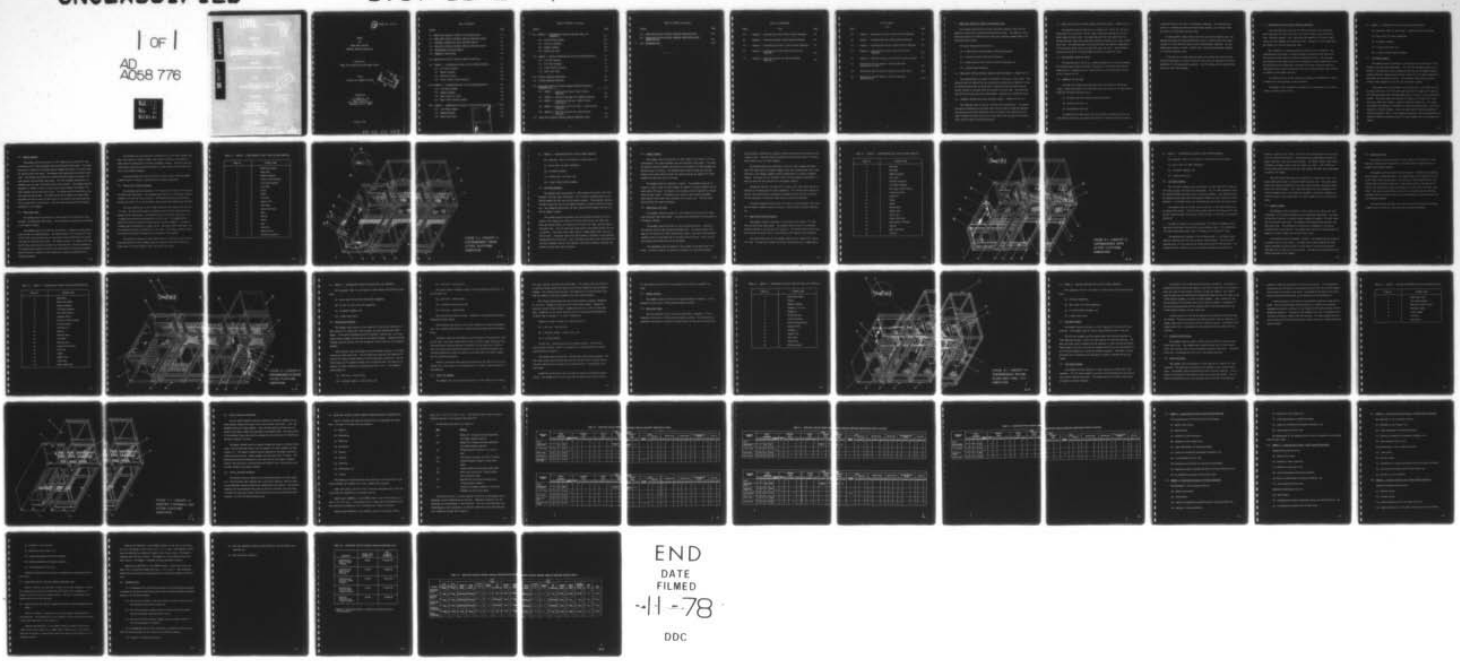
AD-A058 776 HENRY (J.J) CO INC MOORESTOWN N J F/G 15/5
BELOW HATCH VERTICAL MATERIAL HANDLING SUBSYSTEMS.(U)
OCT 76 N00600-75-D-0814
UNCLASSIFIED 1737-11-2 NL



END
DATE FILMED
-11-78
DDC

(2) REPORT NO. 1737-11-2

REPORT

ON

BELOW HATCH VERTICAL

MATERIAL HANDLING SUBSYSTEMS

Prepared For

NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER

Under

Contract No. N00600-75-D-0814

Prepared By

J. J. HENRY CO., INC.
West Park Drive
Mt. Laurel Industrial Park
Moorestown, N. J. 08057

October 1976

ABSTRACT

TABLE OF CONTENTS:

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

CONT

ABSTRACT

LIST OF ILLUSTRATIONS

LIST OF TABLES

1-1. BREAK BULK CAPABILITY CONCEPT FOR CONTAINER SHIPS

This concept would provide non-self sustaining container ships with the capability of being self sustaining palletized load ships. The capability would allow the removing of palletized loads from cargo containers stowed above or below pontoon hatch covers.

The system concept would consist of:

(a) an Above Hatch Vertical Material Handling Subsystem,

(b) a Universal Pontoon Hatch Cover Subsystem,

(c) a Below Hatch Vertical Material Handling Subsystem, and

(d) a Replenishment Subsystem.

1-2. ABOVE HATCH VERTICAL MATERIAL HANDLING SUBSYSTEM CONCEPT - REPORT 1737-11-1

The subsystem would be stowed in containers, located on a hatch cover. The subsystem would be removed from the containers and erected by an industrial truck. The subsystem would have the capability of removing palletized loads from containers located on the hatch cover and stacked up to four high. The palletized load would be transferred to the replenishment subsystem by an industrial truck.

1-3. UNIVERSAL PONTOON HATCH COVER SUBSYSTEM CONCEPT - REPORT 1737-10-1 & 2

The subsystem would fit any 20' container hold configuration. The subsystem would be penetrated by the below hatch vertical material handling subsystem. The subsystem would allow palletized loads to be moved from a below hatch container through the hatch cover and on to the hatch cover top plate by the below hatch vertical material handling subsystem.

1-4. BELOW HATCH VERTICAL MATERIAL HANDLING SUBSYSTEM CONCEPT - REPORT 1737-11-2

The subsystem would be contained in a volume of 8' wide by 20' long and a height equal to the distance from the lowest below deck container to one container above the hatch cover. The subsystem would have the capability of removing palletized loads from below hatch containers stacked up to 2 deep, 8 wide, and 6 high. The subsystem would lift the palletized load through a penetration in the universal hatch cover up to the hatch cover top plate. The palletized load would be moved to the replenishment system by an industrial truck.

1-5. REPLENISHMENT SUBSYSTEM CONCEPT

The subsystem would consist of a sending assembly and a receiving assembly. The subsystem would permit horizontal off-loading of palletized loads from the hatch cover of a sending ship to a receiving ship or a receiving land facility up to a distance of 150'.

1-6. COMMERCIAL APPLICATIONS

The break bulk capability system would allow off-loading of palletized cargo in those areas where a full facilities port exist and also, in those places where the following conditions exist;

(a) No hatch cover and container removal facilities,

(b) No dock facilities, or

(c) No anchoring facilities.

In those ports without hatch cover and container handling facilities, but with docking facilities, the sending ship would off-load the palletized cargo to

a receiving land station using a replenishment subsystem. The subsystem would consist of a sending and receiving replenishment assembly, or a railway receiving crane, or a motorized receiving crane.

In those harbors without docking facilities, but with anchoring areas, the sending ship would off-load the palletized cargo to a smaller break bulk receiving boat or a land receiving station using a replenishment subsystem. The subsystem would consist of either a sending and a receiving replenishment assembly or a floating receiver crane.

In the open sea, without anchoring areas, the sending ship would off-load the palletized cargo to a smaller break bulk ship using the sending and receiving assemblies of the replenishment subsystem. The off-loading would be accomplished, while both ships were underway.

2-1. BELOW HATCH VERTICAL MATERIAL HANDLING SUBSYSTEMS

Five subsystems were developed for lifting palletized cargo from below hatch containers up to the hatch cover for further staging to the off-loading area. Subsystem Concepts 1 and 2 would have the capability of lifting a small industrial truck together with palletized loads - Concepts 3, 4 and 5 would have the capability of lifting palletized loads.

Each assembly of a subsystem would be enclosed in a 20' container. The subsystem would be located in container guides and extend from the tank top to one container height above the universal pontoon hatch cover. The subsystem would penetrate the largest centerline or starboard universal pontoon hatch cover. The positioning of the subsystem is designed for the most effective above and below hatch traffic control, above hatch off-load staging and above hatch anchored or underway replenishment operation.

All function details of the figures are purposely drawn OVERSIZE to clearly illustrate the unique aspects of each subsystem.

The weights of the subsystems and assemblies are approximate and are calculated on a safety factor of four.

3-1. CONCEPT 1 - CONTAINERIZED PINION LIFTED PLATFORM SUBSYSTEM

This subsystem, Table 3-1 and Figure 3-1 would feature the following:

(a) two or more lift shaft assemblies,

(b) an adapter assembly,

(c) a hatch cover house, and

(d) a pinion lifted platform assembly.

3-2. Lift Shaft Assembly

The assembly would be enclosed in a 20'0" deep by 8'0" wide by 8'6" high envelope and weigh about 4380 pounds. The lift shaft assemblies would be installed in the container guides, between the tank top and the adapter assembly. Standard container fasteners would be used to affix the lift shaft assemblies to each other and the adapter assembly. The assemblies would guide the pinion lifted platform between the tank top and the adapter assembly.

The container would be separated into two sections, a lift shaft area and an access shaft area. The lift shaft area would be 15'0" deep by 8'0" wide by 8'6" high and would contain platform guide rails, lift racks, and a platform controller. The access shaft area would be 5'0" deep by 8'0" wide by 8'6" high. The access shaft would contain a vertical ladder and access area. The access would permit the entrance of personnel to any below hatch container, via the appropriate lift shaft assembly. Also, the access would allow the connection of ancillary equipment, such as fire protection equipment, ventilating equipment and electrical power to each below hatch lift shaft assembly and its associated containers.

3-3. Adapter Assembly

The assembly would be enclosed in a 20'0" deep by 8'0" wide by 2'0" high (retracted) or 8'6" high (extended) area and weigh about 4270 pounds. The assembly would be installed in container guides, between the topmost lift shaft assembly and the hatch cover house. The assembly would penetrate the universal hatch cover. The assembly would guide the pinioned platform between the topmost lift shaft assembly and the hatch cover house. The final assembly configuration is dependent upon the type of universal hatch cover selected. The assembly would be adjustable in height in order to take up the distance between the topmost lift shaft assembly and the hatch cover house. The height would be controlled by support posts and jack screws. The support posts would regulate the rough height adjustment and would consist of inner posts or box section that would telescope into an outer post or box sections. The jack screws would provide fine height adjustment of the assembly.

3-4. Hatch Cover House

The assembly would be enclosed in a 20'0" deep by 8'0" wide by 8'6" high envelope and weigh about 5265 pounds. The house would be mounted on and attached to the adapter assembly.

The assembly would be divided into two sections. Entrance to each section would be made via watertight doors. The longer section, 15'0" deep by 8'0" wide by 8'6" high, would provide access to the pinion lifted platform and its palletized loads at the hatch cover level. The smaller section, 5'0" deep by 8'0" wide by 8'6" high, would provide an entrance to the below deck lift shaft assemblies. This section would provide an area for the installation of ventilation equipment and also furnish a terminal for the connection of electrical power and fire fighting equipment.

The platform racks and guide rails installed in the lift shaft assembly and hatch cover would be standard lengths, while those installed in the adapter assembly would be manufactured in various incremental lengths. The racks and rails of the hatch cover house would be adjustable in order to mate with the racks and rails of the adapter assembly.

