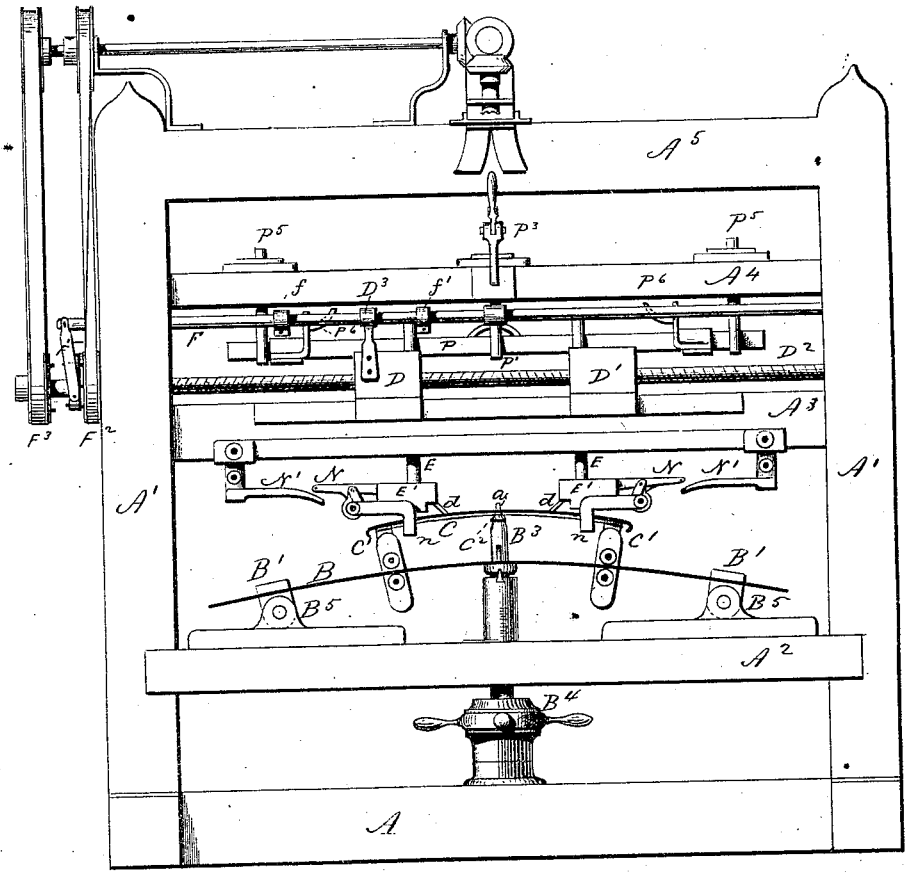
3 Sheets--Sheet 1.

# T. B. De FOREST.

## Machine for Setting Carriage-Springs.

No. 162,040. Patented April 13, 1875.

*fig. 1.*

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## Machine for Setting Carriage-Springs.

No. 162,040. Patented April 13, 1875.

