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FLOW DIVERTING APPARATUS FOR VISCOUS LIQUIDS

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FIG. 1

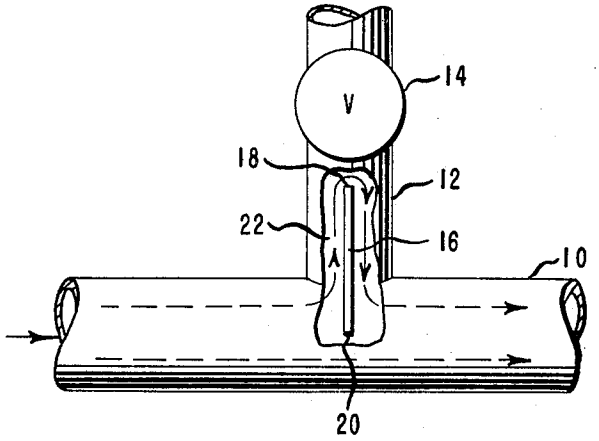


FIG. 2

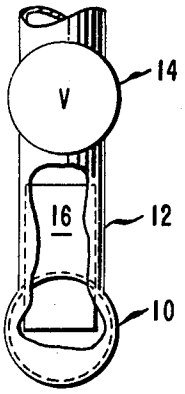


FIG. 3

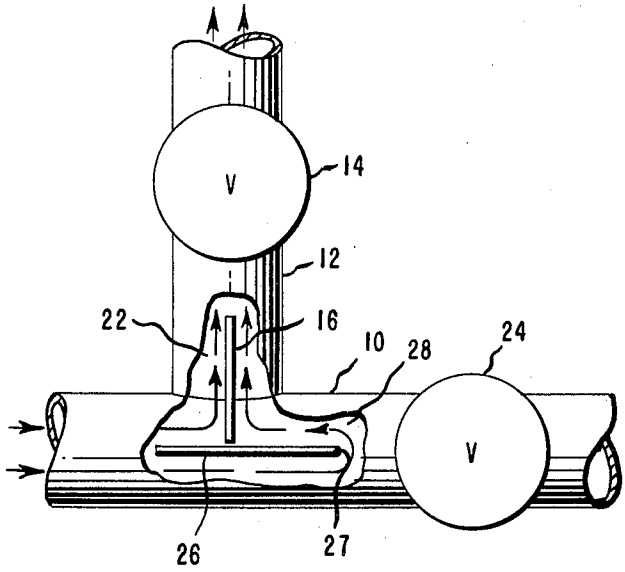
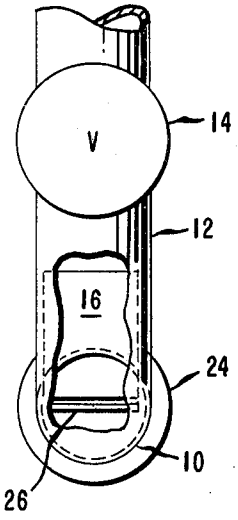


FIG. 4



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FLOW DIVERTING APPARATUS FOR VISCOUS LIQUIDS

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ABSTRACT OF THE DISCLOSURE

In a system for distribution of viscous liquids an apparatus for purging stagnant spaces formed in the system by closing side passages leading from the main supply conduit, an arrangement of flow diverter plates are positioned in the stagnant spaces and extend into the viscous flow to form flow passages through the stagnant spaces and divert viscous liquid through the formed flow passages.

BACKGROUND OF THE INVENTION

In the production of synthetic fibers by dry-spinning or melt-spinning processes, polymer solutions or melts are extruded as filaments which either solidify as they lose their solvent by evaporation or solidify as they cool, respectively. The viscosities of dry-, or melt-spinnable fluids must be high to meet the requirements for shaping. High viscosity is also implicit in the melts or commercially useful spinning solutions of polymers which have fiber-forming molecular weights. Practical considerations dictate that such viscous fluids be handled at high temperatures which, if prolonged, are detrimental to polymer quality. This is of particular concern in relatively stagnant spaces formed in the distribution system. Polymer which has degraded because of being held up for a longer-than-average period of time can contaminate the normal polymer by a slow seepage from such stagnant areas. More-apparent contaminatiton can occur as the result of turbulence with change in flow rate or other non-equilibrium condition which may dislodge a large amount of previously stagnant polymer melt or solution all at once.

