R. M. & J. L. DOWNIE.

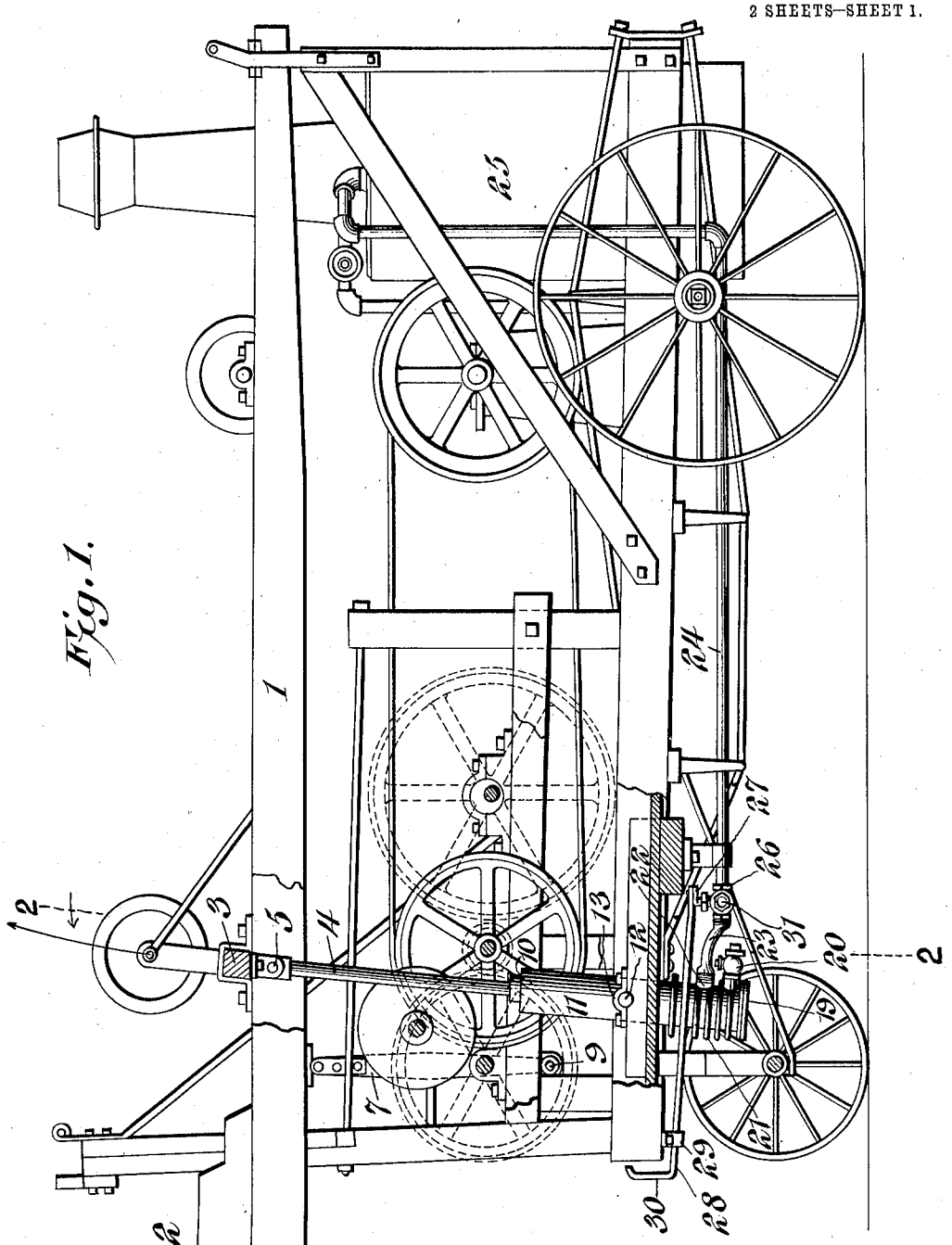
COMBINED SPEED REGULATING AIR CUSHION AND EMERGENCY JARRING DEVICE.

