L. MÉGY, J. de ECHEVERRIA & F. BAZAN.

Internal Spring Couplings and Brakes.

No. 143,293. Patented September 30, 1873.

Fig: 7.

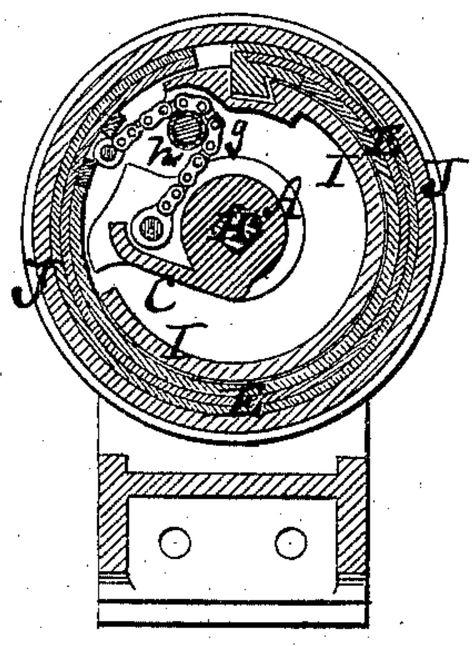


Fig: 5.

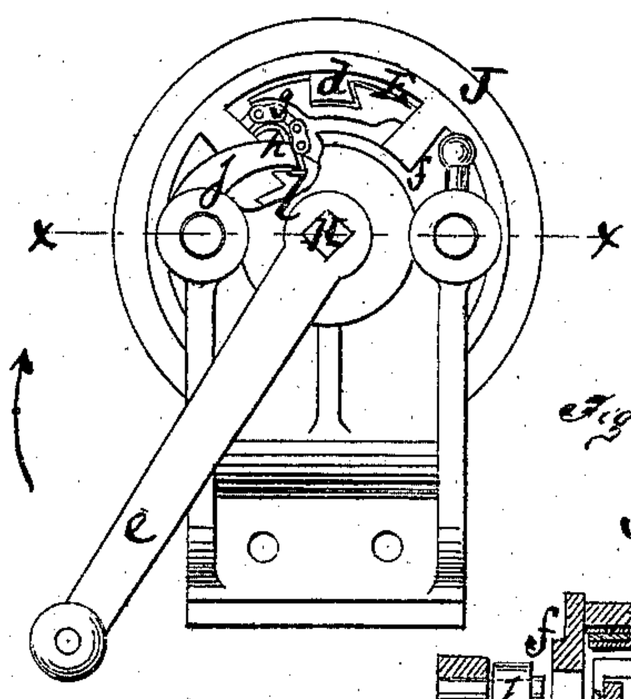


Fig: 8.

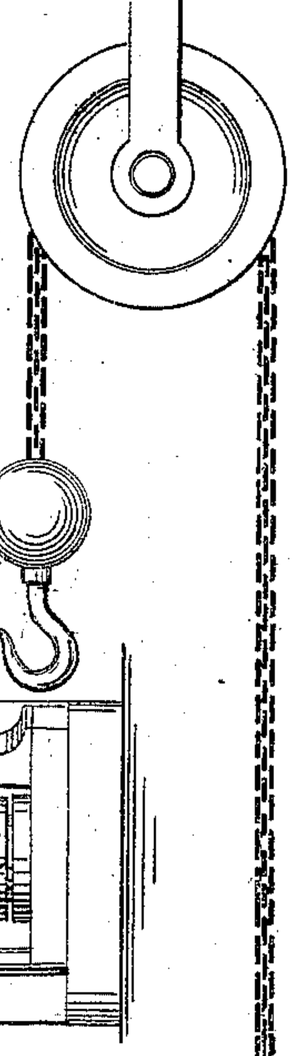


Fig: 6.