The space between the hatch cover house, universal hatch cover and adapter assembly would be closed by a sealing plate and gasket subassembly.

3-5. Pinion Lifted Platform Assembly

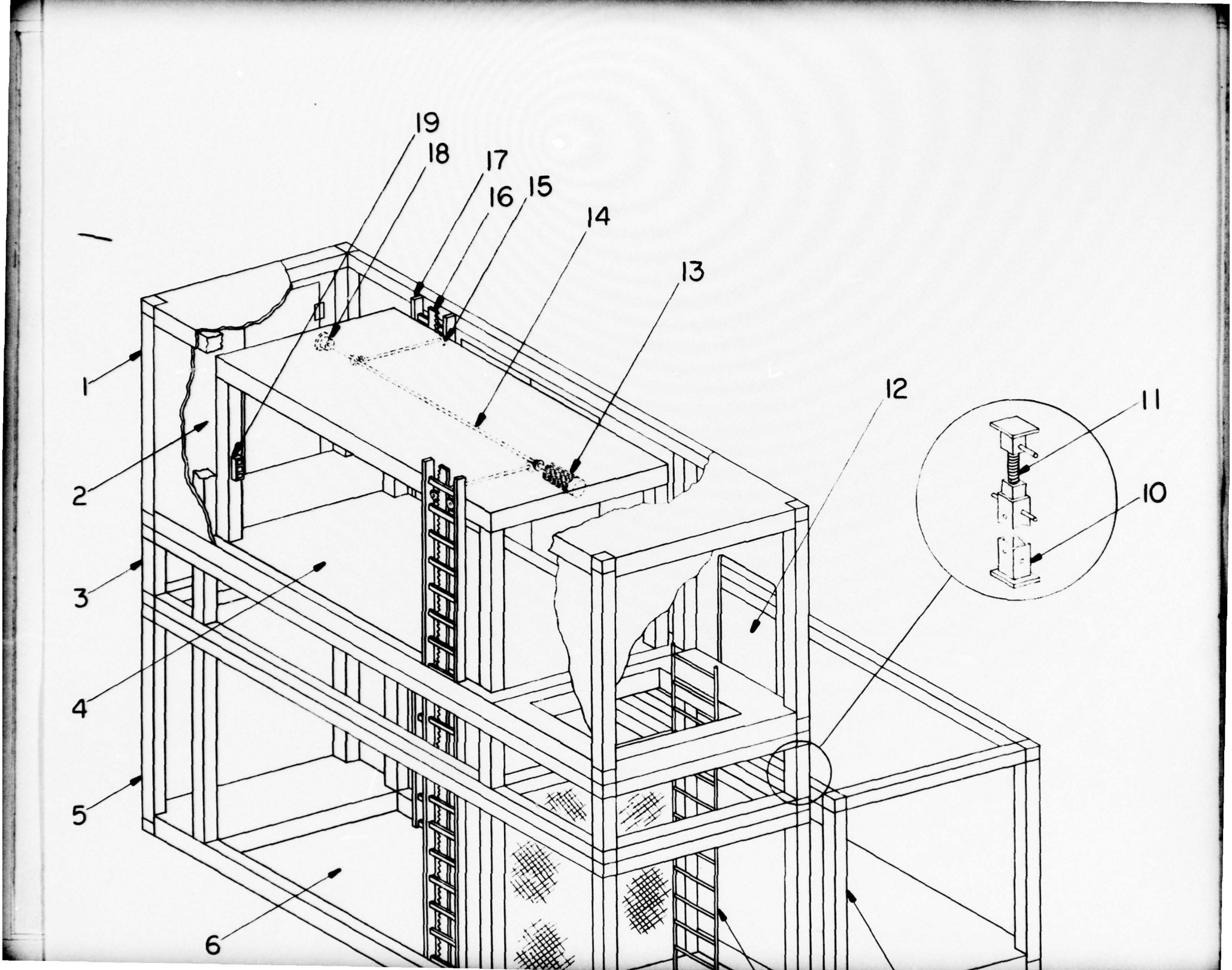
The assembly would be contained in 13'6" deep by 6'6" wide by 7'0" high area and weigh about 3000 pounds. The assembly would consist of a horizontal platform attached to an open box-like structure. The platform would have rollers which contact the guide rails to avoid binding, while raising and lowering the platform.

The cargo landing area of the assembly would be 12'6" deep by 5'6" wide by 7'0" high. The area would support an industrial truck and two palletized loads weighing up to 16000 pounds. The assembly would be raised and lowered by a set of ganged pinions which would engage the vertical racks. The ganged pinions would be driven by an electrical motor through a gearing assembly. The gearing assembly would be attached to a safety device. The device would sense power loss or overspeed and bring the platform to a safe stop. The pinions, gearing, motors and safety device would be mounted in the overhead of the assembly.

The raising or lowering of the platform from or to the hatch cover house to any below hatch lift shaft assembly could be controlled from the platform, any below hatch lift shaft assembly, and/or the hatch cover house.

TABLE 3-1. CONCEPT 1 - CONTAINERIZED PINION LIFTED PLATFORM SUBSYSTEM

Index No.	Assembly Name
1	Hatch Cover House
2	House Door
3	Adapter Assembly
4	Pinion Lifted Platform
5	Lift Shaft Assembly
6	Lift Shaft
7	Access
8	Ladder
9	Flat Rack
10	Support Post
11	Jack Screw
12	Access Shaft Door
13	Motor
14	Gearing
15	Pinion
16	Rack
17	Guide Rail
18	Safety Device
19	Platform Controller


19
18
17
16
15
14
13
12
11
10
1
2
3
4
5
6

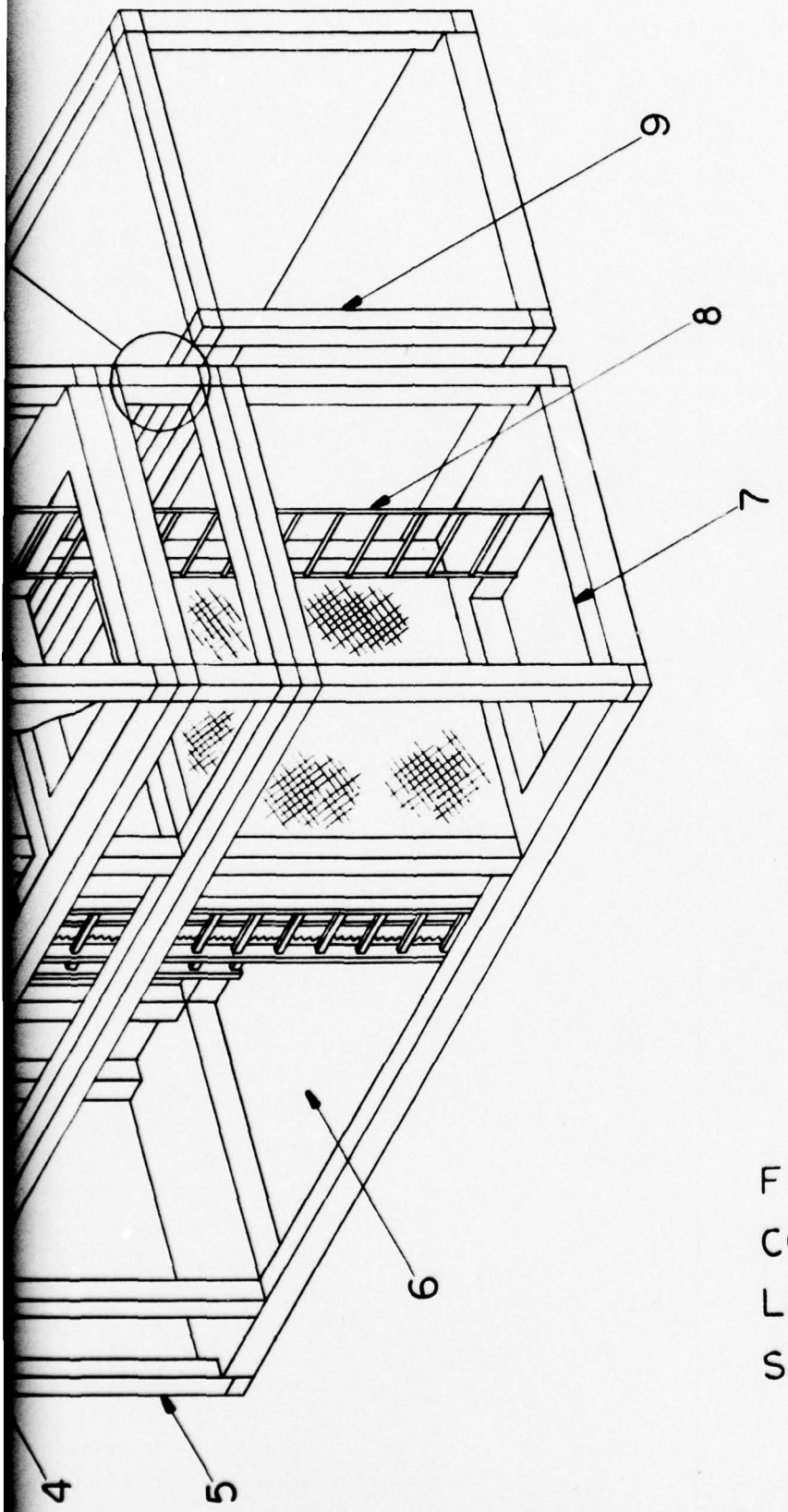


FIGURE 3-1. CONCEPT I-
CONTAINERIZED PINION
LIFTED PLATFORM
SUBSYSTEM

4-1. CONCEPT 2 - CONTAINERIZED ROPE LIFTED PLATFORM SUBSYSTEM

This subsystem, Table 4-1 and Figure 4-1 would consist of:

(a) two or more lift shaft assemblies,

(b) an adapter assembly,

(c) a hatch cover lift house, and

(d) a rope lifted platform assembly.

4-2. Lift Shaft Assembly

The assembly would be enclosed in a 20'0" deep by 8'0" wide by 8'6" high envelope and weigh about 4270 pounds. The lift shaft assemblies would be installed between the tank top and the adapter assembly. The assemblies would be affixed to each other and to the adapter assembly by standard container fasteners. The assemblies would guide the rope lifted platform between the tank top and the adapter assembly.

The assembly would be separated into two functional sections, the first section, 15'0" deep by 8'0" wide by 8'6" high, would be the lift shaft area; while the second section, 5'0" deep by 8'0" wide by 8'6" high, would be the access shaft area. The lift shaft area would contain the platform guide rails and a controller. The access shaft would contain a sloped ladder with a hand rail and an access. The access would allow the entrance of personnel to any container located below the hatch cover. Also, the access would permit the installation of ancillary equipment, such as fire fighting, ventilation equipment and power connections to each below hatch container.

4-3. Adapter Assembly

The assembly would be contained in a 20'0" deep by 8'0" wide by 2'0" high (retracted) or 8'6" high (extended) area and weigh about 4160 pounds. The assembly would be installed between and affixed to the topmost lift shaft assembly and the hatch cover lift house. The assembly would project through the universal pontoon hatch cover and would guide the platform between the topmost lift shaft assembly and the hatch cover lift house.

