G. P. THOMAS.

SPACING TABLE MECHANISM.

APPLICATION FILED MAY 27, 1914.

1,179,475.

Patented Apr. 18, 1916.

4 SHEETS—SHEET 1.

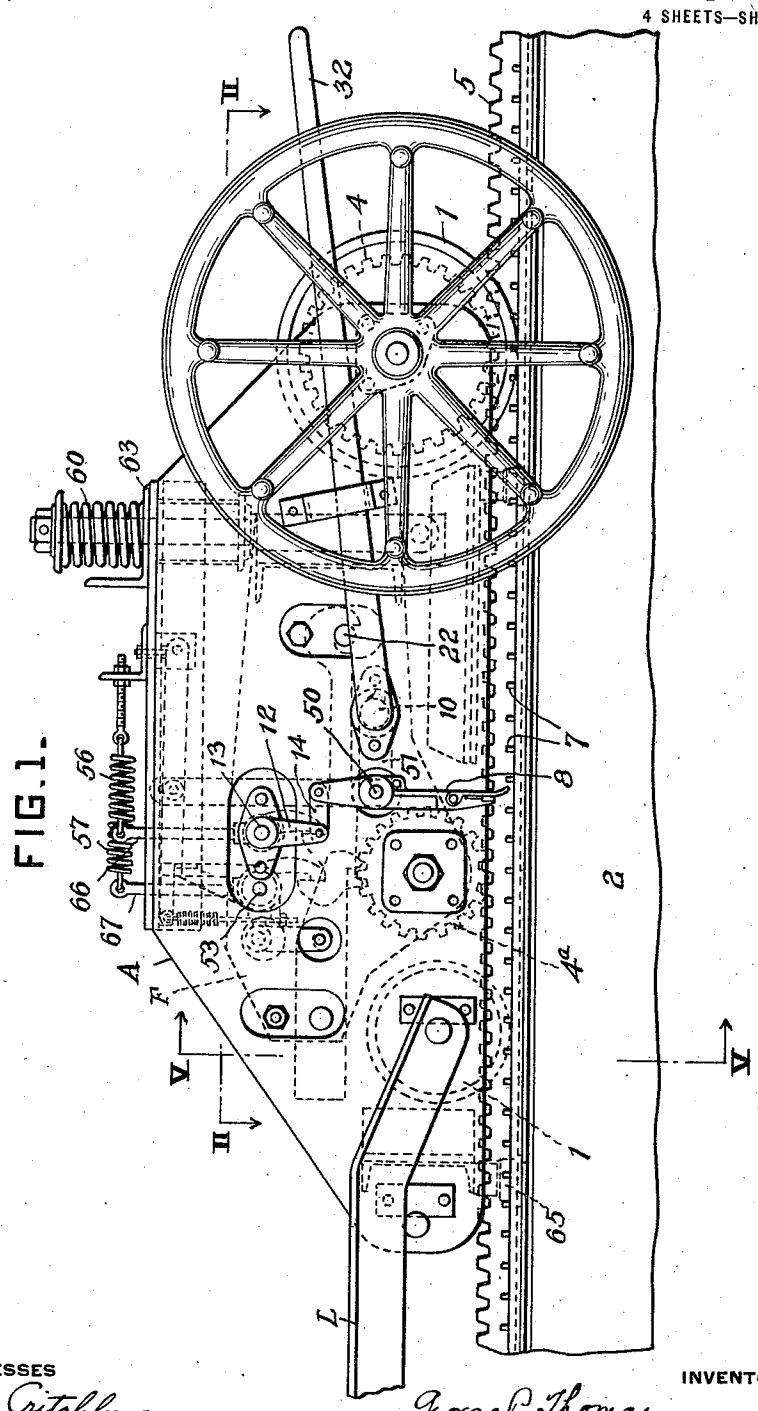


FIG. 1.