APPLICATION FILED MAY 9, 1910.

1,002,971. Patented Sept. 12, 1911.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses

Howard D. Orr.

H. T. Riley

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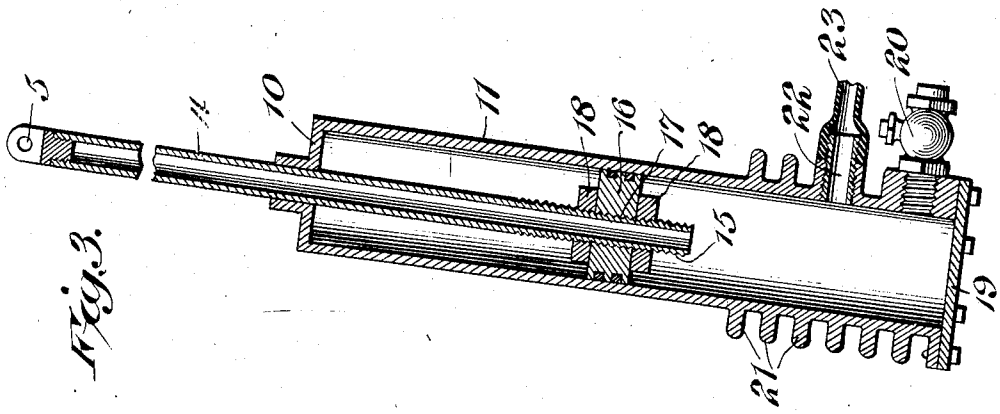

Fig. 3.

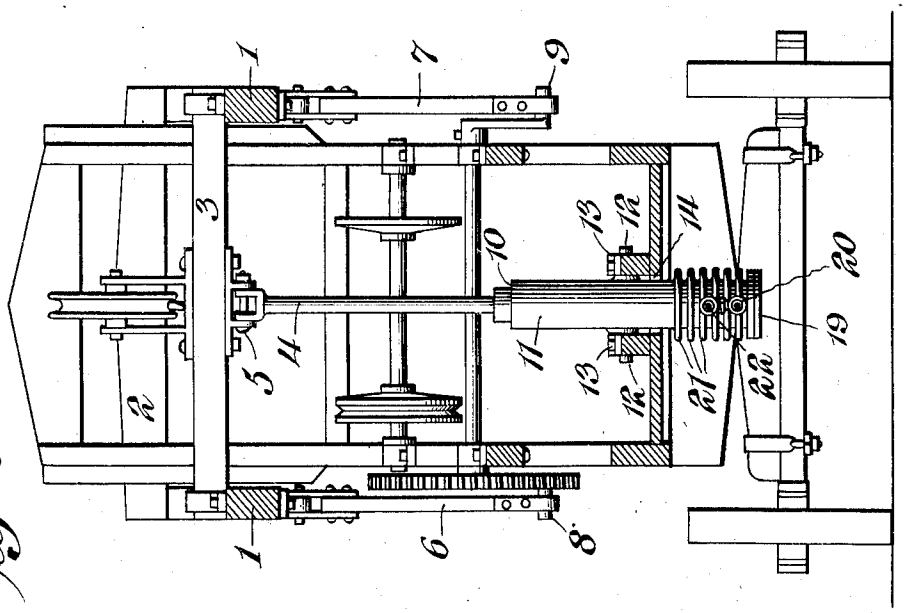

Fig. 2.

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UNITED STATES PATENT OFFICE.

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COMBINED SPEED-REGULATING AIR-CUSHION AND EMERGENCY JARRING DEVICE.

1,002,971. Specification of Letters Patent. Patented Sept. 12, 1911.

Application filed May 9, 1910. Serial No. 560,319.

To all whom it may concern:

Be it known that we, ROBERT M. DOWNIE and JAMES L. DOWNIE, citizens of the United States, residing, respectively, at Beaver Falls and Downieville, in the counties of Beaver and Butler and State of Pennsylvania, have invented a new and useful Combined Speed-Regulating Air-Cushion and Emergency Jarring Device, of which the following is a specification.