fig. 2

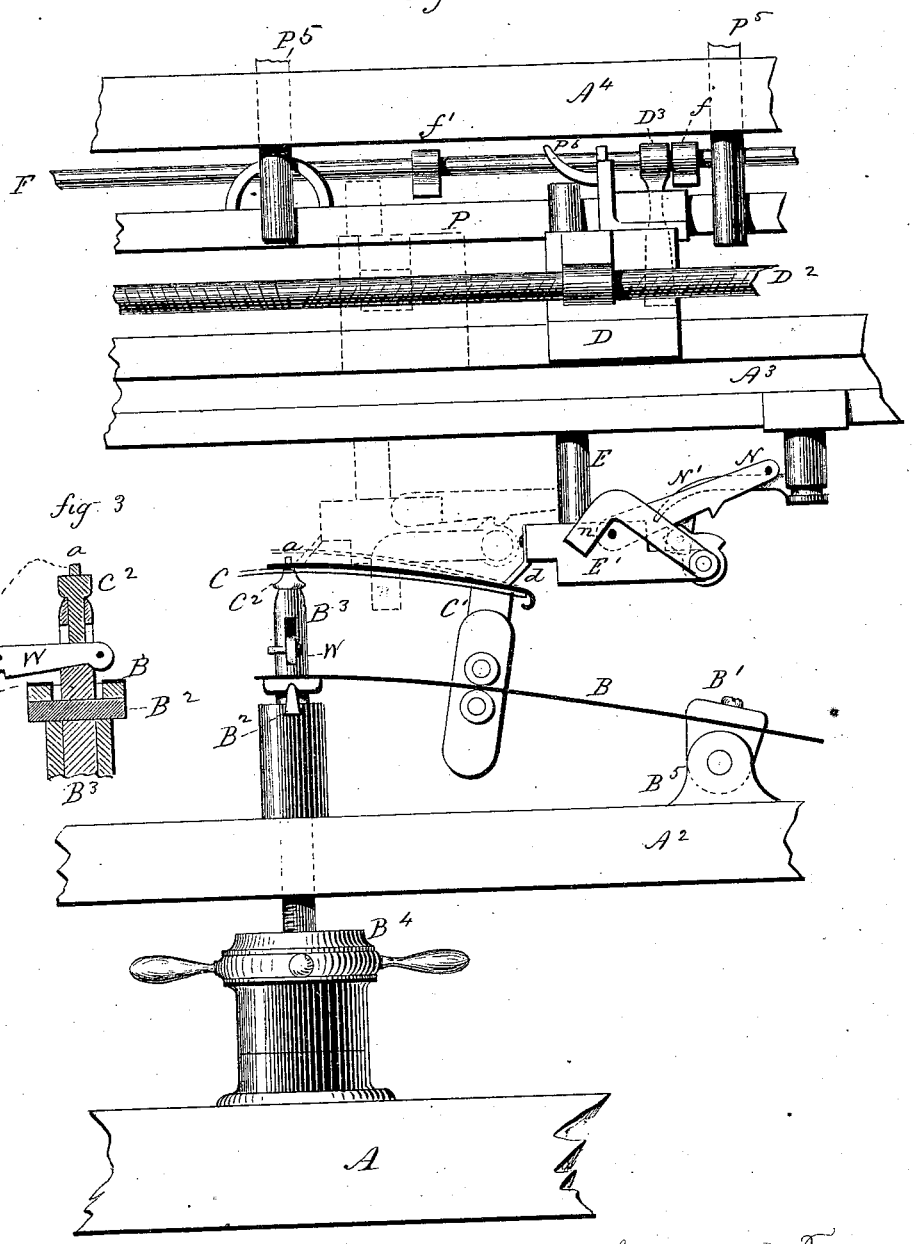


fig. 3




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## Machine for Setting Carriage-Springs.

