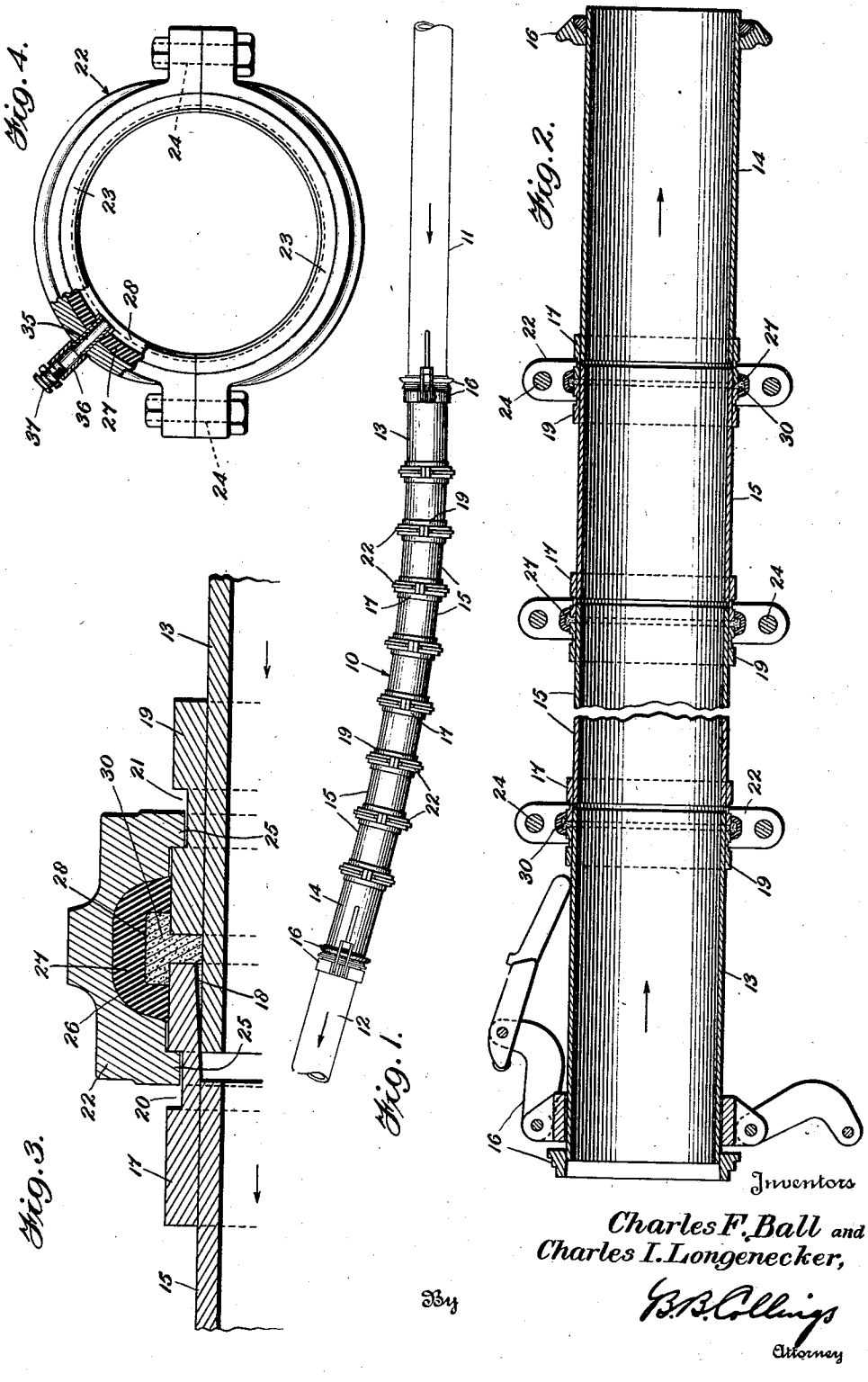
Sept. 8, 1942. C. F. BALL ET AL 2,295,510

FLEXIBLE PIPE SECTION

Filed May 16, 1941



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Patented Sept. 8, 1942 2,295,510

UNITED STATES PATENT OFFICE

2,295,510

FLEXIBLE PIPE SECTION

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Application May 16, 1941, Serial No. 393,812

5 Claims. (Cl. 138—52)

The invention relates to flexible pipes or tubular conduits, and has for its principal object the provision of a pipe or conduit section of this character which is especially adapted for use in pipe line systems for the transportation of plastic concrete mixtures under pressure. Such systems have come into quite extensive use in recent years as a result of the development of a reciprocating piston pump which will effectively and reliably handle commercial concrete mixtures, such pump being generically disclosed in the prior U. S. Patents Nos. 2,017,974 and 2,017,975, both granted October 22, 1935, on applications filed by Otto M. Kastner and Jacobus C. Kooyman respectively.

