Sheet 1, 2 sheets.

E. C. Sanger.

Self-acting Mule

No. 6,670 Patented Jul. 3, 1849.

Fig. 1.

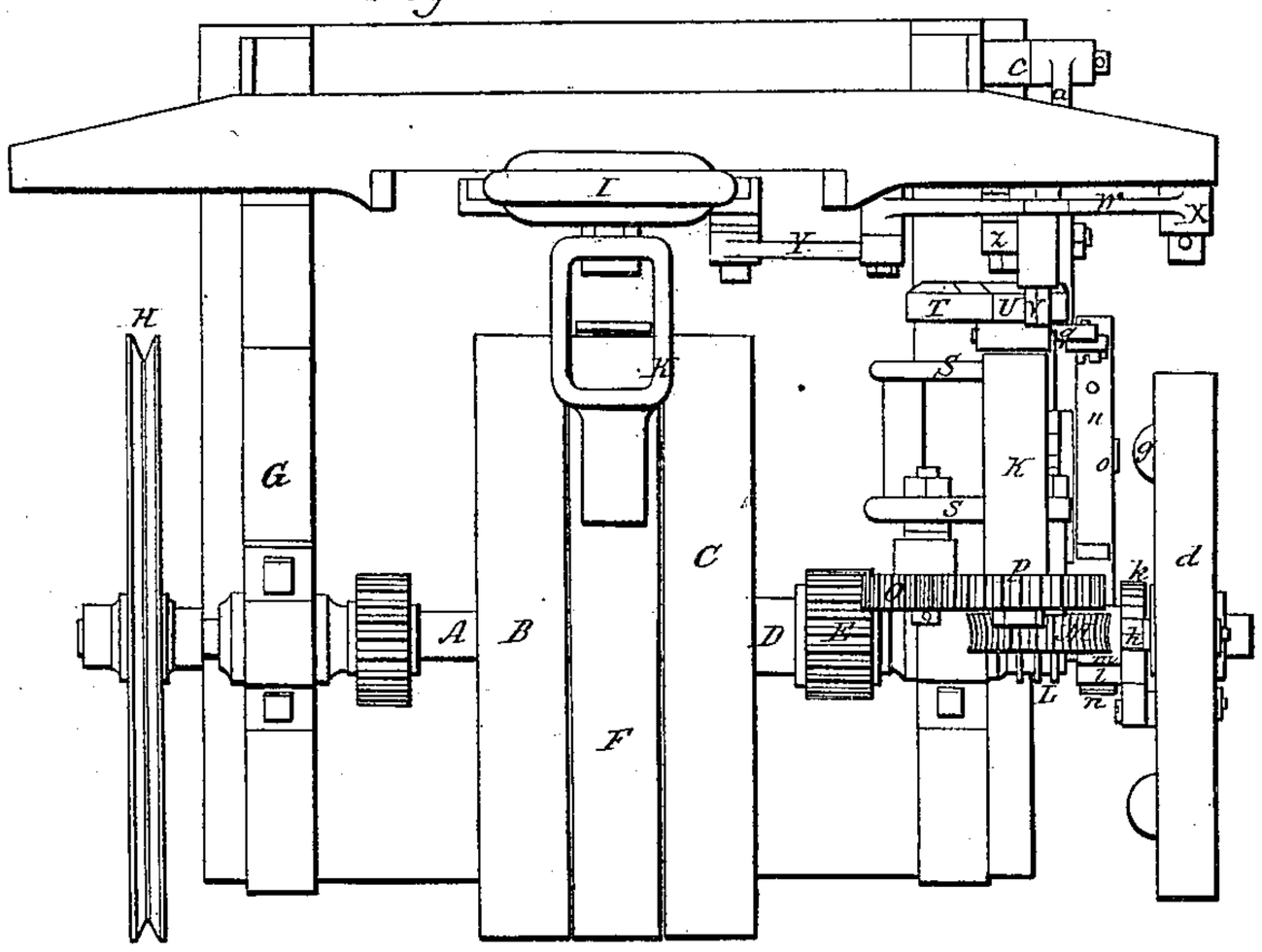
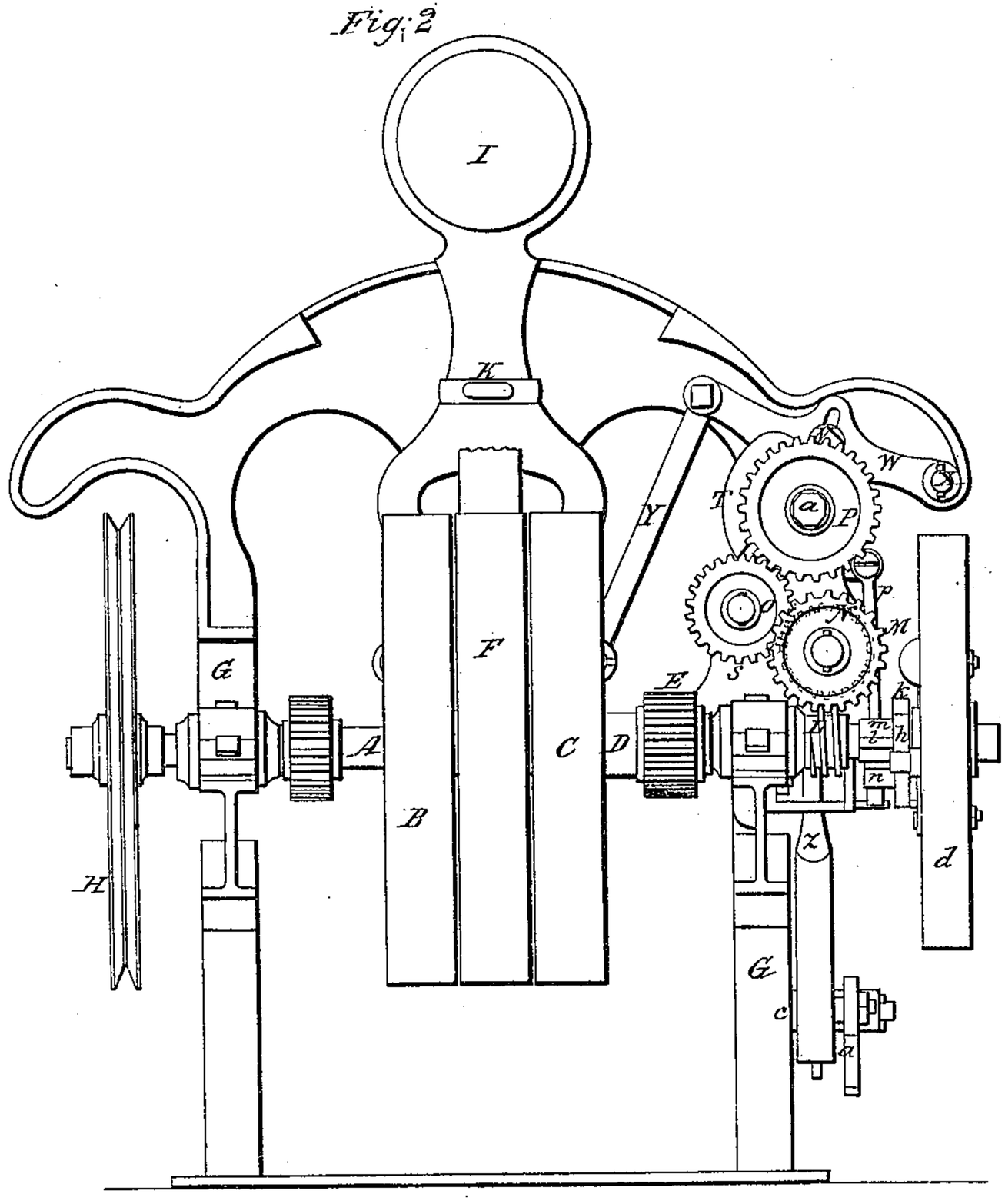


Fig. 2



Sheet 2, 2 Sheets.

