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HYDRAULIC PUMPING APPARATUS

Filed April 20, 1951

4 Sheets-Sheet 1

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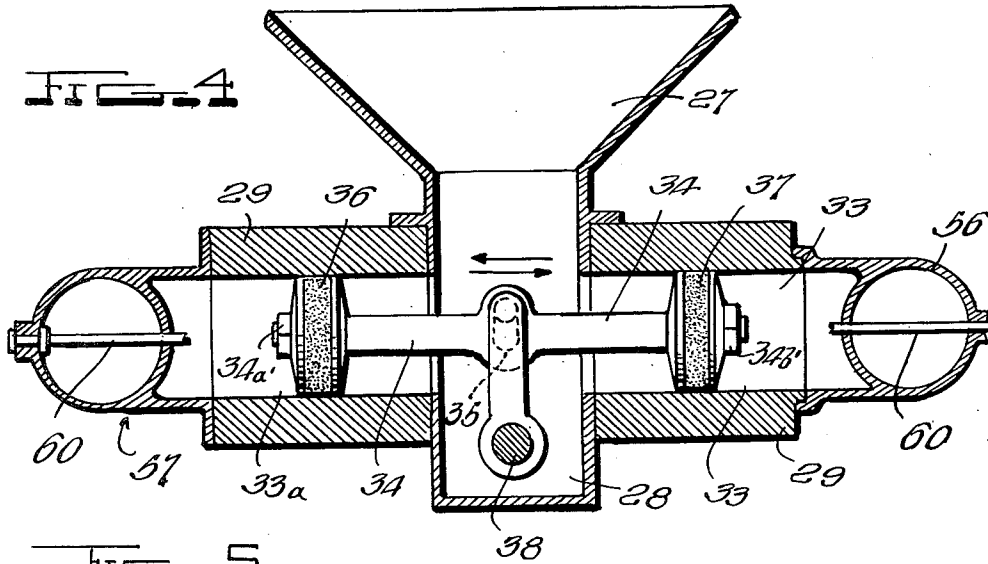


FIG. 5

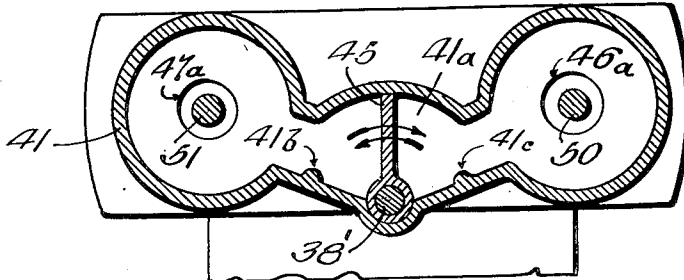
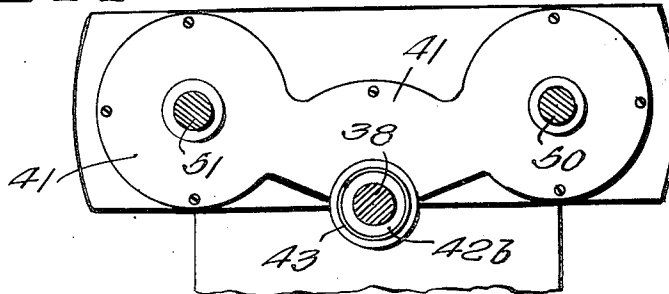
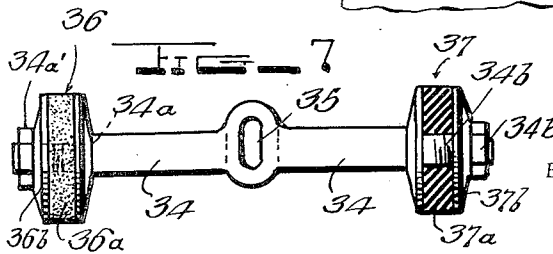


