(No Model.) 2 Sheets—Sheet 1.

I. E. STOREY.

FRICTION CLUTCH.

No. 563,989. Patented July 14, 1896.

Fig. 1.

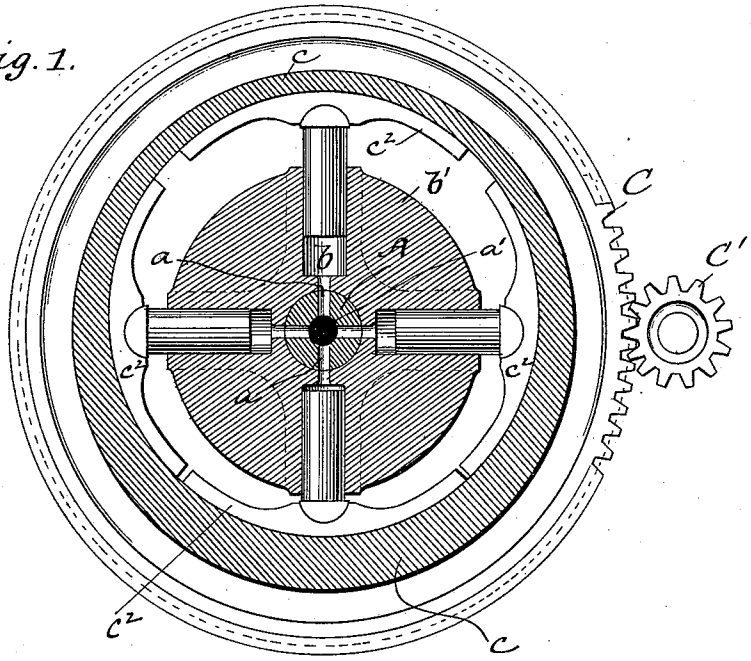
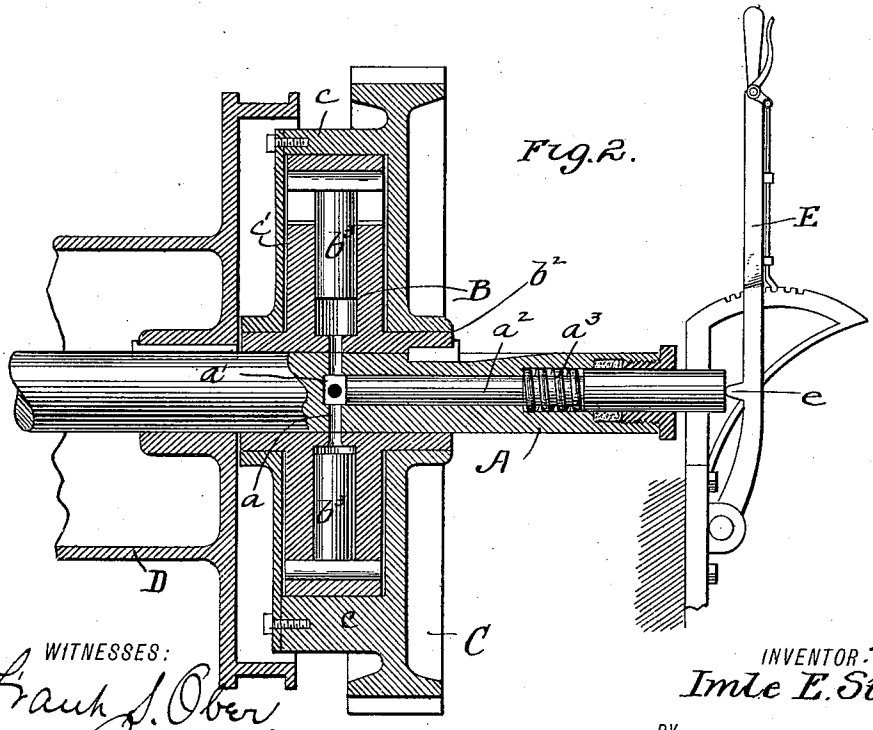


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

I. E. STOREY.

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Fig. 3.

