3 Sheets—Sheet 1.

C. J. GALLOWAY & J. H. BECKWITH.

Friction-Clutch.

No. 226,302. **Patented April 6, 1880.**

Fig: 1

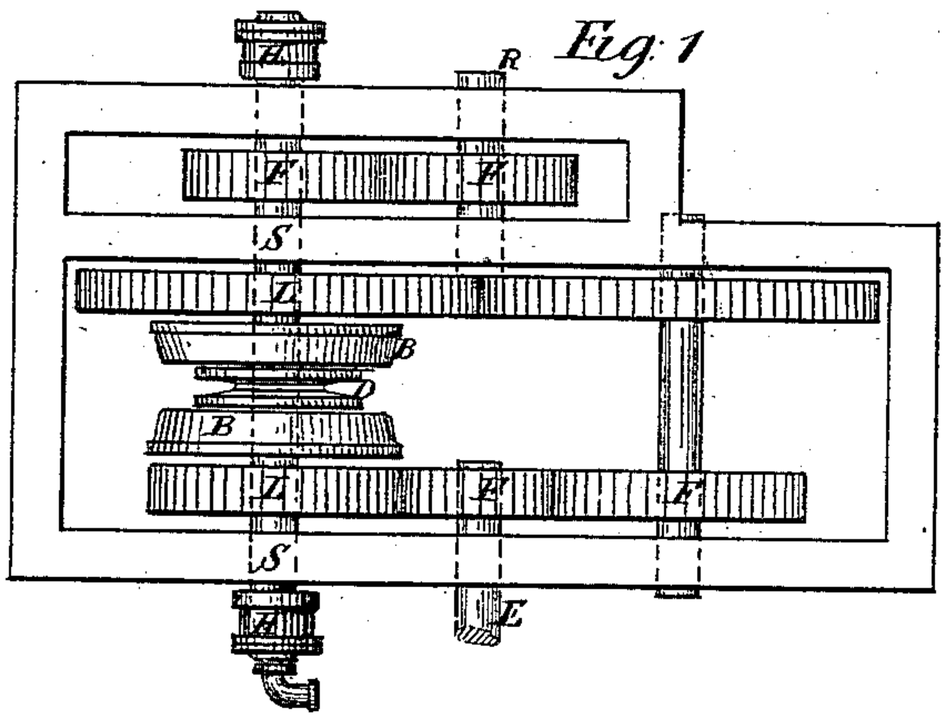


Fig: 2.

