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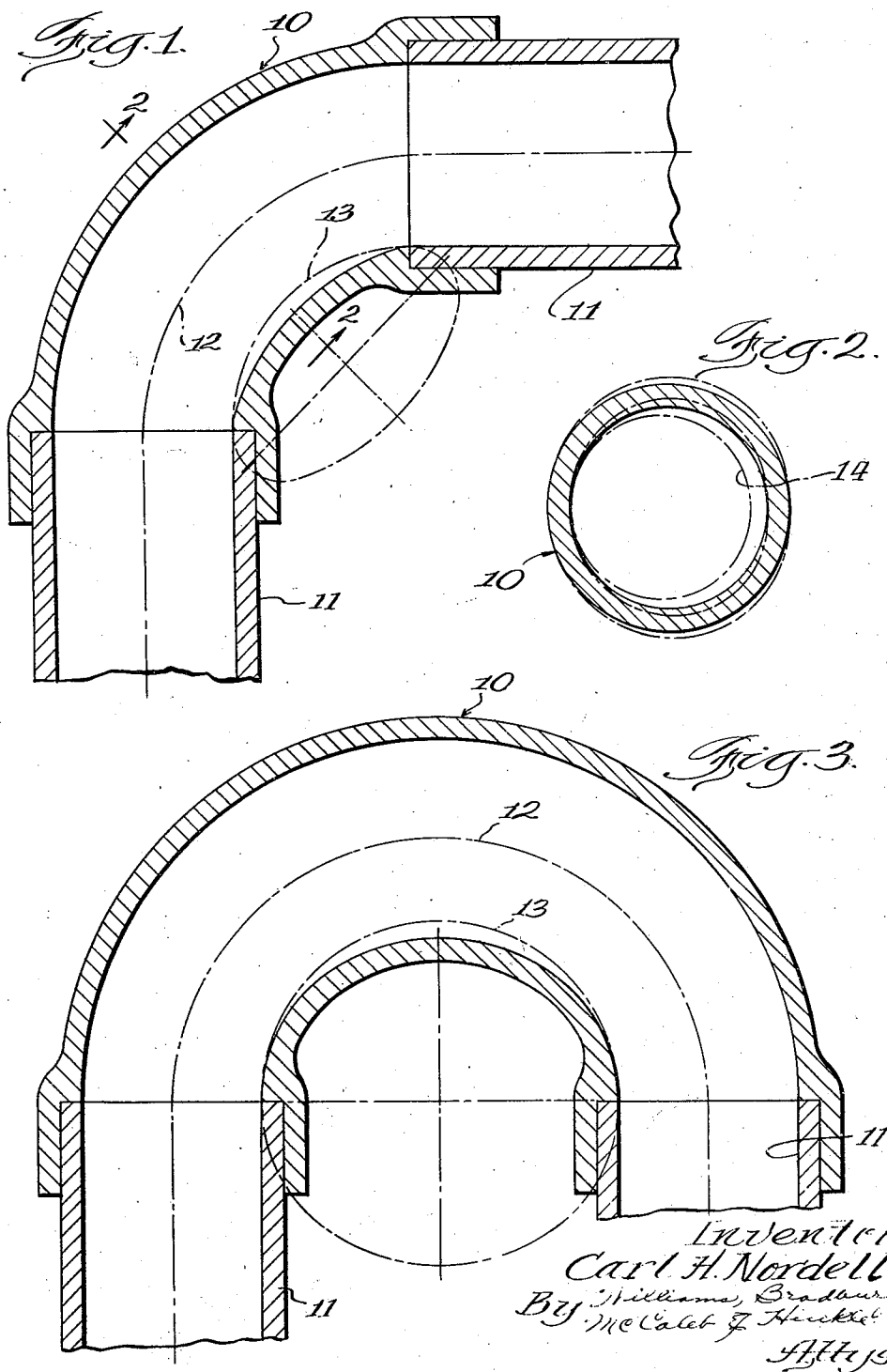
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2,303,949

CONDUIT BEND

Filed Jan. 13, 1940

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Fig. 4.

