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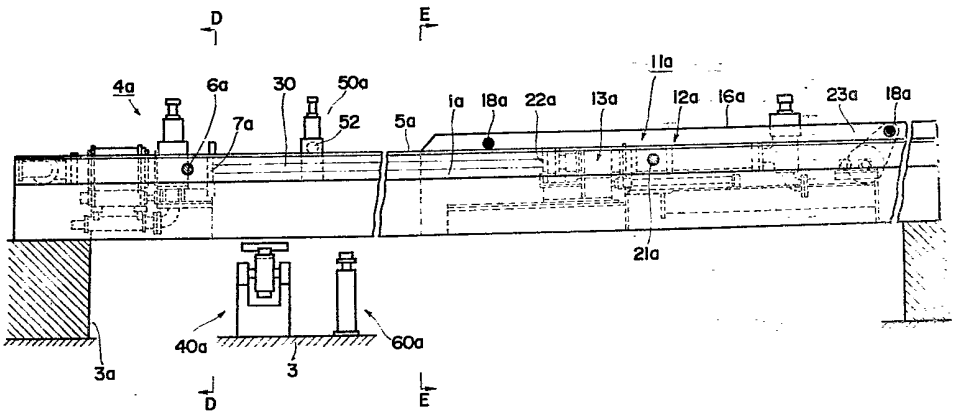
(54) **Hydrostatic testing apparatus**

(57) A hydrostatic testing apparatus for steel pipes or the like comprising a pair of parallel main beams (1a) a front-end stock (4a) and a rear-end stock (11a) which are mounted between the main beams so that they support a pipe to be tested with its axis in the horizontal palne containing the longitudinal axes of the beams which pass through the center of gravity of the main beams.

Thus the bending moment on the beams associated with prior art apparatus, in which the end stocks are mounted above the beams so that the axis of the pipe also lies above the centre of gravity of the beams is avoided and it possible to reduce the size of the main beams. A pipe transfer unit (40a) and a lifting device (60a) may be located below the main beams. Clamping devices (50a) for the pipe are movably positioned on the beam (1a), to facilitate the movement of the rear-end stock (11a).

FIG. 4



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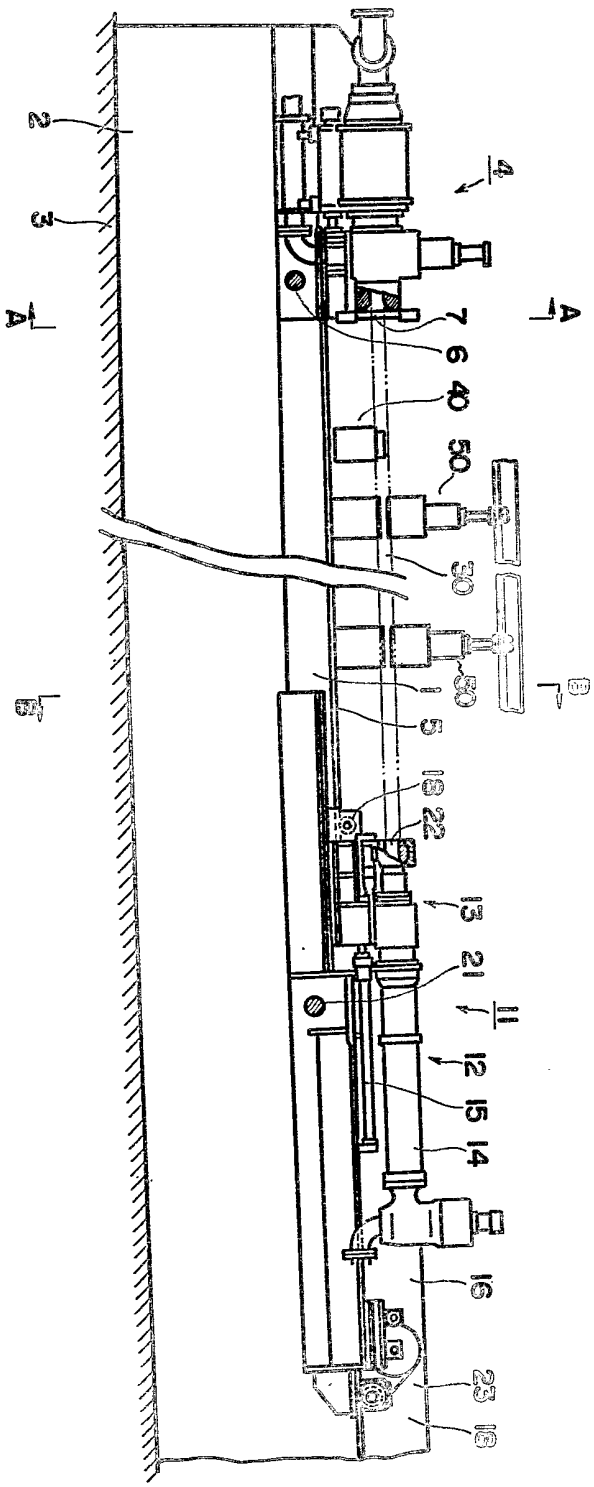

