anchor support "A"* and the *stabilizing bar* are used in the "half" and "half-long" chassis.
The *stabilizing bar* guides *anchor supports "A"* to match the top cover. (Figure 29)
The *stabilizing bar* has a "quick connect" feature that locks onto *anchor supports "A"* . (Figure 31)
The Half and Half-Long Chassis are the only chassis that need a stabilizing bar.

e.- WATER HEATING/WATER PUMPING UNIT

We must take into consideration that this device is the result of the special requirements of the system, for which reason its novelty is applied to the function, exclusively pertaining to the purpose of this patent. However, it is true that the system in general can operate to fulfill certain requirements of the payload to be transported, it is also a fact that the purpose of the system is to maintain the correct temperature so that the organic matter or any other kind of payload (flowers, foliage, protein, lipids, carbohydrate compounds, etc.) is kept within a maximum range of temperature when exposed to variable temperatures.

For the specific case of the Tropical Flowers, this invention keeps the payload warm in a cold environment, but the system is designed in such a way that in can perfectly perform otherwise, meaning that, it could keep the payload cold in a warm environment. Since the major exploitation of the invention will be to transport Tropical Flowers, it was necessary to design a water pump that not only injected the fluid into the storage tanks, but that also acts as water heating unit. Once more, the versatility of the invention allows that depending on the needs of the payload, the system is able to provide either warm or cold water maintaining unaltered its functioning characteristics. The unit works with running water, which means that when shut off, no liquid is stored, because it is only activated when required.

The general physical appearance of the water heating unit, in its storage position, is an upside down, 55 gallon plastic drum on wheels. It has a shopping cart type horizontal handle, half way up the drum, for pushing. The handle has vertical bars going down attached to the platform of the chassis. Thus, the drum can be easily removed. The inside contains the parts hereinafter listed in detail. (See figure 20)

To use the system, the 55 gallon plastic drum is removed, the electric cable and water hose unrolled and connected to its sources. The short application hose with a nozzle is hand held to fill the bottles.

We have designed the system around the electric tank without the water heating elements. These elements are short pipes containing electrical heating elements that transfer heat to the running water passing through the tube. Thus, we are not restricted by tank size which would limit the number of bottles to be filled at one time. Other advantages over a tank system are savings in electricity. A tank system maintains hot water temperatures when not needed. The water heating unit must meet certain specific requirements, by virtue of which it was created.

It must provide enough hot water to fill up an unlimited number of chassis.
It must be able to fill a four liter bottle in less than 30 seconds.
It must heat water to a steady 60°C.
It must use universally available energy, 220 to 240 volts AC electrical current.
It must meet United States' building code standards because it is to be used in the U.S. It must be convenient and easy to use.
It must be safe for the operator to use.
It must be made with parts readily available in the country where it will be used, be it in the United States.
It must be economical.

It must heat water close to the flowers, to avoid cooling in transit.

The following is a general parts list of the water heating unit:

e.1- FOUR, HEATING ELEMENT RESISTORS, IN SERIES

The four heating elements are the system's core. They consist of a short pipe with embedded electrical heating elements which conduct heat through the running water through the pipe. There are many readily available units on the market. The industrial thermal resistors that were chosen are manufactured in the United States and are one of the most powerful units manufactured. This model consists of two separate elements each capable of handling 9.5 kW, or a total of 19 kW each at 240 volts. We require filling a 4 liter bottle in 30 seconds. We estimate a flow rate of 8 liters per minute. This unit is approximately 100% efficient. This is because the heat has no other place to go, except to the surrounding water.

According to the manufacturers' performance data, there will be an increase of 18°C temperature, per element, for an 8 liter per minute water flow rate. We will begin filling the bottles in Miami. Tap water in Miami is approximately 22°C. We want to increase the water temperature to 60°C. The amount of the increase is the difference between 22°C and 60°C. This means a difference of 38°C. Therefore, two elements will almost do the job (18°C x 2 = 36°C). We have designed a four element system, almost double of what is needed. We want the system to perform under ANY circumstance. During rare winter conditions, tap water temperatures could be less than 22°C. We also want a system that keeps on working even if one of the elements fail. Therefore, by using two more elements we would surely have enough power to create our 60°C water in winter with a STAND BY ELEMENT ready to kick in if one of the other three elements fail.

Each individual element has a light that goes on when electricity is passing through the unit. There is a micro-processor that samples input and output temperature 21 times per second. This control module analyzes data and manages power use for maximum efficiency and temperature stability at 60°C. At rest no power is used. The microprocessor will not allow electricity to pass to the element if the output temperature is 60°C or higher.

How do these lights look when we have a series of four elements? The first element in line receives cold water at approximately 22°C. It leaves the first element at approximately 40°C, 18°C hotter. This means the light of the first element is steadily on. The second element in line receives the water at 40°C temperature and adds another 18°C. The water temperature at this point is 58°C and only adds enough energy for the water to reach 60°C. This light flickers on and off in order not to heat the water beyond the capacity of its elements at 18°C due to the regulation of electricity of the microprocessor. Now, the last of the elements in line, receives the water at its maximum 60°C, therefore, it is not necessary to heat the water up any further. This element has a light that does not go on at all, or occasionally possibly flickers on.

e.2- FIVE 25 METER LONG SJO CABLES BY 5 AWG

The heating elements might be the core of the system but the two cables carrying electricity from the breaker supply box to the resistors is the largest, most cumbersome part of the whole unit. These cables weigh 40 kilograms. Each of the four resistors must be connected to separate breakers in the supply box. This means that each pair of resistors must have four hot lines and one ground, for a total of five wires per pair. There are two pairs, therefore we need two cables of five wires each. There are nearly 36 amps passing through each single, hot wire in the cable, for a 25 meter distance. This means we must use at least an 8 gauge thickness wire to carry the electricity. Otherwise the lines would loose amperage and overheat. Its heavy gauge is what makes this wire such a large cumbersome item.

Another characteristic of the cable, is that it must have enough flexibility to be rolled up in tight circles on a spool for convenient storage. In order to have this characteristic each of the five wires of the cable must be contain not only one single wire, but by many.

Each of the five single strands is not a thick copper wire but instead is made of 100 thin hair like strands inside a single plastic sheath, five sheaths to one pair of cables. This is how it attains its very flexible condition and is able to bend around the spool or around corners, while in use and unrolled.

We do not want to limit the unit to a certain part of the Miami importer-distributors storage room. Its 25 meter length allows it freedom to roam away from the electrical source. Bottles can be filled using this method anywhere in the room.

e.3- TWO, 60 AMP, 4 POLE, 5 WIRE, PIN AND SLEEVE, MALE PLUGS-TO PLUG INTO THE ELECTRICAL SOURCE

e.4- TWO PAIRS, 60 AMP, 4 POLE, 6 WIRE, MALE / FEMALE PLUGS

Basically, what we are trying to accomplish with the electric cable and plugs, is to build a very long extension cord. This cable has male and female plugs at its ends, resembling a conventional household extension cord. The cord can be disconnected from the wall (supply box) and can be easily disconnected from the water heating unit, as well. We are designing the unit for easy storage. After using it, the cable can be disconnected from the wall and heater, and rolled up neatly on a spool for easy storage.

We are using pin and sleeve type connector plugs. Once the plugs are in place the pin is inserted so it does not disconnect. The cables are extremely heavy and would pull loose when the unit is rolled around. The pin and sleeve type plugs are also water resistant. This is essential when working with water.

Each of these elements supports 36 amps of electricity. Manufacturers make 30 amp plugs. The next biggest size made is a 60 amp size. So we are a bit over built in this respect. We are satisfied with the 60 amp size. The plugs are 4 pole, 5 wire. This means that they can receive the 4 hot cable wires and a ground.

e.5- ONE, SPOOL FOR ELECTRIC CABLE

After using the cable, it can be disconnected from the wall and heater, and rolled up neatly on a spool for easy storage. This big spool is mounted on the chassis. Unlike the hose on the hose spool, in order to wind it up, it is necessary to be disconnect it from the spool.

e.6- ONE, 25 METER LONG HOSE

As stated earlier, we do not want to limit the unit to a certain part of the Miami importer-distributors storage room. Its 25 meter length hose allows it freedom to roam away from the water source. Bottles can be filled using this method at any location in the building's storage room. The hose must be able to deliver 8 liters per minute. This 8 liter per minute flow rate is mostly a function of the water pressure in the building. It is also a function of the diameter of the hose being used for the supply. In order not to create friction and pressure loss, we selected a hose with an inside diameter of 1.5cm. It does not have to be insulated nor able to withstand extremely high pressure. The water pressure in the building should be approximately 6 kilograms per centimeter (80 PSI). The hose is conveniently screwed on to the water faucet on one side and connected to the spool swivel on the other.

e.7- ONE, WATER HOSE SPOOL

After using it the water hose can be disconnected from the faucet and rolled up neatly on a spool for easy, compact storage. This large spool is mounted on the chassis. Unlike the electric cable, it is not necessary to disconnect the water hose from the spool in order wind it up. Spools with a swivel connection already exist in the market. Therefore, the connection on the spool allows for rotation while being wound up. The spool swivel is connected to the first heating resistor element to provide water for the system.

e.8- ONE, 5 METER LONG INSULATED HOSE

Once the water reaches 60°C it leaves the heating elements and flows into the insulated hose. We chose a five meter long hose in order to give the operator enough distance to circle around a few pallets without moving the entire water heating unit.

e.9 - ONE, NOZZLE-VALVE

A nozzle used to fill the bottles with water is located on the opposite side of the hose from the heating elements. The nozzle is basically a conventional, on-off, water hose nozzle, coated with plastic insulation. A 30cm long piece of 1½ inch diameter PVC pipe is attached to the opposite side of the nozzle-valve. This PVC pipe is inserted into the long neck of the bottle and the handle of the nozzle is squeezed to its open position. Hot water is then poured into the bottle. The 30cm long PVC pipe is inserted into the length of the bottle neck so that the water does not interrupt the escaping air once replaced inside the bottle.

e.10- ONE, CHASSIS TO PLACE PARTS IN AND KEEP ALL PARTS IN STORAGE POSITION

e.11- ONE, 55 GALLON PLASTIC DRUM TO STORE THE SYSTEM IN STORAGE POSITION

The chassis keeps all parts in position, giving it a shape that allows the 55 gallon plastic drum to cover it up side down. The chassis has a shopping cart type horizontal handle, half ways up the drum, for pushing. The handle has bars going down vertically attached to the platform of the chassis. The drum is then free to be removed and placed into ready position.

C.- <u>THERMAL PERFORMANCE</u>

The following procedure was used to asses the thermal performance of the *Invention:*

Thermal survey of a pre-existing molded polystereyne "fish box" was performed under the same environmental conditions, (Section V.D.1.c);

(1) Thermal analysis of the "fish box" (See Section V.D.1.A);
(2) Verification of thermal analysis comparing theoretical and actual performance in the "fish box" and
(3) Based on the validity of the analysis procedure in (1) - (3) the analysis was then performed on the *Invention System.*

1.-THERMAL ANALYSIS

The analytical tests and material properties for the analysis can be found in the Appendix (Section 36). The equation derived for temperature estimates and real time were based upon the basic equation of the partial differential for heat general conduction and storage.-

a.- FISH BOX

The analytical tests and characteristics of the analysis material can be found in Appendix (Section 36). The following simulated thermal environment was used to analyze the "fish box":

a.1.-NO TANK SCENARIO:

Constant outside temperature 3.3°C.
Initial flower temperature 22.2°C
Flower mass 13.3 Kg (70% water & 30% organic wood fiber)

a.1.-TANK SCENARIO

Constant outside temperature at 3.3°C.
Initial flower temperature 22.2°C
Flower mass 13.3 Kg (70% water & 30% organic wood fiber)
Initial water temperature 49°C
Water content 5.5 Kg.

b.- INVENTION SYSTEM

The analytical tests and characteristics of the analysis material can be found in Appendix (Section 36).

b.1.-NO TANK SCENARIO (FOR ALL FOUR CHASSIS)

Constant outside temperature 3.3°C.
Initial flower temperature 22.2°C.
Flower mass changes depending on chassis size (See Section 36)

b.2.-TANK SCENARIO

Constant outside temperature 3.3°C.
Initial water temperature 60°C.
Initial flower temperature 22.2°C.
Flower mass changes depending on chassis size (See Section 36).
Water content changes depending on chassis size (See Section 36).

HALF = 4 Liters
HALF-LONG = 6 Liters
FULL = 6 Liters

FULL-LONG = 6 Liters

The theoretical thermal response for all four different chassis designs of the Invention for the tank and no-tank scenarios can be seen in Figures 37 and 38, respectively.

c.- THERMAL SURVEY

The following environment was used in the "fish box" scenario:

c.1.-NO TANK SCENARIO:

Constant outside temperature of 3.3°C.
Initial flower temperature 22.2°C
Flower mass of 13.3 Kg (70% water & 30% organic wood fiber)

c.2.-TANK SCENARIO:

Constant outside temperature 3.3°C.
Initial water temperature 60°C.
Initial flower temperature 22.2°C.
Flower mass changes depending on the size of the chassis.
Water content 5.5 Kg

The thermal survey was made placing the "fish box" in a refrigerated container. The temperature inside the refrigerator was regulated to maintain a constant 3.3°C environment. A thermocouple was placed on the outside of the box to measure the environmental temperature. A thermocouple was placed on the outside of the hot water bottle (Tank Scenario) to measure the water temperature. A thermocouple was suspended inside the box to measure the temperature of the air inside. A thermocouple was placed inside the flower to measure flower temperature. The theoretical response versus the actual thermal response of the "fish box" for the no tank and tank scenarios can bee seen in Figures 39 and 40, respectively.

d.- RESULTS

Figures 39 and 40 show the actual versus the theoretical thermal response of the for the no tank and tank scenario for the "fish box". The time for 8.9°C ± 2°C for the theoretical *Invention* can be seen in Table 2.

Table 1

Time for 8.9°C ± 2°C FOR "FISH BOX" COMPARISON			
	NO TANK (Hr)	TANK (Hr)	%DIFF.
ACTUAL	19	30	57.9
THEORETICAL	20	31	55
%DIFFERENCE	5.3	3.2	

The margin of error in the analysis within this temperature range is less than 5.3%. There is a 57.9% performance increase between a loaded system and an unloaded system. With this margin of error in mind the analysis was made on the *Invention* system. Table 2 shows the results of the time to 8.9C ± 2C.

Table 2

Time for 8.9C ± 2°C FOR SYSTEM COMPARISON			
	NO TANK (Hr)	TANK (Hr)	%INCREASE
HALF	13	42	323

Table 2 (continued)

Time for 8.9C ± 2°C FOR SYSTEM COMPARISON			
	NO TANK (Hr)	TANK (Hr)	%INCREASE
HALF-LONG	16	42	262
FULL	20	+50	250
FULL-LONG	20	+50	250

In this case, for the half, half-long, full, and full-long there were increases of 323%, 262%, 250%, and 250%, respectively, compared to the unloaded system.

e.-GENERAL CONCLUSIONS

The comparison of the analytical versus the theoretical for the "fish box" experiment shows that the analytical procedure is enough to make a rough estimate of a certain time temperature (8.9°C). Based on this observation we conclude by similarity that the minimal performance of any one of the chassis of the *Invention design* will withstand the 8.9°C environment for al least 35 hours. In this case the maximum increase over an unloaded system was for the half chassis which increased the viable storage of the flowers by 323%. This estimate is based on a 60°C initial water temperature.

This time can be extended by increasing the initial temperature inside the tank. The Invention maintains the temperature of the organic matter (flowers.. foliage ..protein, lipids, carbohydrate compounds...etc....) within a specified temperature range when exposed to varying environmental temperatures.

D.- RELATIONS BETWEEN, CHASSIS GROUP, THERMAL TANKS AND PAYLOAD.

As stated in sections V.C.1.a and c. several ways exist to organize the arrangement of the tanks and chassis in the packing process. IT ALL DEPENDS AND VARIES according to the size of the chassis to be used, kind, size, weight, etc., of the payload. For instance:

The following tanks can be used in the HALF CHASSIS:

BOQX
ROX
TANK #40
BABY BORG 2L
BABY BORG 4L

The following tanks can be used in the HALF-LONG CHASSIS:

TANK #40
BABY BORG 2L
BABY BORG 4L
TANK #50
TANK #60
TANK #70

All tanks used in the FULL and FULL-LONG chassis can be used in the HALF-LONG CHASSIS plus the BIG BORG 4L and BIG BORG 8L.

Therefore, as a result, all tanks except BOQX and ROX can be used interchangeably depending on payload demand and environment thus fulfilling an intrinsic need of modem transportation methods, their ability to adapt to payload needs. The system not only improves the present preservation conditions of the Tropical Flowers, but it also allows the producers to be able to use new and cheaper transportation means for longer periods of time.

APPENDIX

FIGURE No. 36

TESTS TO THERMAL ANALYSIS

CHARACTERISTICS OF THE MATERIAL

Specific temperature of water	=	4.179kJ/(kg*K)
Specific temperature of wood fiber	=	2.553kJ/(kg*K)
Thermal conductivity of Styrofoam	=	3.4E-5kW/(K*m)

GENERAL GEOMETRIC DESCRIPTIONS

"Fish Box" chassis:	=	90 cm.	Long
	=	40 cm.	Width
	=	28 cm.	Height
	=	3.0 cm.	Thickness
"Half" chassis:	=	106 cm.	Long
		26.5cm.	Width
	=	19 cm.	Height
	=	2.5 cm.	Thickness
"Half-Long" chassis:	=	159 cm.	Long
	=	26.5cm.	Width
	=	19 cm.	Height
	=	2.5 cm.	Thickness
"Full" chassis:	=	106 cm.	Long
	=	53 cm.	Width
	=	19 cm.	Height
	=	2.0 cm.	Thickness
"Full-Long" chassis:	=	159 cm.	Long
	=	53 cm.	Width
	=	19 cm.	Height

=	3.0 cm.	Thickness

GENERAL FUNCTIONING CHARACTERISTICS

Flower mass inside the Chassis:

"Fish Box" chassis:	14 Kg.
"Half" chassis:	7.6 Kg.
"Half-Long" chassis:	11.4 Kg.
"Full" chassis:	15.2 Kg.
"Full-Long" chassis:	22.8 Kg.

Percentage of water in the flower mass = 70%

Loaded water mass placed in the Tanks:

"Fish Box" chassis:	5.5 Kg (L)
"Half" chassis:	4.0 Kg (L)
"Half-Long" chassis:	6.0 Kg (L)
"Full" chassis:	6.0 Kg (L)
"Full-Long" chassis:	6.0 Kg (L)

GENERAL ENVIRONMENTAL CONDITIONS

Constant external temperature	=	275 K
Initial flower temperature	=	294 K
Initial temperature of hot water	=	332 K

EQUATION FOR THE REAL TIME TEMPERATURE (DERIVED FROM THE DIFFERENTIAL EQUATION OF HEAT FLOW)

(((MA*((PERCENT/100))*CPWATER+(1PERCENT/100)*CPWOOD)+CPWATER*MB+K*(C25*60)*(2*L*W+2*L*H*+2*H*W)/T)) ∧ -1)*(((MA*((PERCENT/100)*CPWATER+

(1 -

PERCENT/100)*CPWOOD)*TFLOWER+CPWATER*MB*THOT+K*(C24*60)(2*L*W+2*L*H*W)/TEXTERNAL)))

MA	=	FLOWER MASS
PERCENT	=	% MINUS OF THE FLOWER MASS THAT IS WATER
CPWATER	=	SPECIFIC HEAT OF WATER
CPWOOD	=	SPECIFIC HEAT OF WOOD FIBRE
MB	=	HOT WATER MASS
K	=	THERMAL CONDUCTIVITY OF THE STEREOFOAM
TIME	=	TIME IN EQUATIONAL EXECUTION
L	=	LONG
H	=	HEIGHT
W	=	WIDTH
T	=	TICKNESS OF STEROFOAM
TFLOWER	=	FLOWER TEMPERATURE
THOT	=	HOT WATER TEMPERATURE
TEXTERNAL	=	CONSTANT EXTERNAL TEMPERATURE

GENERAL SCHEMATIC:

Claims

1. A multi-component thermal container system transportation means for organic matter, consisting of using a group of three elements, to wit: insulated chassis, water storage thermal tanks, a water pumping unit, and its manufacturing method; its features are its ability to mantain the temperature of the payload inside the chassis within a maximum temperature range when exposed to changing temperatures; as a thermal agent, it uses either hot or cold water pumped by the water pumping unit towards the specially designed storage tanks to adapt to space needs, volume and kind of payload installed in the chassis.

2. The chassis of system claim 1 which are thermal insulators, featuring thermal insulators formed by one bottom, four surrounding walls, two on the side and two on the front and rear, and its top cover, excepting the latter one, formed by one single piece that does not require any assembly; rectangular shape; changeable dimensions depending on the size, type and volume of payload to be transported, and design which allows a variety of options to arrange and organize its contents according to the payload to be transported.

3. The interior support structures of Claim 2, featuring its changeable position inside the chassis, depending on product characteristics, volume and type; keeps the payload in place, and in some cases also provides support structure to the chassis' walls; depending on its needs, the mentioned supports are located at the bottom or sides of the chassis.

4. The interior bottom of the chassis in Claim 2 featuring protruded sphere perforations positioned in a symmetrical

linear pattern in strategic places in order to offer different arrangement possibilities to, the hot water storage tanks located inside the chassis depending on the needs of the product to be transported, and which function as a base providing support and stability to the cold or hot water storage tanks inside the chassis.

5. The exterior bottom of the chassis in Claim 2 featuring external protruded lips which are the basis of the chassis; positioned in a symmetrical linear pattern thus providing firmness, stability and support to the chassis.

6. Side walls of the chassis of Claim 2 with a 90° slot on its upper edge from the center of its thickness towards the outside, allowing it to hermetically lock with the top covers.

7. Front external walls of the chassis of Claim 2 with rectangular lips in its upper edge where the liquid reservoirs are found.

8. Rear external walls of the chassis of Claim 2 with lips in its upper edge where the liquid reservioirs are found.

9. Reservoirs of Claims 7 and 8 hermetically locked to prevent thermal escapes with circular lip pieces cut along its circumference for easy removal by just applying pressure to the touch, depending on the position of the tanks inside the chassis, specially placed in groups that range from one to three locks; for its design, which allows for the perfect matching of its counterpart located in the cover tops; for being access and exit ports to the hot or cold water tanks located inside the chassis, the possibilities of locating the access to the tanks varies depending on the position of the tank inside the chassis which at the same time depends on the volume, type and payload needs to be transported; and because in some cases, depending on the chassis, tank and payload to be used, when placing the located counterpart on the chassis towards the front, the reservoir and access to the front opens up or when placing the located counterpart on the top cover on the chassis towards the rear end both accesses, front and rear, are sealed.

10. The bottom of Claim 4 and the lower parts of the walls of Claims 6, 7, and 8 of the chassis of Claim 2 featuring rounded borders on the exterior edge of the chassis of Claim 2.

11. The top covers or covers of the chassis of Claim 2 that lock preventing the hot or cold water inside the box from escaping; being the perfect match for the upper edge of Claim 6 because it forms the upper exterior edge of the chassis of Claim 2 of rounded borders.

12. The top covers of Claim 11 featuring extruded sphere slots inside, located in a symmetrical linear and parallel pattern in strategic points in order to allow different arrangement possibilities to the hot or cold water reservioir tanks, positioned inside the chassis depending on the needs of the product to be transported; and for functioning as bases or support and stability points for the hot water reservoirs inside the box.

13. The top covers of Claim 12 having linear sphere perforations allowing to arrange and stabilize the access pipes to the tanks and the tanks inside the chassis.

14. The top covers of Claim 12 featuring extrusions on the outside allowing a perfect match with the extrusions of Claim 5 which allows stacking the chassis one on top of the other with the required stability, firmness and rigidity.

15. The top covers of Claim 11 in its front bottom face featuring rectangular solts where the locks of the reservoirs are specially positioned in groups from one to three holes; for being the access and exit ports of the hot water reservoirs located inside the chassis, for its perfect match with its counterpart of Claim 9; for the possibilities of locating the access to the tanks depending on the position of the tanks inside the chassis which at the same time depend on the volume, type and needs of the payload to be transported.