The invention relates to a combined speed regulating air cushion and emergency jarring device.

The object of the present invention is to provide a simple, inexpensive and efficient device, designed for use on all classes of well drilling machines in which some form of walking beam is employed for imparting motion to the drilling tool, and capable of producing a resistance during the period when the drilling tools are dropping by gravity to prevent acceleration in the rotation of the crank element, which operates the walking beam to permit the drilling tools to expend their energy at the bottom of the bore hole before the walking beam commences its up-stroke, whereby the engine is subjected to a uniform strain and the durability of the machine is greatly increased.

A further object of the invention is to provide a device of this character, adapted to store-up energy on the down-stroke of the tools to assist the up-stroke of the walking beam, whereby the speed and efficiency of the drilling machine is increased.

Furthermore, it is the object of the invention to provide a cushioning device, capable of also operating as an emergency jarring device, and adapted should the drilling tools become wedged fast at the beginning of the up-stroke to enable the direct force of the steam from the boiler of the machine to produce a succession of blows on the walking beam, whereby the drilling tools may be jarred loose.

With these and other objects in view, the invention consists in the construction and novel combination of parts hereinafter fully described, illustrated in the accompanying drawings, and pointed out in the claims hereto appended; it being understood that various changes in the form, proportion, size and minor details of construction, within the scope of the claims, may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

In the drawings:—Figure 1 is a side elevation, partly in section, of a drilling machine provided with a combined speed regulating air cushion and emergency jarring device, constructed in accordance with this invention. Fig. 2 is a transverse sectional view, taken substantially on the line 2—2 of Fig. 1. Fig. 3 is an enlarged sectional view of the cylinder.

Like numerals of reference designate corresponding parts in all the figures of the drawings.

In the embodiment of the invention illustrated in the accompanying drawings, the drilling machine is provided with a pair of walking beams 1, pivoted at their rear ends and connected at their front ends by a cross bar 2, having means for connecting it with the drilling tools (not shown). The walking beams are also connected at an intermediate point by a cross bar 3, to which the upper end of a piston rod 4 is connected by a suitable hinge joint 5. The piston rod, which is hollow, is centrally connected with the intermediate cross bar 3, but the combined speed regulating air cushion and emergency jarring device is applicable to drilling machines, equipped with a single walking beam, and also to drilling machines in which the walking beam is pivoted at an intermediate point and the power applied at one side of the pivot, and the tools connected with the walking beam at the opposite side of the pivot. The walking beams 1 are connected by pitmen 6 and 7 with crank elements 8 and 9, which are rotated by suitable gearing, operatively connected with an engine, located at the rear portion of the drilling machine. As the particular construction of the engine and the gearing for rotating the crank elements do not constitute any portion of the present invention, and as any form of gearing or motor may be employed for actuating the walking beam or beams, a detail description of such mechanism is deemed unnecessary.

The hollow piston extends through the

upper end or head 10 of an upright cylinder 11, provided at opposite sides with trunnions 12, which are mounted in suitable bearings 13 upon the floor of the drilling machine. The trunnions 12 are located at a point intermediate the ends of the cylinder, which extends through an opening 14 in the floor of the drilling machine. The pivotal mounting of the cylinder and the hinge joint between the piston rod and the intermediate cross bar 3 of the walking beams permit the device to accommodate itself to the oscillation of the said walking beams. The lower portion of the hollow piston rod is provided with exterior screw threads. 15, and is adjustably connected with a piston 16, provided with a central threaded opening 17 and secured in its adjustment by jam nuts 18, arranged at the upper and lower faces of the piston, but any other suitable means may be employed for adjustably connecting the piston to the piston rod. The lower end of the cylinder is closed by a removable head 19, adapted to afford access to the piston.

