H. Moore,

Wind Wheel.

No. 12,517. Patented Mar. 13, 1855.

Fig. 1

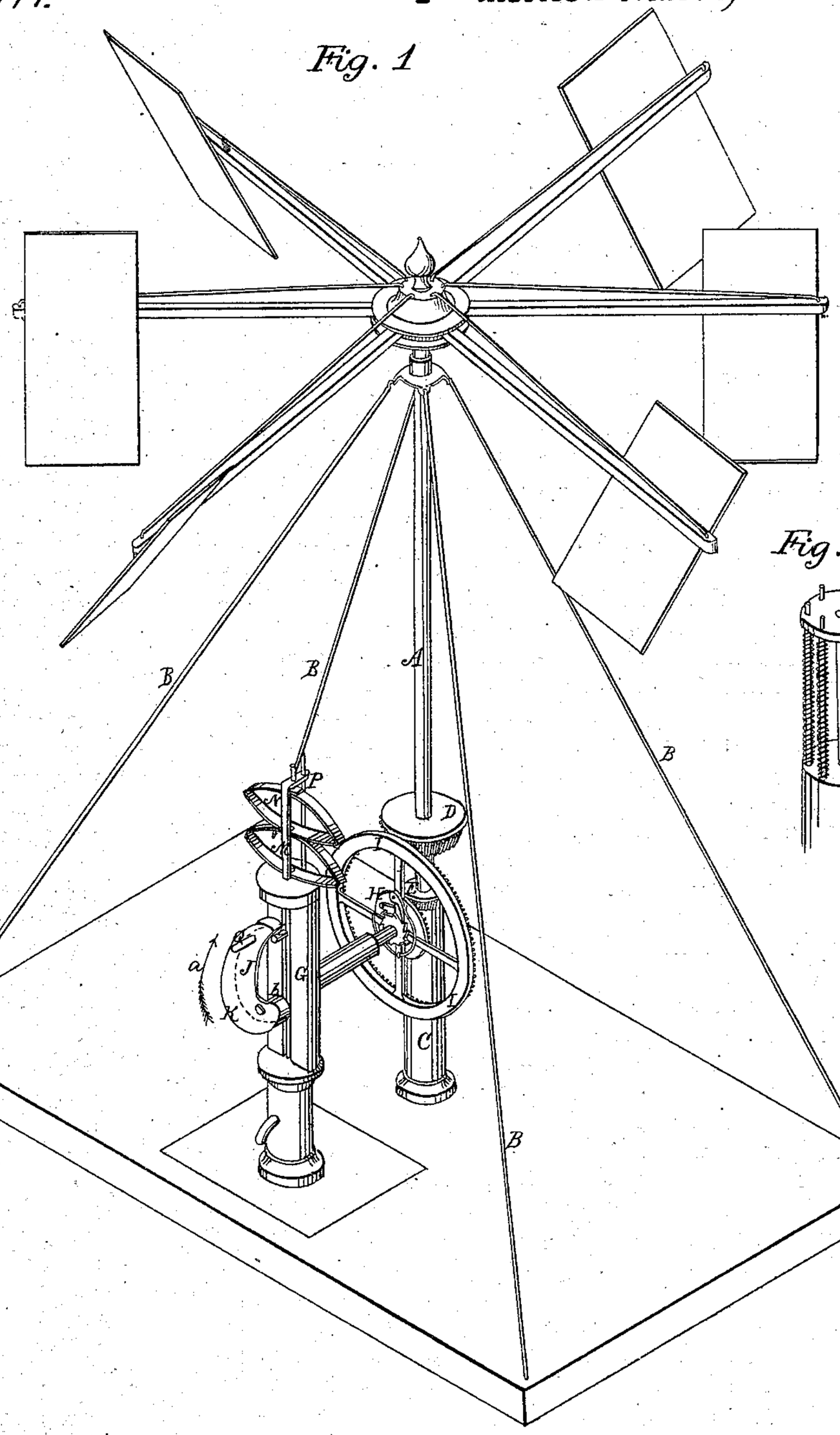
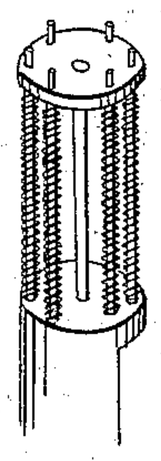


Fig. 2



UNITED STATES PATENT OFFICE.

HIRAM MOORE, OF CHARLESTON, MICHIGAN.

METHOD OF OPERATING PUMPS BY WIND.

Specification forming part of Letters Patent No. **12,517**, dated March 13, 1855.

