

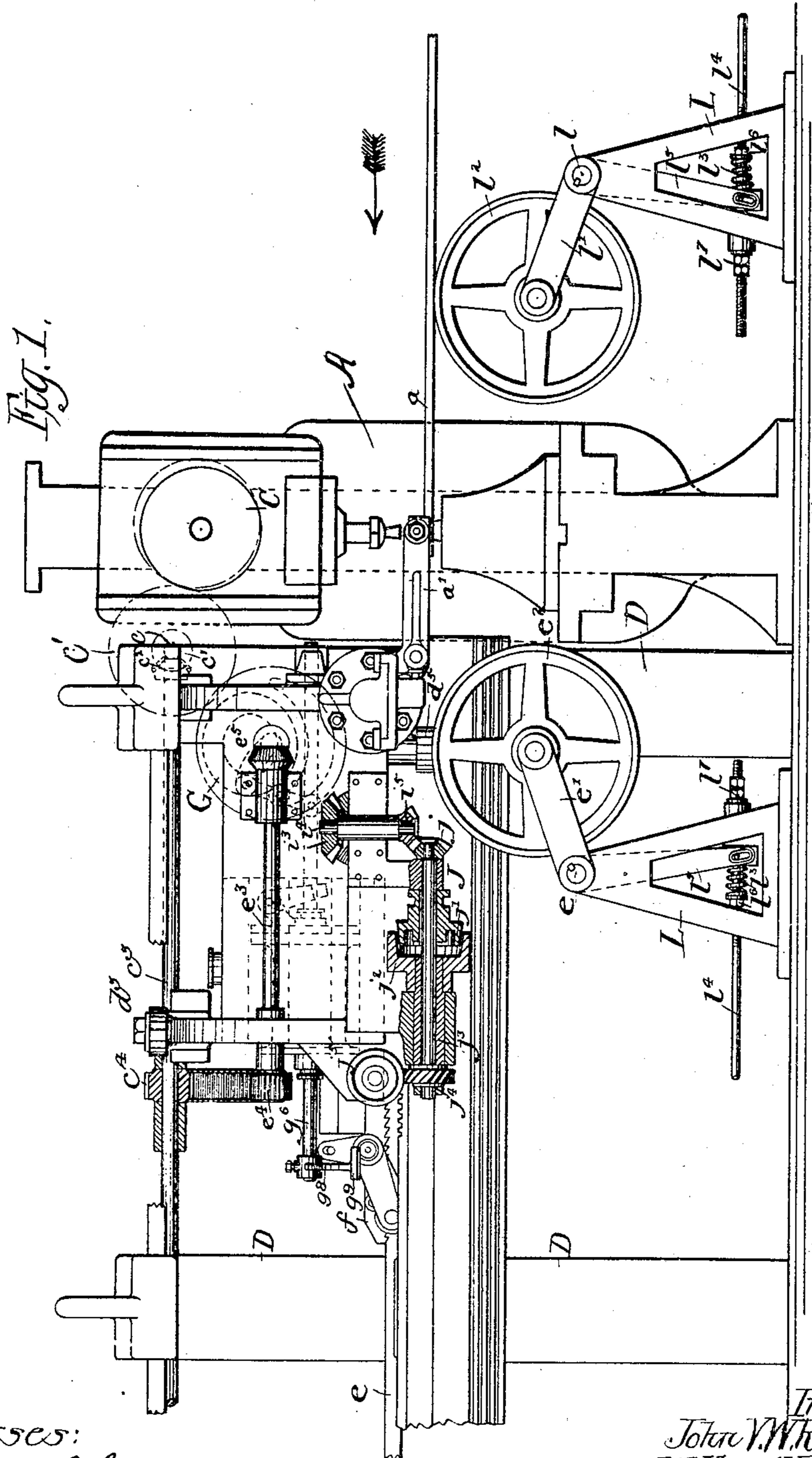
No. 792,457.

PATENTED JUNE 13, 1905.

J. V. W. REYNDERS & W. T. SEARS.
SPACING TABLE FOR PUNCHING MACHINES.

APPLICATION FILED DEC. 26, 1903.

6 SHEETS—SHEET 1.



Witnesses:
Titus H. Gross
Henry Near

Inventors
John V. W. Reynders,
Willard L. Sears,
by their Attorneys,
Howson & Howson

No. 792,457.

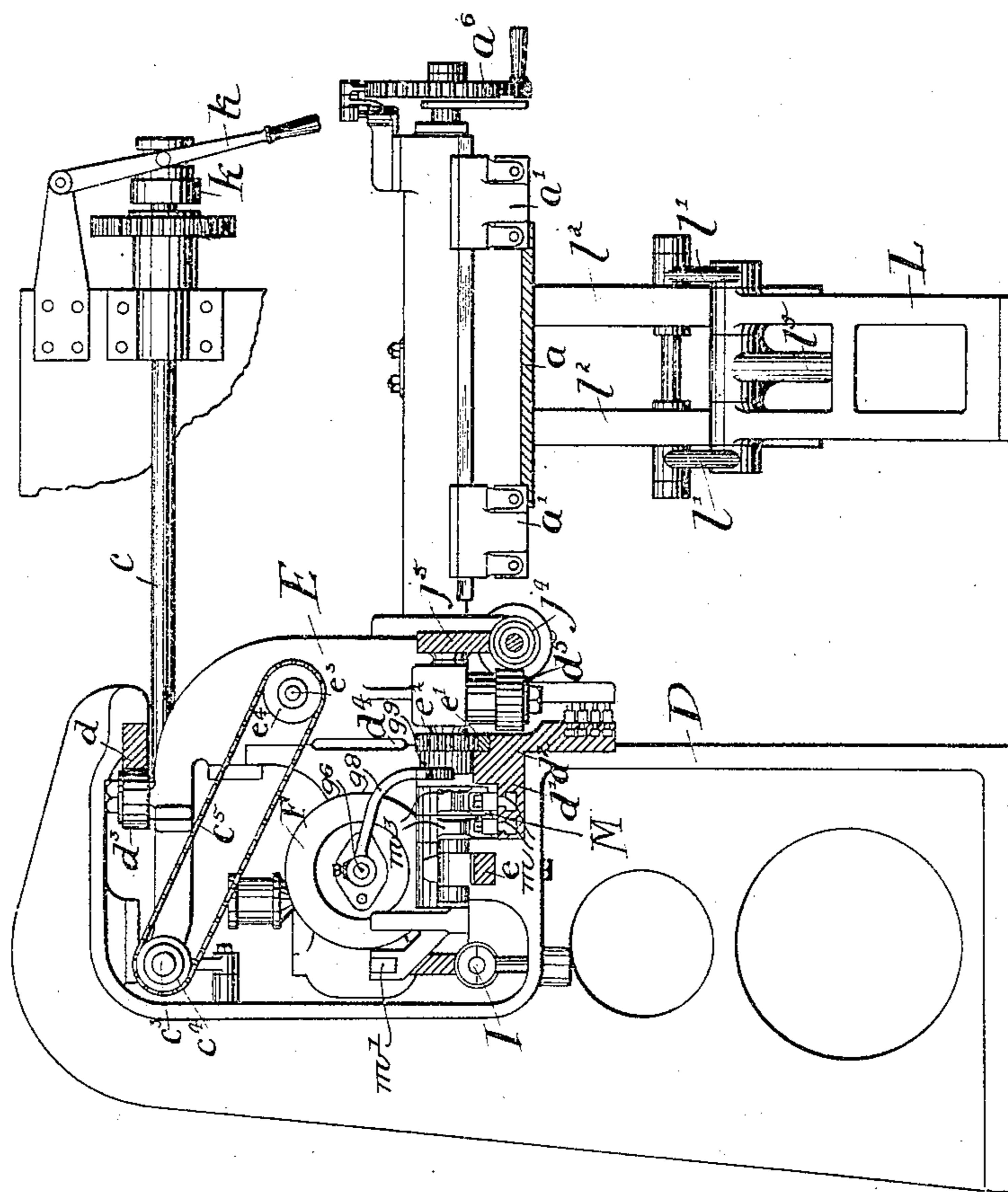
PATENTED JUNE 13, 1905.