16. The top covers of Claim 11 in its bottom rear face featuring rectangular slots where the locks of the reservoirs are located specially positioned in groups from one to two holes; for being the access and exit ports of the hot water reservoirs located inside the chassis, for its perfect match with its counterpart of Claim 9; for the possibilities of locating access to the tanks depending on the position of the tanks inside the chassis which also depend on volume, type and needs of the payload to be transported.

17. The locks of the top covers of Claims 15 and 16 which in some cases remain locked, depending on the chassis, tank and payload utilized, when placing the counterpart found in the front part of the chassis, the reservoir and access when opened or when placing it the counter part located in the chassis towards the end of both accesses, front and end.

18. The tanks of the storage system of Claim 1 featuring the thermal batters inside the chassis once filled with either hot or cold water; variable shapes and dimensions depending on the needs, volume and payload type; the ability to store variables of different amounts in liters; the versatility and universatility of the several tank models since it is possible to use different storage tank models in the same chassis and vice-versa, as well as to be able to combine several tanks in the same model chassis, depending on the type of payload required to be transported.

19. Access pipes to the tanks of Claim 18 featuring the input of hot water from the outside of the chassis to the storage tanks; the possibility of using them with several different length measurements depending on the location of the tank inside the chassis.

20. Extruded lower cone shaped protuberancies of the tanks of Clam 18 featuring the basis and foundation that supports the tanks inside the chassis; provides stability, firmness and secure support to the tanks when full of hot water inside the chassis; and perfectly matching the extrusions of Claim 4.

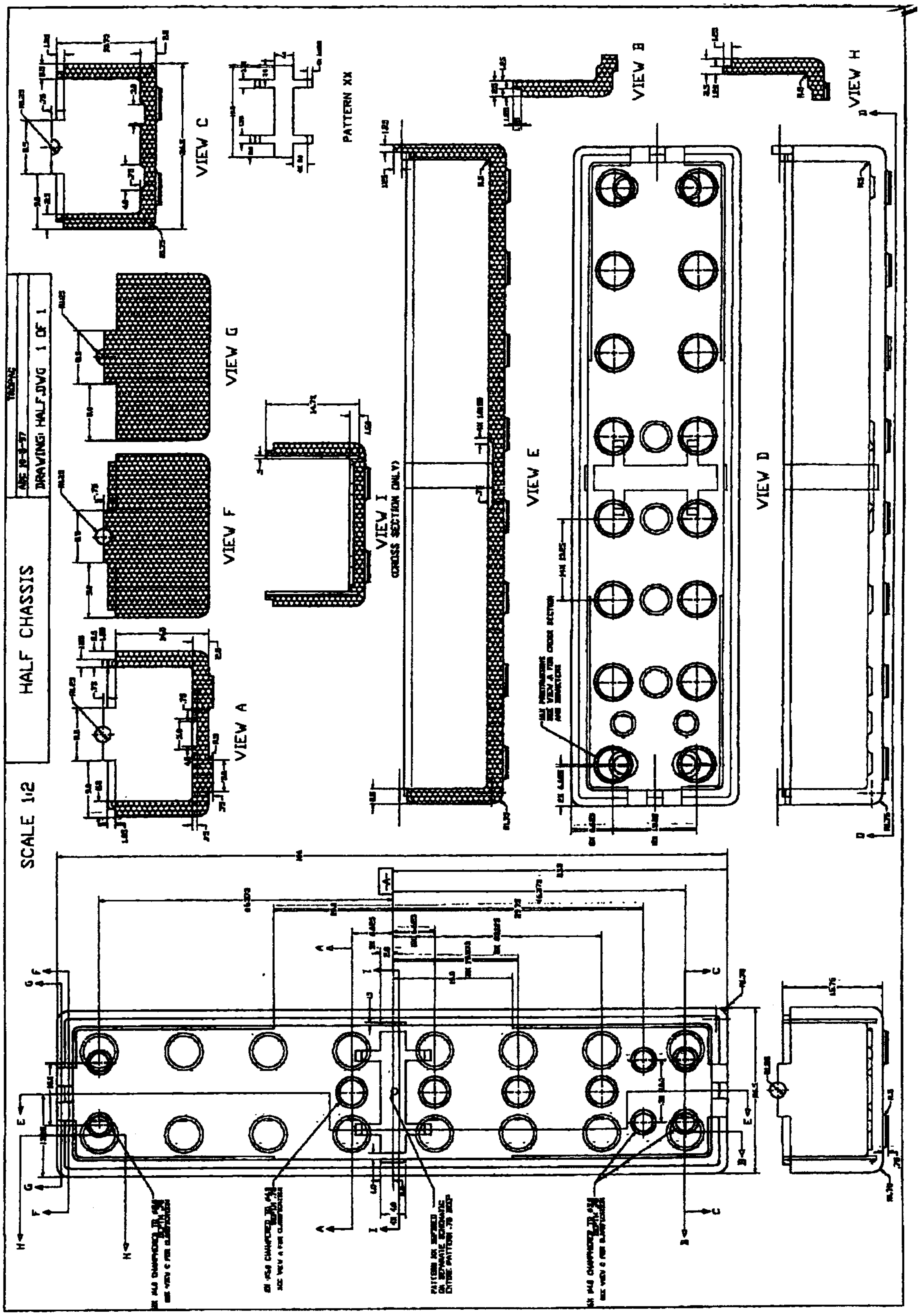
21. Sphere shaped upper extrusions of Claim 18 which perfectly match the extrusions of Claims 12 and 13 not allowing the tanks to shift inside the chassis, providing stability, firmness, support and safety.

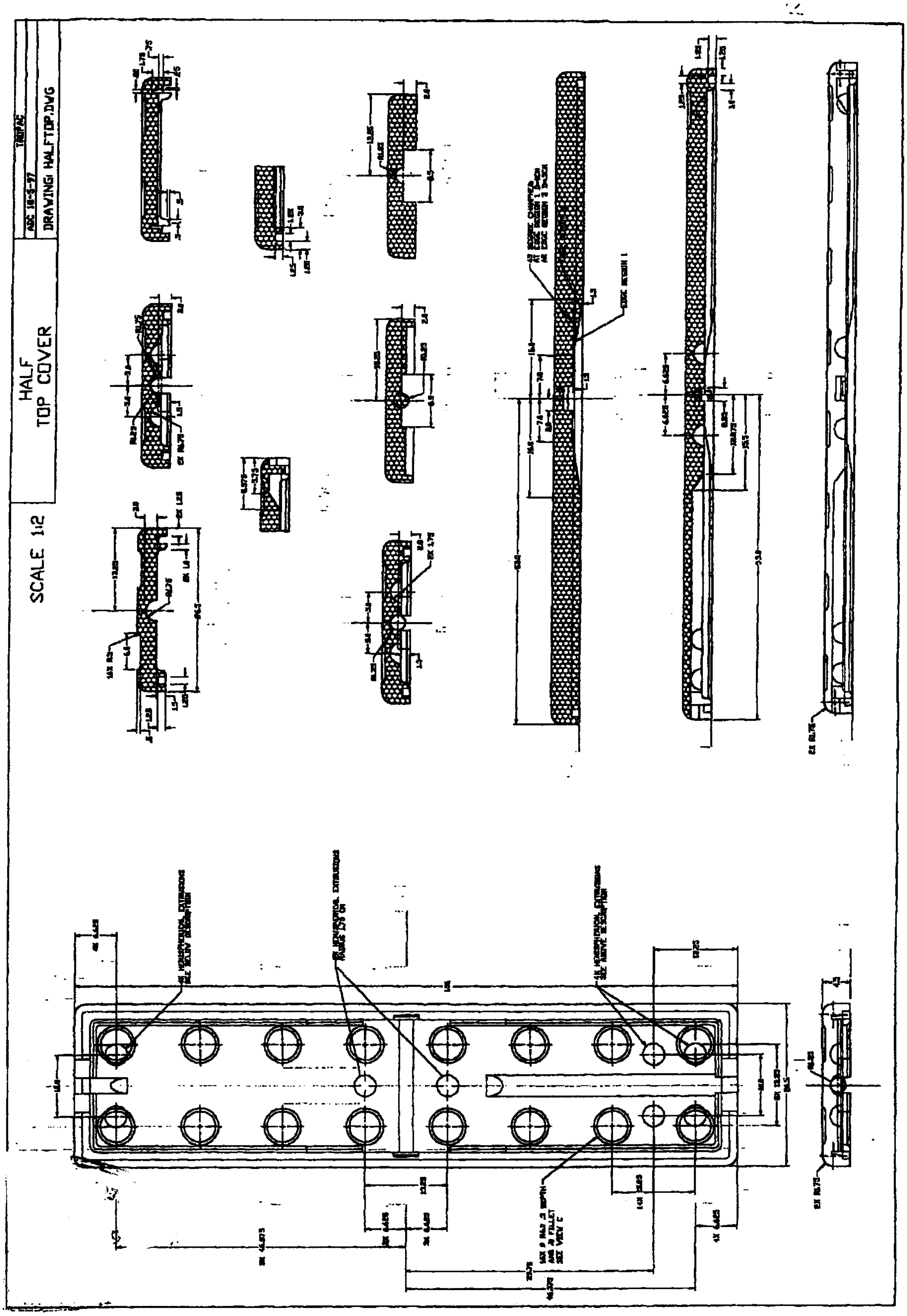
22. The expandible foam seal that is injected through the access pipes of Claim 19 of the tanks of Claim 18 which prevents that once the tank is full of hot or cold water it can flow through the access pipe and escape, thus losing thermal capacity; and which is a thermal insulator.

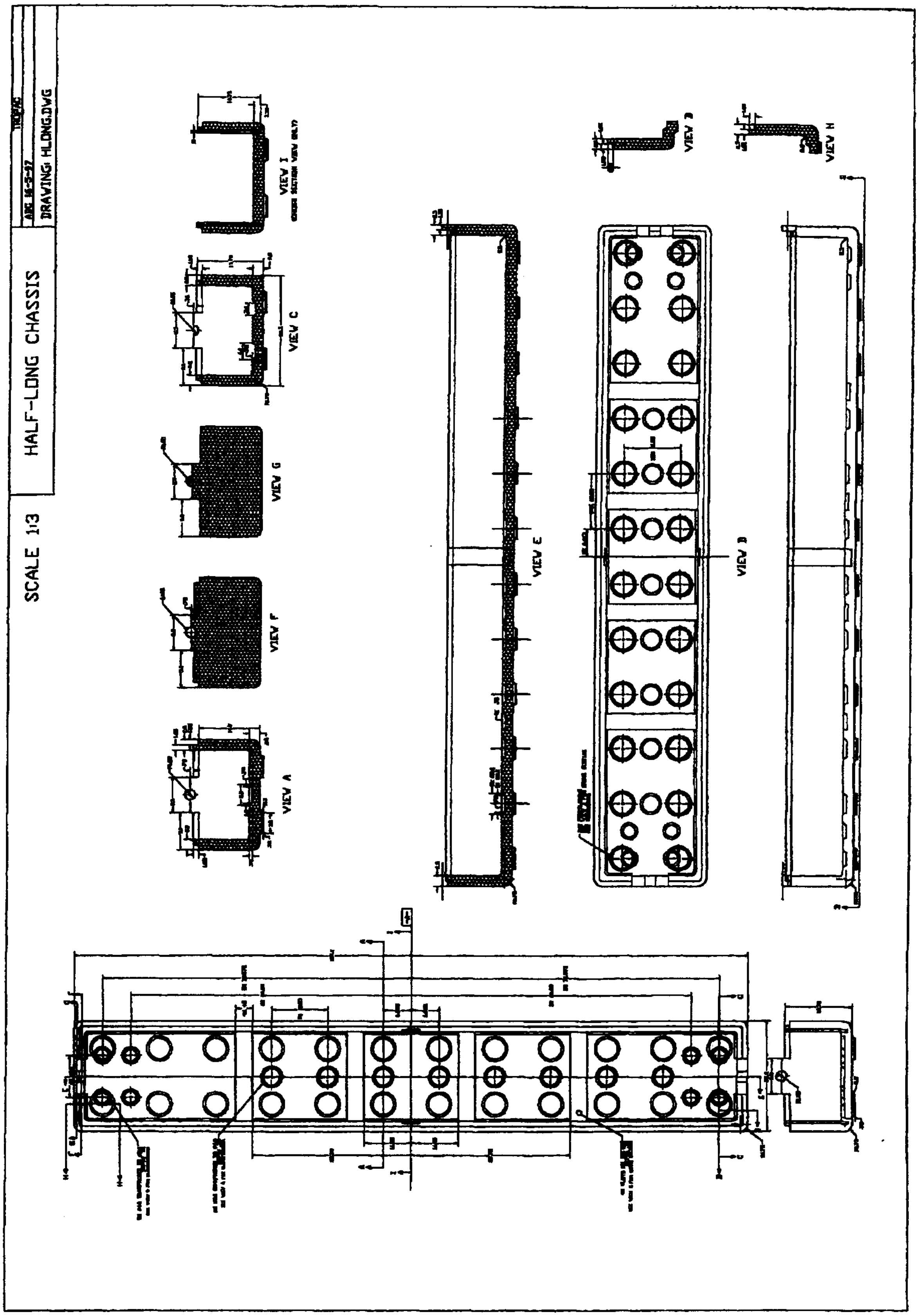
23. The water pump of the system of Claim 1 which supplies the hot or cold water maintaining unaltered its functioning charcteristics, injecting hot or cold water to the storage water tanks located inside the chassis which are able to filling a four liter tank in less than thirty seconds.

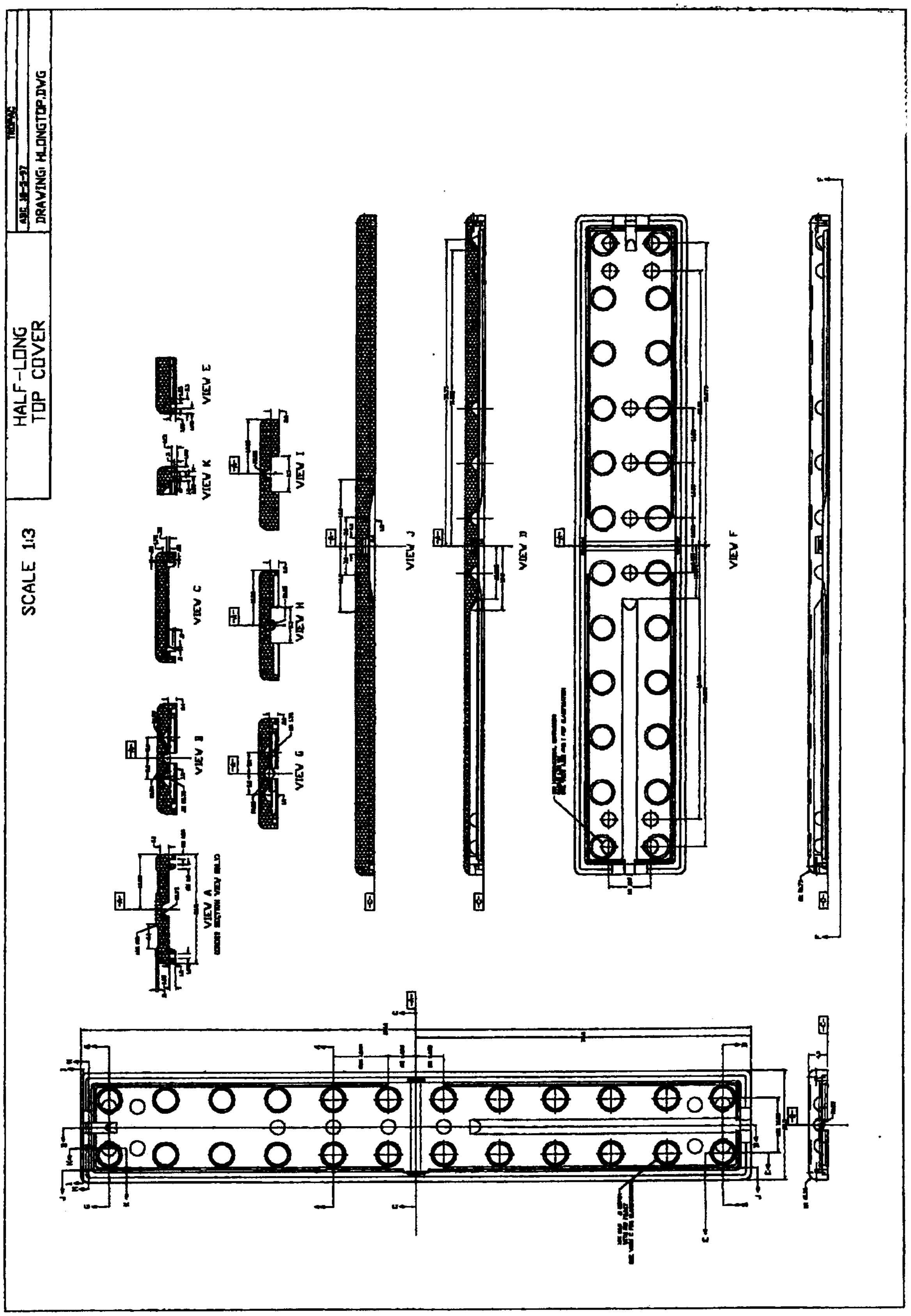
24. The hot water pump of Claim 23 which supplies enough hot water to fill an unlimited number of storage tanks, keeping and pouring water at a standard 60°C temperature; and which uses universially available electricity of two hundred twenty to two hundred forty volts.

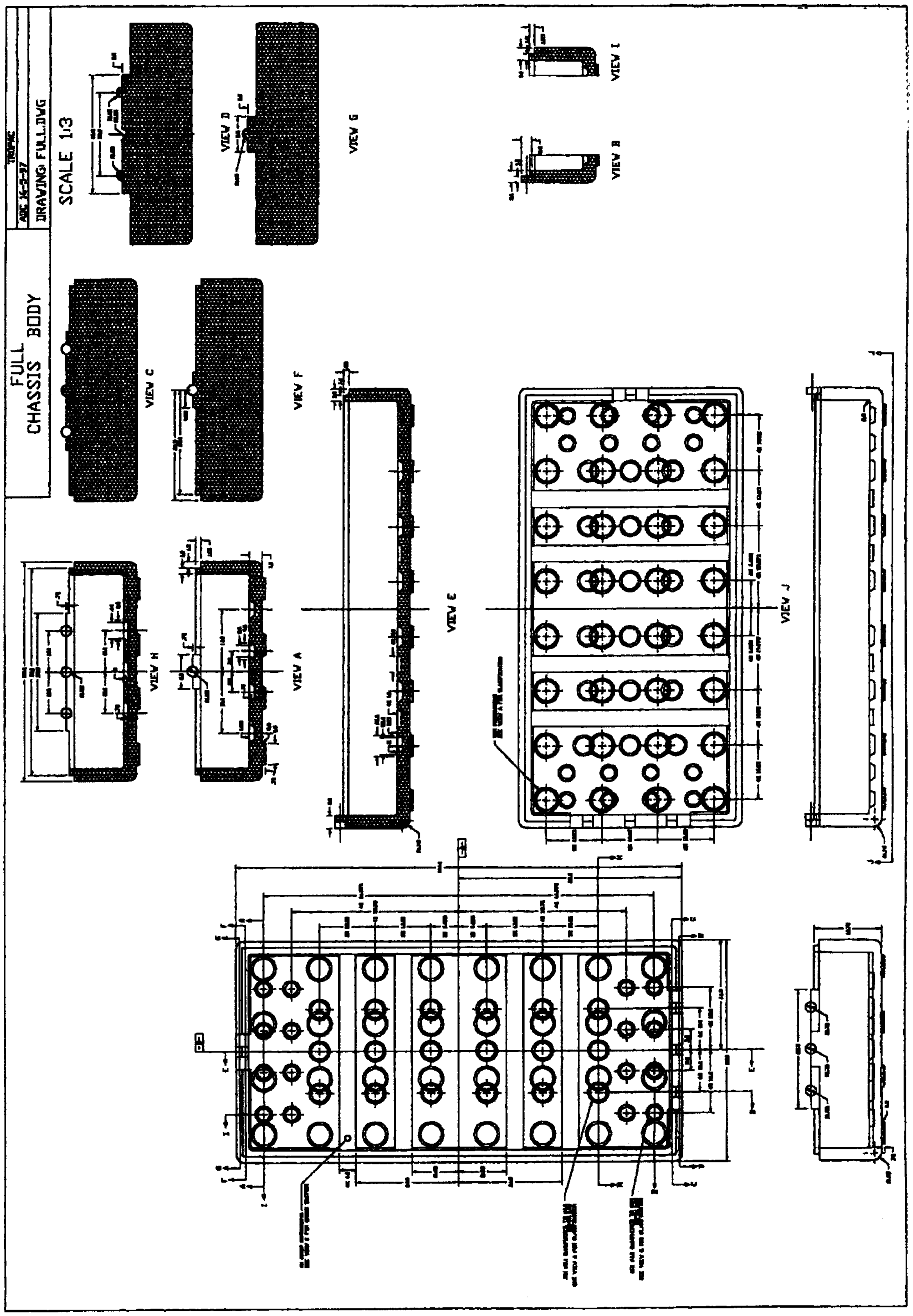
25. The pump of Claim 24 featuring four thermal industrial resistors to heat up the filaments in series; five flexible high amperage cables formed by five cable sleeves per cable pair, containing two male, four pole, wire plugs, pin and sleeve to plug to the power source; two pair high amperage male/female plugs, varied wiring poles, a spool for the electric cable, a simple hose and an insulated hose with a spool for the water hose, a valve with nozzle, a drum to store the system and which contains a chassis.