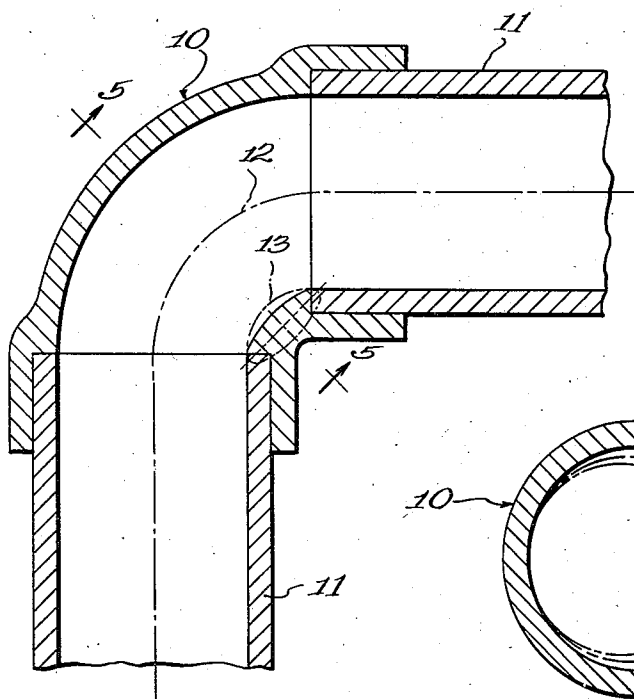


Fig. 5.

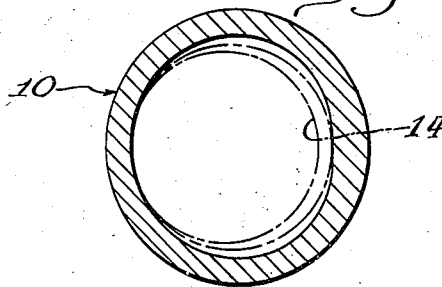
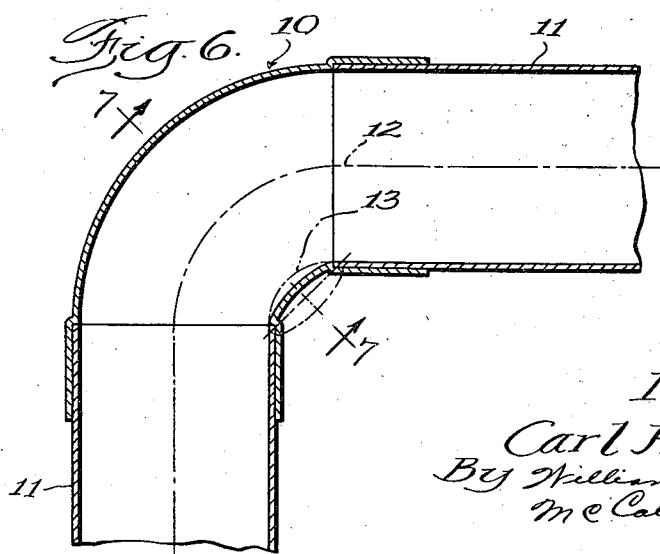


Fig. 6.



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Fig. 7.

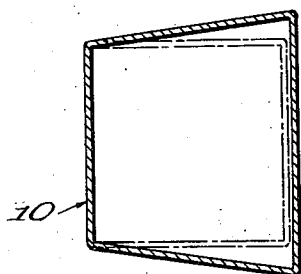


Fig. 9.