J. V. W. REYNDERS & W. T. SEARS.
SPACING TABLE FOR PUNCHING MACHINES.

APPLICATION FILED DEC. 26, 1903.

6 SHEETS—SHEET 2.

Fig. 2.



Witnesses:-

Titus H Irons
Henry Noar.

Inventors

John V. W. Reynolds,
Willard T. Sears,
by their Attorneys
Howson & Howson

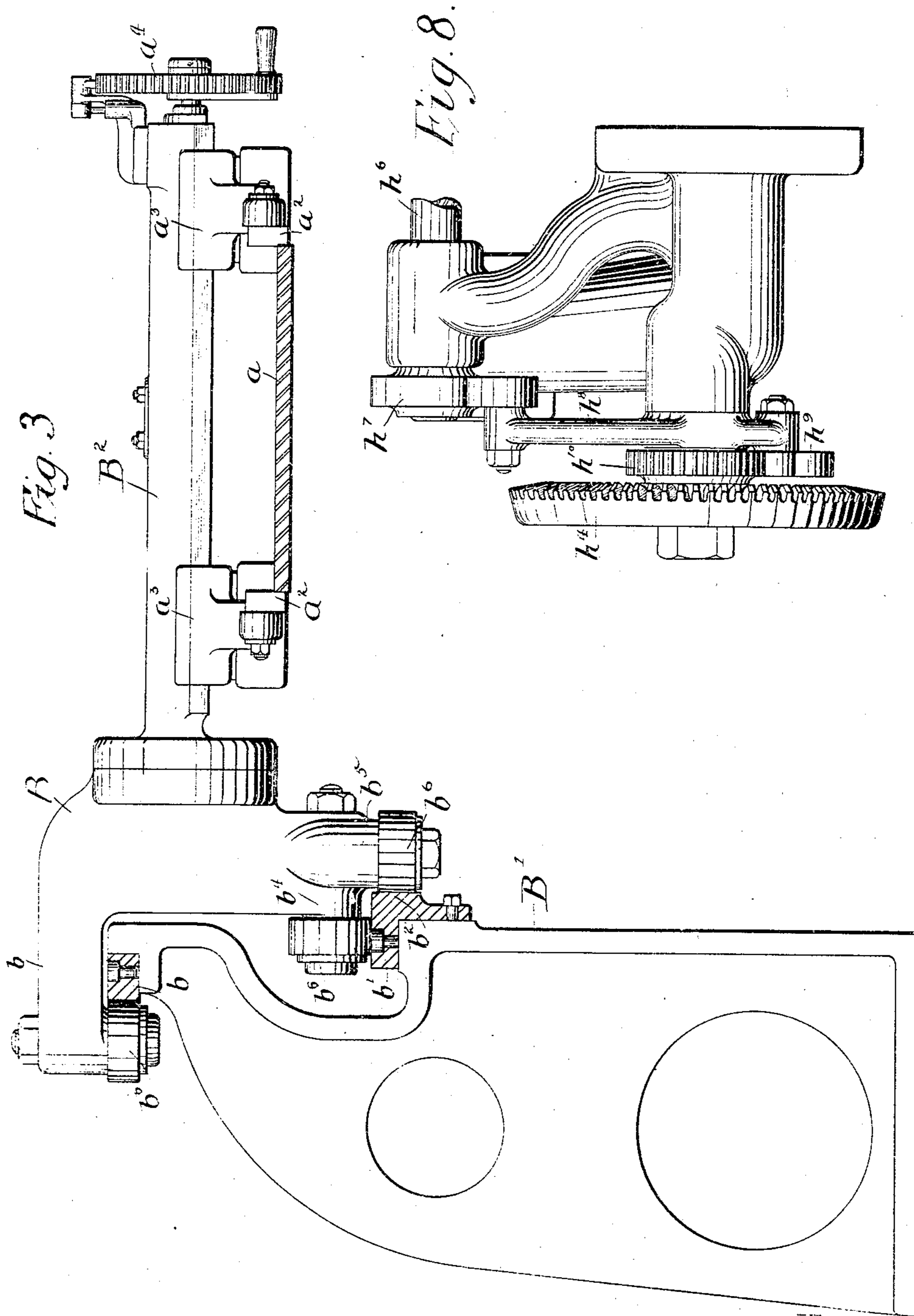
No. 792,457.

PATENTED JUNE 13, 1905.

J. V. W. REYNDERS & W. T. SEARS.
SPACING TABLE FOR PUNCHING MACHINES.

APPLICATION FILED DEC. 26, 1903.

6 SHEETS—SHEET 3.



Witnesses:
T. H. Irons.
Henry Now

Inventors,
John V. W. Reynders
Willard T. Sears,
by their Attorneys.
Howell & Howson