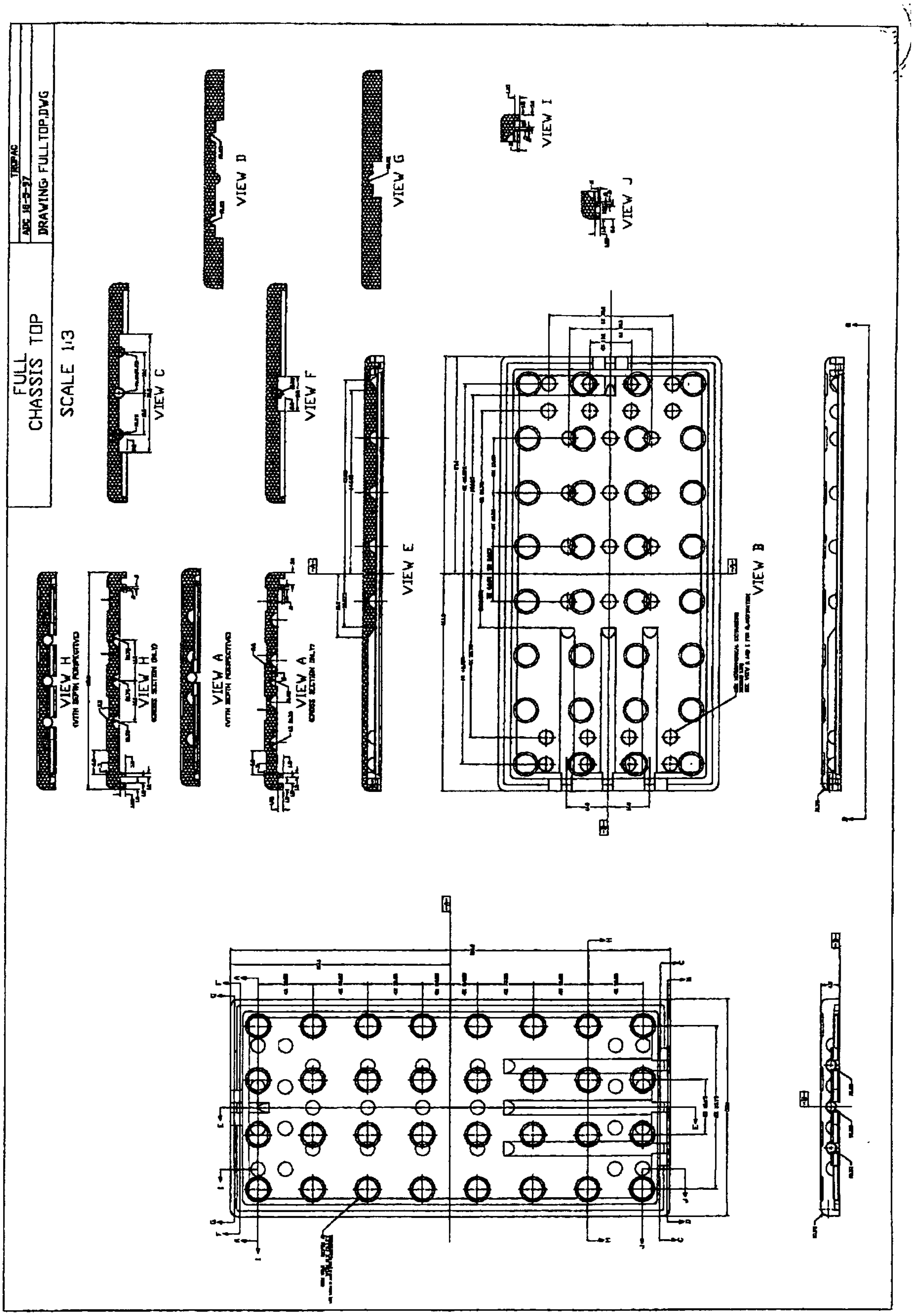

HALF CHASSIS
SCALE 1:2
DRAWING: HALF.DWG 1 OF 1
VIEW A
VIEW B
VIEW C
VIEW D
VIEW E
VIEW F
VIEW G
VIEW H
VIEW I
(CROSS SECTION ONLY)
PATTERN XX

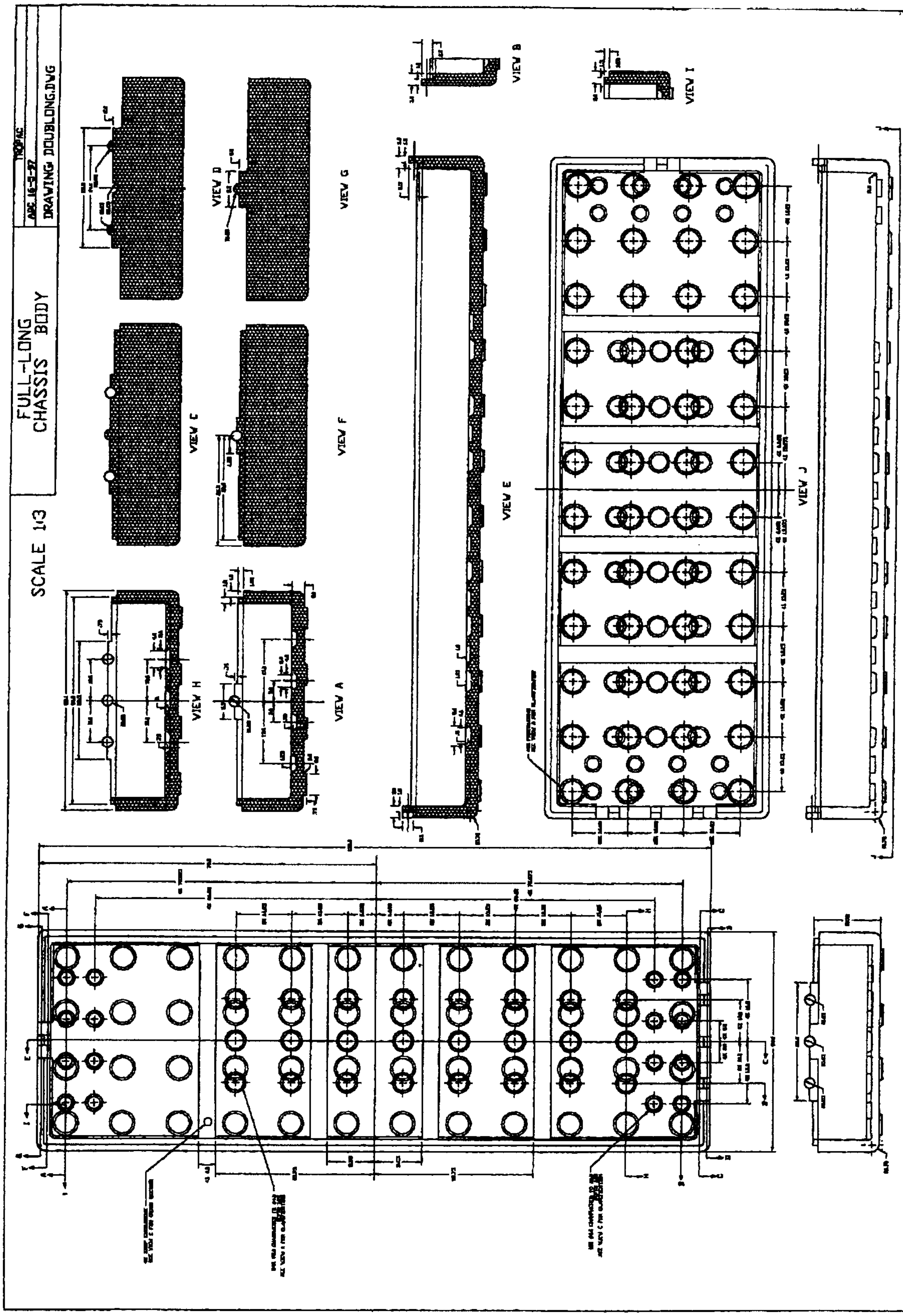

HALF
TOP COVER
SCALE 1:2
DRAWING: HALFTOP.DWG

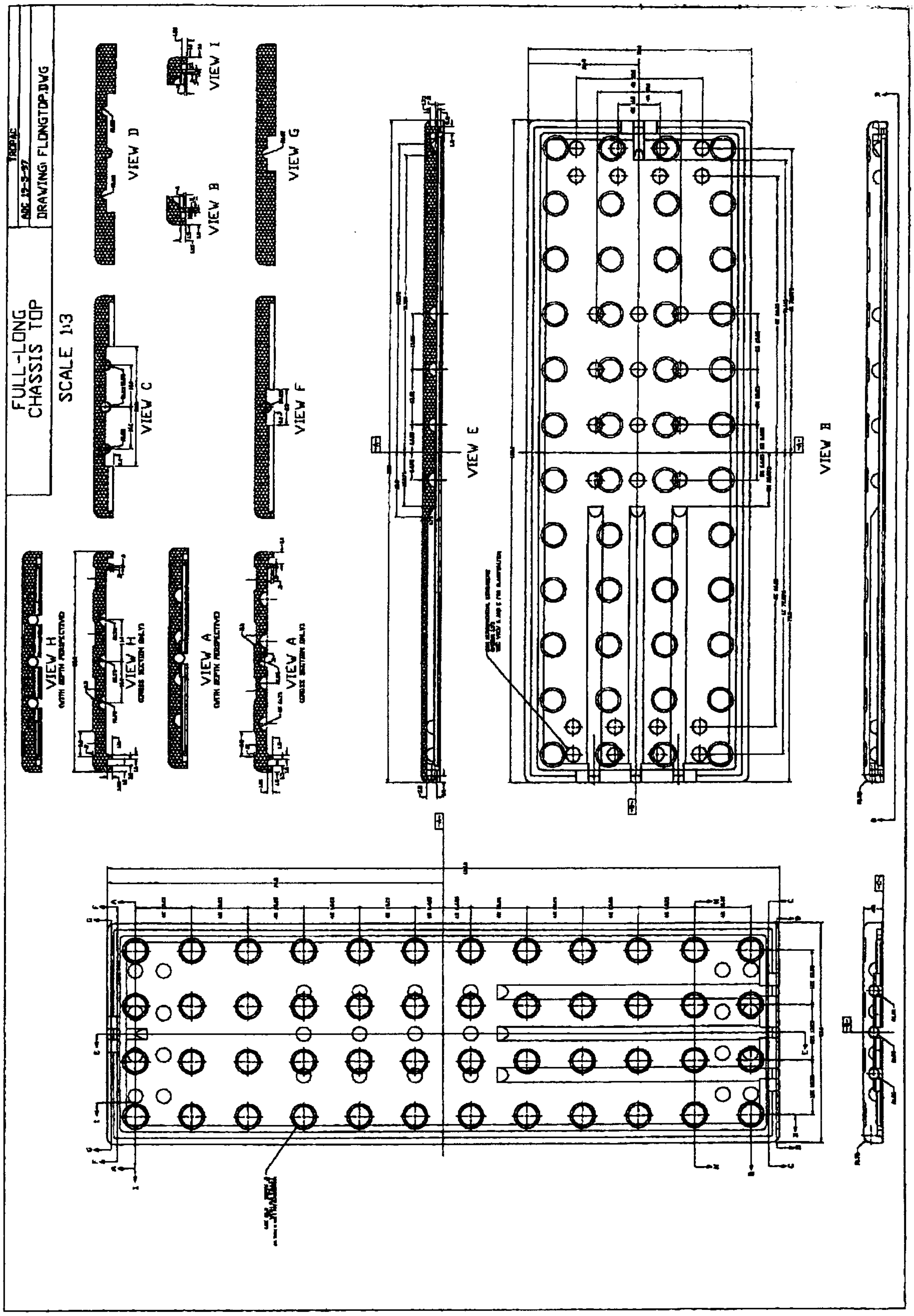

SCALE 1:3
HALF-LONG CHASSIS
DRAWING: HLONG.DWG
VIEW A
VIEW F
VIEW G
VIEW C
VIEW I
VIEW E
VIEW H


HALF-LONG TOP COVER
SCALE 1:3
DRAWING: HLONGTOP.DWG
VIEW A
VIEW B
VIEW C
VIEW K
VIEW E
VIEW G
VIEW H
VIEW I
VIEW J
VIEW D
VIEW F


FULL
CHASSIS BODY
DRAWING: FULL.DWG
SCALE 1:3
VIEW C
VIEW F
VIEW D
VIEW G
VIEW I
VIEW B
VIEW H
VIEW A
VIEW E
VIEW J


FULL
CHASSIS TOP
SCALE 1:3
TROPAC
DRAWING: FULLTOP.DWG
VIEW C
VIEW D
VIEW F
VIEW G
VIEW I
VIEW J
VIEW E
VIEW B
VIEW H
VIEW A


FULL-LONG CHASSIS BODY
SCALE 1:3
DRAWING: DOUBLONG.DWG
VIEW A
VIEW B
VIEW C
VIEW D
VIEW E
VIEW F
VIEW G
VIEW H
VIEW I
VIEW J


FULL-LONG
CHASSIS TOP
SCALE 1:3
DRAWING: FLONGTOP.DWG
TROPAC
VIEW D
VIEW I
VIEW B
VIEW G
VIEW C
VIEW F
VIEW H
VIEW A
VIEW E
VIEW B

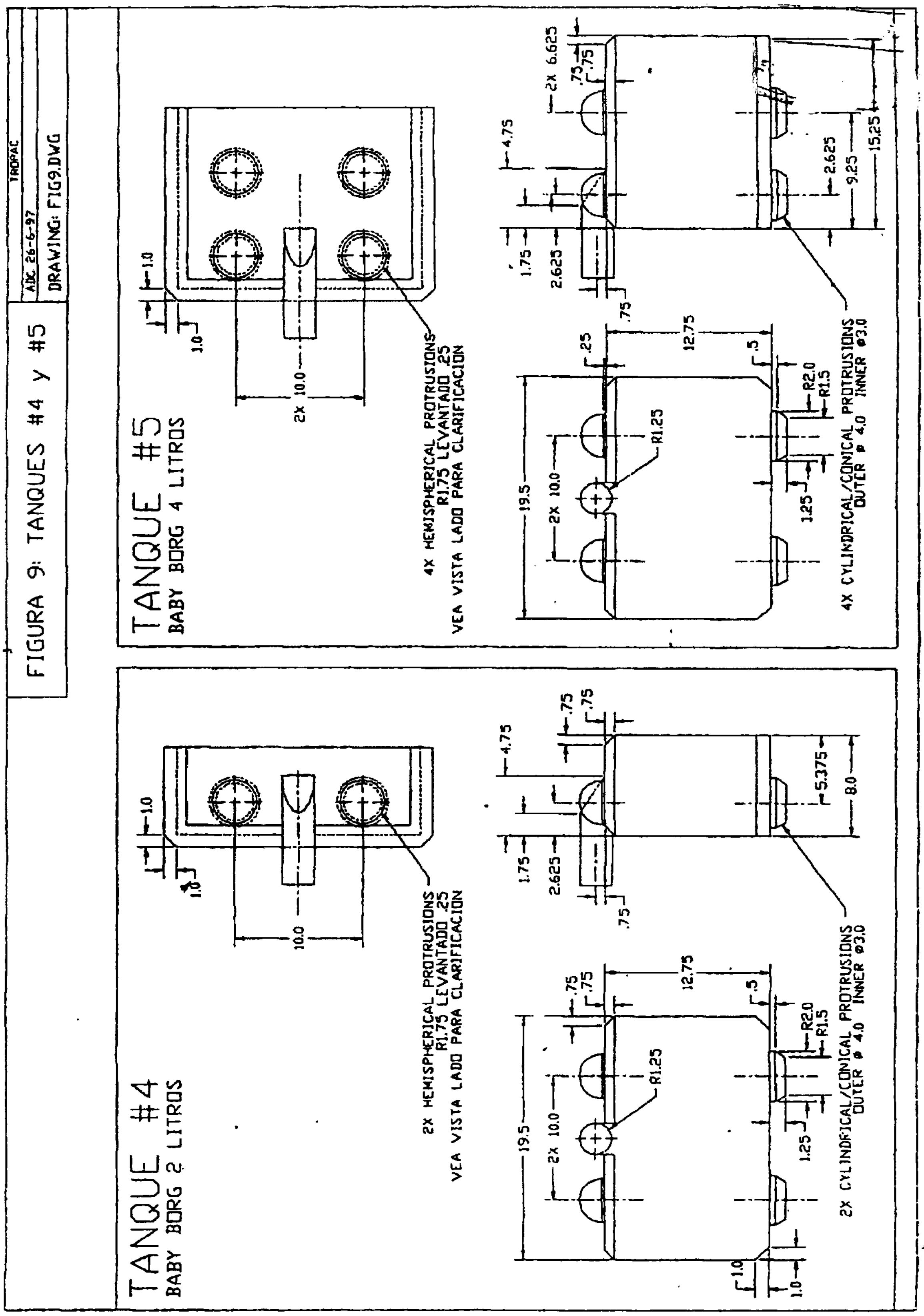


FIGURA 9: TANQUES #4 y #5
TROPAC
ADC 26-6-97
DRAWING: FIG9.DWG
TANQUE #5
BABY BORG 4 LITROS
4X HEMISPHERICAL PROTRUSIONS
R1.75 LEVANTADO .25
VEA VISTA LADO PARA CLARIFICACION
4X CYLINDRICAL/CONICAL PROTRUSIONS
OUTER ø 4.0 INNER ø3.0
TANQUE #4
BABY BORG 2 LITROS
2X HEMISPHERICAL PROTRUSIONS
R1.75 LEVANTADO .25
VEA VISTA LADO PARA CLARIFICACION
2X CYLINDRICAL/CONICAL PROTRUSIONS
OUTER ø 4.0 INNER ø3.0

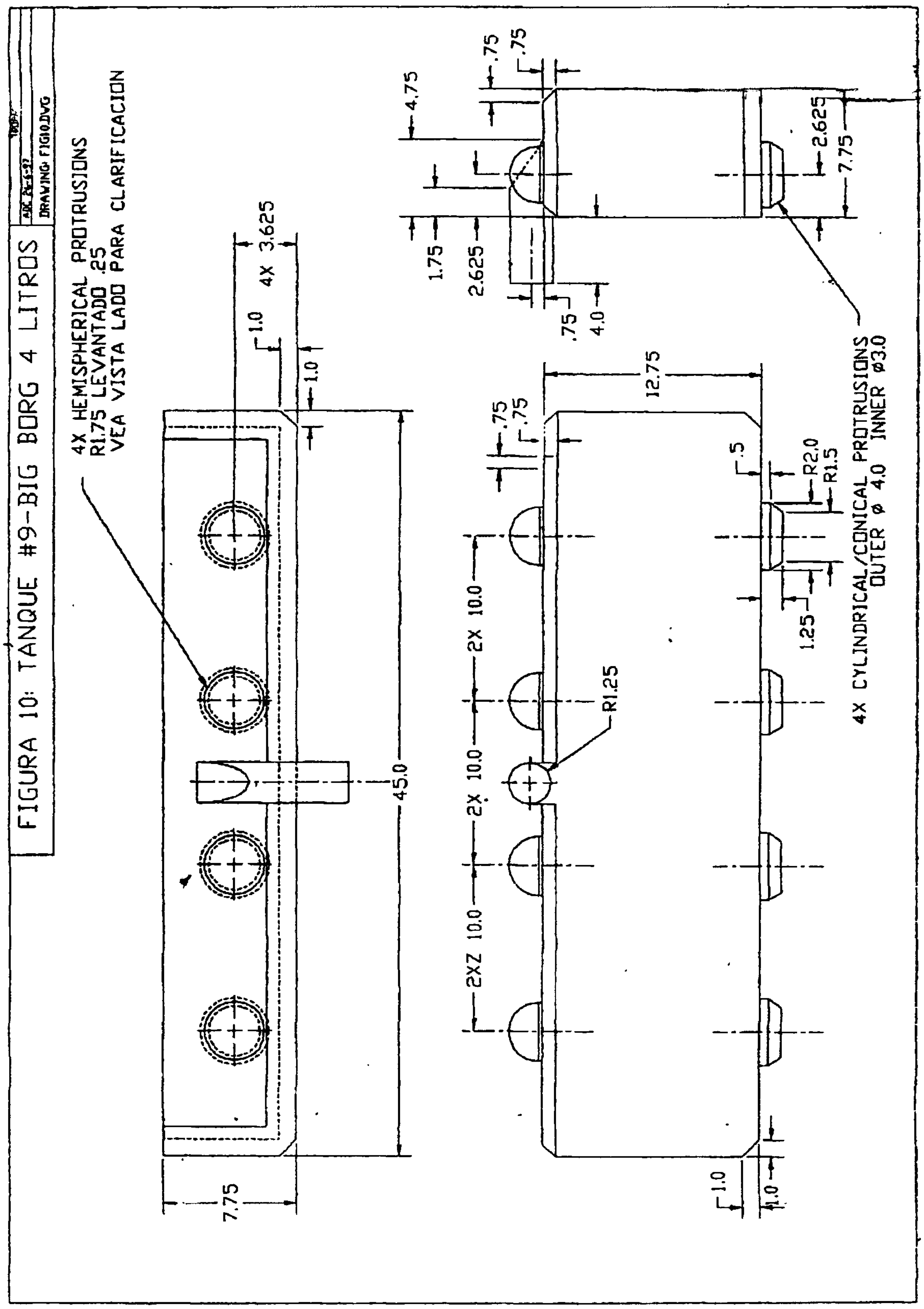


FIGURA 10: TANQUE #9-BIG BORG 4 LITROS
DRAWING: FIG10.DWG
4X HEMISPHERICAL PROTRUSIONS
R1.75 LEVANTADO .25
VEA VISTA LADO PARA CLARIFICACION
4X 3.625
1.0
1.0
45.0
7.75
.75
.75
2X 10.0
2X 10.0
2XZ 10.0
R1.25
12.75
.5
R2.0
R1.5
1.25
1.0
1.0
4X CYLINDRICAL/CONICAL PROTRUSIONS
OUTER ø 4.0 INNER ø3.0
4.75
1.75
2.625
.75
4.0
2.625
7.75

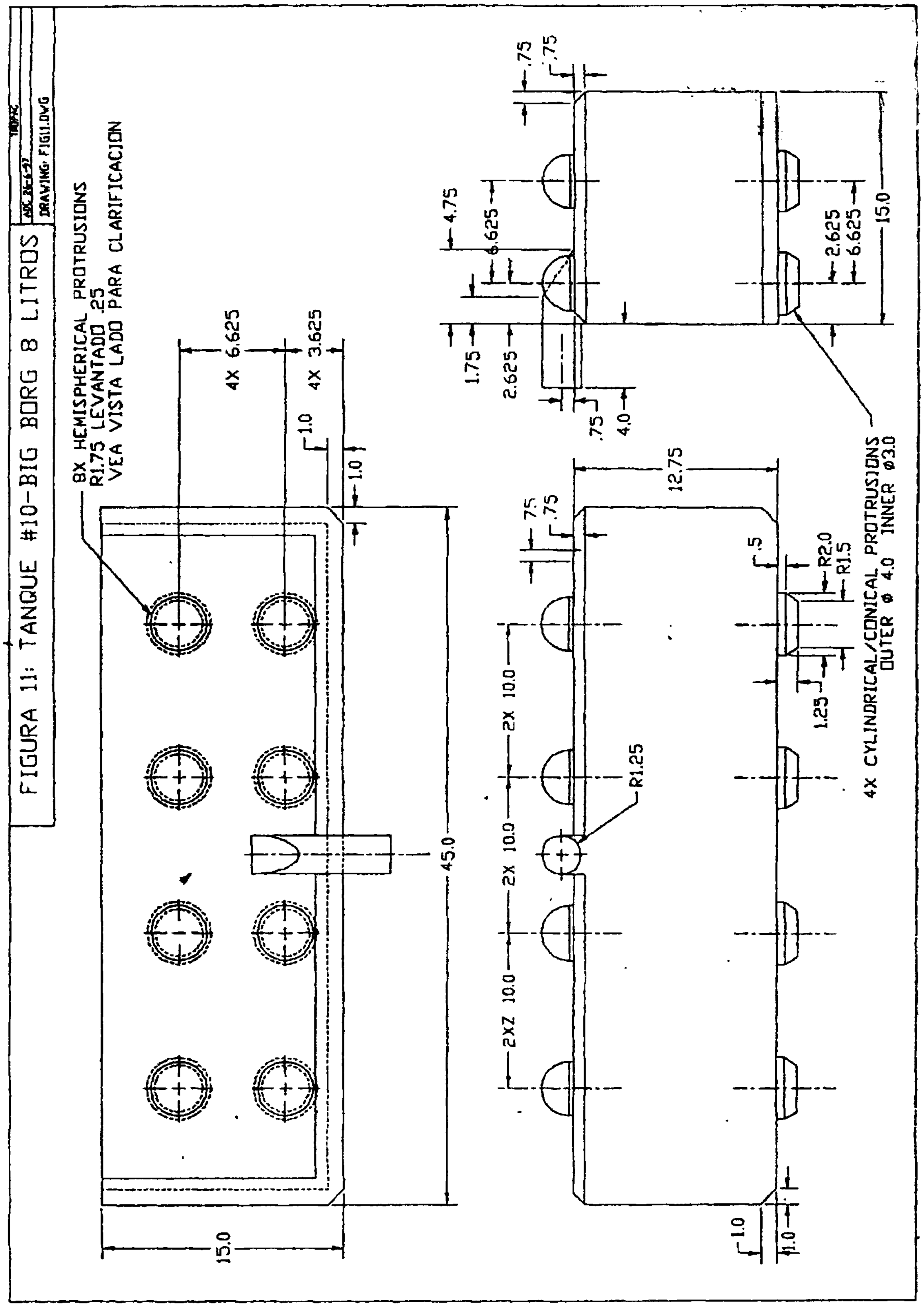


FIGURA 11: TANQUE #10-BIG BORG 8 LITROS
DRAWING: FIG11.DWG
8X HEMISPHERICAL PROTRUSIONS
R1.75 LEVANTADO .25
VEA VISTA LADO PARA CLARIFICACION
4X 6.625
4X 3.625
45.0
15.0
12.75
R1.25
2X 10.0
2XZ 10.0
R2.0
R1.5
1.25
4X CYLINDRICAL/CONICAL PROTRUSIONS
OUTER ø 4.0 INNER ø3.0
4.75
6.625
1.75
2.625
4.0
2.625
6.625
15.0

