June 23, 1964 N. G. KLING ET AL 3,138,111

MULTIPLE TUBE PUMP

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Fig. 1.

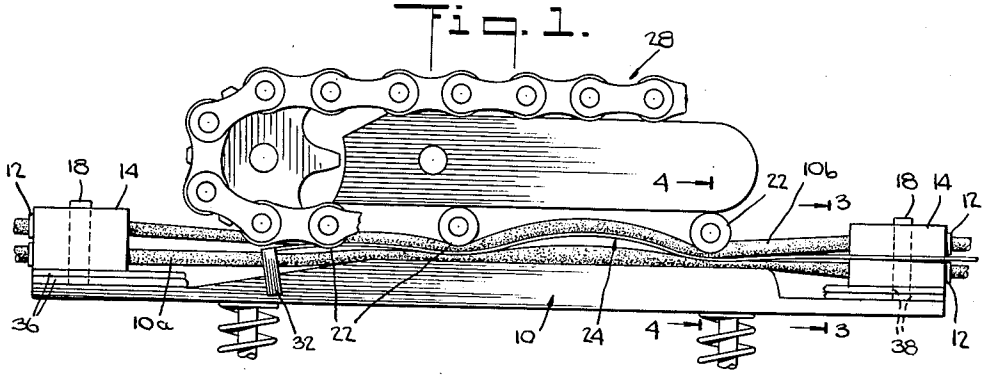
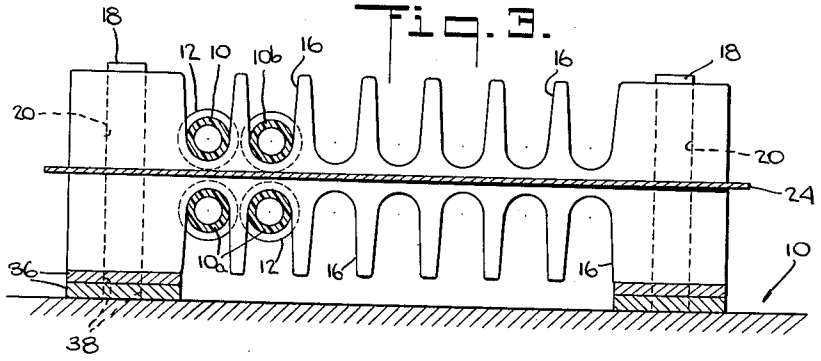


Fig. 3.



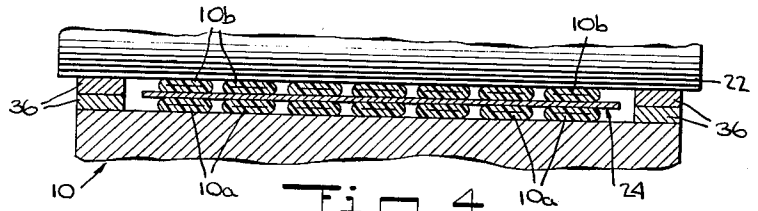
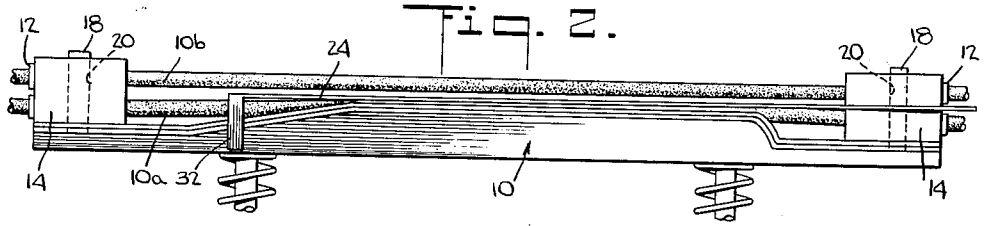


Fig. 4.

Fig. 2.



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Fig. 5.