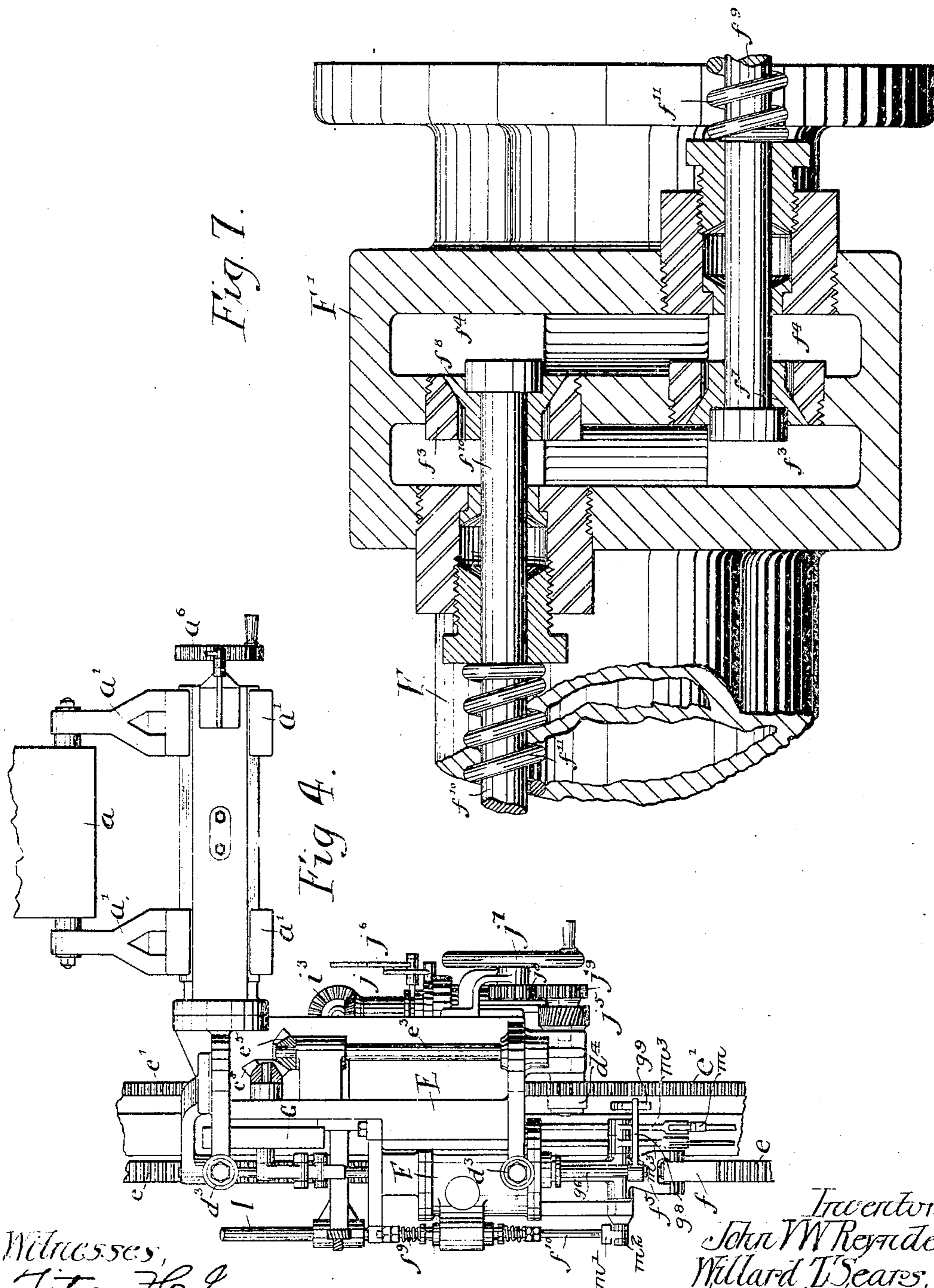
No. 792,457.

PATENTED JUNE 13, 1905.

J. V. W. REYNDERS & W. T. SEARS.
SPACING TABLE FOR PUNCHING MACHINES.

APPLICATION FILED DEC. 26, 1903.

6 SHEETS—SHEET 4.



Witnesses,
Titus H. Gross.
Henry Noar

Inventors
 John W. Reynolds
 Willard T. Sears,
 by their Attorneys
 Howson & Howson

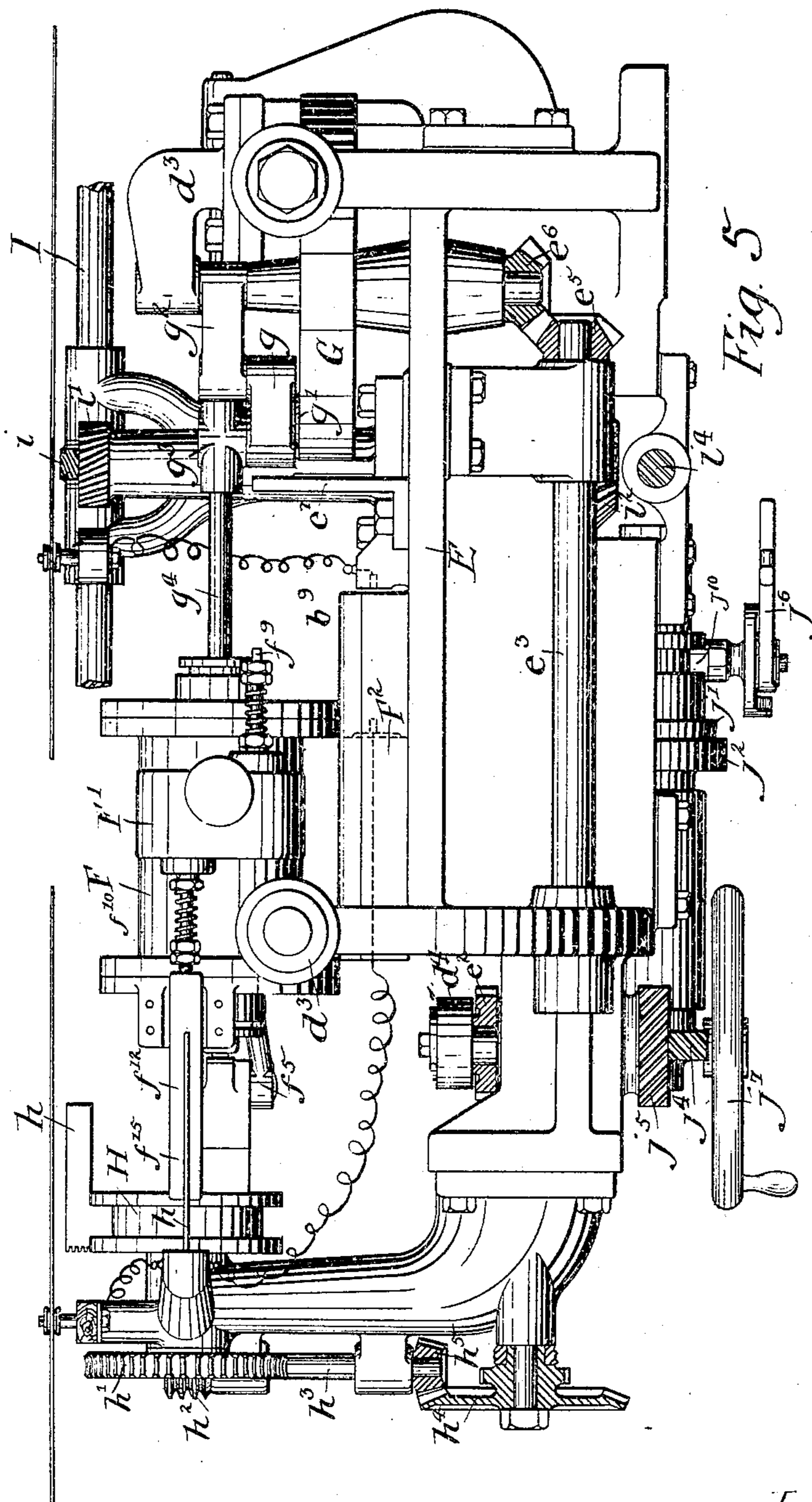
No. 792,457.