WITNESSES

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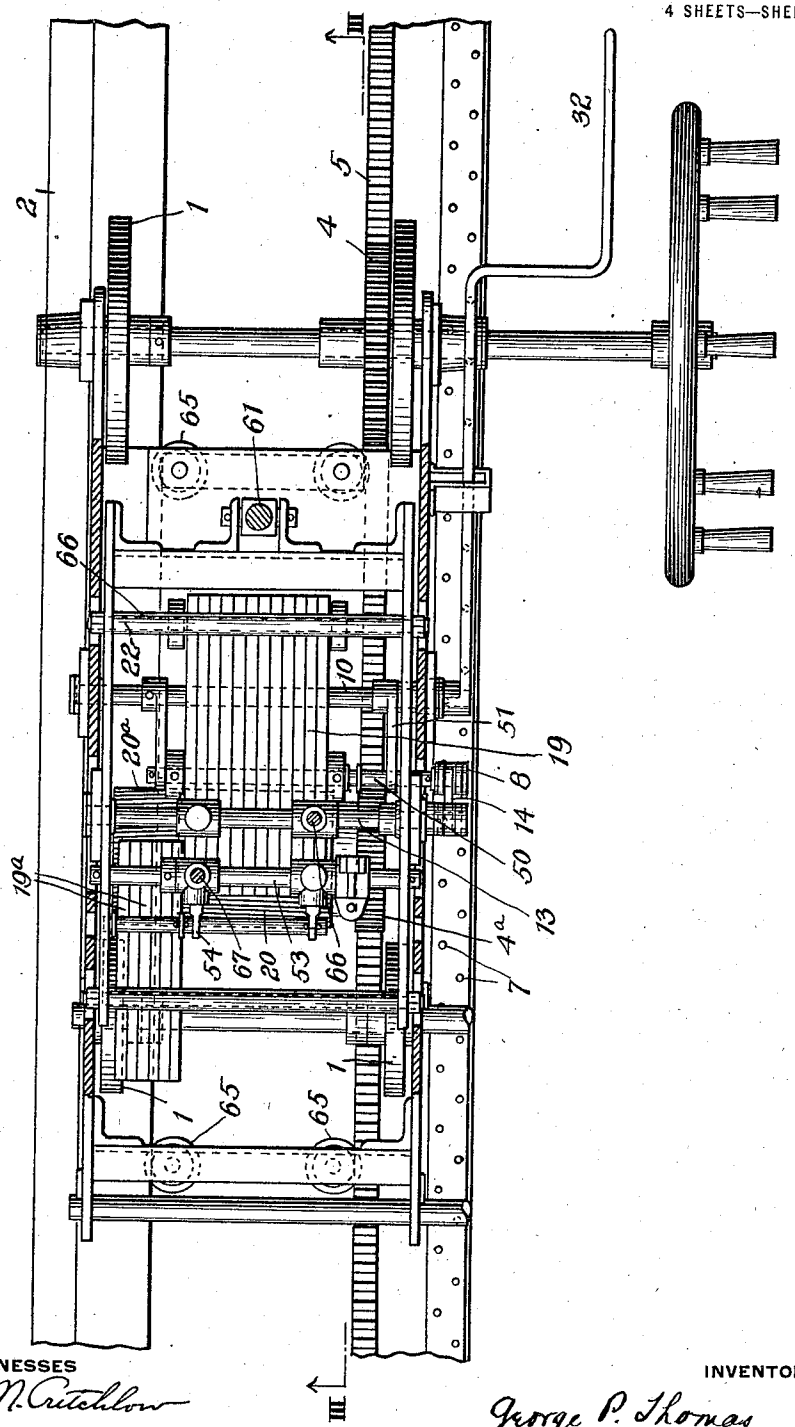


FIG. 2.

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4 SHEETS—SHEET 3.

FIG. 3.