FIG. 6



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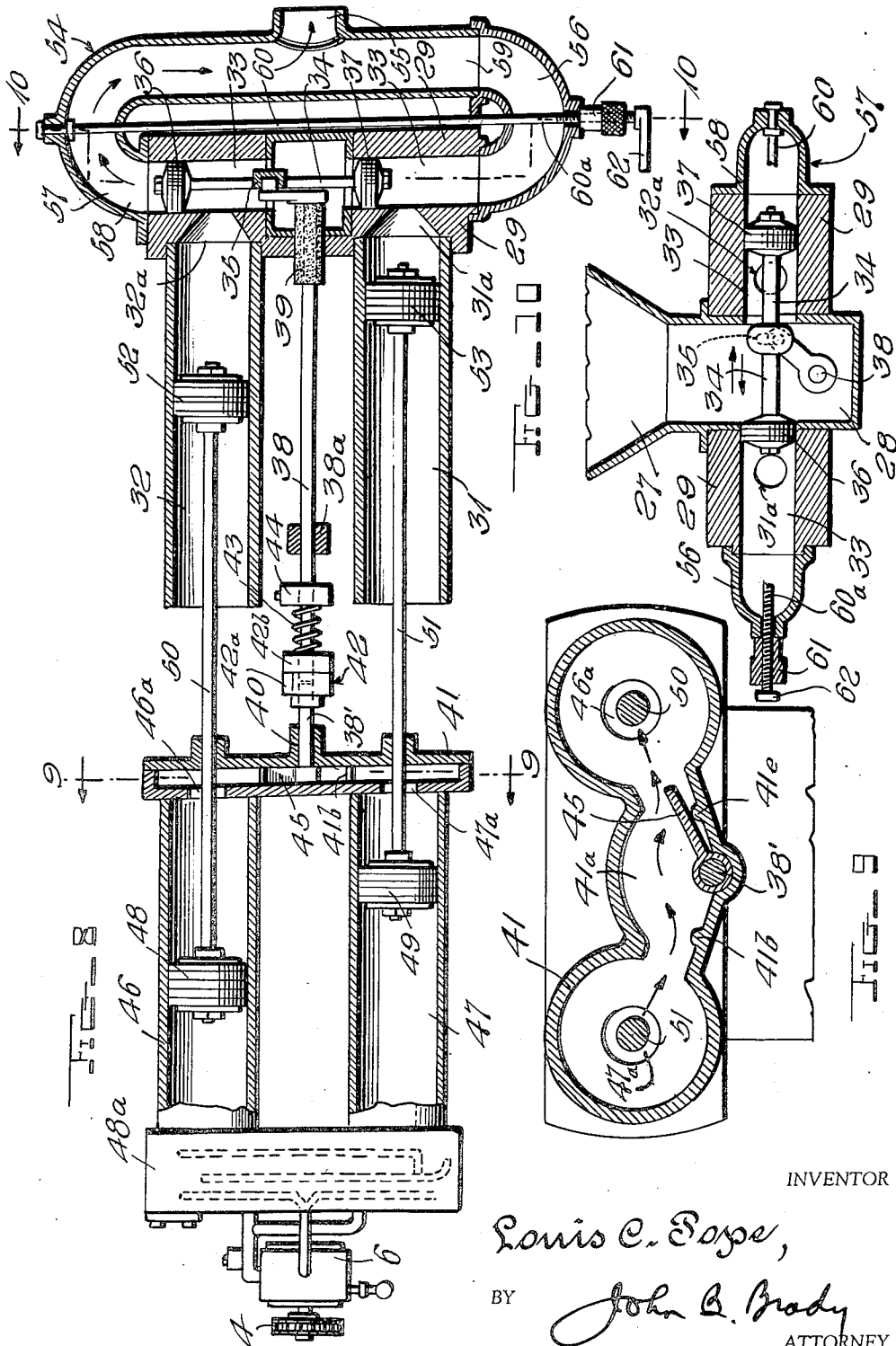
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HYDRAULIC PUMPING APPARATUS

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8 Claims. (Cl. 103—49)

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My invention relates broadly to hydraulic pumping apparatus and more particularly to a valve mechanism for hydraulic pumping systems.

This application is a continuation-in-part of my application 678,740, filed June 24, 1946, for Hydraulic Pumping Apparatus.

One of the objects of my invention is to provide an improved construction of valve mechanism for operation in correlation with the fluid drive apparatus of a hydraulic pumping system.

Still another object of my invention is to provide a valve mechanism which has been developed to efficiently control the pumping of hydraulic agglomerate effectively utilizing the entire piston strokes of the pumping apparatus for delivery of agglomerate under a pressure head.

Still another object of my invention is to provide a construction of valve mechanism for pumping systems for effecting the forced flow of fluid, semi-fluid or non-fluid agglomerate in which the pressure strokes from an oil drive mechanism are timed in relation to the pressure exerted on the agglomerate is synchronized therewith for operating the apparatus at maximum efficiency.

