

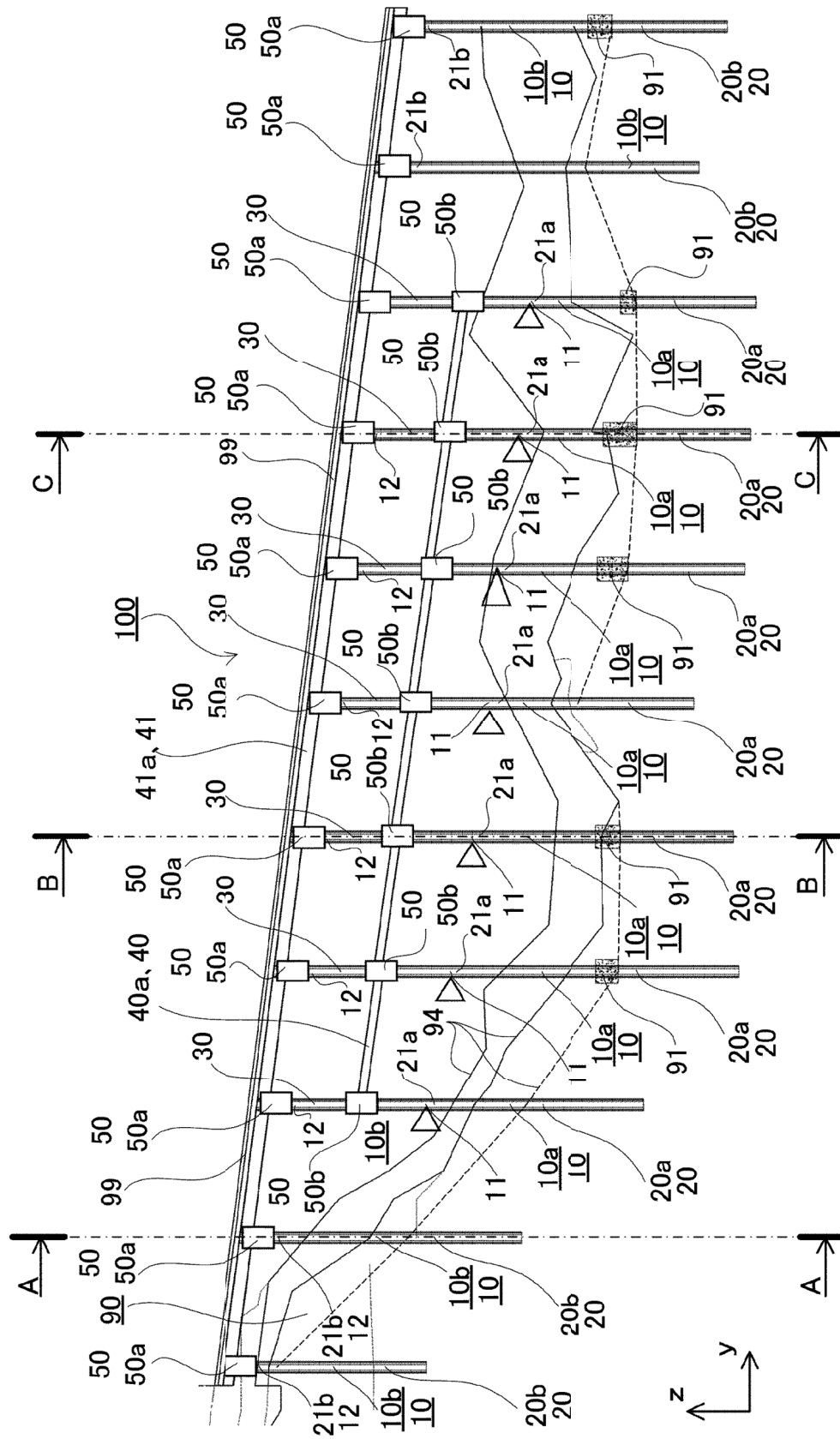


**FIG. 1**

FIG. 2

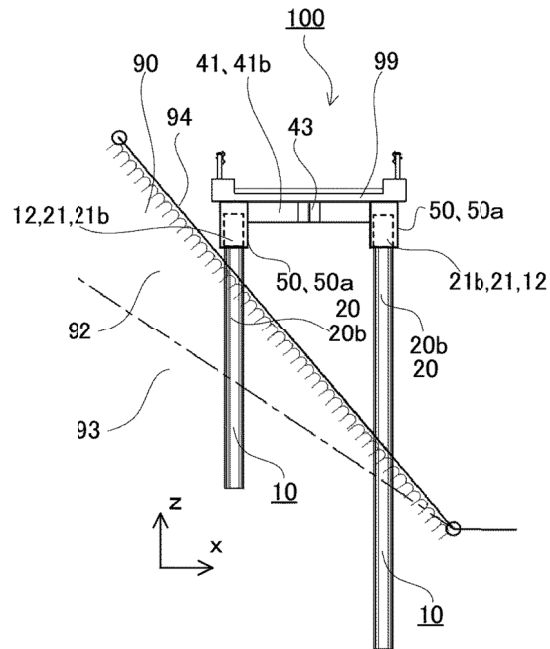


FIG. 3

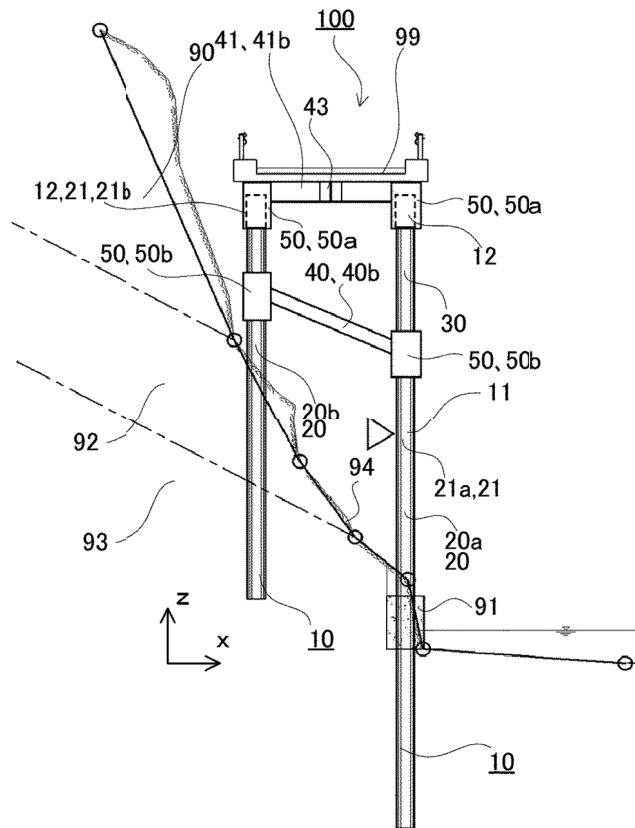


FIG. 4

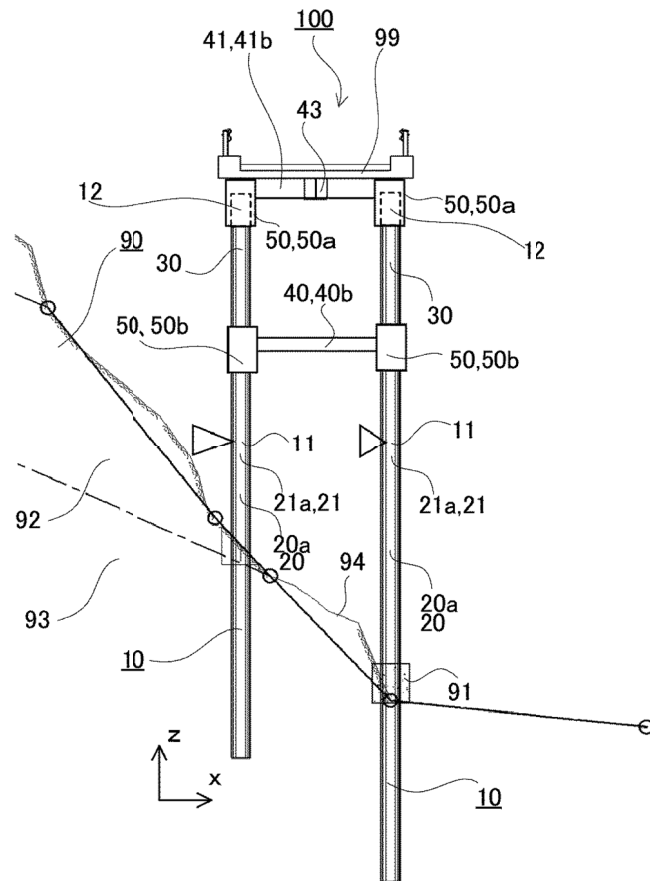


FIG. 5

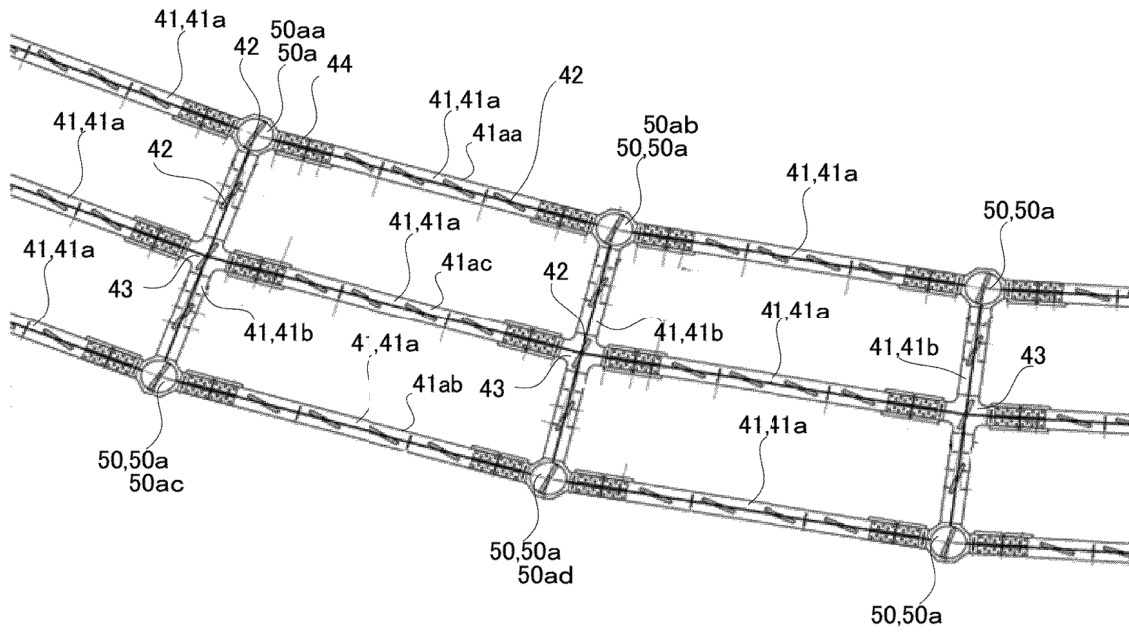


FIG. 6