As is set forth at some length in the specifications of these said prior patents, plastic concrete mixtures inherently possess certain characteristics which distinguish and set them apart from other materials and mixtures which are commonly transported by pumping, which peculiarities introduce problems into the handling of concrete not met with in other fields. Perhaps the most outstanding of these properties is that designated as "stowing," which is due to the presence of the gravel, crushed rock or other large aggregate in the mixture, whereby a perimetrically confined stream of the mixture moving under pressure in a pipe or passageway, upon encountering a sudden reduction in the cross sectional area of the latter, as by reason of an obstruction therein or a sudden decrease in the diameter thereof, will pack or jam at such obstruction or reduction to such an extent as to completely stop the movement of the stream. This of course is directly opposed to the behavior of fluids, semi-fluids and semi-solids, which under like conditions will increase their velocity while passing the obstruction or through that portion of the conduit having the reduced cross sectional area.

Advantage is taken of this stowing property in the valves of the pumps referred to above, but elsewhere in the pumping system sudden reductions in the cross sectional area of the pipes or passages must be carefully avoided, for once stowing takes place in the line no pressures within the limits of the pump and pipes to withstand will again start movement of the stream, and it is necessary to dismantle the pipe line and clean it out by hand, a tedious and time-killing operation.

Another property of the concrete mixtures which must be carefully considered in order to secure continuous trouble-free commercial operation, is its constant tendency to harden or set, due to the chemical reactions between the water and the cement or other binding constituent. This tendency may be retarded or controlled somewhat by keeping the mass in motion, and to this end pockets must be avoided throughout the system, wherein portions of the mixture might become stagnant and harden, for such action then becomes cumulative with the result that in a comparatively short time a sufficient restriction or obstruction is built up to cause stowing.

Although not peculiar to concrete mixtures alone, abrasiveness of the principal constituents thereof is another property which must be taken into consideration in the selection of materials for the pipes or conduits.

In the practical commercial development of these concrete pumping systems the pipe lines have taken the form of straight sections of thin-walled steel tubing of from 6 to 8 inches in diameter, furnished in standard lengths of 10 feet. Each such pipe section is equipped at its ends with suitable quick-detachable coupling members, such for example as those disclosed in the prior U. S. Patent No. 1,991,343, granted February 12, 1935, on an application filed by Charles F. Ball, whereby they may be readily connected together to form a line of any required length. Curved sections of such tubing, providing 22½°, 45° and 90° bends of ample radius to prevent stowing, may also be had to change the direction of the line. Various combinations of these straight and curved rigid pipe sections meet the requirements of most pipe line lay-outs, but occasions do arise where it is desirable if not imperative to have one or more flexible pipe sections in the line. For example, in the building of bridge piers the pump may be located on shore while the pipe line is carried by boats, scows or floats out over a body of water, where it is subject to wave and/or tidal motion of the latter. In such circumstances the practice heretofore has been to introduce sections of rubber hose or tubing in the line wherever necessary or desirable, thereby securing the flexibility necessary to accommodate transverse movements of the line in any direction. However, the cost of such rubber sections is high, since they have to be of the same relatively large diameter as the metal sections, and further, although the best rubber obtainable is employed, because of the abrasiveness of the mixture their life is comparatively short, with the result that they leave considerable to be desired.

It is a prime object of the present invention therefore, to provide a flexible metal pipe section for use in pressure pipe line transportation sys-

tems for plastic concrete mixtures, which will meet the requirements above set forth; which will be appreciably less expensive in initial and subsequent cost than the rubber sections heretofore employed for like purpose; and which will substantially eliminate the shortcomings of such rubber sections.

Referring to the accompanying drawing forming a part of this specification, in which like reference characters designate like parts in all the views—

Figure 1 is a side elevational view of a portion of a pipe line system of the type above described for the pressure transportation of concrete mixtures, illustrating a flexible metallic pipe section constructed in accordance with the present invention in place therein;

Fig. 2 is an enlarged fragmentary longitudinal sectional view through a flexible pipe section of the type shown in Fig. 1;

Fig. 3 is a still further enlarged sectional view through one of the joints; and

Fig. 4 is an elevational view, partly broken away and in section, of one of the joint coupling members, illustrating a slight modification of the idea.