Still another object of my invention is to provide a construction of angularly shiftable valve mechanism operating in coordination with a transversely slidable system of pistons and timed with a transitory oil control valve for efficiently controlling the pumping of agglomerate.

Still another object of my invention is to provide a construction of agglomerate pumping mechanism in which the parts of the agglomerate pump may be readily assembled and disassembled for maintenance and repair for insuring long life in the operation of the agglomerate pumping system.

Still another object of my invention is to provide an automatic valve system for a hydraulic pumping mechanism for positively controlling the strokes of the pistons which force agglomerate from a receiving hopper to a delivery pipe while synchronizing the operation of the pumping mechanism with the operation of the drive mechanism.

Still another object of my invention is to provide an arrangement of control mechanism for the fluid drive and the agglomerate pump of a hydraulic pumping system in which reciprocative slide members are synchronously controlled to operate on the one hand the fluid drive mechanism for the hydraulic pumping apparatus and on the other hand to direct the flow path for agglomerate into and out of the pumping apparatus for force flowing the agglomerate through a distribution line.

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Still another object of my invention is to provide an arrangement of synchronous valve mechanism for simultaneously controlling a fluid drive mechanism for a hydraulic pumping apparatus and controlling the charging and discharging path through a system of hydraulic cylinders for effectively establishing a pressure head for pumping agglomerate from a receiving hopper through a distribution pipe.

Other and further objects of my invention reside in the compact construction of valve control system for hydraulic pumping apparatus as set forth more fully in the specification hereinafter following by reference to the accompanying drawings in which:

Figure 1 is a vertical longitudinal sectional view through the hydraulic pumping apparatus of my invention with certain of the parts shown in elevation; Fig. 2 is a horizontal sectional view taken through the oil pump mechanism and through the agglomerate pump of my invention and showing the synchronous operation of the oil pump mechanism and the agglomerate pump, the view illustrating a neutral position of the slide valve in the agglomerate pump with the agglomerate being detailed to a storing reservoir intermediate the pistons of the hydraulic valve preparatory to an operation for charging one of the hydraulic cylinders; Fig. 3 is a vertical sectional view taken on line 3—3 of Fig. 2; Fig. 4 is a vertical sectional view taken substantially on line 4—4 of Fig. 2; Fig. 5 is a vertical sectional view taken substantially on line 5—5 of Fig. 2; Fig. 6 is a vertical sectional view taken substantially on line 6—6 of Fig. 2; Fig. 7 is an elevational view of the pistons of the slide valve employed in the agglomerate pump and illustrating particularly the interconnecting piston rod and the groove therein by which connection is established with the valve control shaft which interconnects the angularly movable vane of the oil pump mechanism with the slide valve of the agglomerate pump; Fig. 8 is a horizontal sectional view similar to the view shown in Fig. 2 but illustrating the slide valve of the agglomerate pump displaced to a position for discharging agglomerate under pressure from one hydraulic cylinder oil charging the associated hydraulic cylinder, the view illustrating the correlated position of the angularly movable oil valve of the oil drive mechanism; Fig. 9 is a vertical sectional view taken on line 9—9 and illustrating the displaced position of the oil valve for the condition illustrated in Fig. 8; Fig. 10 is a vertical sectional view taken on line 10—10 of Fig. 8 and showing the displaced position of the slide valve for the condition illustrated in Fig. 8 where the

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agglomerate from one hydraulic cylinder is being forced under a pressure head through the distribution pipe; Fig. 11 is a perspective view indicating the manner of correlating the angularly movable vane and the transversely slidable valve for the agglomerate; and Fig. 12 is a view of the separable parts of the manifold in juxta-position preparatory for attachment to the transverse header of the agglomerate pump.