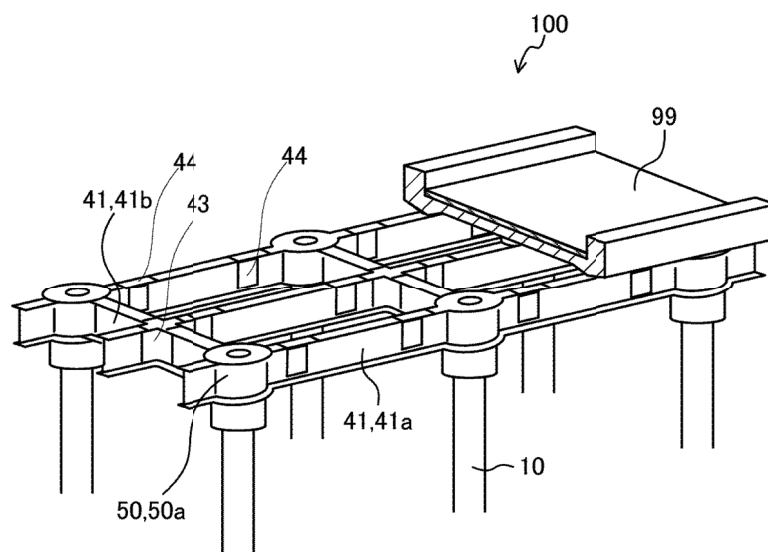


FIG. 7

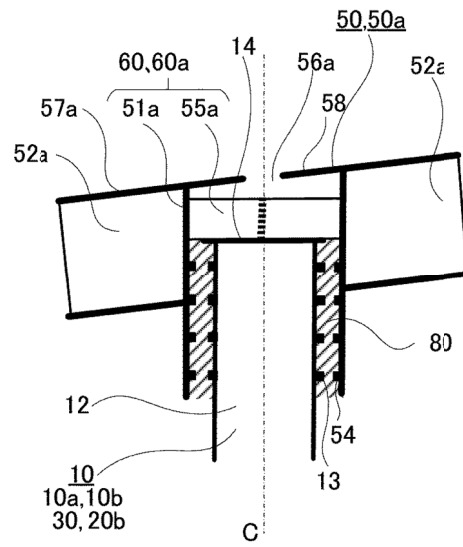


FIG. 8

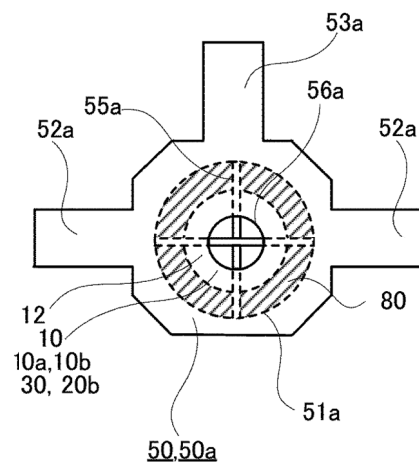


FIG. 9

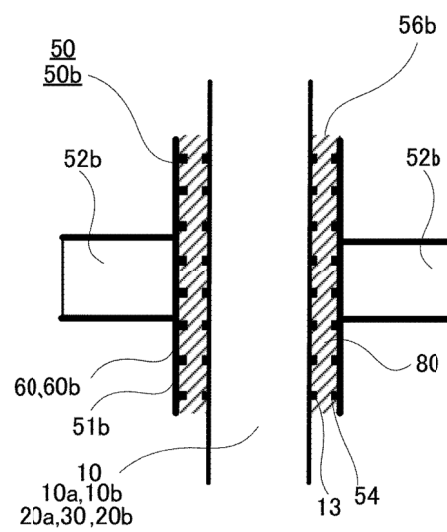


FIG. 10

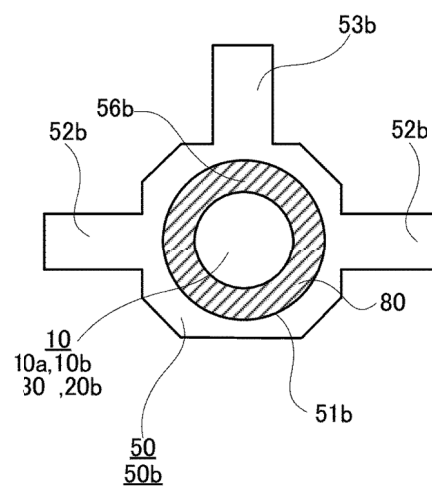


FIG. 11

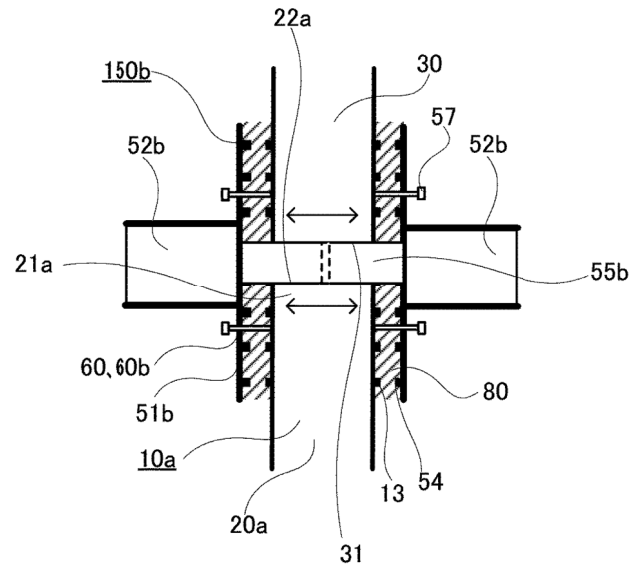


FIG. 12