FIG. 1 (prior art)

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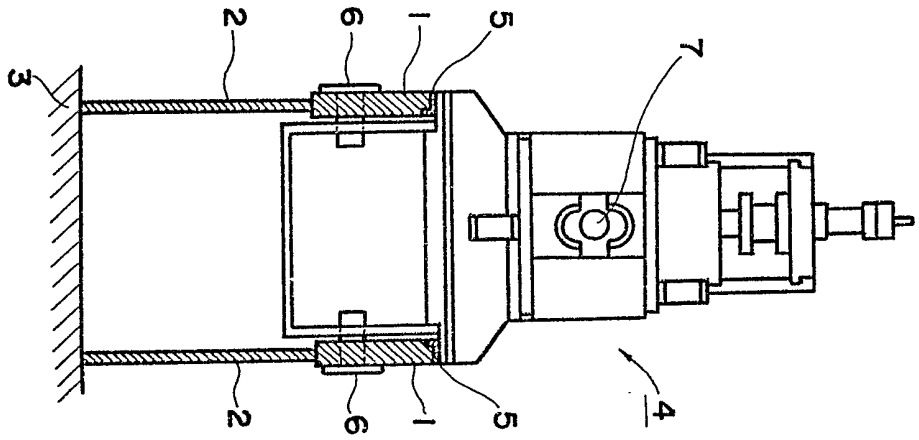

FIG. 2 (prior art)

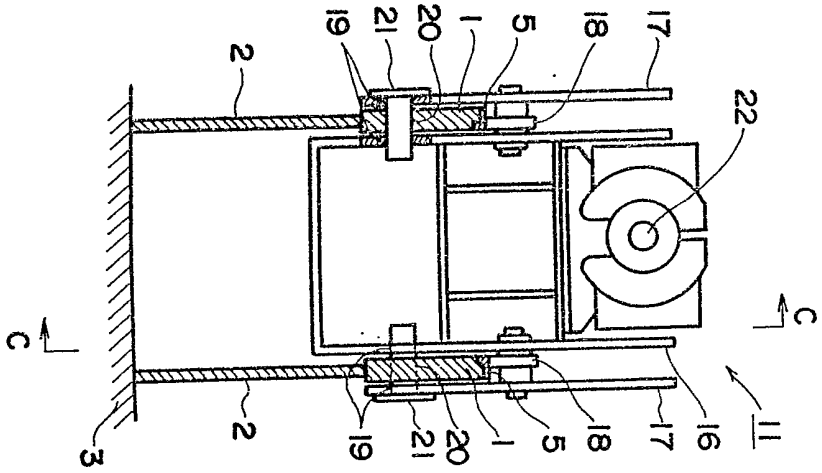

FIG. 3 (prior art)