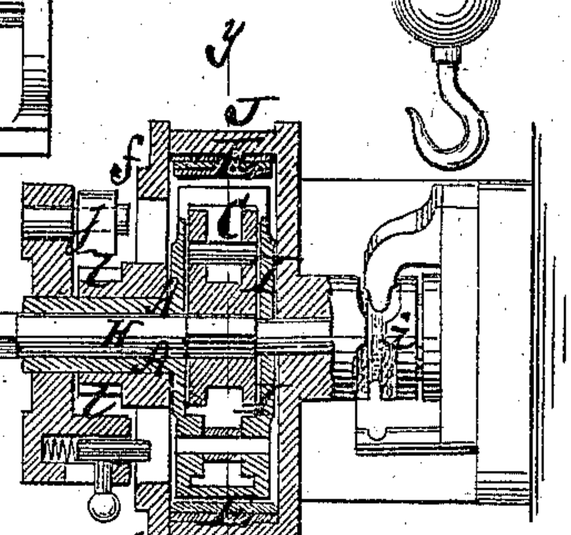


Fig: 3.

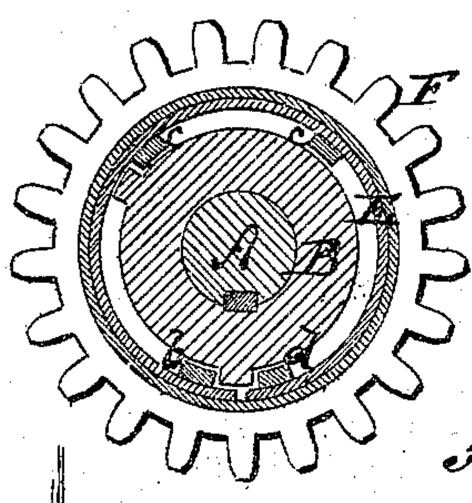


Fig: 4.