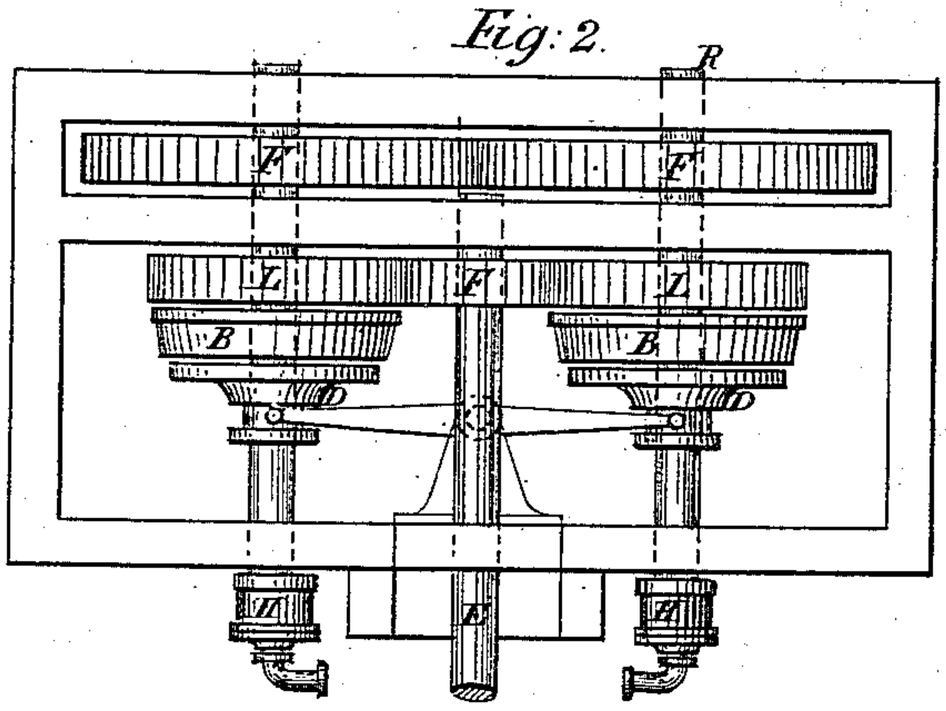
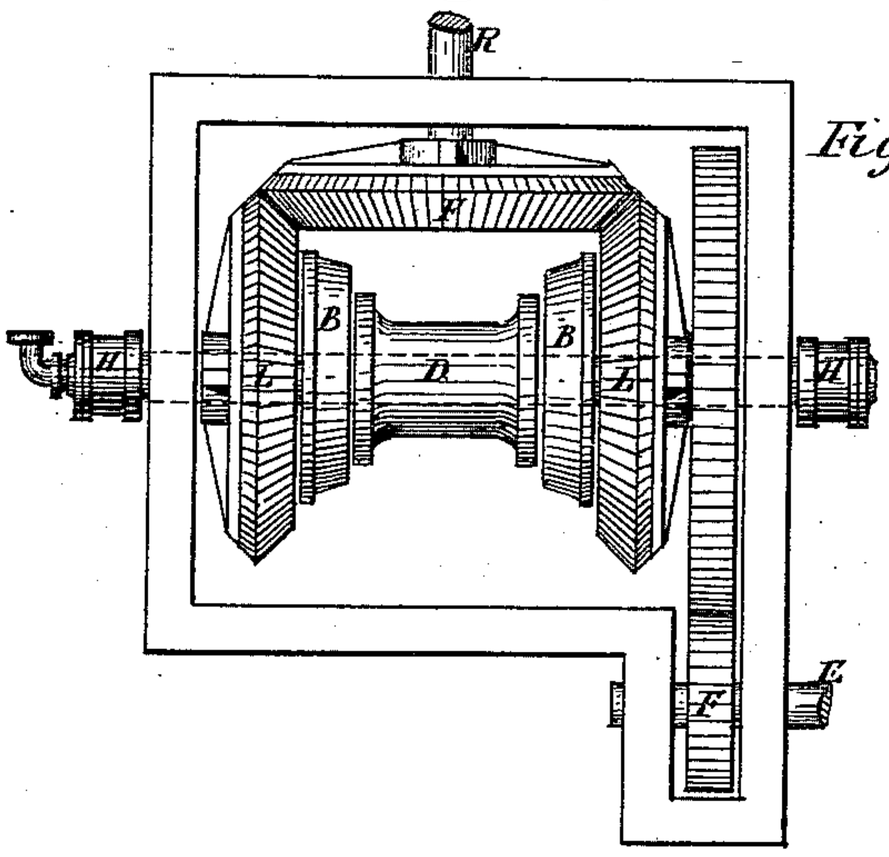


Fig: 3.



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3 Sheets—Sheet 2.

C. J. GALLOWAY & J. H. BECKWITH.

Friction-Clutch.