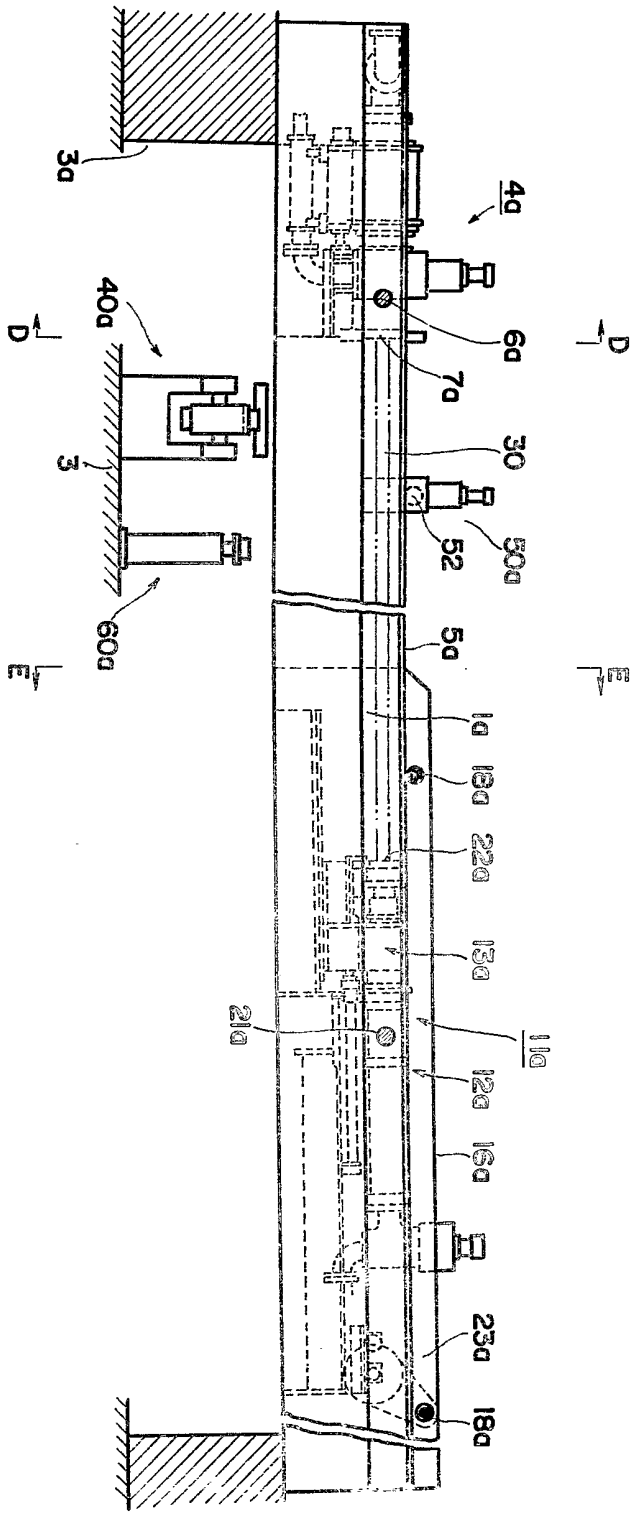
3a
4a
40a
D
D
6a
7a
30
3
52
50a
60a
5a
E
E
1a
18a
22a
13a
21a
11a
12a
16a
23a
18a

FIG. 4

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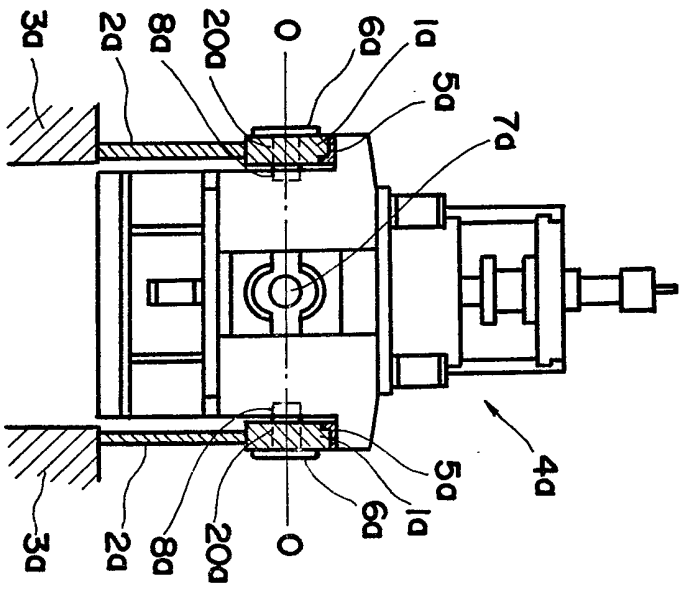