The assembly would be adjustable in height. The adjustment would be required, in order to take up space between the topmost lift shaft assembly and the hatch cover lift house. The height of the assembly would be regulated by support posts and jack screws. The support post, used for coarse height adjustment, would contain inner posts which telescope into an outer post. The jack screw would provide fine height adjustment.

4-4. Hatch Cover Lift House

The assembly would be enclosed in a 20'0" deep by 8'0" wide by 8'6" high area and weight about 5655 pounds. The house would be mounted on and attached to the adapter assembly.

The assembly would be divided into two functional sections. Entrance to the sections would be made through watertight doors. The larger section 15'0" deep by 8'0" wide by 8'6" high, would provide access to the rope lifted platform together with its palletized load at the hatch cover top plate. Also, the larger section would contain the hoist subassembly.

The subassembly would be mounted in the overhead of the hatch cover lift house. The hoist would be an electrically powered wire rope winch assembly.

The winch would incorporate an automatic holding brake which would energize after a power failure. The winch would be controlled from the hatch cover lift house, the platform or any lift shaft assembly.

The platform guide rails installed in the lift shaft assembly and hatch cover lift house would be standard lengths, while the platform guide rails to be installed in the adapter assembly would be manufactured in various incremental lengths. The guide rails of the hatch cover lift house would be adjustable, in order to mate with the guide rails of the adapter assembly.

The smaller section, 5'0" deep by 8'0" wide by 8'6" high, would provide an entrance to the below deck lift shaft assemblies. This section would provide an area for the installation of ventilation equipment and also furnish a terminal for the connection of electrical power and fire protection equipment.

The space between the hatch cover lift house, universal pontoon hatch cover, and the adapter assembly would be closed by a sealing plate and gasket subassembly.

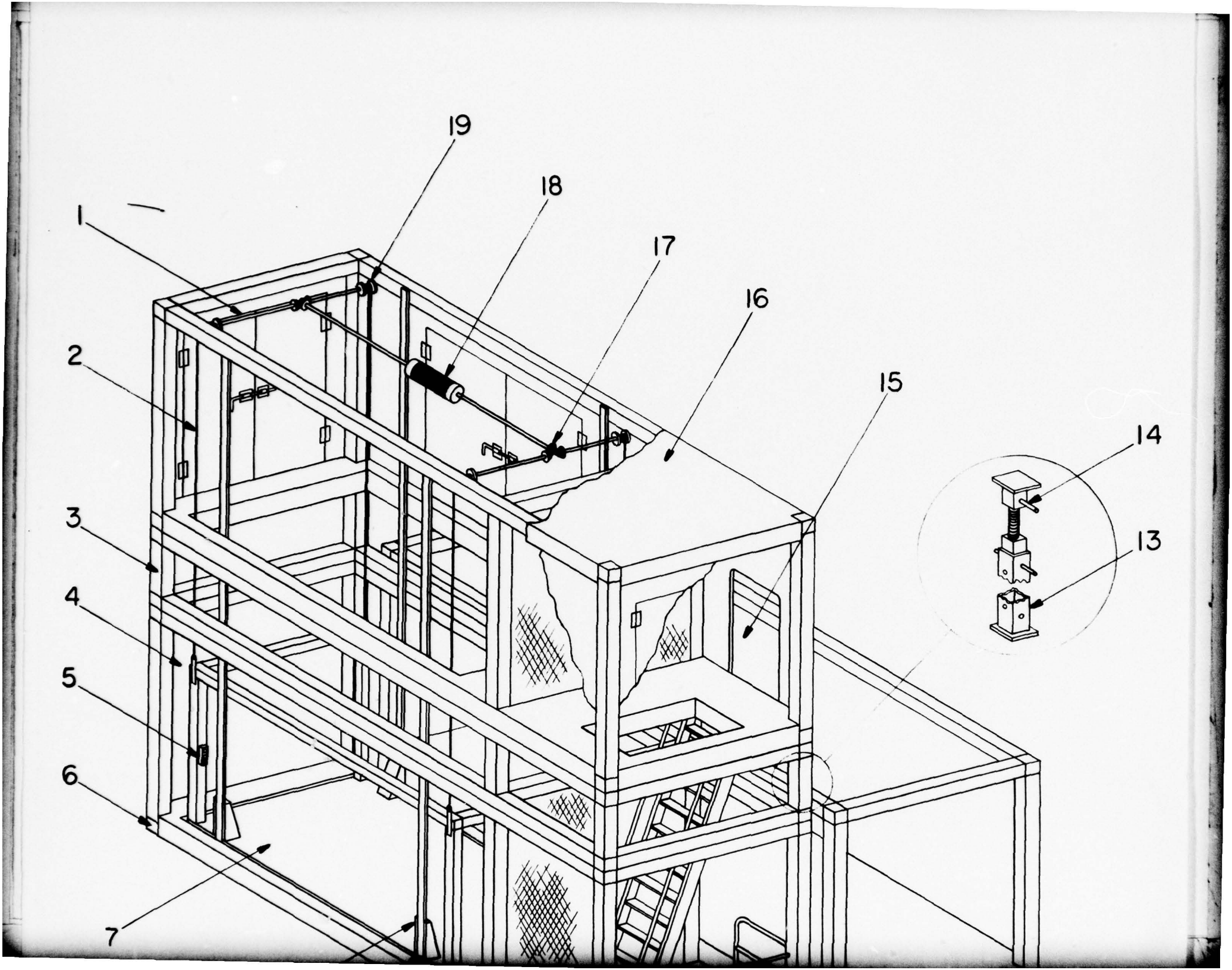
4-5. Rope Lifted Platform Assembly

The assembly would be contained in 13'6" deep by 6'6" wide by 7'0" high area and weigh about 2560 pounds. The assembly would consist of a horizontal platform attached to an open box-like structure. The platform would have rollers which contact the guide rails to avoid binding, while operating the subsystem.

The cargo landing area of the assembly would be 12'6" deep by 5'6" wide by 7'0" high. The area would support palletized loads weighing up to 16000 pounds.

TABLE 4-1. CONCEPT 2 - CONTAINERIZED ROPE LIFTED PLATFORM SUBSYSTEM

Index No.	Assembly Name
1	House Door
2	Wire Rope
3	Adapter Assembly
4	Lift Shaft
5	Platform Controller
6	Lift Shaft Assembly
7	Wire Rope Lifted Platform
8	Frame and Rollers
9	Guide Rail
10	Access
11	Ladder
12	Access Shaft
13	Support Post
14	Jack Screw
15	Access Shaft Door
16	Hatch Cover Lift House
17	Gearing
18	Motor and Brake
19	Winches


19
18
1
17
16
2
15
14
3
13
4
5
6
7

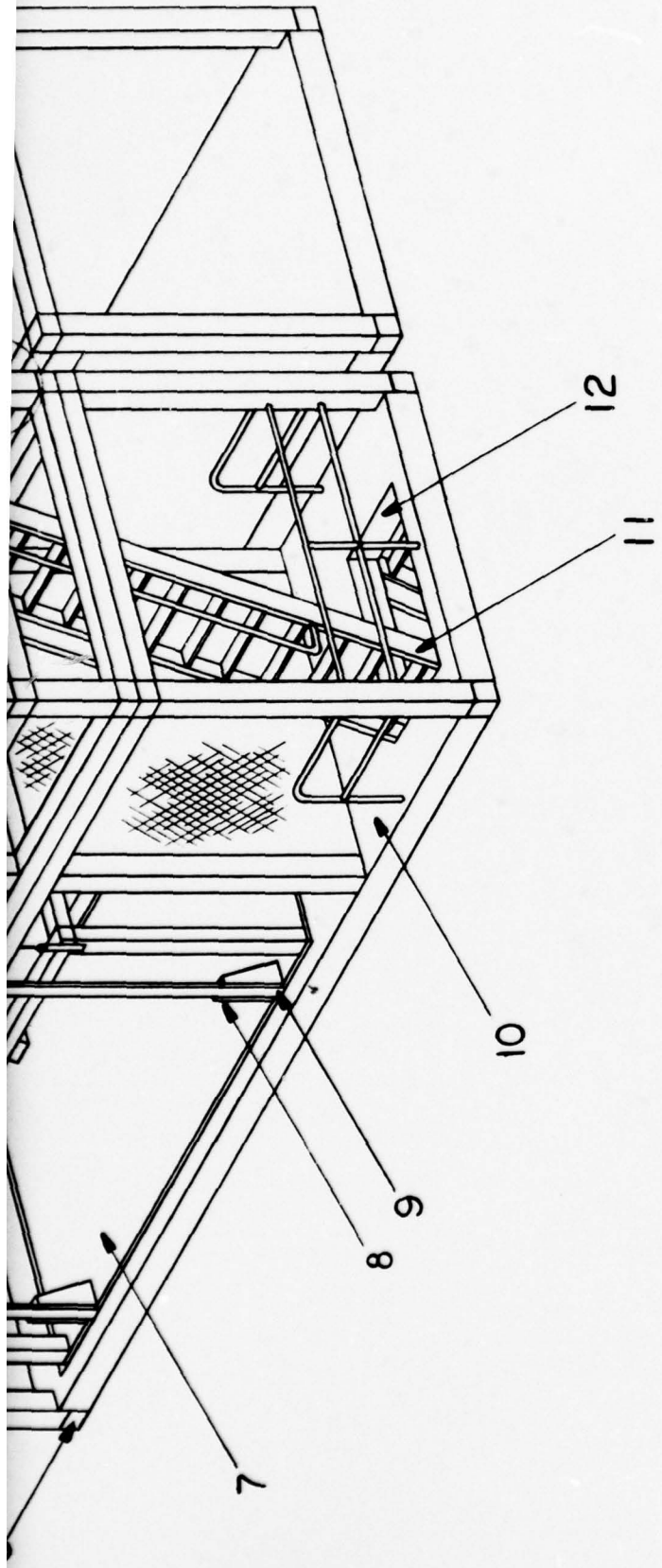


FIGURE 4-1. CONCEPT 2 - CONTAINERIZED ROPE LIFTED PLATFORM SUBSYSTEM

5-1. CONCEPT 3 - CONTAINERIZED SCISSORS LIFTED PLATFORM SUBSYSTEM

This subsystem, Table 5-1 and Figure 5-1 would feature the following:

(a) two or more lift shaft assemblies,

(b) an adapter assembly, and

(c) a hatch cover house.

5-2. Lift Shaft Assembly

The lift shaft assembly would be contained in a 20'0" deep by 8'0" wide by 8'6" high envelope and weigh about 5430 pounds. The lift shaft assemblies would be installed between the tank top and the adapter assembly. The assemblies would be attached to each other and to the adapter assembly by quick acting and locking fasteners. The assembly would lift the palletized load to the hatch cover house.

The assembly would be divided into two sections, a lift shaft section and an access shaft section. The lift shaft section would be 15'0" deep by 8'0" wide by 8'6" high and contain the scissors lifted platform, a lift shaft, and platform controller.

As shown in Figure 5-1, the platform and lift shaft are arranged so that they would be reversed (fore-to-aft) at each container level. The platform and lift shaft would occupy equal areas, 7'6" deep by 6'6" wide by 8'6" high.