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fig. 6

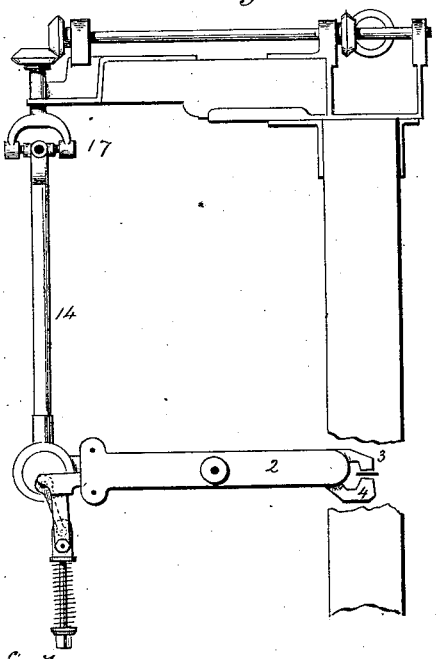


fig. 4

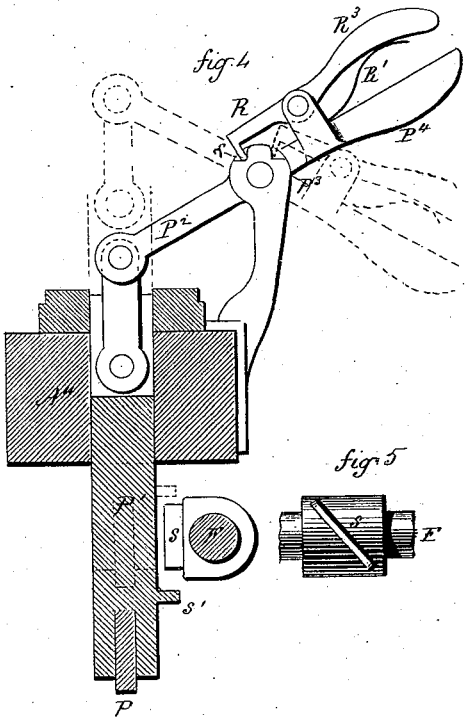


fig. 5




fig. 7

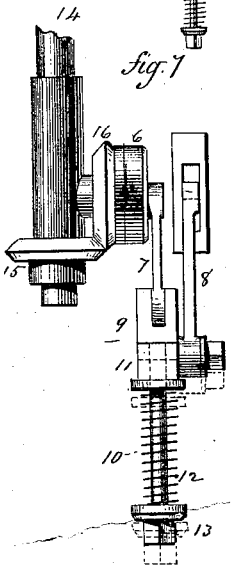


fig. 8

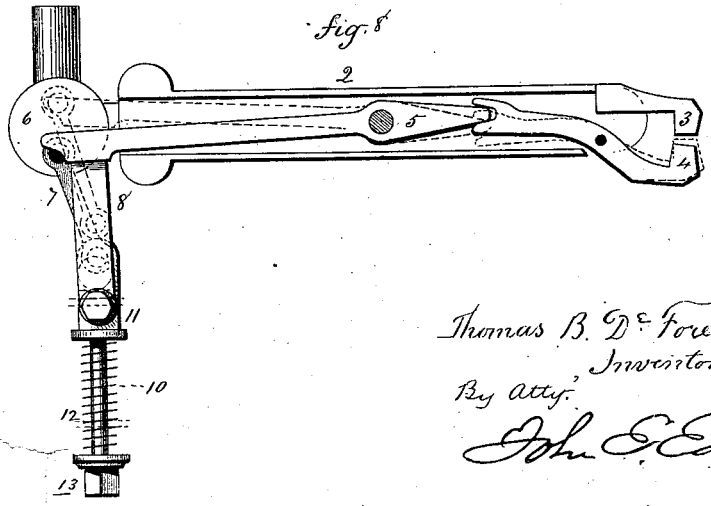


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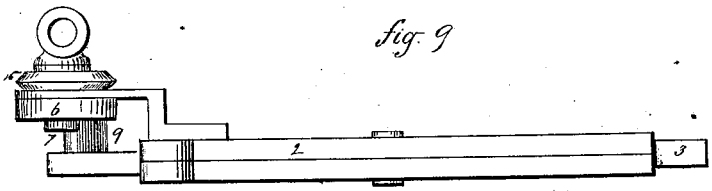
fig. 9



# UNITED STATES PATENT OFFICE.

THOMAS B. DE FOREST, OF BIRMINGHAM, CONNECTICUT.

## IMPROVEMENT IN MACHINES FOR SETTING CARRIAGE-SPRINGS

Specification forming part of Letters Patent No. **162,040**, dated April 13, 1875; application filed January 7, 1875.

*To all whom it may concern:*

Be it known that I, THOMAS B. DE FOREST, of Birmingham, in the county of New Haven and State of Connecticut, have invented a new Improvement in Machine for Setting Carriage-Springs; and I do hereby declare the following, when taken in connection with the accompanying drawings and the letters of reference marked thereon, to be a full, clear, and exact description of the same, and which said drawings constitute part of this specification, and represent, in—

Figure 1, front view; Fig. 2, partial rear view; Figs. 3, 4, 5, 6, 7, 8, 9, detached views.