FIG. 5

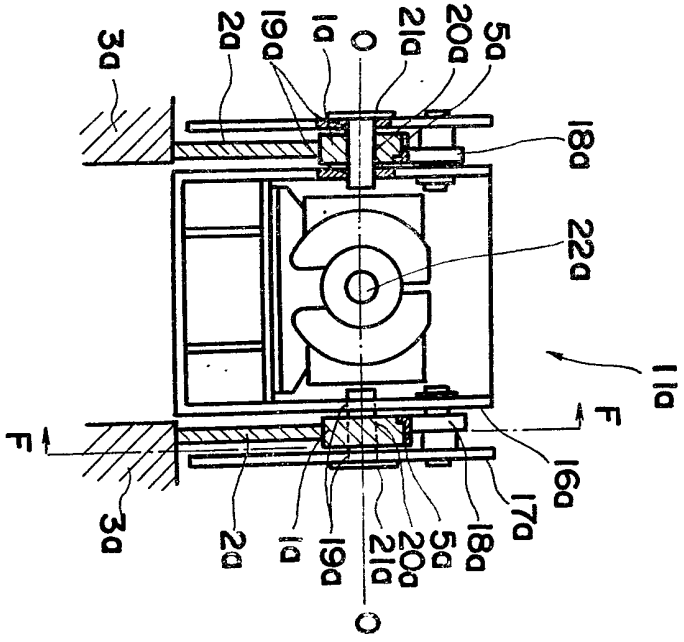

FIG. 6

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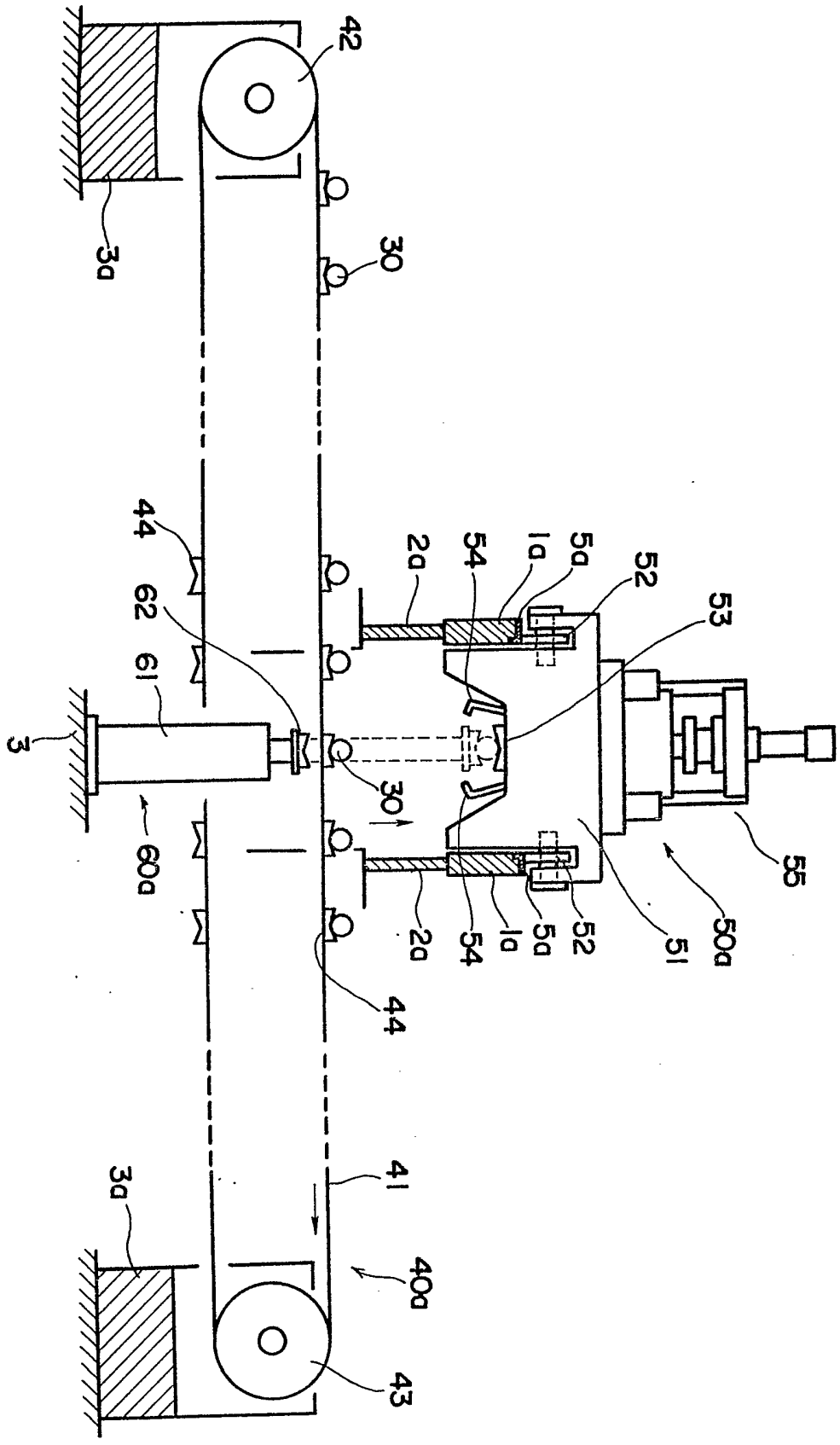

FIG. 7

SPECIFICATION

Hydrostatic testing apparatus

The present invention relates to hydrostatic testing apparatus for testing steel pipes or the like.