The subsystem would operate in the following manner. A palletized cargo would be loaded on the first level scissors lifted platform. The first level platform would lift the cargo to the second level scissors lifted platform. The platform would be lifted by a pair of scissors positioned by traveling nuts

driven by a motor via gear train. The first level platform would roll the cargo on to the second level platform. The feed would be accomplished by belted conveyors contained in the top of both platforms. The belted conveyor would be positioned by a conveyor roller driven by a motor via a chain. This lifting and rolling action would continue until the cargo reached the hatch cover house where it would be off-loaded.

The access shaft area would be 5'0" deep by 8'0" wide by 8'6" high. The access shaft would contain a vertical ladder and access area. The access would permit the entrance of personnel to any below hatch container through the appropriate lift shaft assembly. Also, the access would allow the connection of ancillary equipment such as fire protection equipment, ventilation equipment and electrical power to each below hatch lift shaft assembly and its associated container.

5-3. Adapter Assembly

The assembly would be enclosed in a 20'0" deep by 8'0" wide by 2'0" high (retracted) or 8'0" high (extended) area and weigh about 4000 pounds. The assembly would be installed in container guides, between the topmost lift shaft assembly and the hatch cover house. The assembly would penetrate the universal pontoon hatch cover. The penetration configuration is dependent on the type of universal hatch cover selected. The assembly would take up the space between the topmost lift shaft assembly and the hatch cover house.

The assembly would be adjustable in height. The height would be controlled by support posts and jack screws. The support posts would regulate the rough height adjustment and would consist of inner posts or box section that would telescope into an outer post or box sections. The jack screws would provide fine height adjustment of the assembly.

5-4. Hatch Cover House

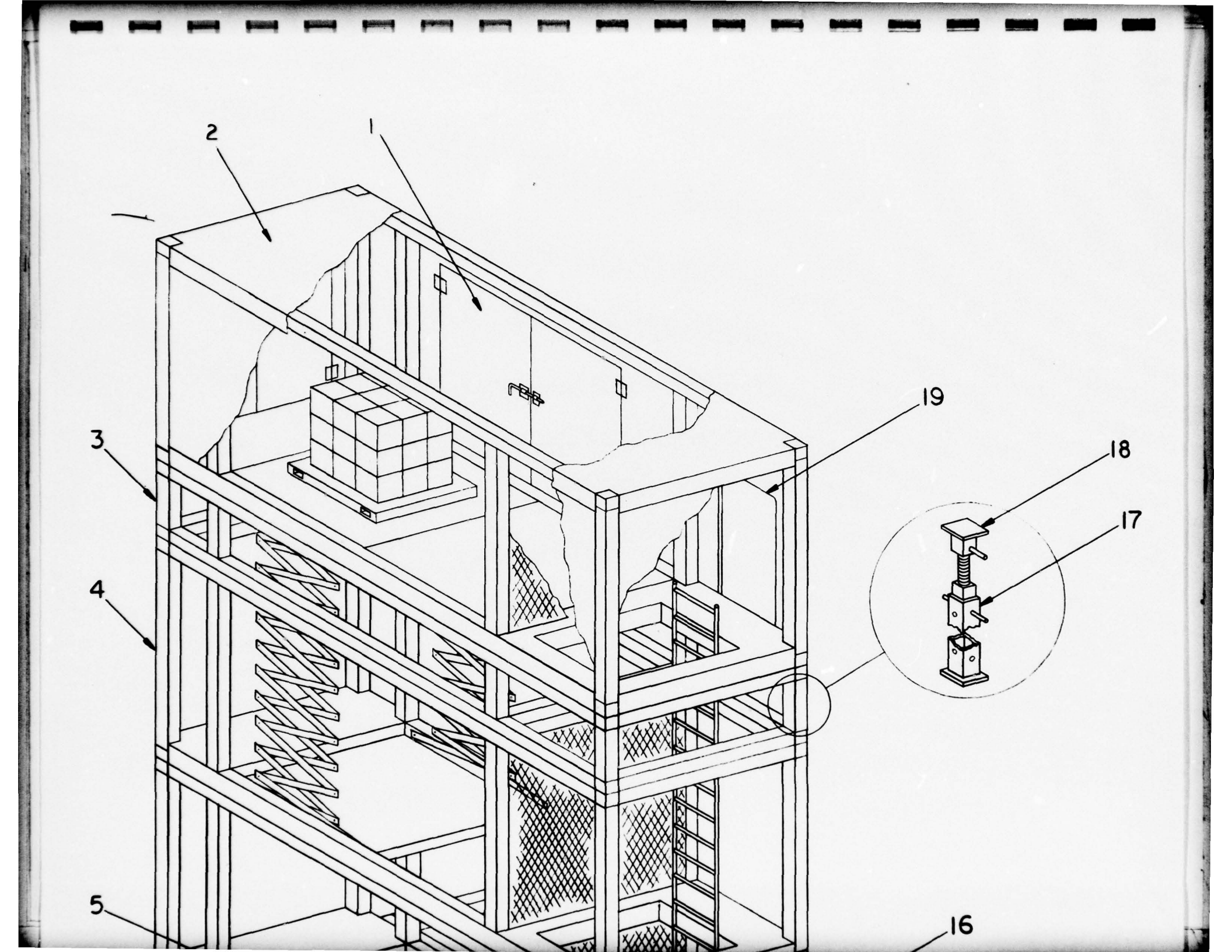
The assembly would be enclosed in a 20'0" deep by 8'0" wide by 8'6" high envelope and weigh about 5245 pounds. The house would be mounted on and attached to the adapter assembly.

The assembly would be divided into two sections. Entrance to each section would be made via watertight doors. The longer section, 15'0" deep by 8'0" wide by 8'6" high, would provide access to the scissors lifted platform and its palletized load at the hatch cover level. The smaller section, 5'0" deep by 8'0" wide by 8'6" high, would provide an entrance to the below deck lift shaft assemblies. This section would provide an area for the installation of ventilation equipment and also furnish a terminal for the connection of electrical power and fire fighting equipment.

The space between the hatch cover house, universal hatch cover and adapter assembly would be closed by a sealing plate and gasket subassembly.

TABLE 5-1. CONCEPT 3 - CONTAINERIZED SCISSORS LIFTED PLATFORM SUBSYSTEM

Index No.	Assembly Name
1	House Doors
2	Hatch Cover House
3	Adapter Assembly
4	Lift Shaft Assembly
5	Lift Shaft Section
6	Conveyor Roller
7	Scissors Lifted Platform
8	Lifting Scissors
9	Traveling Nut
10	Gearing
11	Conveyor Motor
12	Lift Motor
13	Conveyor Belt
14	Access Shaft Section
15	Flat Rack
16	Ladder
17	Support Post
18	Jack Screw
19	Access Shaft Door


2
1
19
3
18
17
4
5
16

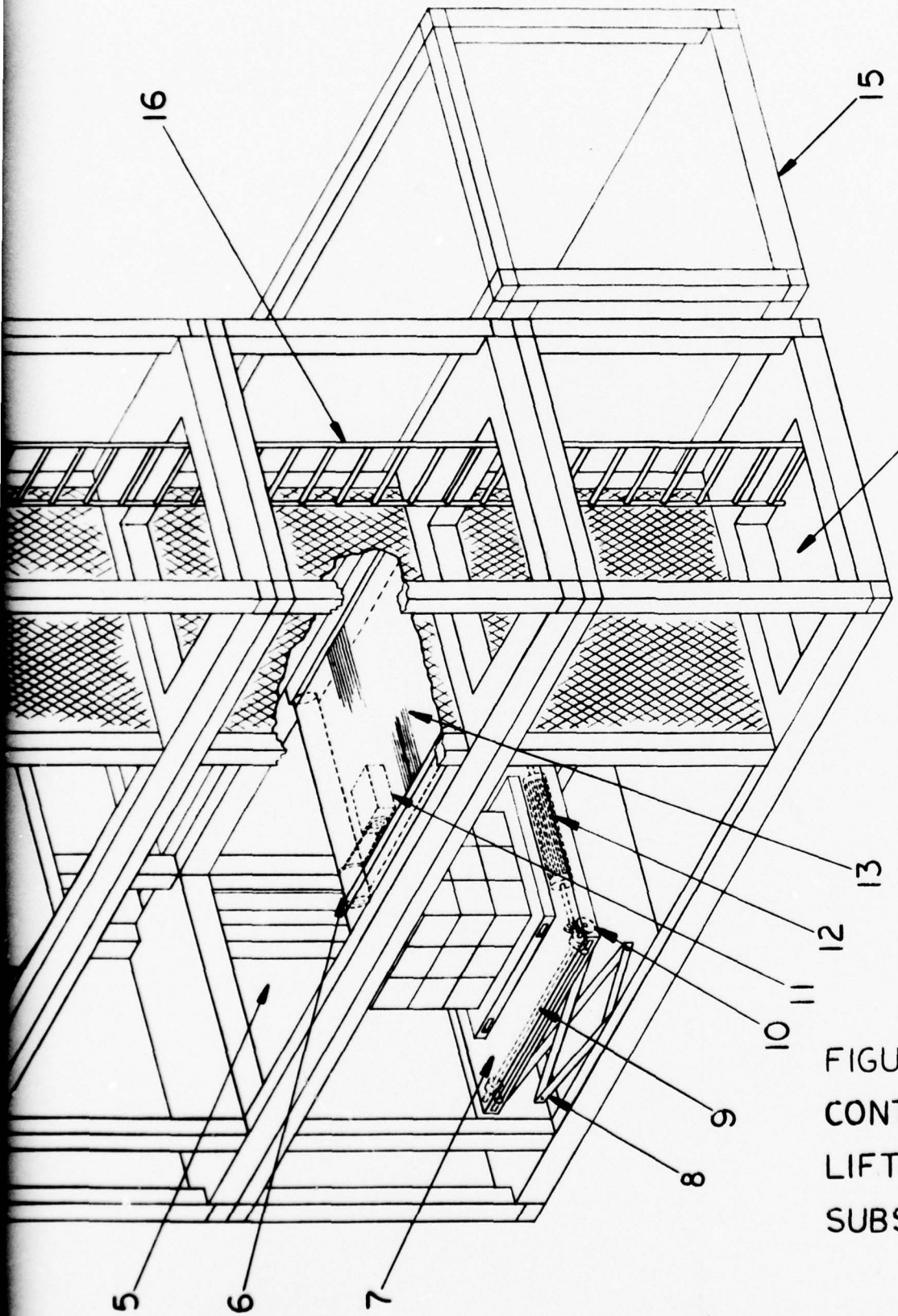


FIGURE 5-1. CONCEPT 3-
CONTAINERIZED SCISSORS
LIFTED PLATFORM
SUBSYSTEM

6-1. CONCEPT 4 - CONTAINERIZED INCLINE PLANE AND FINAL LIFT SUBSYSTEM

This subsystem, Table 6-1 and Figure 6-1 would feature the following assemblies:

(a) two or more incline plane (4A and 4B) assemblies,

(b) a final lift (4C, 4D or 4E) assemblies,

(c) an adapter assembly, and

(d) a hatch cover house.

6-2. Incline Plane Assembly

The assembly would consist of two assemblies (A and B) each enclosed in a 20'0" deep by 8'0" wide by 8'6" high envelope and each weighing about 6400 pounds. The 4A and 4B assemblies would be installed, side-by-side, in the container guides, between the tank top and the adapter assembly. Standard container fasteners would be used to affix the assemblies to each other and to the adapter assembly.