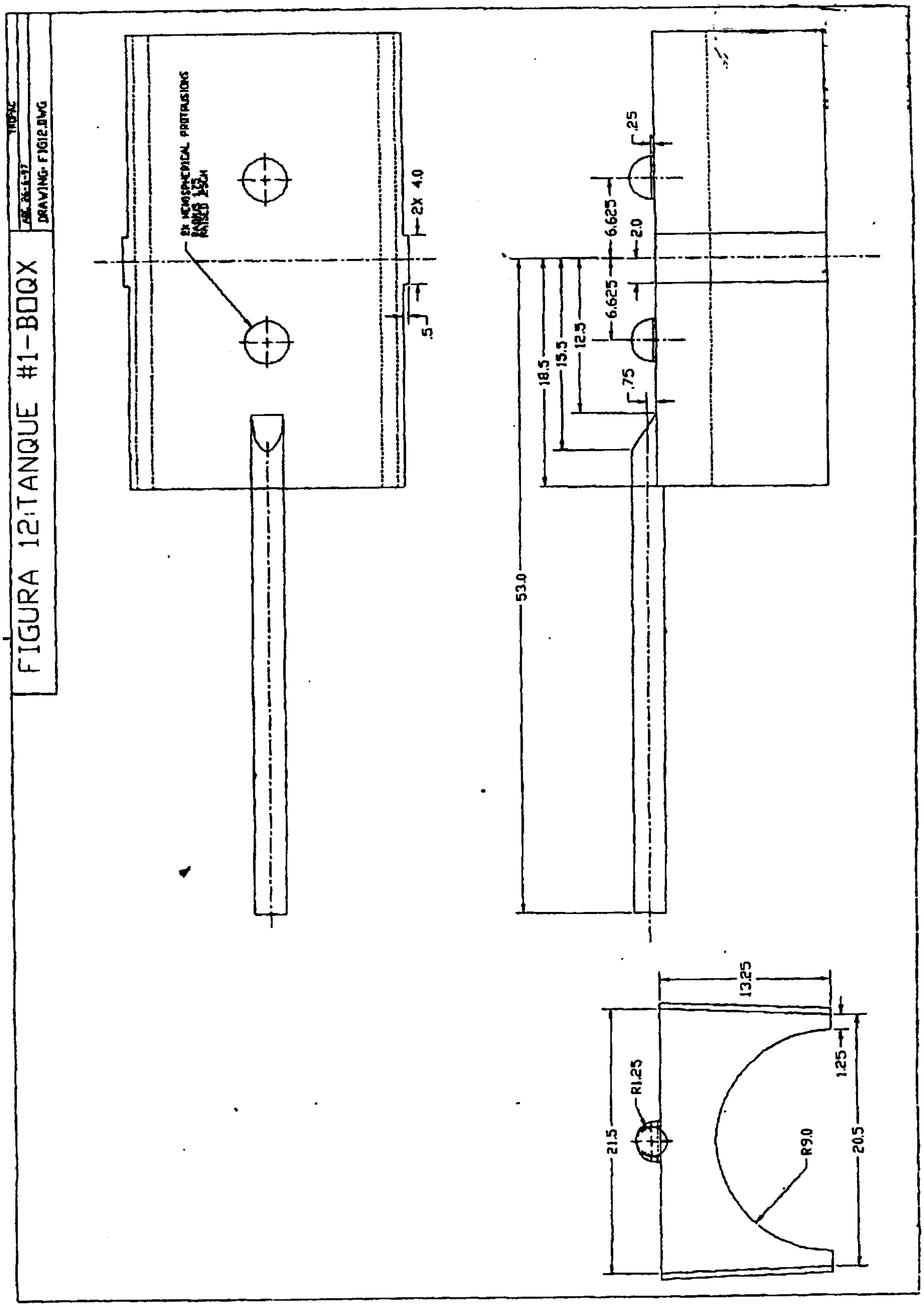


FIGURA 12:TANQUE #1-BOQX
DRAWING: FIG12.DWG
2X 4.0
.5
.25
6.625
2.0
6.625
12.5
15.5
18.5
.75
53.0
13.25
1.25
20.5
R9.0
21.5
R1.25

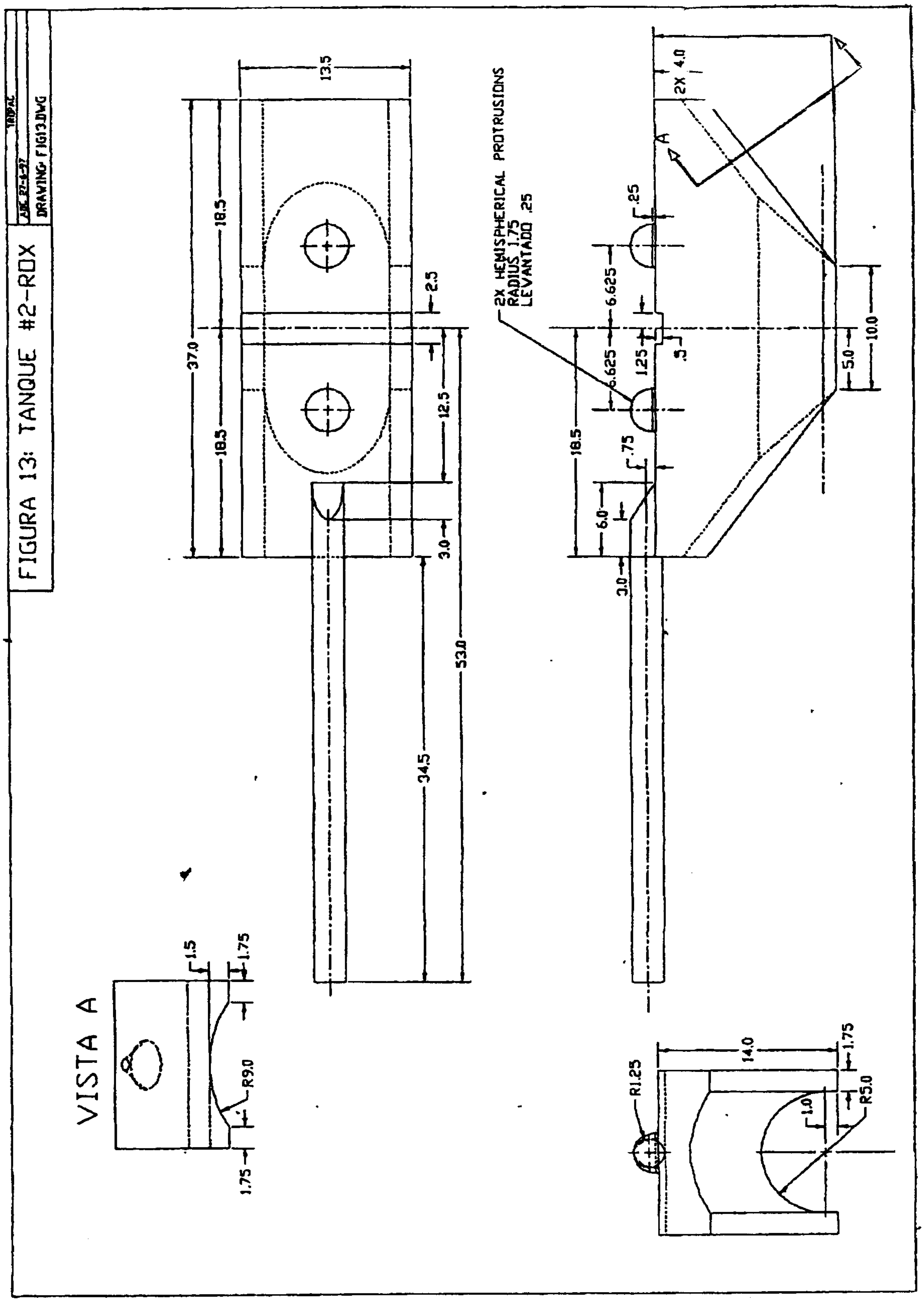


FIGURA 13: TANQUE #2-ROX
VISTA A
2X HEMISPHERICAL PROTRUSIONS
RADIUS 1.75
LEVANTADO .25

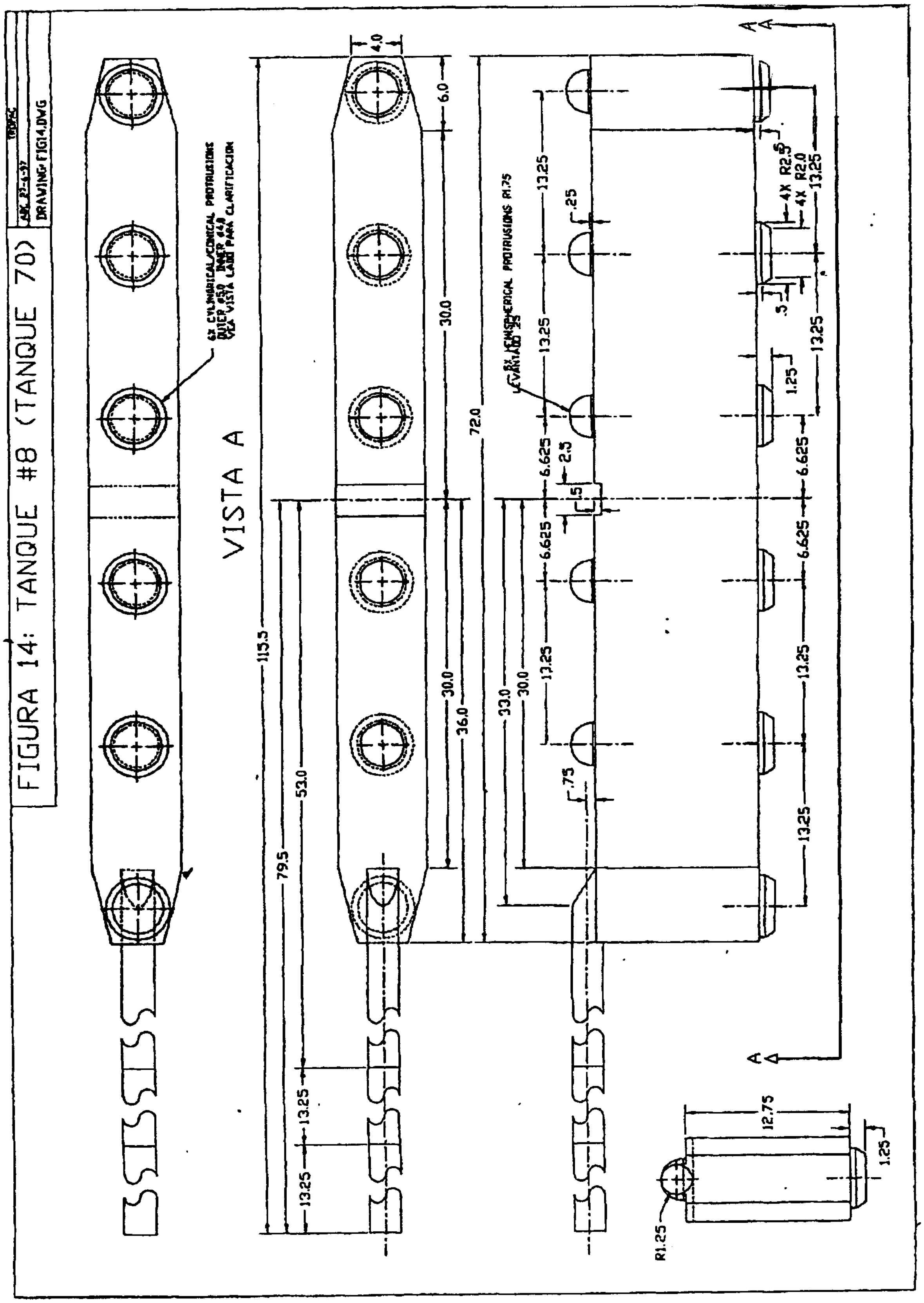


FIGURA 14: TANQUE #8 (TANQUE 70)
VISTA A
DRAWING: FIG14.DWG
115.5
79.5
53.0
72.0
36.0
33.0
30.0
13.25
6.625
R1.25
12.75
1.25
4X R2.5
4X R2.0

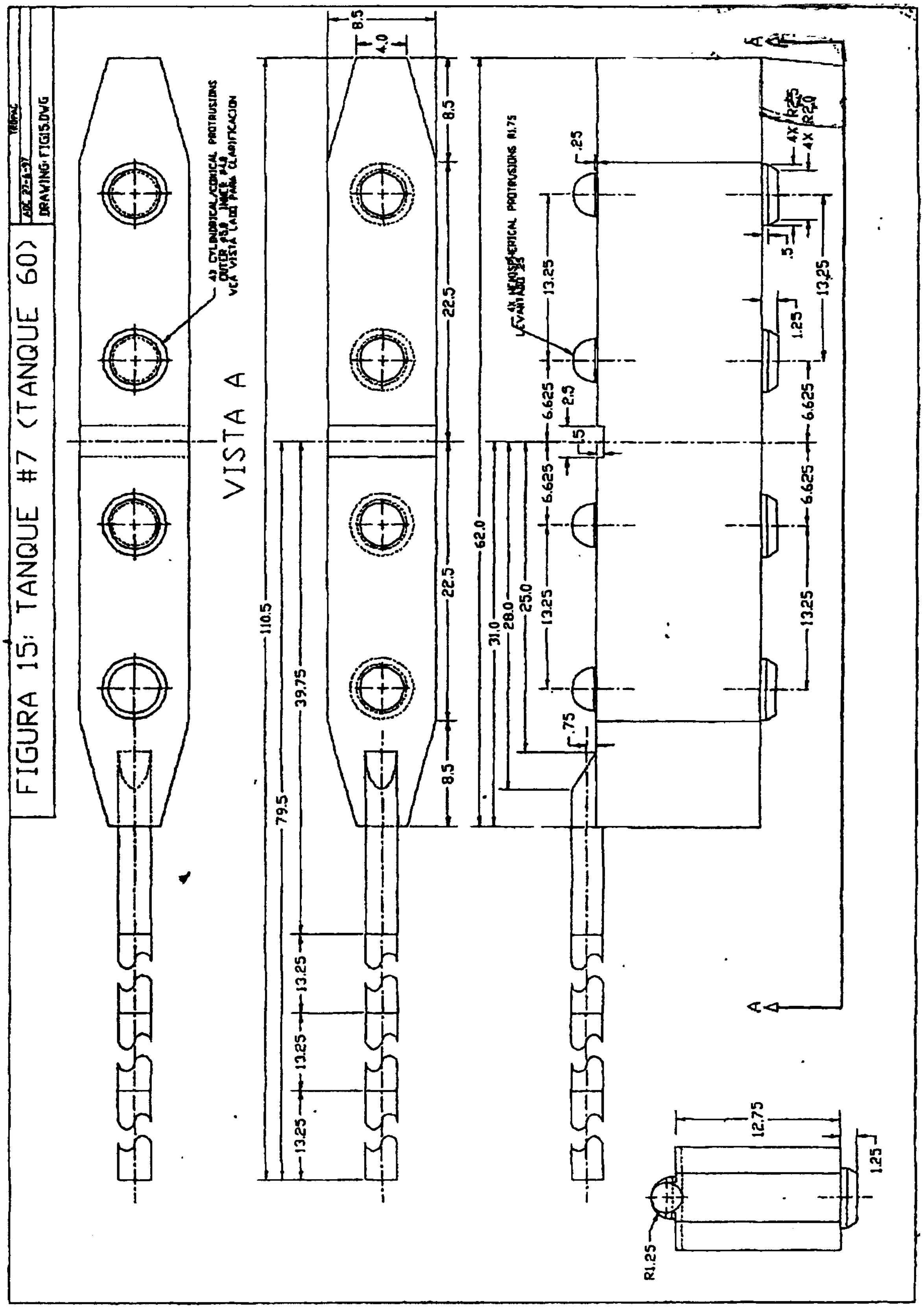


FIGURA 15: TANQUE #7 (TANQUE 60)
DRAWING: FIG15.DWG
VISTA A
4X CYLINDRICAL/CONICAL PROTRUSIONS
4X HEMISPHERICAL PROTRUSIONS
A
8.5
4.0
22.5
110.5
39.75
79.5
13.25
62.0
31.0
28.0
25.0
6.625
2.5
.75
.25
.5
1.25
4X R2.5
4X R2.0
12.75
R1.25

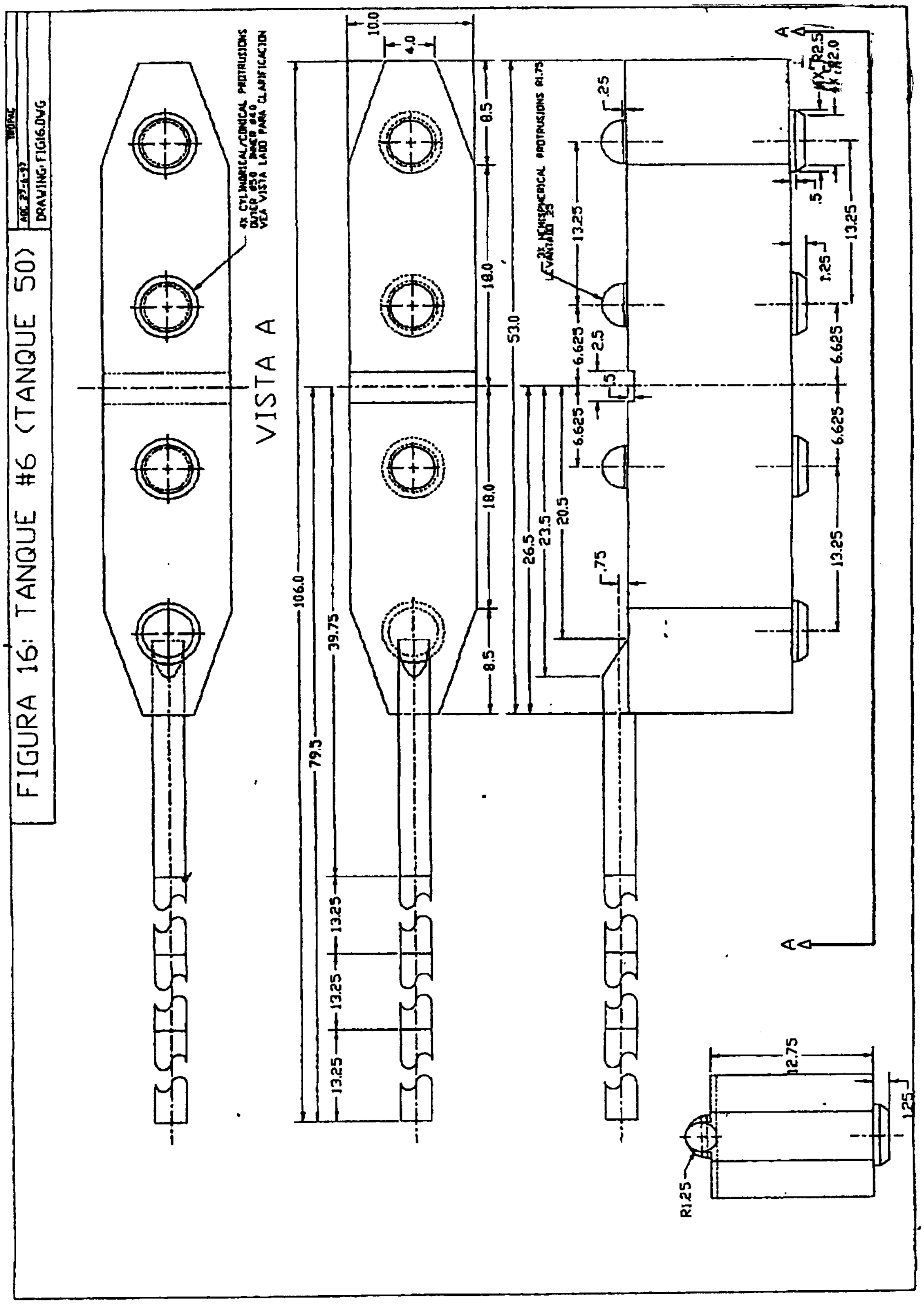


FIGURA 16: TANQUE #6 (TANQUE 50)
DRAWING: FIG16.DWG
VISTA A
4X CYLINDRICAL/CONICAL PROTRUSIONS
2X HEMISPHERICAL PROTRUSIONS
106.0
79.5
39.75
53.0
26.5
23.5
20.5
18.0
8.5
10.0
4.0
13.25
6.625
2.5
.25
.75
.5
1.25
12.75
R1.25
A

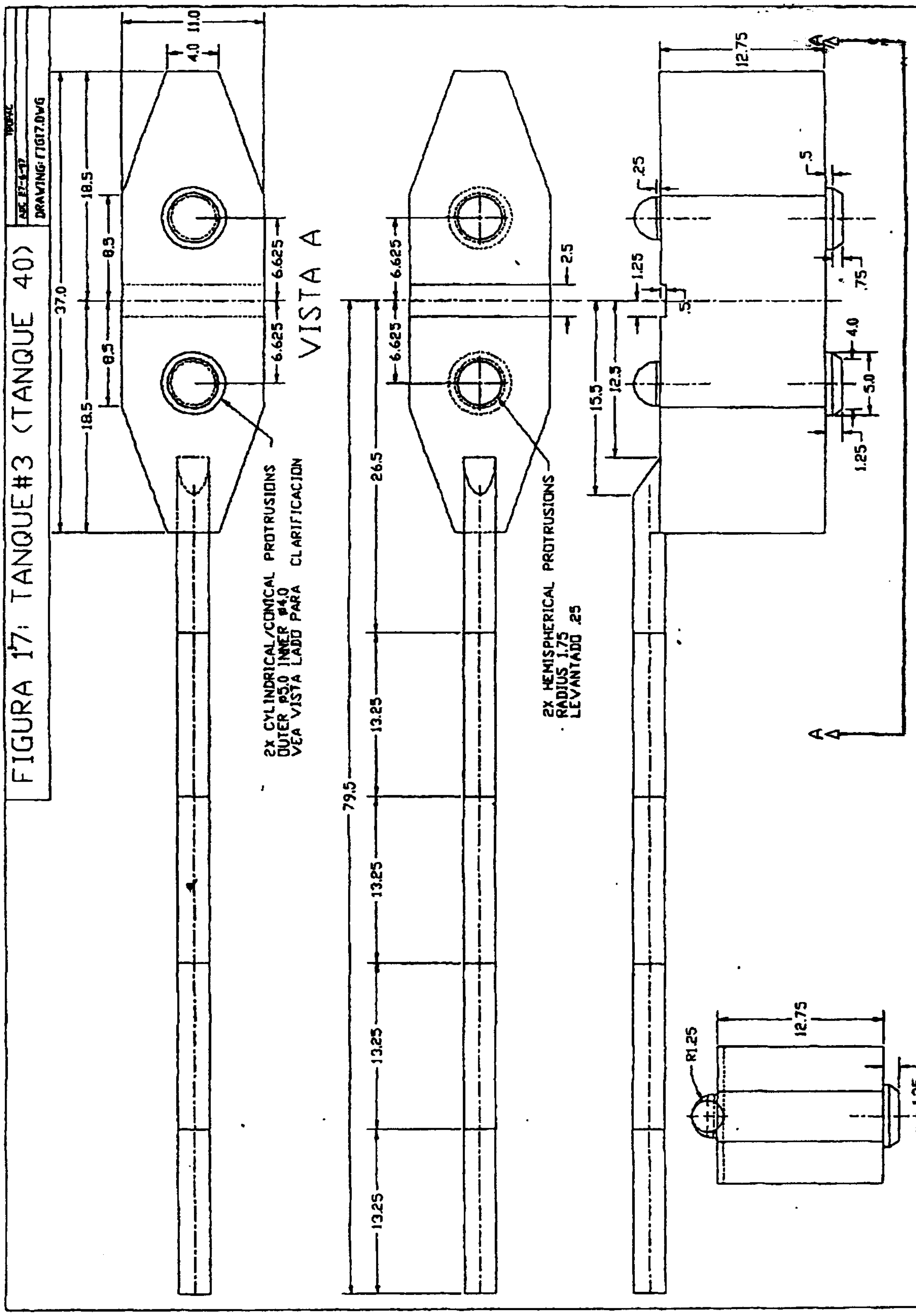


FIGURA 17: TANQUE #3 (TANQUE 40)