This problem is familiar to those skilled in the art, and various means have been employed to minimize its influence on fiber quality. These include use of smooth-bore, seamless tubing, long-radius bends, etc. Elimination of the stagnant space in a valved-off "T" has posed a particularly difficult problem which heretofore has required use of a specially designend and extremely expensive valve whose seat is contoured to the curvature of and seals directly against the wall of the primary conduit. A less-expensive means to avoid stagnant spaces where valved T's are required in conduits for hot, viscous fluids would be highly desirable.

SUMMARY OF THE INVENTION

The advantages of this invention are provided in a generally tubular primary conduit for the transportation of viscous fluid, said conduit having at least one passage leading from it for optional diversion of at least a portion of said fluid to an alternate path, said passage leading to valve means to implement optional diversion of said fluid, the improvement comprising a flow diverting plate having its long dimensions oriented perpendicular to the conduit flow and extending from a line within said passage to a line within said conduit.

In one embodiment, for optional take-off, a flat flow-diverting plate extends from a line in the passage less than two internal diameters removed from said valve means to a line at least one-quarter-diameter into said primary conduit and has a width approximating the internal

diameter of said passage. Optimally, the flow-diverting plate extends from a line about one-half the passage diameter removed from the valve to the mid-point of the primary conduit.

Another embodiment, provides for stagnant-space-free flow through two routes either individually or simultaneously. This embodiment has the flow-diverting plate of that described previously and additionally has a second flow-diverting plate with the long dimension of its face oriented perpendicular to that of the first, positioned approximately in the center of the primary conduit, and extending from a line approximately one-half conduit-diameter from discharge valve means in the primary conduit to a line located beyond the more remote side of the passage.

In this embodiment, flow may be routed straight through the primary conduit valve means only or through the passage valve only without the development of stagnant spaces which normally form when either valve is closed.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURES 1 and 2 schematically illustrate in two partially cross-sectional elevation views an embodiment which is useful in preventing stagnant spaces in a conjointly or intermittently used passage leading from a primary conduit (such as for an optional second-operation requiring the viscous fluid, or for sampling).

FIGS. 3 and 4 schematically illustrated in two partially cross-sectional, elevation views an embodiment which is useful in preventing stagnant spaces in oulets which are used conjointly, or alternately.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

An embodiment of the viscous fluid distribution system of this invention is shown schematically in FIGS. 1 and 2. Viscous fluid from a source, not shown, is fed into conduit **10** and delivered through conduit **10** to and past a passage **12** leading from conduit **10**. In passage **12** adjacent its connection to conduit **10** is located a valve **14** which serves to close off passage **12** when flow through the passage is not required. A flow diverting plate **16** is longitudinally positioned in passage **12** and welded in place. The plate has one end **18** spaced from valve **14** and the other end **20** of the plate extends into conduit **10**. This arrangement forms a partition which results in a flow path as indicated by the arrows (FIG. 1) through space **22** which exists when valve **14** is closed. Flow diverting plate **16** has a width approximately equal to the internal diameter of passage **12** and a length sufficient to reach the center line of conduit **10**.

The embodiment illustrated in FIGS. 3, 4 duplicates FIGS. 1, 2 with the addition of a valve **24** in conduit **10** located downstream from passage **12** and a second flow diverting plate **26** diametrically positioned in conduit **10**. Plate **26**, having one end **27** adjacent and spaced from valve **24**, is oriented perpendicular to plate **16** and extends upstream beyond passage **12**. Plate **26** serves to form a partition which results in a flow path as indicated by the arrows (FIG. 3) through stagnant space **28** which exists when valve **24** is closed.