Referring more particularly to the said drawing, the flexible pipe section **10** constituting the invention is illustrated in Fig. 1 as being interposed between two of the standard rigid pipe sections **11** and **12** in a concrete transportation pipe line system of the character referred to above. The said flexible pipe section comprises a plurality of short lengths of pipe which may be conveniently formed by transversely severing one of the standard **10** foot pipe sections at several points to provide end elements **13** and **14** and a plurality of intermediate elements **15**. The said intermediate elements may conveniently be approximately of one foot length while the two end elements **13** and **14** are or may be of slightly greater length as shown in Figs. 1 and 2. The two end elements **13** and **14** are provided respectively with the complementary members **16** of a quick detachable pipe coupling of any suitable form, here illustrated as being of the type disclosed and claimed in the said prior Patent No. 1,991,343 mentioned above.

The end element **14** and each of the intermediate elements **15** is provided at one end with a sleeve or collar **17** having an internal diameter sufficiently large to enable it to be slipped over the respective pipe section to which it is rigidly secured as by shrinking, welding or in any other appropriate manner. This sleeve or collar is so positioned upon the end of the pipe section as to project beyond the end face thereof thereby providing a bell for the reception of the companion end of the adjacent pipe element to constitute a bell and spigot joint. The receiving end of the said bell is preferably tapered or flared as clearly indicated at **18**, see Fig. 3, whereby a limited amount of flexibility is imparted to the joint so that the adjacent pipe sections may be slightly misalined from a normally true axial relationship.

The spigot end of the end member **13** and of each intermediate member **15** is also provided with a sleeve or collar **19** shrunk or welded thereon in such position as to complement the sleeve **17** of the companion member when the sections are assembled. The parts are preferably so constructed that when so assembled there will be a slight space between the complementary end faces of the respective pipe sections and also between the similar faces of the collars **17** and **19** as will be clear from Figs. 2 and 3. These spaces provide for longitudinal expansion of the metallic sections as well as for axial misalinement thereof as will be readily understood.

The collars or flanges **17** and **19** are provided respectively with the circumferential grooves **20** and **21** and a coupling member **22** is positioned around each joint as shown. These coupling members which in themselves are not novel comprise complementary semi-circular elements **23** which in use are secured together by bolts **24** to form annuli having annular flanges **25** at opposite ends thereof which are receivable in the circumferential grooves **20** and **21** of the sleeves or flanges **17** and **19** as clearly shown in Figs. 2 and 3. These coupling members **22** also have intermediate annular chambers **26** within which annular gaskets or sealing members **27** of rubber or other suitable packing material are seated and which in the assembled position engage with the outer circumferential surfaces of the adjacent end portions of the sleeves or flanges **17** and **19** as shown. The said sealing or packing members are of approximately U-shape in cross section thereby providing an annular chamber **28** which surrounds and communicates with the space between the complementary ends of the sleeves **17** and **19**. This chamber and space is packed during assembly of the parts with a suitable material **30** having properties which inhibit or retard the setting of the binder constituents of the concrete mixture and which material also preferably has lubricating qualities. A relatively hard grease such as is obtainable in the open market may suffice for this purpose or a special lubricant and concrete setting inhibitor marketed under the trade name "Pumpcrete" valve compound is especially efficient in this connection. Graphite, talc and diatomaceous earth may also be mentioned as well known setting inhibitors which may be employed upon occasion, either dry or mixed with a mineral oil, water or other non-hardening liquid to form a paste.

It will be noted that the annular grooves **20** and **21** of the sleeves or flanges **17** and **19** are of sufficient width to provide for longitudinal expansion of the pipe sections and also for transverse deflection thereof whereby the sections may be slightly misalined each from the other in the manner indicated in Fig. 1. It thus results that the pipe section **10** may be bent as indicated in the said figure or may assume a true axial alinement as indicated in Fig. 2 and due to the continued lubrication of the joints by the lubricating material **30** which is located in the annular chamber **28** the flexibility of the several joints will be maintained. The inhibiting properties of this material also prevent the hardening or setting of such portions of the concrete materials as may unavoidably work their way into the joints thereby preventing the stiffening of the latter and further maintaining the flexibility of the pipe section.