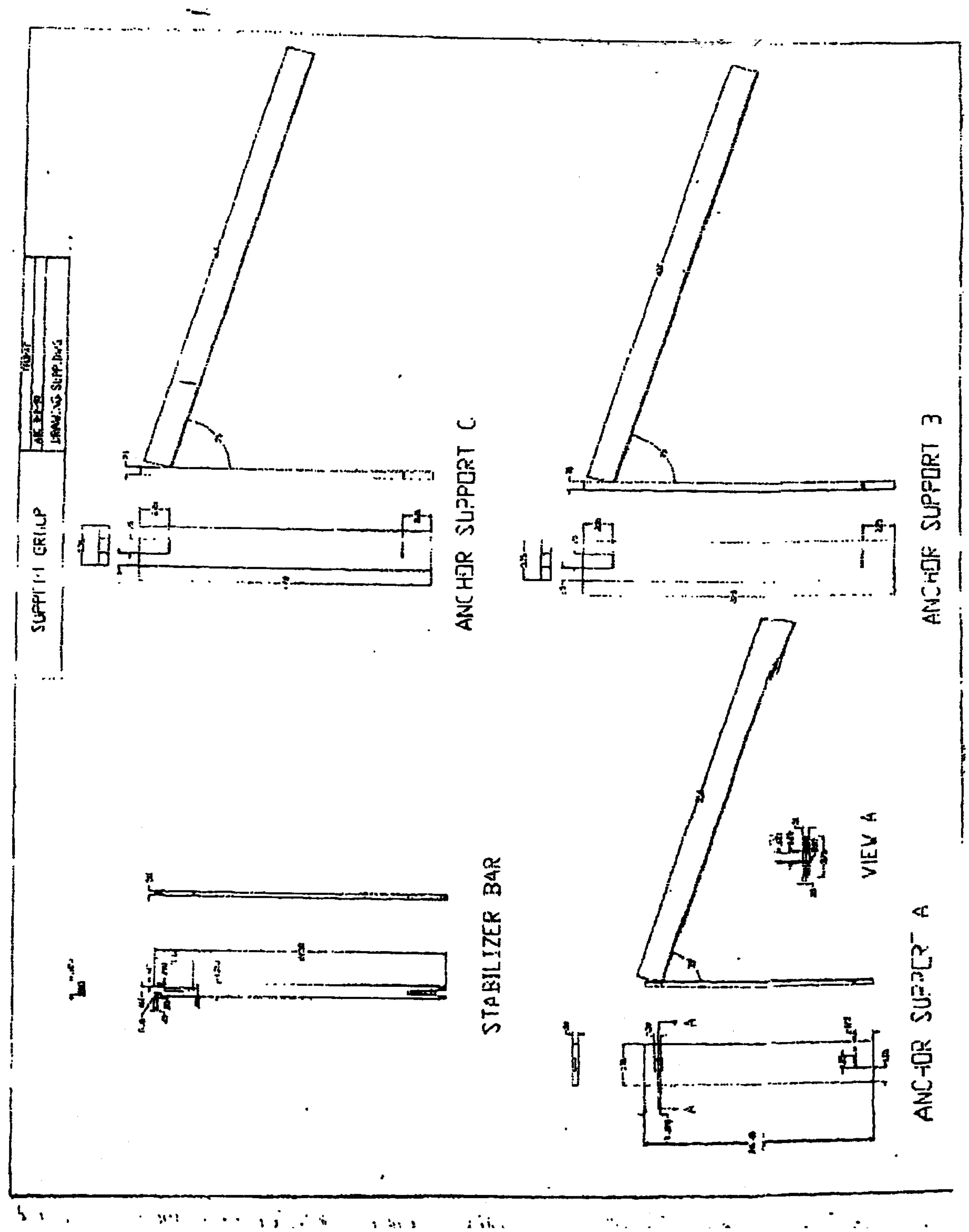
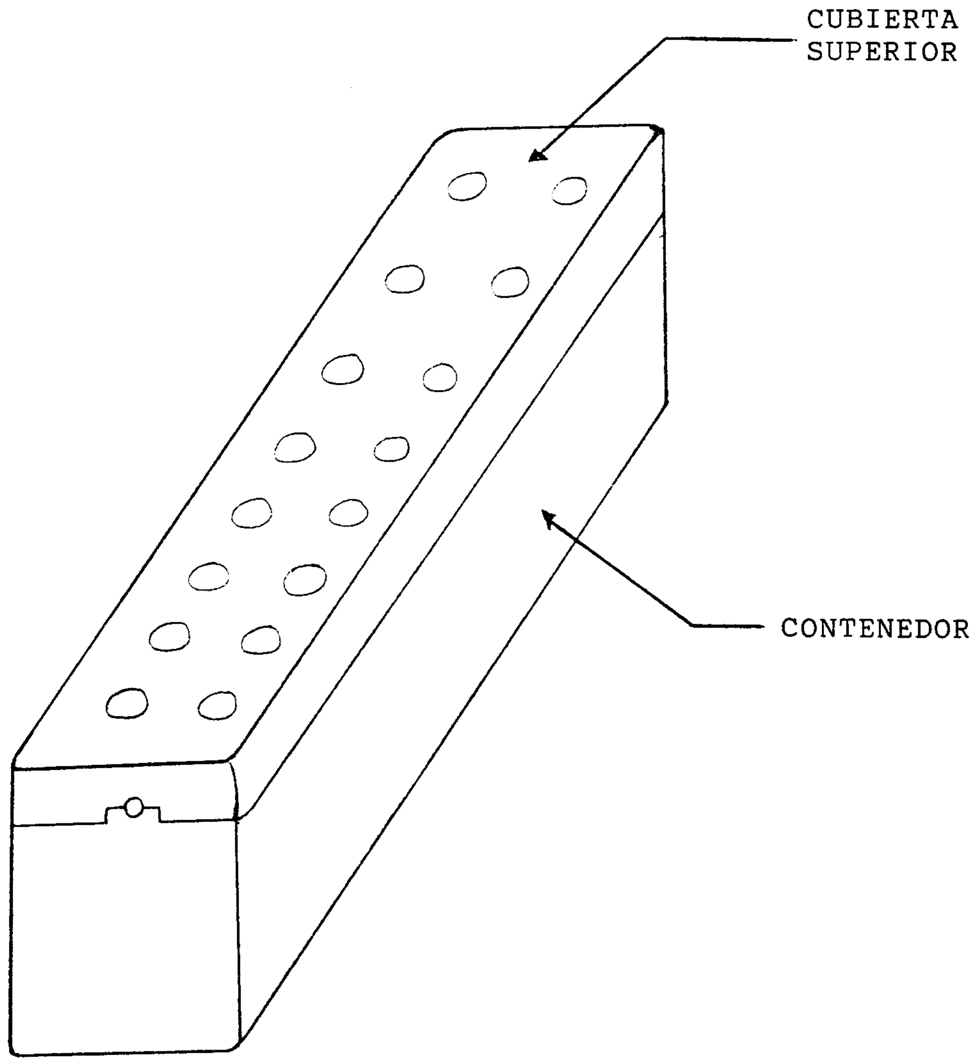

ANCHOR SUPPORT C
STABILIZER BAR
VIEW A

FIGURA 19: CONTENEDOR & CUBIERTA



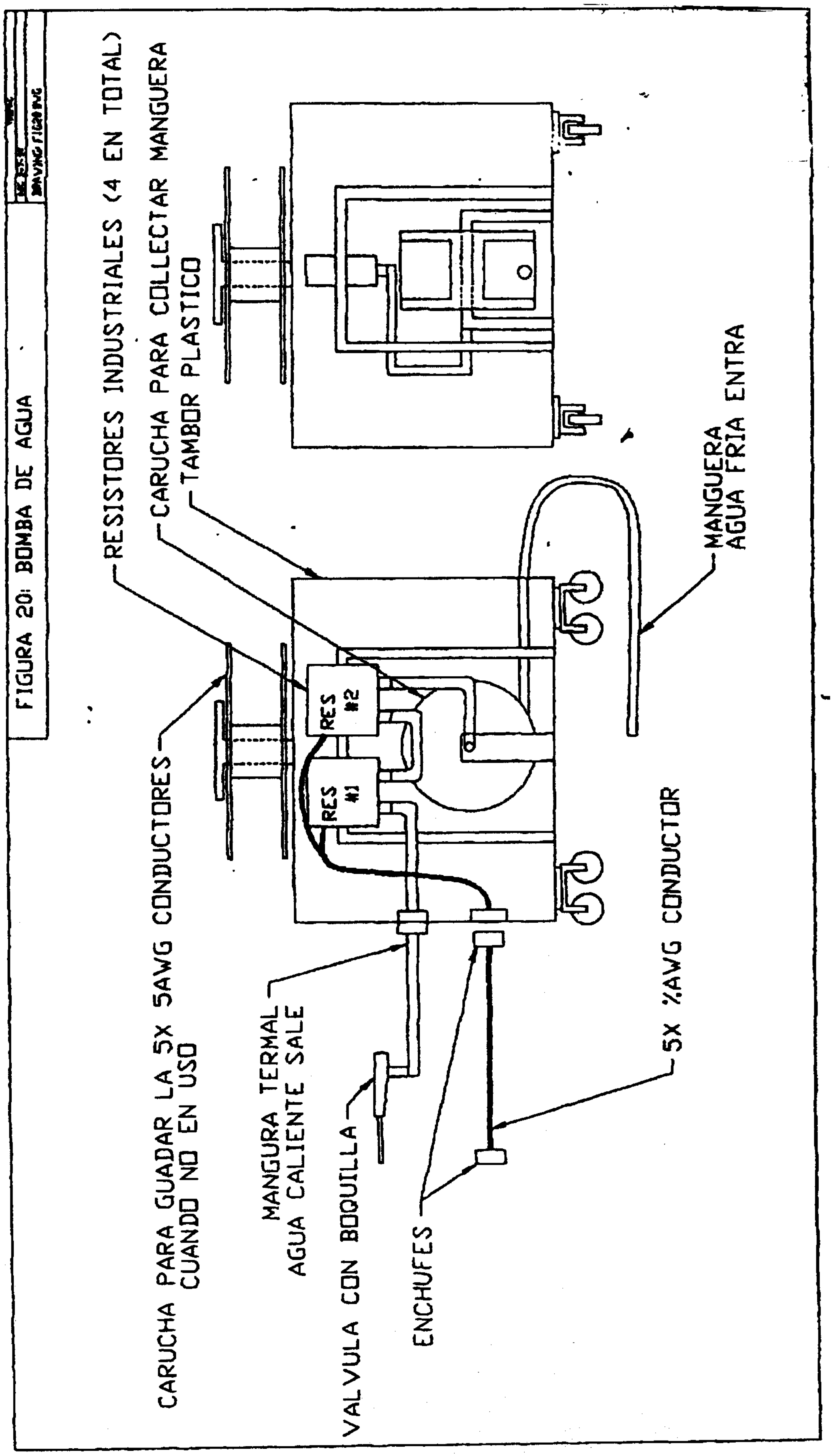


FIGURA 20: BOMBA DE AGUA
RESISTORES INDUSTRIALES (4 EN TOTAL)
CARUCHA PARA COLLECTAR MANGUERA
TAMBOR PLASTICO
MANGUERA AGUA FRIA ENTRA
RES #2
RES #1
CARUCHA PARA GUADAR LA 5X 5AWG CONDUCTORES CUANDO NO EN USO
VALVULA CON BOQUILLA
MANGURA TERMAL AGUA CALIENTE SALE
ENCHUFES
5X %AWG CONDUCTOR

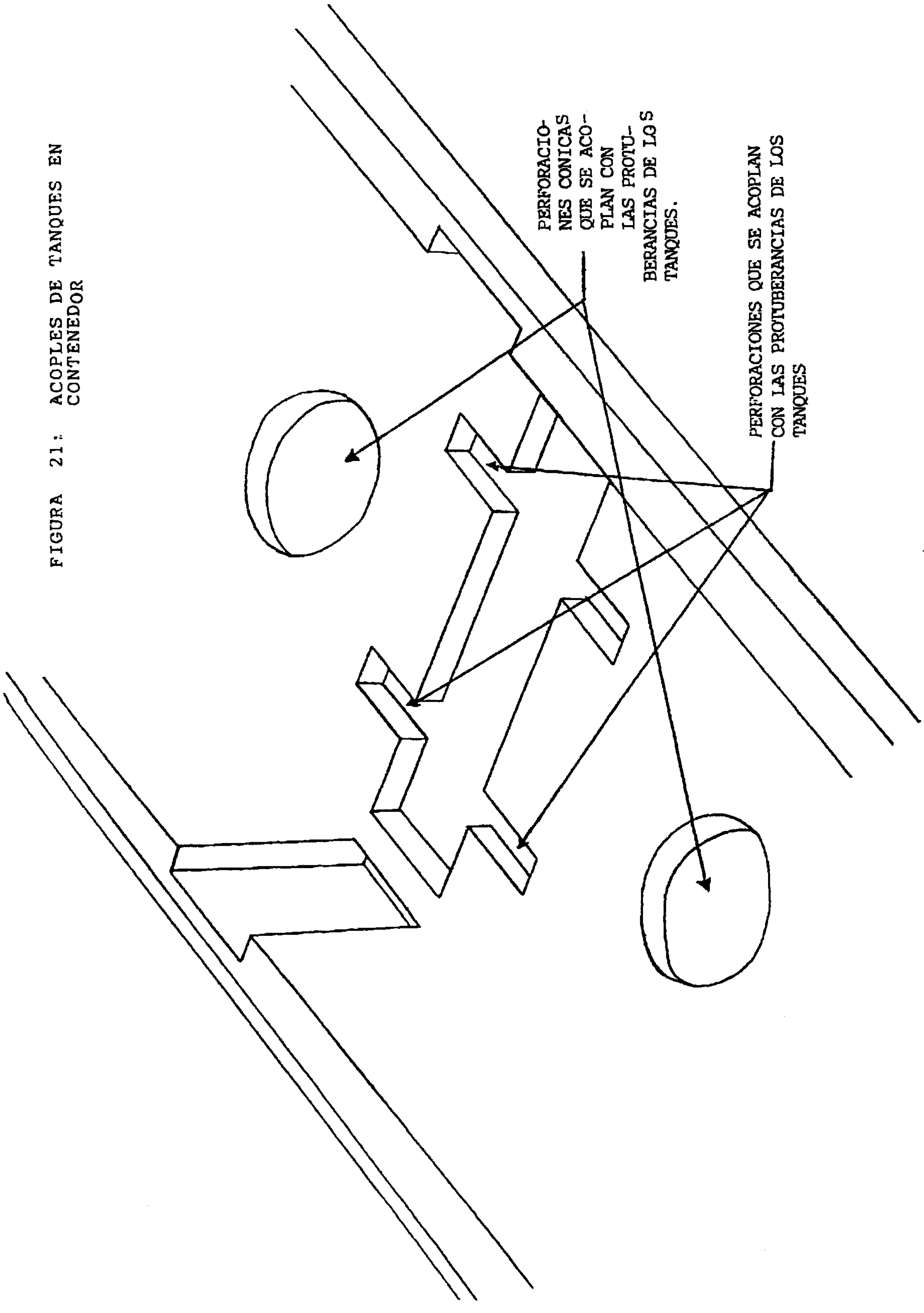


FIGURA 21: ACOPLES DE TANQUES EN CONTENEDOR

FIGURA 22

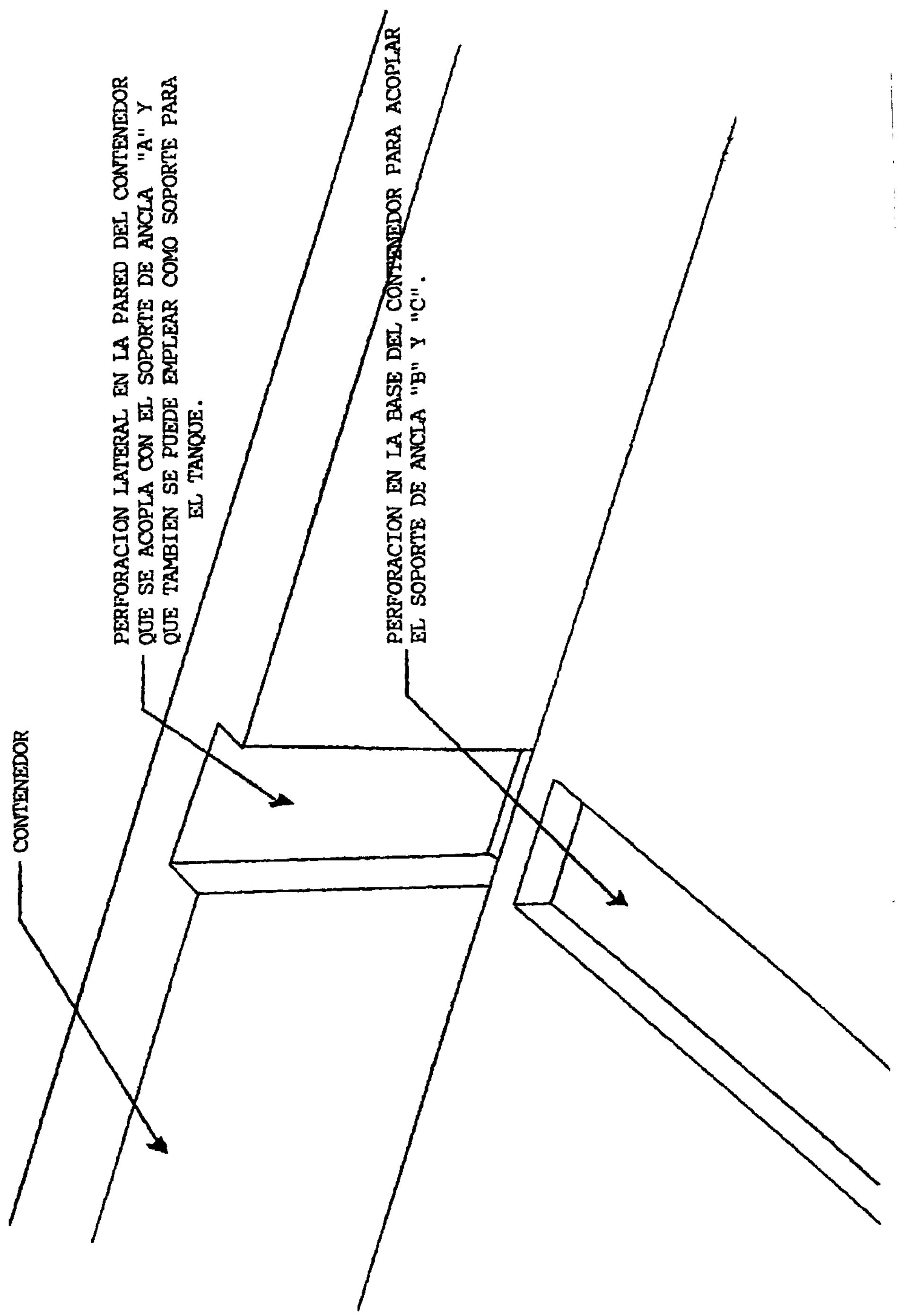

CONTENEDOR
PERFORACION LATERAL EN LA PARED DEL CONTENEDOR QUE SE ACOPLA CON EL SOPORTE DE ANCLA "A" Y QUE TAMBIEN SE PUEDE EMPLEAR COMO SOPORTE PARA EL TANQUE.
PERFORACION EN LA BASE DEL CONTENEDOR PARA ACOPLAR EL SOPORTE DE ANCLA "B" Y "C".

FIGURA 23

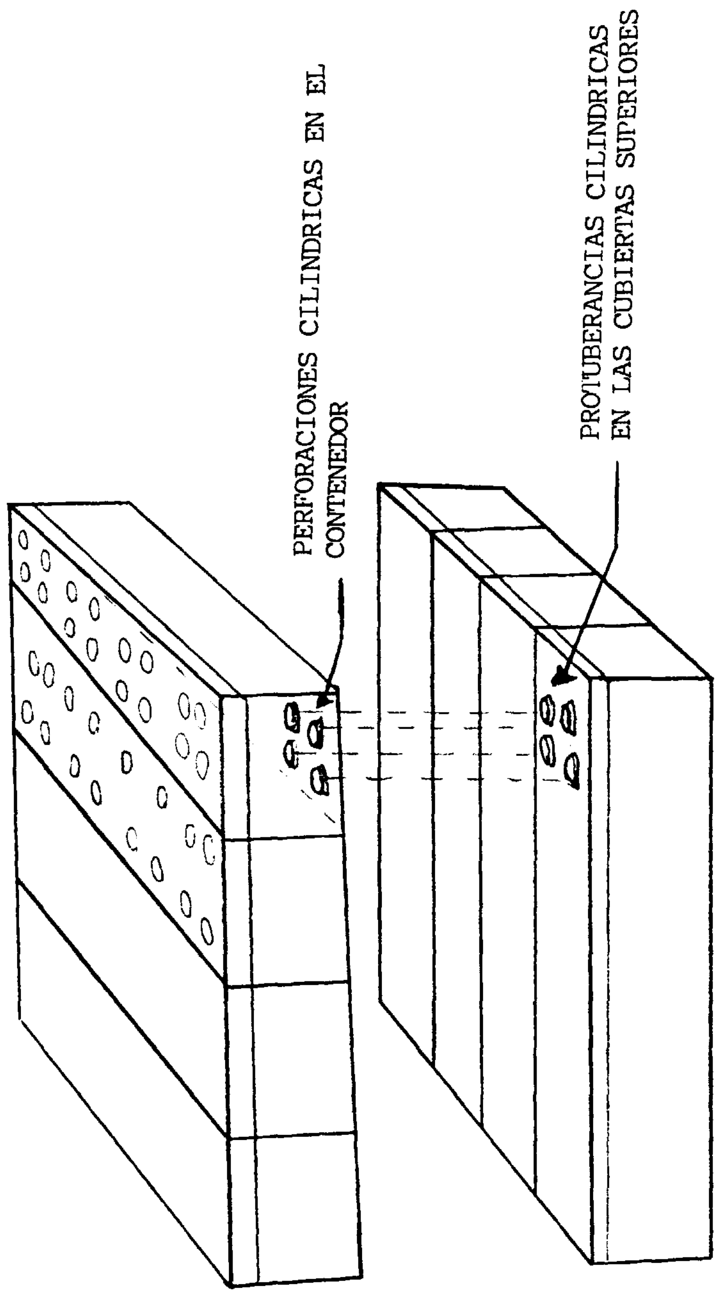
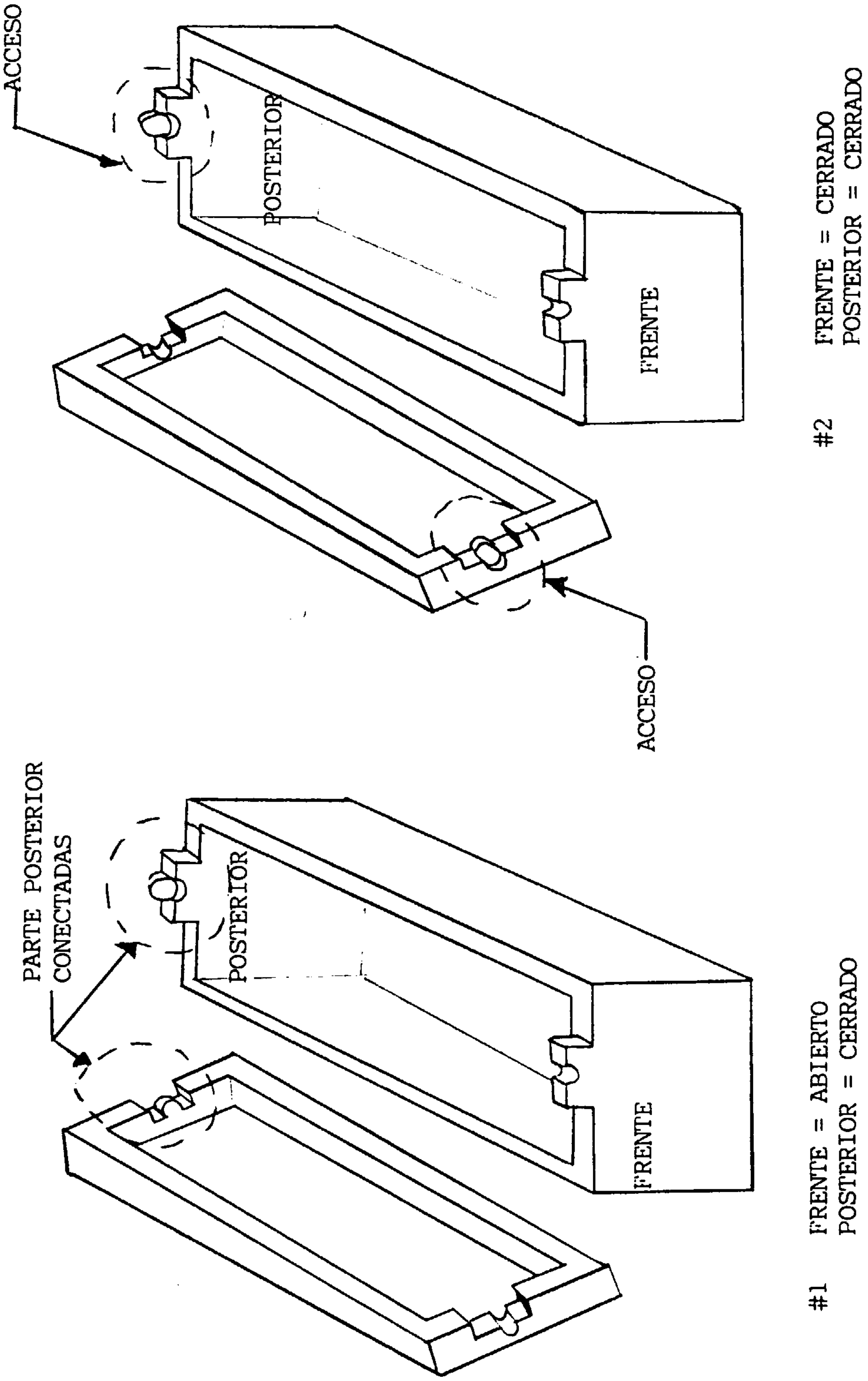