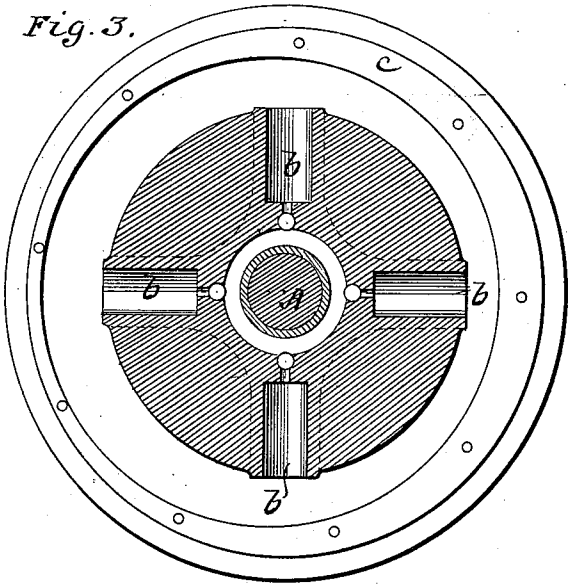


Fig. 4.

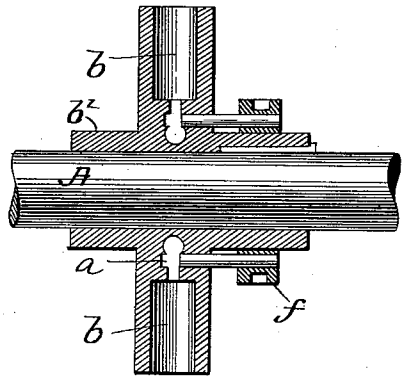


Fig. 6.

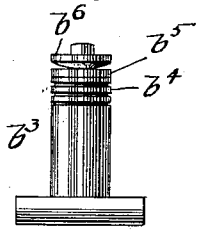
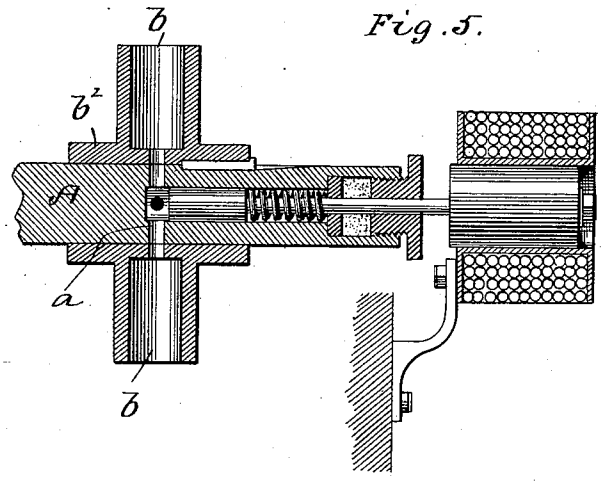


Fig. 5.



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UNITED STATES PATENT OFFICE.

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FRICTION-CLUTCH.

SPECIFICATION forming part of Letters Patent No. 563,989, dated July 14, 1896.

Application filed January 20, 1891. Serial No. 378,430. (No model.)

To all whom it may concern:

Be it known that I, IMLE E. STOREY, a citizen of the United States, residing in Boulder, county of Boulder, and State of Colorado, have invented certain new and useful Improvements in Friction-Clutches, of which the following is a specification.

This invention relates to friction-clutches, with special reference to what are termed "hydraulic" clutches.

The object of the invention is to provide a clutch adapted for all classes of work, but particularly for hoisting, which shall be very simple in operation, simple in construction, and conveniently manipulated.

The invention consists in the combinations of parts hereinafter described and claimed.