Each container would be divided into two functional sections, a lift shaft area and an access shaft area. The lift shaft area would be 18'0" deep by 8'0" wide by 8'6" high and would contain an incline plane and a controller. The incline plane area of assembly 4A would lift a palletized load, 4'0" deep by 4'0" wide by 7'0" high, weighing up to 3200 pounds, from 0' to 4'. The Assembly A would consist of:

(a) a 90° turn - incline strip,

(b) a straight loading - incline strip, and

(c) a 90° turn - incline strip.

The incline plane of Assembly B would lift the palletized load from 4' to 8' and consist of:

(a) a 90° turn - incline strip,

(b) a straight incline strip, and

(c) a 90° turn - incline strip.

The strips would be made of plates. Assemblies A and B would be joined by telescoping spanner plates.

The palletized load would be slid up the assembly by a pallet drag mechanism. The mechanism would consist of a motor driven continuous chain with pallet hooks.

The access shaft area of Assemblies A and B would be 2'0" deep by 8'0" wide by 8'6" high. The access shafts would contain a vertical ladder and access area. The access would allow the entrance of personnel to any below hatch container. Also, the access would permit the connection of fire protection equipment, ventilation equipment and electrical power to each below hatch lift shaft assembly and its associated containers.

Normally, the access shaft would be positioned at the other end of the subsystem, but it was placed in its present position in order to show the details of the subsystem.

6-3. Final Lift Assembly

The assembly (4C, 4D or 4E) would enclosed in a 20'0" deep by 8'0" wide by

8'6" high envelope and weigh about 5240 pounds. The assembly would be installed in container guides between the topmost incline plane Assembly 4A and the adapter assembly. The assembly would provide a lift capability, for the palletized load, from the topmost incline plane Assembly 4B to the lifting platform.

The lifting platform would use one of three different concepts, Assemblies 4C, 4D or 4E. Assembly 4C would be a wire rope lifted platform. Assembly 4D would be a pinion lifted platform. Assembly 4E would be a scissors lifted platform. Assemblies 4C, 4D, and 4E would be similar in construction and operation to those shown in Concepts 1, 2, and 3, respectively.

Assembly 4C, shown in Figure 6-1, would consist of:

(a) a 90° turn - incline strip,

(b) a straight loading - incline strip, and

(c) a lifting platform.

The 90° turn - incline strip and the straight loading - incline strip would be made of plates, similar in construction to that envisioned in incline plane assemblies 4A and 4B.

The platform would incorporate a bidirectional moving belted conveyor. The belt would accept the palletized load from the straight incline loading section. The belt area would be 5'6" deep by 5'6" wide and accept a load weighing up to 3200 pounds.

Assemblies 4A, 4B and 4C, 4D or 4E would be joined by telescoping spanner plates. Each Assembly 4C, 4D or 4E would have an access shaft area to be used

for the entrance of personnel and the connection of ancillary equipment and power.

6-4. Adapter Assembly

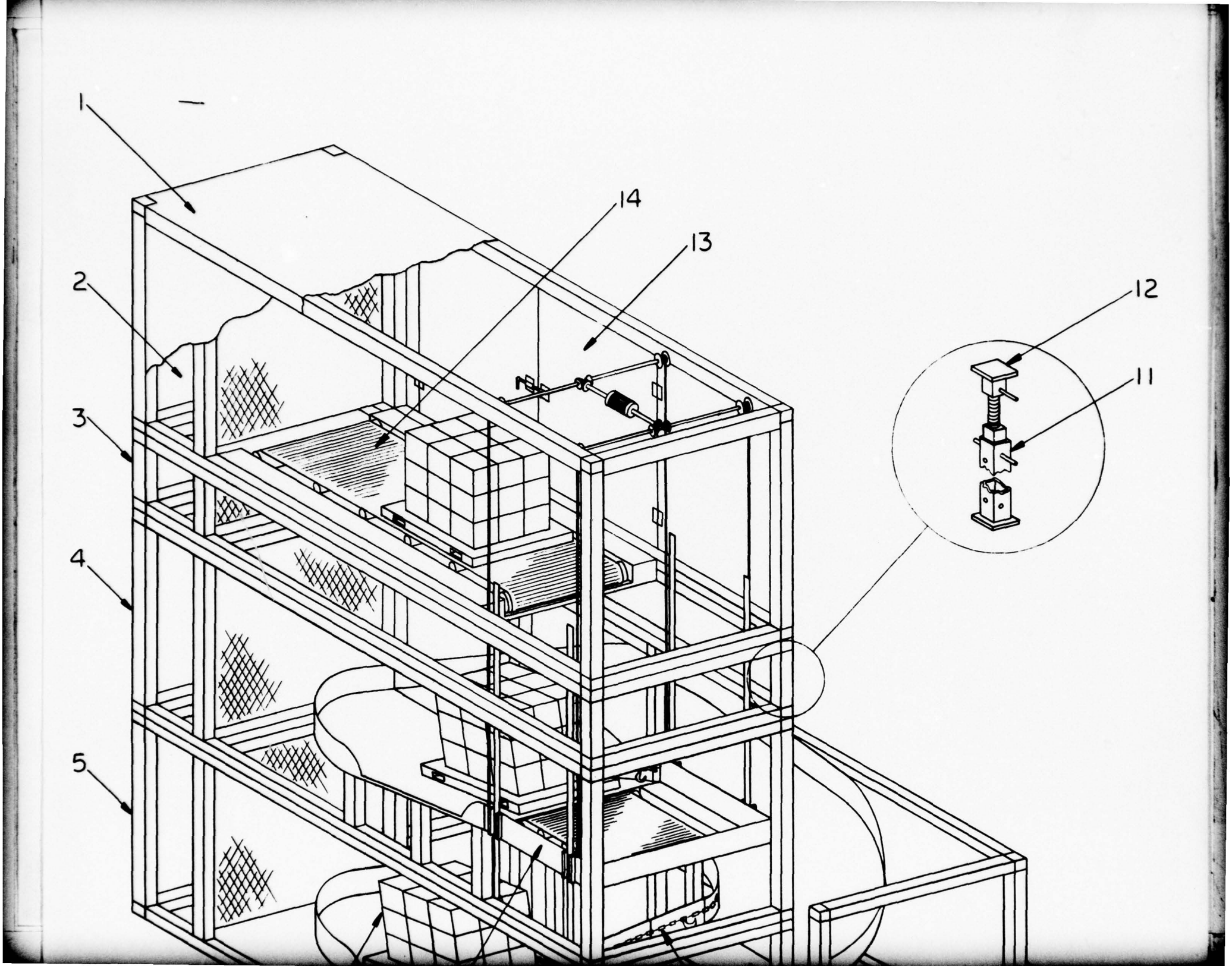
The assembly would be similar to the type described in Concepts 1, 2 or 3, depending on the type of lifted platform assembly involved.

6-5. Hatch Cover House

The house would be similar to the type described in Concepts 1, 2 or 3, depending on the type of lifted platform assembly involved. The house would incorporate a moving belt to accept palletized loads from the belt of the platform.

TABLE 6-1. CONCEPT 4 - CONTAINERIZED INCLINE PLANE AND FINAL LIFT SUBSYSTEM

Index No.	Assembly Name
1	Hatch Cover House
2	Access
3	Adapter Assembly
4	Assembly C, D, or E
5	Assembly A
6	Palletized Load
7	Lifting Platform
8	Pallet Drag Mechanism
9	Spanner Plates
10	Assembly B
11	Support Post
12	Jack Screw
13	House Doors
14	Belted Conveyor


1
2
3
4
5
11
12
13
14

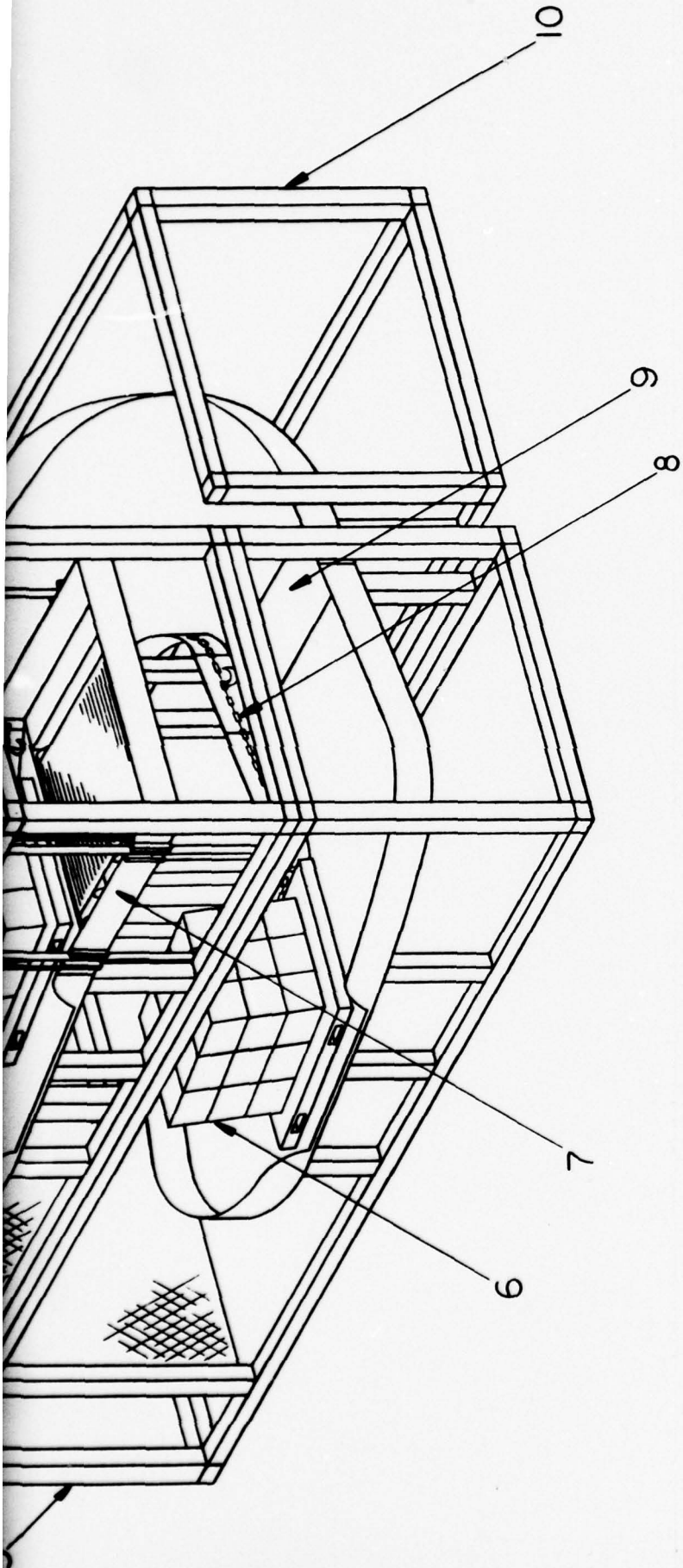


FIGURE 6-1. CONCEPT 4- CONTAINERIZED INCLINE PLANE AND FINAL LIFT SUBSYSTEM

7-1. CONCEPT 5 - MODIFIED CONTAINER AND LIFTING PLATFORM SUBSYSTEM

This subsystem, Table 7-1 and Figure 7-1 would feature the following assemblies:

(a) flat rack assemblies,

(b) two or more lift shaft assemblies,

(c) a lifted platform assembly, and

(d) a hatch cover house.