E. C. Sanger.

Self-acting Mule

No. 6,570. Patented Jul. 3, 1849.

Fig. 4.

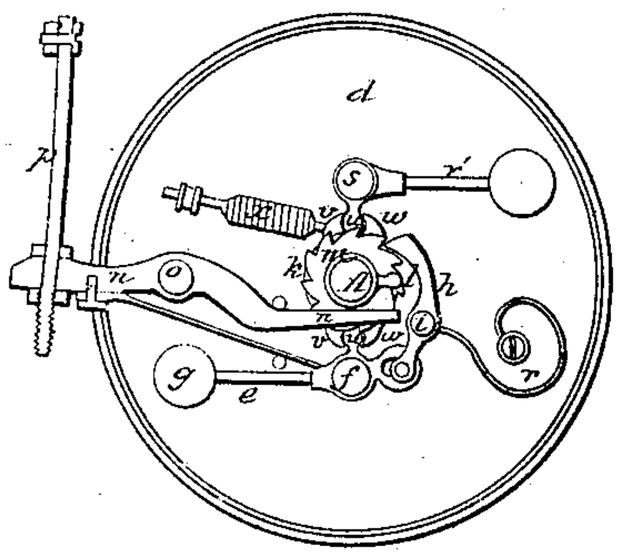


Fig. 5.

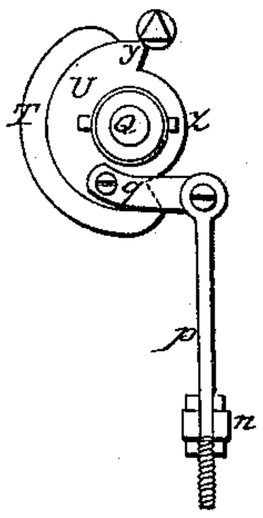


Fig. 3.

