(No Model.) 2 Sheets—Sheet 1.

B. J. ARNOLD.

MAGNETIC CLUTCH AND POWER STATION SYSTEM.

No. 600,941. Patented Mar. 22, 1898.

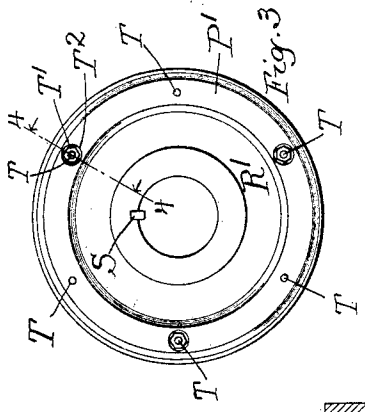

Fig. 3.

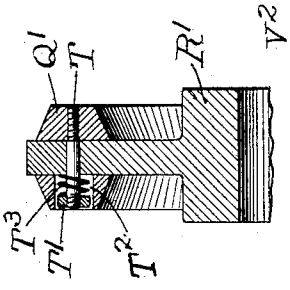

Fig. 4.

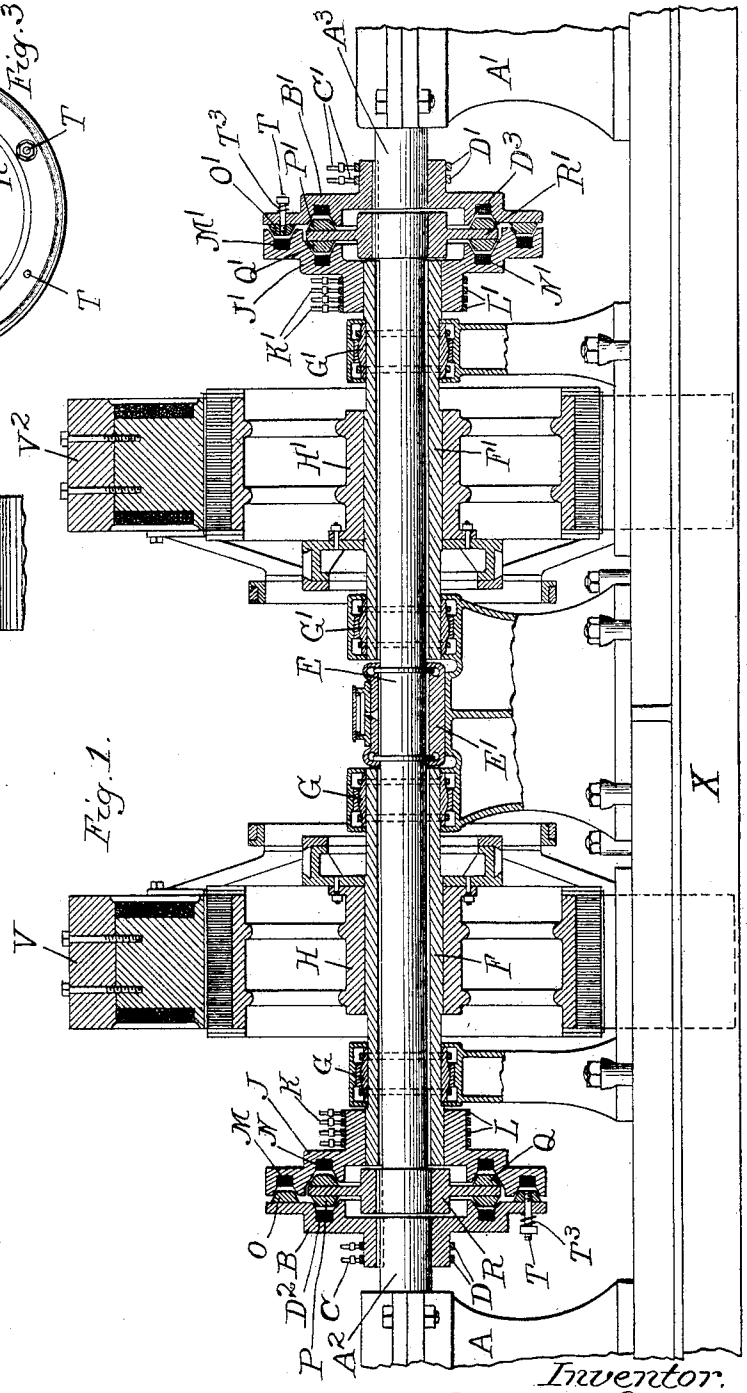

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 6.