PERFORACIONES CILINDRICAS EN EL CONTENEDOR
PROTUBERANCIAS CILINDRICAS EN LAS CUBIERTAS SUPERIORES

FIGURA 24


ACCESO
POSTERIOR
FRENTE
ACCESO
#2
FRENTE = CERRADO
POSTERIOR = CERRADO
PARTE POSTERIOR
CONECTADAS
POSTERIOR
FRENTE
#1
FRENTE = ABIERTO
POSTERIOR = CERRADO

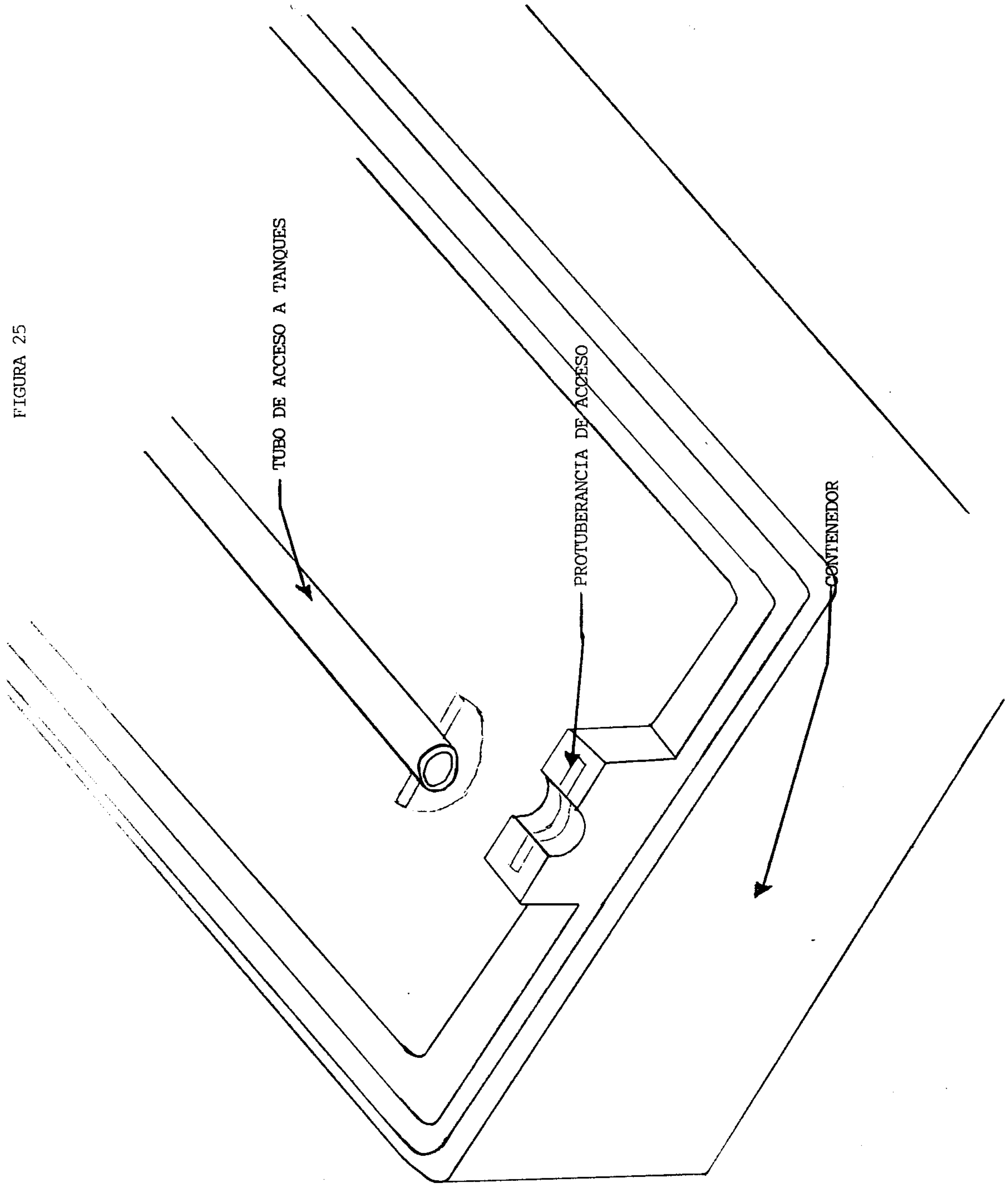

TUBO DE ACCESO A TANQUES
PROTUBERANCIA DE ACCESO
CONTENEDOR

FIGURA 25

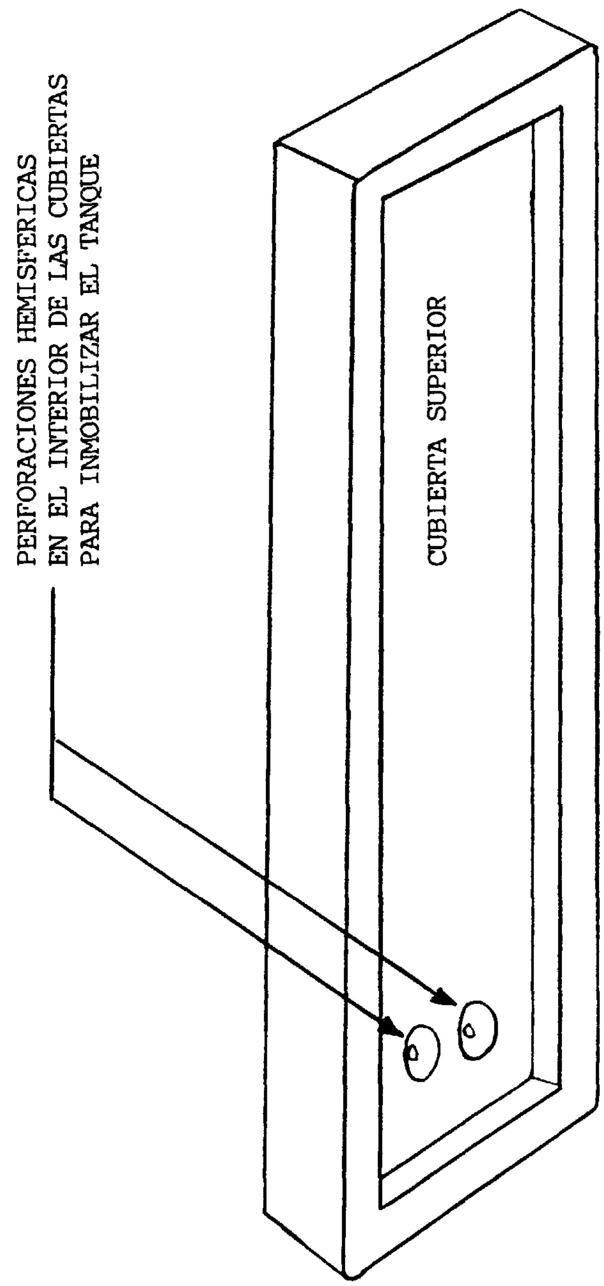

PERFORACIONES HEMISFERICAS
EN EL INTERIOR DE LAS CUBIERTAS
PARA INMOBILIZAR EL TANQUE
CUBIERTA SUPERIOR

FIGURA 26

FIGURA 27: CUBIERTA SUPERIOR (VISTA AL REVES)

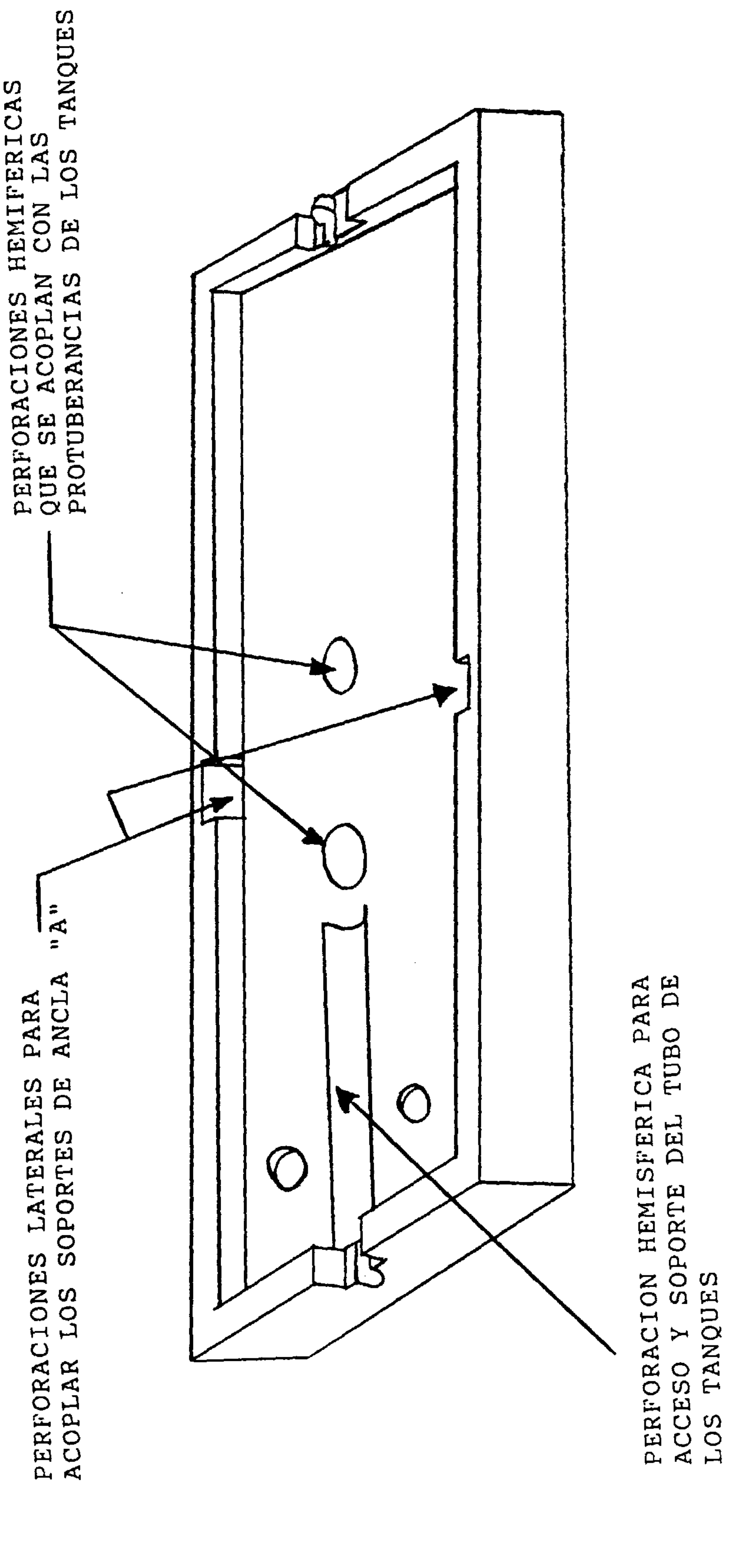


FIGURA 28: VISTA EN CORTE DEL ACOPLE DE LA CUBIERTA CON EL CONTENEDOR (SELLO HERMETICO)

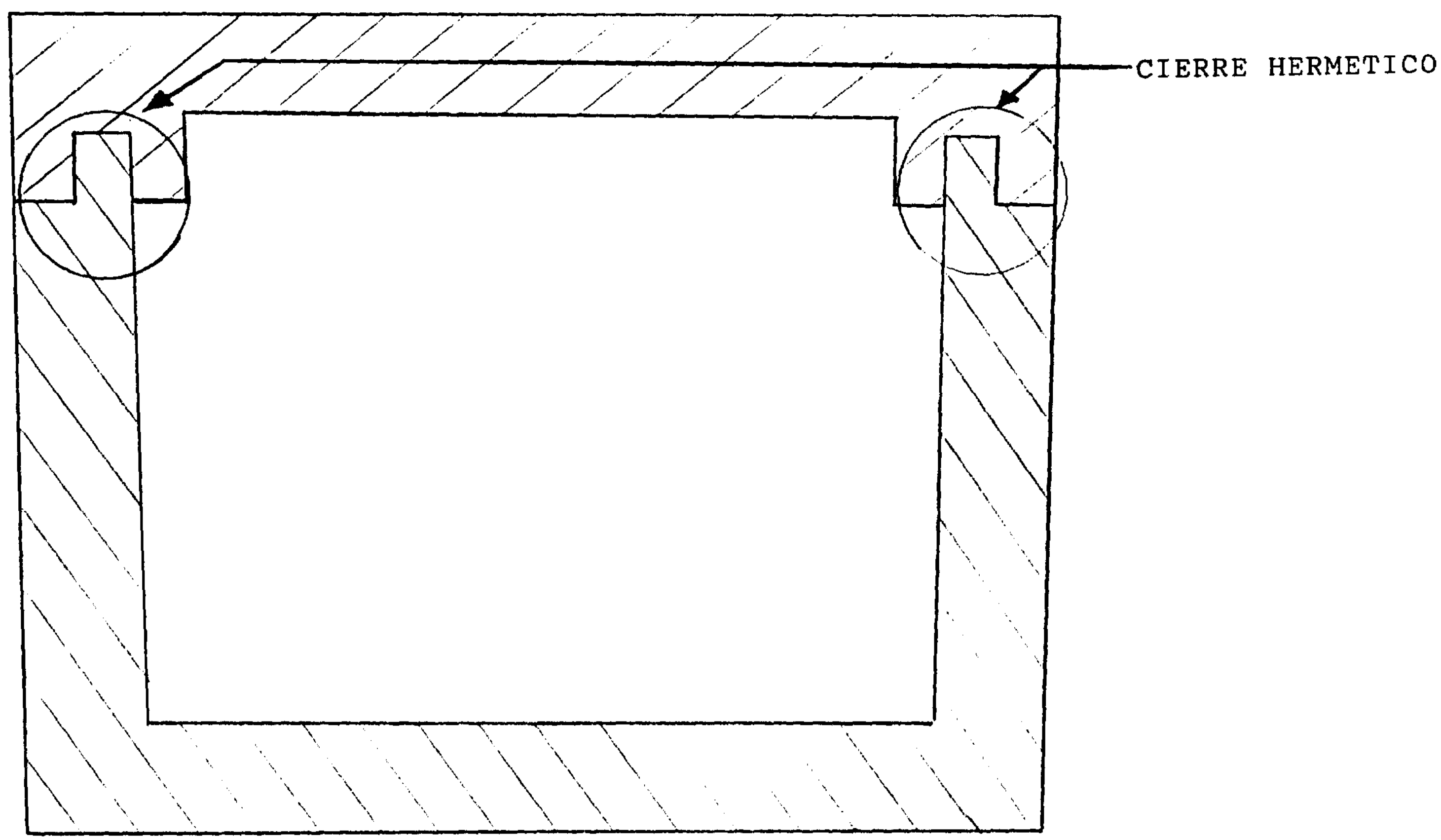
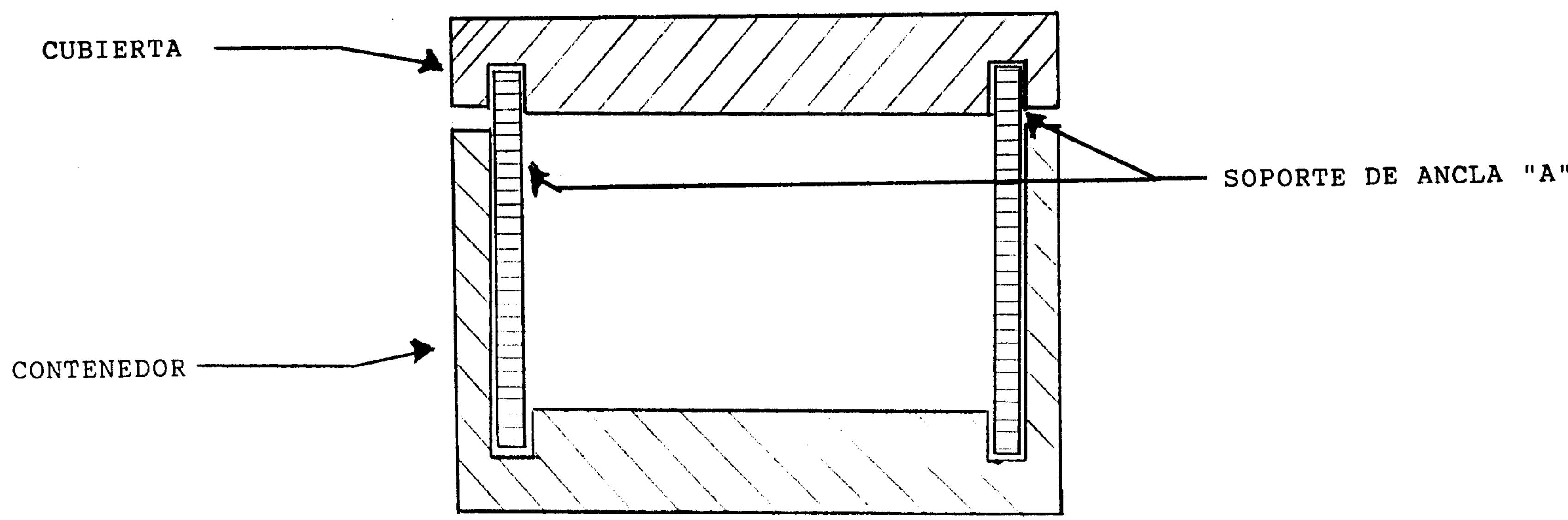


FIGURA 29: VISTA EN CORTE QUE MUESTRA EL ACOPLE DE LOS SOPORTES DE ANCLA "A" CON LA CUBIERTA



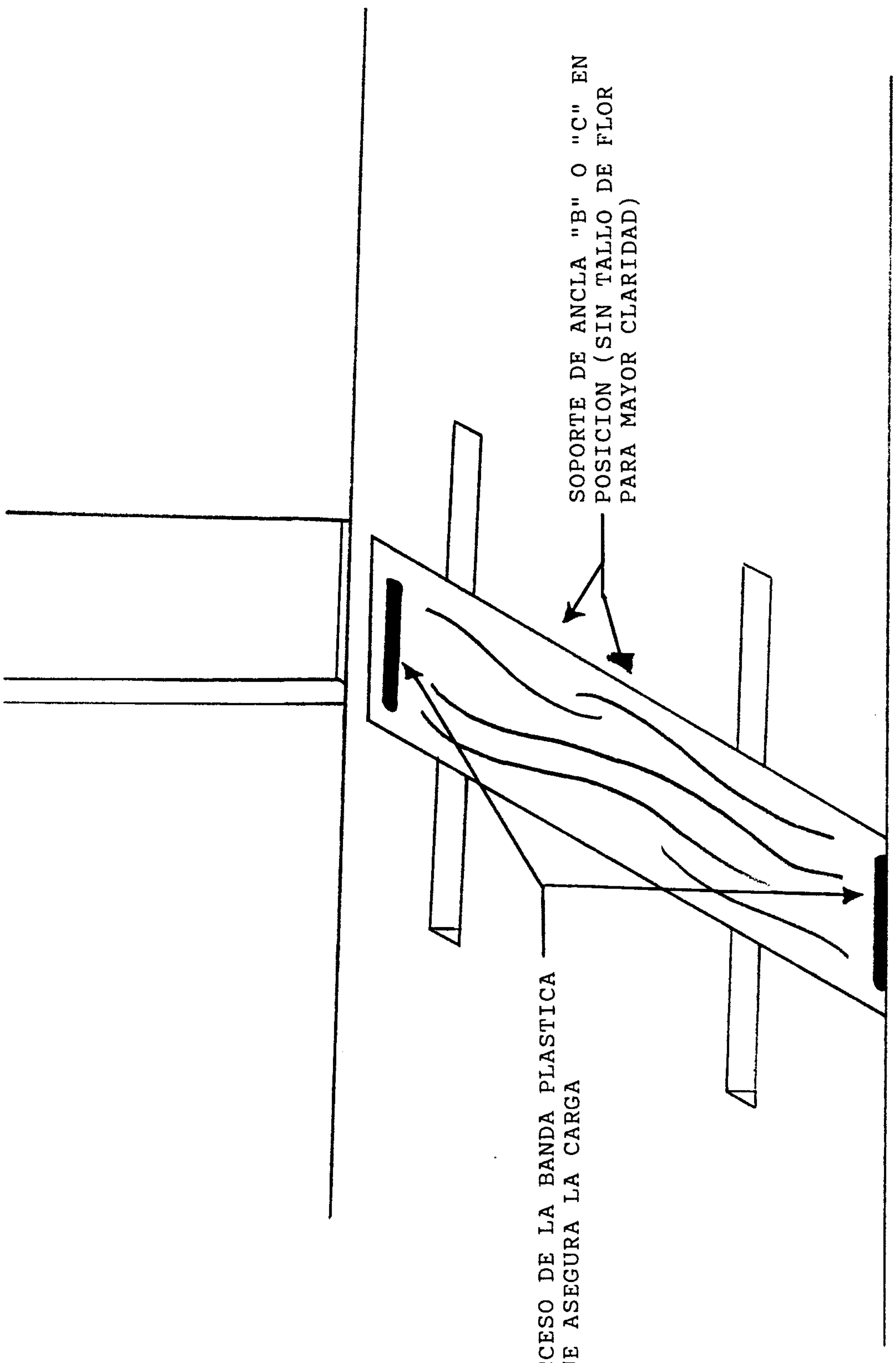

SOPORTE DE ANCLA "B" O "C" EN
POSICION (SIN TALLO DE FLOR
PARA MAYOR CLARIDAD)
ACCESO DE LA BANDA PLASTICA
QUE ASEGURA LA CARGA

