

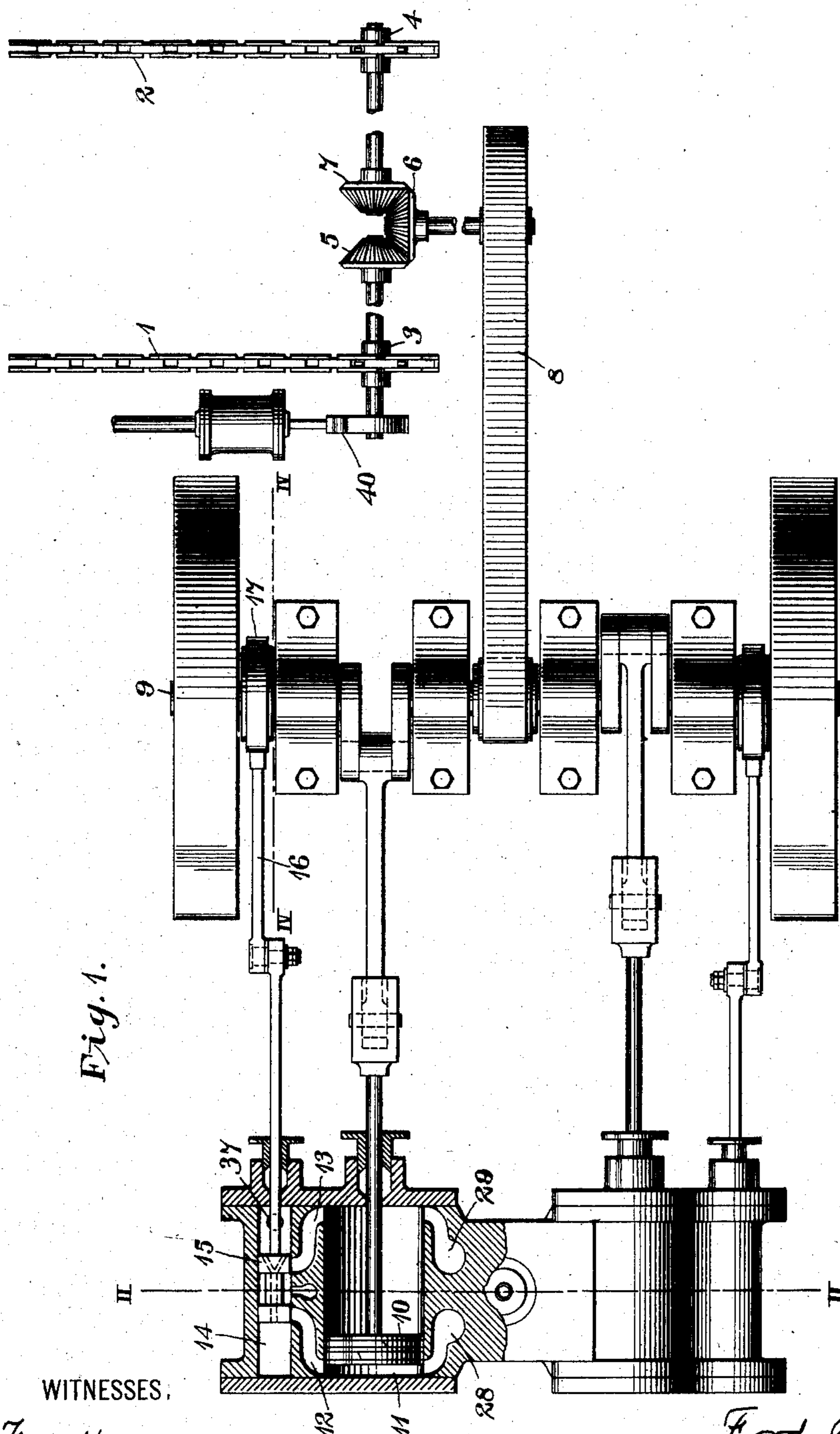
No. 865,303.

F. W. HARRIS.
MINE HAUL.

PATENTED SEPT. 3, 1907.

APPLICATION FILED FEB. 19, 1906.

