(No Model.)

S. G. MILLS.

PNEUMATIC POWER APPARATUS.

No. 489,193. Patented Jan. 3, 1893.

Fig. 1.

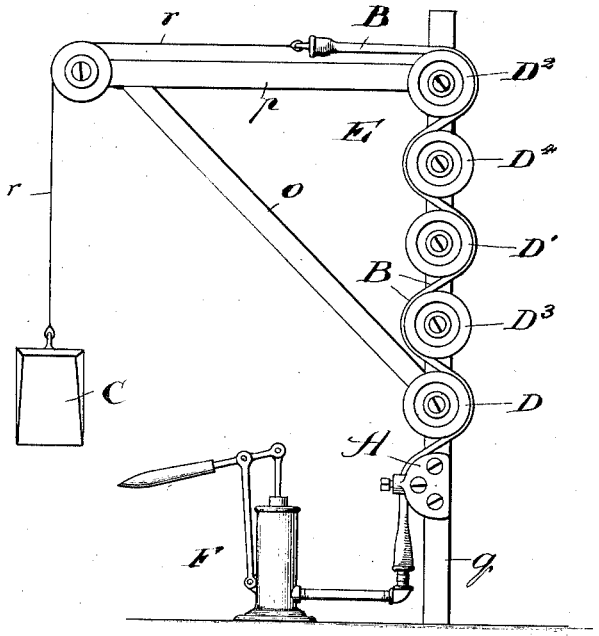


Fig. 2.

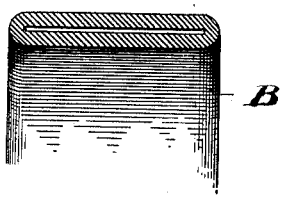
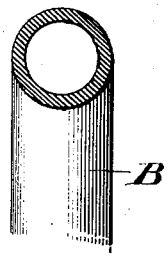


Fig. 3.



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UNITED STATES PATENT OFFICE.

STEPHEN G. MILLS, OF CHICAGO, ILLINOIS, ASSIGNOR TO MORTIMER B. MILLS, OF SAME PLACE.

PNEUMATIC-POWER APPARATUS.

SPECIFICATION forming part of Letters Patent No. 489,193, dated January 3, 1893.

Application filed June 25, 1892. Serial No. 437,960. (No model.)

To all whom it may concern:

Be it known that I, STEPHEN G. MILLS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Pneumatic-Power Apparatus, of which the following is a specification.

The object of my invention is to provide a simple and convenient means as the medium through which to apply the force of pneumatic pressure for accomplishing work and which may be amplified, readily, from its simplest form to multiply the power to any desired degree.

The essential features of my improvement are a collapsible and inflatable tube of material impervious to air, such as rubber hose, closed at one end at or from which it is connected with the object the resistance of which is to be overcome, and adapted at its opposite end (or elsewhere) to receive the supply of pneumatic pressure, and fastened at that end to an unyielding object, and one or more rotary bearings between the ends of the tube which just about reaches, when collapsed, from the point of fastening the one end to the object (or connection therewith), in its normal position, against which the power is to be exerted, the bearing or points being out of a straight line between the said objects to deflect from a straight line the tube, which bears normally against each. Then, with the tube normally collapsed and flat against its bearing or bearings, by forcing air into the tube and inflating it, it will exert a pull or lift, the extent of which will be that of the degree of inflation of the tube multiplied by the number of intermediate bearing points. Thus, the tube being initially flat, but presenting practically no internal diameter, on being inflated to its full internal diameter, say two inches, it will, instead of bearing flatwise, as initially, against each bearing, bear, theoretically, at least, at a longitudinal line, along its then transversely rounded base against the same. Owing to the bearing point or points being out of a direct line between the two ends of the tube (the one unyieldingly fastened, and the other yieldingly by connection with the resistance to be overcome) inflation of the tube will shorten it to the aggregate, or thereabout, of the extent of the diameter of inflation at each bearing, and thus pull or lift the resisting object as many inches as the number of inches of inflation at each bearing multiplied by the number of bearings.