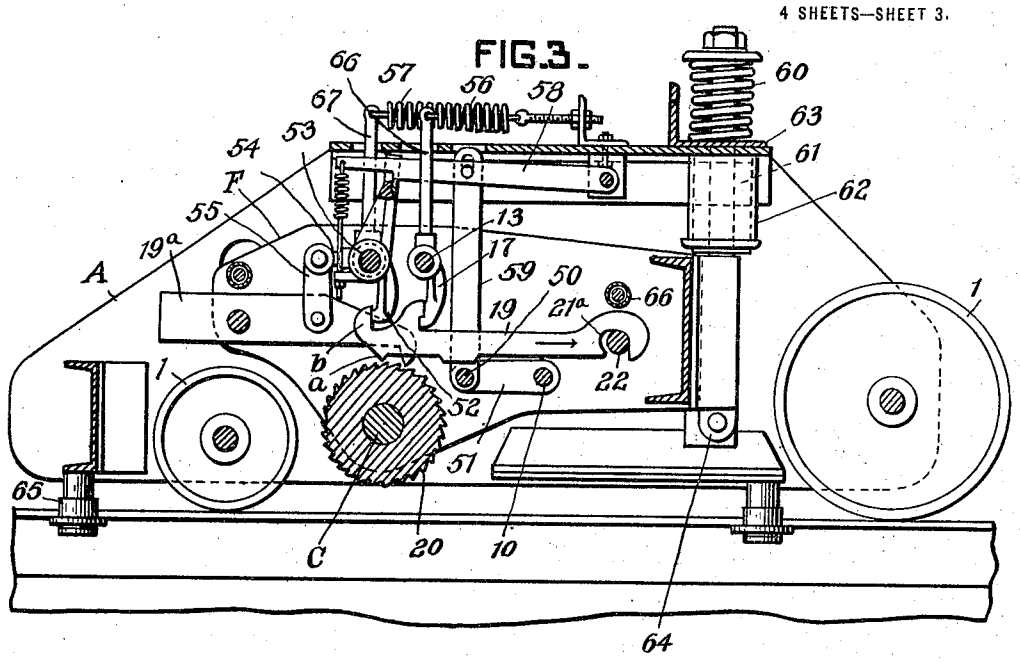
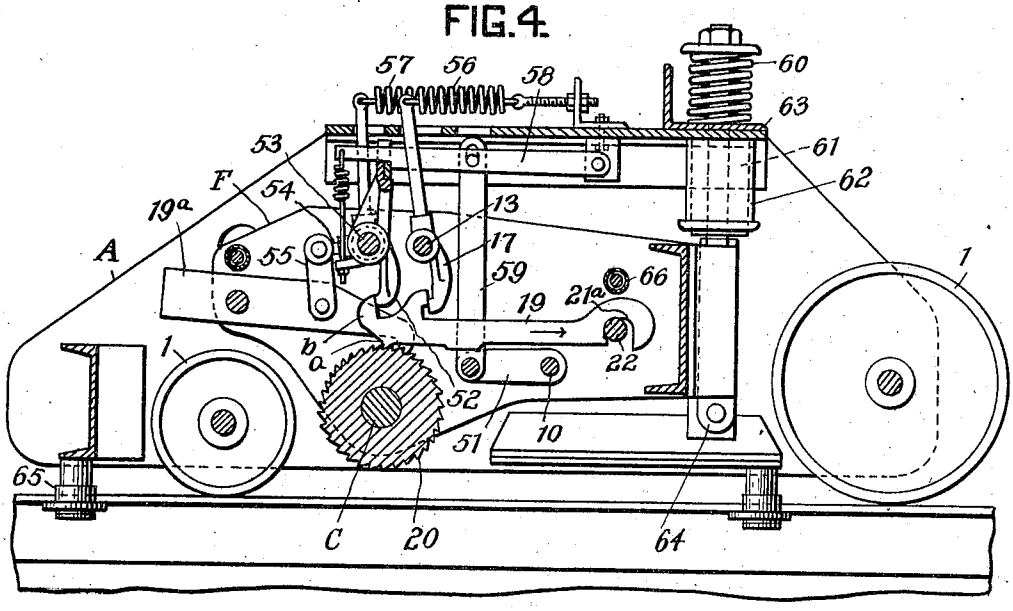


FIG. 4.



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SPACING TABLE MECHANISM.