The cylinder is equipped at its lower end with an inlet valve 20 adapted to admit a free inlet of air on the up-stroke of the piston, and closable automatically to prevent the escape of air on the down-stroke. Any suitable form of check valve may be employed for admitting air on the up-stroke and prevent its escape on the down-stroke. On the up-stroke of the walking beams, the drilling tools are raised two or three feet by the crank elements and the pitmen, and on the down-stroke of the walking beams, the latter descend without any load in advance of the drilling tools, allowing the latter to strike with their full weight on the bottom of the well being drilled. Thus it will be seen that the power necessary to operate the drilling tools must all be applied on the up-stroke, and the driving power, the engine in the present case, being constant, the power of the engine and the weight of the walking beams all combine to accelerate the speed of the crank elements and to cause the walking beams to descend more rapidly than the drilling tools. Unless some cushioning or retarding device be employed, the walking beams will have begun their up-stroke before the drilling tools have had sufficient time to expend their force upon the bottom of the bore hole, the result being that the efficiency of the drilling machine is much lessened, the operating machinery jarred and the drill cable frequently is broken. Also the intermittent or spasmodic action causes uneven wear and breakage of the geared crank wheel, constituting the crank element 8. These objections and dangers are obviated by the combined speed regulating air cushion and emergency jarring device, and on the up-stroke, the piston and the piston rod, which are air tight, draw air into the cylinder through the inlet valve 20. When the piston arrives at the upper limit of its stroke, the inlet check valve 20 automatically closes. On the down-stroke of the piston the air contained in the cylinder is compressed, thereby affording a resistance to the operating power and retarding the same to some extent, and allowing the drilling tools sufficient time in which to descend and expend their force on the piston of the bore hole. At this point the compressed air in the cylinder operating on the piston assists the driving power in lifting the walking beam and the drilling tools for the next stroke. Thus it will be seen that on the down-stroke the power of the engine, during its otherwise idle stroke, is employed in storing up power, which is utilized on the up-stroke. This causes the machine as a whole to run lightly without jar and without injury to itself, and also in the aggregate results in a great saving of power and greatly increases the speed and efficiency of the machine. The efficiency of each blow of the drilling tools is not only increased, but the number of strokes per minute is also increased.

The compression of air in the cylinder will cause it to heat more or less. To carry off this heat radiating rings or ridges 21 are cast upon the lower portion of the cylinder. The piston rod is made hollow and is open at the lower end in order that the air will tend to rise in the long hollow stem, which operates in the nature of a cooler. Also the hollow piston rod acts as a compression chamber and obviates the necessity of lengthening the cylinder, which would be otherwise necessary in order to provide a cylinder of the required capacity. The piston is adjustably attached to the lower portion of the piston rod for the purpose of adjusting or regulating the pressure in the cylinder as the depth of the drilling increases. When the hollow piston rod is lengthened by adjusting the piston toward the lower end of the same, the pressure against the piston will be increased, the adjustment being varied accordingly as more or less resistance is required to regulate the relative velocity of the up and down strokes of the walking beam.

It frequently happens that the drilling tools become wedged fast at the beginning of the up-stroke requiring more force to start them than can be exerted by means of the cranks and gearing. In order to enable increased force to be exerted on the walking beam, the lower portion of the cylinder is provided with a nipple 22 and is connected by a flexible pipe section 23 with a steam pipe 24 leading to the boiler 25 of the engine. The flexible pipe section 23 is of a suitable length to permit the oscillatory movement of the cylinder resulting from the connection of the piston rod with the walking beams. The

steam pipe 24 is equipped with a three-way valve 26, having an arm 27 and operated by a rod 28. The rod 28, which extends rearwardly from the front of the machine, is connected at its inner or rear end with the arm 27 and is mounted in a guide 29. The front end of the rod is provided with a suitable operating handle 30, located at the front of the drilling machine within easy reach of the operator.