PATENTED JUNE 13, 1905.

J. V. W. REYNDERS & W. T. SEARS.
SPACING TABLE FOR PUNCHING MACHINES.

APPLICATION FILED DEC. 26, 1903.

6 SHEETS—SHEET 5.



Witnesses;
Titus H. Irons
Henry Noar

Inventors,
John W. Rynders,
Willard T. Sears,
by their Attorneys,
Howson & Howson

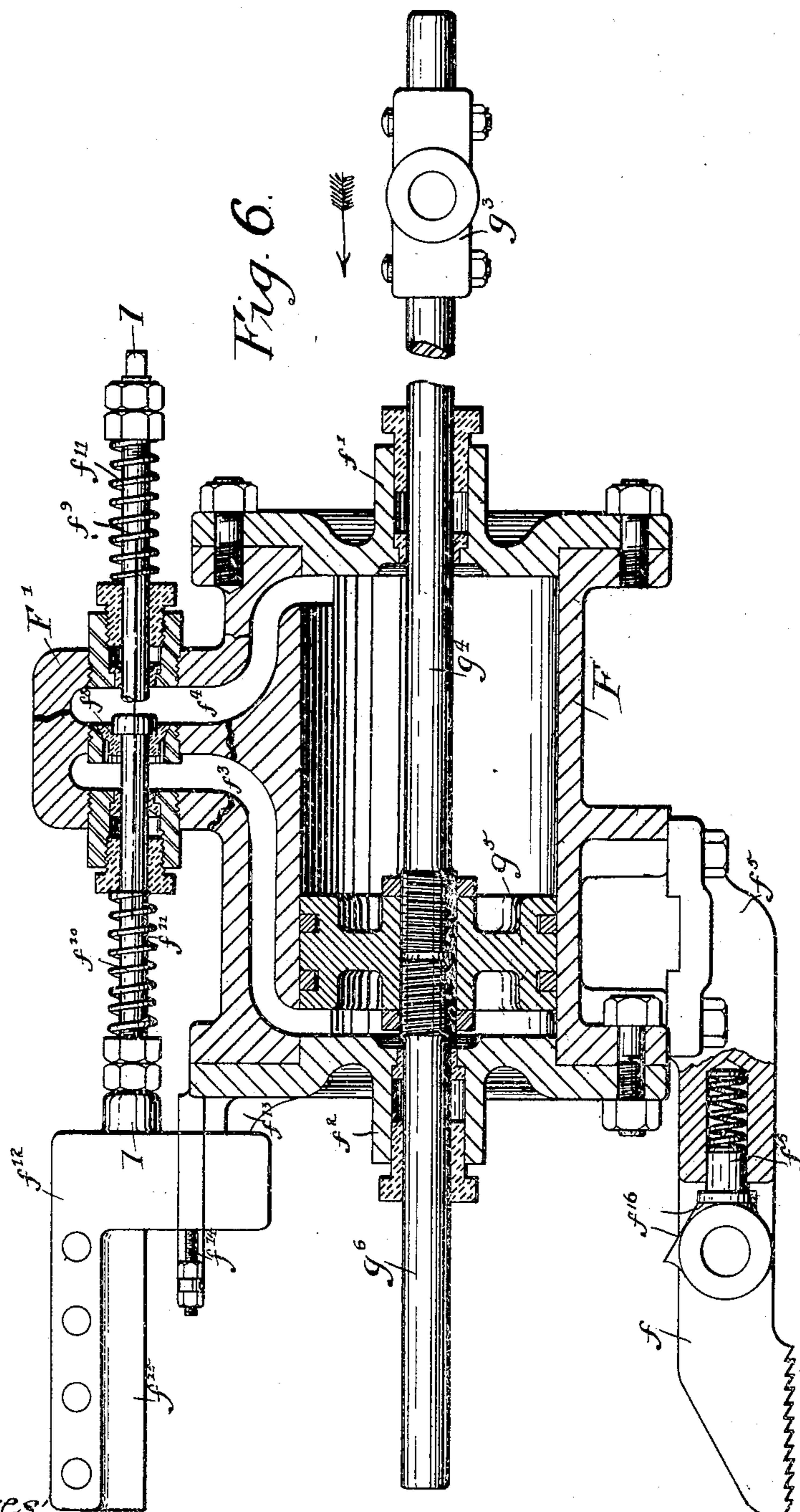
No. 792,457.


PATENTED JUNE 13, 1905.

J. V. W. REYNDERS & W. T. SEARS.
SPACING TABLE FOR PUNCHING MACHINES.

APPLICATION FILED DEC. 26, 1903.

6 SHEETS—SHEET 6.



Witnesses, 
Titus Horton
Henry Hoar

Inventors,
John V. W. Reynolds,
Willard T. Sears,
by their Attorneys,
Hosmer & Hosmer

UNITED STATES PATENT OFFICE.

JOHN V. W. REYNDERS AND WILLARD T. SEARS, OF HARRISBURG,
PENNSYLVANIA.

SPACING-TABLE FOR PUNCHING-MACHINES.

SPECIFICATION forming part of Letters Patent No. 792,457, dated June 13, 1905.

Application filed December 26, 1903. Serial No. 186,725.

To all whom it may concern:

Be it known that we, JOHN V. W. REYNDERS and WILLARD T. SEARS, citizens of the United States, residing in Harrisburg, Dauphin
5 county, Pennsylvania, have invented certain Improvements in Spacing-Tables for Punching-Machines, of which the following is a specification.

Our invention relates to certain improve-
10 ments in attachments for machine-tools; and it more particularly consists in a novel device for intermittently and automatically feeding a plate to a punching-machine or to any machine performing a number of operations on
15 the piece of material operated on.

One object of our invention is to provide mechanism which shall hold and automatically feed a sheet of material to a continuously-operating punch or other machine, as indicated
20 above, in such manner that holes will be formed in said sheet at previously-determined intervals.

A further object of the invention is to provide a work-feeding table which shall be automatically fed forward after each operation
25 of the tool with which it is used and that by the action of said tool itself.

It is also desired to provide means which shall be capable of feeding a piece of material
30 to a punching-machine in such manner that said material shall be automatically moved for variable though predetermined distances.

Another object of the invention is to so support a carriage for holding and feeding material to a machine of the character above
35 noted that when desired said carriage may be moved out of the way and the machine used independently of the same without interference from the carriage-supporting structure.