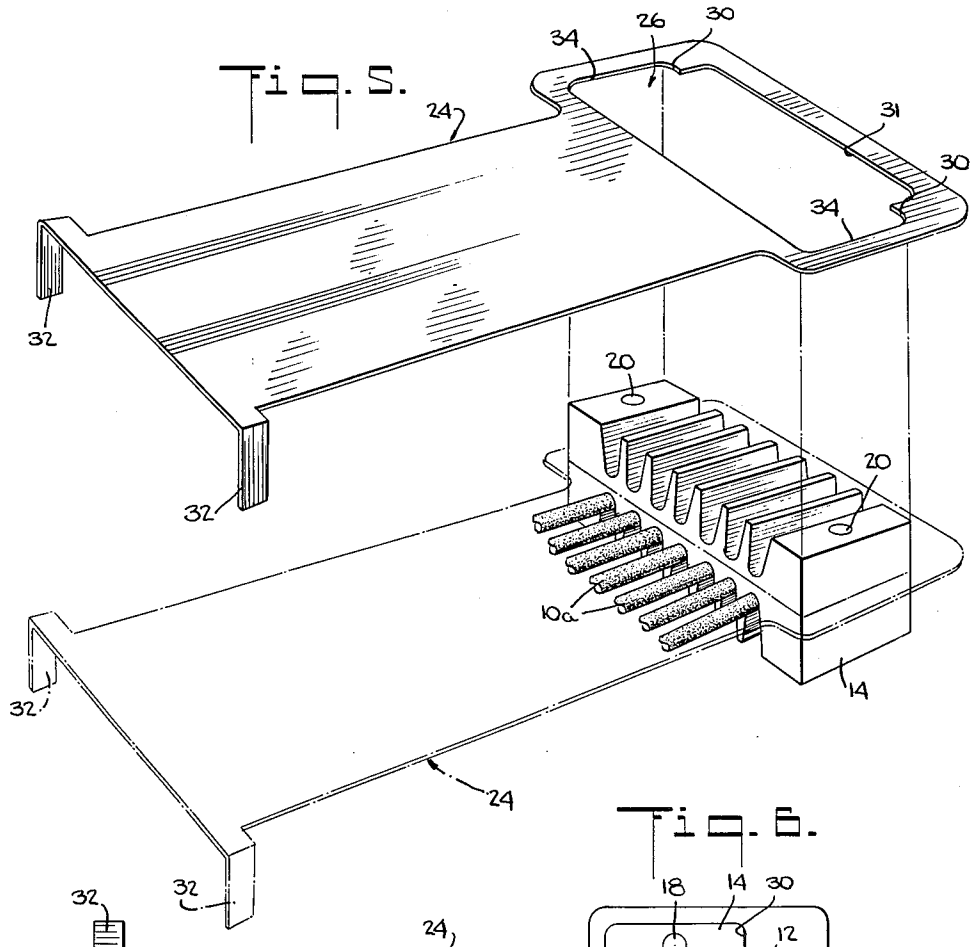
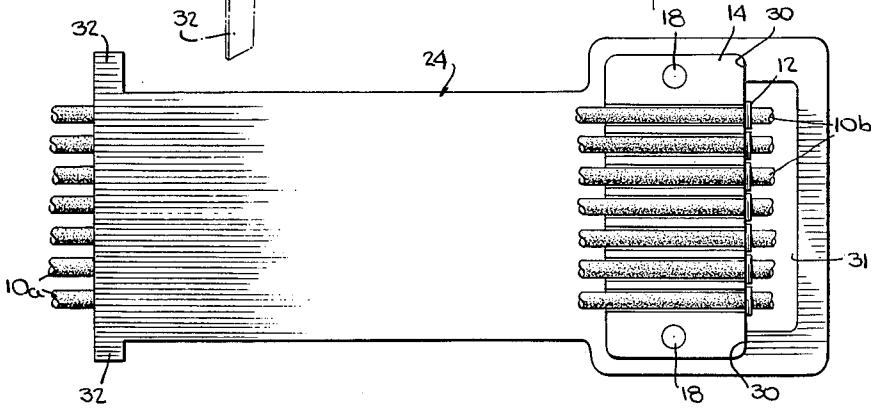


Fig. 6.



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MULTIPLE TUBE PUMP

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Filed Nov. 21, 1962, Ser. No. 239,253
5 Claims. (Cl. 103—149)

The present invention relates to multiple tube pumps and, more particularly, to compressible tube pumps of the general type shown by U.S. Patent No. 2,935,028 and by the U.S. application of Jack Isreeli, Ser. No. 168,140, filed in the United States Patent Office January 25, 1962, said patent and said application being owned by the assignee of the present application.

The primary object of the present invention is to provide a compressible tube pump with means for the arrangement of a plurality of the tubes in each of a plurality of layers together with means disposed between the tubes in the different layers for transmitting to the tubes of one of said layers the pressure applied to the tubes of another of said layers for compressing the tubes of said one of said layers when the tubes of another of said layers are compressed.