The three-way valve has a lateral outlet 31, and it is of the ordinary construction and is adapted to cut off the steam and also close that portion of the pipe leading to the cylinder. It is also operable to close the lateral outlet and open the steam pipe 24 to permit steam direct from the boiler to pass into the cylinder for directly actuating the piston. This valve-controlled pipe connection between the cylinder and the boiler enables a greatly added force to be brought into action on the up-stroke of the walking beam at such times as the drilling tools may become lodged or fastened in the well. This is accomplished by simply opening the three-way valve admitting steam pressure under the piston. The sudden inlet of steam has the effect of a very forcible upward blow, which generally starts the drilling tools, but if the drilling tools are not thus loosened at the first effort, the three-way valve is turned so that the steam contained in the cylinder is allowed to exhaust through the lateral opening 30. The piston then falls to the bottom of the cylinder, when the steam is again turned on and the blows may be repeated until the drilling tools are jarred loose. Heretofore in well drilling a heavy set of loose links or jars have been employed for the purpose of knocking the drilling tools loose. These links or jars when used with the drilling tools are recognized as a sort of necessary evil or emergency device, adding no direct efficiency to the drilling tools, but on the contrary creating friction in the bore hole and forming a source of danger for breakage, etc. For these reasons operators often run the risk of leaving off the drill jars, resulting sometimes in getting the drilling tools fastened. The present device is, therefore, an efficient emergency appliance located safely above the ground out of the way and yet also instantly at the command of the operator. It may be used for either of these purposes without any change as the exigencies of the operation require.

If the drilling operations are carried on to such a depth that the operating cranks and gearing are no longer able to raise the drilling tools promptly, the steam valve end may be left open thus admitting pressure of the boiler against the piston. On the down-stroke of the walking beam, while the engine would otherwise be idle, the latter will operate to force the steam contained in the cylinder back into the boiler, but at the instant when the cranks pass their lower centers, the direct pressure of the boiler upon the piston comes to the assistance of the engine, and in that way a machine and its gearing will easily operate a set of drilling tools at least twice as heavy as would otherwise be possible with the same machine without the combined speed regulating air cushion and emergency jarring device. While we have shown the cylinder connected with the boiler of the engine, it will be clear that it may be connected with any other source of fluid pressure, such as compressed air.

Having thus fully described our invention, what we claim as new and desire to secure by Letters Patent, is:—

1. In a machine of the class described, the combination with a walking beam, and actuating means for oscillating the same, of a cylinder mounted on the frame of the machine, a piston operating in the cylinder, and a piston rod connected with the piston and with the walking beam independently of the actuating means, said piston being hollow and carrying means for closing its outer end and being open at its inner end to form a compression chamber.

2. In a machine of the class described, the combination with a walking beam, and actuating means for oscillating the same, of a cylinder mounted on the frame of the machine, a piston operating in the cylinder, and a piston rod adjustably connected with the piston for varying the pressure produced by the same, said piston rod being also connected with the walking beam independently of the actuating means.

3. In a machine of the class described, the combination with a walking beam, and actuating means for oscillating the same, of a cylinder mounted on the frame of the machine, a piston operating in the cylinder, and a hollow piston rod connected with the walking beam independently of the actuating means and having an adjustable connection with the piston and open at its lower end to form a compression chamber.

4. In a machine of the class described, the combination with a walking beam, and actuating means for oscillating the same, of a cylinder mounted on the frame of the machine, a piston operating in the cylinder and having a threaded opening, a piston rod connected with the walking beam independently of the actuating means and provided with a threaded portion arranged in the threaded opening of the piston, whereby it is adjustably connected with the same for varying the pressure produced by the said piston.

5. In a machine of the class described, the combination with a walking beam, and

actuating means for oscillating the same, of a cylinder mounted on the frame of the machine, a piston operating in the cylinder and having a threaded opening, a piston rod connected with the walking beam independently of the actuating means and provided with a threaded portion arranged in the threaded opening of the piston, whereby it is adjustably connected with the same for varying the pressure produced by the said piston, and means for securing the piston in its adjustment.

6. In a machine of the class described, the combination with a walking beam, and actuating means for oscillating the same, of a cylinder mounted on the frame of the machine, a piston operating in the cylinder and having a rod connected with the walking beam independently of the actuating means, and means connected with the cylinder for introducing pressure therein to assist the operation of the walking beam.