Steel pipes or the like (hereinafter referred to as pipes) are subjected to hydrostatic testing as a means of detecting defects in the pipes. This hydrostatic testing of the pipe consists of applying an internal hydrostatic pressure of a predetermined magnitude to the pipe for a predetermined time to inspect the pipe for leakage, etc., and hydrostatic pressure testing of as high as 400 to 900 Kg/cm² has been performed in the case of super-high pressure piping or special oil well pipes.

In a known type of hydrostatic testing apparatus, a front-end stock and a rear-end stock are mounted on a pair of main beams vertically mounted on a base plate by means of supporting members and the plane which passes through the axis of a pipe to be tested is above the longitudinal axis passing through the center of gravity of the main beams. As a result, a bending moment is caused in the main beams when the pipe to be tested is subjected to the hydrostatic test and thus the main beams must be of a structure which withstands such bending moment. This makes the main beams including the supporting members very large in size and the coupling between the front-end and rear-end stocks and the main beams must also be made rigid, thus not only increasing the size of the apparatus but also increasing the equipment cost. Also, due to the fact that a transfer unit, clamping devices, etc., are mounted in place above the main beams, there are many disadvantages that the rear-end stock cannot be easily moved thus making it necessary to make considerable changes of the arrangements for testing pipes of different lengths and very greatly deteriorating the efficiency and so on.

With a view to overcoming the foregoing deficiencies of the prior art apparatus, it is the object of the present invention to provide an improved hydrostatic testing apparatus in which a front-end and rear-end stock are mounted by pins between main beams in such a manner that the plane passing through the axis of a pipe to be tested practically coincides with the longitudinal axis passing through the center of gravity of the main beams, thus reducing the size of the main beams and making it possible to arrange a pipe transfer unit, etc., below the main beams and thereby allowing easy movement of the rear-end stock.

The above and other objects, features and advantages of the present invention will become apparent from the following description taken in conjunction with the accompanying drawings in which:

Fig. 1 indicates the section taken along the line C-C of Fig. 3 and is a front view showing schematically a prior art hydrostatic testing apparatus, which is useful in explaining the present invention;

Fig. 2 is a sectional view taken along the line A-A of Fig. 1;

Fig. 3 is a sectional view taken along the line B-B of Fig. 1;

Fig. 4 is a front view showing an embodiment of the present invention;

Fig. 5 is a sectional view taken along the line D-D of Fig. 4;

Fig. 6 is a sectional view taken along the line E-E of Fig. 4; and

Fig. 7 is a side view showing an embodiment of the pipe transfer unit, the clamping device and the lifting device used in the hydrostatic testing apparatus according to the invention.

Referring to Figs. 1 to 3 showing a prior art hydrostatic testing apparatus, numeral 1 designates a pair of main beams arranged with a predetermined space therebetween and vertically mounted on a base plate 3 by means of supporting members 2. Numeral 4 designates a front-end stock placed on a pair of rails 5 laid on the upper surface of the main beams 1 and fastened to the main beams 1 by pins 6. The front-end stock 4 includes a pipe connecting opening 7 having one end connected to a hydraulic pressure source (not shown).