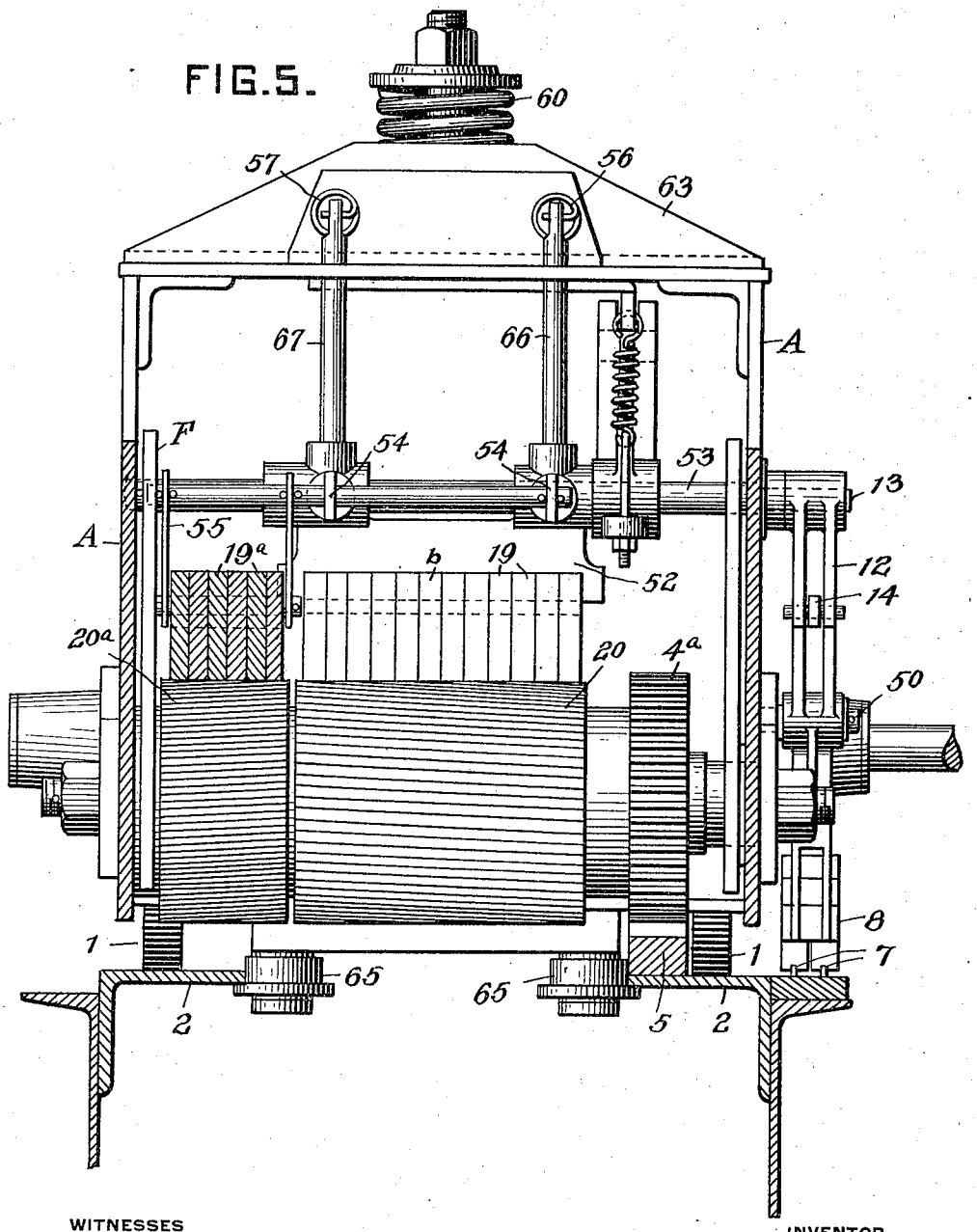
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4 SHEETS—SHEET 4.

FIG. 5.



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UNITED STATES PATENT OFFICE.

GEORGE PAUL THOMAS, OF GLENSHAW, PENNSYLVANIA.

SPACING-TABLE MECHANISM.

1,179,475. Specification of Letters Patent. Patented Apr. 18, 1916.

Application filed May 27, 1914. Serial No. 841,334.

To all whom it may concern:

Be it known that I, GEORGE PAUL THOMAS, residing at Glenshaw, in the county of Allegheny and State of Pennsylvania, a citizen of the United States, have invented or discovered certain new and useful Improvements in Spacing-Table Mechanism, of which improvements the following is a specification.

My invention relates to improvements in spacing-tables, and the object in view is this: by nice adaptation of means to end, to improve the machine in matters of accuracy and speed.

A spacing-table is a mechanism commonly employed in connection with machinery for punching rivet-holes in structural steel; it moves intermittently, during the time interval between successive operations of the punch, to shift the work through desired and predetermined space intervals and bring it to rest in proper successive positions; so that rivet-holes in the finished work shall succeed one another at the desired intervals. The spacing-table consists essentially of a stationary part—a bed or support, which is the "table" proper; and a moving part called the "carriage" which travels upon the table, and which engaging the work carries it forward and brings it to rest, as the carriage itself alternately moves and stops. The properly regulated movement and stopping of the carriage then affords a corresponding properly regulated movement and stopping of the work. I have said of this spacing-table mechanism, that it is commonly employed in connection with machinery for punching rivet-holes in structural steel; it will be understood that this specific case is mentioned here by way of illustration, and not by way of limitation: the mechanism may be used to advantage in machinery for punching rivet-holes in boiler-plates, in punching paper, in cutting gains in wooden car-sills—and, generally, wherever a piece of work of any considerable extent is to be acted on by a tool at a number of points separated at specific intervals. The conditions of punching in the structural-steel art require a machine readily adaptable to one job and another, to afford a punching of rivet-holes which may succeed one another at regular or at irregular intervals and in which the intervals between successive holes may be of any length desired (within the capacity of the machine) and may follow one another in any order of succession.

The machine which I am about to describe is one which has a minimum interval of movement, and in the use of which the distance between rivet-holes may be predetermined in multiples of that minimum distance; the minimum is so small that, taken with the precision of the machine in its operation, the resulting spacing of the rivet-holes will satisfy any specification, within the limits of permissible variation.

In an earlier patent of mine, No. 908,819, I have shown and described a spacing-mechanism in which the work-engaging carriage is caused to move along the table by means of a rack-and-pinion drive, and in which movement is arrested by a pawl-and-ratchet lock—by engagement of a pivoted detent with the surface of a toothed drum rigidly carried on the shaft of the carriage-driving pinion. The improvements which constitute my present invention are applicable to a machine of that character.