It will be noted that the space between the ends of the several pipe sections is offset longitudinally from the space between the ends of the respective flanges or collars thereby providing a tortuous joint which tends to reduce the working of the concrete constituents through the joint under the high pressures employed. The concrete material is preferably moved through the conduit in the direction indicated by the arrows in the respective figures so that the joints between the

ends of the pipe-section are offset from the joints between the ends of the flanges in the direction of the flow of the material.

In the slightly modified form of the invention shown in Fig. 4 each of the coupling members **22** is provided with means for facilitating the introduction of the lubricating and inhibiting material into the annular channels **28**. As here shown such means comprises a tube **35** passing radially through one of the coupling members **23** and having a nipple **36** secured to its outer end which nipple receives a suitable grease fitting **37** of any well known type in common use which permits the introduction of the inhibiting material into the chamber **28** while preventing outward movement thereof.

While one generic form of the invention has been illustrated and described it is obvious that those skilled in the art may vary the details of construction as well as the precise arrangement of parts without departing from the spirit of the invention and therefore it is not wished to be limited to the above disclosure except as may be required by the claims.

What is claimed is:

1. In a conduit for conducting plastic concrete mixtures under pressure, a flexible section comprising a plurality of lengths of pipe of uniform internal diameter disposed end to end to provide a passageway of substantially uniform cross sectional area and free from restrictions or obstructions which would induce stowing of the concrete mixture; means encircling the joints between the adjacent ends of the lengths of pipe for preventing transverse and undue longitudinal separation of the latter while providing for angular deflection thereof from true axial alinement; and a concrete-setting inhibitor retained at said joints by said encircling means, whereby to prevent hardening of ingredients of the mixture which may work their way into said joints.

2. Flexible piping for conducting plastic concrete mixtures under pressure, comprising a plurality of lengths of pipe of uniform internal diameter disposed end to end to provide a passageway of substantially uniform cross sectional area throughout and free from restrictions or obstructions which would induce stowing of the concrete mixture; coupling means encircling the joints between the adjacent ends of the lengths of pipe for preventing transverse and undue longitudinal separation of the latter while providing for angular deflection thereof from true axial alinement, said means having an annular chamber in communication with the joint; and a material in said chamber having concrete-setting inhibiting properties, for preventing hardening of ingredients of the mixture which may work their way into said joints, whereby the flexibility of the joints may be maintained.

3. In a conduit for conducting plastic concrete mixtures under pressure, a flexible section comprising a plurality of lengths of pipe of uniform internal diameter, including opposite end elements and at least one intermediate element, said elements being disposed end to end to provide a passageway of substantially uniform cross sectional area throughout and free from restrictions or obstructions which would induce stowing of the concrete mixture, one end of one of the end elements and of each intermediate element being provided with a bell for receiving the end portion of the adjacent element thereby providing a bell and spigot joint, the spigot end of each intermediate element and of the other end element having an external circumferential flange complemental to the end of the bell of the adjacent element; a coupling member encircling and engaging the bell and flange of each joint to prevent transverse and undue longitudinal separation of the elements while providing for angular deflection of the latter from true axial alinement; and a lubricating material having concrete-setting inhibiting properties retained by said coupling members at the bell and flange joints, for preventing hardening of ingredients of the mixture which may work their way into the joints, whereby the flexibility of the latter may be maintained.

4. A flexible pipe section for conducting plastic concrete mixtures under pressure, comprising a plurality of short lengths of pipe of uniform internal diameter, including opposite end elements and at least one intermediate element, said elements being disposed end to end to provide a passageway of substantially uniform cross sectional area throughout and free from restrictions or obstructions which would induce stowing of the concrete mixture, one end of each intermediate element and of one of said end elements being provided with a bell having a flaring opening for receiving the end portion of the adjacent element thereby providing a flexible bell and spigot joint, the spigot end of each intermediate element and of the other end element having an external circumferential flange complemental to but somewhat spaced from the end of the bell of the adjacent element, the joint between the flange and bell being longitudinally offset from that between the ends of the pipe sections; a coupling member encircling and engaging the bell and flange of each joint to prevent transverse and undue longitudinal separation of the elements while providing for angular deflection of the latter from true axial alinement, said coupling member including a flexible packing provided with an annular chamber encircling the joint between the flange and bell; and a semi-solid lubricant having concrete-setting inhibiting properties, packed in said annular chamber, whereby to prevent hardening of ingredients of the mixture which may work their way into the joints and maintain the flexibility of the latter.

5. The combination stated in claim 2, characterized in that each coupling means is provided with means for facilitating the pressural introduction of the concrete-setting inhibiting material into the annular chamber and retaining it therein.

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