My invention is directed to an arrangement of valve control mechanism for use in hydraulic mixing and pumping apparatus for agglomerate used in construction of foundations, pavements, walls, and building construction. I utilize the principles set forth in my co-pending application 678,740, filed June 24, 1946, for Hydraulic Pump Apparatus, but provide improvements for the positive control of the flow of the agglomerate to and from the hydraulic pumping cylinders in timed relation to the operation of the oil cylinder drive mechanism. I do not depend upon mere bypass connection at the rearward ends of the oil drive cylinder or gravitationally operated valves for controlling the flow of agglomerate but on the contrary I introduce a system of synchronously operating valves wherein the strokes of the oil pump pistons produce an angular movement of a valve control shaft, at the same time controlling the flow path through the oil drive cylinders for insuring the alternate operation of the oil driven pistons and correspondingly controlling the strokes of the hydraulic pumping mechanism. The valve control shaft positively operates a transversely arranged slide valve in the agglomerate pump which in one position directs agglomerate from a receiving hopper into one agglomerate pumping cylinder while directing the discharge of agglomerate from the associated hydraulic pumping cylinder through a delivery line, the said slide valve in its oppositely displaced position serving to cut off the last mentioned hydraulic pumping cylinder from the delivery line for recharging the said hydraulic pumping cylinder with agglomerate while directing the discharge of agglomerate from the associated hydraulic pumping cylinder. In other words, the valve mechanism of my invention is synchronized both with respect to the operation of the oil pump system and the operation of the agglomerate controlling pistons in the agglomerate pumping system to insure the alternate supply of agglomerate to one hydraulic pumping cylinder while the associated pumping cylinder is discharging and effecting the discharging of the last mentioned hydraulic pumping cylinder while the associated hydraulic pumping cylinder is being charged with agglomerate preparatory to the discharge stroke for forcing the agglomerate under pressure through the distribution line. In order to insure the convenient repair and replacement of parts in the hydraulic pumping apparatus, I provide special means of assembly for the agglomerate manifold with respect to the pumping cylinders enabling replacement of parts to be made without extended shut-down of the equipment.

The apparatus of my invention is readily portable and may be transported from one location to another in building construction projects. The cementitious aggregate may be dumped into the main hopper of the equipment and subjected to a mixing operation by a rotatable agitator driven from the same prime mover which drives the oil pump system for controlling the operation of the hydraulic pumping apparatus. The mixed ce-

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mentitious aggregate is screened and then passed through a discharge aperture to the delivery hopper leading to the hydraulic pumping apparatus which positively controls the force feed of the aggregate under a pressure head through the distribution line.

I provide special means interconnecting the slide valve of the agglomerate pump and the angularly movable valve of the oil pump mechanism for relieving undue strain upon the valve control mechanism in the event that an obstruction should occur against the movement of the slide valve in the agglomerate pump. Under conditions of such obstruction which might normally give rise to an increase in stress in the valve control mechanism, I provide an arrangement of coupling through a slip clutch which eliminates strains which might otherwise arise from excessive stress permitting slippage of parts instead of the tendency of shear thereof which might otherwise exist.

Referring to the drawings in more detail reference character 1 designates a base structure on which there is supported a prime mover such as a gasoline engine 2 driving shaft 3 which connects through the sprocket chain 4 with a sprocket carried by a drive shaft 5 of oil pump 6. Drive shaft 5 of oil pump 6 connects through sprocket chain 7 with a sprocket carried by the horizontally extending shaft 8 mounted in anti-friction bearings 9 and 10 supported on end walls 11 and 12 of the cementitious aggregate mixing drum 14. The mixing drum 14 includes a cylinder 15 supported from base structure 1 on suitable structural members unreferenced. The shaft 8 extends through cylinder 15 and passes through the screen 16. Agitator members 17 are carried by shaft 8 at spaced intervals and serve to thoroughly mix the cementitious aggregate such as sand, gravel and cement dumped through hopper 18. Water is supplied to the mixing drum through spout 19 connected with water pump 20 supplied from water pipe 21. The water pump 20 is driven by a sprocket carried on shaft 8 connected through chain 22 to a sprocket carried by shaft 23 of the water pump 20. The mixed cementitious aggregate is sized by screen 16 and further broken up by agitator members 17 in the course of its flow through discharge aperture 24 in the bottom of one end of the cylindrical drum 15. Aperture 24 may be closed by slide valve 25 which is slidable and adjustable operative in suitable guides 26 carried by cylindrical drum 15. The mixed aggregate is delivered to the hopper 27 of the hydraulic pumping apparatus and fills the reservoir 28 in the fluid end header 29.

The fluid end header 29 extends transversely of the base structure 1 and serves to support hopper 27 on the top thereof and is supported on base structure 1 adjacent the bottom thereof. The fluid end header 29 serves to support the two horizontally extending hydraulic cylinders 31 and 32 disposed in horizontally spaced positions and connected through passages 31a and 32a with the transversely extending bore 33 in the fluid end header 29. The bore 33 constitutes a cylinder within which the slide valve for controlling the flow of agglomerate is slidably mounted. The slide valve is shown more clearly in Fig. 7 as comprising the intermediate connecting link 34 which is centrally grooved as represented at 35 and which carries pistons 36 and 37 adjacent opposite ends thereof. The opposite ends of the intermediate connecting link 34 are reduced in section and screw threaded as

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represented at 34a and 34b for receiving the pistons 36 and 37 and permitting the said pistons to be clamped by means of adjustable nuts 34a' and 34b'. Each of the pistons 36 and 37 is constructed from rubber members 36a and 37a clamped between sets of metallic discs 36b and 37b enabling the surface areas of the pistons to be adjustably expanded to insure a good fit within bore 33 for effectively pumping aggregate.