Referring to the drawings, Figure 1 shows in side elevation a carriage upon a table, in which my present invention is embodied; Fig. 2 shows the mechanism in horizontal section, the plane of section being indicated at II—II, Fig. 1; Figs. 3 and 4 are views in longitudinal section on the plane indicated by the line III—III, Fig. 2, showing the parts, in the one case in unlocked and in the other case in locked positions; and Fig. 5 is a view in section on the plane indicated by the line V—V, Fig. 1.

The carriage A travels on wheels 1 upon the table 2. Parallel with the rails for wheels 1, and preferably between them and closely adjacent one of them extends the rack 5, rigid upon the top of the table. The pinion 4 is borne by the carriage. The turning of pinion 4, of course causes the carriage to advance along the table. Any preferred means of turning may be employed; while large machines may be power-driven, smaller ones will ordinarily be hand-driven; and, for the sake of simplicity of showing in an incidental matter, I have indicated a hand-wheel for driving pinion 4. I have also shown (and this also is an incidental and non-essential feature) wheels 1 and the pinion 4 mounted on a common axle. The pinion of course and the hand-wheel turn in unison. I show the rack on the table and the pinion on the carriage;

ordinarily this is the simpler and preferable arrangement, though it is no novelty in this art to reverse the arrangement, mounting the rack on the carriage and the pinion on the table. Such known variations of incidental matters are of course to be recognized as available to a designer in adopting my invention.

In my already granted Patent, No. 908,819, referred to above, the toothed drum 20 which forms the ratchet part of the stopping-mechanism is shown to be mounted on the shaft of the carriage-driving pinion 4, and if desired the same arrangement may be adopted in carrying my present invention into practice; I prefer however (as the drawings accompanying this specification show) to provide another pinion 4^a journaled in the carriage and coöperating with a rack laid down on the table-top—and preferably and conveniently the same rack 5—on whose shaft the toothed drum 20 is rigidly borne. It will be apparent that the moving of the carriage and the turning of the drum are thus conditioned the one on the other; that the arresting of the drum in its rotation will mean the stopping of the carriage, and that when the parts are at rest if the drum be released and left free to turn it will cease to be an obstruction to carriage advance.

The surface of drum 20 is corrugated with a succession of teeth, and a movable detent 19 (the pawl member) provided with a tooth *a* is adapted, when the detent moves to proper position, to engage one or another of the teeth in the drum 20. This movable detent is anchored—and, in this case (the drum traveling with the carriage) is anchored in the carriage by being pivoted therein, on a shaft 22. Accordingly, when detent 19 thus engages drum 20 (the carriage being in motion, advancing along table 2) the carriage will be stopped. The pivot-hole 21^a formed in detent 19 is elongate, for reasons presently to be described; it may conveniently be open on the lower side and thus the pivoted end of the detent will be hook-shaped, as shown in Fig. 3. The hooked shape is preferable to a complete loop, in that it permits of the easy replacement of parts. The rod 66 serves as a keeper, preventing accidental displacement of the detents.

The detent 19 is held normally in elevated position, free of engagement with drum 20, by a latch 17 rigidly carried on a shaft 13; which shaft 13 is caused to turn, and by turning to open the latch, by the engagement of a finger 8, pivoted in the carriage, with one and another of a succession of stops, in the form of pins 7, set athwart the path of carriage advance. These pins, it will be understood, are prearranged at proper intervals. With the swinging of finger 8 (the finger being pivoted on the end of a bar 50) shaft 13 is through suitable connections turned and the latch 17 opened. The connections referred to consist, in this instance, of the crank-arm 12 on shaft 13 and the link 14 connecting finger and crank-arm.

When the carriage has been stopped, by engagement of detent 19 with drum 20, and it is desired to effect release, preparatory to further advance of the carriage, a lever 32 is swung. This lever is indeed a crank-arm on a shaft, 10, journaled in the carriage, and the shaft 10 carries on crank arms 51 the bar 50 on the end of which the finger 8 is pivoted. When the lever is swung, finger 8 is raised above the line of pins 7 and swings forward (under the action of instrumentalities presently to be described) free of the pin which has last engaged it; and the bar 50 engaging the under surface of detent 19 raises it also, free of drum 20, and latches it to the part 17. When then the lever 32 is swung back or allowed to swing back, the parts thus far described resume their positions, permitting the advance of the carriage, but ready to effect stopping when finger 8 shall engage the next succeeding pin 7.