My improvement may be advantageously applied to numerous purposes, including the operation of air-gates and air-brakes; but for demonstration it need only be shown and described as applied to lifting a weight. Accordingly I so illustrate it in the accompanying drawings in which—

Figure 1 is a view in elevation of an apparatus diagrammatically illustrating my invention. Fig. 2 is a perspective view of a broken portion of the tube in its collapsed form. Fig. 3 is a similar view of the same as it appears when inflated.

A is a stationary or unyielding bearing.

B is the hose fastened near one end to the bearing A.

C is a weight representing the work to be done, and with which the free closed end of the hose B is connected, as by a cable r, the hose passing from its point of fastening on A in a deflected direction about a bearing D, but without being fastened thereto. In the same way that the hose passes about the bearing D, it may pass about any desired number of additional bearings D′ D^2, and contrarily about intermediate bearings D^3, D^4.

For the purpose of illustration I show a stationary frame E, comprising an upright q, a horizontal arm p extending from its upper end and a diagonal brace o, the purpose of the former being to support the parts already referred to. The preferred but not only practicable form of the bearing A is that of a roller or wheel, or segment as shown, immovably fastened to the upright q; and the preferred form of each movable bearing is that of a pulley or wheel, the periphery of which should be grooved and as wide, at least, as the hose B in its collapsed condition, the pulley being pivotally fastened at its center upon the upright.

The form of air-gate to which my improvement is particularly applicable, as hereinbe-

fore suggested, is that of the variety known as the pneumatic gate for railway-crossings and involving a swinging arm on a post, the arm being operated to raise and lower it by air-pressure. To apply my improvement to such a gate the arm should be weighted at the rear end to tend to rise and to the weighted end the hose B would be attached (the arm thus taking the place of the weight C); and inflation of the hose will obviously effect raising the rear end of the gate-arm to lower the barrier, the same as it effects raising the weight. To apply the device to operate an air-brake, the closed end of the hose may be connected with the brake-beam to pull the shoes against the wheels by inflating the hose. If there were but the one bearing D between the point of fastening the hose B, at A, and the weight C the operation and its result would be as follows: By forcing air, through the medium of the pump F, into the tube B at its lower end, and inflating it, say to its full capacity (for example to the extent of two inches in diameter) from its flat condition representing, practically, no internal diameter, the inflation will take place, obviously, in an outward direction from the periphery of the bearing D, thereby practically increasing the diameter thereof to the extent of the inflation and, also obviously, shortening the length of the tube to that extent, to which, therefore, the weight C will be raised. To effect the same result at each of any number of bearings, the hose B must pass about them alternately in opposite directions as, or substantially as, represented, when the result of inflation will be that the lifting distance will equal or about equal the extent of inflation of the hose multiplied by the number of bearing points.

As will be seen, while with the form of bearings presented the centers may be, as shown, in line with each other, the bearing points are necessarily out of line with the work and point of fastening of the tube and with each other in the sense I intend to convey.

What I claim as new and desire to secure by Letters Patent is—

1. In a pneumatic power apparatus, the combination of an inflatable tube fastened toward one end and closed at the opposite end at which to connect it with the resistance to be overcome, and a rotary bearing between the ends of the tube against which it bears and is deflected, substantially as and for the purpose set forth.

2. In a pneumatic power apparatus, the combination of an inflatable tube fastened toward one end and closed at the opposite end at which to connect it with the resistance to be overcome, and a series of rotary bearings between the ends of the tube against successive ones of which it bears and is deflected in different directions, substantially as and for the purpose set forth.

3. A pneumatic power apparatus comprising, in combination, an air-pump F, hose B communicating with the pump and closed at one end and there connected with the object to be moved, and fastened at its opposite end to a rigid bearing A, and a series of pulley bearings pivotally supported with the centers in alignment with each other and having the hose passed about and bearing against them successively in opposite directions, substantially as and for the purpose set forth.

STEPHEN G. MILLS.

In presence of—
J. N. HANSON,
M. J. FROST.