In an experiment to verify the effectiveness of the simple device of this invention is preventing stagnant spaces, such as **22**, **28** a model of apparatus such as depicted in FIGS. 3, 4 was constructed of transparent plastic and a clear, viscous liquid pumped therethrough. It was found that the path of flow illustrated in FIG. 3 was followed by the liquid when valve **24** was closed and valve **14** open. The path of flow illustrated in FIG. 1 was followed when valve **24** was open and valve **14** closed. Insofar as could be determined by visual

estimation of the speeds of travel of foreign matter deliberately introduced into the feed liquid, there was no difference between those of the direct path and the diverted path.

It is surprising that so simple a device can resolve so vexing a problem. It will also be apparent that the device is more widely applicable than is suggested by the figures. For example, a simple adaptation of the contours of the flow diverting plates makes them operative in a two-way conduit apparatus the members which are 60° apart instead of 90° and 180°, as illustrated. It is also applicable for three- (or more) way distribution systems by obvious modifications.

While the illustrated relative dimensions are those found approximately optimum for a given viscous fluid, it will be apparent that they are not critical. Extension of the flow-diverting plates to a line closer to the valves, or other flow-interrupting means, will reduce the amount of flow through the diverted path. This reduced flow will in some cases be entirely adequate. Likewise a flow reduction is encountered by reducing the projection of the flow-diverting plate into the primary flow stream which may be entirely adequate for many uses.

It is not necessary that the flow-diverting plates be sealed against the conduits or against each other. Since the objective is only to estabish *some* definite flow through a space which is normally stagnant, refinements in construction directed at precise control of rate are, in many instances, not justifiable on the basis of the minor further benefit obtained.

In some cases, however, where instability of the fluid makes it necessary to provide nearly equal flows through the two paths, it is possible to attain such by careful sizing of the area of the primary conduit subtended by the flow diverting plate and equilibration thereof with the area of free flow between the opposite end of the plate and the valve.

A significant advantage in the apparatus of this invention is its ready adaptability to existing equipment. With reference to FIG. 1, plate **16** can be inserted into passage **12** without dismantling primary conduit **10** by removing valve **14**, or by dropping it through the open valve if it is of the gate type. Contamination of the main conduit by welding splatter can be minimized by spot-welding through small holes drilled in passage **12**, if desired. It will also be apparent that welding may be avoided by contouring one end of plate **16** to fit the inside curvature of conduit **10** and providing an orifice through plate **16** of the appropriate size; if installed in a vertical, upwardly directed passage, such a plate will retain its orientation perpendicular to the primary-conduit flow.

What is claimed is:

1. In a system for the distribution of viscous liquid including a conduit through which the liquid flows, a passage leading from said conduit, means for closing said passage adjacent said conduit and conduit closing means downstream and adjacent said passage, said passage and said conduit downstream from said passage when not in use forming stagnant spaces opening into the viscous liquid flow stream, an apparatus for diverting said viscous liquid through said stagnant spaces, said apparatus comprising:

(a) a first flow diverting plate diametrically positioned in said passage, said first plate having one end spaced from the passage closing means, said plate extending into said conduit and being oriented across the flow stream; and

(b) a second flow diverting plate diametrically positioned in said conduit, said second plate having one end spaced from and adjacent said conduit closing means, said second plate extending upstream and being oriented perpendicular to said first plate.

2. The apparatus of claim **1** wherein said passage and said conduit closing means are valves.

3. The apparatus of claim **1** wherein said second plate extends upstream beyond the passage.

4. The apparatus of claim **1** wherein said one end of the first plate is spaced from the passage closing means a distance equal to approximately ½ the diameter of the passage, said first plate extending into said conduit a distance of approximately ½ the conduit diameter and said second plate being spaced from said conduit closing means a distance of approximately ½ the diameter of the conduit.

5. The apparatus of claim **1** wherein said first and said second plates are flat and have a width approximately equal to the respective diameters of the passage and the conduit.

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U.S. Cl. X.R.

137—561; 251—127