7-2. Flat Rack Assembly

The assembly would be enclosed in a 20'0" deep by 8'0" wide by 8'6" high container. The assembly would be used to stow palletized loads in the hold.

The flat rack assembly would be manufactured from existing containers by first removing the doors. Next, the sides would be cut from the container. The doors and sides would be removed from the container in order that the palletized loads stowed in the flat rack could be removed from the flat rack and transferred to lift shaft assembly by a horizontal movement subsystem. The weight of assembly would vary in accordance with the amount of material removed from the container.

7-3. Lift Shaft Assembly

The assembly would be enclosed in a 20'0" deep by 8'0" wide by 8'6" high container. The lift shaft assemblies would be installed between the tank top and the universal pontoon hatch cover. The assemblies would be fixed to each other by standard container fasteners.

The assembly would be fabricated from existing containers. The method of manufacturing would require the removal of the doors at each end of the container. Next, the sides of the container would be cut away and removed. This removal would provide room for transferring of palletized loads from the flat racks to the lifted platform assembly, via the lift shaft assembly. Then, a portion of the top and bottom of the container would be cut away and removed. The removal of the top and bottom portions of the container would allow the insertion of the lifted platform assembly into the shaft area.

A smaller portion of the top and bottom of the container would be cut away and removed. The access provided by the removals would allow the insertion of a ladder, power cabling, ventilation and fire protection piping. The weight of the assembly would vary in accordance with the amount of material removed from the container.

7-4. Lifted Platform Assembly

The assembly would be a pallet lifting elevator similar to the type used aboard Naval ships. The assembly would project through the lift shaft assemblies, the universal hatch cover and penetrate the hatch cover house. The weight would vary in accordance with the size of the assembly selected.

7-5. Hatch Cover House

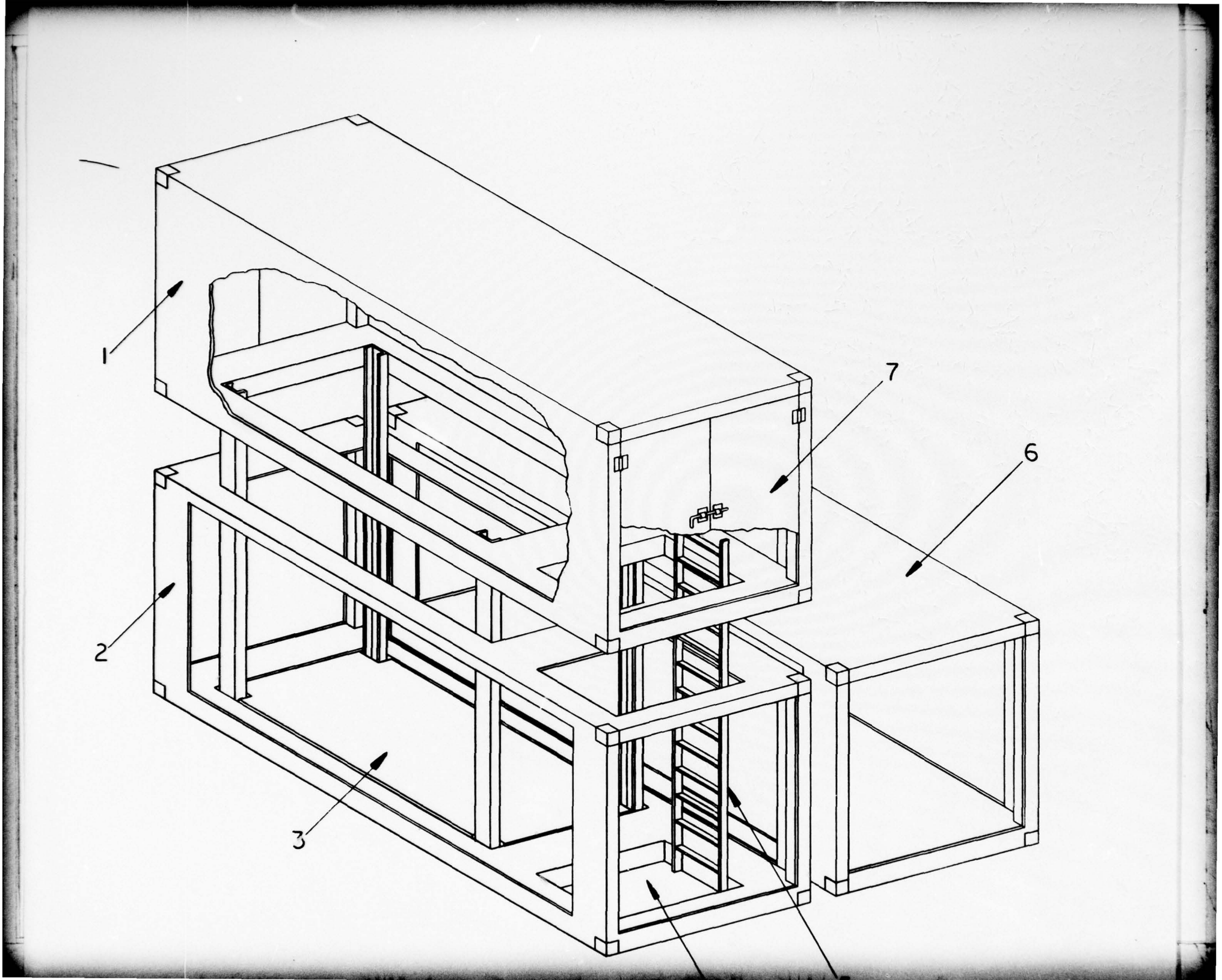
The assembly would be enclosed in a 20'0" deep by 8'0" wide by 8'6" high container. The house would be mounted on and attached to the universal hatch cover. The assembly would be manufactured from an existing container. First, a portion of the bottom of the container would be cut away and removed. This removal of the bottom portion of the container would allow the lifted platform

assembly to penetrate the bottom of the hatch cover house. This configuration would permit the off-loading of palletized cargo from the lift platform assembly onto the deck of the hatch cover house. The opening of the doors of the house would allow the palletized cargo to be removed to the off-loading area.

A smaller portion of the bottom of the container would be cut away and removed. This area would permit the installation of a ladder and ventilation equipment and provide a terminal for the connection of electrical power and fire protection equipment. The weight of the assembly would vary in accordance with the amount of material removed from the container. The space between the hatch cover house and the Universal hatch cover would be closed by a sealing plate and gasket assembly.

TABLE 7-1. CONCEPT 5 - MODIFIED CONTAINER AND LIFTING PLATFORM SUBSYSTEM

Index No.	Assembly Name
1	Hatch Cover House
2	Lift Shaft Assembly
3	Modified Lifted Platform
4	Personnel Access
5	Access Ladder
6	Flat Rack
7	House Doors


1
2
3
6
7

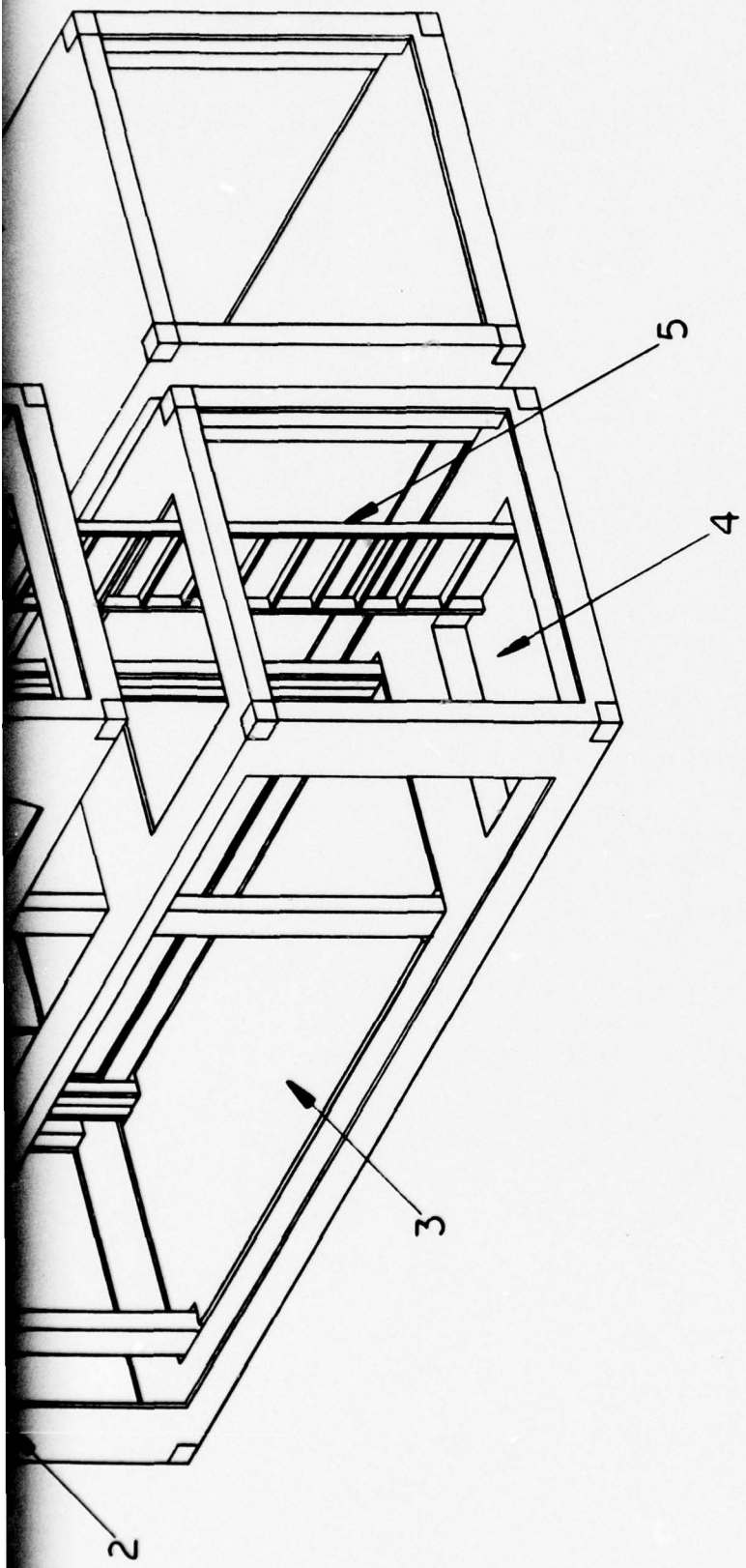


FIGURE 7-1. CONCEPT 5-
MODIFIED CONTAINER AND
LIFTING PLATFORM
SUBSYSTEM

8-1. TYPICAL SUBSYSTEM EMPLACEMENT

The lift shaft assemblies would be lowered into the hold, between the container guides, beneath the access area of the universal hatch cover. Then, the assemblies would be locked together. Next, the hold would be filled with containers (flat racks), whose load consisted of palletized cargo. The access plate of the universal hatch cover would be removed and the cover would be installed on the hatch coaming of the hold.