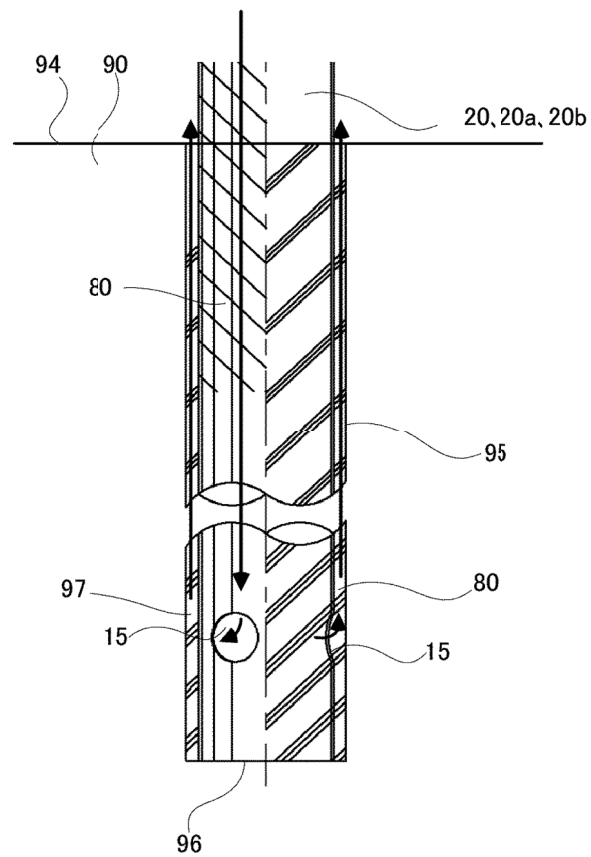


FIG. 13

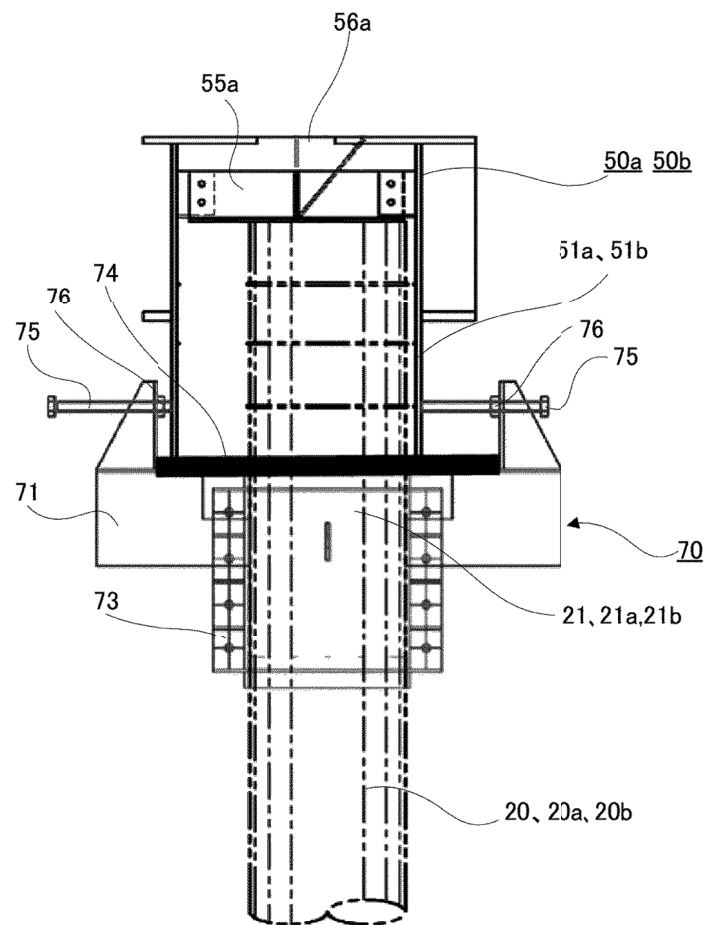


FIG. 14

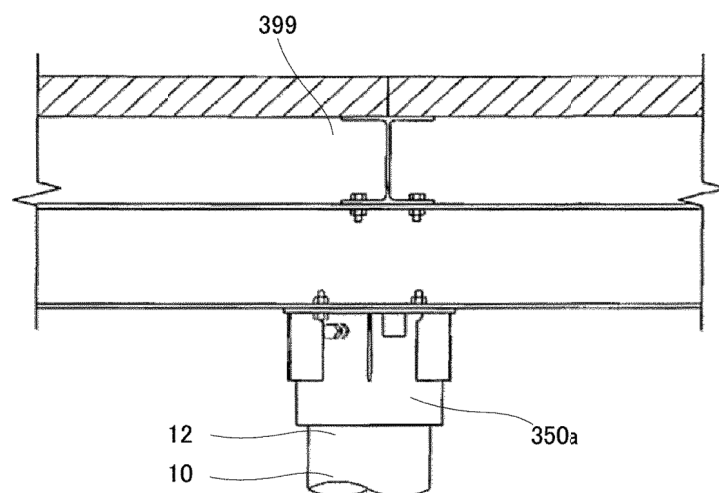


FIG. 15

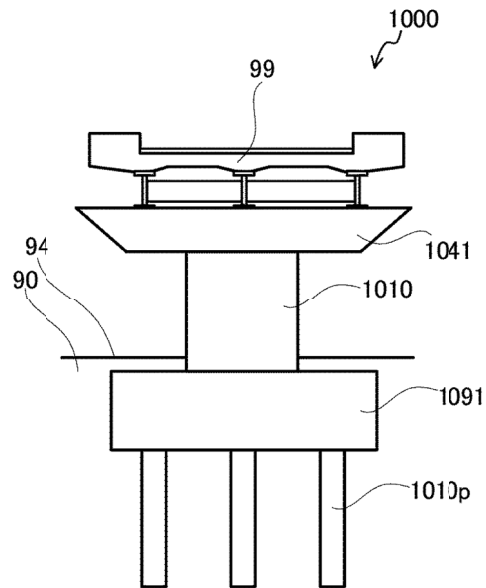


FIG. 16

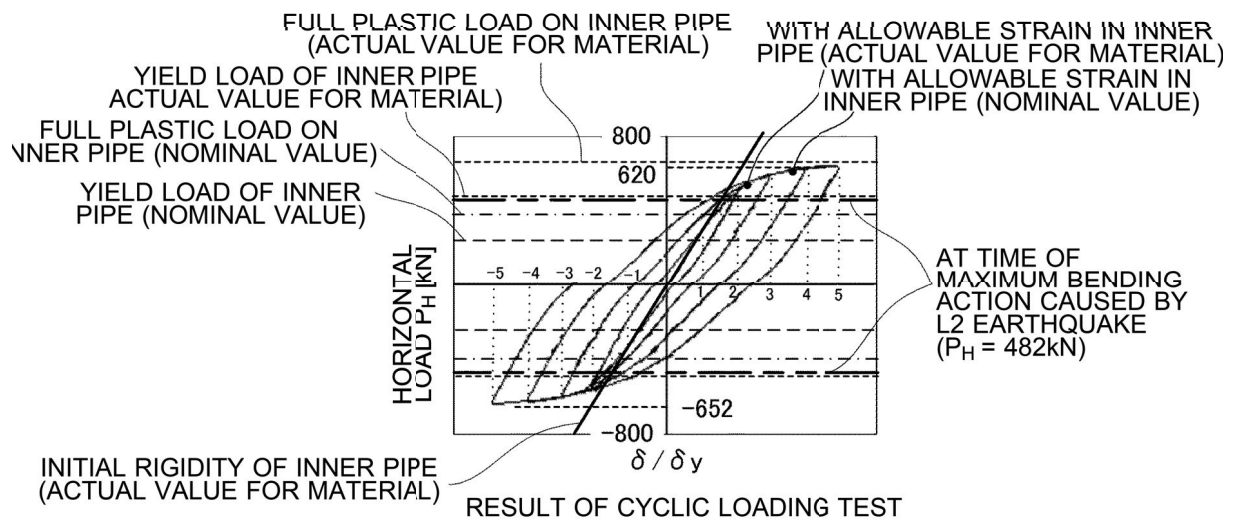
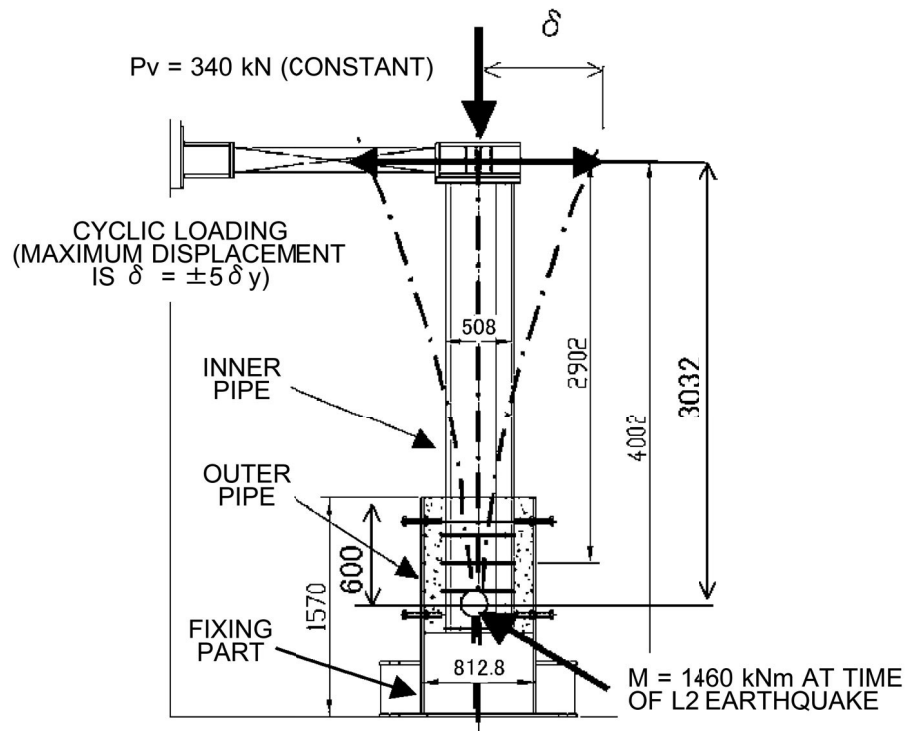