The ratchet-wheel or drum 20 is prolonged, the pawl or detent 19 is multiplied (in this instance twelve detents 19 are shown—Figs. 2 and 5) and the edge of each tooth on the drum 20 extends at a slight angle to the edge of the assembled detents 19 (see Fig. 5), to the end that with a structure whose parts are made heavy to endure hard service great nicety of operation and accuracy of spacing may still be obtained. All this is fully explained in my patent referred to, No. 908,819. Indeed, all of the machine parts thus far described are present in that earlier patent, serving there the same ends as I have here pointed out.

My earlier Patent, No. 908,819, shows a lock by which the detent is secured in drum-engaging position. In the machine of my present invention I dispense with that specific kind of lock and replace it with other instrumentalities, accomplishing ends in some measure the same as those which are served by this lock of the earlier patent. In all pawl-and-ratchet structures it is of course requisite that the pawl and the ratchet teeth be structurally strong, and they are indeed members of considerable mass, ordinarily wedge-shaped: their mutually engaging faces disposed in planes substantially perpendicular to the direction of relative movement, while their opposite faces are for structural reasons inclined, to wide substantial bases. Now, while the pawl-and-ratchet mechanism of my earlier patent secures the parts in the manner desired, and that effectively, it is in some cases desirable to guard against an escape of the drum be-

neath the locked detent in retrograde movement—a movement which may in some instances (particularly when the parts are worn) occur accidentally, in consequence of the necessary inclination of the posterior faces of the teeth. To guard against such a chance, I provide (and herein lies one feature of my present invention) another pawl-and-ratchet stop, oppositely disposed, and I provide means for operating this second stop in proper correlation to the stop already described.

A second drum or ratchet-wheel 20^a, with teeth oppositely disposed, is mounted to turn as a unit with a pinion which engages a rack and which by such engagement controls carriage movement. This second drum may conveniently be mounted as drum 20 is mounted rigidly upon the shaft which forms the rigid axle of pinion 4^a. A second pawl or detent 19^a with its drum-engaging tooth shaped to engage the oppositely disposed teeth of drum 20^a is also mounted as detent 19 is mounted—in this instance in the carriage. The detent 19^a may be made a compound detent, and the line of its drum-engaging teeth may be inclined with respect to the edges of the elongated teeth upon drum 20^a in like manner and to like ends as in the case of drum 20 and detent 19.

It will be observed in Fig. 5, that in the machine shown, drum 20 is longer than drum 20^a, its teeth are heavier, fewer and of coarser pitch, while the coöperating detents 19 are more numerous. The reason is that the drum 20 and detents 19 sustain the direct shock of stopping, while drum 20^a and detents 19^a sustain the less severe shock of rebound—which rebound shock is reduced to little or nothing in consequence of other instrumentalities yet to be described.

The detent 19^a (and my use of the singular as applicable in proper case to a plurality of detents, collectively, will be understood) is correlated in operation with detent 19 by the instrumentalities now to be described.

It will be observed that detent 19 is pivoted on shaft 22 through an elongate piovot-hole 21^a. Consequently, when after the swing of finger 8 detent 19 engages drum 20, the carriage will still be free to advance (for all that has thus far appeared) by a distance permitted in the elongation of this pivot-hole. As the carriage thus advances the detent 19 is pushed to the right (Figs. 1, 3, and 4) by engagement of drum 20 with tooth *a*. A hooked end *b* formed upon detent 19 engages and turns a crank 52 on a shaft 53. The detent 19^a is hung from arms 54 on shaft 53, by hangers 55. Thus, when detent 19 turns crank arm 52, detents 19^a are swung down, and come into engagement with drum 20^a, to resist more effectively retrograde turning of pinion 4^a.

When the opposite detents 19 and 19^a come into play and the carriage is locked, an automatic lock in the shape of a spring-controlled bar 58 comes into play, engaging a crank-arm on shaft 53 and holding shaft 53 against turning; when shaft 53 is thus secured against retrograde turning, it is impossible that the detents can either of them jump out from ratchet engagement. Each pawl-and-ratchet stop holds the other against retrograde turning.

When by the engagement of finger 8 with a pin 7 and the consequent operation of the instrumentalities which have been described, the carriage has been stopped, and it then becomes necessary to release the carriage for further advance, the lever 32 is swung, as has been said. Finger 8, raised above the pin which has engaged it, swings forward in response to the tension of spring 56, exerted through a crank-arm 66 on shaft 13; detents 19 are raised and latched, as already explained (the latches 17 coming forward to detent-engaging position by the turning of shaft 13). Another spring, 57, exerting its tension on a crank-arm 67 extending from shaft 53 carries detent 19 backward, so far as the elongation of its pivot-slot 21^a permits, and at the same time raises detent 19^a. The spring-impelled stop-bar 58, which on the locking operation comes into play to engage a crank-arm on shaft 53 and hold such shaft against retrograde rotation while the carriage-stopping parts are in action, is by the swinging of lever 32 raised out of the way by means of the link 59. It will be apparent that the bar 58 has this effect: to hold shaft 53 from turning, with the consequences already named, and to relieve detent 19, during the time the carriage is locked, of the tension of spring 57 which otherwise would be continuously exerted in a direction to rearward, that is, to the left, Figs. 1, 3, 4.