An additional object of the invention is to provide a work-holding carriage having upon it means driven directly from the punch, which shall make a stroke of fixed length, in combination with means for automatically trans-
40 forming this action, so that the carriage may be made to move through any desired succession of variable distances.

These objects we attain as hereinafter set

forth, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation of a portion of our invention, indicating the punch and showing the position of the carriage-track and its supporting structure relatively thereto, the figure also showing our improved work-hold-
50 ing carriage and illustrating a portion of the mechanism thereof in section. Fig. 2 is an end elevation of our improved carriage or spacing-table, showing the supporting-track thereof in section and illustrating in detail the
55 means for supporting a plate of material operated on. Fig. 3 is an end elevation of the auxiliary carriage and the supporting structure therefor. Fig. 4 is a plan view showing our improved work-holding carriage or
60 spacing-table. Fig. 5 is an enlarged plan view showing certain of the details of our invention, it being noted that detail arrangements of certain of the parts in this figure are slightly different from those shown in the
65 other figures. Fig. 6 is a sectional elevation showing the detail construction of the cylinder and its adjacent parts as illustrated in Fig. 5. Fig. 7 is a sectional plan view of a portion of the cylinder, on an enlarged scale,
70 the same being taken on the line 7 7, Fig 6; and Fig. 8 is a side elevation of the templet-feeding mechanism.

While we have illustrated our invention as employed in connection with a punching-
80 machine and in the specification have so described it, it is to be understood that we do not limit ourselves to such a use, since it is obvious that our improved carriage or spacing-table may be advantageously employed with any ma-
85 chine requiring a piece of material to be periodically fed to it.

In the above drawings we have shown our device as designed for use in connection with a continuously-operating punch, and it will be
90 understood that the function of our improved work-holding carriage is to intermittently feed a plate of material to said punch, moving it forward automatically after each stroke of the punch for any desired distance, as pre-
95 determined by a templet.

Referring first to Figs. 1 to 4, inclusive, we have indicated a punch at A, the plate of material to be operated upon being shown at *a* as held by clamping-jaws *a'*, which engage it at one end, and by jaws *a''*, which engage it at the opposite end. While the first pair of jaws are carried by the spacing-carriage in the manner hereinafter described, the jaws *a''* are supported from an auxiliary carriage B, which consists of a relatively light framework supported so as to overhang the desired line of motion of the plate to be punched by means of any desired number of standards B', upon which are fastened a series of tracks *b*, *b'*, and *b''*.

There are suitably-projecting arms *b''*, *b'*, and *b''* upon the carriage-framework, provided with rollers *b''*, bearing, respectively, upon the above-mentioned tracks in such manner that the outward side thrust of the carriage is transmitted to and taken by the track *b*, the downward thrust of the carriage by the track *b'*, and the inward side thrust of the carriage by the track *b''*. The clamping-jaws *a''* of the auxiliary carriage are supported from a pair of movable pieces *a''*, which can be adjusted upon the overhanging arm B' of the carriage by means of a hand-wheel *a'*, which is connected to said pieces by means of any desired forms of mechanism well known to the art or, if desired, by that form of clamping mechanism shown in our pending application for patent, Serial No. 175,663, filed October 3, 1903, for patent on an improved spacing-table for punching-machines. The clamps *a'* are, like the clamps *a''*, provided with a hand-wheel *a'* and connecting mechanism, whereby they may be simultaneously moved toward and from one another. The plate *a* is provided with any desired number of supporting devices, preferably of the form shown in Figs. 1 and 2, in which L is a standard having bearings for a spindle *L*, to which are keyed one or more arms *L'*, carrying at their ends roller-wheels *L''*. Said arms are yieldingly pressed upward by means of a spring *L''*, carried upon a supporting-rod *L'* on the standard, which spring engages the end of an arm *L''*, also keyed to the spindle *L*. By means of a nut *L''* the position of the spring *L''* may be adjusted so as to elevate or lower the roller-wheel *L''*, while by means of nuts *L''* the amount of compression of the said spring may be varied so as to exert greater or less pressure upon the wheel in order to suit the weight of the plate operated upon.

Referring to Fig. 1, we have shown in dotted lines a wheel C, which is so connected to the punch-driving mechanism that it is given one complete revolution at each complete reciprocation of the punch. Meshing with this gear-wheel is a second wheel C', fixed upon a shaft *c*, having a bevel-pinion *c'*, which meshes with a second bevel-pinion *c''* upon a shaft *c''*. Said latter shaft is carried in any convenient form of tumbler-bearings supported from a

series of standards D, which are placed at intervals on the side of a punch opposite to that having the standards B'. Splined to the shaft *c''* is a slidable sprocket-wheel *c''*, which is so constructed as to be moved with the spacing-carriage E and from which is driven the mechanism on said carriage. Extending between the standards D are three tracks *d*, *d'*, and *d''*, with which engage rollers *d''*, *d'*, and *d''*, journaled on the carriage E in such manner as to effectively take the side and downwardly-acting thrusts of the carriage E. In addition there is a fourth track *e*, which is provided with teeth for engagement by a foot *f*, having similar teeth and pivotally connected to a cylinder F, hereinafter described. There is also a rack *e'* supported by and extending between the standards D, there being on the carriage E a gear-wheel *e''*, meshing with the same. Journaled in suitable bearings upon the carriage E is a shaft *e''*, extending parallel with the shaft *c''* and having on it a sprocket-wheel *e''*, operatively connected to the sprocket-wheel *c''* on said shaft by means of a chain *e''*. The shaft *e''* serves to turn, through the medium of a pair of beveled gear-wheels *e''* and *e''*, a shaft, upon which is carried a cam G, having in its face an eccentric groove, as indicated in dotted lines in Fig. 1.

Referring now to the enlarged view shown in Fig. 5, it will be seen that there is a lever *g*, carrying a roller *g'*, which enters the eccentric groove of the cam G, one end of said lever being pivoted to a link *g''*, which is movably supported upon an extension of the shaft carrying the cam-wheel G, while the second end of said lever engages a cross-head *g''* upon a piston-rod *g''*. This rod, as shown in Fig. 6, has fixed to it a piston *g''*, which operates within the cylinder F, there being an extension *g''* to said rod projecting from the opposite face of the piston. The said cylinder has projecting from it the portion indicated in dotted lines at F' in Fig. 5, which portion is engaged by guides *h''* on the framework of the carriage E in such manner as to permit motion thereof relatively to the carriage in a line parallel to the longitudinal axis of said cylinder. The cylinder F is provided with stuffing-boxes *f''* and *f''* for the passage of the piston-rod and its extension and, as shown in Figs. 6 and 7, has passages *f''* and *f''* extending from its ends into a valve-chest F'. There are two openings in the valve-chest connecting the ports *f''* and *f''*, having valves, one of which is so placed, as indicated at *f''*, as to be held to its seat by pressure exerted in the port *f''*, while the other valve *f''* is so placed as to be pressed to its seat by pressure exerted in the port *f''*. These valves are loosely carried by headed valve-rods *f''* and *f''*, respectively, both of which pass through stuffing-boxes, as shown. The rod *f''* has upon it a spring *f''*, extending between the stuffing-box gland and a pair of nuts adjacent to