FIGURA 30

FIGURA 31

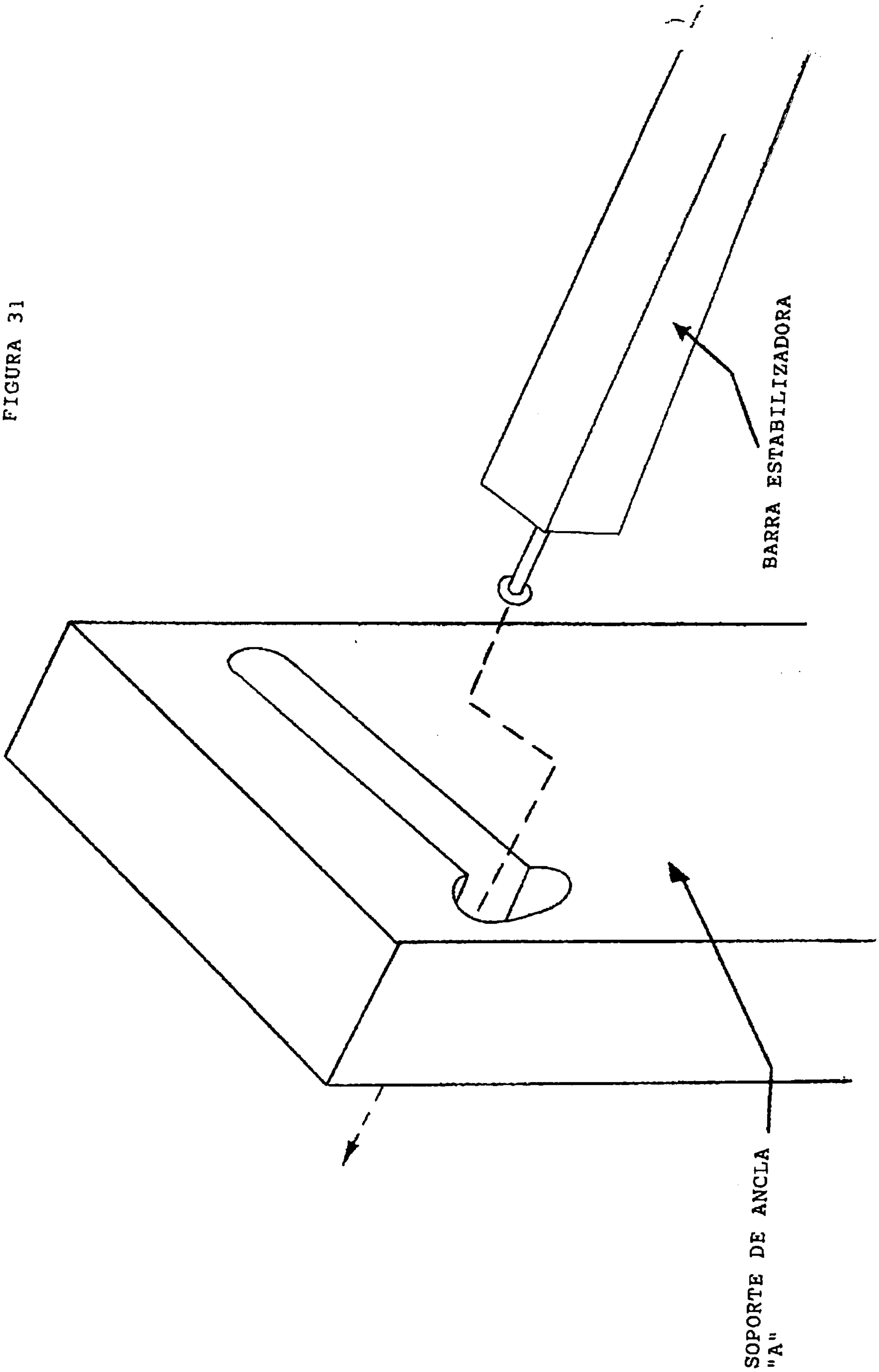


FIGURA 32: TANQUE EN POSICION SUJETADO POR EL SOPORTE DE ANCLA "A" Y LA BARRA ESTABILIZADORA (NO SE MUESTRA EL TALLO DE LA FLOR POR CLARIDAD)

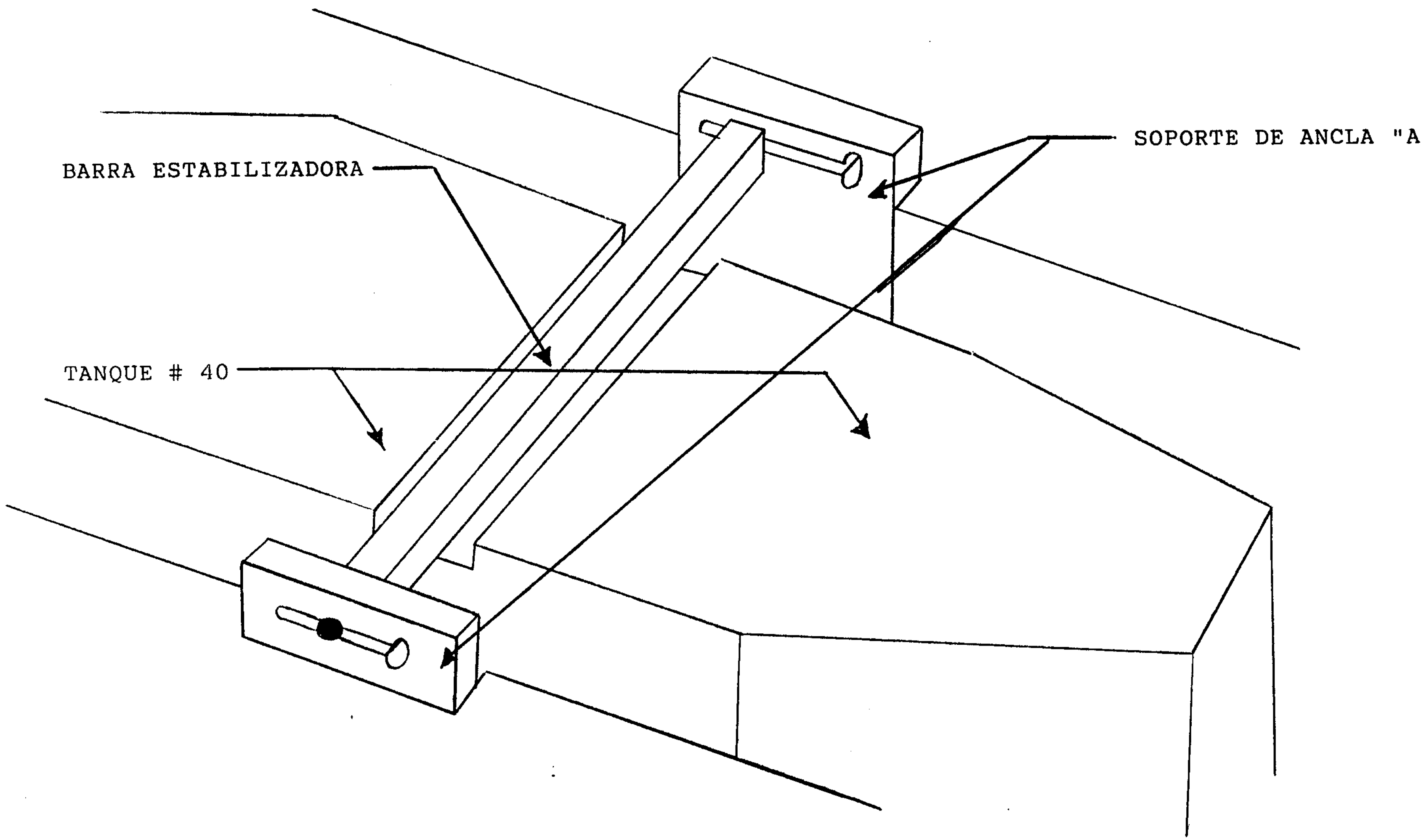


FIGURA 33

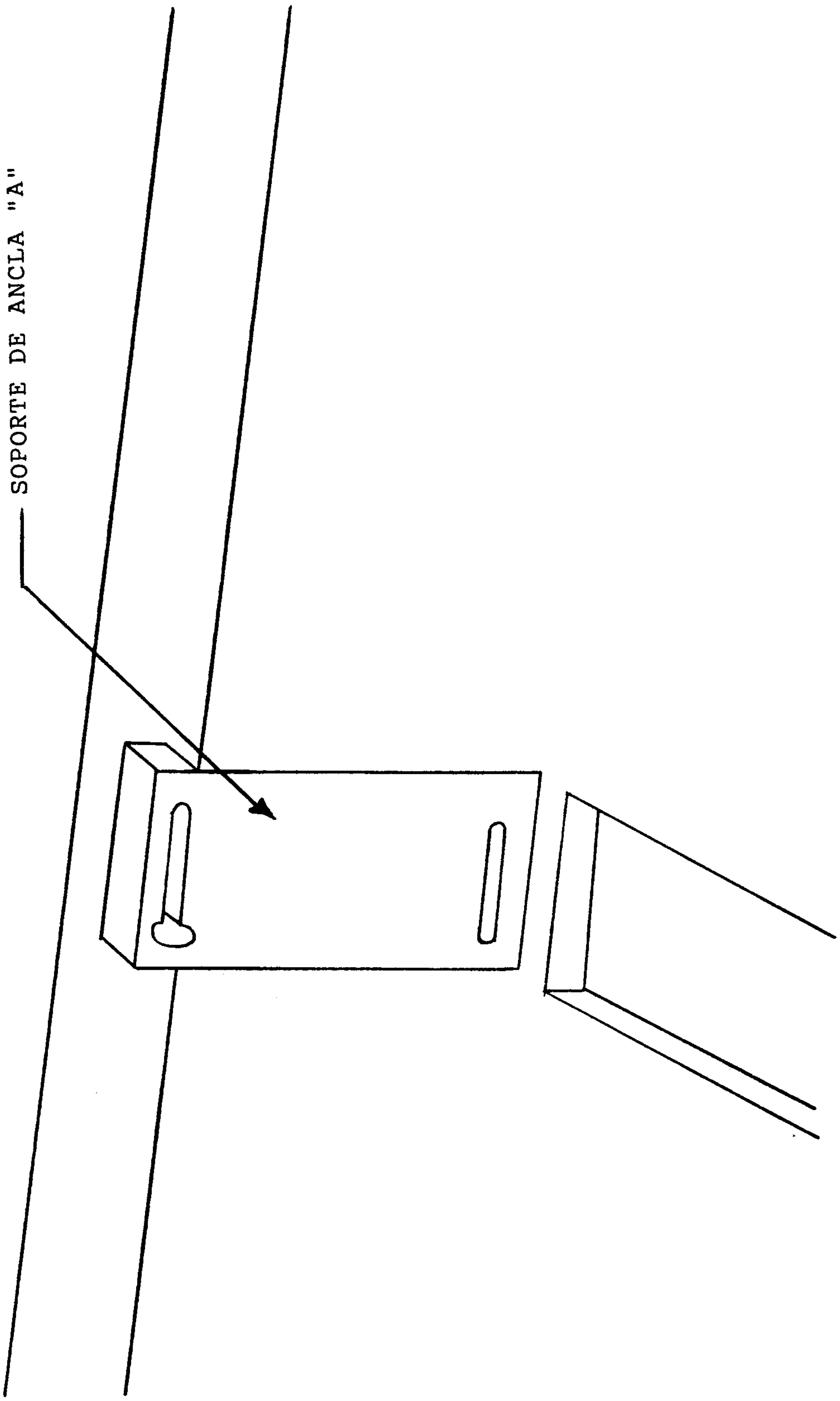


FIGURA 34: GRUPO DE SOPORTES

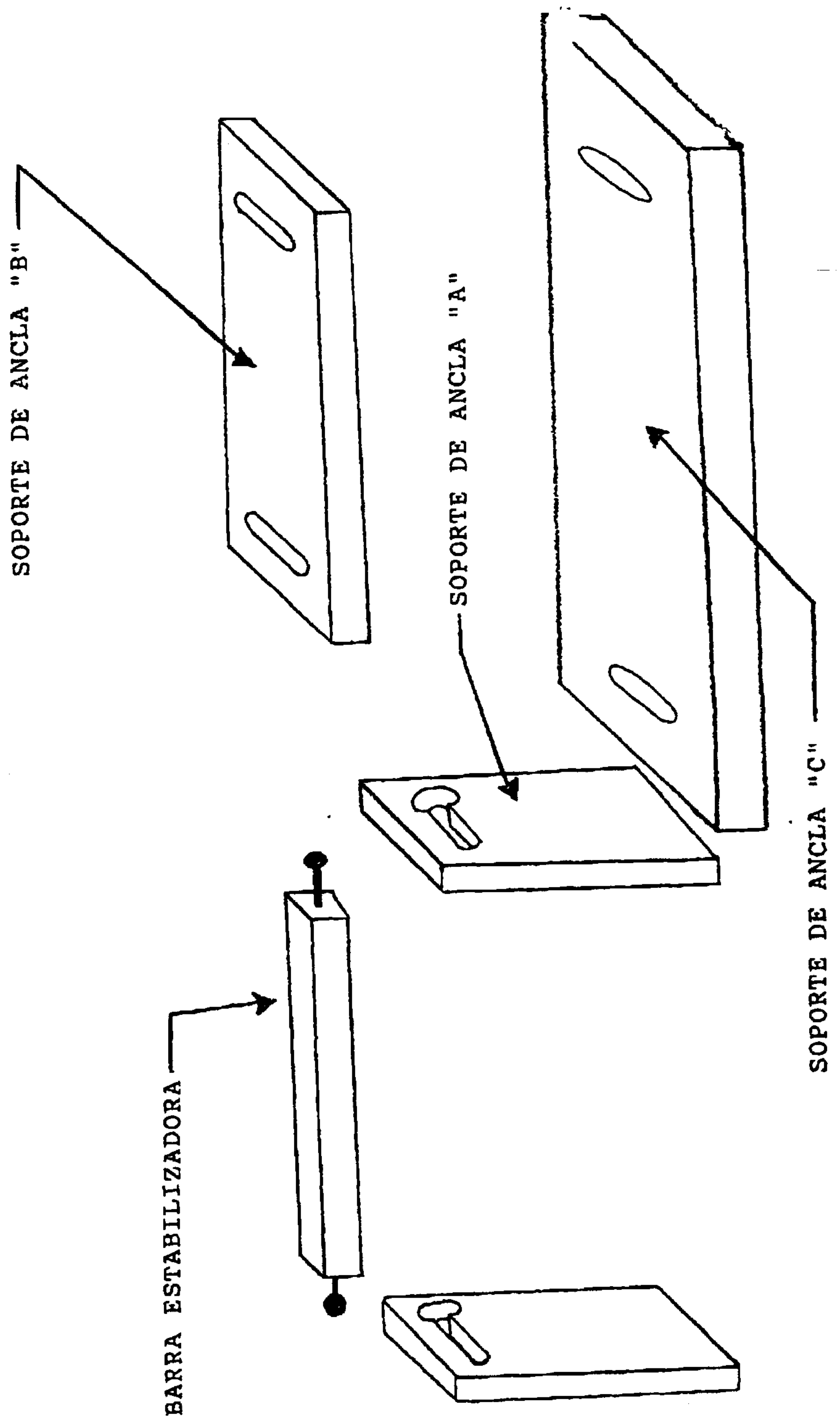


FIGURA 35: TANQUE No. 01 BOQX

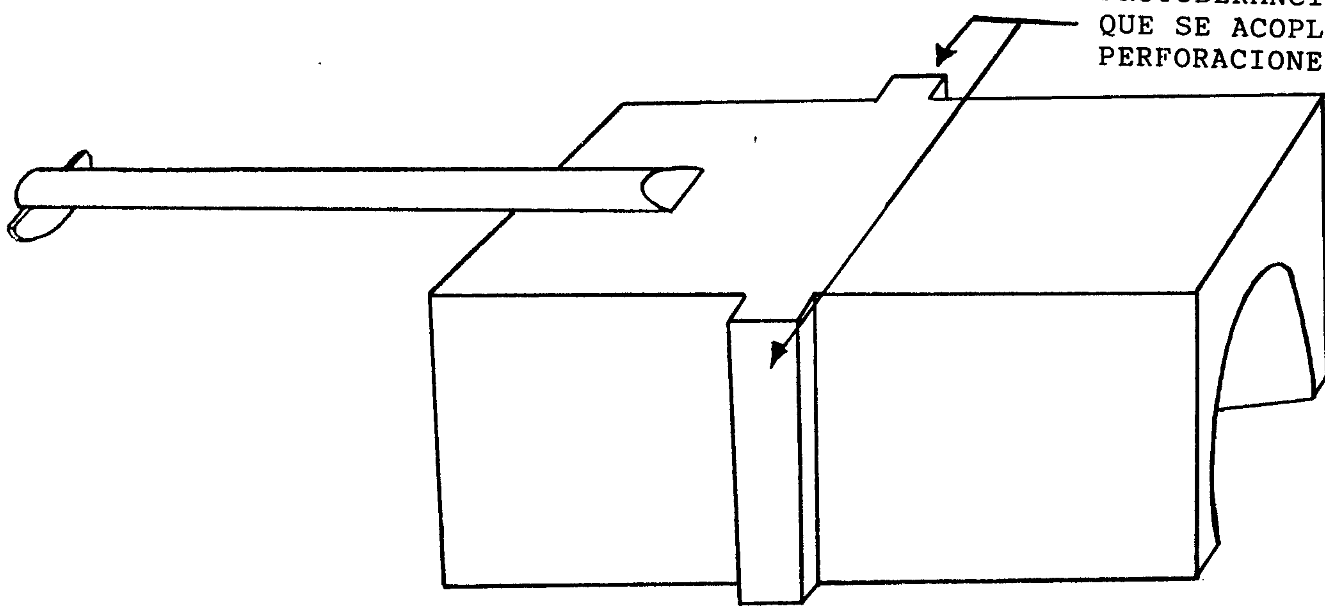


FIGURA No. 36

PRUEBAS DE ANALISIS TERMAL

PROPIEDADES DEL MATERIAL

Calor específico del agua	=	4.179 J/(kg K)
Calor específico de la fibra de madera	=	2.553 J/(kg K)
Conductividad termica del estamfón	=	3.1E-5 W/(K m)

DESCRIPCIONES GEOMETRICAS GENERALES

Contenedor del "Fish Box"	Largo =	96 cm
	Ancho =	40 cm
	Alto =	25 cm
	Grosor =	3.0 cm
Contenedor Medio	Largo =	106 cm
	Ancho =	26.5 cm
	Alto =	19 cm
	Grosor =	2.5 cm
Contenedor Medio Largo	Largo =	159 cm
	Ancho =	26.5 cm
	Alto =	19 cm
	Grosor =	2.5 cm
Contenedor Completo	Largo =	106 cm
	Ancho =	53 cm
	Alto =	19 cm
	Grosor =	3.0 cm
Contenedor Completo Largo	Largo =	159 cm
	Ancho =	53 cm
	Alto =	19 cm
	Grosor =	3.0 cm

CARACTERISTICAS GENERALES OPERACIONALES

Masa de Flores dentro del Contenedor.

Contenedor "Fish Box"	=	1.4 kg
Contenedor "Medio"	=	7.6 kg
Contenedor Medio Largo	=	11.4 kg
Contenedor "Completo"	=	15.2 kg
Contenedor Completo Largo	=	22.8 kg

Porcentaje de Agua en la masa de las Flores = 70%

Masa de Agua Cargada Colocada en los Tanques

Contenedor "Fish Box"	=	5.5 kg (L)
Contenedor "Medio"	=	4.0 kg (L)
Contenedor Medio Largo	=	6.0 kg (L)
Contenedor "Completo"	=	6.0 kg (L)
Contenedor Completo Largo	=	6.0 kg (L)

CONDICIONES AMBIENTALES GENERALES

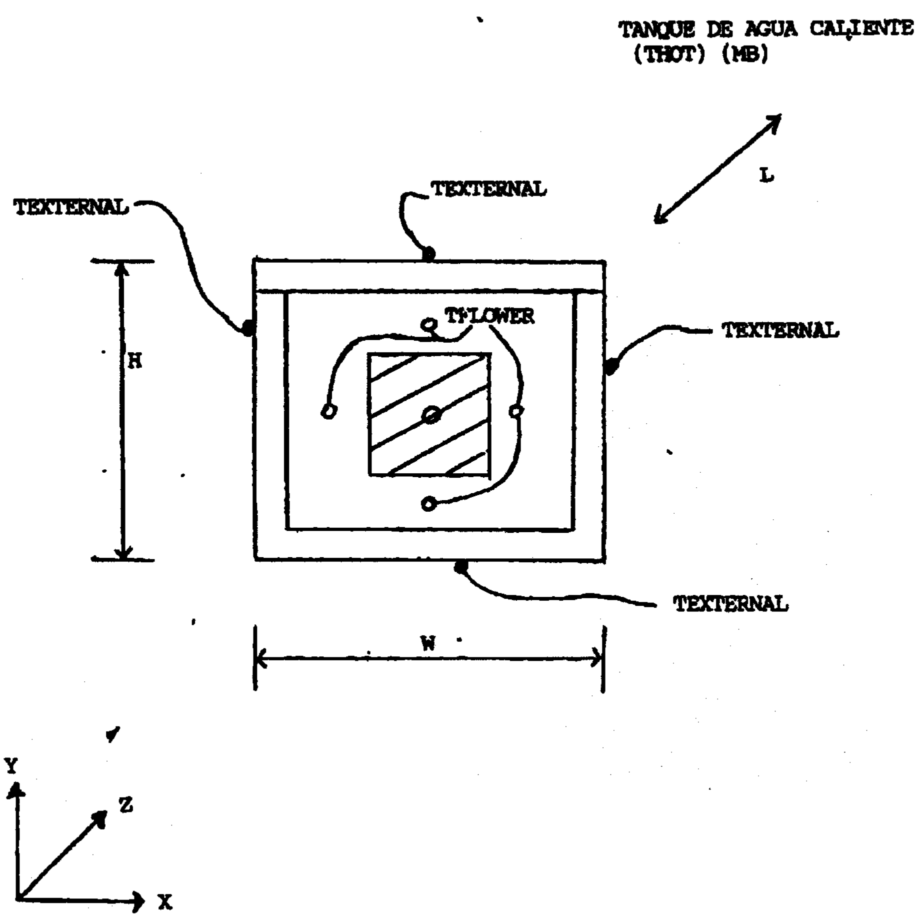
Temperatura externa constante	=	275 K
Temperatura inicial de la Flor	=	294 K
Temperatura inicial del agua caliente	=	332 K

EQUACION PARA LA TEMPERATURA TIEMPO REALES (DERIVADA DE LA ECUACION DIFERENCIAL DE FLUJO DE CALOR)

(((MA*((PERCENT/100)*CPWATER+(1-ERCENT/100)*CPWOOD)+CPWATER*MB+K*
(C25*60)*(2*L*W+2*L*H+2*H*W)/T))^-1)*(((MA*((PERCENT/100)*CPWATER+
(1-PERCENT/100)*CPWOOD)*TFLOWER+CPWATER*MB*THOT+K*(C25*60)*(2*L*W+2*L*
H+2*H*W)/T*TEXTERNAL)))

DONDE:
MA= MASA DE LA MASA DE LA FLOR
PERCENT=% MENOS DE LA MASA DE LA FLOR QUE ES AGUA
CPWATER = CALOR ESPECIFICIO DEL AGUA
CPWOOD = CALOR ESPECIFICO DE LA FIBRA DE MADERA
MB = MASA DE AGUA CALIENTE
K = CONDUCTIVIDAD TERMAL DEL ESTEROFON
TIME = TIMEPO EN LA EJECUCION ECUACIONAL
L = LARGO
H = ALTURA
W = ANCHO
T = GROSOR DEL ESTEROFON
TFLOWER = TEMPERATURA DE LA FLOR
THOT= TEMPERATURA DEL AGUA CALIENTE
TEXTERNAL= TEMEPRATURA CONSTANTE EXTERNA