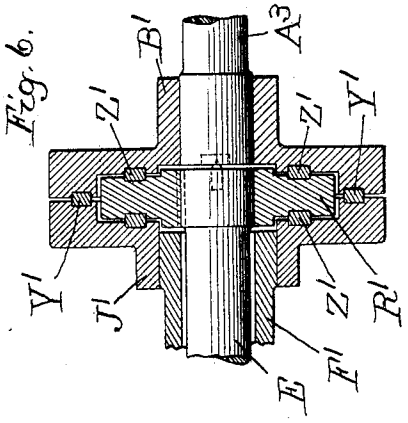


Fig. 5.

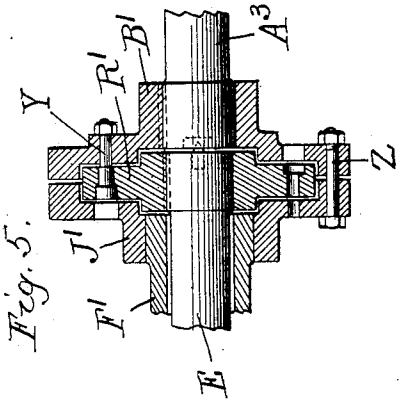
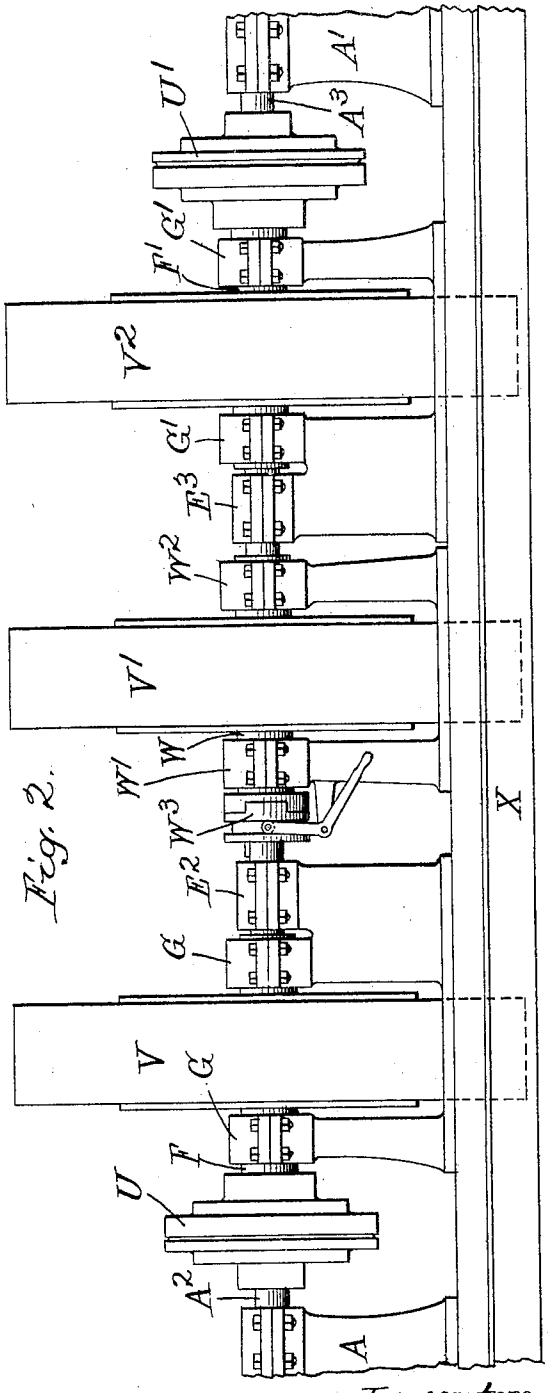


Fig. 2.



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UNITED STATES PATENT OFFICE.

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MAGNETIC-CLUTCH AND POWER-STATION SYSTEM.

SPECIFICATION forming part of Letters Patent No. 600,941, dated March 22, 1898.

Application filed June 20, 1896. Serial No. 596,290. (No model.)

To all whom it may concern:

Be it known that I, BION J. ARNOLD, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Magnetic-Clutch and Power-Station Systems, of which the following is a specification.

My invention relates to power systems or devices for transmitting power in power plants and to the particular clutch mechanisms whereby the several shaft portions are properly connected.