2 SHEETS—SHEET 1.



WITNESSES.

Fred H. Miller
Birney Hines

INVENTOR
Ford H. Harris
BY
Otto S. Schairer
ATTORNEY

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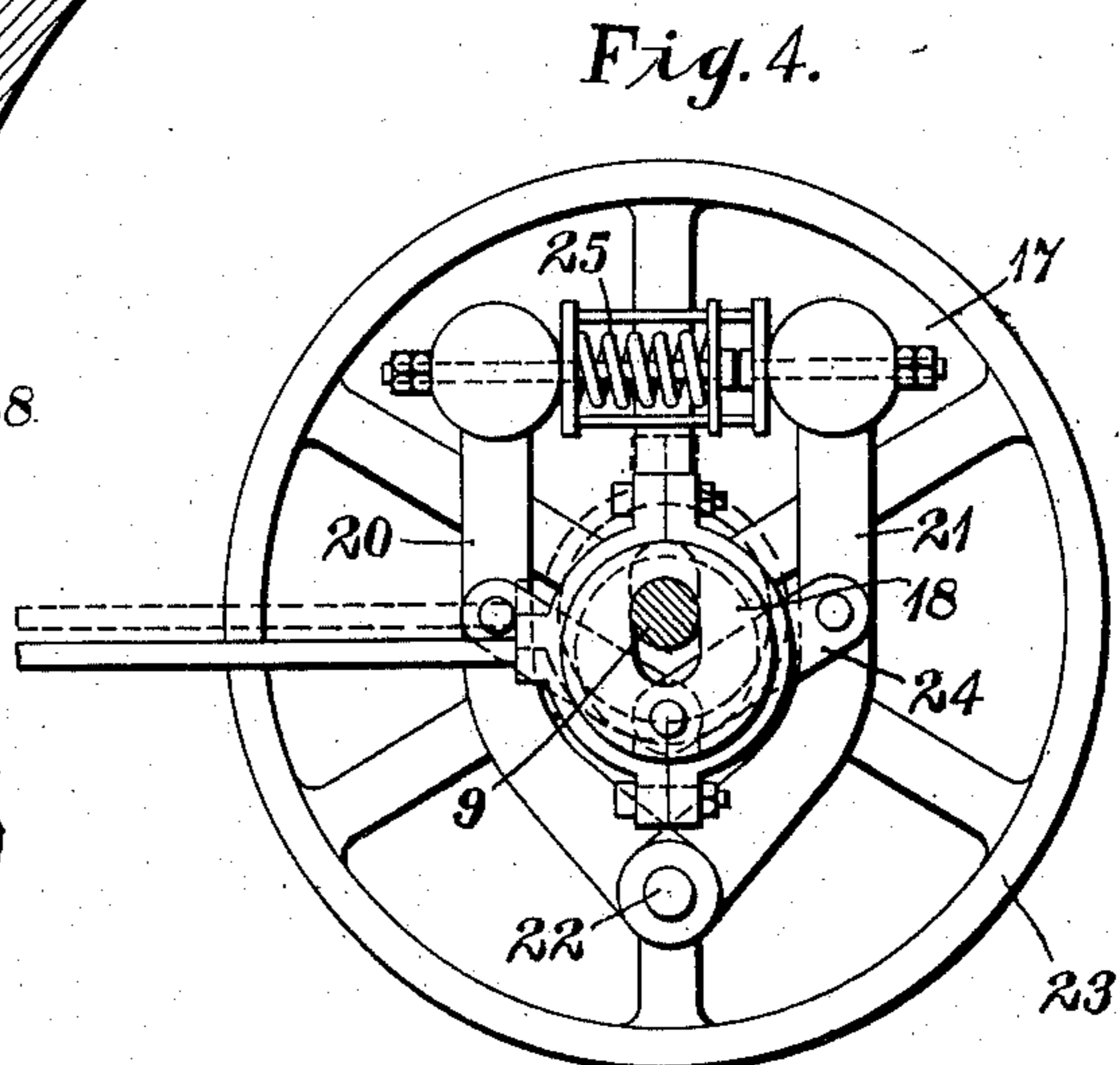
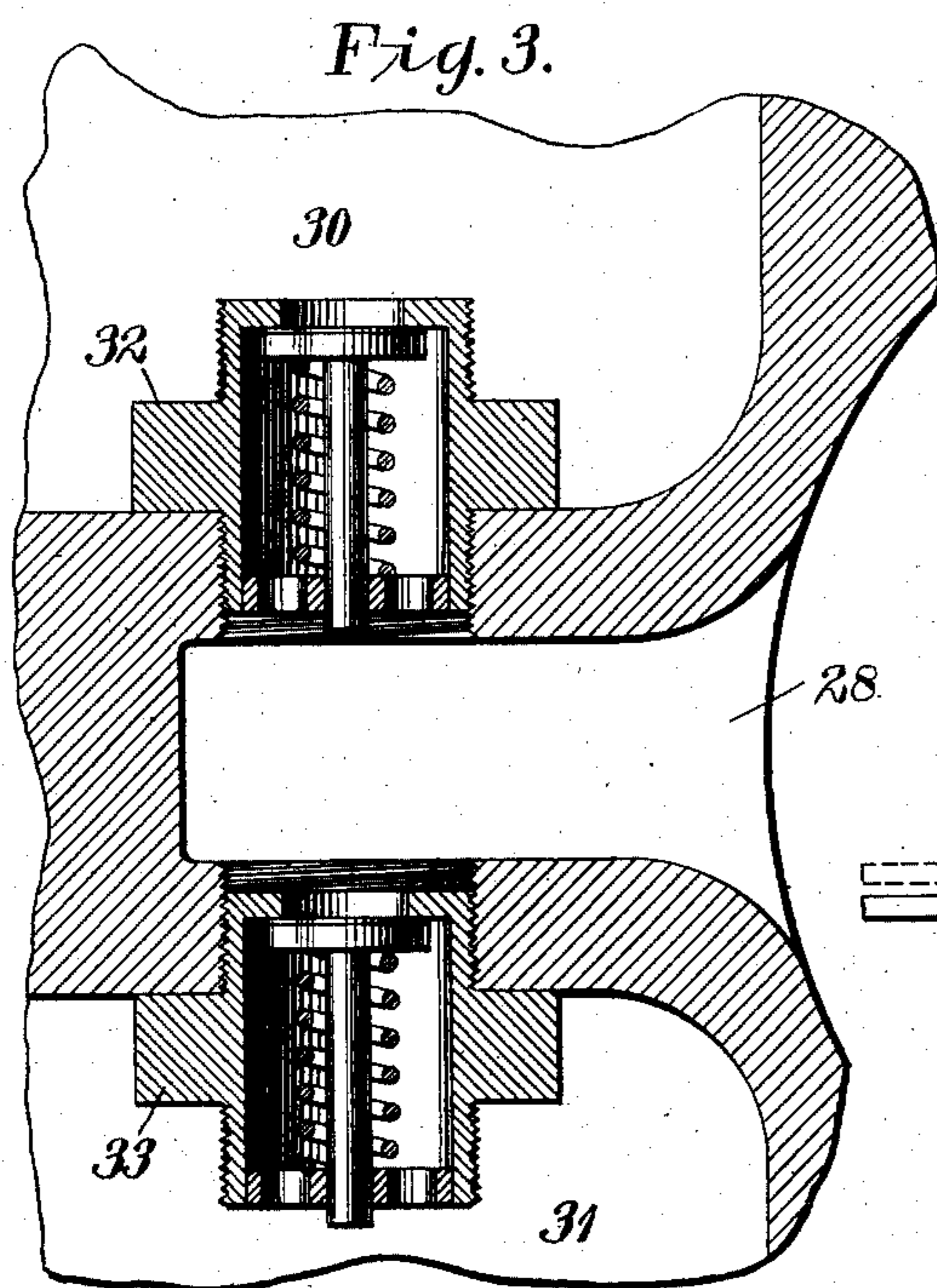