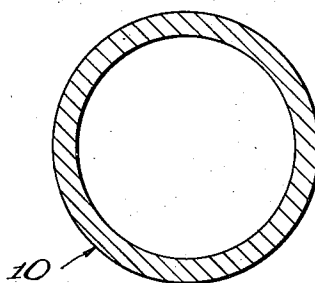
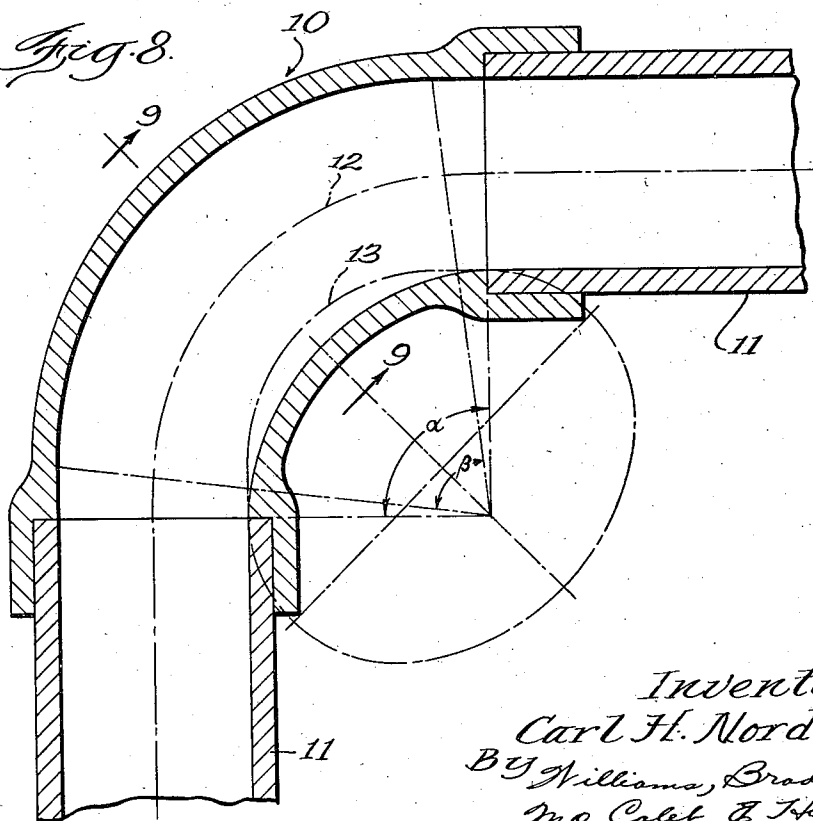


Fig. 8.



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UNITED STATES PATENT OFFICE

2,303,949

CONDUIT BEND

Carl H. Nordell, Chicago, Ill.

Application January 13, 1940, Serial No. 313,660

7 Claims. (Cl. 138—39)

This invention relates to fluid conduit bends, including pipe bends, and has for its principal object to provide bends in which the resistance to flow and erosion resulting therefrom are minimized to a great extent.

Other objects, advantages and capabilities of the invention will appear from the following description of preferred embodiments thereof, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a sectional view showing a 90 degree bend and associated conduits embodying my invention;

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a sectional view of a U-bend embodying my invention;

Fig. 4 is a sectional view of a short 90 degree bend embodying my invention;

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 4;

Fig. 6 is a sectional view of a 90 degree bend intended for rectangular conduits;

Fig. 7 is a sectional view taken on the line 7—7 of Fig. 6;

Fig. 8 is a sectional view of a modified 90 degree bend embodying my invention, and

Fig. 9 is a sectional view taken on the line 9—9 of Fig. 8.

Referring to the drawings and particularly to Figs. 1 and 2, my improved bend is designated by the reference numeral 10, this particular bend being adapted for bell and spigot work. The communicating conduits are designated by the reference numeral 11. The axis of the bend is a curved line designated by the reference numeral 12. Since this line is curved, it defines a plane of reference, will be designated the main plane of the bend.

The outer wall of the bend, that is, the outer wall which lies in the main plane, is of substantially circular form, being approximately a quadrant of a circle. The inner wall of the bend which lies in the main plane, is in the form of a segment of an ellipse, this ellipse being shown in dotted lines in Fig. 1. The minor axis of the ellipse preferably lies substantially in the apical direction of the bend and consequently passes through the center of the outer surface.