its end, there being, as shown in Fig. 5, a projecting stop e^7 so placed upon the carriage E as to engage the end of the said rod f^9 at a definite point in the stroke of the cylinder. The valve-rod f^{10} also has a spring f^{11} , held in place by a pair of nuts, and in addition carries upon its end a piece f^{12} , preferably of an L shape, it being noted from Fig. 6 that there is upon the cylinder a projecting arm f^{13} , carrying an adjustable screw f^{14} , so placed as to engage the downwardly-projecting part of the piece f^{12} . This piece f^{12} carries a relatively thin rearwardly-projecting plate f^{15} , designed to coact with a series of stop-plates carried by a templet-wheel H, there being one of said plates shown at h in Fig. 5. Said templet-wheel is carried upon a shaft supported in suitable bearings on the carriage E and is provided with some form of mechanism so constructed as to turn it to the extent of the angle occupied by the end of one stop-plate after each reciprocation of the punch or after each forward movement of the carriage. In the present instance a worm-wheel h' is fixed to the templet-wheel shaft, and this is engaged by a worm h^2 , carried on a shaft h^3 , driven from a bevel gear-wheel h^4 through a bevel-pinion h^5 . A shaft h^6 , revolved in any desired manner from the shaft e^3 , is provided with a cam h^7 , and this engages a roller carried by one end of a lever h^8 , the other end of said lever having a pawl h^9 constructed to operatively engage the teeth of a wheel h^{10} , fixed to the bevel-gear h^4 when said pawl is moved in one direction and to slip over said teeth when it is moved in the opposite direction. It will be understood that the stop-plates h are held to the periphery of the templet-wheel H, so that as said wheel is turned the various stop-plates are successively brought in line with the plate f^{15} , carried by the valve-rod f^{10} . Bolted to the cylinder F is a piece f^3 , which is forked for the reception of the toothed foot f , this latter being pivoted to it so as to be free to move in a vertical plane. Upon the rear face or end of said foot are two flat surfaces f^{16} at an angle to one another, and there is a spring-pressed plunger f^6 , carried by the piece f^5 , so as to engage either one of said two faces, and thereby tend to keep the toothed foot either in the position shown in Fig. 6 or in an elevated position at an angle to the horizontal.

In addition to the various parts described above it will be noted that there are various electrical connections shown on the carriage as well as trolley-wires, which, since they form no part of the structure claimed in the present application, but have been covered in a companion application for patent, Serial No. 186,175, filed December 22, 1903, have not been shown nor described in detail.

In addition to the shaft e^3 , which, as before described, is connected to the piston-rod g^4 , there is a shaft I, which is preferably driven

from the punch-operating mechanism by any convenient gearing, (not shown,) and similarly to the shaft e^3 is supported in tumbler-bearings upon the standard G. Splined to this shaft is a spiral gear i , which meshes with a second spiral gear i' , fixed to a shaft, which also carries a bevel-gear i^2 . Said bevel-gear transmits power through a bevel-gear i^3 , a shaft i^4 , and a bevel-pinion i^5 to a second bevel-pinion j , keyed to a shaft J. Also fixed to said shaft is one of the members j' of a friction-clutch, whose second member j^2 is fixed to a sleeve j^3 , revoluble upon but independent of the shaft J and having fixed to it a spiral gear-wheel j^4 . This latter in turn meshes with a second spiral gear j^5 , which is fixed to a shaft, also having keyed to it a gear-wheel e^2 , which meshes with the rack e' , as above noted.

An operating-handle j^6 has connected to it a forked arm j^{10} , one end of which is shown in Fig. 5 as engaging a collar on the movable member j' of the friction-clutch for throwing said member into and out of engagement with the fixed member thereof, and there is in addition a hand-wheel j^7 , having connected to it a gear-wheel j^8 , which meshes with a second gear-wheel j^9 on the same shaft as that having the spiral gear j^5 .

In operating the above apparatus the cylinder F, as well as the ports f^3 and f^4 , is filled with oil or some other incompressible fluid, and as long as the valves f^7 and f^8 remain seated the cylinder will be compelled to move on its guides whenever the piston-rod g^4 , and consequently the piston g^5 , is moved. Prior to starting the machine a number of stop-plates are fixed in position upon the templet-wheel H, it being understood that these plates are of lengths bearing a definite relation to the spaces through which it is desired the carriage, and consequently the piece held thereby, is to be moved between each stroke of the punch. As above noted, the shaft e^3 and also the sprocket e^4 are turned by the punch-operating mechanism through the gear-wheels C and C', shaft c , and bevel-gears c' and c^2 . From said sprocket-wheel e^4 power is transmitted through the chain e^5 , sprocket-wheel e^4 , shaft e^3 , bevel-pinions e^5 and e^6 to the cam G, which through the link g reciprocates the piston-rod g^4 and the piston g^5 once for each reciprocation of the punch. If now the piston g^5 be in the end of the cylinder opposite to that in which it is shown in Fig. 6 and the piston-rod be moved in the direction of the arrow, the cylinder F will be moved bodily in the same direction, since there is no way by which the fluid can pass from one side of the piston to the other, the spring f^{11} being sufficiently strong to keep the valve f^8 seated in spite of the pressure in said cylinder. Owing to the shape of the teeth upon the foot f , this latter will when the cylinder is moved be turned upon its pivot to a slight extent, so

as to permit it to slip over the teeth upon the track e . The movement of the cylinder and its attached parts will continue until one of the stop-plates h upon the templet-wheel H engages the plate f^{15} , carried by the piece f^{12} on the valve-rod f^{10} , at which time the spring f^{11} on said rod will be compressed as this latter is moved longitudinally, so that the pressure of fluid in the cylinder will cause the valve f^8 to open, thus allowing said fluid to pass from one end of the cylinder to the other and permitting the valve-rod g^4 , with the piston g^5 , to complete their stroke without further motion of the cylinder and its toothed foot f . As the piston-rod and piston begin their return stroke the spring-pressed plunger f^6 , aided by gravity, causes the toothed foot f to engage the toothed track e , and since, as before, both valves f^7 and f^8 are closed there is no passage of the fluid in the cylinder from one end thereof to the other. Consequently the carriage as a whole, with the plate a to be operated upon and the auxiliary carriage B, will be moved in the direction of the arrow in Fig. 1. Such motion will continue until the end of the valve-rod f^9 is engaged by the stop e^7 on the carriage, which causes said rod to be moved sufficiently to permit the valve f^7 to open. This again allows fluid to pass from one end of the cylinder to the other and permits relative motion between the piston g^5 and the said cylinder, so that while the said cylinder and carriage remain stationary relatively to the track e the piston g^5 again moves to the right-hand end of the cylinder, after which the above-described cycle of operations is repeated. During the interval between the time that the cylinder has started to move away from the templet-wheel and the time when it is again moved into a position ready to engage one of the stop-plates on said wheel the feeding mechanism (shown in Fig. 8) has caused the wheel to be turned to an extent sufficient to bring a second stop-plate in line with the plate f^{15} , carried by the valve-rod f^{10} , it being further noted that the movement of the device is so timed that the punch operates upon a plate a at some time other than when the carriage E is being moved.