FIG. 17



TEST SPECIMEN FOR CYCLIC LOADING TEST

FIG. 18

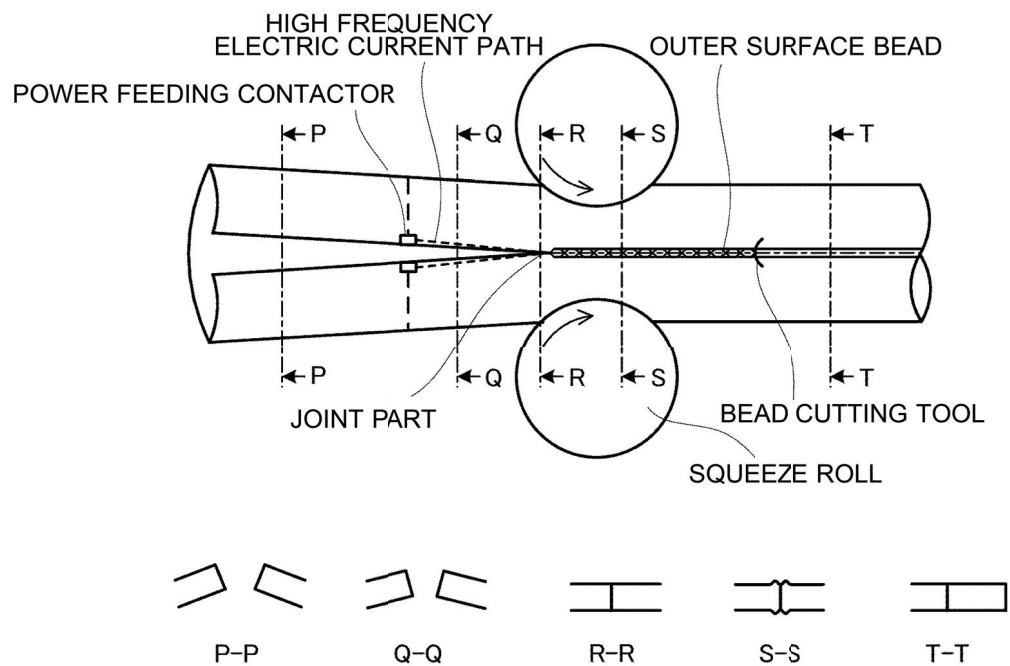


FIG. 19

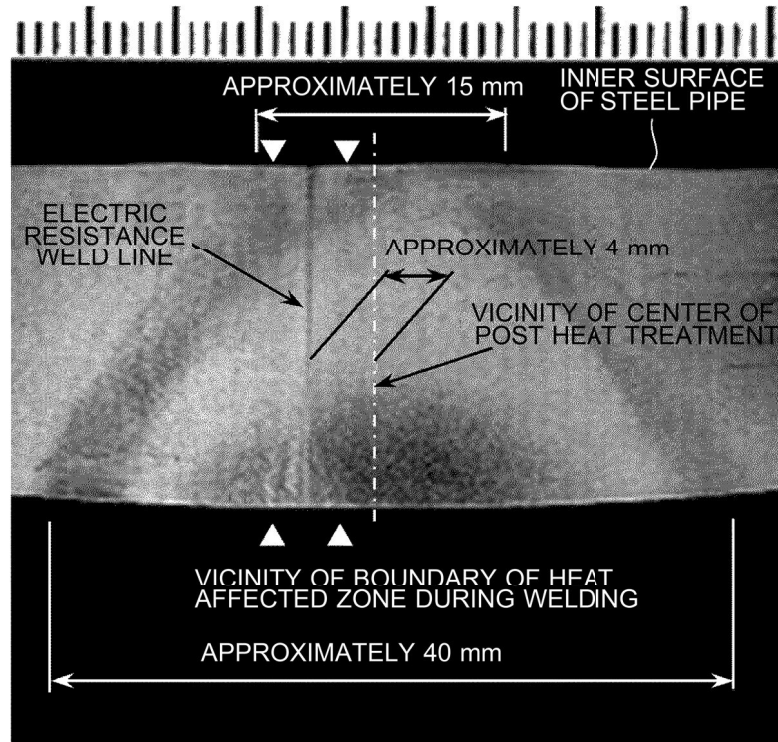


FIG. 20

| TEST STEEL PIPE | OUTER DIAMETER, PLATE THICKNESS | C    | Si   | Mn   | P     | S     | REMARKS                                        |
|-----------------|---------------------------------|------|------|------|-------|-------|------------------------------------------------|
| SKK190          | $\phi=508$ , $t=19$             | 0.16 | 0.19 | 0.83 | 0.022 | 0.004 | POST WELD HEAT TREATMENT-PERFORMED (ERW-T)     |
| SKK490          | $\phi=508$ , $t=19$             | 0.16 | 0.19 | 0.82 | 0.014 | 0.005 | POST WELD HEAT TREATMENT-NOT PERFORMED (ERW-N) |

FIG. 21

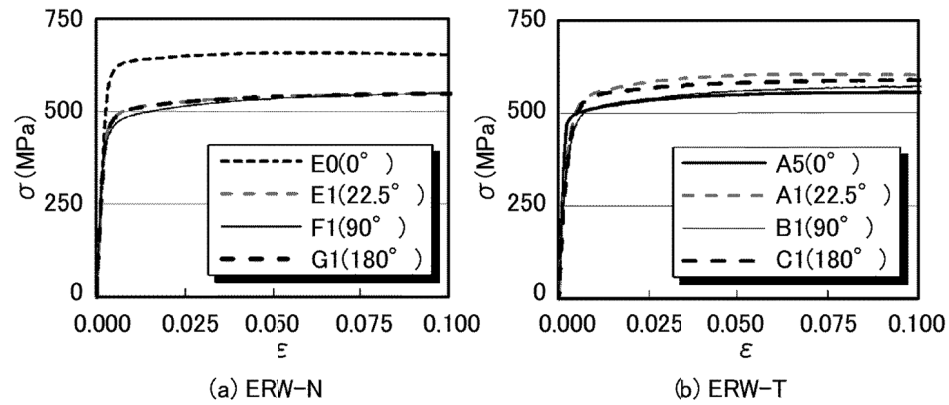


FIG. 22

| SAMPLING DIRECTION | SAMPLING POSITION |                           | ERW-N (POST WELD HEAT TREATMENT-NOT PERFORMED) |                  |                  |      | ERW-N (POST WELD HEAT TREATMENT-PERFORMED) |                  |                  |      |
|--------------------|-------------------|---------------------------|------------------------------------------------|------------------|------------------|------|--------------------------------------------|------------------|------------------|------|
|                    |                   | CIRCUM-FERENTIAL POSITION |                                                | $\sigma_y$ (MPa) | $\sigma_u$ (MPa) | YR   |                                            | $\sigma_y$ (MPa) | $\sigma_u$ (MPa) | YR   |
|                    | WELDED PART       | 0°                        | E0-T                                           | 617              | 657              | 0.94 | A5-T                                       | 474              | 556              | 0.85 |
| PIPE AXIS          | BASE METAL PART   | 22.5°                     | E1-T                                           | 476              | 551              | 0.86 | A1-T                                       | 497              | 604              | 0.82 |
|                    |                   | 90°                       | F1-T                                           | 451              | 551              | 0.82 | B1-T                                       | 464              | 572              | 0.81 |
|                    |                   | 180°                      | G1-T                                           | 473              | 549              | 0.86 | C1-T                                       | 481              | 589              | 0.82 |
|                    | BASE METAL PART   | MS VALUE                  | MS VALUE                                       | 407              | 542              | 0.75 | MS VALUE                                   | 423              | 575              | 0.74 |

\*MS VALUE (MILL SHEET VALUE)

