US 20180070538A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2018/0070538 A1**

Marek (43) **Pub. Date: Mar. 15, 2018**

(54) **VERTICAL FARM**

(71) Applicant: **Lawrence Marek**, New York, NY (US)

(72) Inventor: **Lawrence Marek**, New York, NY (US)

(21) Appl. No.: **15/378,927**

(22) Filed: **Dec. 14, 2016**

Related U.S. Application Data

(60) Provisional application No. 62/267,192, filed on Dec. 14, 2015.

Publication Classification

(51) **Int. Cl.**
A01G 9/14 (2006.01)

(52) **U.S. Cl.**
CPC ***A01G 9/14*** (2013.01)

(57) **ABSTRACT**

A spiral building having greenhouse enclosures mounted thereon is provided where the greenhouse enclosures have a slanted glass surface over the growing trays which is oriented toward the perpendicular rays of the sun at the equinox and where the glazing in portions of the exterior is reversed from its normal orientation and the reflective surfaces are on the inside, thus reflecting the light admitted through the glass and directing it to parts of the interior growing area.

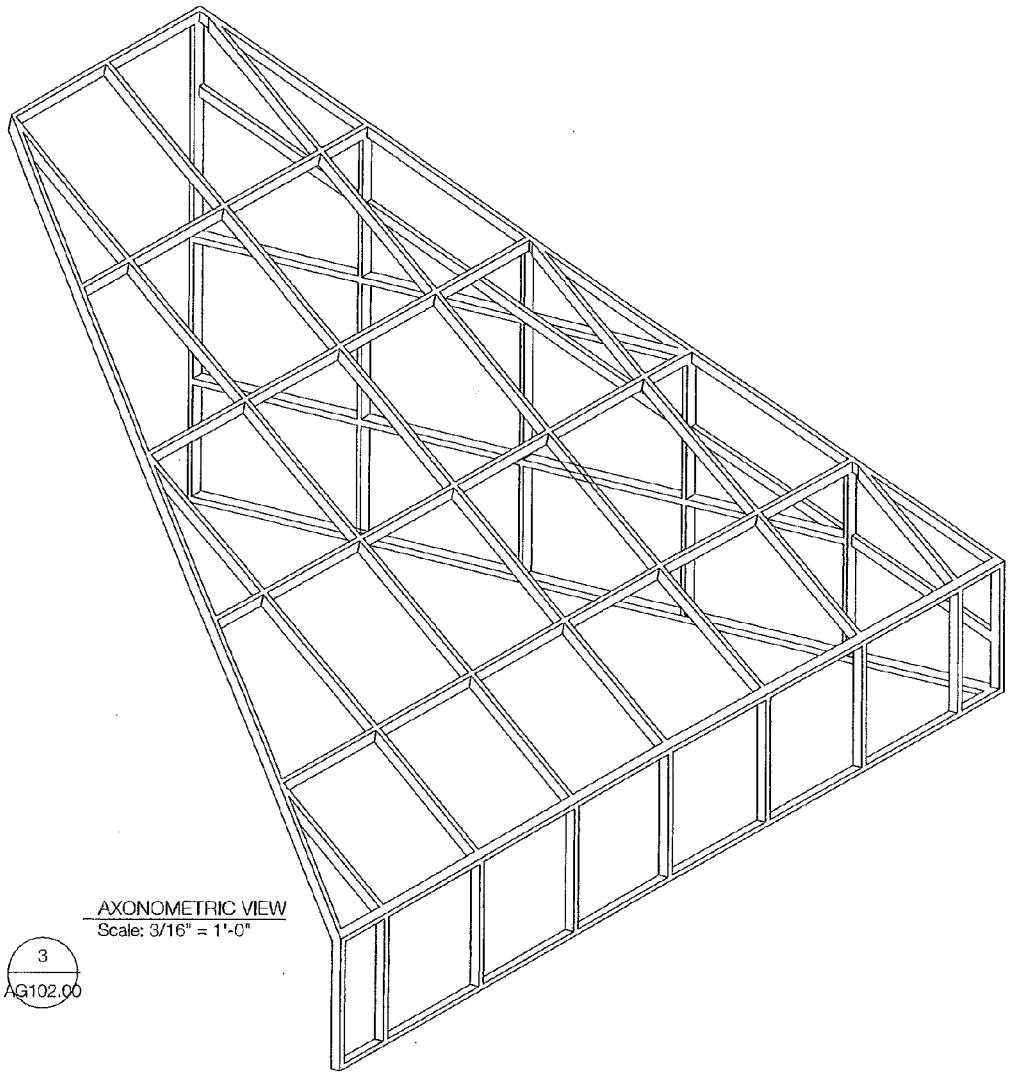


FIG. 1

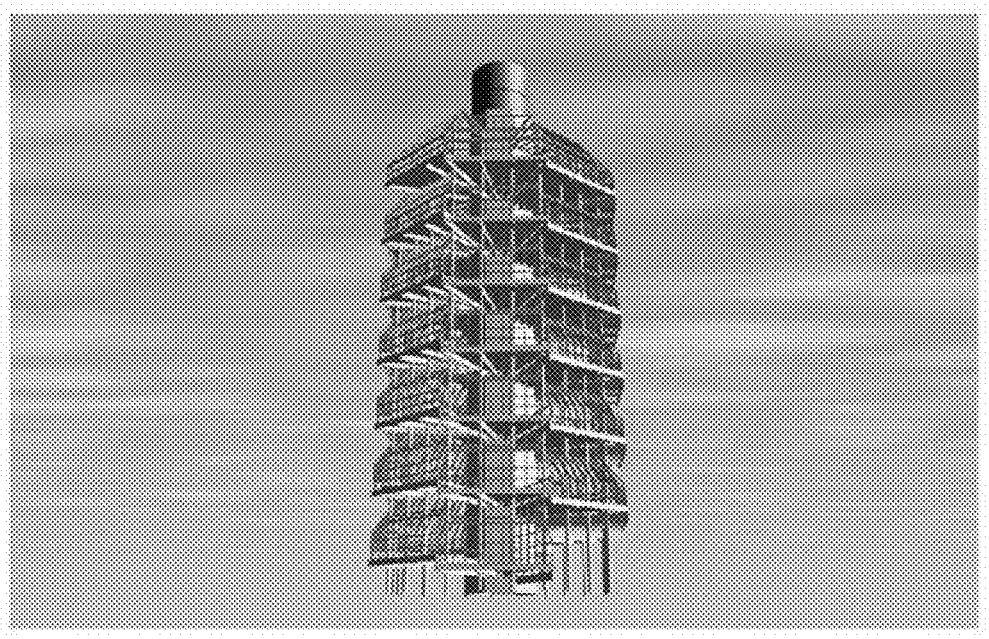


FIG. 2