It would be well nigh impossible for me in a single patent to show all the different applications of my invention, as the construction and erection of such power plants vary greatly with the conditions under which they are set up and used. I have therefore simply undertaken to show one or two constructions and arrangements wherein my invention is employed and wish to use these merely as illustrative of such invention. In the drawings this particular application has been shown.

Figure 1 is a longitudinal section through a power plant containing two dynamo-electric machines and two driving-shafts. Fig. 2 is a side elevation of a somewhat similar arrangement in which three dynamo-electric machines are employed. Fig. 3 is an enlarged side view of the clutch-body on the intermediate shaft. Fig. 4 is a cross-section on line 4 4 of Fig. 3. Figs. 5 and 6 are detail cross-sections of modified forms of the clutch.

Like parts are indicated by the same letters in all the figures.

A A′ are bearings for the short driving-shafts A^2 A^3. I do not deem it necessary to show more with regard to these driving-shafts. They may be of any length, size, or shape and driven in any desired manner or by any kind of power and may be connected so as to do other work than that with which I am concerned in this description. It is enough for my present purposes that these two parts A^2 A^3 indicate the extremities of driving-shafts. Each of these carries the clutch-body portions B B′, with suitable brushes C C′, bearing on the rings D D′, whereby current may be introduced to the magnets D^2 D^3 on such clutch-body when the same is a magnetic clutch.

E is an intermediate shaft, which in this instance is placed so that the axes of the three shafts coincide. The intermediate shaft has its bearing at E′, and it is normally idle—that is to say, it is idle in the first instance, as will be hereinafter explained. The dynamo-electric machines are each driven and can be kept in continuous operation without the aid of the intermediate shaft so long as they are driven each from its own associated driving-shaft, and hence the intermediate shaft is spoken of as normally idle or at rest.

F F′ are hollow shafts which encircle each a portion of the intermediate shaft E, and which preferably have their independent bearings G G′. On each of these hollow shafts is a power-transmitter H H′, which in this case is the rotating armature of a dynamo-electric machine. This is the application of my invention which I have at present particularly in mind, though it is evident that various features of my invention are entirely applicable in a case where some other power-transmitter—as, for instance, a pulley and belt or gear-wheel for driving any kind of machinery—should be employed. The best example of my invention, however, is that in which, as in the device illustrated in Fig. 1, I obtain the advantages without the disadvantages of both the direct-connection system for dynamos and for dynamo-electric machines and the system wherein such machines are belt connected with a common driving-shaft. On each of these hollow shafts is placed a clutch-body portion J J′, with its brushes K K′ bearing on the rings L L′ when the same is organized as a magnetic clutch. These bodies J J′ also contain the magnets M M′ and N N′. Opposed to each of these several magnets are rings O O′, P P′, and Q Q′. These rings are preferably V-shaped in cross-section. R R′ are the clutch-bodies carrying the rings Q Q′ and P P′ and keyed to the intermediate shaft by the key S, so as to rotate therewith. These rings are held to the body by means of the bolts T, which pass through the body portion R′ and are screw-threaded into the ring on one side of that body and provided with a projecting head T′, which moves in a cavity

T^2 in the ring on the opposite side of the body. A spiral spring T^3 encircles the bolt between the head T′ and the body R′ and thus tends elastically to hold the ring against the body. Each ring is preferably secured in this manner to, say, three of such bolts, so that it is free to move to or from the body, though normally held against it, and so that it will rotate with the body. A like method of securing the rings O O′ is employed as indicated in Fig. 1 at the right-hand side, though in this case the head and spring are outside the body portion B.

Turning now to Fig. 2, the driving-connection devices or clutches are not shown in detail. They are indicated by the letter U. The dynamo-electric machines are not shown in detail, but are indicated by the letters V V′ V^2. The intermediate shaft is here provided with two bearings E^2 E^3, and a third hollow shaft W is introduced supported on the bearings W′ W^2 and provided with a different clutch—as, for example, the mechanical clutch W^3. All these parts are of course suitably mounted on a proper bed, plate, or base X, which may be of iron, stone, concrete, or other suitable material, so as to maintain them in proper relation. In lieu of the magnetic clutch which I have shown the mechanical clutch W^3 could be used to throw the central dynamo-electric machine in or out of operative connection with the intermediate shaft. As a substitute for the other clutches N N′, I might employ either the clutch of Fig. 5 or the clutch of Fig. 6. In the clutch of Fig. 5 the three clutch-bodies are connected, as occasion may require, by either or both of the bolts Y Z, so as to get the same result as has been previously set forth. In the device of Fig. 6 the same result is reached by the use of some or all of the keys Y′ Z′. In Fig. 5, when it is desired to operatively connect the part R′ with the part B′, the bolt Y is placed in position. When it is desired to connect the part B′ with the part J′, the bolt Z is placed in position, as shown, and when it is desired to connect both of said parts together the two bolts will be placed in position. When it is desired to connect the part J′ with the part R′, a bolt similar to the bolt Y will be placed in the similar opening shown below the shaft E. In Fig. 6 these several connections instead of being made by bolts are made by means of the keys Z′. These devices of Figs. 5 and 6 are the mechanical means by which a result similar to that obtained by the use of the magnetic clutches may be reached. As previously pointed out, I do not wish to be limited here to specific mechanism or to the precise form and arrangement of the several parts or to the use of the exact number of the several parts which I have illustrated.