The pistons 36 and 37 are controlled in transverse position by means of a valve control mechanism which includes a longitudinally extending control shaft comprising two aligned sections 38 and 38' which extend intermediate the longitudinally extending hydraulic cylinders 31 and 32. Shaft section 38 is journaled at one end in resilient sleeve bushing 39 mounted in header 29 and adjacent the other end in standard 39a. The shaft section 38' is journaled in bushing 40 carried by the transversely extending manifold 41. The shaft sections 38 and 38' are axially aligned and interconnected by means of an intermediate releasable clutch mechanism 42 which normally transmits the torque necessary to correlate the functioning of the oil drive mechanism and the agglomerate pistons 36 and 37 but which is subject to slippage for all excess loads encountered under conditions of obstructions which may occur between the pistons 36 and 37 and the agglomerate in bore 33.

The releasable clutch mechanism 42 consists of a clutch disc member 42a carried by shaft section 38' and clutch disc member 42b slidably keyed on shaft section 38, and carrying clutch teeth which are yieldably pressed into engagement with aligned recesses in clutch disc member 42a by means of coil spring 43 which is concentrically positioned on shaft section 38 and secured thereon by means of stop 44. The clutch teeth on clutch discs 42a and 42b which interengage are in the nature of cam members which under conditions of excessive torque will slip one upon another with clutch disc 42b displaced toward the right against the action of coil spring 43 permitting slippage between shaft sections 38 and 38', thereby preventing excessive strains under conditions of obstruction which may be encountered in the agglomerate in bore 33.

The shaft 38' carries the vane 45 which is annularly displaceable in the intermediate passage 41a and manifold 41. The vane 45 is shiftable throughout a range which is less than 180° and is limited at opposite ends of its travel by means of stops represented at 41b and 41c carried by the lower wall of the manifold 41. These stops insure the positioning of vane 45 in such a position that the change in direction of oil flow through the oil drive cylinders 46 and 47 is assured. The arrangement of the oil drive cylinders 46 and 47 is illustrated more clearly in Figs. 2 and 8 where the left ends of the oil drive cylinders are interconnected through an oil directing header 48a while the right hand ends of the oil drive cylinders 46 and 47 are interconnected through the transversely extending manifold 41. The oil drive cylinders 46 and 47 each contain reciprocative pistons 48, 49 connected to piston rods 50 and 51, respectively. The oil feed is controlled through pump 6 for operating pistons 48 and 49 in alternate strokes as oil is permitted to flow through the manifold 41. The vane 45 is positively driven under control of the flow of oil between oil drive cylinders 46 and 47 and is

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shifted angularly as the direction of oil flow through the manifold 41 reverses. The oil from cylinder 46 passes through annular aperture 46a around piston rod 50 through manifold 41 and the oil from cylinder 47 passes through aperture 47a around piston rod 51 through manifold 41. The force of the oil applied to pistons 48 and 49 is confined within the circulatory path through the cylinders 46 and 47 and around the manifold 41 and oil directing header 48a. The oil is sealed-in and fluctuates back and forth under control of vane 45. The force of the oil driven pistons 48 and 49 is transmitted to the pistons 52 and 53 operating in the hydraulic cylinders 31 and 32 which serve to alternately suck in the agglomerate and force out the agglomerate which is fed from intermediate reservoir 28 under control of the pistons 36 and 37. The pistons 36 and 37 move within bore 33 for alternately pumping the aggregate into the hydraulic cylinders 31 and 32 and ultimately forcing the aggregate through the sections of the manifold 54 which interconnect the opposite ends of the header 29 with the agglomerate delivery pipe 55.