In the accompanying drawings, Figure 1 represents a sectional view of the device, the section being on a plane at right angles to the shaft. Fig. 2 is a section taken at right angles to the section shown in Fig. 1, and showing an operating device. Fig. 3 and 4 are similar views, respectively, of a modification of the invention. Fig. 5 is a section showing a modified form of operating device, and Fig. 6 is a view of one of the pistons.

A represents a shaft; B, a casting keyed thereupon. This casting is circular and is provided with a number of cylinders *b*. As shown here there are four, but any suitable number may be employed. The cylinders are connected by a web *b'* to give strength and symmetry to the casting, and a hub b^2 is provided.

The shaft is provided with a number of radial passages or ports *a*, one for each cylinder, and each port registers with a radial passage communicating with the respective cylinders at the inner ends thereof, forming continuous passages. The passages all meet in the center of the shaft, where a small concentric cylindrical chamber *a'* is formed. The shaft is bored out from the end to this chamber to form a valve-chamber for a reciprocating valve a^2. A stuffing-box for the valve is provided at the end of the shaft and a spring a^3, located in a suitable opening, acts against a shoulder on the valve to force the valve outward. The valve-stem projects beyond the end of the shaft.

Each cylinder *b* is provided with a piston b^3, the construction of which is shown in Fig. 6. The outer end carries a semicylindrical cross-head, forming one half of a socket, as will appear hereinafter. The inner end is provided with several annular grooves b^4 b^4, a rubber disk b^5, and metal disk b^6, having a convex surface resting against the center of the rubber disk. The metal disk is held freely on a spindle, so that when pressure is applied from the inside it will force the rubber disk to expand radially and pack the piston. The grooves also aid in packing the pistons.

C is a wheel adapted to be driven from any source of power and through any style of gearing. It is here represented as a gear-wheel, to which motion is transmitted through a pinion C'. This wheel has its bearing upon the extended hub of the casting B or upon the shaft. The bearing, however, is loose, and the wheel is free to turn independently of its shaft. Upon one side of the wheel an annular flange *c* is formed. The flange stands at right angles to the plane of the wheel, and a circular plate or disk *c'* is bolted to its outer edge, thus inclosing the space within the flange. The disk has a loose bearing upon the extended hub of the casting B or upon the shaft. The circular inner wall of the flange *c* is eccentric to the shaft A and has a ground or smooth surface. The eccentricity is shown clearly in Fig. 1. The wheel C, the flange *c*, and disk *c'* therefore inclose or form a circular chamber eccentric to the shaft A. Within this chamber, as shown, the casting B with the pistons is located. The outer end or cross-head of each piston connects with a segmental shoe c^2, the segment being slightly less than a quarter of a circle and having a surface corresponding to the surface of the eccentric against which it bears. The connection between the shoe and the piston is a simple rolling or cylindrical joint having no positive attachment, the parts being held together by pressure.

D represents the drum of a hoist. It is keyed upon the shaft A.

Into the cylinder, the passages *a*, and the chamber *a'* is placed a quantity of oil or other suitable liquid. The quantity is such that

the valve may be pushed in to occupy the chamber a' without exerting any pressure upon the pistons. The function of the clutch as here constructed is to lock the wheel C to the shaft A or drum D.

The operation is as follows: Assuming that the valve is in the position shown in Fig. 2, the wheel C is rotated by pinion C'. This rotation causes a reciprocation of the pistons in their cylinders by reason of the eccentric flange. As the pistons reciprocate the oil is pumped from one cylinder to the other through the valve-chamber and passages, and so long as the valve remains in the position shown in Fig. 2 this pumping operation takes place, and only the wheel C and its connections rotate. As soon, however, as the valve is forced inward until it occupies the valve-chamber and cuts off connection between the passages a the cylinders, which are being forced inward by the eccentric, meet the incompressible bodies of oil located in their respective cylinders and ports a and are prevented from proceeding farther. This sets up friction between the segmental shoes and the eccentric surface sufficient to prevent any slipping. Consequently there is a perfect lock between the wheel C and the casting B. The casting being keyed to the shaft, the latter must rotate, and thus motion and power are communicated from the pinion C' to the shaft A and thence to the drum or other load.