As shown in Fig. 2, there is a hand-operated clutch K, by which the shaft c may be operatively connected to or disconnected from the driving mechanism of the punch, and if the lever h , by which this clutch is operated, be so thrown as to disconnect the said shaft from said mechanism the hand-wheel j^7 may then be operated to traverse the carriage at will. If it be desired to quickly move said carriage, the handle j^6 is thrown so as to operatively connect the two members j^7 and j^2 of the friction-clutch, in which case power is transmitted from the shaft I, through the spiral gears i and i' , through shafts i^4 and J to the friction-clutch $j' j^2$, spiral gear-wheels j^4

and j^5 to the spur-wheel e^2 , which, meshing with the rack e' , will cause motion of the carriage at a relatively high rate of speed.

As previously indicated, the detail mechanism for regulating the stroke or distance moved through by the carriage, and consequently the work held thereby, at each operation of the punch may be widely varied without departing from the main idea of our invention. For example, if desired, such parts may be constructed and arranged as indicated in Figs. 1, 2, and 4, in which is shown a construction accomplishing the same object as is attained by the revolving templet-wheel and stop-plates shown in Fig. 5.

As shown by Fig. 2, we provide a grooved portion M, in which may be fastened stops m , arranged in the grooves at any desired distances from each other. It will be understood that one groove with its series of stops may be employed, although in the case illustrated we have shown two grooves with the stops placed in staggered positions, so that it may be possible for them to be engaged by the stopping mechanism even though the distance between two consecutive stops be very short. In this arrangement of templet we provide an arm m' , fixed to a shaft whose end portion is shown at m^2 and which carries a pair of arms m^3 for engaging with the stops m . The end of the piston-rod g^6 has fixed to it an adjustable arm g^8 , having at the end a portion g^9 so placed as to trip the arms m^3 and cause them to be disengaged from the stops m , as shown in Figs. 2 and 4.

From the above it will be seen that we provide means by which a plate or other piece of material will be automatically fed to the machine which is to operate upon it and by automatic mechanism regulate this feeding so that it occurs for any predetermined variable distance and at predetermined times. It will further be seen that if it be desired to use the punch without the carriage this latter may be removed altogether or run to the extreme end of its track, so that there will be nothing to interfere with the free operation of the machine, since it will be noted that both sets of the standards D and B' are at a relatively great distance to the rear of the punch.

While we have shown our preferred device for automatically regulating the amount by which the work-holding carriage is fed forward after each stroke of the punch, it will be understood that this same end may be accomplished by other devices which are merely the mechanical equivalents of that shown.

We claim as our invention—

1. The combination with a punch or similar machine, of a carriage for work to be operated upon, mechanism driven by said machine for moving said carriage through successive spaces, and controlling mechanism on the carriage for varying the spaces moved through, substantially as described.

2. The combination of a punch or similar machine with a carriage for work to be operated upon, and automatically-operating means for moving said carriage, including a device
5 for automatically varying the distance moved through, substantially as described.

3. The combination of a punch or similar machine with a carriage for work to be operated upon, means on the carriage having mechanism connecting it to a source of power for giving a portion of said carriage motion to a uniform extent upon each action of the punch, and means operated from said first means for moving the carriage bodily to any desired extent,
15 substantially as described.

4. The combination of a punch or similar machine with a carriage for work to be operated upon, a device on the carriage connected to a source of power, including means for giving motion to a uniform extent upon each action of the punch and means operated from said device for moving the carriage to any desired extent, said latter means including an adjustable templet and a device cooperating
25 therewith, substantially as described.

5. The combination of a punch or similar machine, a carriage for work to be operated upon, a device having mechanism connecting it to the punch whereby motion to a uniform extent is imparted to it upon each action of said punch, a device supported on the carriage and actuated from said first device, said second device including means for causing bodily motion of the carriage, with means for automatically varying the amount of said motion,
35 substantially as described.

6. The combination with a punch or similar machine of a carriage for work to be operated upon, a cylinder having a piston, means for moving one of the members comprised by the cylinder and piston to a uniform extent and means for transmitting motion from said part to the other member, substantially as described.
40

7. The combination with a punch or similar machine of a carriage for work to be operated upon, a fixed track, a cylinder and piston, one of the members comprised by the cylinder and piston having means whereby it is reciprocated
50 and the other having means whereby it may be temporarily fixed to said track, with means for transmitting motion from one of said members to the carriage, substantially as described.

8. The combination with a punch or similar machine of a carriage for work to be operated on, a cylinder and a piston supported by said carriage, means for reciprocating one of said members through a constant distance and means for temporarily preventing motion of
60 one of said members, substantially as described.

9. The combination with a punch or similar machine of a carriage for work to be operated upon, a cylinder and piston on said carriage,
65 means operated by the punch for reciprocating

one of said members, a fixed track, means for connecting one of the members comprised by the cylinder and piston to said track, with means for varying the length of time for which said member is connected to said track,
70 substantially as described.

10. The combination of a punch or similar machine, of a carriage for the work to be operated upon, a fixed track, a cylinder and piston on the carriage, means for temporarily fixing one of said members to the track, means for reciprocating the other member through a constant distance and means for causing the carriage to be moved to a predetermined extent by the reciprocation of said member, substantially as described.
80

11. The combination of a carriage for work to be operated upon, a templet on said carriage, a cylinder and piston also on the carriage, means for reciprocating one of said members and means including a device cooperating with the templet, for causing the carriage to be moved through a variable distance by said reciprocating member, substantially as described.
90

12. The combination of a carriage for supporting work to be operated upon, a cylinder and a piston on said carriage, means for reciprocating one of said members, means for preventing motion of the other member and means for establishing communication between the ends of the cylinder so as to permit motion of the piston relatively thereto at predetermined times, substantially as described.
95

13. The combination of a carriage for work to be operated upon, a cylinder on the carriage having a piston and provided with a passage connecting its ends, a valve in said passage, means for reciprocating one of the members comprised by the cylinder and the piston, means for preventing motion of the other member and means for actuating the said valve at predetermined times, substantially as described.
100

14. The combination of a carriage for work to be operated upon, a cylinder on the carriage having a piston and provided with a passage connecting its ends, a valve in said passage, means for reciprocating one of the members comprised by the cylinder and the piston, means for preventing motion of the other member and a templet having portions placed to act upon said valve at predetermined points in the stroke of the structure carrying the same, substantially as described.
110 120

15. The combination of a carriage having means for holding work to be operated upon, a member having driving means whereby it is reciprocated, a second member coacting with the first and having means whereby it is permitted to move in but a single direction under the action of said first member, with a movable piece and stop-plates of variable length upon the same, said plates being placed to act upon one of said members to regulate the dis-
125 130

tance said member is moved by the other member, substantially as described.