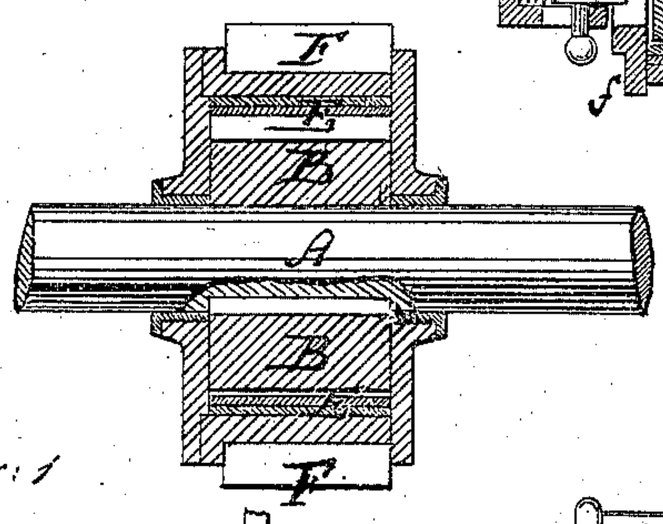


Fig: 1

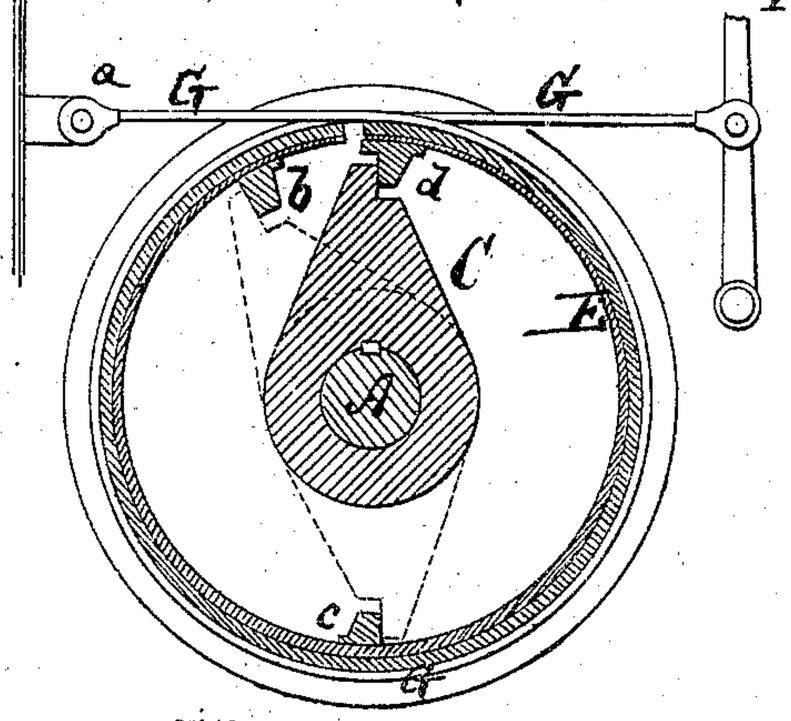
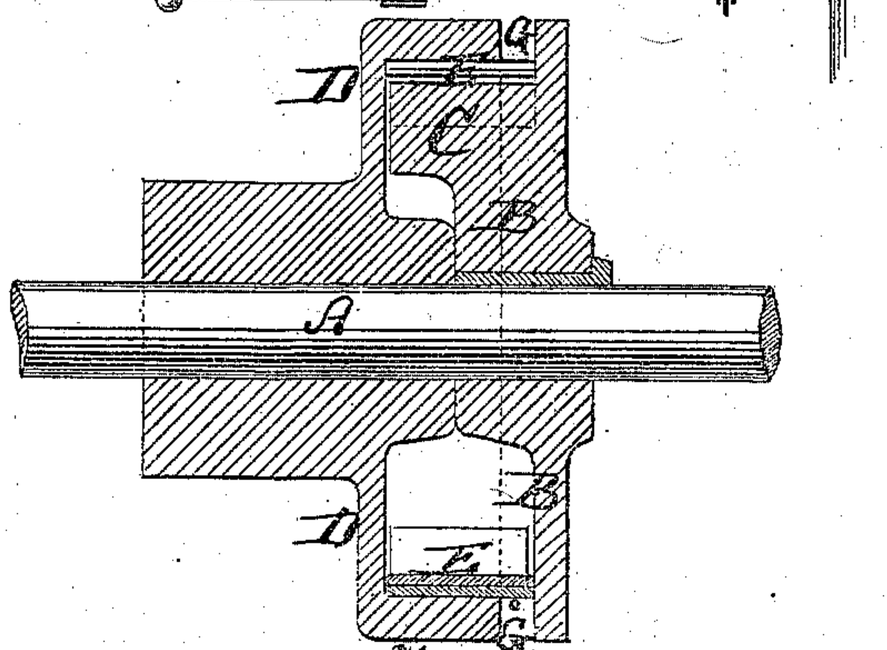


Fig: 2.



Witnesses:

Chas. Nida
C. Sedgwick

PER

Inventor:
L. Mégy
J. de Echeverria
F. Bazan
Munn & Co
Attorneys.

UNITED STATES PATENT OFFICE

LÉANDRE MÉGY, JOSÉ DE ECHEVERRIA, AND FELIX BAZAN, OF PARIS, FRANCE.

IMPROVEMENT IN INTERNAL SPRING COUPLINGS AND BRAKES.

Specification forming part of Letters Patent No. **143,293**, dated September 30, 1873; application filed January 25, 1873.

To all whom it may concern:

Be it known that we, LÉANDRE MÉGY, JOSÉ DE ECHEVERRIA, and FELIX BAZAN, of Paris, in the Republic of France, have invented a new and Improved Internal Spring Coupling and Brake, of which the following is a specification:

Our coupling system is based on the use of one or several blade-springs suitably curved, inclosed within a hollow drum or pulley, and working by their own expansive force, which keeps them pressing more or less closely against the internal cylindrical face of the said drum or pulley. This expansive force, independent of any exterior action, causes a close adhesion of the said spring to the hollow pulley, which makes them, as it were, a single piece by preventing their sliding on one another, and this adhesion can only be destroyed by an impulsion from the exterior. It follows, therefore, that, if one of the two-mentioned pieces, either the spring or the pulley, is set in motion, it naturally carries along the other one, so long as the resistances which the latter has to overcome are insufficient to produce the sliding of the said pieces on each other, or so long as the adhesion between the spring and drum is not destroyed either completely or partially by any exterior action.

Our invention is fully illustrated in the annexed drawing. We will first refer to the Figures 1 and 2 of the same, which exhibit our spring coupling and brake system in its greatest simplicity.