To all whom it may concern:

Be it known that I, HIRAM MOORE, of Charleston, in the county of Kalamazoo and State of Michigan, have invented a new and useful improvement in machinery which is specially adapted for actuating pumps by the power of the wind, but which can be used for working pumps by other than wind-power, of which the following is a specification.

It has long been a desideratum in those sections of country where springs and brooks are scarce and wells deep to compensate these disadvantages by taking advantage of the power of the wind to actuate pumps, particularly to supply water for cattle and for household purposes, and as it is seldom perfectly calm for twelve hours at a time a sufficiently regular supply of water could by this means be obtained without labor so long as the pump and the mechanism by which the pump was actuated remained in good order. Here, however, the main difficulty lies, and it has heretofore defeated every attempt to operate common pumps in this manner.

Among the various difficulties that have been met with one of the most troublesome results from the unsteadiness of the wind as a motive power, which sometimes, as in a hurricane, moves with immense velocity and power, while at other times its current is very slow, as in a gentle breeze. Yet, since the wind generally blows gently, often briskly, and it is only occasionally that we have either a hurricane or a perfect calm, the mechanism for pumping by means of the power derived from the wind must be adapted to raising an adequate supply of water when the wind is blowing gently. Now, if we suppose the pump to be adapted to raising one gallon of water per minute when the wind is blowing at the rate of three miles an hour, and that the well or spring will only yield two gallons per minute, it is evident that when the wind increases to nine miles an hour the well will be pumped nearly dry very speedily and the sand and other earthy matter will be agitated and mixed with the water and drawn with it into the pump, and the rapid motion of the piston will abrade and speedily destroy the barrel, when the pump will be disabled and the raising of the water stopped. Further, the sand and other earthy matter carried up by the water, although comparatively inconsiderable in quantity for a short time, yet in the course of even a few months will, in friable earth, be sufficient to undermine the walls of the well and cause them to cave in, and thereby at once both stop the pump and shut up the source of supply of water. Further, in those parts of the country where running water is scarce it usually happens that even deep wells yield a very scanty supply of water, which unless used with economy will be entirely insufficient. An excessive discharge will be wholly inconsistent with due economy, for although the surplus be returned to the well, yet the evaporation in dry warm weather, consequent upon the exposure of the water, will waste it away very rapidly, and therefore where water is scarce such exposure to evaporation is wholly inadmissible. Further, since any application of the windmill to pumps, in order to be generally useful for domestic purposes, for which my invention is designed, must be adapted to the common pump, it will be indispensable to construct and arrange the mechanism in such manner that the force for the lifting-stroke of the plunger will be strong and quick, for it always fits loosely in the barrel of a common pump, and if not lifted quickly it would not raise the water, but would permit it to pass down between the barrel and plunger as the latter rises. If, as in the common as well as all windmill pumps heretofore known, the upward and downward strokes of the plunger are made at the same velocity, then the wear and tear would, and has in practice proved to be such, that the pump and driving machinery would soon become deranged and fail to supply water.

The foregoing and other objections which might be named have prevented the introduction into general use of windmill-pumps, and water is still raised by hand at great labor and expense; and a practical windmill-pump capable of furnishing a small but constant supply of water has continued up to the date of my invention to be a desideratum. For although machinery of a complex and expensive character for furnishing a regular supply of water by power derived from the wind has been well known to mechanics and engineers, yet this machinery is wholly inad-

missible for pumps for dwellings and farms from its expensiveness, complexity, and the impossibility of its being managed and repaired by farmers, who, as a class, are unskilled in such matters.

My invention and improvement consists in a combination of a spring or weight for raising the plunger of the pump quickly with a cam of peculiar construction for compressing the spring or raising the weight very slowly, and at the same time depressing the plunger in such manner that it will make one stroke down and another up at each revolution of the cam, the length of which stroke will be inversely proportioned to the rapidity with which the cam revolves. From which it follows that if the cam be caused to rotate with great rapidity by the rapid rotation of the sails of a windmill during a high wind the strokes of the plunger will be reduced so short that little if any more water will be discharged than when the sails are turned slowly by a gentle breeze when the strokes are longer. The cam producing these effects I term a "compensating" cam, and it not only compensates the irregularities in the motion of the wind, but also, like the fusee in a watch, compensates the variations in the resistance of a spring or the leverage of a weight; for while the spring is most compressed and offers the greatest resistance that part of the cam which has the shortest radius and acts with the greatest power is acting upon it, and when it is least compressed and opposes the least resistance that part of the cam which has the longest radius, and therefore acts with the least power, is compressing it. In this way this differential cam compensates both irregular power and irregular resistance.