In the machine of my earlier Patent, No. 908,819, the momentum of the moving carriage is absorbed, when the stopping-mechanism comes into play, by the raising of a weight, and thus rebound or back-lash of the loaded carriage is guarded against; in another earlier patent of mine, No. 1,068,465, a brake is shown, in the form of a friction clutch, and this brake serves the same end: namely, to absorb momentum and eliminate back-lash. Either of these devices of my earlier patents may be used in the machine of my present invention, as thus far described. I prefer, however, particularly in machines of small size and designed for light work, to employ another shock-absorbing mechanism, which I shall now describe as part of my present invention.

The carriage A consists of two parts: the carriage or truck frame proper, to which the reference letter A is applied, which is borne

on the wheels 1, and the frame F arranged between the sides of carriage and pivoted on the axle C of the pinion 4^a. This inner frame F carries the detents 19, 19^a and their operating parts; and it will be observed (Fig. 1) that the side-walls of the carriage A are provided with openings through which parts of the stopping-mechanism extend laterally, and that these openings are of such size as to permit a pivotal movement of frame F with respect to carriage A upon the pivot-shaft C. The work is secured to the carriage proper, as is indicated by the work-connecting link L (Fig. 1). When then the stopping-mechanism acts and pinion 4^a is locked against turning, the momentum of the loaded and advancing carriage tends to cause frame F to turn on its pivot. Pivotal turning of frame F is resisted by a heavy spring 60, and in the stretching of this spring the momentum is absorbed. The spring is preferably of such strength that when so stretched and when the loaded carriage has stopped, it will give up its tension again in turning the frame F back to its initial position and so cause the work to set back a small amount to the precise point desired. Precision here is obtained by means of a rod 61 pivoted at 64 in frame F, and extending beyond the cross-beam 63 of the carriage proper. Pivotal motion of the frame in the carriage is limited in one direction by the detents 19^a and the distance-sleeve 62 surrounding the rod 61 and arranged between frame F and the cross-beam 63, and in the other direction by the tension of spring 60. Normally, spring 60 holds frame F at the limit of permissible swing in retrograde direction. Thus it appears that this pivotal movement of frame F within the carriage is a cushioned movement, and that the function of the spring is first to absorb the momentum of the carriage and then exert the energy so received in bringing the work by a slight retrograde movement back very precisely to the predetermined point of stopping. Furthermore, the construction is such that the forward movement of the carriage, after the relatively movable parts of the stopping mechanism (the pawls and detent drum) have been brought into engagement with each other, will be in proportion to the acquired momentum of the carriage and its load, but, regardless of the extent of such continued forward movement, the carriage will, under the action of the spring buffer, be moved backwardly to a position determined by the setting of the stopping mechanism,

I claim as my invention:

1. In a spacing-table the combination of a movable carriage, two rotatable ratchet-wheels provided with oppositely disposed ratchet-teeth, the movement of the carriage and the rotation of the ratchet-wheels being conditioned the one on the other, pawls movable to and from engagement one with each of said ratchet-wheels, and means controlling the movement of said pawls at predetermined points in the path of carriage-advance.

2. In a spacing-table the combination of a table, a carriage movable on said table, a rack on said table, a pinion on said carriage engaging said rack, a pair of ratchet-wheels with oppositely disposed teeth mounted to turn in unison with said pinion in said carriage, a pair of oppositely arranged pawls mounted in said carriage and movable to and from engagement one with each of said ratchet-wheels, and means controlling the movement of said pawls to ratchet-engaging position.

3. In a spacing-table the combination of a movable carriage, two rotatable ratchet-wheels provided with oppositely disposed teeth, the movement of the carriage and the rotation of the ratchet-wheels being conditioned the one on the other, a pawl movable to and from engagement with one of said ratchet-wheels, means for controlling the movement of said pawl, a second pawl movable to and from engagement with the other of said ratchet-wheels, and means controlling the movement of the second pawl and operating in sequence when the first pawl has come to position of ratchet-engagement.