Numeral 11 designates a rear-end stock comprising a stock proper 12 and a front stock 13 which are connected to each other by a drain pipe 14 included in the stock proper 12. Numeral 15 designates a hydraulic cylinder for actuating the front stock 13. Numeral 16 designates a supporting frame. Rollers 18 are positioned between the supporting frame 16 and a pair of outer frames 17. The supporting frame 16 and the outer frames 17 are each provided with at least one pin hole 19 on the same lengthwise line, and the main beams 1 are each provided with a plurality of pin holes 20 on the same plane with the pin holes 19 in the lengthwise direction, thereby fastening the main beams 1 and the supporting frame 16 together by means of pins 21. Numeral 22 designates an opening provided at the forward end of the front stock 13 for receiving a pipe to be tested. The rollers 18 positioned between the supporting frame 16 and the outer frames 17 are adapted to turn over the main beams 1 by way of the rails 5 and thus the rear-end stock 11 is movable over the main beams 1 lengthwise through turning of the rollers 18 by a drive unit 23 which is positioned in the rear of the rear-end stock 11. Also, the front stock 13 including the pipe receiving opening 22 is actuated by the hydraulic cylinder 15 and thus the stock proper 12 is moved in the lengthwise direction. Numeral 40 designates a transfer unit for a pipe 30 to be tested, and 50 a plurality of clamping devices arranged between the front-end stock 4 and the rear-end stock 11 to clamp the pipe 30. The units 40 and 50 are arranged above the main beams 1.

In the prior art hydrostatic testing apparatus constructed as described above, the pipe 30 introduced by the transfer unit 40 is clamped by the clamping devices 50 and it is also firmly fitted between the connecting opening 7 and the receiving opening 22. Then, high pressure water is supplied from the hydraulic pressure source into the pipe 30 to effect the hydrostatic test. In this case, pipes 30 to be tested may be of different lengths (e.g., 15, 20 and 30m) so that if the length differs considerably, the pins 21 of the rear-end stock 11 are removed and the rear-end

stock 11 is moved along the rails 5 by the drive unit 23. When a position is reached where the pin holes 20 of the main beams 1 are aligned with the pin holes 19 of the supporting frame 16 and the outer frames 17 near the position corresponding to the length of the pipe 30, the rear-end stock 11 is stopped and they are fastened together by the pins 21. Then, the front stock 13 is moved by the hydraulic cylinder 15 to a position corresponding to the length of the pipe 30, thus positioning the rear-end stock 11.

The prior art hydrostatic testing apparatus of this construction has many disadvantages as mentioned previously and early solution of these problems has been looked for.

Fig. 4 is a front view of an embodiment of the present invention, and Fig. 5 is a sectional view taken along the line D-D of Fig. 4. Fig. 5 is a sectional view taken along the line E-E of Fig. 4. Fig. 4 shows a section taken along the line F-F of Fig. 6. In the apparatus of this invention, a pair of main beams 1a are arranged in higher positions and a front-end stock 4a and a rear-end stock 11a are arranged between the main beams 1a. The front-end stock 4a and the rear-end stock 11a are respectively fastened by pins 6a and 21a to the main beams 1a in the same plane with a line connecting the center of a connecting opening 7a of the front-end stock 4a and the center of a receiving opening 22a of the rear-end stock 11a (and hence the axis of the pipe 30 to be tested). More specifically, the main beams 1a are formed with pin holes 20a along the longitudinal axis passing through the center of gravity of the main beams 1a, and the front-end stock 4a is formed with pin holes 8a whose axis is the center line 0-0 of the connecting opening 7a as shown in Fig. 5 thus fastening it to the main beams 1a by the pins 6a. On the other hand, as shown in Fig. 6, a supporting frame 16a and outer frames 17a are formed with pin holes 19a whose center is the center line O-O of the receiving opening 22a and rollers 18a positioned along the upper part of the supporting frame 16a are placed by way of rails 5a on the main beams 1a to turn thereover. Then, the rear-end stock 11a is fastened to the main beams 1a by the pins 21a.

With the construction described above, the hydrostatic testing of a pipe according to the apparatus of the invention is performed in the same manner as in the case of Fig. 1. In accordance with the invention, the bending moment that will act on the main beams 1a can be practically ignored since the pipe 30 is positioned in such a manner that its axis lies substantially on the same plane as the longitudinal axis passing through the center of gravity of the main beams 1a. As a result, the main beams 1a and their supporting members 2a are considerably reduced in size as compared with the prior art apparatus (to about one half in terms of sectional area). Also, due to the reduced size of the main beams 1a including the supporting members 2a, their ends (as well as their intermediate portions, if desired) may be placed on bases 3a arranged on a base plate 3 so as to define a space below the apparatus. This allows to arrange for example a transfer unit 40a and a lifting device 60a for the pipe 30 below the main beams 1a, and moreover clamping devices 50a for the pipe 30 to be tested are also positioned on the main beams 1a so as to be moved therealong by means of rolls. Thus, the rear-end stock 11a can be moved independently of these devices and units. As a result, the necessary arrangements for testing pipes of different lengths can be made very easily and in a short period time.