The manifold 54 is constructed from a plurality of sections shown more clearly in Fig. 12 wherein one section is constituted by a U-shaped conduit 56 and the other section is constituted by a conduit 57 having one short leg 58 and a long leg 59. The long leg 59 couples with one of the ends of the U-shaped conduit 56 while the short leg 58 thereof connects with header 29. The delivery pipe 55 connects substantially midway of the length of the long leg 59. The sections of the manifold are separable to permit repairs to be readily made from time to time. The sections of the manifold are clamped together on opposite ends of header 29 in registry with bore 33 therein by means of rod 60 which is fastened in the manifold section 57 and passes through manifold section 56 and is clamped by means of the screw threaded sleeve member 61 which engages screw threads 68 on rod 60. A hand lever 62 is provided on the end of rod 60 to maintain rod 60 stationary while turning screw 61 into a firmly anchored position.

The agglomerate passes through passages 31a and 32a in header 29 in the course of the forced flow thereof into and out of the bore 33 of the pump constituted by pistons 36 and 37 and the cyclic strokes thereof insure the pumping of a steady stream of agglomerate which is force-fed through delivery pipe 55.

While I have described my invention in certain preferred embodiments I realize that modifications may be made and I desire that it be understood that no limitations upon my invention are intended other than may be imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. A hydraulic pumping system for agglomerate comprising a pair of horizontally disposed agglomerate receiving and pumping cylinders arranged on spaced parallel extending axes and having force feeding pistons therein, a feed hopper for agglomerate translatory linearly connected multiple, valve mechanism located adjacent the ends of said agglomerate receiving and pumping cylinders for controlling the force feeding of agglomerate delivered from said feed hopper to said agglomerate receiving and pumping cylinders, a fluid operated drive means for the pistons in said agglomerate receiving and pumping cylinders axially aligned with the respective

agglomerate receiving and pumping cylinders, a periodically reversing angularly moving valve disposed intermediate the ends of said agglomerate receiving and pumping cylinders and the ends of said drive means for controlling the operation of said fluid operated drive means and means for correlating the operation of said valve and said valve mechanism for controlling the force feeding of agglomerate.

2. A hydraulic pumping system for agglomerate as set forth in claim 1 in which said valve and said valve mechanism are synchronously controlled by means extending longitudinally between and spaced from said agglomerate receiving and pumping cylinders.

3. A hydraulic pumping system for agglomerate as set forth in claim 1 in which said valve and said valve mechanism are controlled by a shaft member that extends longitudinally between said agglomerate receiving and pumping cylinders, said shaft member interconnecting said valve and said valve mechanism and mounted for angular movement in alternately opposite directions synchronously with the operation of said fluid drive means.

4. A hydraulic pumping system for agglomerate as set forth in claim 1 in which said valve and said valve mechanism are interconnected by an operating shaft which includes a slip clutch located between said cylinders and intermediate said operating shaft for relieving excessive strains on said valve and said valve mechanism under conditions of obstruction to the movement of said valve mechanism.

5. A hydraulic pumping system for agglomerate as set forth in claim 1 wherein the means for correlating the operation of said valve and said valve mechanism is alternately displaceable within an angular distance of not more than 180°.

6. A hydraulic pumping system for agglomerate as set forth in claim 1 wherein said valve is a flat plate movable with respect to either of two ports for directing fluid through said fluid operated drive means and wherein said agglomerate receiving and pumping cylinders are interconnected by a transverse manifold having a cylindrical bore therethrough and wherein said

valve mechanism comprises two pistons movable through the bore in said manifold in a path transverse to the axes of said agglomerate receiving and pumping cylinders.

7. A hydraulic pumping system for agglomerate as set forth in claim 1 in which the intake and discharge ends of said agglomerate receiving and pumping cylinders are interconnected by a transverse header in which said valve mechanism for force feeding the agglomerate is operative, and a manifold connecting opposite ends of said header with a delivery pipe said manifold comprising a multiplicity of separable alignable agglomerate conveying sections operative in assembled position to convey agglomerate from opposite ends of said header into said delivery pipe.

8. A hydraulic pumping system for agglomerate as set forth in claim 1 in which the intake and discharge ends of said agglomerate receiving and pumping cylinders are interconnected by a transverse header in which said valve mechanism for controlling the force feeding the agglomerate is operative, and a manifold connecting opposite ends of said header with a delivery pipe, said manifold comprising a pair of sections, one consisting of a U-shaped conduit with substantially equal legs and the other a U-shaped conduit with one short leg and one long leg and with one leg of the first mentioned section coupled with the long leg of the last mentioned section, said delivery pipe extending from substantially the center of said long leg of said last mentioned section, and fastening means extending longitudinally through both of said sections for securing said sections with respect to said header.

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