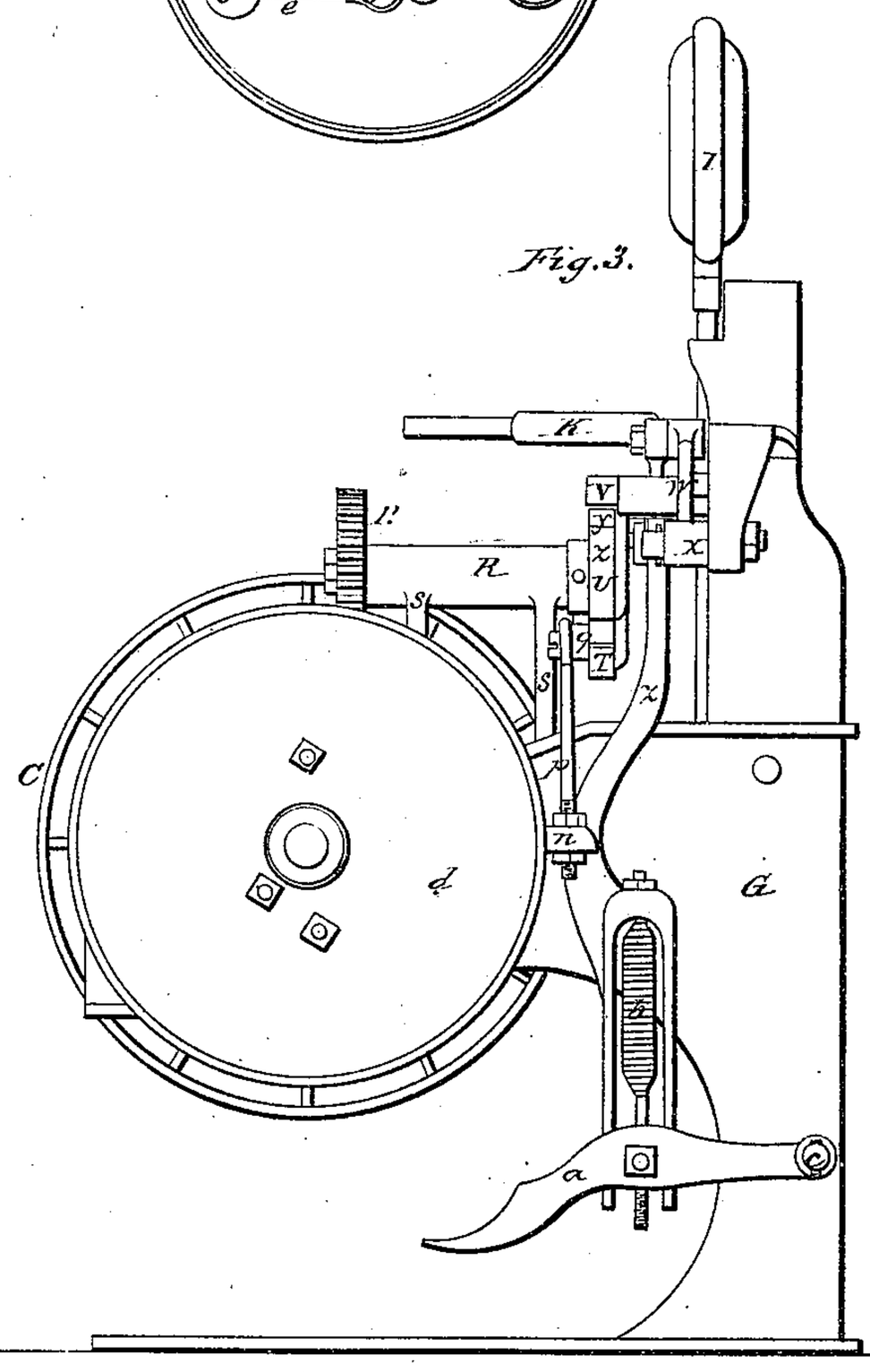


Fig. 7.

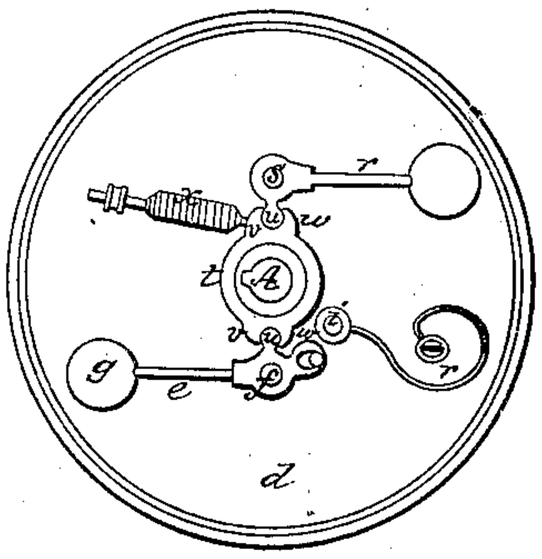
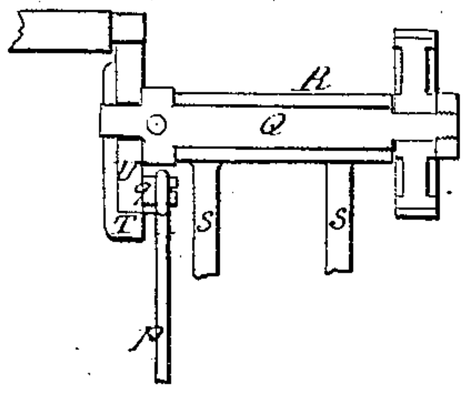


Fig. 6.



UNITED STATES PATENT OFFICE.

E. C. SANGER, OF SALEM, MASSACHUSETTS.

REGULATOR FOR SELF-ACTING MULES.

Specification of Letters Patent No. 6,570, dated July 3, 1849.