16. The combination of a carriage for work to be operated upon, a cylinder and a piston on said carriage, means for reciprocating said piston, means for permitting motion of the cylinder in but a single direction, said cylinder having a passage connecting its ends, a valve in said passage and means for permitting said valve to open at predetermined points in the stroke of the piston, substantially as described.

17. The combination of a carriage for work to be operated upon, a cylinder and a piston on said carriage, means for reciprocating one of said members, means for permitting motion of the cylinder in but a single direction, said cylinder having a passage connecting its ends, a plurality of valves in said passage, means for permitting one of said valves to open at any predetermined point in the stroke of the reciprocating member and means for causing opening of the other valve at a fixed point in the stroke of said member, substantially as described.

18. The combination of a carriage for work to be operated upon, a cylinder and a piston on said carriage, means for reciprocating one of said members, means for preventing motion of the cylinder in other than a single direction, said cylinder having a passage connecting its ends, a valve in said passage, a series of stop-plates, and means for moving said stop-plates to cause them to be successively brought into operative relation to said valve, substantially as described.

19. The combination with a carriage for work to be operated upon, of a cylinder and piston on the carriage, means for reciprocating one of said members, means for permitting motion of the other member in but a single direction, the cylinder having a passage connecting its ends, a valve in said passage, a movable templet having means whereby different parts of it are successively brought into operative relation with said valve and means independent of said valve for establishing communication between the ends of the cylinder at a fixed point in the stroke of the reciprocating member, substantially as described.

20. The combination of a carriage for work to be operated upon, a cylinder having a piston, there being passage connecting the ends of the cylinder, a valve in the passage, means for preventing one of said members comprised by the cylinder and the piston from moving in but a single direction, and means for reciprocating the other member, said cylinder and the passage thereof being filled with an incompressible fluid, with means for causing said valve to open at a predetermined point in the stroke of the reciprocating member, to permit flow of said fluid from one end of the cylinder to the other.

21. The combination of a carriage for work

to be operated upon, a track for said carriage, a toothed surface, a cylinder and piston, means for reciprocating one of said members and a toothed portion on the other member formed to engage said toothed surface, means for establishing communication between the ends of the cylinder, said means including a templet having removable stop-plates, substantially as described.

22. The combination of a carriage for work to be operated upon, a toothed track, a device on the carriage having a part operated from a source of power through a fixed range of motion and including an arm operative upon said toothed track, with means for connecting the moving portion of said device with said arm and means for automatically varying the time of such connection, substantially as described.

23. The combination of a carriage for work to be operated upon, a toothed track, a constantly-operated device on the carriage having a fixed range of motion and including a piece operative upon said toothed track, with means for connecting the moving portion of said device with said piece and means for varying the length of time during which said two members remain connected, substantially as described.

24. The combination with a punch or similar machine, of a carriage having means for holding a piece of work to be operated upon, tracks for said carriage, and standards independent of the machine for supporting said tracks, said standards and tracks being at one side and out of the line of motion of the piece of work held by the carriage, the construction being such that said carriage is supported wholly from one side, substantially as described.

25. The combination with a punch or similar machine of a track or tracks extending parallel to the line of motion of the piece of work through the machine, standards independent of the machine for supporting said track, a carriage operative on the track, said carriage including an arm extending at right angles to the line of motion of the work and having means for holding said work, said tracks and the supports therefore being to one side and out of the line of motion of the material operated upon, so that the carriage is supported wholly from one side, substantially as described.

26. The combination of a carriage for work to be operated upon, means for automatically moving said carriage through predetermined and variable distances and means independent of said first means for traversing said carriage by power, substantially as described.

27. The combination of a carriage for work to be operated upon, with a shaft having means whereby it is rotated, means connected with said shaft and supported on the carriage for moving said carriage through predetermined

and variable distances, a second shaft, and means on the carriage independent of said first means for causing the movement of said carriage, substantially as described.

5 28. The combination of a standard or standards, a track supported thereby, a shaft having bearings on said standard, a carriage movable on said track and mechanism supported on the carriage operatively connected to said shaft whereby said carriage is moved through
10 predetermined distances and means also carried by the carriage for automatically varying the successive spaces moved over by it, substantially as described.

15 29. The combination of a standard or standards, a track supported thereby, a carriage movable on the track, a driven shaft, means operated by said shaft and movable with the carriage, for causing the latter to be inter-
20 mittently moved, with a templet on the carriage and means coacting therewith for determining the amount of each movement of the carriage, substantially as described.

25 30. The combination of a carriage for supporting work to be operated upon, with a cam having means whereby it is rotated, a rod having a piston, a link engaging said cam and connected to said piston-rod, a cylinder for said piston, means on the cylinder for permitting
30 motion thereof in but a single direction, said cylinder having a passage connecting its ends and a valve therein, with means for causing said valve to open at predetermined points in the stroke of the piston-rod.

35 31. A carriage having on it a pawl, means for reciprocating said pawl, a device for automatically varying the distances moved through by said pawl, the same including adjustable stops for controlling the distances moved
40 through by the carriage and means for cooperating with the stops, substantially as described.

32. The combination of a carriage having a pawl, means for reciprocating said pawl, a
45 structure for cooperating with the pawl, and a device for varying the amount of movement given to the pawl, said device including stops

and mechanism cooperating therewith, the stops being variable as to the position of their working faces, substantially as described. 50

33. The combination with a punch or similar machine of a carriage having means for holding a piece of work to be operated upon, a track at one side of the carriage placed to receive horizontal and vertical components of
55 its weight, and rollers on the carriage in engagement with said track, the device being so constructed that the carriage is supported wholly from one side, substantially as described. 60

34. The combination with a punch or similar machine of a carriage having means for holding a piece of work to be operated upon, two tracks for receiving horizontal components of the weight of the carriage and one
65 track for the vertical component of said weight, said tracks being at one side of the carriage and having supporting-standards, with rollers on the carriage for engagement with said tracks, the construction being such
70 that the carriage is supported wholly from one side, substantially as described.

35. The combination with a punch or similar machine of a carriage having means for holding a piece of work to be operated upon
75 and an overhung arm provided with a roller rotatable in a horizontal plane, a second roller at the lower portion of the carriage also rotatable in a horizontal plane and a third roller rotatable in a vertical plane, with a standard
80 or standards and tracks thereon placed to be respectively engaged by said rollers, the construction being such that the carriage is supported wholly from one side, substantially as described. 85

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

JOHN V. W. REYNDERS.
WILLARD T. SEARS.

Witnesses:

WM. C. ARMOR,
MARY E. HAUER.