FIG. 23

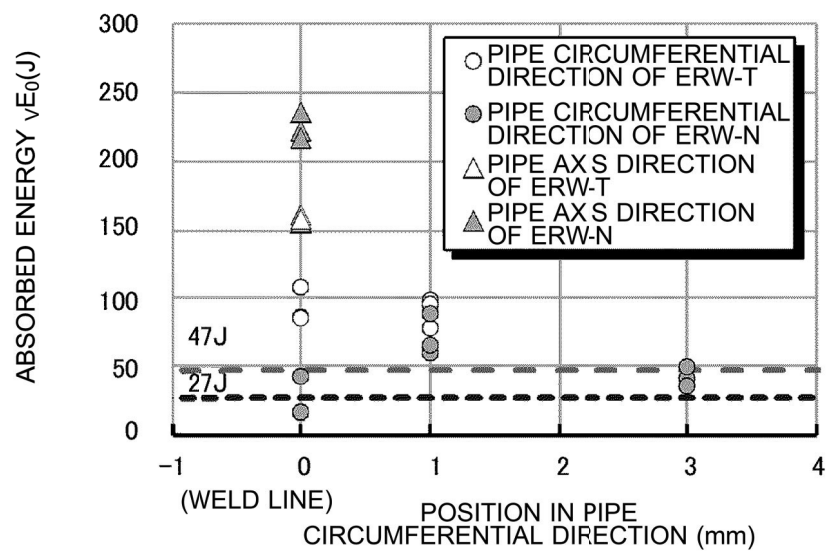




FIG. 25

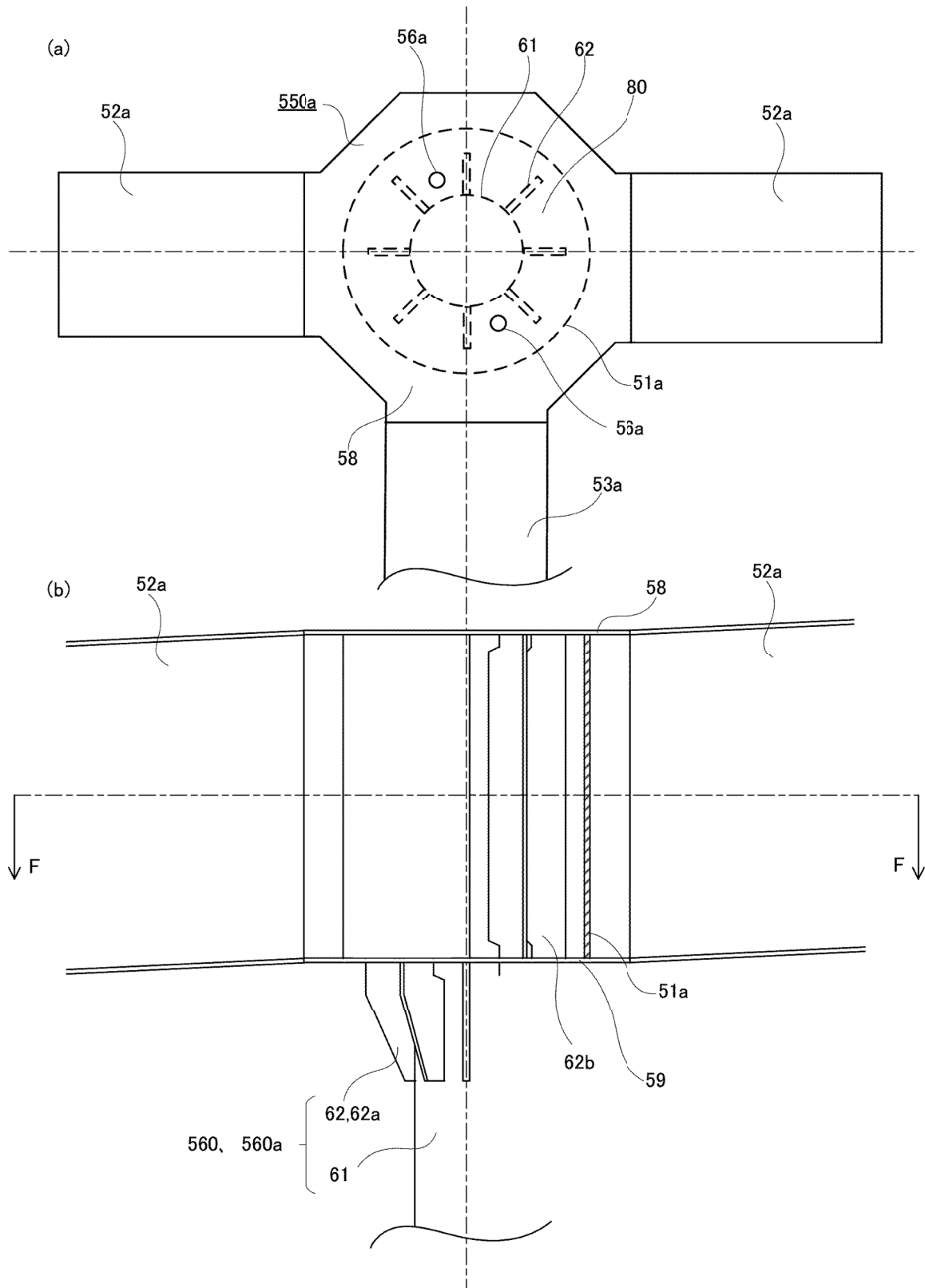


FIG. 26

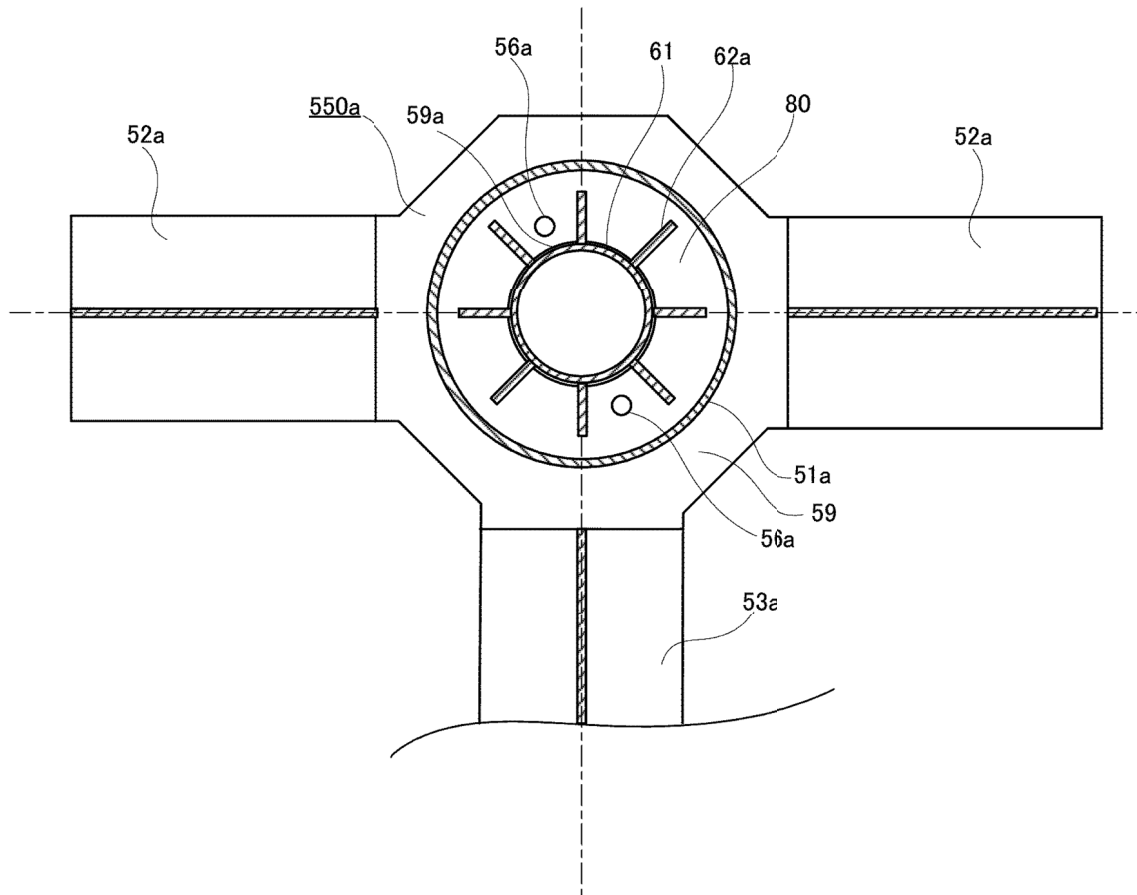


FIG. 27

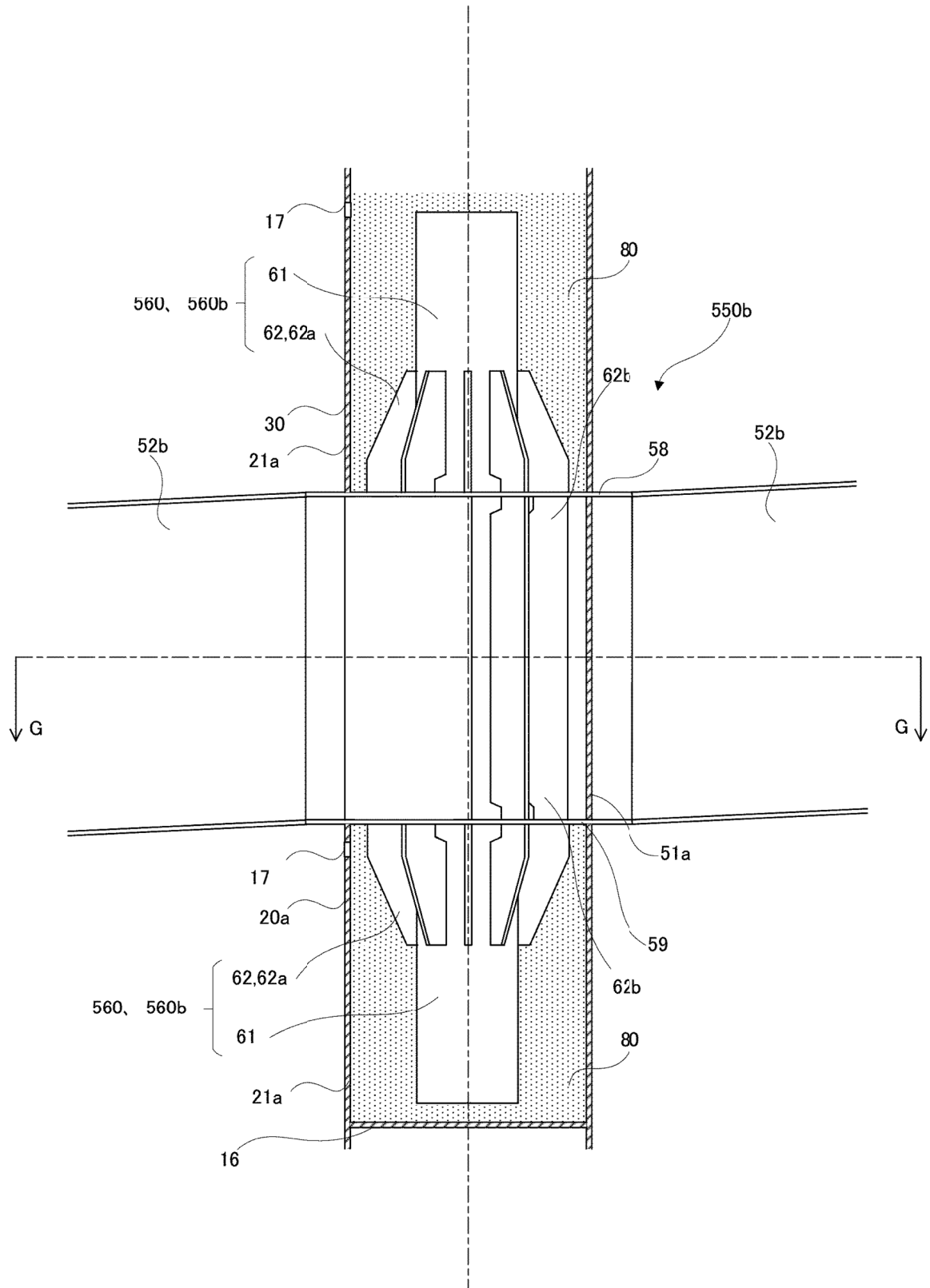


FIG. 28

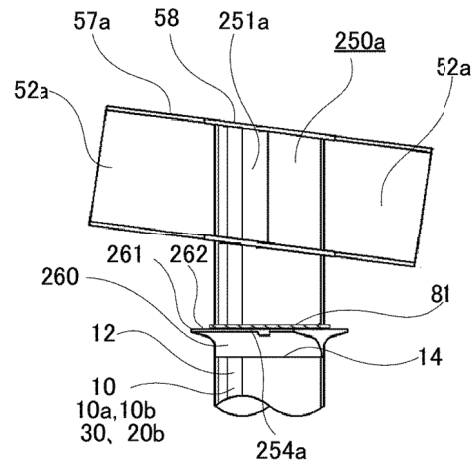