The mechanism for operating the valve may be of any suitable character. In Fig. 2 I show a hand-lever E, which is provided with a lug e, resting against the head of the valve. By means of this, the valve may be forced inward against the pressure of the spring and locked at any point. In Fig. 5 I have shown a substitute for this mechanism, consisting of an electromagnet or solenoid whose armature is connected with the valve. In this case the tendency of the coiled spring is to force the valve inward and the magnet is used to withdraw it. It is understood, of course, that with the use of a rheostat the armature of the magnet may be moved to any desired extent.

The advantageous feature of this clutch is its sensitiveness. It is obvious that by forcing the valve inward and slightly throttling the circulation of oil there will be more or less slipping of the shoes on the eccentric surface, and the speed of the driven shaft will be proportionately less than the speed of the wheel C. The speeds may therefore be regulated to a nicety.

In Figs. 3 and 4 a modification in the valve mechanism is illustrated. This is particularly adapted for use at an intermediate location on the shaft. It will be observed that the mechanism shown in Fig. 1 is applicable only to the end of the shaft. The modification consists in a separate valve for each chamber surrounding the shaft. The valves are all connected with a ring f, so that when the latter is moved all of the valves move together to restrict or relieve the passages. The result is the same in both instances.

It is well to make note of a peculiar feature in the operation of this device. When there is no lock between the parts, that is, when the pistons are running free and pumping the oil from one to the other, practically no power is required to force the pistons in, inasmuch as those which are on the inward stroke are aided in their movement by the suction of those on the outward stroke, and the latter are being moved by centrifugal force. No power is therefore wasted when running free.

This clutch will be found particularly useful in electric locomotives where it is desired that the motor shall run continuously and that the clutch shall be thrown in gradually.

Having thus described my invention, I claim—

1. The combination with a rotating body provided with a surface eccentric to the axis of rotation, of a rotatable element concentric to said axis and provided with a plurality of cylinders, communicating with one another, a piston in each cylinder having a bearing against the said eccentric surface, a liquid in the cylinders, and a valve to cut off communication between the cylinders.

2. In a clutch, the combination with the driving and driven elements, of a plurality of pistons connected with one element an eccentric surface upon the other element acting upon the said pistons, a body of liquid in circulation between the pistons and a valve for controlling the circulation of said liquid.

3. The combination with a body of liquid, of a plurality of pistons acting thereon, the liquid being in circulation between the pistons, an eccentric surface acting upon the pistons causing their reciprocation, a valve controlling the flow of the liquid and a shaft, the pistons being carried by the shaft, and the eccentric surface being independent of the shaft.

4. In a clutch, the combination with the driving and driven elements, of a plurality of pistons connected with one element an eccentric surface upon the other element acting upon the said pistons, a body of liquid in circulation between the pistons, a valve for controlling the circulation of said liquid and means for operating said valve.

5. In a clutch, the combination of the driving and driven parts, a shaft upon which one part is fixed, said shaft provided with passages through or across it, a body of liquid circulating through said passages, one or more pistons carried by one part and acting upon the liquid, an eccentric surface on the other part acting upon the pistons and means for controlling the circulation of the liquid.

6. In a clutch, the combination of the driving and driven parts, a shaft upon which one part is fixed, said shaft provided with passages through or across it, a body of liquid

circulating through said passages, one or more pistons carried by one part and acting upon the liquid, an eccentric surface on the other part acting upon the pistons, and a valve located in the shaft for controlling the circulation of the liquid.

7. In a clutch, the combination of a rotating body provided with a surface eccentric to the axis of rotation, a rotatable element concentric to said axis and provided with a plurality of cylinders communicating with one another through passages leading across or through the axis of rotation, a piston in each cylinder having a bearing against the said eccentric surface, a liquid in the cylinders and a valve adapted to control the communication between the cylinders.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

IMLE E. STOREY.

Witnesses:
FRANK S. OBER,
EDWARD A. WAGNER.