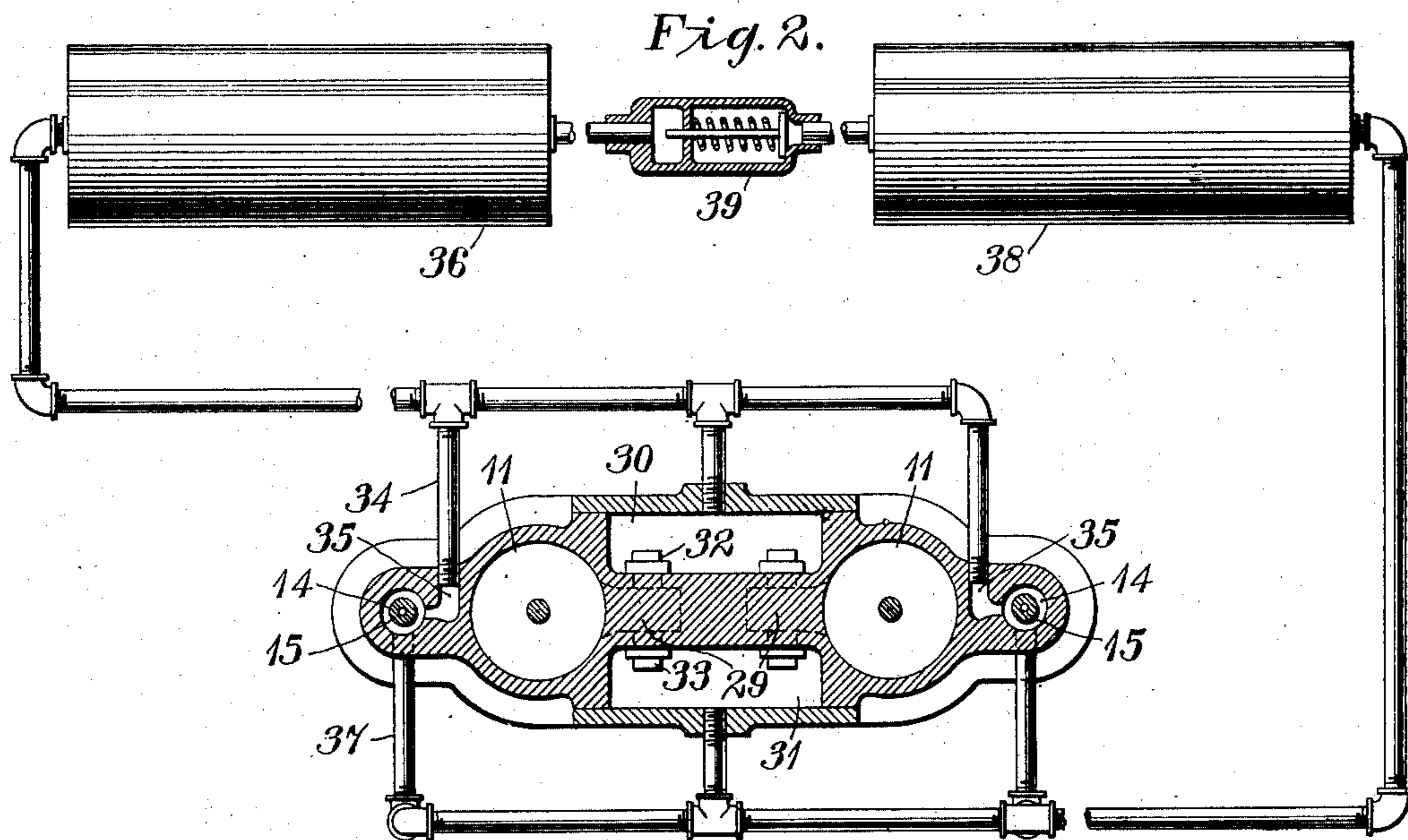
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UNITED STATES PATENT OFFICE.