FIG. 29

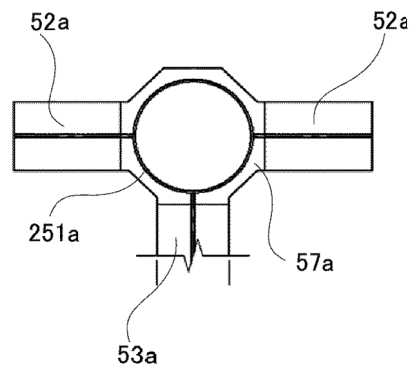


FIG. 30

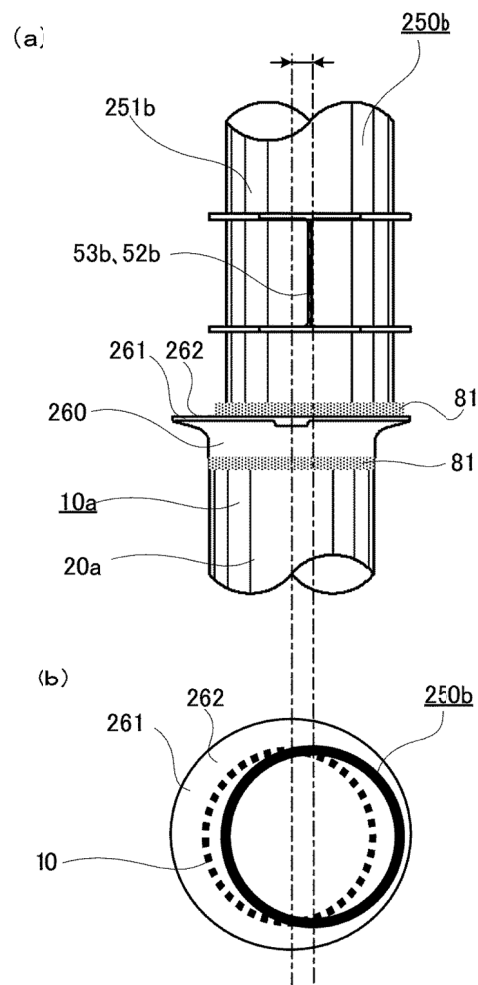


FIG. 31

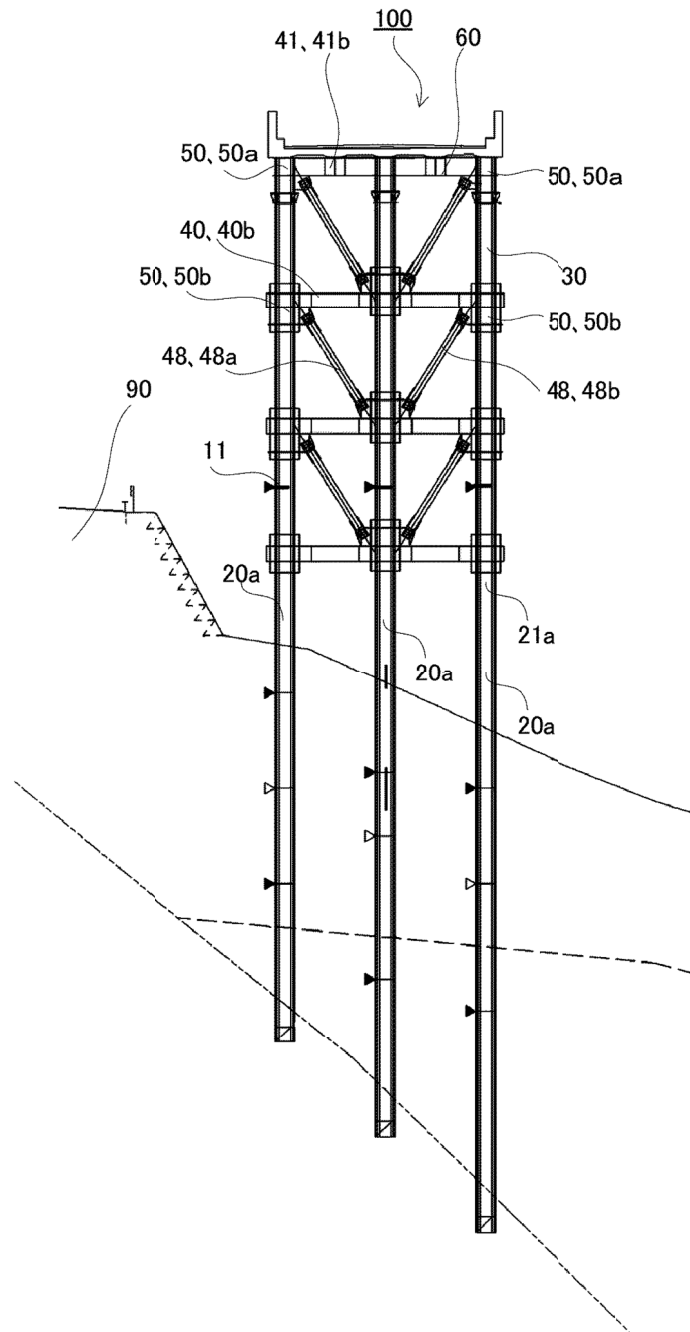


FIG. 32

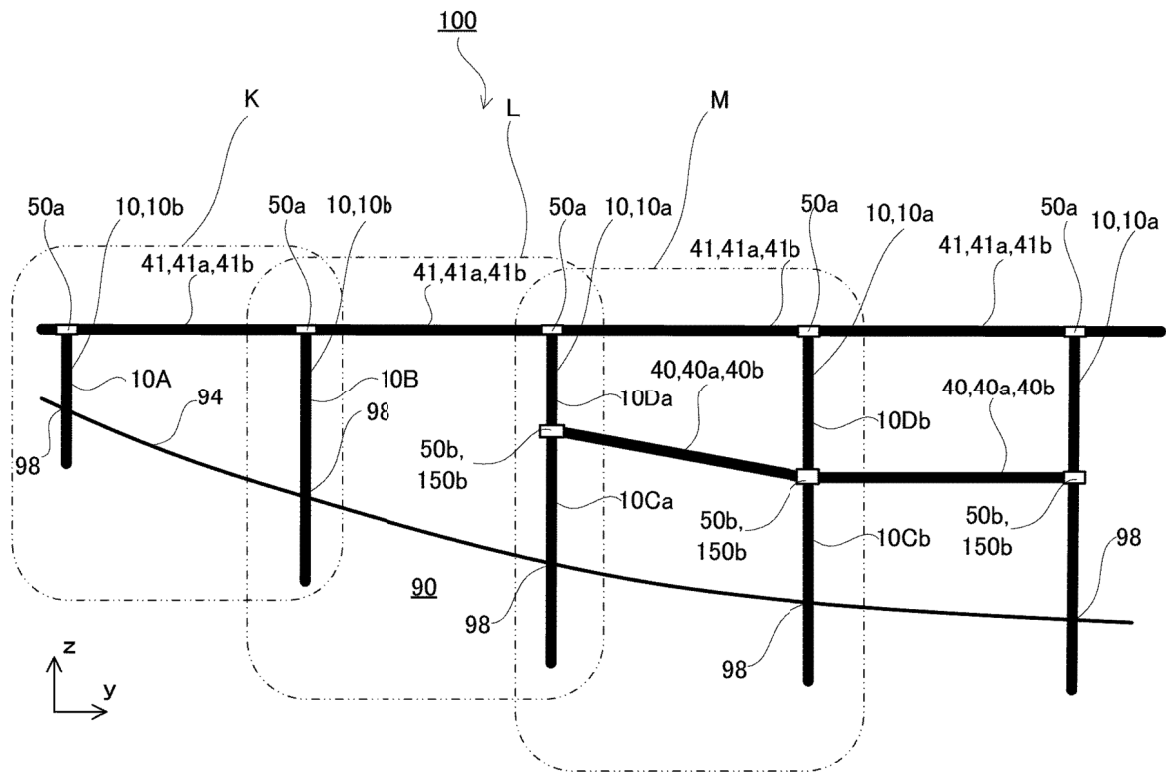


FIG. 33

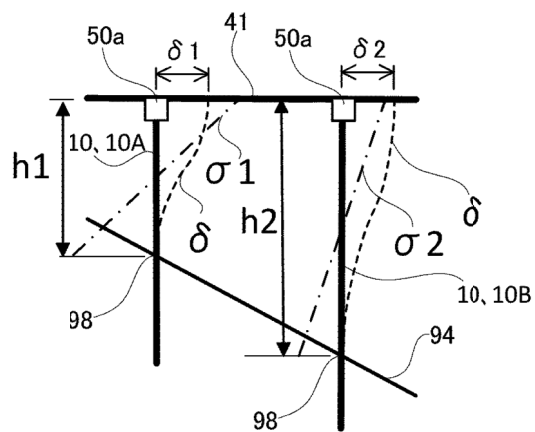


FIG. 34