This invention relates to an improvement in machines for performing that part of the work on carriage-springs technically known as "setting"—that is, giving to the back and leaves the requisite curvature.

The process of setting has usually been done by two men, who take the heated part of the spring and bend it over a thin former of about the same width as the spring, and clamp the ends firmly thereon; then each man (one on each side) takes a pair of tongs and continually bites or pinches the spring and former from end to end until the spring is completely set down upon the former. This is a very laborious operation, and necessarily slow, as must be all hand labor.

Numerous devices have been contrived to reduce this labor, such as rolling or pressing the spring mechanically onto the former, but unsuccessfully, as the spring cannot by such devices be properly set.

The object of this invention is to construct a machine which shall mechanically perform the work substantially as it has heretofore been well done by hand.

The invention consists, principally, in automatically-operated pinchers, and in details of construction, as more fully hereinafter described, whereby the spring is bent and secured upon its former, and such former made adjustable for various sets, or to put in the "gather"—that is, the extra curvature which is required to be given to the leaves more than is given to the backs or principal leaves.

A is the bed or base of the machine, from which rise two uprights, $A^1$, connected by beams $A^2$ $A^3$ $A^4$ $A^5$. These parts constitute the frame which supports the operative parts of the machine. B is an elastic plate or bar, or pair of bars, laid in the same plane parallel to each other, each end secured in a head, $B^1$, and the center resting upon a bar, $B^2$, projecting from a vertical spindle, $B^3$. This spindle extends downward, and its lower end is screw-threaded to fit a nut, $B^4$, so that by turning the nut $B^4$ to throw up the spindle the centers of the bars B will be raised accordingly, or vice versa. The ends of the bars B being held, and the bars elastic, the raising of the centers curves the bars accordingly. To allow of such curvature in the bars B, the heads $B^1$ are pivoted on slides $B^5$, which move toward or from the spindle as the centers are raised or lowered. By this means the radius of the circle of the bars may be diminished or increased, as may be desired, the curvature of the bars being that desired for the set or completed spring. The distance between the two heads should be more than the length of the longest spring to be produced, in order that the same machine may be used for all sizes of springs.

From these bars the former C is supported—its ends in heads $C^1$, and its center on the end of an auxiliary spindle, $C^2$, in the end of the spindle $B^3$; hence, as the centers of the bars are raised, the center of the former will be raised to the same extent. The ends of the former, however, will throw up only to the extent that the points in the bars B, where the heads $C^1$ are connected, are raised, thus giving to the former C the same variation of curvature as that of the bars B. The former consists of a thin elastic bar, substantially such as used in hand setting. A stud, *a*, on the end of the spindle $C^2$ projects up through the former to enter the perforation in the center of the back or leaves, they all being perforated at the center as a means for securing them together in the completed spring. This former is used for setting the back—that is, the inner part or leaf of the spring, the ends of which terminate in the head. The other parts or layers of the spring are called leaves,