FORD W. HARRIS, OF WILKINSBURG, PENNSYLVANIA.

MINE-HAUL.

No. 865,303.

Specification of Letters Patent.

Patented Sept. 3, 1907.

Application filed February 19, 1906. Serial No. 301,956.

To all whom it may concern:

Be it known that I, FORD W. HARRIS, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have
5 invented a new and useful Improvement in Mine-Hauls, of which the following is a specification.

My invention relates to mine hauls and other similarly operated means that are capable of either yielding or receiving power.

10 The object of my invention is to provide means for receiving and storing the excess of energy exerted by a mine haul when it is operated by loaded cars, and for utilizing the stored energy to effect operation of the haul when insufficient loaded cars are available
15 for the purpose.

A further object is to automatically adapt the said means to either receive or yield power according as the mine haul yields or receives power; *i. e.*, according to the speed of operation thereof.

20 In many sections of the country the entrances to coal and other mines occur in hill-sides, and the mineral is brought to the surface in small cars that are lowered to tipples in the valleys where it is screened or sorted and loaded into other cars for further transportation. Several means have heretofore been provided whereby the loaded cars in going down to the
25 tipples may be caused to haul the empty cars up from the tipples to the entrances to the mines, and a means whereby the power furnished by the lowering of the loaded cars in excess of that necessary to raise the empty cars may be conveniently disposed of forms the subject-matter of a Patent No. 764,633, granted jointly to Louis J. Robb and myself. In the present application I propose to utilize the excess of power
30 advantageously.

As heretofore arranged when all of the loaded cars have been lowered to the tipple at night it is impossible to haul them back to the entrance when empty until morning, when more loaded cars may be lowered
40 to actuate the haul. As it is quite desirable to clear the tipple and the haul at night of empty cars and to have them ready for use in the mine in the morning, I propose to store the excess of power during the day, or at least a part of it, and to utilize it in the evening
45 to haul the empty cars up to the mine entrance, or to utilize it at any other time for operating the haul when loaded cars are not available.

In the specific embodiment of my invention the excess of power is employed to operate an especially
50 constructed fluid compressing device that may also be utilized as a prime mover for the haul when supplied with the compressed fluid from a storage reservoir. I also so arrange the system that the device may be converted automatically from a compressor
55 into a prime mover, or vice versa according as there may be an excess of power or not.

Figure 1 of the accompanying drawings is a plan view of a system and a device embodying my invention, a portion of the structure being broken away for the sake of clearness of illustration. Fig. 2 is a view
60 in cross-section on the line II—II of Fig. 1 and of the connections of the device to suitable means for storing energy. Fig. 3 is an enlarged view in cross-section of a portion of the structure shown in Fig. 2 and Fig. 4 is a view, in elevation and in section, on the line IV—IV
65 of Fig. 1.

One form of mine haul to which my invention may be conveniently applied, comprises two endless chains 1 and 2 that may pass over sprocket wheels 3 and 4, respectively, at the entrance to a mine and that are
70 adapted, respectively, to lower loaded cars from the mine entrance to the tipple below and to raise empty cars from the tipple to the mine entrance. The sprocket wheels 3 and 4 may be operatively connected by means of suitable shafting and a set of bevel gears
75 5, 6 and 7 so that the power exerted by the loaded cars upon the chain 1 in passing down the haul may serve to operate the sprocket 4 and the chain 2 to draw the empty cars up the haul. The gear 6 may be operatively connected by any suitable means, such as a
80 belt 8 to a crank shaft 9 of a device that is adapted either to convert energy into a form which may be conveniently stored or to utilize the stored energy in operating as a prime mover for the haul.

The crank shaft 9 is connected in different angular
85 relations to pistons 10, that operate in cylinders 11, the latter communicating by means of inlet ports 12 and 13 with a valve chest 14 in a manner in all respects similar to that in which the cylinders and valve chests of ordinary steam engines communicate. A valve 15 is con-
90 nected in operative relation to the crank shaft 9 in the usual manner by means of a connecting rod 16 and a governor 17, (Fig. 4) which, in the present instance, is somewhat differently constructed from those which are employed in most steam engines. Many forms of
95 governors suitable to the specific use may be devised, though the one which I have found convenient to employ, comprises a slotted eccentric 18, that is mounted upon an extension of the crank shaft 9, and a pair of weighted levers 20 and 21, one end of each of which is
100 pivotally secured at 22 to a fly wheel 23 and to the eccentric 18 by means of links 24, the outer free ends being normally retained in the position shown by means of a spring 25. Thus when the speed of rotation of the crank shaft is less than a predetermined limit, as will
105 occur when the device operates as a prime mover for the haul, the eccentric operates to give a reciprocating motion to the valve 15 in the manner in which such operations occur in ordinary steam engines. However, when the loaded cars are operating the haul, the excess
110 of power developed may be sufficient to cause the crank shaft to rotate at a speed greater than the afore-