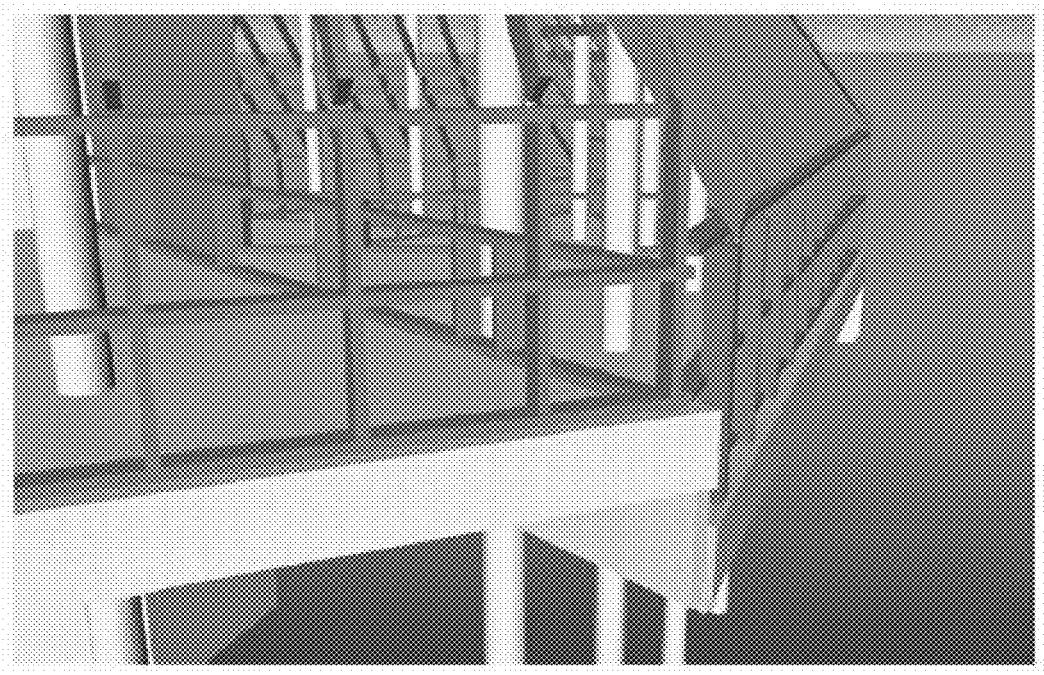


FIG. 3

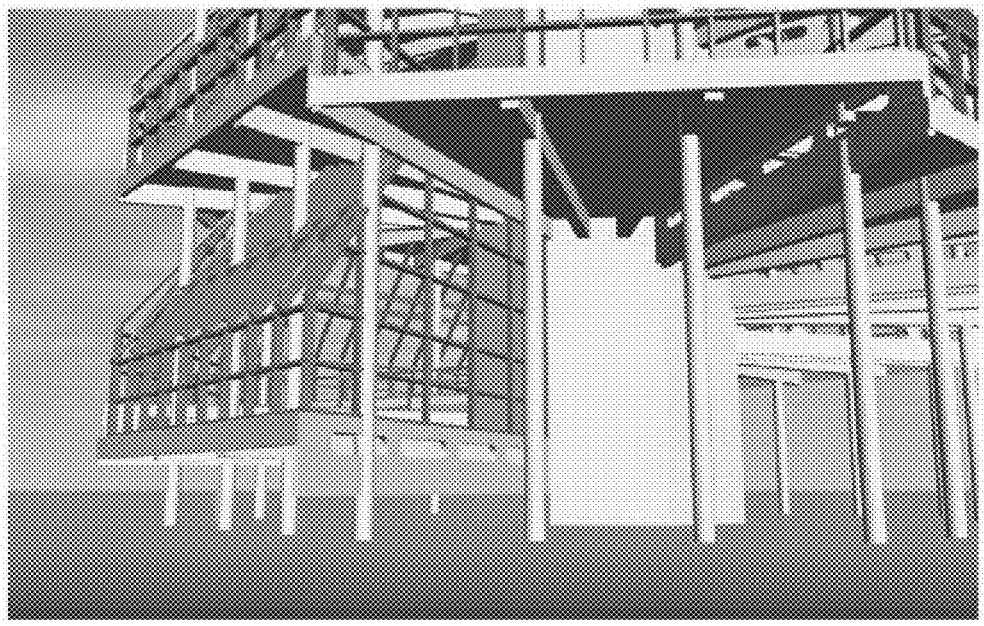


FIG. 4

FIG. 5

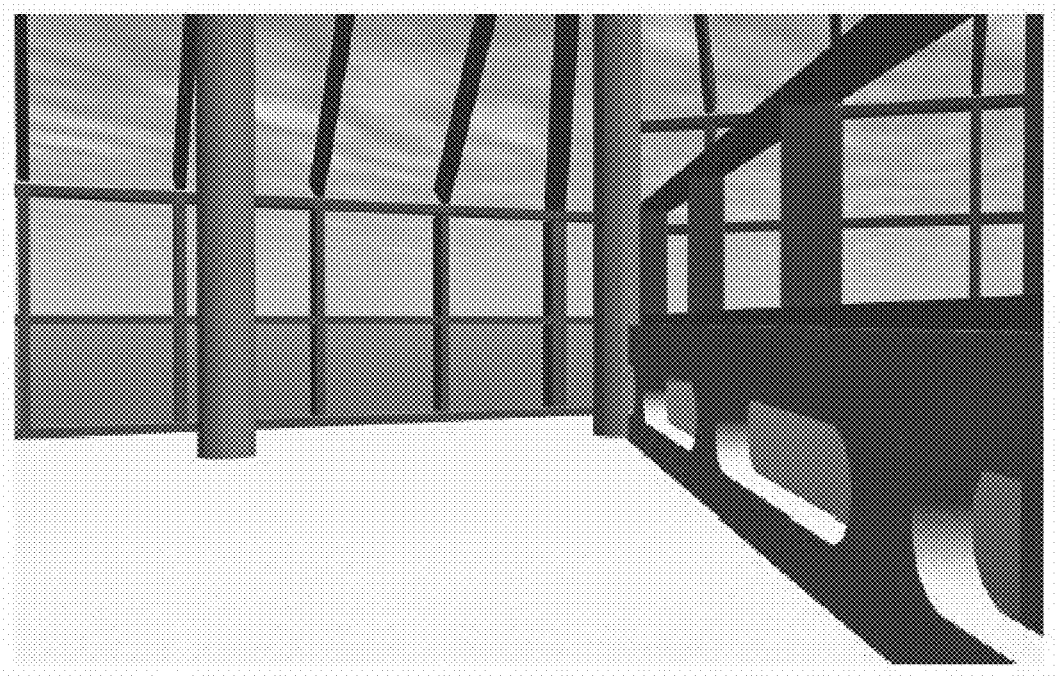


FIG. 6

FIG. 7

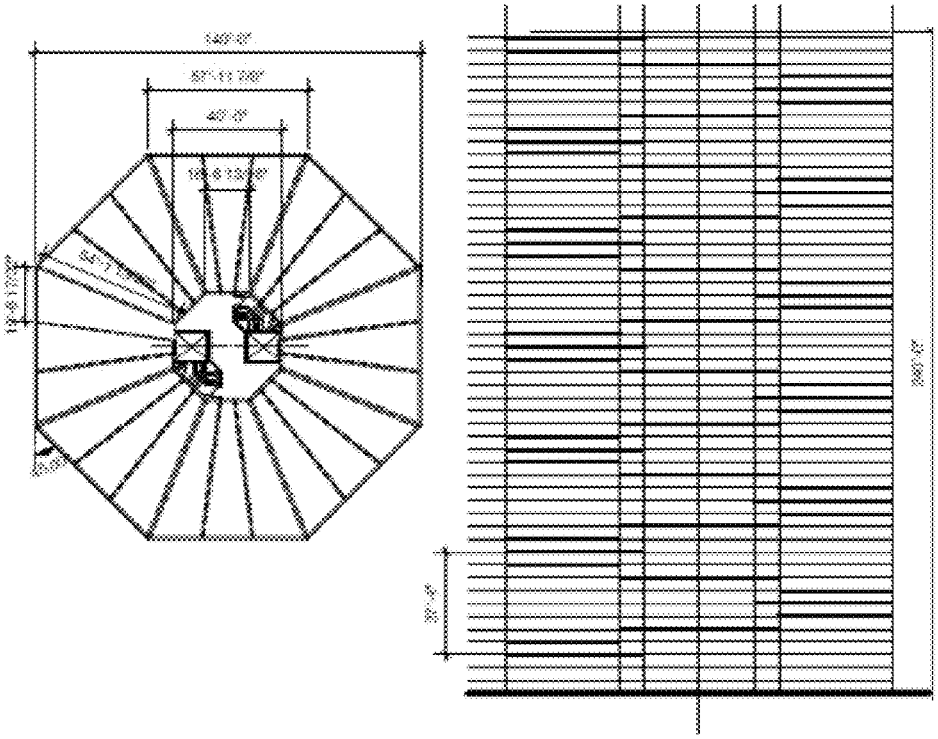


FIG. 8

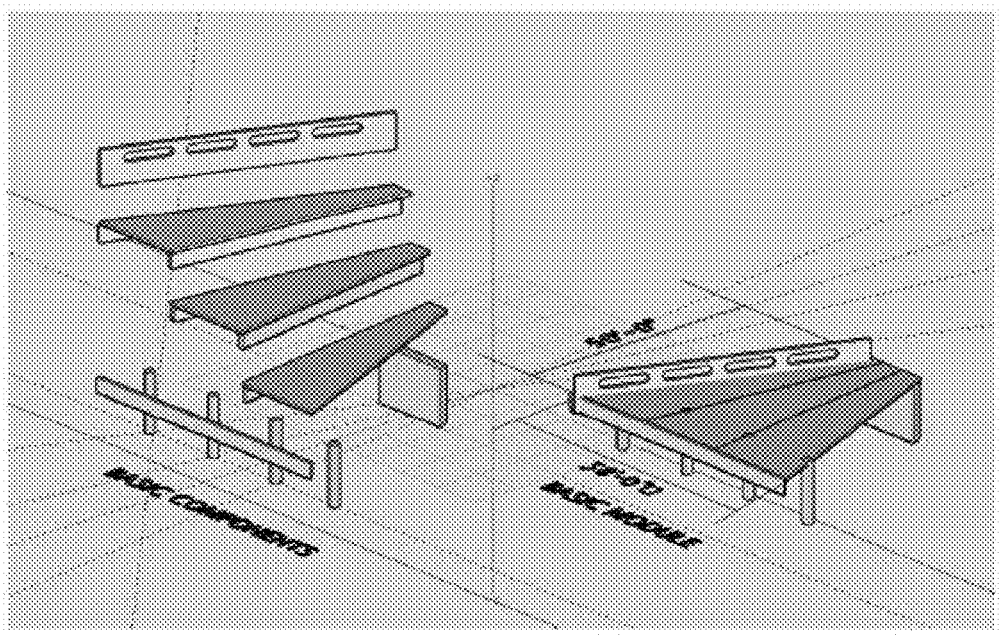


FIG. 9

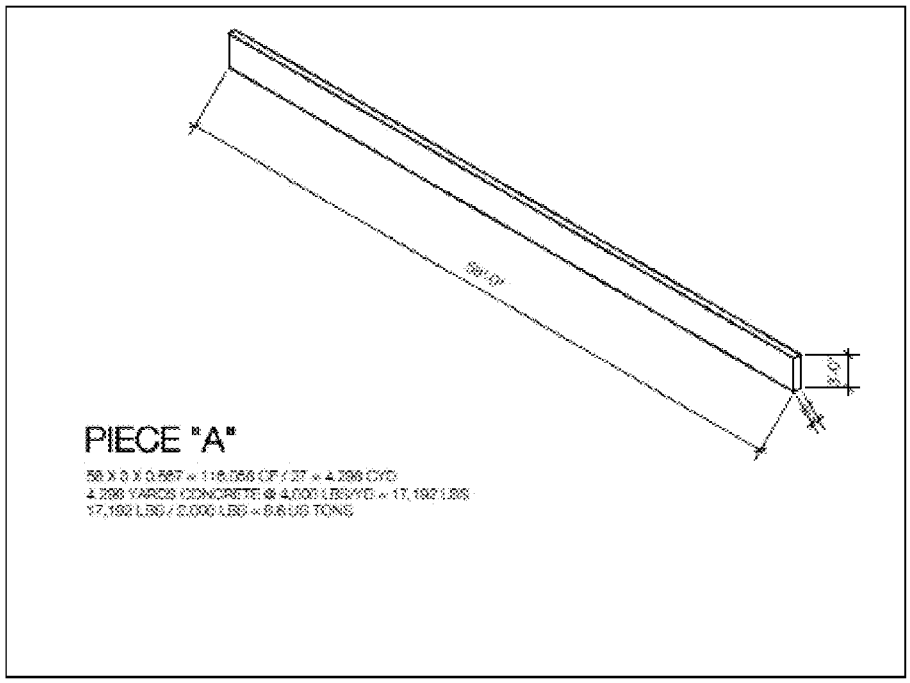


FIG. 10

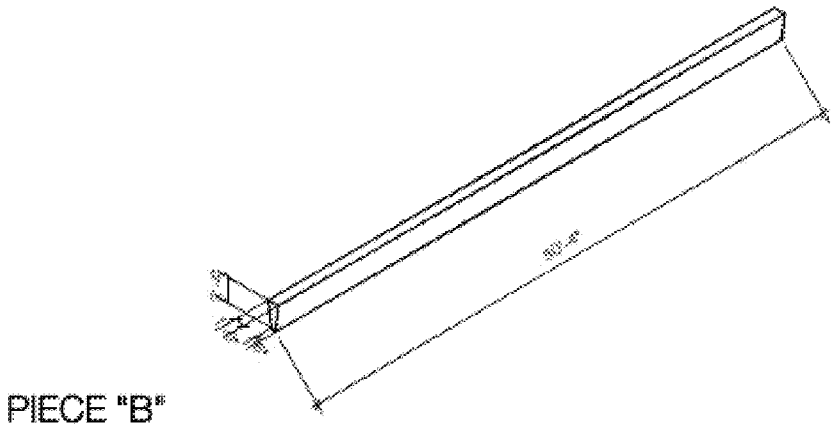
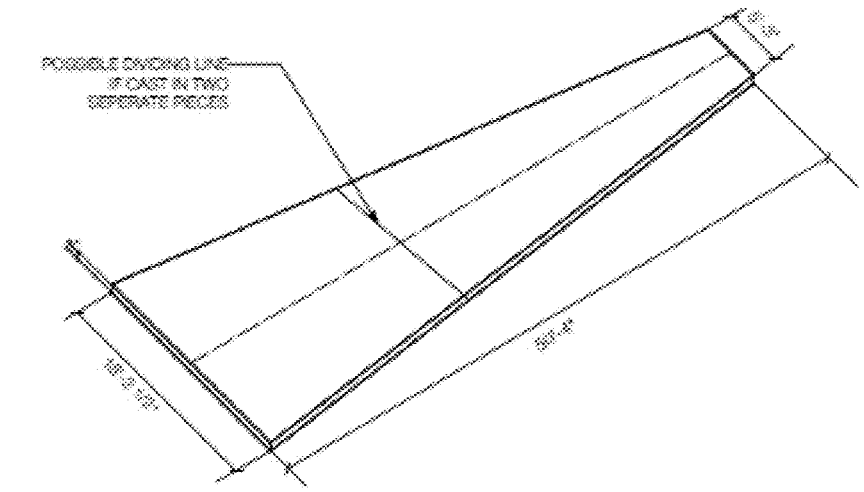


FIG. 11



PIECE "C.1"

50,304 X 11.729 X 0.667' = 393.778 CF / 27 = 14.584 CYD
14.584 YARDS CONCRETE @ 4,000 LBS/YD = 58,336 LBS
58,336 LBS / 2,000 LBS = 29.2 US TONS