ESQUEMATICO GENERAL



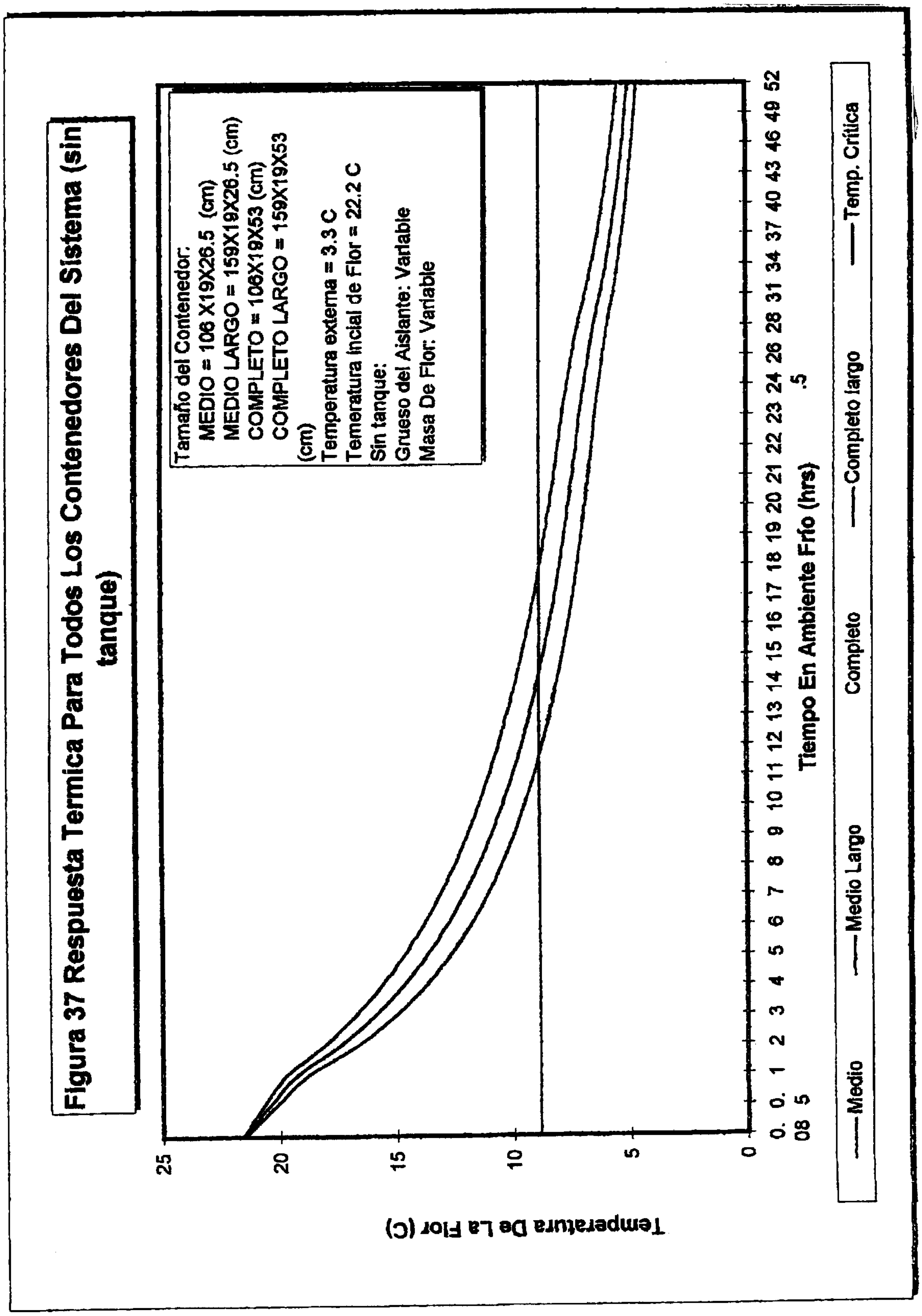


Figura 37 Respuesta Termica Para Todos Los Contenedores Del Sistema (sin tanque)

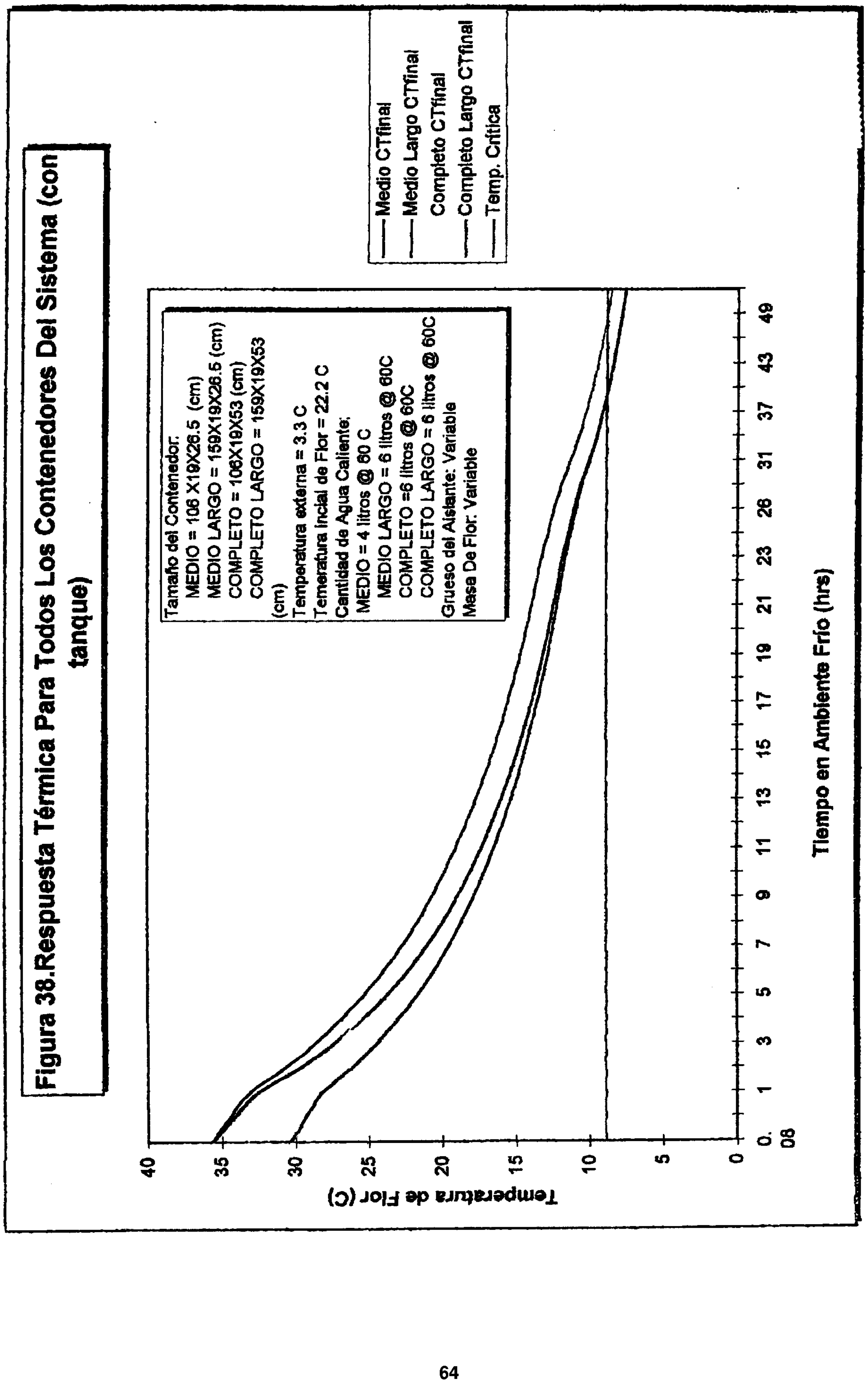


Figura 38.Respuesta Térmica Para Todos Los Contenedores Del Sistema (con tanque)

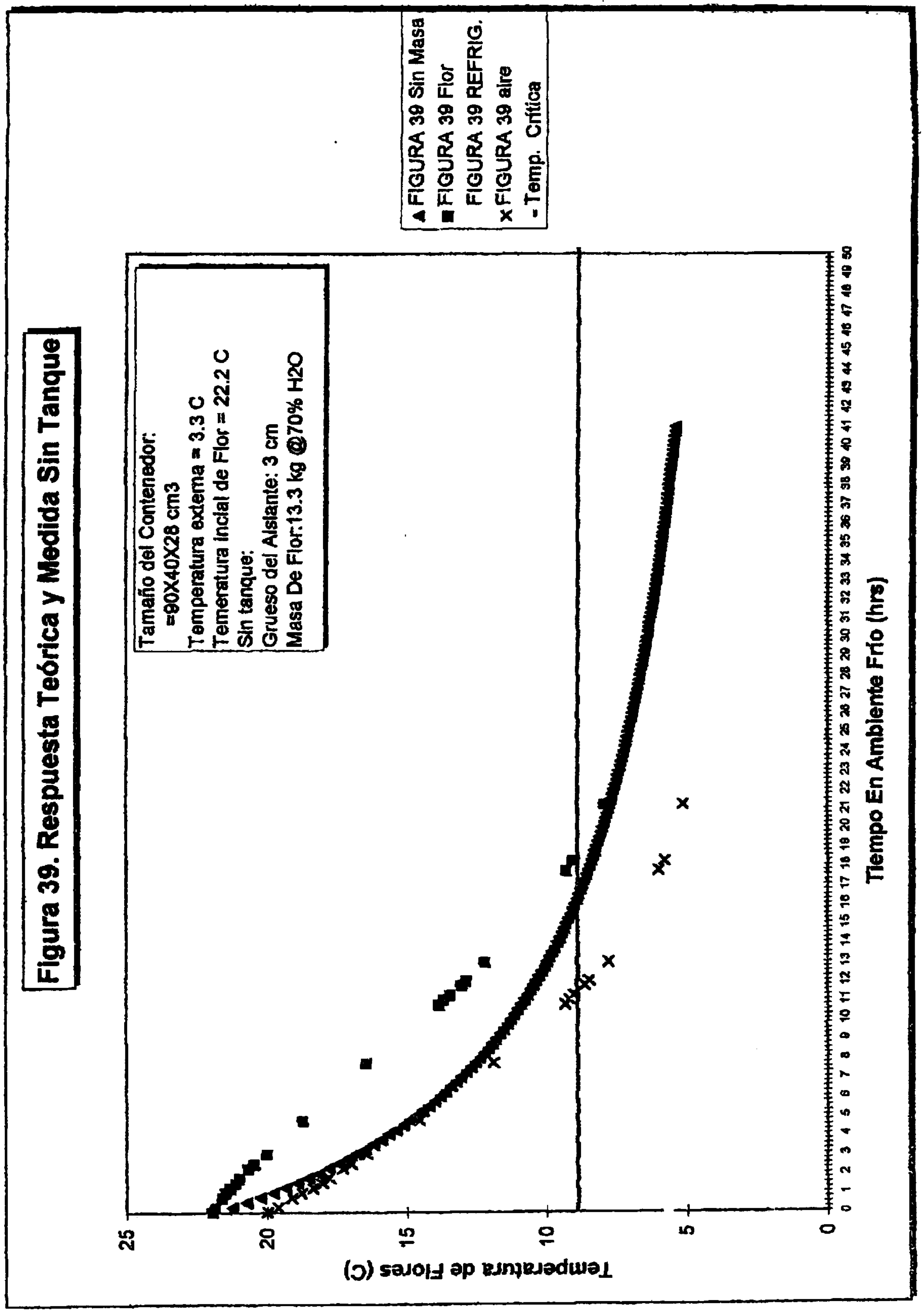


Figura 39. Respuesta Teórica y Medida Sin Tanque
Tamaño del Contenedor:
=90X40X28 cm3
Temperatura externa = 3.3 C
Temeratura Incial de Flor = 22.2 C
Sin tanque:
Grueso del Aislante: 3 cm
Masa De Flor:13.3 kg @70% H2O
FIGURA 39 Sin Masa
FIGURA 39 Flor
FIGURA 39 REFRIG.
FIGURA 39 aire
Temp. Crítica
Temperatura de Flores (C)
Tiempo En Ambiente Frío (hrs)
25
20
15
10
5
0

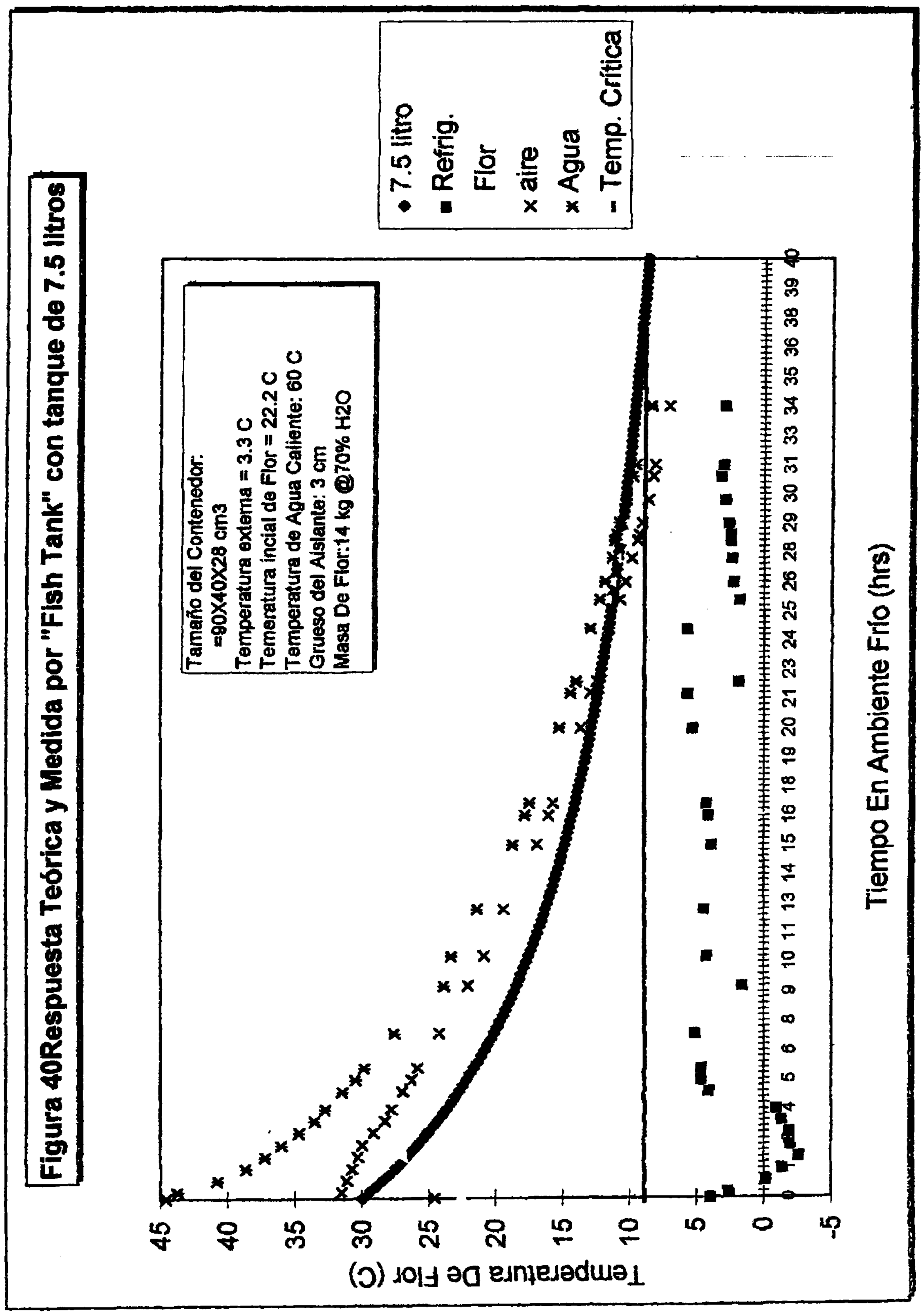


Figura 40Respuesta Teórica y Medida por "Fish Tank" con tanque de 7.5 litros
Tamaño del Contenedor:
=90X40X28 cm3
Temperatura externa = 3.3 C
Temeratura incial de Flor = 22.2 C
Temperatura de Agua Caliente: 60 C
Grueso del Aislante: 3 cm
Masa De Flor:14 kg @70% H2O
7.5 litro
Refrig.
Flor
aire
Agua
Temp. Crítica
Temperatura De Flor (C)
45
40
35
30
25
20
15
10
5
0
-5
0 2 4 5 6 8 9 10 11 13 14 15 16 18 19 20 21 23 24 25 26 28 29 30 31 33 34 35 36 38 39 40
Tiempo En Ambiente Frío (hrs)

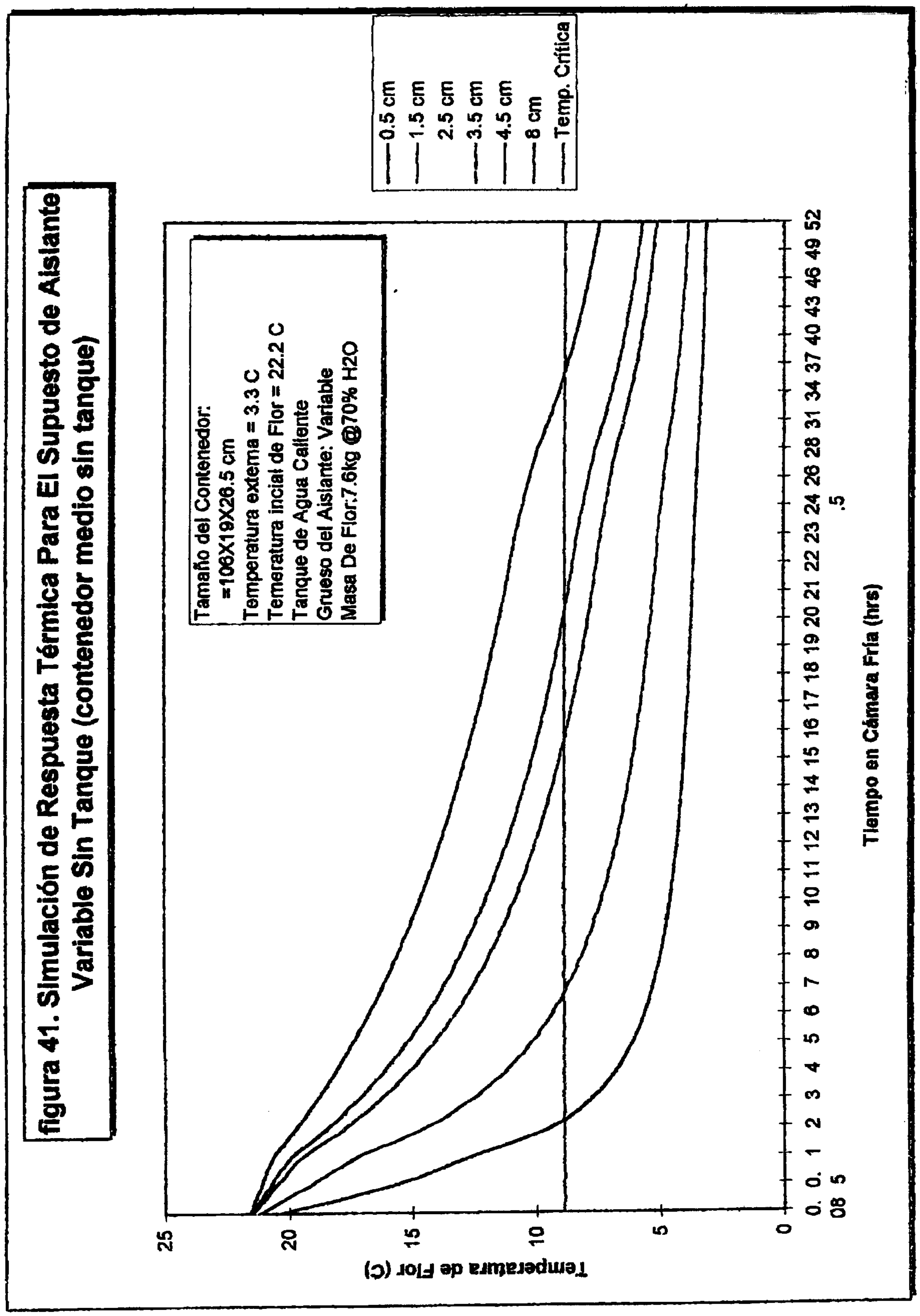
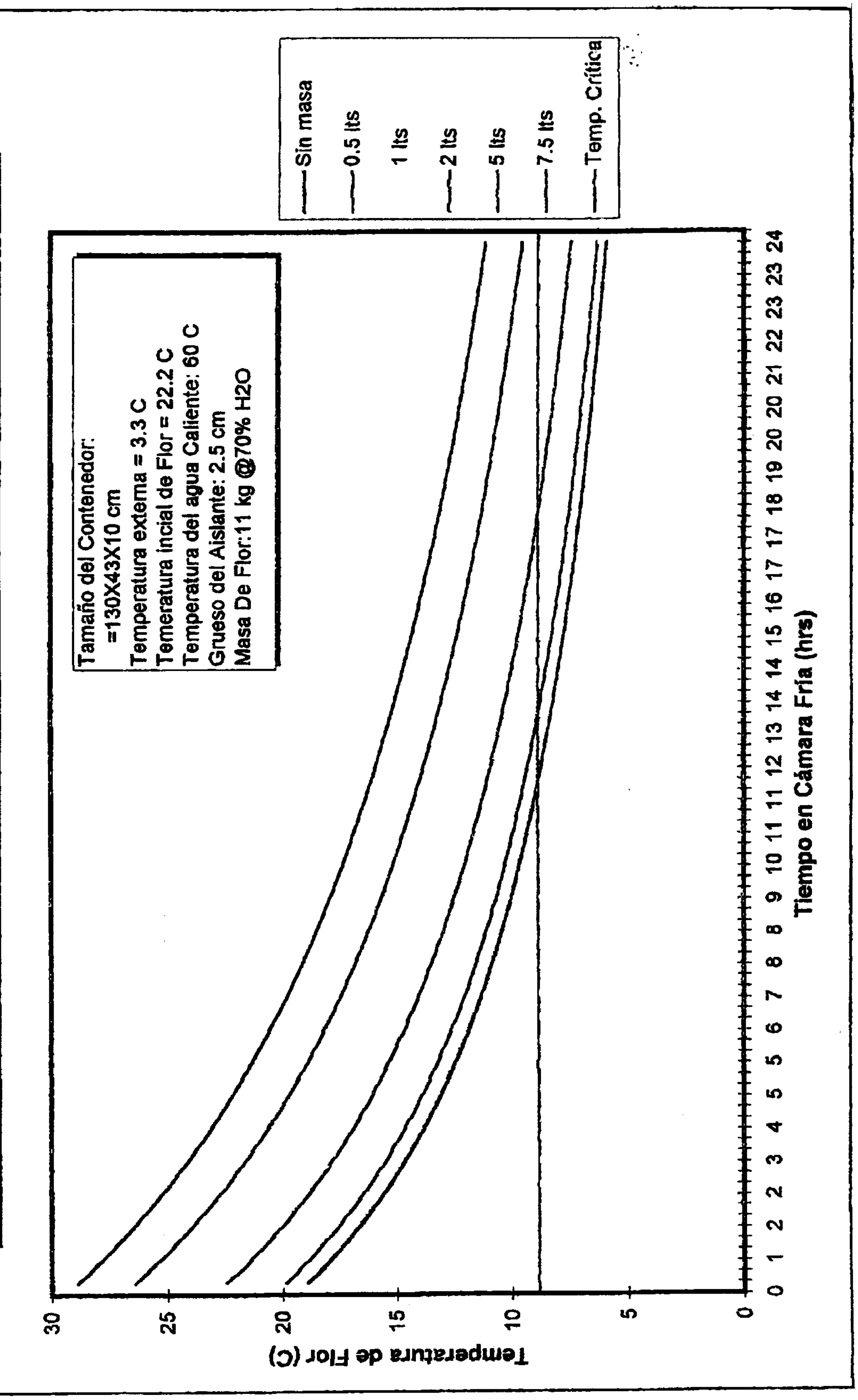


figura 41. Simulación de Respuesta Térmica Para El Supuesto de Aislante Variable Sin Tanque (contenedor medio sin tanque)

Figura 42. Simulación de Respuesta Térmica de Diferentes Cantidades De Agua Caliente (contenedor medio de 2.5 cm de grueso)



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 20 2262

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.6)
A	US 3 799 386 A (MADALIN) 26 March 1974 * column 1-6; figures 1-11 *	1-25	B65D85/50 B65D81/18 B65D81/38
A	US 5 134 858 A (ABBONDANZO) 4 August 1992 * column 1-8; figures 1-6 *	1-25	
A	US 5 405 012 A (SHINDLER) 11 April 1995 * column 1-6; figures 1-6 *	1-25	
A	DE 297 01 256 U (REIMERS) 24 April 1997 * page 1-23; figure 6 *	1-25	
A	EP 0 451 285 A (KANEGAFUCHI KAGAKUKOGYO KABUSHIKI KAISHA) 16 October 1991 * column 1-13; figures 1-19 *	1-25	
A	US 4 446 705 A (LOUCKS) 8 May 1984 * column 1-6; figures 1-4 *	1-25	
A	US 5 417 082 A (FOSTER) 23 May 1995 * column 1-8; figures 1-5 *	1-25	**TECHNICAL FIELDS SEARCHED (Int.Cl.6)**
A	FR 1 124 270 A (WORSCHITZ) 8 October 1956 * page 1-3; figures 1-3 *	1-25	B65D
A	US 2 486 957 A (MCGREW) 1 November 1949 * column 1-4; figures 1-5 *	1-25	
A	US 2 180 298 A (OHLHAVER) 14 November 1939 * page 1-3; figures 1-11 *	1-25	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	21 October 1998	Vollering, J

CATEGORY OF CITED DOCUMENTS

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