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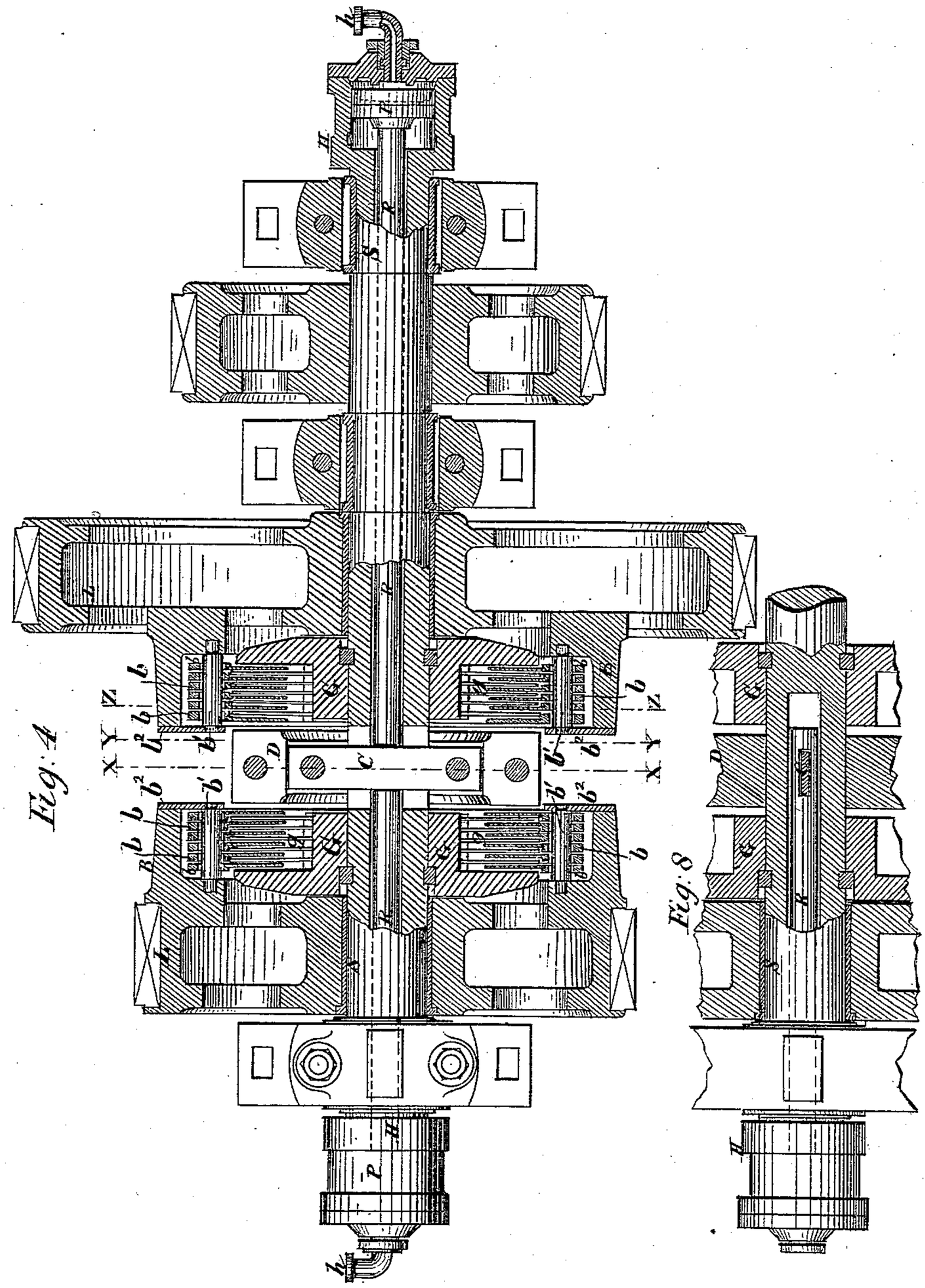

Fig. 4

Fig. 8

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C. J. GALLOWAY & J. H. BECKWITH.

Friction-Clutch.