and are successively shortened. The length of the former is so much less than that of the back that the heads will project beyond the ends of the former, as seen in Figs. 1 and 2. The properly-heated back is placed on the former over the center stud *a*, and is then bent down onto the former, as denoted in solid black, Figs. 1 and 2, in the following manner: On the beam $A^3$ two carriages, D $D^1$, are arranged to slide longitudinally on the beam toward and from the center, this movement being produced by a leading-screw, $D^2$, the thread of which is right hand one way from the center, and left hand the other way. With these respective portions of this screw the carriages D $D^1$ engage, so that, by turning the screw $D^2$ in one direction, the carriages will be drawn toward each other, and in the other direction they will be forced from each other. In each of these carriages is a vertical spindle, E, which have a free vertical movement, but travel with their respective carriages. These spindles extend down below the beam $A^3$, their lower ends terminating in heads E′. Each of these heads is provided with a finger, *d*, which, when the heads are brought to the center, as in broken lines, Fig. 2, will bear upon the upper surface of the back. Then the two heads are moved away from the center, dragging the finger *d* over the surface of the heated back, the weight of the head and spindle and counter-weight or spring, if necessary, forcing or bending the back down onto the former until near the end, as denoted in Fig. 2. Here the further movement of the heads E′ is arrested by disconnecting the power which drives the screw $D^2$. This arrest is produced through a shifting-bar, F, which extends across the machine, parallel with the leading-screw, into connection with the clutch-lever $F^1$, so that, as the bar F is thrown one way, the clutch will engage the pulley $F^2$ on the screw, or in the other direction will, in like manner, engage the other pulley, $F^3$, or, in an intermediate position, engage with neither. The pulleys being driven in opposite directions, and the clutch splined to the screw, the screw will be driven in the direction of the pulley, with which it is thus engaged in substantially the usual manner for obtaining similar reverse motion in other machines. On the bar F are two stops, *f f′*, adjustably fixed to the bar, and from one of the carriages D an arm, $D^3$, extends up, so as to run in the line of the stops *f f′*, preferably encircling the rod, as shown. These stops are adjusted, one, *f′*, where the arm $D^3$ will strike it just before the carriage reaches its most central position, and so that the completion of the movement of the carriage will force the clutch out of connection with the pulley then driving the screw. The other stop, *f*, is set where the arm $D^3$ will strike, and in like manner move it, as the carriage completes its most distant movement from the center.

In order to keep the "back" parallel with the former during the bending-down operation there is hung to each head a pair of fingers, *n*, one upon each side, so as to lie down beside the former, as seen in Fig. 1, and in broken lines, Fig. 2, while the carriage is moving, and thereby prevent the back from moving out of line with the former, but so that when the bending is complete the fingers may be turned up, as seen in Fig. 2. This turning up is necessitated in order to conveniently remove the back from the former, and such lifting is automatically done by an arm, N, hung to each head, E′, and in connection with the fingers, so that raising the free end of the arm N, as in Fig. 2, raises the fingers *n*. As the heads E′ approach their extreme outward position, the arms N pass up on stationary inclines N′, causing the arms to rise and turn up the fingers, as seen in Fig. 2. These inclines N′ are made adjustable on the frame relative to the stopping-point of the heads E′. The back is now upon the former in substantially the same condition as in the usual hand process, and may be treated and set with the hand pinchers or tongs in the usual manner, or by the automatic pinchers hereinafter described. After the back has been set the heads E′ require to be raised. For this purpose a horizontal bar, P, is employed, passing through both spindles E, or is connected with them, but so as to allow said spindles to move longitudinally. This bar is centrally attached to a spindle, $P^1$, extending up through the beam $A^4$, and there connected to one arm, $P^2$, of a lever hung upon a fulcrum, $P^3$, (see Fig. 4,) the other arm, $P^4$, forming a handle by which to turn the lever. By drawing down the handle the bar P is raised, as denoted in broken lines, Fig. 4, and this raises the spindles E and the parts attached thereto clear from the former, to allow the introduction or removal of a back.

The spindles E are slotted for the passage of the bar P through them, the slots being longer than the depth of the bar, so as to allow free vertical movement to the spindles; but the slots are of such length that when the bar is raised it will lift the fingers *d* clear from the highest point of the former. The bar has additional vertical guides $P^5$, as seen in Figs. 1 and 2. For the purpose of locking the fingers *d* down upon the ends of the back, arms $P^6$ are adjustably attached to the bar P. Said arms incline upward and project toward the center. One of these arms is provided at each end of the bar, and they are set in such position on the bar that as the spindles E approach their extreme outward movement they will each pass beneath one of the arms $P^6$, as seen in Fig. 2, and thus be forced hard down and locked in the position of holding the end of the back. If an increased power, more than the weight of the spindle E and connections, be required, the arms $P^6$ may extend

toward the center, and be curved the same as the former. In such case the upper end of the spindles E would follow the arms $P^6$, and be thereby forced down to cause the bending of the back.