On a shaft, A, is keyed a round plate, B, bearing a cam, C. Before this plate B is placed a hollow pulley, D, loose on the shaft. The said pulley is fitted with a blade-spring, E, which is kept in its place by the internal force of the pulley against which it presses more or less strongly by its own expansive force, which will constantly aim at bringing it back to its primitive shape. When the shaft revolves it carries along with it the round plate B, which sets the spring in motion by means of the cam C, and the pulley follows the motion, being carried away by the adhesion of the spring. If the resistances which impede the motion of the pulley are able to overcome the friction produced by the pressure of the spring, the latter slides and the pulley revolves no longer. If, by any means, both ends of the spring are brought nearer to one another, its action on the pulley will cease, and the latter becomes free. If a rope, G, for instance, is rolled round the spring and pulled at both ends, or only at one, the other end of the rope being fastened at a steady-point, *a*, as shown in Fig. 1, it would produce the desired effect by contracting the spring, and, consequently, annulling the friction resulting from its pressure on the concave side of the pulley D. The latter becoming again loose would no longer be carried round by the shaft, and could not impel any other piece. As soon as the rope was released the expansive force of the spring would cause it to stick once more to the pulley, the friction would be reproduced, and the pulley carried along by the shaft if it were to resume its motion.

We will hereafter describe some of the mechanical contrivances which can be employed in practice to obtain the same result in a suitable manner, and to cause at pleasure the shaft A and the pulley D to be either bound together or independent of each other. The example given is, however, all that is necessary for a proper understanding of the principle of our invention.

The pressure of the spring on the pulley depends on the strength of the former—viz., of the area of its transverse section—on the elasticity of the material, and on the ratio between its shape of fabrication and the curvity it is forced to assume within the pulley. This pressure will be the same in the whole periphery, if the size and curvity of the spring have been so well calculated that when forced into the hollow pulley its shape suits exactly the circular periphery of the latter. On the other hand, the friction resulting from this pressure evidently depends on the nature of the materials employed and conditions of the rubbing surfaces; the nature and state of the material employed must, therefore, be considered when calculating the size and curvity to be given to the springs; but these

secondary considerations will not, any more than sundry other particulars in the construction of our spring-coupling brake, modify in the least our system, and it is therefore not necessary to enter into further considerations on the subject. But a most important remark to be made is that the friction, and consequently the action, of the spring which is worked upon by the cam C, is modified according to the point of the spring acted upon. Thus if we suppose the spring provided with several catching-bits, *b c d*, when the cam C works upon the spring at *b*, the effort to be applied on the pulley to maintain it motionless must only counterpoise the friction of the spring on the internal side of the hollow pulley—that is to say, the total pressure of the spring multiplied by the coefficient of friction corresponding to the nature of the rubbing material; while, if the cam C works upon the spring through the catching-bit *c*, the effort to be exerted on the pulley must be greater. This effort, or the friction of the spring on the pulley which it must counterpoise, increases in proportion to the distance of the acting-point of the cam C from the end *b* of the spring, till it reaches the other end *d*, where it attains the maximum of its power. This course of reasoning led us to foresee, and a series of experiments furnished us with the proof, that this effect is entirely similar to the coiling of a leather band round a drum, and that the increase of the effort, owing to a greater length of the concave segment brought into contact with the surface worked upon, can be ascertained by the same formula as that used for leather bands. If, instead of a single spring, we employ several, the total pressure on the pulley will be the sum of the pressure of all the said springs, and by working upon them successively the same result will be obtained of increasing gradually the tangential effort on the pulley. In the same way, if their action is successively stopped a gradual ungearing will be produced. Further, if each spring can be worked upon at different points, many combinations may be made, so as to obtain gradually and almost insensibly any required effort. The springs can be placed either above one another, near each other, or in any other combined order. The result will be the same if they can be acted upon at pleasure either all at once, or one by one. The springs placed within a hollow pulley or drum in the aforesaid shape, can then be used to produce the elastic keying of the said pulley on the shaft, the resistance of the said keying depending upon the strength of the springs. The effort to be transmitted is, of course, limited to the efforts which it is possible to impart with the faculty of modifying the said efforts within limits of a certain extent, to throw in and out of gear in a gradual manner—consequently, without any percussion—pieces set on the same shaft or on different shafts, whatever may be their speed, by graduating at pleasure the efforts to be produced, to regulate either the lowering of a load or the speed of vehicles, or generally of any running pieces, since it forms a powerful brake, its inherent power depending on the very strength of the springs; and it is essentially self-acting, for they are constantly working, unless by any contrivance their action be temporarily impeded, which action is resumed as soon as the impeding force ceases.