The adapter assembly would be lowered through the access in universal hatch cover, into the container guides, onto the topmost lift shaft assembly and then locked to it. The adapter assembly would be adjusted to the height required to accept the sealing plate - gasket assembly and the hatch cover lift house. The sealing plate would be penetrated by and installed over the adapter assembly. Finally, the hatch cover lift house would be placed on top of the sealing plate and then locked to the adapter assembly.

8-2. TYPICAL SUBSYSTEM OPERATION

The platform would be lowered to the desired below deck lift shaft assembly. The palletized load, selected from a below deck container, would be moved by the horizontal material handling and loaded aboard the platform. The platform together with the palletized load would be raised to the hatch cover top plate. An industrial truck would remove the palletized load from the platform and then transfer it to the off-loading staging area.

9-1. BELOW HATCH VERTICAL MATERIAL HANDLING SUBSYSTEM DETAILED CHARACTERISTICS

Table 9-1 presents the detailed characteristics of subsystems and assemblies. The table is divided into nine elements;

(a) physical,

(b) engineering,

(c) detailing,

(d) purchasing,

(e) stowing,

(f) erecting,

(g) operating,

(h) maintenance, and

(i) failure.

The elements are selected because they would give a starting point of comparison between each assembly and in turn, between each subsystem.

Under each concept, the first line is the total subsystem entry, while the lines below the subsystem are the assembly entries.

Opposite each ASSEMBLY, in the ELEMENT column is the criteria entry (e.g., 20'0", 8'0", 8'6", etc.). The criteria entry is based upon an engineering estimate obtained by examination of all preceding text, figures and tables.

Opposite each SUBSYSTEM, in the ELEMENT column is the totaled criteria

entry (e.g., 20'0", 8'0", 25'6", etc.). The totaled criteria entry provides a detailed overview of the subsystem characteristics.

The following notes pertain to Table 9-1:

Note	Meaning
(a)	Height will increase with each additional Lift Shaft Assembly required.
(b)	Weight will increase with each additional Lift Shaft Assembly required.
(c)	Maximum quantity required is six (6) per hold.
(d)	Like letters indicate similarity in design.
(e)	Platform Assembly Stowed in Hatch Cover House.
(f)	Lifted platform and machinery weigh 2600#.
(g)	Worst case using pinion lifted platform with associated house.
(h)	Modification of hoisting containers and lifted platform assembly.
(i)	Sections of Assembly stowing in Lift Shaft Assembly and Hatch Cover House.

The table functions as a source document from which the advantages and disadvantages of each subsystem may be obtained. Subsequent paragraphs list the advantages and disadvantages of each subsystem. The list of the advantages and disadvantages of each subsystem is an internal comparison within each subsystem, not a comparison between each subsystem.

TABLE 9-1. BELOW HATCH VERTICAL MATERI

SUBSYSTEM AND ASSEMBLY	ELEMENTS													
	PHYSICAL CONFIGURATION					ENGINEERING DESIGN				DETAILING DESIGN			PURCHASE METHOD	
	DEPTH	WIDTH	HEIGHT	WEIGHT	QUANTITY REQUIRED	SIMILAR (d)	SIMPLE	INTERMEDIATE	COMPLEX	SIMPLE	INTERMEDIATE	COMPLEX	NEW BUILD	
CONCEPT 1														
Containerized Pinion Lifted Platform	20'0"	8'0"	25'6" (a)	16915# (b)	1	A	-	X	X	-	X	X	4 Assemblies out of 4	
Lift Shaft Assembly	20'0"	8'0"	8'6"	4380#	1 (c)	B	-	-	X	-	-	X	X	
Adapter Assembly	20'0"	8'0"	8'6"	4270#	1	C	-	X	-	-	X	-	X	
Hatch Cover House	20'0"	8'0"	8'6"	5265#	1	D	-	-	X	-	-	X	X	
Pinion Lifted Platform Assembly	13'6"	6'6"	7'0"	3000#	1	E	-	-	X	-	-	X	X	

SUBSYSTEM AND ASSEMBLY	ELEMENTS													
	PHYSICAL CONFIGURATION					ENGINEERING DESIGN				DETAILING DESIGN			PURCHASE METHOD	
	DEPTH	WIDTH	HEIGHT	WEIGHT	QUANTITY REQUIRED	SIMILAR (d)	SIMPLE	INTERMEDIATE	COMPLEX	SIMPLE	INTERMEDIATE	COMPLEX	NEW BUILD	
CONCEPT 2														
Containerized Rope Lifted Platform	20'0"	8'0"	25'6" (a)	16645# (b)	1	A	X	X	X	X	X	X	4 Assemblies out of 4	
Lift Shaft Assembly	20'0"	8'0"	8'6"	4270#	1 (c)	B	-	X	X	-	X	-	X	
Adapter Assembly	20'0"	8'0"	8'6"	4160#	1	C	X	-	-	X	-	-	X	
Hatch Cover Lift House	20'0"	8'0"	8'6"	5655#	1	D	-	-	X	-	-	X	X	
Rope Lifted Platform Assembly	13'6"	6'6"	7'0"	2560#	1	E	-	X	-	-	X	-	X	

L MATERIAL HANDLING SUBSYSTEMS CHARACTERISTICS MATRIX

ELEMENTS																	
PURCHASING METHOD		STOWING				EMPLACEMENT METHOD			OPERATING METHOD			PREVENTIVE MAINTENANCE PROCEDURE			FAILURE RATE		
			SHELF LIFE														
M BUILD	OFF-SHELF	CONTAINERS REQUIRED	SHORT	MODERATE	LONG	SIMPLE	INTERMEDIATE	COMPLEX	NONE	SIMPLE	COMPLEX	SIMPLE	INTERMEDIATE	COMPLEX	LOW	MODERATE	HIGH
ssemblies ut of 4	None	3	-	X	X	X	-	-	-	X	-	X	X	-	X	X	-
X	-	1	-	X	-	X	-	-	X	-	-	X	-	-	X	-	-
X	-	1	-	-	X	X	-	-	X	-	-	X	-	-	X	-	-
X	-	1	-	X	-	X	-	-	-	X	-	X	-	-	X	-	-
X	-	>1 (e)	-	X	-	X	-	-	-	X	-	-	X	-	-	X	-

ELEMENTS																	
PURCHASING METHOD		STOWING				EMPLACEMENT METHOD			OPERATING METHOD			PREVENTIVE MAINTENANCE PROCEDURE			FAILURE RATE		
			SHELF LIFE														
M BUILD	OFF-SHELF	CONTAINERS REQUIRED	SHORT	MODERATE	LONG	SIMPLE	INTERMEDIATE	COMPLEX	NONE	SIMPLE	COMPLEX	SIMPLE	INTERMEDIATE	COMPLEX	LOW	MODERATE	HIGH
Assemblies ut of 4	None	3	-	X	X	X	-	-	-	X	-	X	X	-	X	X	-
X	-	1	-	-	X	X	-	-	X	-	-	X	-	-	X	-	-
X	-	1	-	-	X	X	-	-	X	-	-	X	-	-	X	-	-
X	-	1	-	X	-	X	-	-	-	X	-	-	X	-	-	X	-
X	-	>1 (e)	-	-	X	X	-	-	-	X	-	X	-	-	X	-	-

TABLE 9-1. BELOW HATCH VERTICAL MATERIAL HA

SUBSYSTEM AND ASSEMBLY	ELEMENTS													
	PHYSICAL CONFIGURATION					ENGINEERING DESIGN				DETAILING DESIGN			PURCHASING METHOD	
	DEPTH	WIDTH	HEIGHT	WEIGHT	QUANTITY REQUIRED	SIMILAR (d)	SIMPLE	INTERMEDIATE	COMPLEX	SIMPLE	INTERMEDIATE	COMPLEX	NEW BUILD	OFF-SHEL
CONCEPT 3 Containerized Scissors Lifted Platform	20'0"	8'0"	25'6" (a)	14675# (b)	1	A	X	X	X	X	X	X	3 Assemblies out of 3	None
Lift Shaft Assembly	20'0"	8'0"	8'6"	5430#	1 (c)	B	-	-	X	-	-	X	X	-
Adapter Assembly	20'0"	8'0"	8'6"	4000#	1	C	X	-	-	X	-	-	X	-
Hatch Cover House	20'0"	8'0"	8'6"	5245#	1	D	-	X	-	-	X	-	X	-

SUBSYSTEM AND ASSEMBLY	ELEMENTS													
	PHYSICAL CONFIGURATION					ENGINEERING DESIGN				DETAILING DESIGN			PURCHASING METHOD	
	DEPTH	WIDTH	HEIGHT	WEIGHT	QUANTITY REQUIRED	SIMILAR (d)	SIMPLE	INTERMEDIATE	COMPLEX	SIMPLE	INTERMEDIATE	COMPLEX	NEW BUILD	OFF-SHE
CONCEPT 4 Containerized Incline Plane - Lifted Platform	20'0"	16'0"	25'6" (a)	28075# (b)	1	A	X	X	X	X	X	X	4 Assemblies out of 4	None
Incline Plane Assembly (A & B)	20'0"	16'0"	8'6"	12800#	1 (c)	G	-	X	-	-	X	-	X	-
Final Lift Assembly (C, D, or E)	20'0"	8'0"	8'6"	5240#	1	B	-	X to	X	-	X to	X	X	-
Adapter Assembly	20'0"	8'0"	8'6"	4270# (f)	1	C	X	-	-	X	-	-	X	-
Hatch Cover House	20'0"	8'0"	8'6"	5765# (g)	1	D	-	X to	X	-	X to	X	X	-

TERIAL HANDLING SUBSYSTEMS CHARACTERISTICS MATRIX (Continued)

ENTS																		
URCHASING METHOD		STOWING				EMPLACEMENT METHOD			OPERATING METHOD			PREVENTIVE MAINTENANCE PROCEDURE			FAILURE RATE		
			SHELF LIFE														
LD	OFF-SHELF	CONTAINERS REQUIRED	SHORT	MODERATE	LONG	SIMPLE	INTERMEDIATE	COMPLEX	NONE	SIMPLE	COMPLEX	SIMPLE	INTERMEDIATE	COMPLEX	LOW	MODERATE	HIGH
1es 3	None	3	-	X	X	X	-	-	X	X	-	X	X	-	X	X	-
	-	1	-	X	-	X	-	-	-	X	-	-	X	-	-	X	-
	-	1	-	-	X	X	-	-	X	-	-	X	-	-	X	-	-
	-	1	-	X	-	X	-	-	-	X	-	X	-	-	X	-	-

ENTS																		
PURCHASING METHOD		STOWING				EMPLACEMENT METHOD			OPERATING METHOD			PREVENTIVE MAINTENANCE PROCEDURE			FAILURE RATE		
			SHELF LIFE														
LD	OFF-SHELF	CONTAINERS REQUIRED	SHORT	MODERATE	LONG	SIMPLE	INTERMEDIATE	COMPLEX	NONE	SIMPLE	COMPLEX	SIMPLE	INTERMEDIATE	COMPLEX	LOW	MODERATE	HIGH
1es 4	None	4	-	X	X	X	-	-	-	X	-	X	X	-	X	X	-
	-	2	-	-	X	X	-	-	-	X	-	X	-	-	X	-	-
	-	>1 (e)	-	X	-	X	-	-	-	X	-	-	X	-	-	X	-
	-	1	-	-	X	X	-	-	-	-	-	X	-	-	X	-	-
	-	1	-	X	-	X	-	-	-	X	-	X	-	-	X	-	-