To lock the bar P down, so that the lifting tendency of the spindles E, as they pass beneath the arms $P^6$, may not raise the bar, a pawl, R, is hung to the lever $P^2$, as seen in Fig. 4, which, when the bar is down, catches over a shoulder, *r*, on the lever-support, actuated so to do by a spring, $R^1$, between the handle $R^3$ of the pawl and the handle $P^4$ of the lever. To raise the bar P, the operator grasps the two handles $P^4$ $R^3$, and, pressing down the pawl-handle $R^3$, releases the lever, and allows the handle to be pulled down to raise the bar and its connections, and when so raised the pawl R falls upon the opposite side of the shoulder *r*, and holds the bar and its connection suspended at their highest elevation until released by a similar operation upon the pawl R. The bar P is not lowered until a back has been placed upon the former, and when the bar is thus lowered the fingers *d* are ready to be drawn out to bend the back. In order, therefore, to make connection between the leading-screw and the power, an incline, S, (see Figs. 4 and 5,) is arranged on the shifting-rod F, in the path of a stud, S′, on the spindle $P^1$, when the clutch is in its midway position. When the bar is let down the stud S′ (then above the incline) strikes the incline S on the rod F, and, passing down over the incline, gives to the rod a longitudinal movement sufficient to engage the clutch with the pulley, to turn the screw and draw outward the fingers *d*. So soon as the fingers *d* have reached their extreme outward position the rod F is moved to disconnect the power, as before described, which will bring the incline S again into the path of the stud S′, but above it. Before the fingers can again commence their work they must be brought to this central position. This is accomplished after the bar P is drawn up. In drawing up the bar the stud S′ strikes the opposite side of the incline and forces the shifting-bar in the opposite direction, thereby engaging the clutch with the reverse pulley, and when the fingers *d* approach their extreme central position the power is disconnected, as before described. When all the backs desired have been set the former is removed and a back substituted in its place on which to set the leaves, as in the usual hand process. The leaves are set upon a shorter radius than the backs, giving to them what is technically called the "gather," in order that they may be somewhat strained when all are secured together on the back. To give this extra curvature to the back when that is substituted for the former, the auxiliary spindle $C^2$ (see Fig. 3) is set into the end of the spindle $B^3$, its lower end resting upon a wedge, W. This wedge passes through a slot in the spindle $B^3$, so that by forcing the wedge inward the spindle will be raised according to the incline, and this will force up the center of the back or former without changing the position of the ends, and therefore shorten the radius of the curvature of the former to that extent.

The original former may be used instead of the back, and put the gathers into that in the manner described; but it is found advantageous to substitute the back for the former.

In the machine, as thus far described, the parts of the spring—back or leaf, as the case may be—are mechanically arranged, bent, and held upon the former preparatory to setting, and in a far more perfect and expeditious manner than can be done by the old hand process, and having been thus perfectly arranged, the spring may be set by the use of the hand-pinchers, if desired; but to lessen the labor of setting, and yet preserve all the advantages of the pinchers set, I have devised automatic pinchers, which I will now proceed to describe by reference to Figs. 6, 7, 8, and 9.

2 is a hollow case, at the forward end of which is a fixed jaw, 3, and a hinged jaw, 4, these two jaws corresponding to the two jaws of a pair of setting-pinchers. The case 2 is made of a size to be conveniently held in the hand of the operator.