Now, we will expound some cases of applications in order to make the mode of working of our system better understood, and, at the same time, several of the mechanical contrivances which may be used in practice for annulling and restoring at pleasure the action of the springs.

Figures 3 and 4 show the elastic keying of a cog-wheel, F, one of the simplest and most general applications of the spring coupling-brake. The wheel F is fitted loosely on the shaft A, and carries within its nave, suitably disposed for that purpose, a spring, E, which can be worked upon by the round plate B, keyed fast on the shaft. The latter as it revolves carries along the wheel through the expansive action of the spring, or, on the contrary, is carried along by the latter as long as the resistance to be overcome shall not exceed the utmost effort which can be produced by the spring. If, through any cause, the resistances increase, the piece acted upon stops, and the spring slides within the hollow of the wheel; but the cogs will not break off if their size be proportionate to the utmost effort which the spring can produce, whatever may be the intenseness of the force which is in opposition to the motion. If the spring be provided with several catching-bits *b c d*, the limits of the effort can be modified at pleasure by modifying the position of the plate B with regard to the spring, so as to have the said plate acting upon any catching-bit one chooses. The mechanism may be disposed for this purpose in a very simple manner. Here, the object of the spring is not to produce a gearing; its object is only to attenuate the effort of concussion, and to prevent the pieces from being subjected to efforts beyond their resisting power. This combination constitutes a safety-organ, to preserve the mechanism from any breakage, caused either by concussion or straining work, which a stiff keying could not fail to produce in certain cases. A single wheel or any other working piece being keyed by means of the spring, as just described, and placed as near as possible to the motive power, would be sufficient to prevent such accidents in any machine.

As a specimen of the application of the spring coupling-brake to lifting apparatus, we give in Figs. 5, 6, and 7, three views, to wit: In Fig. 5, an end view, partly in section; in Fig. 6, a horizontal section on the line *x x*, Fig. 5; and in Fig. 7, a vertical section on the line *y y*, Fig. 6, of a winch provided with said brake. It is composed of a cast-iron frame, bearing the shaft A, which is hollow, and is

fitted inwardly with another shaft, H, on which is firmly keyed the cam C. The same shaft H is carrying a hand-crank, *e*. The cam C is free in its movements to a certain extent between the faces of a hollow round plate, I, which is embodied with the shaft A, and in which an aperture cut through the crown allows the cam C to be introduced in the interior. The hollow pulley J, carrying inwardly the spring E, is fitted loose on the hollow shaft A. It is closed on the other side with a round plate, *f*, similarly loose on the same shaft. The catching-bit *d*, carried by one end of the spring, is lodged in a recess cut in the crown of the hollow plate I. The other end of the spring is fastened to the cam C by means of a small chain, *g*, passing over an axle-pin, *h*, made fast to the hollow plate I. The shaft A in an extension carries the nut or pinion *i*, acting upon the links of the chain and cast together with the pulley J.

We will now describe how the apparatus works. By turning the crank round in the direction of the arrow, Fig. 5, the cam C, mounted on the same shaft, catches the knobs of the round plate I, which plate carries the axle-pin *h*, and the latter is driven along by the cam. The plate pushes forward the spring by means of the cog or catching-bit *d*, and the spring carries along the pulley by virtue of its adhesive force, as before explained. The pinion *i* will thereby be revolved and act on the links of the chain, so that the load is raised up. If at any moment the handle is let loose the hollow plate I, held fast by the catch *j*, engaged in the ratchet-wheel *l*, which is keyed fast on the shaft A, remains motionless as well as the spring and pulley, and the latter, being retained by the adhesive force, prevents the load from moving downward. Now, by weighing down on the crank, so as to reverse its movement, the cam acts upon the small chain *g*, and, of course, the end of the spring fastened to it, and the said spring slides a little, as much as is allowed by the notch within which the catching-bit *d* is lodged. If the pressure be continued the other end of the spring yields to the action of the small chain *g*, and comes nearer the end retained by the catching-bit, the spring is contracted and removed from the pulley, which becoming loose, revolves in an inverted direction under the action of the load, which moves downward. It is evident that by weighing more or less strongly on the crank, the spring will allow the pulley to revolve more or less freely, and that by so simple a contrivance one may regulate at pleasure the velocity of the descent. If the crank is left to itself the spring, being at liberty to resume its normal position, will again adhere to the concave side of the pulley, and through its action the load remains motionless.