The above and other objects, features and advantages of the invention will be fully understood from the following description considered in connection with the accompanying illustrative drawings.

In the drawings:

FIG. 1 is a side view, in elevation, of the pump, with parts omitted for purposes of illustration;

FIG. 2 is a side view of the pump with the pressure rollers and some other parts of the pump omitted for the purposes of illustration;

FIG. 3 is a sectional view, on a larger scale, on 3—3 of FIG. 1;

FIG. 4 is a sectional view on the line 4—4;

FIG. 5 is a perspective view of parts of the pump showing, in full lines, the means for transmitting the pressure of the rollers to the pump tubes in one of the layers and showing, in broken lines, the position of said means in relation to a tube holder and the tubes which as shown by FIG. 1 are engaged by the pressure rollers; and

FIG. 6 is a top plan view of parts of the pump showing one of the tube holding members and the pressure applying means as well as parts of the tubes of one layer and tubes of the other layer.

As shown by the drawings the pump comprises a platen **10** which provides a support for a plurality of resiliently compressible tubes which are arranged in side-by-side relation in different layers, the tubes in one of said layers being indicated at **10***a* and the tubes of another of said layers being indicated at **10***b*. Tubes **10***a* and **10***b* are provided with collars or enlargements **12** which are fixed thereto at points spaced longitudinally of the companion tube for engagement with the adjacent faces respectively of the tube holding blocks **14** when the tubes are positioned in the grooves **16** of said blocks. Said blocks are removably secured to the platen **10** by pins **18** which are secured to said platen and project through openings **20** in said blocks adjacent the opposite ends thereof, as described in the above mentioned patent application. The tubes **10***a* and **10***b* are in taut condition longitudinally thereof when mounted in the grooves of the end blocks **14** with the collars **12** engaged with said blocks and the latter positioned on the platen **10** by pins **18**. As here shown, the grooves **16** for one layer of tubes are in alignment with the corresponding grooves **16** for the other layer of tubes, but it will be understood that the grooves of one set may be laterally offset from the grooves of the other set, if so desired, as described in said patent application Ser. No. 168,140.

Pursuant to the present invention, provision is made for transmitting to tubes **10***a* pressure of the tube compressing rollers **22** which engage the tubes **10***b* to compress the tubes **10***a*. As here shown, said means comprises a thin and flexible metal plate or sheet **24**. As a non-limitative example, said plate **24** is made of stainless steel which has a thickness of about .005 of one inch and has a spring temper. Said plate is provided at one end thereof with an opening **26** in which the block **14** at the up-stream end of the tubes is received for holding said plate against movement longitudinally of the pump tubes toward the opposite end block during movement of the pressure rollers **22** from right to left viewing FIG. 1 by the endless conveyor **28**. In this connection, it will be understood that the shoulders **30** at the opening **26** at plate **24** engage the outer face of the up-stream block **14** as illustrated in FIG. 6 to prevent said longitudinal movement of plate **24**. The recessed part **31** beyond shoulders **30** provide spaces for the collars **12**. Said plate is provided at its downstream end with transverse depending portions **32** which engage the opposite side edges of the platen **10** and which together with the side edges **34** of the plate at the opening **26** prevent movement of said plate transversely of the platen.

It will be understood that during the movement of the pressure rollers **22** progressively along the lengths of the tubes **10***b* for the pumping liquid or other fluid through said tubes pressure of said rollers **22** on tubes **10***b* is concomitantly transmitted by plate **24** to the tubes **10***a* progressively along their length for the pumping operation. Side rails **36** are disposed at the opposite side edges of the platen **10** for limiting the pressure of the rollers **22** on the tubes **10***a* and **10***b* so that said tubes are not compressed more than is necessary to completely close said tube under the pressure of rollers **22**, so as to prevent damage to the tubes. As here shown there are two side rails **36** at each side edge of the platen **10** so that each upper side rail can be removed if the pump is operated with a single layer of tubes, namely the tubes **10***a*, in which case plate **24** need not be used and said tubes **10***a* can be compressed by directed engagement of the rollers **22** therewith as described in the above mentioned patent. Also it will be understood that instead of utilizing two side rails at each side edge of the platen, when the pump is operated with two layers of tubes, a single side rail of twice the thickness of side rails **36** may be employed, one at each side edge of the platen. The side rails **36** are provided with openings **38** adjacent their opposite ends for engagement with the pins **18** under the end blocks **14** to hold said side rails in position on the platen.