IF NECESSARY, THIS PIECE CAN BE CAST IN TWO SEPARATE
SECTIONS WEIGHING 14.6 TONS EACH

FIG. 12

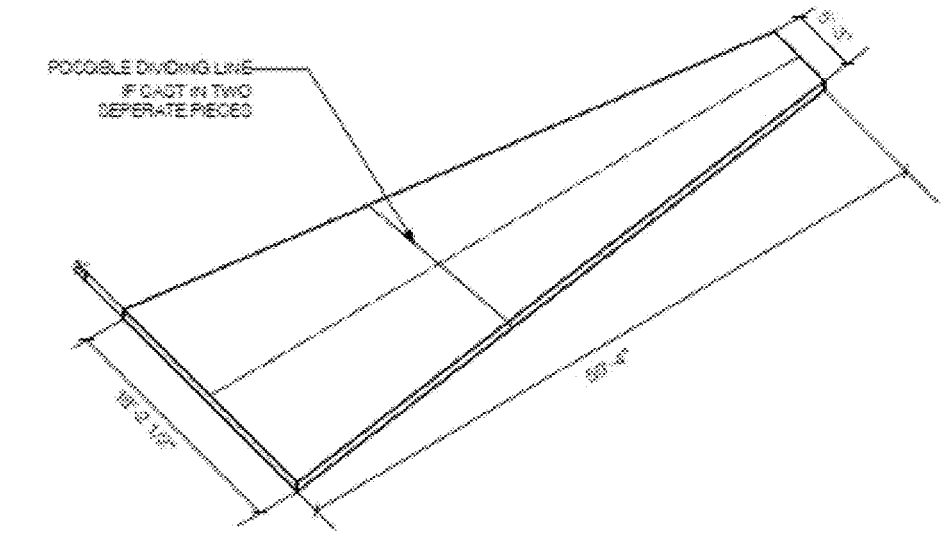
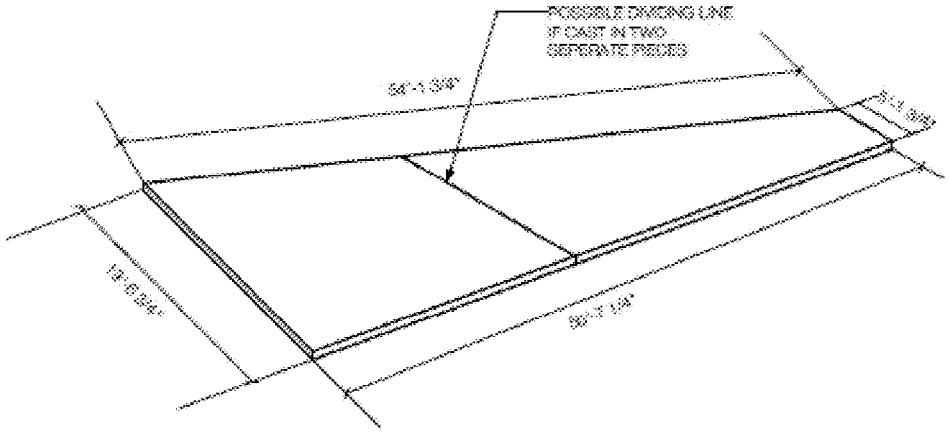

POSSIBLE DIVIDING LINE
IF CAST IN TWO
SEPERATE PIECES
PIECE "C.1"
60.334 X 11.729 X 0.997 = 693.776 CF / 27 = 14.682 CYD
14.682 YARDS CONCRETE @ 4,850 LBS/YD = 68,636 LBS
68,636 LBS / 2,000 LBS = 28.2 US TONS
IF NECESSARY, THIS PIECE CAN BE CAST IN TWO SEPARATE
SECTIONS WEIGHING 14.0 TONS EACH

FIG. 13

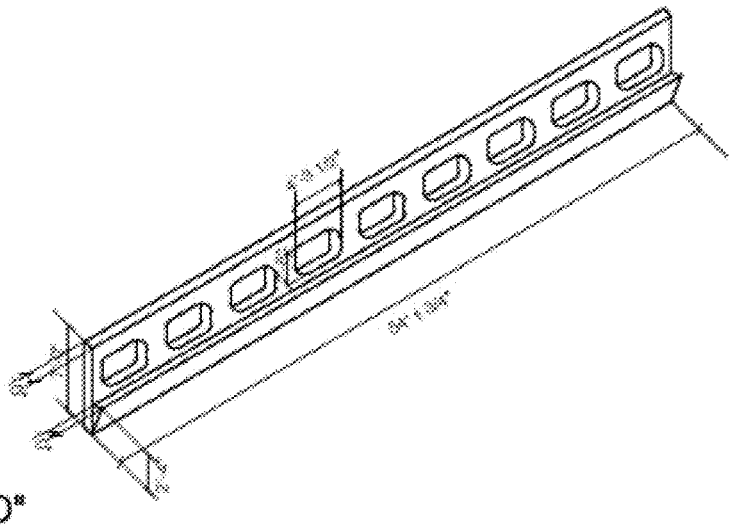


PIECE "C.2"

30,334 X 12.500 X 0.667 = 413,828 CF / 27 = 15,552 CYD
15,552 YARDS CONCRETE @ 4,000 LBS/YD = 62,208 LBS
62,208,000 / 2,000 LBS = 31 US TONS

IF NECESSARY, THIS PIECE CAN BE CAST IN TWO SEPARATE
SECTIONS WEIGHING 15.5 TONS EACH

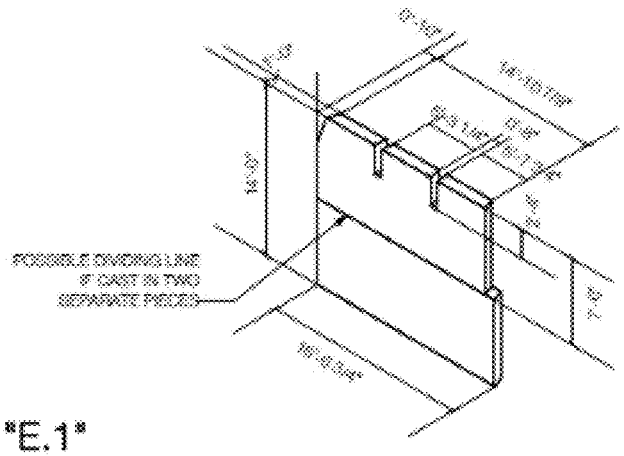
FIG. 14



PIECE "D"

(54.1458 X 7.0 X 0.5000) + (54.1458 X 10.3334 X 0.6333) / 2) = 966.49 CF
966.49 + (54.2916 X 2.8667 X 0.6333 X 2) = 1230.38 CF
1230.38 / 27 = 10.8553 CYD
10.86 YARDS CONCRETE @ 4,000 LBS/YD = 43,440 LBS
43,440 LBS / 2,000 LBS = 21.72 US TONS

FIG. 15

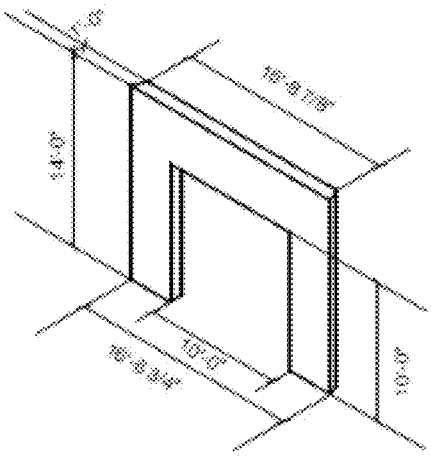


PIECE "E.1"

16.7396 + (24.5005-15.7396)/2) = 16.131 CF
16.131 X 14 = 226.834 CF
226.834 - (7 X .833 X 1) - (2.334 X .667 X 1) X 2) - ((2.334 X .833 X 1) / 2) = 216.917 CF
216.917 / 27 = 7.9969 CYD
7.9969 YARDS CONCRETE @ 4,000 LBS/YD = 31,987.6 LBS
31,987.6 LBS / 2,000 LBS = 15.9 US TONS