said predetermined limit, whereupon the outer, free ends of the weighted levers 20 and 21 will be moved away from each other by centrifugal force against the resiliency of the spring 25, and the eccentric 18 will be moved to the position indicated in dotted lines, or to an intermediate position depending upon the speed of the crank shaft. The eccentric thereupon becomes concentric or approaches concentricity with the crank shaft so that reciprocating motion of the valve 15 is precluded or reduced. The parts are so adjusted with reference to each other, that, when the eccentric occupies the position shown in dotted lines both of the inlet ports 12 and 13 to the cylinder 11 will be closed by the valve. The device differs further from an ordinary steam engine in that passages 28 and 29 that communicate with the cylinders 11 are provided at opposite ends thereof, each of the passages being separated from chambers 30 and 31 by means of pressure actuated valves 32 and 33, respectively. The valves 32 are arranged to admit passage of fluid from the chamber 30 to the cylinder 11 when the pressure within the cylinder 11 falls below that within the chamber 30, and the valves 33 are so constructed that they will admit the passage of fluid from the cylinder 11 to the chamber 31 only when the pressure within the cylinder 11 exceeds that within the chamber 31, as will be understood from an inspection of Fig. 3. The chamber 30 is connected by means of piping 34 or other suitable means with exhaust ports 35 from the valve chests 14 and also with a low pressure storage reservoir 36, and the chamber 31 communicates by means of piping 37 with the valve chests 14 and with a high pressure storage reservoir 38. The two storage reservoirs 36 and 38 may be connected by means of a suitable pressure actuated valve 39 which operates to admit of passage of fluid from the high pressure reservoir 38 to the low pressure reservoir 36 when the pressure in the reservoir 38 exceeds a predetermined limit. When thus arranged the air or other fluid may be used over and over again and all difficulties that may be occasioned by reason of moisture condensations will be obviated, though, if desired, the low pressure storage reservoir may be omitted and the low pressure chamber 30 may communicate directly with the atmosphere.

From what has been shown and described, it will be readily understood that when the power exerted by the loaded cars in passing down the haul is in excess of that required to draw the empty cars up the haul, the crank shaft 9 will be rotated at such a speed that the eccentric 18 will be moved to the position shown in dotted lines in Fig. 4 or to some intermediate position and the reciprocating motion that is imparted to the valve 15 will vary in proportion to the speed of the crank shaft; that is, to the excess of power. The device may then operate through a part or all of its stroke, as an air compressor as will be understood presently. If the piston 10 is moved from the position shown, to the right, the fluid in the right-hand end of the chamber will be compressed and forced into the passage 29 against the valve 33 which opens when the pressure exceeds a predetermined limit and admits the compressed air to the chamber 31 and the storage reservoir 38. At the same time, the pressure of the air in the left-hand end of the cylinder is reduced and when a predetermined difference of pressure exists between the fluid in the pas-

sage 28 and that in the chamber 30, the valve 32 will open and permit the entrance of the fluid at low pressure from the reservoir 36. When the piston 10 is moved from the right-hand end of the cylinder to the left-hand end, the valve 32, that communicates with the passage 28, opens when the pressure exceeds the predetermined limit and the valve 32 at the other end of the cylinder opens and admits air at low pressure into the passage 29.