The important advantages of our self-acting brake will readily be understood with regard to the great simplicity of the working motions, and the great security it affords for the handling of the heaviest loads. The ascending movement being caused by the effect of the adhesion of the spring to the pulley, then if this adhesive force was able to raise the load it will, of course, be able to maintain it in suspension at any period of its ascent. The workman has no ratchet to lift up, no kind of operation to perform in which he could make a mistake; he has only to turn the crank round to cause the load to ascend, to weigh lightly on the same crank in a contrary direction in order to cause the said load to descend; he may, at pleasure, regulate the descending speed and stop it at any moment by only letting go the handle, having no effort to make, no danger to run, since the crank does not revolve when the load moves down, so that he has nothing to preoccupy his mind. The almost instantaneous stoppage which takes place when suddenly letting loose the handle cannot have any hurtful effect on the chain, for the active impulse is employed only to cause the spring to slide till that impulse is annulled by the friction of the latter on the pulley. The apparatus cannot be overloaded, for the spring will slide as soon as the effort for which it was calculated is exceeded, and the pulley will not revolve; consequently if the size of the chain and the organs of the apparatus are proportionate to this effort they cannot be broken by an overload.

We have already stated that during the descent of the load the shaft carrying the pulley of the brake remains motionless as well as the other pieces fitted within the said pulley, which allows of the apparatus being impelled by steam-power by means of a very simple engine with a single cylinder, without any contrivance for reversing the motion applied directly to the frame of the winch, the steam-power being used for raising up the load. The letting down is operated by means of the brake, the engine being stopped; but it will not be necessary specially to describe such an apparatus, since the principle thereof is the same as that of the small winch which has just been mentioned, the only change consisting in the arrangement of the organs for regulating the speed and for tightening the spring—in a word, the details of the mechanism and the size of the pieces, on account of the heavier work it is intended to perform.

Fig. 8 gives a side view of a hand hoisting apparatus of our improved construction, and its connection with hoisting chains and weight. The object of the view is only to show the great simplicity of the apparatus.

Now, there are numerous mechanical contrivances for the tightening of the spring from which to choose, according to requirements; but the system is always the same, whatever the means applied, and it is useless to describe particularly any more of them. For instance, the small chain may be superseded by a short lever fastened to the circular plate, and acted upon by the cam. Wedges can also be used, so arranged that, by causing them to enter inclined

apertures, they drive aside either collar or levers fastened at the ends of the springs, which would be drawn nearer to each other. Many other contrivances, which it is useless to describe, could be employed, even such which will, by the rotative motion itself of the driving-shaft, obtain the gearing and ungearing of the coupling-brake.

Now, it will be also remarked that, contrary to what takes place in the common brakes, the tightening of the said brakes can be made to correspond to the slacking of the spring, so it will not require any effort, unless it is attempted to carry it farther than the limit given by the free expansion of the spring; and, consequently, the tightening will be performed quicker than in common brakes. For the slackening, on the contrary, the resistance of the spring, in such case, would have to be overcome, the said spring always tending to expand. The slackening movement is, necessarily, performed more slowly, which is advantageous. The mechanism can even be arranged so as to have, in some instances, the brake self-tightening. It will always be performed gradually, as well as the slackening, and without any concussion.