No. 226,302. **Patented April 6, 1880.**

Fig. 1

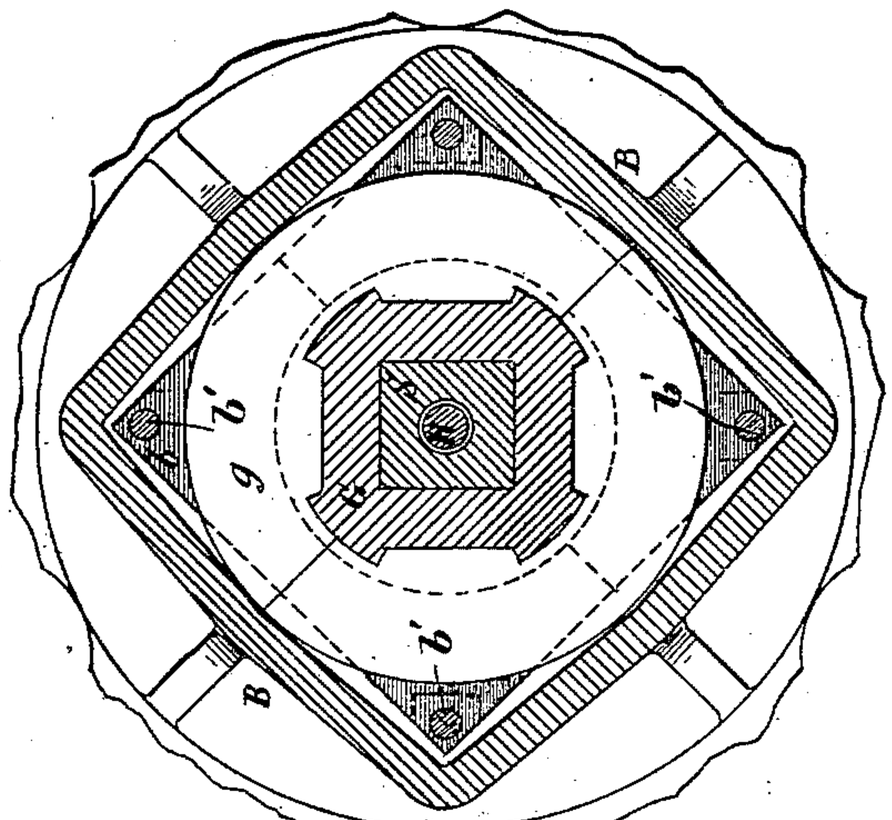


Fig. 6

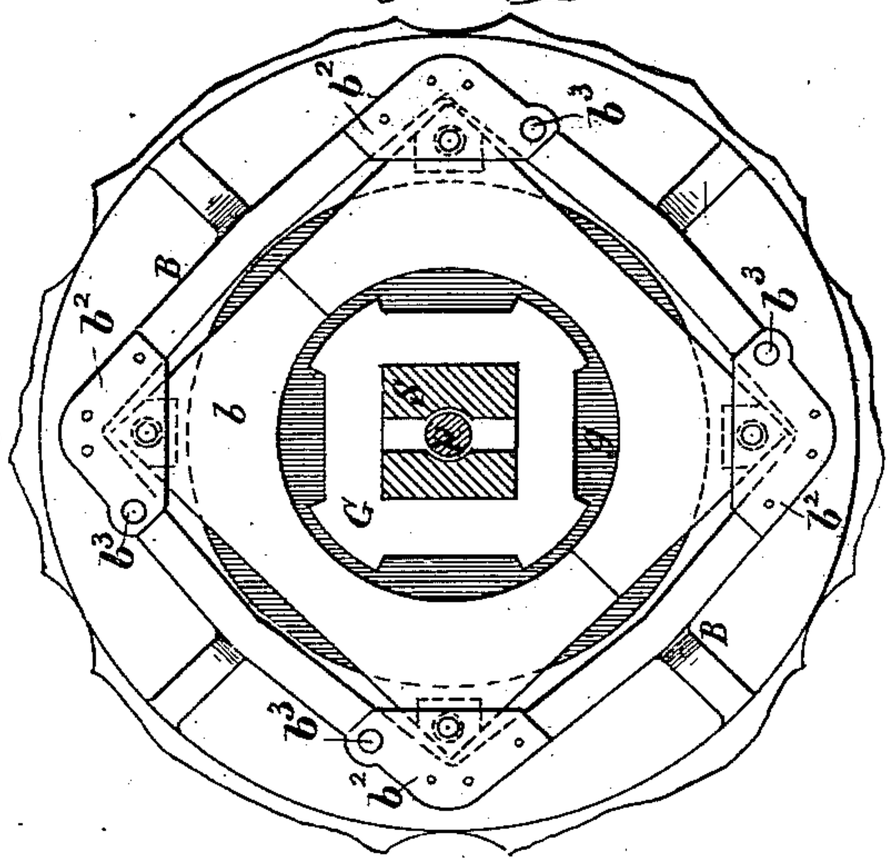
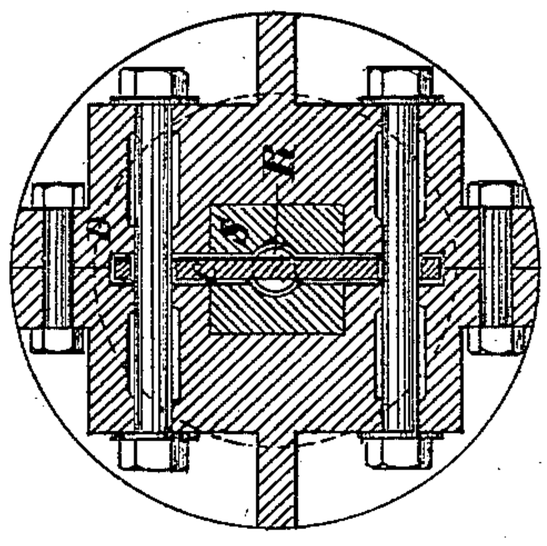


Fig. 5



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UNITED STATES PATENT OFFICE.