TABLE 9-1. BELOW HATCH VERTICAL MATERIAL HAN

SUBSYSTEM AND ASSEMBLY	ELEMENTS													
	PHYSICAL CONFIGURATION					ENGINEERING DESIGN				DETAILING DESIGN			PURCHASING METHOD	
	DEPTH	WIDTH	HEIGHT	WEIGHT	QUANTITY REQUIRED	SIMILAR (d)	SIMPLE	INTERMEDIATE	COMPLEX	SIMPLE	INTERMEDIATE	COMPLEX	NEW BUILD	OFF-SHELF
CONCEPT 5 Modified Container and Lifted Platform	20'0"	8'0"	25'6"	13397# (b)	1	A	X	-	-	X	-	-	X	X
Lift Shaft Assembly	2 0"	8'0"	8'6"	4599#	1 (c)	B	X	-	-	X	-	-	-	X
Lifted Platform Assembly	13'6"	6'6"	8'6"	3450# (1)	1	E	X	-	-	X	-	-	X	-
Hatch Cover House	20'0"	8'0"	8'6"	5348#	1	D	X	-	-	X	-	-	-	X

AL MATERIAL HANDLING SUBSYSTEMS CHARACTERISTICS MATRIX (Continued)

ELEMENTS																	
PURCHASING METHOD		STOWING				EMPLACEMENT METHOD			OPERATING METHOD			PREVENTIVE MAINTENANCE PROCEDURE			FAILURE RATE		
		CONTAINERS REQUIRED	SHELF LIFE														
NEW BUILD	OFF-SHELF		SHORT	MODERATE	LONG	SIMPLE	INTERMEDIATE	COMPLEX	NONE	SIMPLE	COMPLEX	SIMPLE	INTERMEDIATE	COMPLEX	LOW	MODERATE	HIGH
X	X	2	-	X	X	X	-	-	-	X	-	X	X	-	X	-	-
-	X	1	-	-	X	X	-	-	-	-	-	X	-	-	X	-	-
X	-	>1 (e)	-	X	-	X	-	-	-	X	-	-	X	-	-	X	-
-	X	1	-	-	X	X	-	-	-	X	-	X	-	-	X	-	-

9-2. CONCEPT 1 - Containerized Pinion Lifted Platform Subsystem

This subsystem would provide the following advantages;

(a) medium sized volume,

(b) medium weight,

(c) enclosed in three containers,

(d) moderate-to-long stowage life,

(e) simple emplacement and operating methods,

(f) simple-to-intermediate maintenance procedures, and

(g) low-to-moderate failure rate.

This subsystem would provide the following disadvantages;

(a) moderate-to-complex engineering design and design detailing, and

(b) no assemblies purchased from off-shelf stock.

9-3. CONCEPT 2 - Containerized Rope Lift Platform Subsystem

The advantages of this subsystem would be;

(a) medium sized volume,

(b) light weight,

(c) simple-to-intermediate engineering design and design detailing,

(d) enclosed in three containers,

(e) moderate-to-long stowage life,

(f) simple emplacement and operating methods,

(g) simple-to-intermediate maintenance procedures, and

(h) low-to-moderate failure rate.

The disadvantage of the subsystem would be that no assemblies are purchased from off-shelf stock.

9-4. CONCEPT 3 - Containerized Scissors Lifted Platform Subassembly

Subsystem advantages would be;

(a) medium sized volume,

(b) enclosed in three containers,

(c) moderate-to-long shelf life,

(d) simple emplacement and operating methods,

(e) simple-to-intermediate maintenance procedures, and

(f) low-to-moderate failure rate.

Subsystem disadvantages would be;

(a) heavy weight,

(b) intermediate-to-complex engineering design and design detailing, and

(c) no assemblies purchased from off-shelf stock.

9-5. CONCEPT 4 - Containerized Incline Plane - Lifted Platform Subsystem

The advantages of this subsystem would be;

(a) moderate-to-long stowage life,

(b) simple emplacement and operating methods,

(c) simple-to-intermediate maintenance procedures, and

(d) low-to-moderate failure rate.

The disadvantages of this subsystem would be;

(a) large volume,

(b) heaviest weight,

(c) intermediate to-complex engineering design and design detailing,

(d) no assemblies purchased from off-shelf stock, and

(e) enclosed in four containers.

9-6. CONCEPT 5 - Modified Container and Lifted Platform Subsystem

Subsystem advantages would provide:

(a) smallest volume,

(b) lightest weight,

(c) simple engineering design or design detailing,

(d) simple modification of off-shelf containers and lifted platform,

(e) enclosed in two containers,

(f) moderate-to-long stowage life,

(g) simple emplacement and operating methods,

(h) simple-to-moderate maintenance procedures,

(i) low-to-moderate failure rate.

Subsystem disadvantage would be that no assemblies are purchased from off-shelf stock.

9-7. BELOW HATCH VERTICAL MATERIAL HANDLING SUBSYSTEMS COSTS

Table 9-2 provides an approximate overall cost of each subsystem. The cost of a subsystem was obtained by multiplying the weight of the assemblies, in pounds, by $1.50 per pound of assembly weight. The cost of the Concept 5 subsystem would be less than indicated.

9-8. BELOW HATCH VERTICAL MATERIAL HANDLING SUBSYSTEMS WEIGHTED CHARACTERISTICS MATRIX

Table 9-3 presents a condensed version of the general characteristics of each subsystem. The characteristics are assigned a relative value which provides a quick look comparison of each subsystem.

Opposite the SUBSYSTEM, in the ELEMENT columns, between the horizontal lines is the criteria entry (e.g., 10880, 38815, Complex, etc.) The criteria entry was based upon a value decision obtained by analysis and evaluation of all preceding material.

Opposite the SUBSYSTEM, in the ELEMENT columns, to the left of the diagonal line is the weight criteria entry (e.g., 2, 3, 3, etc.). The weighted criteria entry was developed by assigning a number to the criteria entry. The number 1, indicates most desirable criteria. The numbers 2, 3 and 4 indicate less desirable criteria. The number 5, indicates the least desirable criteria.

Opposite the SUBSYSTEM, in the ELEMENT columns, to the right of the diagonal line is accumulated weight entry (e.g., 2, 5, 8, etc.). The accumulated weight entry was obtained by adding together all previously weighted criteria entries.

9-9. RECOMMENDATIONS

It is recommended that the Modified Container and Lifted Platform Subsystem be adopted as the most desirable below hatch vertical material handling subsystem because of the following reasons:

(a) the flat rack assembly, lift shaft assembly and hatch cover house can be fabricated from existing containers.

(b) the lifted platform assembly could be selected from one of several existing subsystems used aboard Naval ships.

(c) the existing lifted platform assembly could be readily modified to fit the requirements of Concept 5.

It is recommended that the other subsystems be rejected as the most desirable lift devices because of one or more of the following reasons:

(a) unproven or limited proof design,

(b) long lead engineering design, design detailing, and fabrication time required, and

(c) high costing for subsystem.

TABLE 9-2. BELOW HATCH VERTICAL MATERIAL HANDLING SUBSYSTEMS COSTS

SUBSYSTEM	WEIGHT (LBS) ASSEMBLIES *	COST $1.50/LB ASSEMBLIES
Containerized Pinion Lifted Platform	38,815	$ 58,222.50
Containerized Rope Lifted Platform	37,995	56,992.50
Containerized Scissors Lifted Platform	41,825	62,737.50
Containerized Incline Plane - Lifted Platform	79,275	118,912.50
Modified Container and Lifted Platform	36,392	54,588.00

* Weight is the maximum number of assemblies required for worst case emplacement.

TABLE 9-3. BELOW HATCH VERTICAL MATERIAL HANDLING SUBSYSTEMS WEIGHTED

SUBSYSTEM	ELEMENT								
	OVERALL VOLUME (CU FT)	OVERALL WEIGHT (LBS)	ENGINEERING DESIGN	DETAILING DESIGN	PURCHASING OFF SHELF (%)	STOWING CONTAINERS REQUIRED	STOWING SHELF LIFE	EMPLACEMENT METHOD	OPERAT METH
Containerized Pinion Lifted Platform	10880	38815	Complex	Complex	0	3	Intermediate	Simple	Simpl
	2 / 2	3 / 5	3 / 8	3 / 11	2 / 13	2 / 15	2 / 17	1 / 18	1
Containerized Rope Lifted Platform	10880	37995	Intermediate	Intermediate	0	3	Long	Simple	Simpl
	2 / 2	2 / 4	2 / 6	2 / 8	2 / 10	2 / 12	1 / 13	1 / 14	1
Containerized Scissors Lifted Platform	10880	41825	Intermediate	Intermediate	0	3	Intermediate	Simple	Simpl
	2 / 2	4 / 6	2 / 8	2 / 10	2 / 12	2 / 14	2 / 16	1 / 17	1
Containerized Incline Plane - Lifted Platform	17680	79275	Intermediate	Intermediate	0	4	Intermediate	Simple	Simpl
	3 / 3	5 / 8	2 / 10	2 / 12	2 / 14	3 / 17	2 / 19	1 / 20	1
Modified Container and Lifted Platform	10265.8	36392	Simple	Simple	0	2	Long	Simple	Simp
	1 / 1	1 / 2	1 / 3	1 / 4	1 / 5	1 / 6	1 / 7	1 / 8	1

W HATCH VERTICAL MATERIAL HANDLING SUBSYSTEMS WEIGHTED MATRIX

ELEMENT								
		STOWING						
DETAILING DESIGN	PURCHASING OFF SHELF (%)	CONTAINERS REQUIRED	SHELF LIFE	EMPLACEMENT METHOD	OPERATING METHOD	PREVENTIVE MAINTENANCE PROCEDURES	FAILURE RATE	COST
Complex	0	3	Intermediate	Simple	Simple	Simple	Low	38815
3 / 11	2 / 13	2 / 15	2 / 17	1 / 18	1 / 19	1 / 20	1 / 21	3 / 24
Intermediate	0	3	Long	Simple	Simple	Simple	Low	37995
2 / 8	2 / 10	2 / 12	1 / 13	1 / 14	1 / 15	1 / 16	1 / 17	2 / 19
Intermediate	0	3	Intermediate	Simple	Simple	Simple	Low	41825
2 / 10	2 / 12	2 / 14	2 / 16	1 / 17	1 / 18	1 / 19	1 / 20	4 / 24
Intermediate	0	4	Intermediate	Simple	Simple	Simple	Low	79275
2 / 12	2 / 14	3 / 17	2 / 19	1 / 20	1 / 21	1 / 22	1 / 23	5 / 28
Simple	0	2	Long	Simple	Simple	Simple	Low	36392
1 / 4	1 / 5	1 / 6	1 / 7	1 / 8	1 / 9	1 / 10	1 / 11	1 / 12