PIECE E.1 CAN BE CAST IN TWO SEPARATE PIECES = 7.95 US TONS

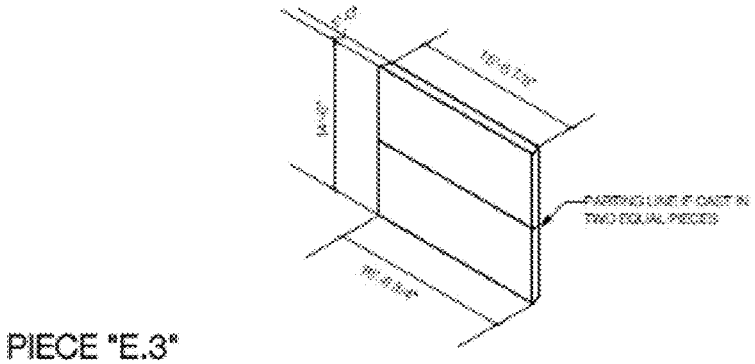
FIG. 16



PIECE "E.2"

16.7396 + ((16.6226-16.7396)/2) = 16.1131 CF
16.1131 X 14 = 225.8834 CF
225.8834 - (10 X 10 X 1) = 125.8834 CF
125.8834 / 27 = 4.6606 CYD
4.6606 YARDS CONCRETE @ 4,000 LBS/YD = 18,642.0 LBS
18,642.0 LBS / 2,000 LBS = 9.3 US TONS

FIG. 17



PIECE "E.3"

FIG. 18

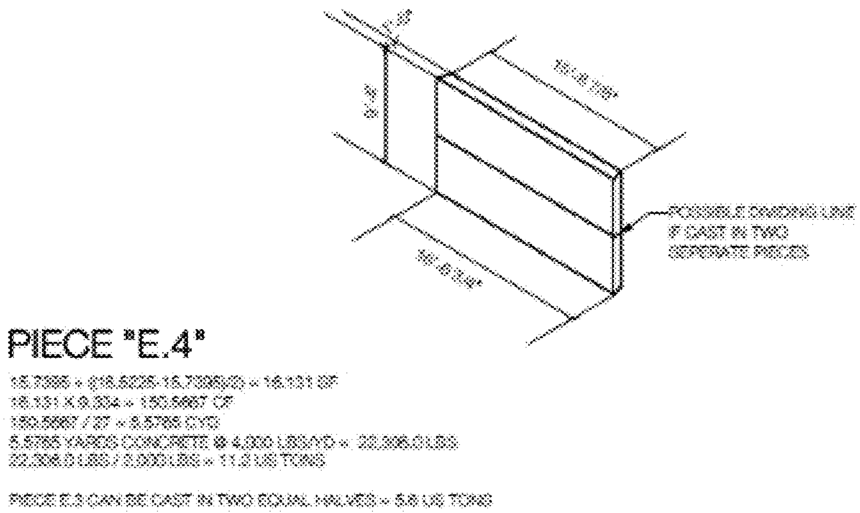

POSSIBLE DIVIDING LINE
IF CAST IN TWO
SEPERATE PIECES
PIECE "E.4"