CHARLES J. GALLOWAY AND JOHN H. BECKWITH, OF MANCHESTER, ENGLAND.

FRICTION-CLUTCH.

SPECIFICATION forming part of Letters Patent No. 226,302, dated April 6, 1880.

Application filed January 27, 1880. Patented in England May 27, 1879.

To all whom it may concern:

Be it known that we, CHARLES JOHN GALLOWAY and JOHN HENRY BECKWITH, both of Manchester, in the county of Lancaster, England, engineers, have invented an Improvement in Friction-Clutches; and we do hereby declare that the following description, taken in connection with the accompanying sheets of drawings, hereinafter referred to, forms a full and exact specification of the same, wherein we have set forth the nature and principles of our said improvement, by which our invention may be distinguished from others of a similar class, together with such parts as we claim and desire to secure by Letters Patent—that is to say:

Our invention relates to means of working friction-clutches, such as are employed for engaging wheels with rotating shafts or disengaging them therefrom in order to effect the driving, stopping, or reversing of some parts of machinery while other parts continue to move in a uniform direction. Examples of the use of friction-clutches for this purpose are found in many rolling-mills, where it is desired to reverse the direction of rotation of the rollers while the engine or prime-moving shaft continues to rotate in one direction. In such cases various kinds of friction-clutches have been employed, and hydraulic pressure has been applied to work these; but usually the hydraulic apparatus has been situated in or at the clutches themselves in positions which are not conveniently accessible for packing or other purposes.

Now, our invention consists, mainly, in an arrangement of the clutch apparatus such that the hydraulic cylinders and pistons employed for working the clutches are situated in readily-accessible positions at the outer ends of the revolving shafts, the force being conveyed from them by the piston-rods, which are extended along central bore-holes in the shafts to the clutches, which may be in the midst of the gearing at or about the middles of the shafts.

We will explain the construction which we adopt for this purpose as applied to reversing-gear for rolling-mills.

Referring to the accompanying drawings, Figures 1, 2, and 3 show various arrangements of the gear that may be used for reversing, with our invention applied thereto. Fig. 4 is a longitudinal section, partly in plan, of a shaft, such as that marked S in Fig. 1, with its set of friction-clutches. Figs. 5, 6, and 7 are transverse sections taken, respectively, on the lines *x x*, *y y*, *z z* of Fig. 4; and Fig. 8 shows a modification of the means of working the clutches shown in Fig. 4.

Referring first to Figs. 1, 2 and 3, E indicates the engine-shaft or other prime-moving shaft, revolving always in one direction. R indicates the roller-shaft, which has to revolve in either direction. F indicates a wheel or pinion fast on its shaft, and L indicates a wheel or pinion loose on its shaft, except when it is clutched thereto. This clutching is effected by the pressure of a disk or sliding block, D, against certain plates in a clutch-box, B, as will hereinafter be described, and this pressure is communicated from the piston of a hydraulic cylinder, H, situated at the outer end of the shaft, to the disk D, which always must revolve with the shaft, but can be slid longitudinally thereon.

In the arrangements of gearing shown in Figs. 1 and 3 there is one disk, D, slid in either direction by the action of two hydraulic cylinders, H, one at each end of the shaft.

In the arrangement shown in Fig. 2 the two hydraulic cylinders H H are on separate shafts, each working a disk, D, and the two disks D are connected by a lever, so that when the one is pushed forward to engage its clutch the other is retracted. By introducing a spring to retract each disk when relieved from the hydraulic pressure the lever might be dispensed with.