To all whom it may concern:

Be it known that I, EBENEZER C. SANGER, of Salem, in the county of Essex and State of Massachusetts, have invented a regulator or improvement in mechanism to be applied to the self-acting mule, and for the purpose of gradually and properly reducing to a certain velocity the speed of the spindles after the mule-carriage has been run out to the extent of its motion and the necessary amount of twist has been put in the yarns previous to the backing-off of the spindles and running in of the carriage; and I do hereby declare that my said invention is fully described and represented in the following specification and accompanying drawings, letters, figures, and references thereof.

Of the said drawings Figure 1, represents a top view of my invention and certain parts of the mule to which it is directly applied. Fig. 2, is a front, and Fig. 3, a side elevation of the above. Fig. 4, is a vertical section of the depressing cam and lever of the regulator, the said view being made to represent an inner side view of the regulator. Fig. 5, is a side view of the twist cam, and the slide which works or turns within it, and which is connected with the lever of the regulator.

In Figs. 1, 2, 3, A, denotes the main shaft of the mule.

B, is the fast pulley or that which drives the mule while the carriage of it is running out, the said pulley being made fast on the driving shaft. C, is a pulley fixed on a short tubular shaft D, which is placed and runs on the driving shaft, and has a toothed pinion or gear E, fixed on it. The said pulley C, is that which drives the mule when the carriage is running in. Between the pulleys B, and C, is a loose pulley F, which is made to run freely on the driving shaft, the three pulleys B, C, and F, being each made of the same diameter.

G, is that part of the main frame of the mule which supports the operative parts. H, is the twist pulley, or that which gives motion to the band—which drives the spindles, for the purpose of twisting the yarn. I, is the weighted shipper, or lever for changing the driving belt from one of the pulleys B, C, and F, to the other as circumstances may require, the said band being made to run through an eye piece K, projecting from the shipper.

L, is a worm or endless screw placed on the driving shaft, the said worm being made to engage with a train of gear wheels M, N, O, P, the wheel N, being shown by dotted lines as directly in rear or by the side of the wheel M. The upper wheel P, is fixed on one end of a shaft Q, (represented in longitudinal section in Fig. 6,) which is supported in a bearing R, sustained in position by arms S, S. On the opposite end of the shaft Q, is the twist cam T, within which the rotary slide U, works or turns, the said slide being made to turn freely on the shaft Q. A small stud V, projecting from the side of a lever W, rests either on the twist cam or its slide, according to circumstances as will be hereinafter explained. The said lever W, turns at one end on a fulcrum or a pin X, while at its other end it is connected with the shipper I, by a connecting rod or link Y, jointed to both.

Z, is a bar which is jointed at its upper end to about the middle part of the lever W, and extends downward, and is connected to a lever *a*, by a spring *b*, one end of which is affixed to the bar Z, and the other end to the lever *a*. The said lever *a*, turns on a fulcrum at *c*, and is depressed at the proper times, by a cam or some other suitable contrivance.

All the above described mechanism is such as is in common use, and to which I have applied my improvement which I shall now particularly describe. Before proceeding however to an explanation of my invention, I will state what is well known, viz: that the twist cam T, and slide U, are ordinarily connected by a clamp screw, which when my invention or regulator is employed is dispensed with.

On one end of the driving shaft is a circular plate or disk *d*, which is firmly fixed to the shaft and revolves with it. On the inner face of this disk a lever *e*, is applied, so as to turn on a fulcrum or pin *f*, projecting from the face of the plate. The said lever has a ball or weight *g*, affixed on its outer end while its inner end is jointed to one arm of a small lever click or pawl *h*, which turns on a fulcrum or pin *i*, projecting from the plate *d*.

The pawl *h*, works in connection with the teeth of a ratchet wheel *k*, which plays or turns freely on the main shaft A, and has a cam *l*, projecting from its side, and from the external surface of a small tubular shaft *m*, which is made to extend from the

ratchet wheel, and toward the worm L, and over one end of a lever *n*, which turns on a fulcrum or pin *o*, and is connected by a rod *p*, and an arm *q*, to the rotary slide U, of the twist cam T, the arm *q*, being made to project from the lower part of the slide as seen in Fig. 5.