While we have shown and described the preferred embodiment of the invention, it will be understood that the invention may be embodied otherwise than as herein specifically illustrated or described, and that certain changes in the form and arrangement of parts and in the specific manner of practicing the invention may be made without departing from the underlying idea or principles of this invention within the scope of the appended claims.

What we claim is:

1. A multiple tube fluid pump comprising, a support, a plurality of resiliently compressible tubes positioned in side by side relation on said support, pressure rollers operable to compress said tubes progressively along their lengths for the pumping operation, means for positioning a plurality of said tubes in said side by side relation in each of a plurality of layers, and means adapted to be interposed between said layers of tubes and extending longitudinally and laterally thereof whereby pressure applied by said rollers on said tubes of one of said layers in the pumping operation is transmitted to said interposed means for applying pressure to the tubes of said

other layers for the pumping operation of fluid through said last mentioned tubes.

2. A multiple tube fluid pump comprising, a support, a plurality of resiliently compressible tubes positioned in side by side relation on said support, pressure rollers operable to compress said tubes progressively along their lengths for the pumping operation, means for positioning a plurality of said tubes in said side by side relation in each of a plurality of layers, and means comprising a flexible plate adapted to be interposed between said layers of tubes and extending longitudinally and laterally thereof whereby pressure applied by said rollers on said tubes of one of said layers in the pumping operation is transmitted to said interposed means for applying pressure to the tubes of said other layers for the pumping operation of fluid through said last mentioned tubes.

3. A multiple tubt fluid pump comprising, a support, a plurality of resiliently compressible tubes positioned in side by side relation on said support, tube holding members mounted on said support and spaced from each other longitudinally of the tubes, one of said tube holding members being disposed near the inlet ends of said tubes, each of said tube holding members comprising means for holding a plurality of the tubes in each of a plurality of layers, pressure rollers operable to compress said tubes progressively along their lengths for the pumping operation, and means adapted to be interposed between said layers of tubes and extending longitudinally and laterally thereof whereby pressure applied by said rollers on the tubes of one of said layers in the pumping operation is transmitted to said interposed means for applying pressure to the tubes of said other layer for the pumping operation of fluid through said last mentioned tubes, said pressure transmitting means comprising a flexible plate adapted to be removably secured to said one of said tube holding members.

4. A multiple tube fluid pump comprising, a support, a plurality of tubes positioned on said support in said side-by-side relation, tube holding members mounted on said support and spaced from each other longitudinally of the tubes, one of said tube holding members being disposed near the inlet ends of said tubes, each of said tube holding members comprising means for holding a plurality of the tubes in each of a plurality of layers, pressure rollers operable to compress said tubes progressively along their lengths for the pumping operation, and means adapted to be interposed between said layers of tubes and extending longitudinally and laterally thereof whereby pressure applied by said rollers on the tubes of one of said layers in the pumping operation is transmitted to said interposed means for applying pressure to the tubes of said other layer for the pumping operation of fluid through said last mentioned tubes, said pressure transmitting means comprising a flexible plate adapted to be removably secured to said one of said tube holding members, said flexible plate having an opening in which said one of the tube holding members is received for preventing movement of said plate longitudinally of said tubes during the operation of said pressure rollers.

5. A multiple tube fluid pump comprising, a support, a plurality of tubes positioned on said support in said side-by-side relation, tube holding members mounted on said support and spaced from each other longitudinally of the tubes, one of said tube holding members being disposed near the inlet ends of said tubes, each of said tube holding members comprising means for holding a plurality of the tubes in each of a plurality of layers, pressure rollers operable to compress said tubes progressively along their lengths for the pumping operation, and means adapted to be interposed between said layers of tubes and extending longitudinally and laterally thereof whereby pressure applied by said rollers on the tubes of one of said layers in the pumping operation is transmitted to said interposed means for applying pressure to the tubes of said other layer for the pumping operation of fluid through said last mentioned tubes, said pressure transmitting means comprising a flexible plate adapted to be removably secured to said one of said tube holding members, said tube holding members comprising a plurality of sets of tube-positioning grooves with the grooves of each set disposed laterally of each other and with the bottoms of grooves of the different sets in different planes, respectively, said flexible plate having an opening in which said one of the tube holding members is received for preventing movement of said plate longitudinally of said tubes during the operation of said pressure rollers.

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UNITED STATES PATENTS

2,865,303 Ferrari et al. ---------- Dec. 23, 1958