FIG. 19

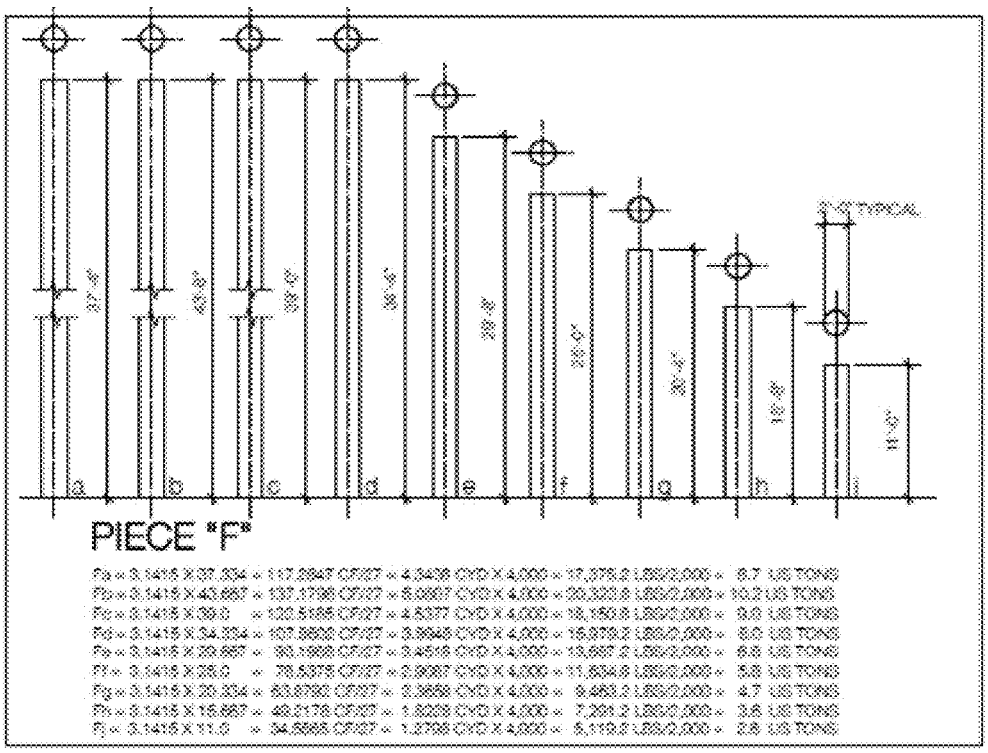


FIG. 20

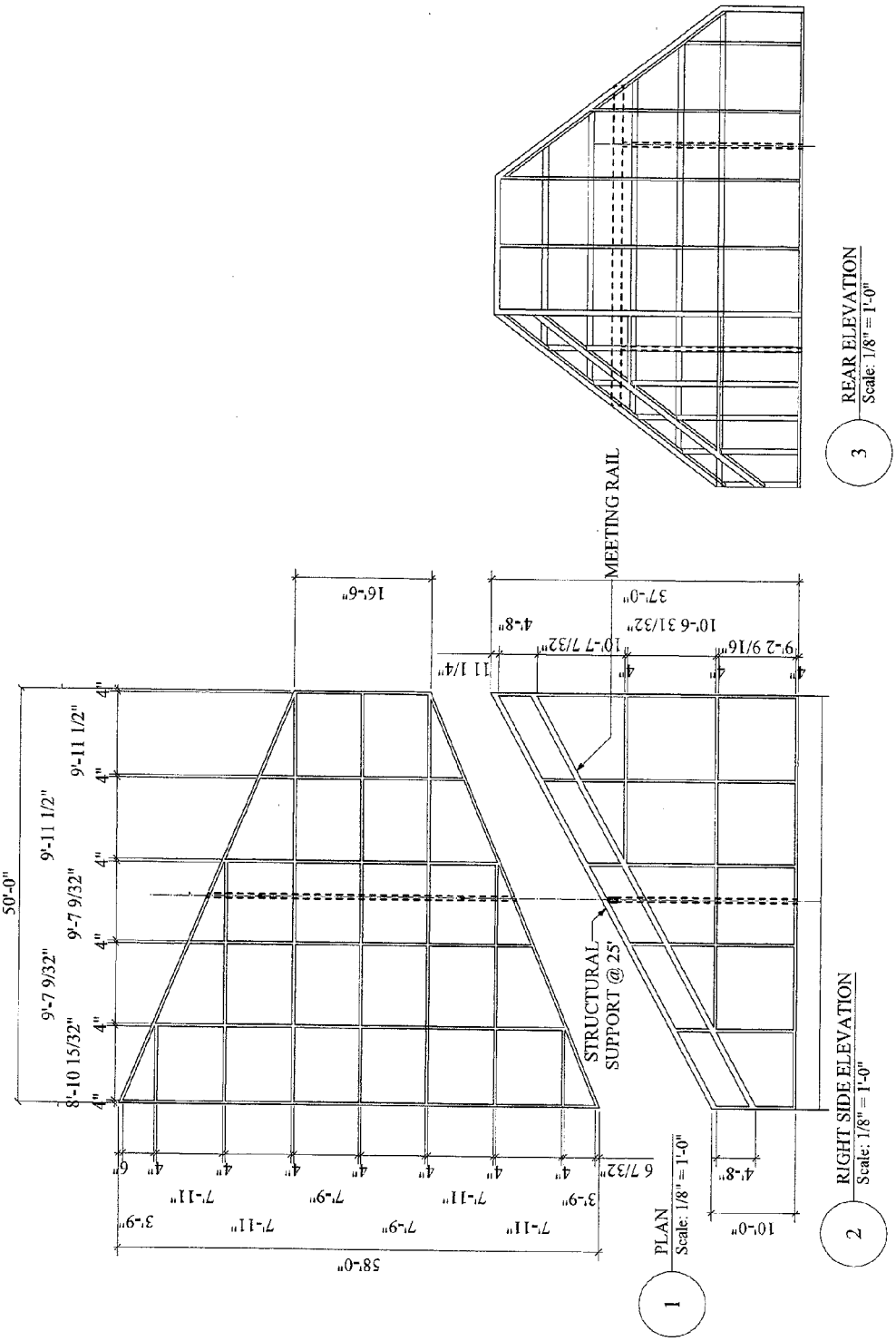

REAR ELEVATION
Scale: 1/8" = 1'-0"
3
MEETING RAIL
RIGHT SIDE ELEVATION
Scale: 1/8" = 1'-0"
2
PLAN
Scale: 1/8" = 1'-0"
1
STRUCTURAL SUPPORT @ 25'
50'-0"
9'-11 1/2"
9'-7 9/32"
8'-10 15/32"
58'-0"
37'-0"
16'-6"
10'-0"

FIG. 21

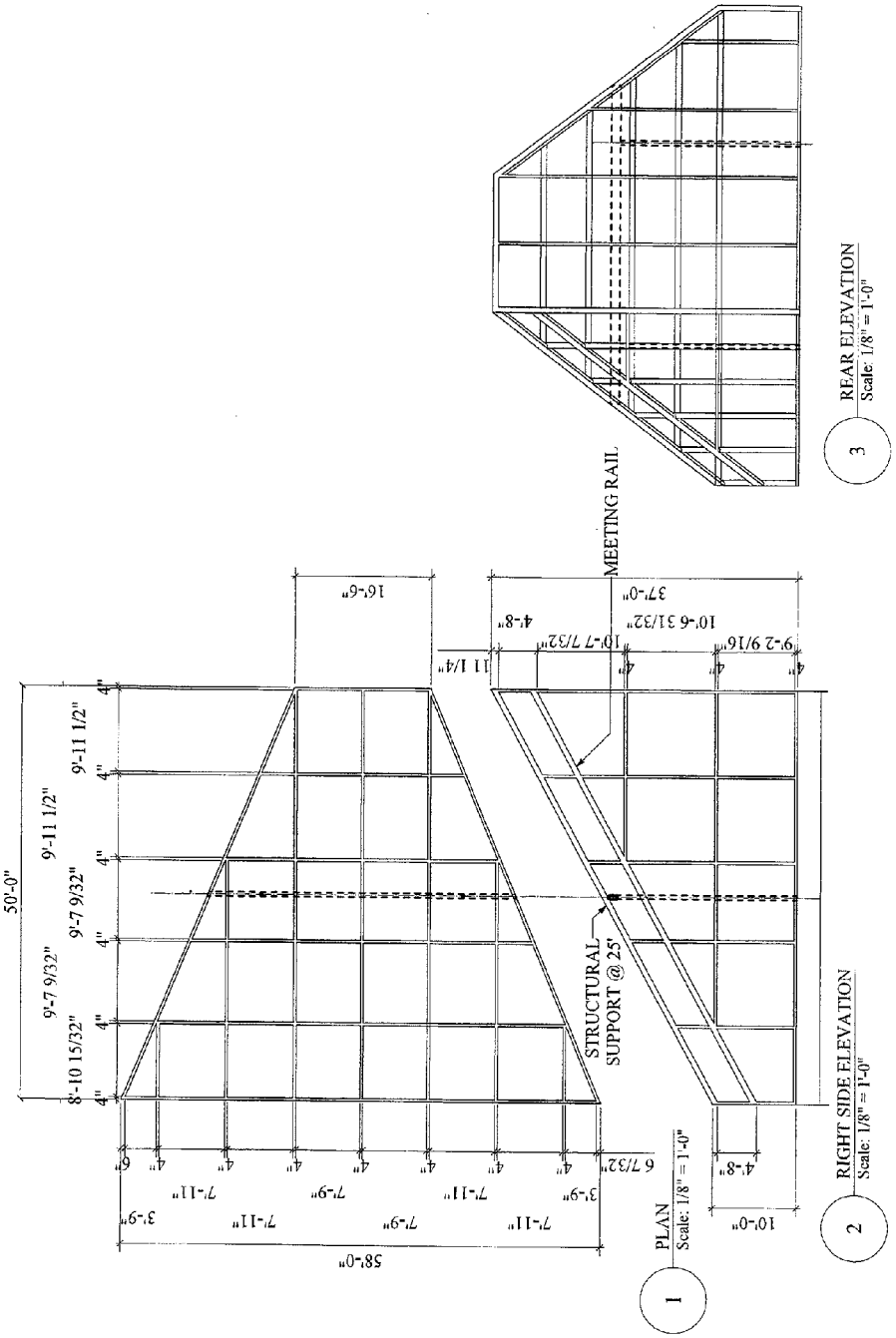

REAR ELEVATION
Scale: 1/8" = 1'-0"
3
MEETING RAIL
RIGHT SIDE ELEVATION
Scale: 1/8" = 1'-0"
2
PLAN
Scale: 1/8" = 1'-0"
1
STRUCTURAL SUPPORT @ 25'
50'-0"
9'-11 1/2"
9'-11 1/2"
9'-7 9/32"
9'-7 9/32"
8'-10 15/32"
58'-0"
37'-0"
16'-6"
10'-0"
4'-8"
4"
6"