The lever pawl or click *h*, is pressed down toward the ratchet wheel by a spring *r*, which is fixed to the pawl and to the disk or plate *d*.

In order to counterbalance any improper centrifugal strain, which might or would be produced by the action of the weighted lever *e*, I employ another and similar lever *r'*, which I place on the opposite side of the main shaft, and made to turn on a fulcrum or pin *s*, projecting from the face of plate *d;* see Fig. 7, which represents a section of the two levers *e*, and *r'*, and the connecting ring *t*; between them; the said section being taken in a plane parallel to the plate *d*.

The said connecting ring *t*, is placed and turns loosely on the main shaft, and between the ratchet wheel *k*, and plate *d*. It is connected with each of the levers *e*, and *r'*, by means of a small arm *u*, which is made to extend from each lever and between two ears *v*, *w*, projecting from the slide ring as seen in Fig. 7. To either the arm *u*, of the lever *r'*, or to the ring *t*, one end of a spring *x*, is attached, the said spring being also attached at its other end to the plate *d*.

While the main shaft is kept in revolution at a velocity which will impart to the spindles a speed above that at which we desire to reduce them, just previous to the performance of the backing off, the centrifugal force generated in the ball or weight of the lever *e*, will so throw said ball in a direction toward the circumference of the plate *d*, as to cause the lever to turn on its fulcrum in such manner as to lift the lever pawl *h*, out of gear with the teeth of the ratchet wheel beneath it. Consequently while it so remains out of gear with them, it can produce no revolution of the ratchet wheel, nor of the cam thereof. As soon however as the speed of the main shaft falls or lessens so as to allow the ball to fall back sufficiently to throw the click or pawl *h*, into gear with the ratchet wheel, the latter will be turned on the shaft, and will so move around the cam *l*, as to carry it against the lever *n*, and depress the end thereof directly under the cam. Such depression of the end of the lever will be attended with a consequent elevation of the opposite end of it. This elevation of the opposite end creates a partial rotation of the slide U; such a one as will cause the stud V, to fall from the part *y*, down to the part of the slide U. When this takes place the shipper I, falls over from a vertical position, into an inclined one and toward the stud V, and so as to carry the driving belt from the loose or middle pulley F, to and upon the pulley C.

While the driving belt is on the pulley B, the slide U, of the twist cam T, is stationary, the twist cam in motion or revolution, and the stud V, is resting on the periphery of the twist cam. When the shipper is thrown up, by the machinery of the mule which actuates the lever *a*, the driving belt is moved from the fast pulley to the loose one, the twist machinery being still in motion under the momentum generated in it. This momentum gradually decreases until the velocity of the spindles is reduced to the speed which they are to have when the driving belt is shifted from the loose pulley to and upon the third pulley, or that which produces the running in of the carriage. And while the momentum is being reduced the stud V, rests on the periphery of the slide U, which as soon as the reduction has been effected is put in motion so as to permit the stud to fall from the extremity *y*, down upon the part *z*, of the slide as before mentioned. Thus it will be seen that the stud V, is suffered to remain on the slide, while the momentum is being reduced, and does not fall from it while the momentum is greatest as it does in the usual way heretofore practiced.

Having thus described my invention, that which I claim as new is—

1. The regulator constructed and made to operate substantially as above described; the same consisting of the combination of the weighted centrifugal lever *e*, the lever pawl or click *h*, the ratchet wheel *k*, its cam *l*, and the lever *n*, applied together and to the main driving shaft A, and the slide U, of the twist cam T, essentially as above specified.

2. And as auxiliary to the above I claim, the second centrifugal weighted lever *r'*, and the ring *t*, and retractive spring in combination therewith, the same being for the purpose above explained.

In testimony whereof I have hereto set my signature this fifth day of Feby. A. D. 1849.

EBENEZER C. SANGER.

Witnesses:

GEO. O. HARRIS,

F. M. CREAMER.