Owing to the relation of the inner wall referred to above, the diameter of the bend in the main plane thereof is larger than the diameter of the ends of the bend, these ends being preferably circular to conform to the conduits 11. It is pre-

ferred that the cross-sectional area of the bend in the apical plane is between about 10% and about 30% greater than the cross-sectional area of the ends of the bend or the cross-sectional area of the conduits 11. For bends having a smooth internal surface the enlargement of cross-sectional area may be somewhat less than 10%, while for bends having a rough internal surface and particularly where the bends are of large size, the enlargement may be somewhat larger than 30%. Preferably the cross-section of the bend in its apical plane, as shown in Fig. 2, is substantially circular although it may be in the form of a distorted circle in order to provide a cross-sectional area which falls within the degree of magnitude indicated. Where such distortion is necessary it is preferred to increase the area on the inner side of the bend as suggested in dotted lines in Fig. 2.

It will be noted that the inner wall, which is of elliptical contour, is substantially tangential to the adjacent portions of the conduits. The wall of elliptical section is displaced inwardly of the corresponding circular quadrant 13. This displacement is preferably between 5% and 15% of the normal conduit diameter when the maximum cross-section, as shown in Fig. 2, is substantially circular. When this cross-section is of oblate form the displacement may be correspondingly less. The bend has been defined principally with reference to the outer contour, the inner contour and the cross-section in the apical plane of the bend. The walls of the bend are preferably faired from the apical cross-section towards the ends of the bend.

In the case of a U-bend as shown in Fig. 3, the structure is substantially similar, the outer contour of the bend is preferably semi-circular while the inner contour conforms substantially to a semi-ellipse, the minor axis of which coincides with the apical plane of the bend. The cross-sectional area of the bend in the apical plane is preferably between about 10% and about 30% greater than the cross-sectional area of the ends of the bend. As in the case of the embodiment of Fig. 1, the cross-section of the U-bend of Fig. 3 in its apical plane is either circular or of substantially elliptical form. In the case of sharp bends the ellipse which determines the inner contour of the bend tends to become flatter and the cross-section may be made oblate in order to provide cross-sectional area within the limit stated.

As in the previously described embodiment, the walls of the bend are faired from the cross-section in the apical plane towards the ends of the bend.

In the case of short bends as shown in Fig. 4, the ellipse defining the inner contour becomes relatively short and considerably flattened. In other words, it becomes an ellipse having a short major axis and a relatively short minor axis. In this case, in order to provide a cross-sectional area in the apical plane of the bend, which is between 10% and 30% greater than the cross-sectional area of the ends of the bend, it is necessary to increase the diameter of the bend in a direction at right angles to the main plane of the bend over the diameter in the main plane of the bend. In this case the cross-section of the bend in its apical plane is preferably approximately an ellipse in which the minor axis lies in the main plane of the bend and is preferably displaced somewhat towards the inner contour of the bend, as is shown in Fig. 5. In Figs. 2 and 5 I show in dotted lines 14 the normal cross-section of the end of the bend.

The inner and outer bend contours as defined above are suitable for use with conduits of rectangular cross-section. Such a bend is shown in Fig. 6, with inner and outer contours substantially similar to those shown in Fig. 4 in connection with bends for conduits of circular form. To obtain a cross-sectional area in the apical plane with the desired enlargement it is preferred to increase the average dimension of the bend at right angles to the main plane of the bend. This is preferably attained by increasing the height of the inner wall of the bend, as shown in Fig. 7.

In the embodiments of the invention described above, the inner and outer curved contours have been substantially angularly coextensive. In some cases it is advantageous to extend the inner curved contour through a greater angle than the outer curved contour. Thus, as shown in Fig. 8, the inner contour may subtend an angle of 90 degrees at the intersection of the normals to the tangents at the ends of the curved portion of the inner contour, and the curved portion of the outer contour subtends a lesser angle at this point of intersection. The extremities of the curved portion of the inner contour lie opposite tangential portions of the outer contour.