4. In a spacing-table the combination of a movable carriage, two rotatable ratchet-wheels provided with oppositely disposed teeth, the movement of the carriage and the rotation of the ratchet-wheels being conditioned the one on the other, a pawl borne by said carriage and movable to and from engagement with one of said ratchet-wheels and when engaged having a limited range of movement in said carriage, a second pawl borne by the carriage and movable to and from engagement with the other of said ratchet-wheels, means operating at intervals as the carriage advances for controlling the movement of the pawl first named into ratchet-engaging position, and means operated by the first pawl when in ratchet engagement and moving through its aforementioned limited range for controlling the movement of the pawl second named to its ratchet-engaging position.

5. In a spacing-table the combination of a carriage, a stopping-mechanism therefor including a carriage-borne pawl and ratchet; the pawl member having a limited range of movement in its mounting in the carriage, movable in one direction against a yielding resistance, a lock for said pawl, operating when the said pawl has reached the end of its movement against such yielding resistance, and a second carriage-borne pawl and ratchet operated by the aforesaid movement of the first-named pawl.

6. In a spacing table, the combination of a movable carriage, means including a rotary shaft for moving said carriage, two ratchet-wheels movable in unison with said shaft and provided with ratchet-teeth adapted to act oppositely with relation to the advance of the carriage, a pair of pawls each movable to and from engagement with one of said ratchet-wheels, and means for controlling the movement of said pawls at predetermined points in the path of carriage advance.

7. The combination of a spacing table, a work-carriage movable thereon, means for moving said carriage forwardly, carriage-stopping mechanism including relatively-movable mutually-engaging parts, and a momentum-absorbing buffer permitting said carriage to advance a small distance after said stopping parts have been brought into engagement with each other, said buffer causing the carriage to move backwardly at the conclusion of its advance movement.

8. The combination of a spacing table, a work-carriage movable thereon and including a truck frame, means for moving said carriage forwardly, carriage-stopping mechanism including relatively-movable mutually-engaging parts, and a yielding momentum-absorbing buffer between the stopping mechanism and the truck frame and permitting said carriage to advance a small distance after said stopping parts have been brought into engagement with each other, said buffer causing the carriage to move backwardly at the conclusion of its forward movement.

9. The combination of a spacing table, a work-carriage movable thereon and including a truck frame, means for moving said carriage forwardly, carriage-stopping mechanism including relatively-movable mutually engaging parts, a momentum-absorbing yielding buffer between the stopping mechanism and the truck frame and permitting said carriage to advance a small distance after said stopping parts have been brought into engagement with each other, said buffer causing the carriage to move backwardly at the conclusion of its forward movement, and means for limiting the backward movement of the carriage.

10. The combination of a spacing table, a work carriage movable thereon, means for moving said carriage forwardly, carriage-stopping mechanism including a rotary detent drum and a movable detent bar, means for bringing said bar into engagement with the drum, a yielding buffer effective to resist further movement of said drum after its engagement by said bar, said buffer causing a reverse movement of said drum and in consequence thereof a backward movement of the carriage immediately at the conclusion of its forward movement, and means for limiting said reverse movement of the drum.

11. The combination of a spacing table, a work-carriage movable thereon and including a truck frame, carriage stopping mechanism including a movable detent pivotally mounted on said carriage and a plurality of stop elements engageable by said detent, a yielding momentum-absorbing buffer interposed between said bar and said truck frame and permitting the carriage to advance a short distance after said detent has been brought into engagement with one of said stops, said buffer causing the carriage to move backwardly at the conclusion of its forward movement, and means for limiting the backward movement of the carriage.

12. In a spacing-table mechanism the combination of a table, a carriage-body movable upon said table, a rack upon said table, a pinion rotatably mounted in said carriage-body and engaging said rack, a ratchet-wheel rotatable in unison with said pinion, a frame borne by said carriage-body and pivotally mounted therein on a common axis with said pinion, a pawl borne by said frame and movable to and from engagement with said ratchet-wheel, means for holding said frame yieldingly in a fixed position in said carriage-body, and means for operating said pawl.

13. The combination of a spacing table, a work-carriage comprising a truck frame movable upon said table and a supplementary frame pivotally mounted on said truck frame, a spring buffer between said truck and supplementary frames, a stop limiting in one direction the pivotal movement of said supplementary frame with relation to said truck frame, a drum borne by said carriage and rotatable in unison with the longitudinal movement of the carriage, oppositely-disposed ratchet teeth on said drum, oppositely-acting pawls pivotally mounted on said supplementary frame and movable to and from engagement with said ratchet teeth, and means for controlling the movement of said pawls.

In testimony whereof I have hereunto set my hand.

GEORGE PAUL THOMAS.

Witnesses:
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FRANCIS J. TOMASSON.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."