Fig. 7 is a side view schematically showing an embodiment of the pipe transfer unit, the lifting device and the clamping device according to the invention. In the Figure, numeral 40a designates at least one transfer unit for the pipe 30 to be tested, which is positioned between the front-end stock 7a and the rear-end stock 11a in Fig. 4. A large number of pipe rests 44 are arranged at predetermined spaces on a belt 41 and the belt 41 is run in the direction of the arrow by a sprocket 42 (or 43) which is driven by a motor (not shown) in such a manner that the belt 41 is stopped for a predetermined time after the run and it is again run in the direction of the arrow. However, the invention is not intended to be limited to the illustrated transfer unit and any other device such as a walking beam may be used.

Numeral 50a designates a clamping device for the pipe 30 in which rollers 52 are mounted on a device proper 51 and which is placed on the main beams 1a by way of the rails 5a. Numeral 53 designates a pipe holder, and 54 clamping arms adapted to be opened and closed by a hydraulic cylinder 55. A plurality of units or more than ten units, if necessary, of the clamping device 50a are arranged between the front-end and rear-end stocks 4a and 11a. The device proper 51 may be fastened to the main beams 1 by pins. Numeral 60a designates a lifting device for the pipe 30, and one or more than two units of the lifting device 60a are arranged below the line connecting the connecting opening 7a of the front-end stock 4a and the receiving opening 22a of the rear-end stock 11a. A holder 62 is vertically moved by a hydraulic cylinder 61.

With the construction described above, the operation of the apparatus according to the invention is as follows. A pipe 30 to be tested is placed on each of the rests 44 of the transfer unit 40a and the pipes 30 are moved in steps each corresponding to the space between the rests 44. When a pipe 30t to be tested is fed to a position below the line connecting the connecting opening 7a of the front-end stock 4a and the receiving opening 22a of the rear-end stock 11a, the transfer unit 40a is stopped, and the lifting device 60a comes into operation so that the pipe 30t is placed on the holder 62 and the holder 62 is raised thus holding the pipe 30t between the holder 62 and the holders 53 of the clamping devices 50a. When this occurs, the hydraulic cylinders 55 of the clamping devices 50a come into operation so that the clamping arms 54 are closed and the pipe 30t is held in the position. In this case, the axis of the pipe 30t lies substantially on the same plane as the longitudinal axis passing through the center of gravity of the main beams 1a.

In this condition, the ends of the pipe 30t are respectively connected to the connecting opening 7a of the front-end stock 4a and the receiving opening 22a of the rear-end stock 11a and high pressure

water is supplied under pressure to the pipe 30t from the hydraulic pressure source, thus performing the hydrostatic testing of the pipe 30t.

After the hydrostatic test has been completed, the pipe 30t is disconnected with the connecting opening 7a and the receiving opening 22a and the clamping arms 54 are opened. Then, the holder 62 of the lifting device 60a is lowered so that the pipe 30t is placed on the rest 44 and it is moved stepwise. In this way, the pipes 30 are successively subjected to hydrostatic test.

While, in the embodiment described above, the number of the connecting opening 7a of the front-end stock 4a, the receiving opening 22a of the rear-end stock 11 and the holder 53 of each clamping device 50a, respectively, is one and the pipes 30 are tested one at a time, the invention is not intended to be limited to this arrangement and the number may be two or more so as to test two or more of the pipes simultaneously. Also, while the movement of the front stock 13a, the opening and closing of the clamping arms 54, the raising and lowering of the lifting device holder 62, and the actuation of the other parts are effected by means of the hydraulic cylinders, any other driving means may also be used.

CLAIMS

1. A hydrostatic testing apparatus which comprises:

a pair of main beams arranged with a predetermined space therebetween; and

a front-end stock and a rear-end stock which are mounted in position between said main beams, whereby the axis of a pipe to be tested lies substantially in a plane containing the center of gravity of the main beams.

2. A hydrostatic testing apparatus as claimed in Claim 1, which further comprises means for clamping said pipe, said clamping means being positioned on said main beams.

3. A hydrostatic testing apparatus as claimed in Claim 1 or 2 which further comprises pipe transfer means and pipe lifting means, said transfer means and said lifting means being positioned below said main beams.

4. A hydrostatic testing apparatus as claimed in Claim 1 and substantially as hereinbefore described with reference to Figures 4 to 7 of the accompanying Drawings.

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