The use and operation of my invention are as follows: Assuming, for example, two machines, preferably dynamo-electric, having each its rotating part mounted upon the hollow shaft, we will have the following operation: This rotary shaft preferably has its independent bearings, and within it lies or rotates the intermediate shaft, having its independent bearing. At one side is mounted the driving-shaft, which, by means of the clutch mechanism or the driving-connection device, can be operatively connected with the hollow shaft by means of the magnet M and ring O. Thus the driving-shaft A^2 drives the rotating part of the dynamo-electric machine. I do not show the circuits of any of these parts, as that is a matter well understood by electricians and can be varied at will. If now, for some reason, it becomes desirable for the driving-shaft A^2 to be made to drive the dynamo-electric machine V^2, the machine V being at rest, the magnet M is caused to release the ring O, whereupon the springs T^3 restore the ring to its normal position and disengage the two parts of the clutch. Current is now supplied to the magnet D^2 and an operative connection made between the two clutch-bodies R and B, whereupon the shaft A^2 drives the intermediate shaft E, while the hollow shaft F is at rest. Turning to the right-hand clutch, the magnet N′ is energized so as to effect operative connection between the two clutch-bodies R′ and J′, whereupon the hollow shaft F′ is set in motion and the rotating part of the dynamo-electric machine V^2 is set in operation. Thus the shaft A^2 operates the right-hand dynamo-electric machine. If now we wish to operate two machines from the one driving-shaft, the magnet M may be again energized to make operative connection between the clutch-bodies J and B as well as between the clutch-bodies R and B. Thus both dynamos are operated from the same shaft. The parts all being in this case duplicates of each other, it is plain that in like manner either or both of the machines may be driven from the right-hand shaft. Now in the construction shown in Fig. 2, or, in other words, where there are series of dynamo-electric machines, the intermediate shaft may have one or more of these coupled to it, and this may be done either by mechanical or magnetic clutches, as indicated. In other words, there may be a series of hollow shafts; but of course there might be more than one rotating part of a dynamo-electric machine on either or all of such hollow shafts. When the magnet M is energized, the ring O is attracted, so as to be brought in contact with the part J. Since this ring O is connected to the part B by means of the longitudinally-movable bolts T, it will be seen that the ring will move away from the part B, thereby making contact with the part J without bringing either of the parts B or J into contact with the ring on the part R. When this magnet is energized, the driving-shaft A^2 drives the rotating part of the dynamo-electric machine. When the magnet M is deënergized, the springs T^3, surrounding the bolts

T, move the ring O back in contact with the part B, thereby disconnecting the shaft A^2 from the intermediate shaft E.

I claim—

1. The combination of a driving-shaft with two power-transmitting shafts, said power-transmitting shafts located at one end of said driving-shaft one surrounding the other, power-transmitters adapted to be operatively connected one with each of said power-transmitting shafts, and a driving-connection device associated with each of said shafts whereby either of said power-transmitting shafts may be separately and independently connected with the driving-shaft.

2. The combination of a driving-shaft with two power-transmitting shafts one hollow and encircling the other, power-transmitters adapted to be operatively connected one with each of said transmitting-shafts, and a driving-connection device adapted to operatively connect the driving-shaft with either or both of the power-transmitting shafts.

3. The combination of a driving-shaft with two power-transmitting shafts, one hollow and encircling the other, a power-transmitter normally operatively connected with the hollow shaft, and a driving-connection device adapted to operatively connect the hollow shaft with either of the other two shafts.

4. The combination of a driving-shaft with two power-transmitting shafts, both adapted to be operatively connected to a power-transmitter one hollow and encircling the other, a dynamo-electric machine, its movable part operatively connected with the hollow shaft, and a driving-connection device adapted to connect the hollow shaft with either of the other two.