7. In a machine of the class described, the combination with a walking beam, and actuating means for oscillating the same, a cylinder mounted on the frame of the machine, a piston operating in the cylinder and having a rod connected with the walking beam independently of the actuating means, and a fluid pressure pipe connected with the cylinder and having means for controlling the admission of pressure to the same.

8. In a machine of the class described, the combination with a walking beam, and actuating means for oscillating the same including an engine having a boiler, of a cylinder mounted on the frame of the machine, a piston operating in the cylinder and connected with the walking beam independently of the actuating means, and a valve controlled steam pipe connected with the cylinder and with the boiler.

9. In a machine of the class described, the combination with a walking beam, and actuating means for oscillating the same including an engine having a boiler, of a cylinder mounted on the frame of the machine, a piston operating in the cylinder and connected with the walking beam independently of the said actuating means, and a steam pipe connected with the cylinder and with the boiler and having a three-way valve for admitting steam to the cylinder and for exhausting the steam from the cylinder.

10. In a machine of the class described, the combination with a walking beam, and actuating means for oscillating the same including an engine having a boiler, of a cylinder pivotally mounted on the frame of the machine, a piston operating in the cylinder and connected with the walking beam independently of the said actuating means, and a steam pipe connected with the boiler and having a flexible section connected with the cylinder.

11. In a machine of the class described, the combination with a walking beam, and actuating means for oscillating the same including an engine having a boiler, of a cylinder pivotally mounted on the frame of the machine, a piston operating in the cylinder and connected with the walking beam independently of the said actuating means, a steam pipe connected with the boiler and having a flexible section connected with the cylinder, a valve for controlling the admission of steam to the cylinder, and operating mechanism for the said valve.

12. In a machine of the class described, the combination with a walking beam, and actuating means for oscillating the same, of a cylinder pivotally mounted on the frame of the machine and located beneath the walking beam, a piston having a rod hinged to the walking beam independently of the said actuating means, an inlet check valve connected with lower portion of the cylinder, and a fluid pressure pipe also connected with the lower portion of the cylinder and having valve controlled means for admitting pressure to and exhausting the same from the cylinder.

13. In a machine of the class described, the combination with a walking beam, and actuating means for oscillating the walking beam including a boiler, of a cylinder pivotally mounted at an intermediate point on the frame of the drilling machine below the walking beam, a piston connected with the cylinder and having a hinge connection with the walking beam independently of the said actuating means, a steam pipe connected with the boiler and provided with a three-way valve, a flexible pipe section extending from the steam pipe to the lower end of the cylinder, operating mechanism connected with the valve, and an inlet check valve also connected with the lower end of the cylinder.

14. In a machine of the class described, the combination with a walking beam, and actuating means for oscillating the same including a boiler, of a cylinder pivotally mounted on the frame of the machine and arranged in an upright position on the walking beam, a piston operating in the cylinder and connected with the walking beam independently of the actuating means, and a steam pipe connected with the boiler and with the cylinder at the lower portion thereof.

15. In a machine of the class described, the combination of a frame provided with a floor having an opening, spaced walking beams pivotally connected at their rear ends to the frame and having a transverse connecting bar located above the opening in the

floor, actuating means including opposite cranks arranged at the sides of the frame and connected with the walking beams, an upright cylinder pivoted at an intermediate point to the floor of the frame and extending through the said opening, a piston operating in the cylinder and having a hinge connection above the floor with the cross bar, and a steam pipe connected with the lower portion of the cylinder below the floor for introducing pressure within the cylinder to assist the operation of the walking beam.

In testimony, that we claim the foregoing as our own, we have hereto affixed our signatures in the presence of witnesses.

ROBERT M. DOWNIE.
JAMES L. DOWNIE.

Witnesses for Robert M. Downie:
J. W. McAulis,
Jos. C. Rowzer.

Witnesses for James L. Downie:
Geo. W. Neff,
Josiah H. Pisel.