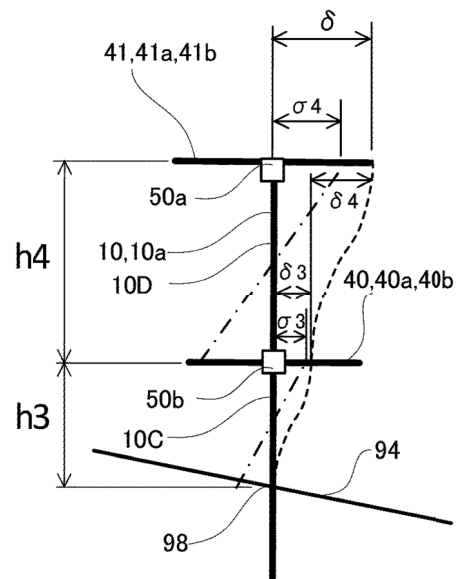


FIG. 35

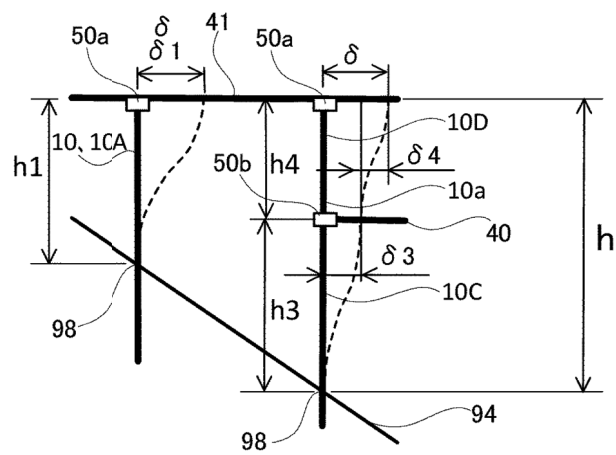


FIG. 36

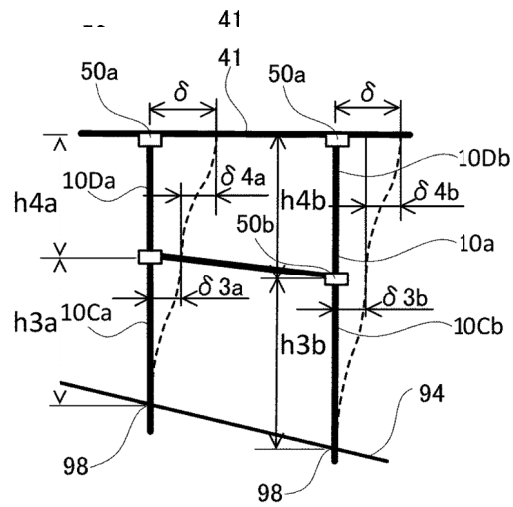


FIG. 37

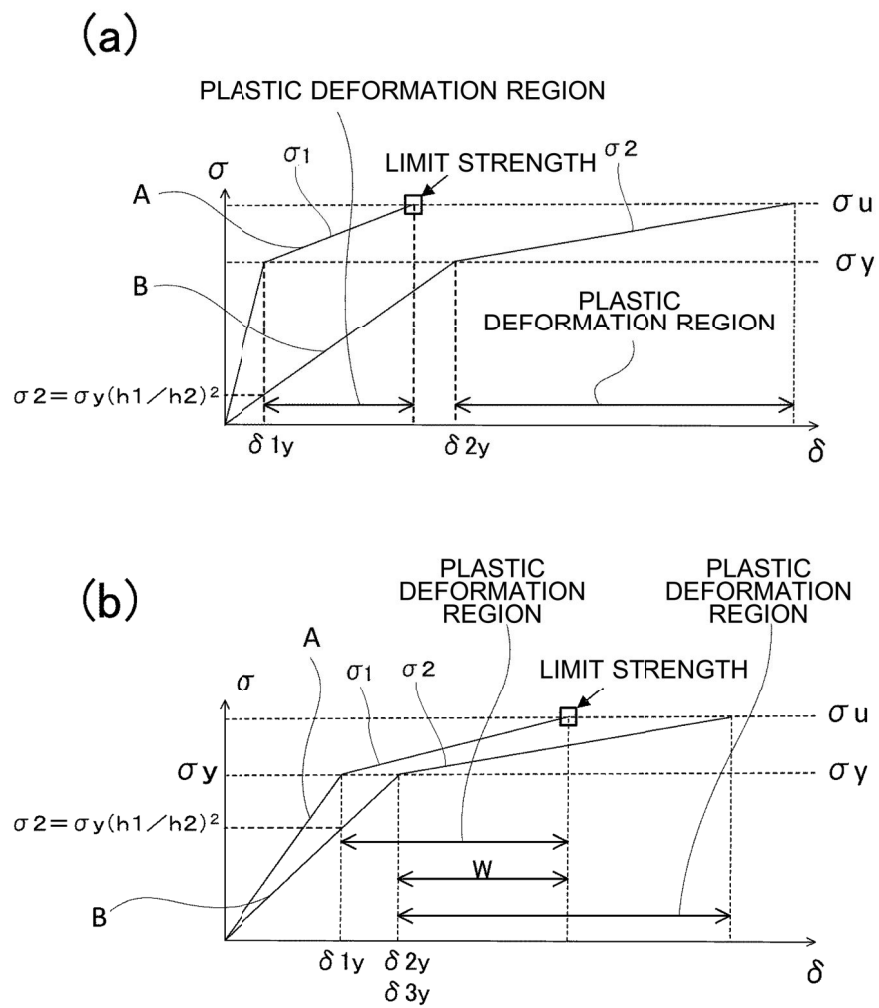


FIG. 38

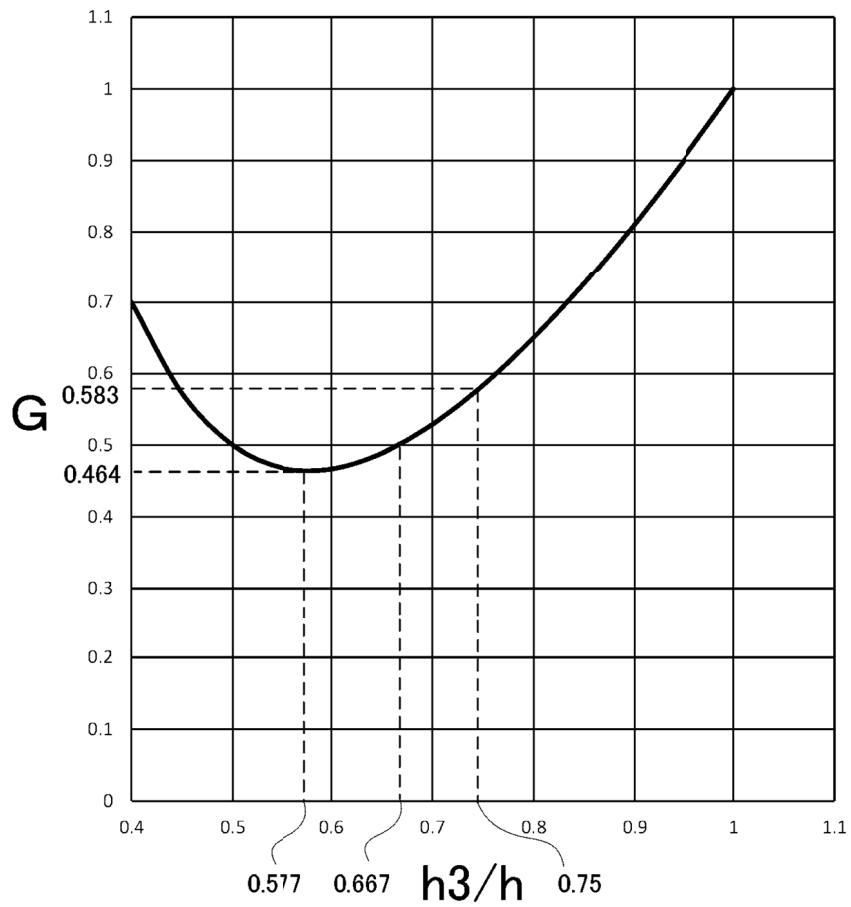


FIG. 39