If the power exerted by the loaded cars in passing down the haul is not in excess of that required to draw the empty cars up the haul, as may occur, for instance, in the evening, when all of the loaded cars have been lowered to the tippie, the speed of the crank shaft 9 will fall and the eccentric 18 will approach or occupy the position shown in full lines in Fig. 4. A larger amount of reciprocating motion will then be imparted to the valve 15, and fluid at high pressure, will be supplied from the reservoir 38 and the chamber 31 through the piping 37 to the valve chest 14 the device then being operated like an ordinary steam engine as a prime mover for the haul. Thus it is seen from the description and the drawings that when there is an excess of power supplied by the mine haul, the device operates to store the energy in a form which may be readily utilized, and that when the mine haul is no longer operated automatically by the loaded cars it may be operated at least for a period sufficient to enable clearing the tippie of empty cars, by supplying the stored energy to the device in order to cause it to operate as a prime mover. It is further seen that the change in the character of the device is caused to occur automatically, according to the speed of operation of the haul, and that it may therefore serve to keep the haul in continuous operation between definite speed limits. The compressed air may also be utilized, if desired, in the ventilation of the mine, or for applying a brake such as that shown at 40, or in any other manner.

It will be readily understood that the invention may be applied to other devices than mine hauls, the term "automatically" as here applied to the manner in which such devices operate being intended to signify all such as may be operated by gravity, inertia or similar means.

Obviously the structural details and arrangements of the parts and the manner in which the device is applied may be modified within considerable limits without altering the mode of operation of the invention or departing materially from its spirit and I desire that all such modifications be included within its scope.

I claim as my invention:

1. The combination with a haul comprising means whereby the lowering of loaded cars is caused to raise empty cars, of means for storing the excess of energy exerted by the lowering of the loaded cars over that required to raise the empty cars, and for utilizing the stored energy to operate the haul when it is not operated by the loaded cars.

2. The combination with a haul comprising means whereby the lowering of loaded cars is caused to raise empty cars, of means for storing the excess of energy exerted by the lowering of the loaded cars over that required to raise the empty cars, and for utilizing the stored energy to operate the haul when it is not operated by the loaded cars and means for causing the character of the aforesaid means to change automatically.

3. The combination with a haul comprising means whereby the lowering of loaded cars is caused to raise

empty cars, of means for utilizing the excess of energy exerted by the lowering of the loaded cars over that required to raise the empty cars to compress fluid and for utilizing the compressed fluid to operate the haul when it is not operated by the loaded cars.

4. The combination with a haul comprising means whereby the lowering of loaded cars is caused to raise empty cars, of means for utilizing the excess of energy exerted by the lowering of the loaded cars over that required to raise the empty cars to compress fluid and for utilizing the compressed fluid to operate the haul when it is not operated by the loaded cars and means for causing the character of the aforesaid means to change automatically.

5. The combination with a haul comprising means whereby the lowering of loaded cars may be caused to raise empty cars, of a device that may be operated as a fluid compressor when the power exerted by the lowering of the loaded cars exceeds that required to raise the empty cars and that may be caused to operate as a prime mover for the haul when it is not operated by the loaded cars.

6. The combination with a haul comprising means whereby the lowering of loaded cars may be caused to raise empty cars, of a device that may be operated as a fluid compressor when the power exerted by the lowering of the loaded cars exceeds that required to raise the empty cars and that may be caused to operate as a prime mover for the haul when it is not operated by the loaded cars and means for causing the device to change its character automatically.

7. The combination with means that may either receive or yield power, of other means that are connected thereto

and that may also either receive or yield power automatically, the function of the latter means changing automatically in accordance with the speed of operation thereof.

8. The combination with means that may either receive or yield power, of other means that are connected thereto and that may also either receive or yield power, the function of the latter means changing automatically in accordance with the speed of operation thereof, and the functions of the respective means being different at a given instant.

9. The combination with a haul that is normally operated by the lowering of loads, of means for storing the excess of energy exerted by the lowering of the loads and for utilizing the stored energy to operate the haul when there are insufficient loads available for the purpose, and means for causing the character of the aforesaid means to change automatically.

10. The combination with means that is normally actuated by gravity and that may yield an excess of energy, of means for storing the excess of energy and for utilizing the stored energy to effect operation of the aforesaid means when gravity alone is incapable of effecting operation thereof, and means for causing the function of the energy storing and utilizing means to change automatically.

In testimony whereof, I have hereunto subscribed my name this 17th day of February, 1906.

FORD W. HARRIS.

Witnesses:

OTTO S. SCHAIRER,
BIRNEY HINES.