FIG. 22

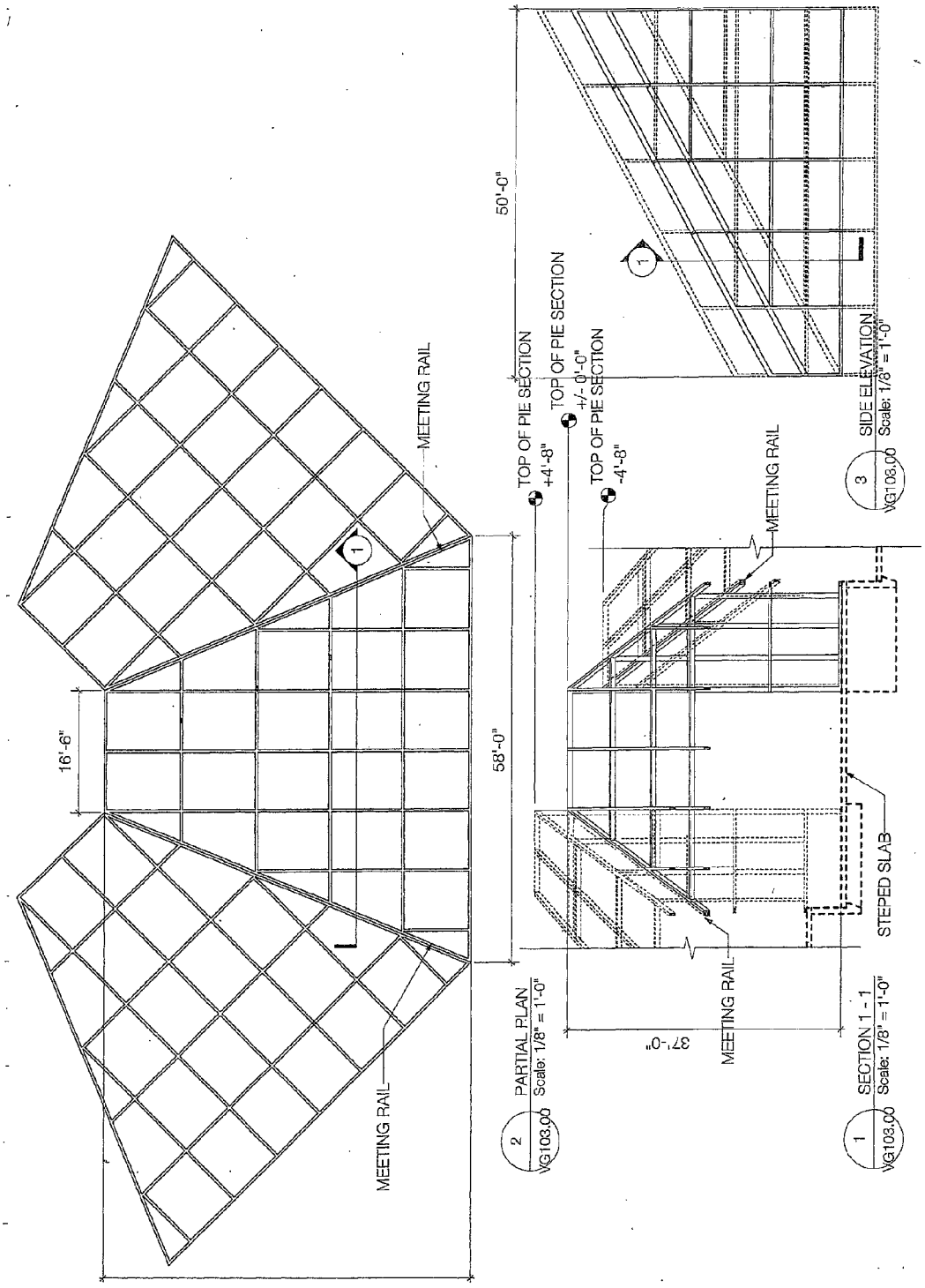

MEETING RAIL
16'-6"
58'-0"
MEETING RAIL
1
2
PARTIAL PLAN
Scale: 1/8" = 1'-0"
VG103.00
TOP OF PIE SECTION
+4'-8"
TOP OF PIE SECTION
+/- 0'-0"
TOP OF PIE SECTION
-4'-8"
MEETING RAIL
MEETING RAIL
37'-0"
STEPED SLAB
1
SECTION 1 - 1
Scale: 1/8" = 1'-0"
VG103.00
50'-0"
1
3
SIDE ELEVATION
Scale: 1/8" = 1'-0"
VG103.00

FIG. 23

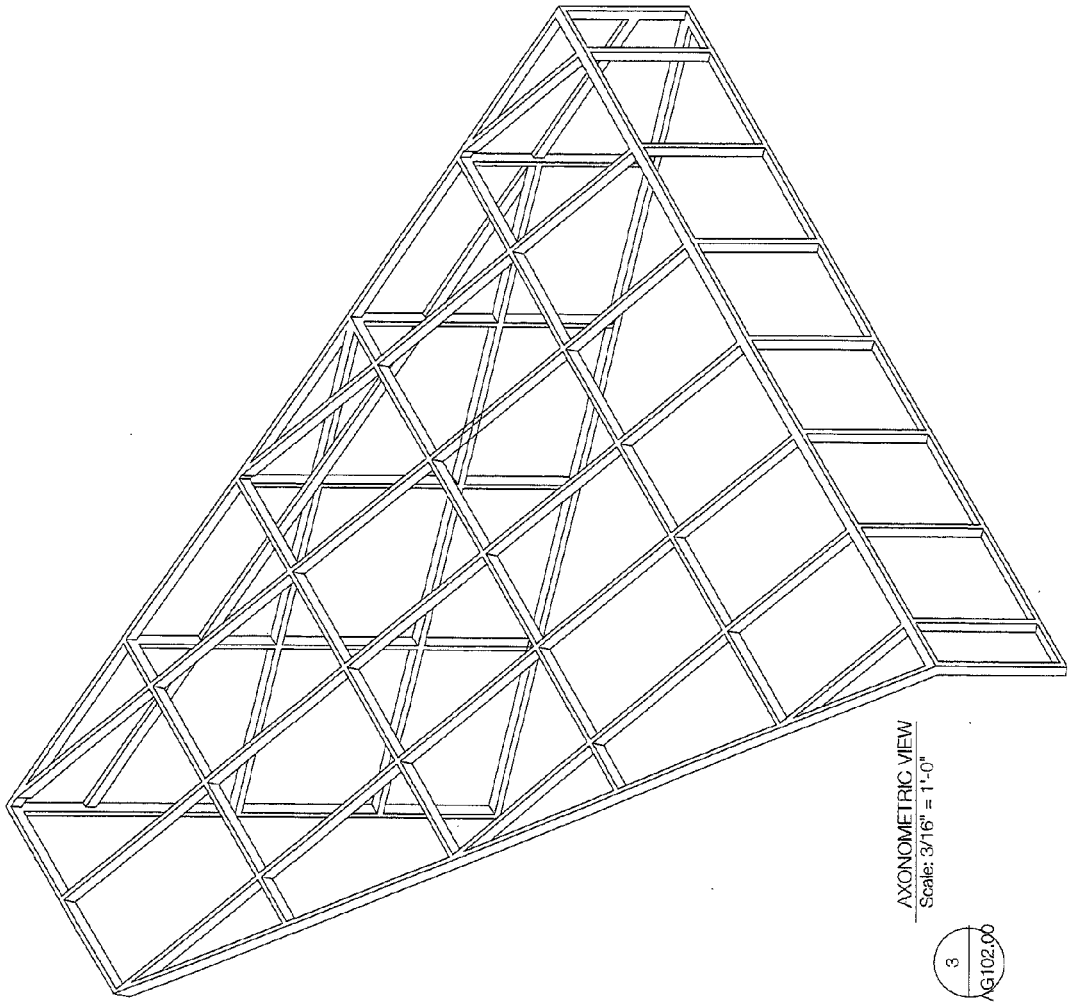


FIG. 24

VERTICAL FARM

[0001] A list of design items that include some, but not all of the novel aspects of my version of the vertical farm follows:

[0002] 1. The spiral design will aways be oriented towards the morning light and reduce the glare of the western (setting) sun, which is the optimum daylight spectra for growing plants.

[0003] 2. The slanted surface of the glass over the growing trays will be oriented toward the perpendicular rays of the sun at the equinox, thus allowing the maximum amount of natural light to reach the growing surfaces, averaged over the full twelve months of the year. The angle of this surface will vary depending on the position of the farm north or south of the equator. The further north or south, the more vertical the angle, as the sun is, on average, lower in the sky the further north or south of the equator one moves.

[0004] 3. The glazing in selected portions of the exterior will be reversed from its normal orientation and the reflective surfaces will be on the inside, thus reflecting the light admitted through the glass and directing it to parts of the interior growing area that would normally not get natural light. This will diminish the need for the use of LED lights. Even though the LED lights consume less electric power than do other types of bulbs, they still consume power and thus cost money.