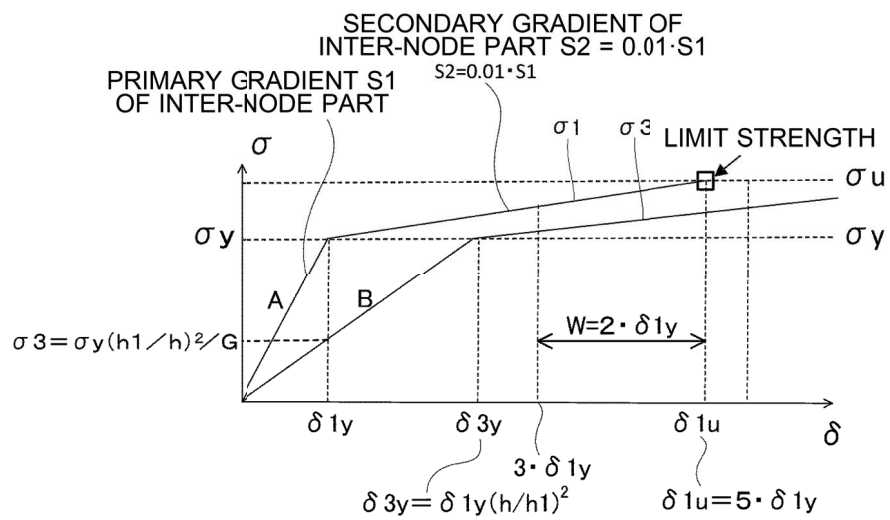




FIG. 42

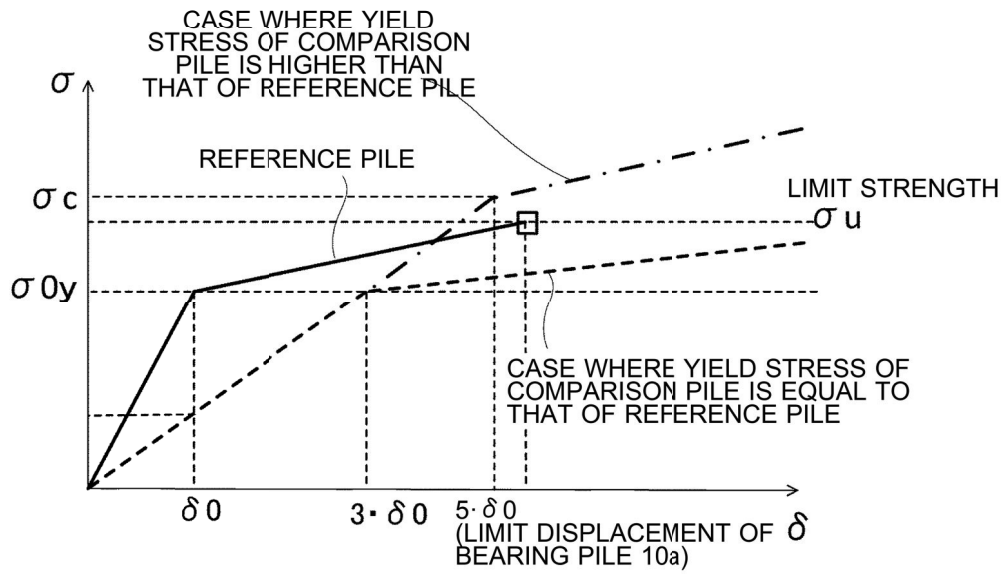


FIG. 43

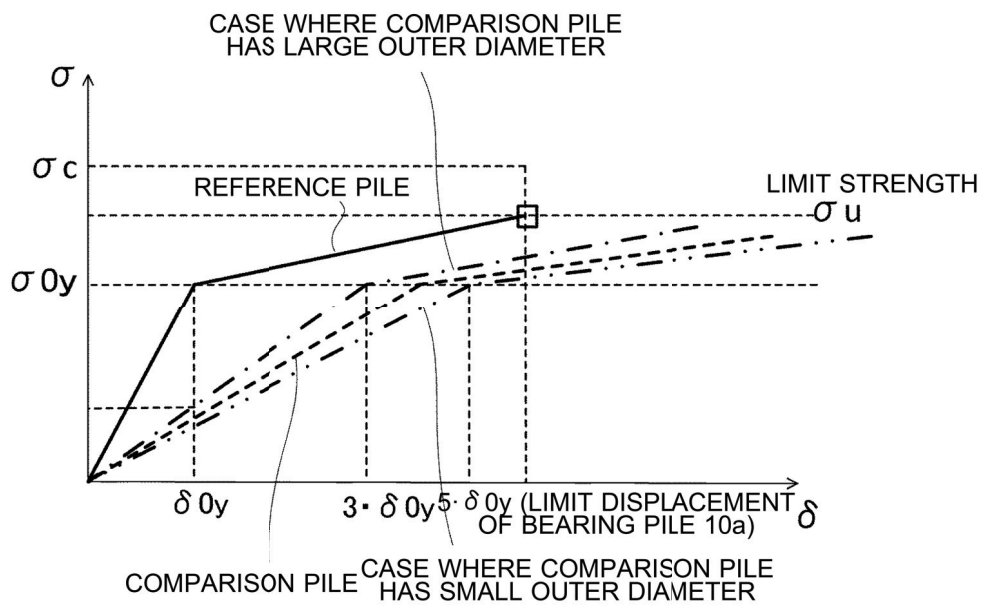




FIG. 45

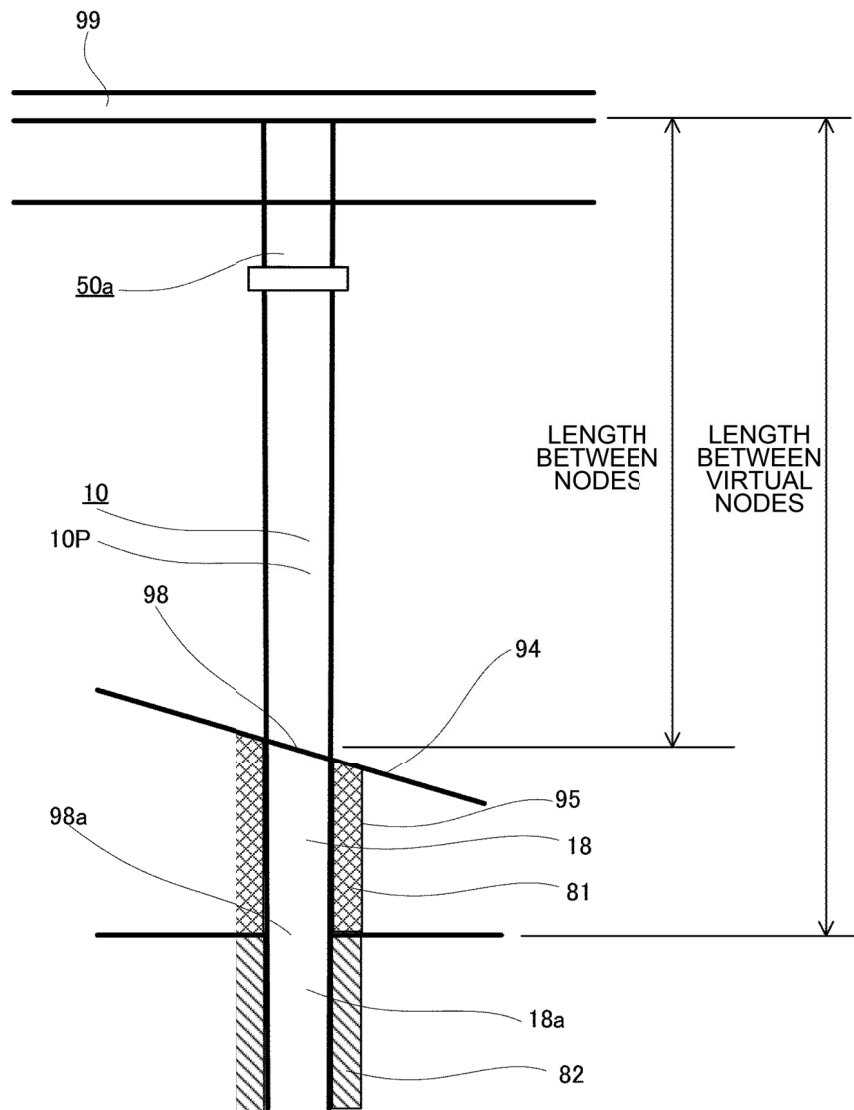


FIG. 46

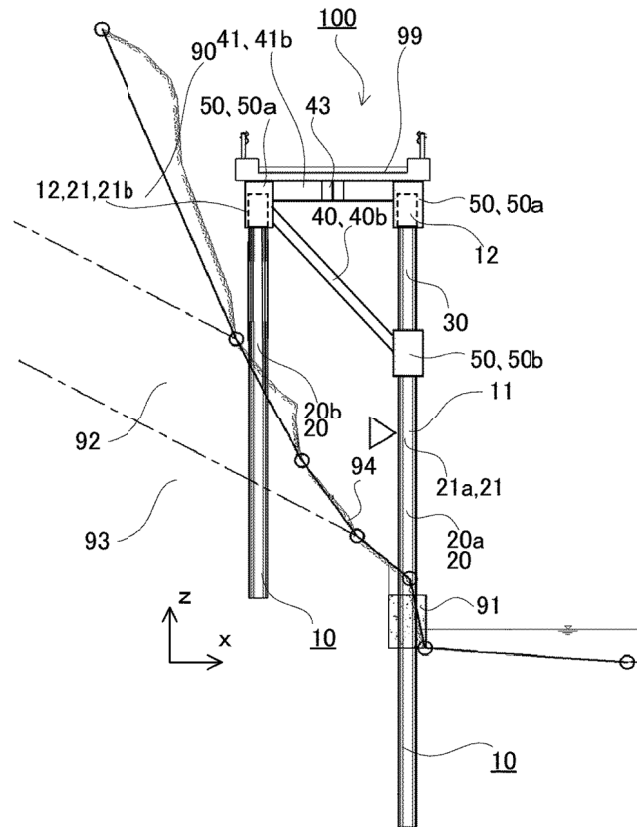


FIG. 47