In the various applications heretofore described for causing the spring to expand or be contracted we only throw in or out of gear a loose piece in order to make it connect with, or independent of, the driving-shaft. Consequently, this system may be employed for any kind of gearing. An example of its advantageous application would be its use on a propelling-screw for steamboats; but the same result may be obtained, by means of other contrivances, without tightening or slackening the springs. In effect, the said springs can be displaced and brought either from the loose pulley to a drum in connection with the shaft, to annul their action, or from the drum to the loose pulley to obtain, at pleasure, the present gearing.

The total pressure required for the work to be performed may be divided among a certain number of springs, although it is evident that each of them may work independently of the others when introduced into the hollow pulley; and that the throwing in or out of gear will be operated gradually and without the least shock whatever may be the speed of the shaft and the effort to be imparted. This effort can, evidently, be graduated at pleasure by introducing more or fewer of the said springs into the hollow pulley. Besides, each spring can act upon the pulley only after its insertion; consequently, the moving pieces must pass from rest to motion by insensible degrees, and with the utmost gentleness. The throwing in or out of gear can also be obtained without removing the springs from the interior of the pulley, and without binding or contracting them, by contriving that the tooth or catching-bit which carries them on be removed, or leave them free when it is required to throw out of gear.

Many other contrivances could also be employed to obtain the same result of annulling or re-establishing at pleasure the action of the springs on the hollow pulley or drum; but whatever the means employed, it will always be a combination of mechanical organs already in use, which have nothing to do with the principle of our invention—the spring gearing and brake—and it is, therefore, useless to dwell any longer on this subject.

The sundry applications, which we have summarily expounded, seem to us sufficient to convey to the mind an idea of the advantages to be obtained by the use of our gearing and brake system. It would be too long to enumerate the various manufactures in which it could be applied. We will only point out some of the most general applications, besides those already mentioned. First, as a means of preventing the hirer of motive power from taking more of the power than he is entitled to take. This is easily accomplished by using one of our improved pulleys as a driving-pulley, the driving power whereof has been previously established and recorded. If, for example, it is desirable to supply a shop with ten-horse motive power from a line-shaft having, say, one hundred horse-power, we take one of our improved pulleys, which has been previously adjusted so that the springs will slide whenever a force of more than ten-horse power is applied to its periphery, and we place such pulley upon the shaft of the shop to which we wish to communicate ten-horse power from the main shaft. It is obvious that no more power than ten-horse power can, under any circumstances, be taken from the main supply-shaft, because the pulley aforesaid has been graduated to deliver that amount of power, and no more. By the employment of our improvements, substantially as described, we are enabled to measure and distribute motive power with great convenience and accuracy. Second, as an elastic keying in dredging-machines, rolling-mills, engines of all kinds used for working metals, and generally in all engines or machinery exposed in certain cases to great resistance in the working. Third, as an organ of safety in engines of all kinds to prevent the breaking of pieces through an overcharge of accidental work. Fourth, as a brake in lifting apparatus, in vehicles, and in all cases which require the movement to be stopped or the speed accelerated. Fifth, as a brake in machinery for transmitting motion, and in machines and apparatus advantageously to supersede not only the common clutch or coupling boxes, but also the pulleys and leather bands, the motion being conveyed by means of our spring-gearing through shafts and cog-wheels with simplicity and economy. In a word, our spring gearing and brake is susceptible of a great many useful applications, as well in fixed machines and apparatus as in circulating engines used in manufactures.

We must likewise state that we intend to employ not only springs such as we have described, but also springs of various shapes composed of one or several blades, whether the said springs possess of themselves the required force, or that their own force be increased by adding other springs, as also metallic blades either elastic or not, either straight or of a curved shape.

Our invention having been sufficiently described in its principle, and illustrated by the annexed drawing exhibiting various applications thereof, we declare in conclusion that we do not confine or restrict ourselves to particular forms or shapes of the mechanical contrivances hereinbefore described, so long as the general feature and character of the said invention are preserved.

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

The open band-spring E, applied on the inside of pulleys, spur-wheels, or analogous devices, in connection with a cam-piece, B C, tight on a rotary shaft, as and for the several purposes described.

LÉANDRE MÉGY.
JOSÉ DE ECHEVERRIA.
FELIX BAZAN.

Witnesses:
DOMBZEVILLE, C. E.,
DESJUARQUETS.