In this embodiment of the invention also, the cross-sectional area is preferably between 10% and 30% greater than the cross-sectional area at the ends of the bend. In this embodiment of the invention the cross-section of the bend in the apical plane of the bend may be substantially circular in form or it may be substantially elliptical in form, the minor axis of the ellipse lying in the main plane of the bend. As in the embodiments of the invention described above, the walls of the bend are faired from this major cross-section into the circular ends of the bend.

My improved bends possess a radically lower resistance to flow of fluids when compared with bends previously known and consequently they do not incur the loss of head or mechanical erosion of prior bends. Further, my improved bends are remarkably independent of variations due to roughness of the inner surface.

Although the invention has been disclosed in connection with the specific details of preferred embodiments thereof, it must be understood that such details are not intended to be limitative of the invention except in so far as set forth in the accompanying claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patents of the United States is:

1. A hydraulic fluid conduit bend having an

outer curved surface of substantially segmentary circular form, an inner surface which conforms substantially to a segment of an ellipse having its minor axis in substantial alignment with the apex of the bend, said conduit having an apical cross-sectional area substantially 10% to 30% greater than the cross-sectional area at the ends of the conduit, whereby the bend will offer a resistance to flow of the hydraulic fluid substantially less than that offered by a corresponding bend of uniform cross-sectional area.

2. A hydraulic fluid conduit bend having an outer curved surface of substantially segmentary circular form, an inner surface which conforms substantially to a segment of an ellipse, said conduit having an apical cross-sectional area substantially 10% to 30% greater than the cross-sectional area at the ends of the conduit, the apical cross-section being of substantially elliptical form and the walls of the bend being faired from that cross-section to the ends of the bend, whereby the bend will offer a resistance to flow of the hydraulic fluid substantially less than that offered by a corresponding bend of uniform cross-sectional area.

3. A fluid conduit bend having an outer curved surface of substantially segmentary circular form, an inner surface which conforms substantially to a segment of an ellipse, the inner curvature extending over a greater angle than the outer curvature, said conduit having an apical cross-sectional area substantially 10% to 30% greater than the cross-sectional area at the ends of the conduit, the apical cross-section being of substantially elliptical form and the walls of the bend being faired from that cross-section to the ends of the bend.

4. A hydraulic fluid conduit bend having a low resistance coefficient, said bend comprising substantially rectangular ends, an outer curved surface substantially a segment of a circle, and an inner surface substantially a segment of an ellipse, said conduit having an apical cross-sectional area of substantially 10% to 30% greater than the cross-section at the ends, the average width of the bend at its apex in a direction at right angles to the main plane of the bend being greater than the corresponding dimension at the ends.

5. A fluid conduit bend having substantially rectangular ends, an outer curved surface substantially a segment of a circle, and an inner surface substantially a segment of an ellipse, said conduit having an apical cross-sectional area of substantially 10% to 30% greater than the cross-section at the ends, the width of the bend on the inner side and in a direction at right angles to the main plane of the bend being greater than the corresponding dimension at the outer surface of the bend and at the ends of the bend.

6. An integral hydraulic fluid conduit bend having a low resistance coefficient, said bend comprising ends conformed for attachment to pipes or the like having an inside surface which in its medial section taken in the plane of the bend presents an outer circular arc extending throughout the angle of the bend and substantially tangent to lines extending in the directions of pipes attached to the bend, the inside of the bend in said cross-sectional plane conforming to a portion of an ellipse, the passageway through said bend having an apical cross-sectional area substantially 10% to 30% greater than the cross-sectional area at the ends thereof.

7. In integral hydraulic fluid conduit bend

having a low resistance coefficient, said bend comprising ends conformed for attachment to pipes or the like, having an inside surface which in the medial section taken in the plane of the bend presents an outer circular arc extending throughout the angle of the bend and substantially tangent to corresponding lineal elements of pipes attached thereto, the inside of the bend in said cross-sectional plane conforming to a portion of

5 an ellipse, said bend having an apical cross-sectional area substantially 10% to 30% greater than the cross-sectional area at the ends thereof, the apical cross-section being of substantially elliptical form and the walls of the bend being faired from such elliptical cross-section to the ends of the bend.

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