Referring now to Figs. 4, 5, 6, and 7, which show to an enlarged scale the details of the clutch-gear on the shaft S of Fig. 1, D is the sliding disk, put on in halves on the shaft S, which is there of square section, as shown, or may be of polygonal section, or may be fitted with feathers, so that the disk D must turn with the shaft, but can be slid to and fro thereon. Throughout the length of the shaft is bored a central hole, in which freely work the rods R R of the pistons P P of the two

hydraulic cylinders H H, one of which is attached at each end of the shaft. The ends of the rods R R butt against a cross-head, C, which passes through a slot of the shaft S and is secured between the halves of the disk D. Each of the hydraulic cylinders H is connected, by a pipe, *h*, and suitable supply and discharge valves, with a high reservoir or accumulator and with a waste-pipe, so that either of the pistons P can be subjected to or relieved from the fluid-pressure. As the cylinders H revolve with the shaft while the pipes *h* are stationary, the latter are fitted to the cylinder-covers with trunnion or packed joints. On each side of the disk D is fixed on the shaft, against a collar or ring put on in halves, a boss, G, on which are fitted a number of plates, *g*, so that they must revolve with the boss, but are free to slide thereon longitudinally.

To each of the two loose wheels L is attached a box, B, containing a number of plates, *b*, fitted in the box so that they must revolve therewith, but can slide longitudinally therein. The plates *b* in the box in each case alternate with the plates *g* on the boss. For convenience of removing and replacing the plates *b* and *g* they are made in halves, as shown, the plates *g* fitting ribs on the boss G, and the plates *b* being thickened at their angles and sliding on pins *b'*, provided at the angles of the box B. Cover-plates b^2 are fitted on these angles, and these cover-plates may be hinged, as shown, on pins, and secured by screws. When the disk D is in an intermediate position, as shown in Fig. 4, not bearing against the plates *g* and *b* on either side, these plates are all loose, and both the wheels L are left free from the shaft S.

When water or other liquid under pressure is admitted to one of the hydraulic cylinders H while the other is relieved from pressure, then, one of the pistons P being pressed inward, its rod R pushes the cross-head C, and with it the disk D, to the one side, so as to squeeze together the plates *g* and *b* of the one boss and box. The friction thus produced effects the clutching to the shaft of the one wheel L, while the other wheel is left loose.

It is convenient to arrange the supply and discharge valves of the two hydraulic cylinders in connection with one another, so that when the supply to the one is opened the discharge from the other is opened at the same time.

In cases where it is inconvenient to fix a hydraulic cylinder at both ends of a shaft one double-acting cylinder may be fixed at one end, its rod being made to pull and push the disk D by passing the cross-head C through a slot in the rod, as shown in the sectional plan, Fig. 8, of a part of a shaft so arranged.

Having thus described the nature of our invention and the best means we know of carrying it out in practice, we claim—

1. In a reversing-clutch mechanism, a revolving horizontal shaft having a longitudinal central bore and carrying a loose wheel constructed with a friction-box in one of its sides, a hydraulic cylinder fixed to and revolving with one end of said shaft, and provided with a fixed pipe for supplying and discharging the fluid-pressure, a piston within said cylinder, a rod arranged within the central bore of the revolving shaft and attached to the piston, a cross-head centrally connected with the said rod and extending through transverse longitudinal slots in the shaft in which the cross-head slides, and an annular disk connected to the cross-head, and to which a longitudinal sliding motion is imparted by the action of the piston-rod and cross-head, substantially as described.

2. The combination of a revolving main shaft carrying two loose wheels having their adjacent sides provided with friction-boxes and provided with a central bore extending entirely through the same, two hydraulic cylinders attached, respectively, to the opposite ends of the shaft and revolving therewith, a piston arranged in each of the cylinders, a rod connected with the pistons and extending through the central bore of the shaft, a cross-head centrally connected with the rod and capable of a sliding motion in a transverse slot in the shaft intermediate the two loose wheels, and a friction-disk attached to the cross-head, and to which a longitudinally-sliding motion is imparted by the piston-rod and cross-head, substantially as described.

In testimony whereof we have signed our names to this specification, in the presence of two subscribing witnesses, this 11th day of November, A. D. 1879.

CHARLES JOHN GALLOWAY.
JOHN HENRY BECKWITH.

Witnesses:
JNO. B. PAYNE,
HENRY GALLOWAY,
Solicitors, Manchester.