[0005] 4. Various reflective surfaces will be incorporated into the structure to facilitate the distribution of natural light to all parts of the growing trays. These will probably be made of mylar canvas, so that they can be adjusted by the farm workers to operate at maximum efficiency at all times of the year.

[0006] 5. The 240' high version is designed as precast concrete pieces that can be cast anywhere and shipped anywhere in the world and then erected on site. This is accomplished in the following manner:

[0007] a. Each component is sized so that 96% of the seaports in the world have cranes strong enough to lift an individual piece.

[0008] b. All of the components can be transported by truck from the port to the building site. They will fit on a flatbed truck, not exceed the load limits on most roadways in the world and clear most obstacles on most roadways in the world.

[0009] c. All of the components will fit on a standard sea going barge, allowing them to be towed by seagoing tug boats to any place in the world.

[0010] Larger versions of the vertical farm can be easily done using standard cast in place concrete as the building method, being able to be erected higher and larger in diameter if the site and the projected need warrant it.

[0011] In all other aspects the vertical farm utilizes standard construction techniques as would be applied to any factory structure, anywhere in the world.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. **1** is a close up depiction of a skyscraper embodiment of the present invention.

[0013] FIG. **2** is a depiction of a skyscraper embodiment of the present invention.

[0014] FIG. **3** is a close up depiction of a skyscraper embodiment of the present invention.

[0015] FIG. **4** is a close up depiction of the bottom of a skyscraper embodiment of the present invention.

[0016] FIG. **5** is a close up depiction of the side of a skyscraper embodiment of the present invention.

[0017] FIG. **6** is a close up depiction of an interior floor of a skyscraper embodiment of the present invention.

[0018] FIG. **7** is a close up depiction of interior windows of a skyscraper embodiment of the present invention.

[0019] FIG. **8** is a cross section of a skyscraper embodiment of the present invention.

[0020] FIG. **9** is blown out view of basic components and a basic module of a skyscraper embodiment of the present invention.

[0021] FIG. **10** is a depiction of a piece of a skyscraper embodiment of the present invention.

[0022] FIG. **11** is a depiction of another piece of a skyscraper embodiment of the present invention.

[0023] FIG. **12** is a depiction of yet another piece of a skyscraper embodiment of the present invention.

[0024] FIG. **13** is a depiction of yet another piece of a skyscraper embodiment of the present invention.

[0025] FIG. **14** is a depiction of yet another piece of a skyscraper embodiment of the present invention.

[0026] FIG. **15** is a depiction of a further piece of a skyscraper embodiment of the present invention.

[0027] FIG. **16** is a depiction of yet another piece of a skyscraper embodiment of the present invention.

[0028] FIG. **17** is a depiction of yet another piece of a skyscraper embodiment of the present invention.

[0029] FIG. **18** is a depiction of yet another piece of a skyscraper embodiment of the present invention.

[0030] FIG. **19** is a depiction of yet another piece of a skyscraper embodiment of the present invention.

[0031] FIG. **20** is a depiction of component pieces of a skyscraper embodiment of the present invention.

[0032] FIG. **21** is a depiction of a pie shaped glass enclosure in an embodiment of the present invention.

[0033] FIG. **22** is a depiction of another pie shaped glass enclosure in an embodiment of the present invention.

[0034] FIG. **23** is a depiction of another pie shaped glass enclosure in an embodiment of the present invention.

[0035] FIG. **24** is a depiction of another pie shaped glass enclosure in an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0036]

TABLE 1

SCHEDULE OF PRECAST STRUCTURAL CONCRETE COMPONENTS NEEDED TO CONSTRUCT A 240 FOOT HIGH VERTICAL FARM BUILDING

PIECE MARK	APPROXIMATE DIMENSIONS	WEIGHT PER PIECE	NUMBER REQUIRED	TOTAL WEIGHT
A	58' × 3' × 0.667'	8.6 US Tons	49 Pieces	421.4 US Tons
B	51' × 2' × 0.75'	6.5 US Tons	98 Pieces	637.0 US Tons
C1*	51' × 12' × 0.667'	29.2 US Tons	49 Pieces	1,430.8 US Tons
C2*	51' × 12.667' × 0.667'	31.0 US Tons	98 Pieces	3,038.0 US Tons
D	54' × 7' × 0.833'	21.72 US Tons	50 Pieces	1,086.0 US Tons

TABLE 1-continued

SCHEDULE OF PRECAST STRUCTURAL CONCRETE COMPONENTS NEEDED TO CONSTRUCT A 240 FOOT HIGH VERTICAL FARM BUILDING

PIECE MARK	APPROXIMATE DIMENSIONS	WEIGHT PER PIECE	NUMBER REQUIRED	TOTAL WEIGHT
E1*	16' × 14' × 1'	15.9 US Tons	49 Pieces	779.1 US Tons
E2	16' × 14' × 1'	9.3 US Tons	12 Pieces	111.6 US Tons
E3*	16' × 14' × 1'	16.7 US Tons	37 Pieces	617.9 US Tons
E4*	16' × 9.334' × 1'	11.2 US Tons	50 Pieces	560 US Tons
Fa	37.334' × 2' Diam.	8.7 US Tons	147 Pieces	1,278.9 US Tons
Fb	43.667' × 2' Diam.	10.2 US Tons	3 Pieces	30.6 US Tons
Fc	39.000' × 2' Diam.	9.0 US Tons	3 Pieces	27.0 US Tons
Fd	34.334' × 2' Diam.	8.0 US Tons	3 Pieces	24.0 US Tons
Fe	29.667' × 2' Diam.	6.8 US Tons	3 Pieces	20.4 US Tons
Ff	25.000' × 2' Diam.	5.8 US Tons	3 Pieces	17.4 US Tons
Fg	20.334' × 2' Diam.	4.7 US Tons	3 Pieces	14.1 US Tons
Fh	15.667' × 2' Diam.	3.6 US Tons	3 Pieces	10.8 US Tons
Fi	11.000' × 2' Diam.	2.6 US Tons	3 Pieces	7.8 US Tons

*Pieces marked with an asterisk may be cast in two equal pieces doubling the number and halving the weight of each piece
See drawings for specific dimensions and weights of each piece and a diagram of the overall structure.

[0037] Referring now to FIGS. **21-24**: Design standards are (i) withstand category 5 hurricane winds, (ii) withstand tornado force winds for standard duration, (iii) withstand storm surge forces, (iv) withstand seismic forces, (v) require no major maintenance. Quantity required: make 8 complete sections per one story structure, make 40 complete sections per 240' structure. Note; each pie shaped glass enclosure consists of a truncated sloped glass section, a vertical front wall of 10'-0' height and one vertical side wall. Each adjacent section forms the side closure for the next lower section. The side closure can be glazed or left open depending on the requirements of the uses.

[0038] For the purposes of pricing assume all sides are glazed. The drawings represent the major structural members only. The glazier can insert whatever number of smaller mullions in the larger openings as they see fit to obtain the strongest and most economical glazing option.

[0039] Referring now to FIG. **21**, materials are 4×8 steel tube, insulated on exterior face and tied into thermally broken casing of infill glazing.

[0040] Referring now to FIG. **22**, materials are 4×8 steel tube, insulated on exterior face and tied into thermally broken casing of infill glazing, and 1" insulated engineered glass.

1. A device comprising:

(a) a spiral building having greenhouse enclosures mounted thereon

wherein said greenhouse enclosures have a slanted glass surface over the growing trays which is oriented toward the perpendicular rays of the sun at the equinox and wherein the glazing in portions of the exterior is reversed from its normal orientation and the reflective surfaces are on the inside, thus reflecting the light admitted through the glass and directing it to parts of the interior growing area.

* * * * *