In order to multiply the power of the pinchers, a compound lever is employed, as seen in Fig. 8, the second lever, 5, working in connection with the hinged jaw 4, so that by vibrating the lever 5 the jaw will be closed and opened accordingly. This vibration of the lever 5 is imparted by a crank, 6, hung in a bearing in the end of the case by a connecting-rod, 7, from the crank-pin to a joint on the rigid arm 8 from the lever 5. Each revolution of the crank imparts closing and opening movement to the hinged jaw 4. The closing of the jaw 4 would always be to the same point, but for some provision to the contrary, necessitated by slight variation in the parts of a spring being operated upon. To accommodate this variation, as well as to adjust the power of the pinch, the connecting-rod 7 is jointed to a head, 9, from which a spindle, 10, extends downward, and on this spindle is a slide, 11, to which the arm 8 is jointed, and on the spindle 10, beneath this slide 11, a spring, 12, is arranged, said spring being adjusted by a nut, 13. The jaws are arranged so as to naturally close very nearly or quite together; then, if they be closed upon something which will prevent their coming so close together, the head 11 will stand, while the crank 6 goes on. This will draw the spindle 10 up through the head to the extent the head 11 is held back, the spring 12 bearing against the head 11, to hold and make the pressure of the jaw. The force of the pressure of the jaw in closing is, therefore, determined by the spring 12, and this may be adjusted by compressing the

spring more or less with the nut 13. Such a pair of jaws is used upon both sides of the spring, the operators taking each one pair, and holding them onto the spring and former, as seen in Fig. 6. Power is applied to rotate the crank to rapidly open and close the pinchers upon the spring and former, the operators moving the pinchers along the surface of the spring, in the usual manner, until the spring is completely set.

To thus operate the pinchers, the crank 6 is driven by a shaft, 14, turning a bevel-gear, 15, working in a corresponding gear, 16, on the crank-shaft, and the shaft 14 is driven by other gearing, a universal joint, 17, of some character being interposed to allow of the free movement of the case 2 in the hands of the operators. It may be in connection with the driving-shaft on the machine, as shown, or otherwise. Pinchers thus constructed and operating may be employed in place of the hand-pinchers, in connection with the common former and devices for holding the spring, and also for other purposes where such automatic pinchers are useful.

By the use of these automatic pinchers much more rapid and effective pinching is accomplished, and without tax upon the muscle of the operator, enabling him to very greatly increase the amount of work in a given time.

Having thus fully described the construction and operation of my invention, what I claim as new and useful, and desire to secure by Letters Patent, is—

1. The combination of the elastic bar or bars B, secured at both ends, the heads $C^1$, for holding the ends of the former, and the central adjusting-spindle $B^3$, substantially as described.

2. The combination of a former, supported at both ends, the central adjusting-spindle $B^3$, and the auxiliary adjusting-spindle $C^2$, substantially as and for the purpose specified.

3. In combination with a former to support the part of the spring to be set, the fingers *d*, having a reciprocating movement from the center to bend the part of the spring to be set down upon the former, substantially as described.

4. The combination of the former, the fingers *d*, the spindles E, and the locking-arms $P^6$, to hold the said fingers down upon the spring at its extremes, substantially as described.

5. The combination of the carriages D $D^1$, the spindles E, each carrying one of the fingers *d*, the said fingers having a vertical movement independent of said carriages, and the right and left hand leading-screws $D^2$, substantially as described.

6. The combination of the former, the fingers *d*, the spindles E, the lifting-bar P, and lever $P^2$, whereby both fingers are simultaneously raised or lowered, substantially as described.

7. The combination of the former, the fingers *d*, the spindles E, the lifting-bar P, lever $P^2$, and pawl R, substantially as and for the purpose described.

8. The combination of the fingers *d*, the spindles E, the lifting-bar P, and the incline S on the shifting-bar F, substantially as described.

9. The combination of a former, the fingers *d*, and the side or guiding fingers *n*, substantially as described.

10. The combination of a former, the fingers *d*, side fingers *n*, and the stationary inclines N′, for automatically raising the side fingers *n*, substantially as described.

11. The herein-described automatic pincher, consisting of a pair of jaws, one or both of which have a reciprocating movement, combined with a mechanism, substantially such as described, for imparting automatically such reciprocating movement to the said jaw or jaws.

12. In combination with a former for setting carriage-springs, automatic pinchers, substantially such as described, for giving the set to the spring, substantially as specified.

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