The accompanying drawings represent a pump and windmill connected by means of my improvements.

Figure 1 represents a view in perspective of the same; and Fig. 2 represents a view of an arrangement of helical lifting-springs, which I have sometimes used instead of the elliptic springs shown in Fig. 1.

Any kind of force or lifting pump and any kind of windmill may be used that the constructor prefers. I have merely represented one form of each in the drawings to illustrate more clearly the manner in which my invention for connecting them may be applied.

The drawings represent a windmill and pump erected upon a platform for convenience of representation; but in practice I erect the pump in the usual manner in the well, and erect the mill as near to it as may be convenient, extending the braces more or less according to the height of the mill and anchor them in the ground or otherwise fasten them at the lower end. The windmill is of a horizontal variety and revolves on a vertical shaft A. This shaft is braced from near the top by rods B, which are anchored at the bottom in the ground, and is stepped upon a pedestal C. Near the lower end of the shaft two bevel-pinions D and E are secured, which are of unequal size and take into corresponding bevel-wheels on a horizontal shaft F, one end of which rests in a bearing in the pedestal C, and the other in a bearing in the upper part of the pump-stock G. When it is required to work the pump fast relatively to the windmill, the smallest wheel E on the shaft A is connected with the small wheel H on the shaft F, and when a slower motion is required the wheel D is connected with the large wheel I on the shaft and the other two wheels E and H are disconnected. These changes may be effected by means of any of the well-known clutches and shifting mechanism in common use for connecting and disconnecting gearing.

On the end of the shaft F a cam is mounted. This cam consists of a plate J, on the inner side of which a spiral rib K is attached. This rib, when the cam is rotated in the direction of the arrow *a*, will catch a pin L, that projects from the piston-rod M of the pump, and will depress this pin by the convergence of the rib toward the center of motion of the cam until the pin passes the inner end *b* of the rib K, when the pin and piston-rod will be free to rise, and in this case will be promptly raised by a spring N, connected to the top of the piston-rod, and which was compressed by the depression of the piston-rod, which is bent over the top of the spring at P for that purpose. As the water is raised by the lifting of the piston-rod and piston, as in ordinary pumps, the spring will raise the water, and the piston will ascend with a speed proportioned to the strength of the spring and the degree to which it is compressed; but as the force which the spring exerts is the same at one stroke of the pump as at any other stroke it follows that the ascent of the piston will be at a regular and uniform rate, and as the piston will be left free to rise from the time the end *b* of the spiral rib releases the pin L until the opposite end of the rib again strikes the pin L, which is an interval of about half a revolution of the cam, the piston will make a full stroke when the cam turns slowly; but when it turns fast the piston will have raised but little before it is again struck by the rib and depressed. This makes the strokes of the piston short when the cam revolves rapidly, and long when it revolves slowly, and in this way the operation of the machinery is such that however irregular the motion of the motive power may be the quantity of water discharged remains practically constant, and the injurious effects heretofore produced by irregularity will be avoided. If the spring is substituted by a weight mounted on an arm, which will be horizontal, or thereabout, when the plunger is down and vertical when the plunger is raised, the action of the spiral cam would remain unchanged, and as the cam would start the weight upward very slowly and gradually and the arrangement and operation of the lever would arrest it on its de-

scent gradually and without shock the machinery would work without injurious shocks or jars whether the water be raised by the elastic force of a spring or the gravitation of a weight.

In using a weight for the raising-power or a force instead of a lifting pump the motion of the cam might in some cases be reversed with advantage and the pin work on the outside instead of the inside of the spiral rib.

For the purpose of diminishing friction, the depressing-pin L is fitted with a friction-roller. The wheels, too, might be dispensed with, and the cam connected directly with the windmill-shaft A.

Numerous other modifications besides those I have indicated might be made in the construction of this machine without any departure from the principle of my invention; but as those changes and modifications will be sufficiently obvious to any skillful constructor to enable him to adapt the machine to the varying uses and circumstances under which my invention will be employed, I deem it unnecessary to mention them.

When the windmill is for any cause inoperative, the cam J may be turned by the handle Q to raise water, as in any ordinary pump, in which case the windmill should be disconnected from the shaft F.

What I claim is—

The combination of a compensating-cam and spring or the equivalent thereof for operating a pump driven by a windmill, substantially in the manner and for the purpose herein set forth.

In testimony whereof I have hereunto subscribed my name.

HIRAM MOORE.

In presence of—

F. G. DE FONTAINE,

A. E. H. JOHNSON.