5. The combination of two driving-shafts with an intermediate shaft and two hollow shafts, having separate bearings and encircling each a portion of the intermediate shaft, a driving-connection device located at one end of each of said driving-shafts and adapted to operatively connect each driving-shaft with the adjacent hollow shaft and also with the intermediate shaft whereby either or both of the driving-shafts may be operatively connected with the intermediate shaft.

6. The combination of two driving-shafts with an intermediate normally idle shaft, and two hollow shafts having separate bearings and encircling each a portion of the normally idle shaft, driving-connection devices located at one end of each of said driving-shafts so that either or both of the driving-shafts may be operatively connected with the normally idle shaft, and a driving-connection device located at the ends of said hollow shafts and adapted to connect each hollow shaft with its associated driving-shaft.

7. The combination of two driving-shafts with an intermediate normally idle shaft, and two hollow shafts having separate bearings and encircling each a portion of the normally idle shaft, a driving-connection device located at one end of each of said driving-shafts, whereby either or both the driving-shafts may be operatively connected with the normally idle shaft, a driving-connection device located at the end of each hollow shaft and adapted to connect each hollow shaft with the associated driving-shaft, and a driving-connection device on said normally idle shaft intermediate between the driving-connection device on the driving-shaft and each hollow shaft whereby either hollow shaft may be operatively connected with the normally idle shaft.

8. The combination of two driving-shafts with an intermediate-shaft portion, power-connection devices located at or near the ends of said driving-shafts and said intermediate-shaft portion, whereby the intermediate-shaft portion may be connected to either or both of said driving-shafts, a series of hollow shafts encircling the intermediate-shaft portion and carrying each a power-transmitter, said hollow shafts each carrying a driving-connection device at its end thereof, opposed to the driving-connection device on the associated driving-shaft and on the intermediate-shaft portion so that each hollow shaft may be connected with its associated driving-shaft or with the intermediate shaft.

9. The combination of two driving-shafts with an intermediate normally idle shaft, hollow shafts, having separate bearings, encircling each a portion of the intermediate shaft, and a driving-connection device associated with the three shafts and provided with controllable interlocking parts connected with the respective shafts and constructed so that each driving-shaft can be connected with its associated hollow shaft or its associated end of the intermediate shaft when the interlocking parts of the connection device are brought into engagement.

10. The combination of a driving-shaft with a second shaft, a hollow shaft encircling the same, the three ends of the shafts provided each with a portion of a driving-connection device so that any two of them or all three of them may be operatively connected.

11. The combination of a driving-shaft with a second shaft, a hollow shaft encircling the same, the three ends of the shafts provided each with a portion of a driving-connection device so that any two of them or all three of them may be operatively connected, and power-transmitting devices connected one with the hollow shaft and one with the second shaft.

12. In a clutch device for operatively connecting the adjacent ends of shafts in a power system, the combination of opposed clutch-bodies, one having a ring adapted to move to or from but to rotate with the body, the other having a magnet to draw and clamp the ring.

13. In a clutch device for operatively connecting the adjacent ends of shafts in a power

system, the combination of opposed clutch-bodies, one having a ring adapted to move to or from but to rotate with the body, the other having a magnet to draw and clamp the ring, said ring somewhat V-shaped in cross-section, and the opposed clutch-body provided with a correspondingly-shaped annular groove to receive the ring.

14. In a clutch device for connecting the adjacent ends of three shafts in a power system, the combination of a clutch-body portion connected with each shaft with rings and magnets associated with said bodies, the rings adapted to rotate with and to move to or from their respective bodies, and the magnets connected in opposition to the rings on one of the other bodies.

15. In a clutch device for connecting the adjacent ends of shafts in a power system, the combination of clutch-body portions one on each shaft with rings V-shaped in cross-section, and opposed annular grooves of like shape, magnets in the bottom of such groove and means whereby the rings are held so as to rotate with but move to or from their respective clutch-bodies.

16. In a power system the combination of three shafts, one hollow, the three ends adjacent to each other, with a clutch-body portion on each shaft, and a series of clutch connections whereby either clutch-body can be operatively connected with either or both of the others.

17. In a power system the combination of three shafts, one hollow, the three ends adjacent to each other, with a clutch-body portion on each shaft, and a series of clutch connections whereby either clutch-body can be operatively connected with either or both of the others, such clutch connections consisting of magnets and opposed rings, the latter connected so as to move to or from but to rotate with their respective clutch-body portions.

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