(No Model.) 6 Sheets—Sheet 1.

F. KOHLER.

GANG PUNCHING MACHINE.

No. 369,344. Patented Sept. 6, 1887.

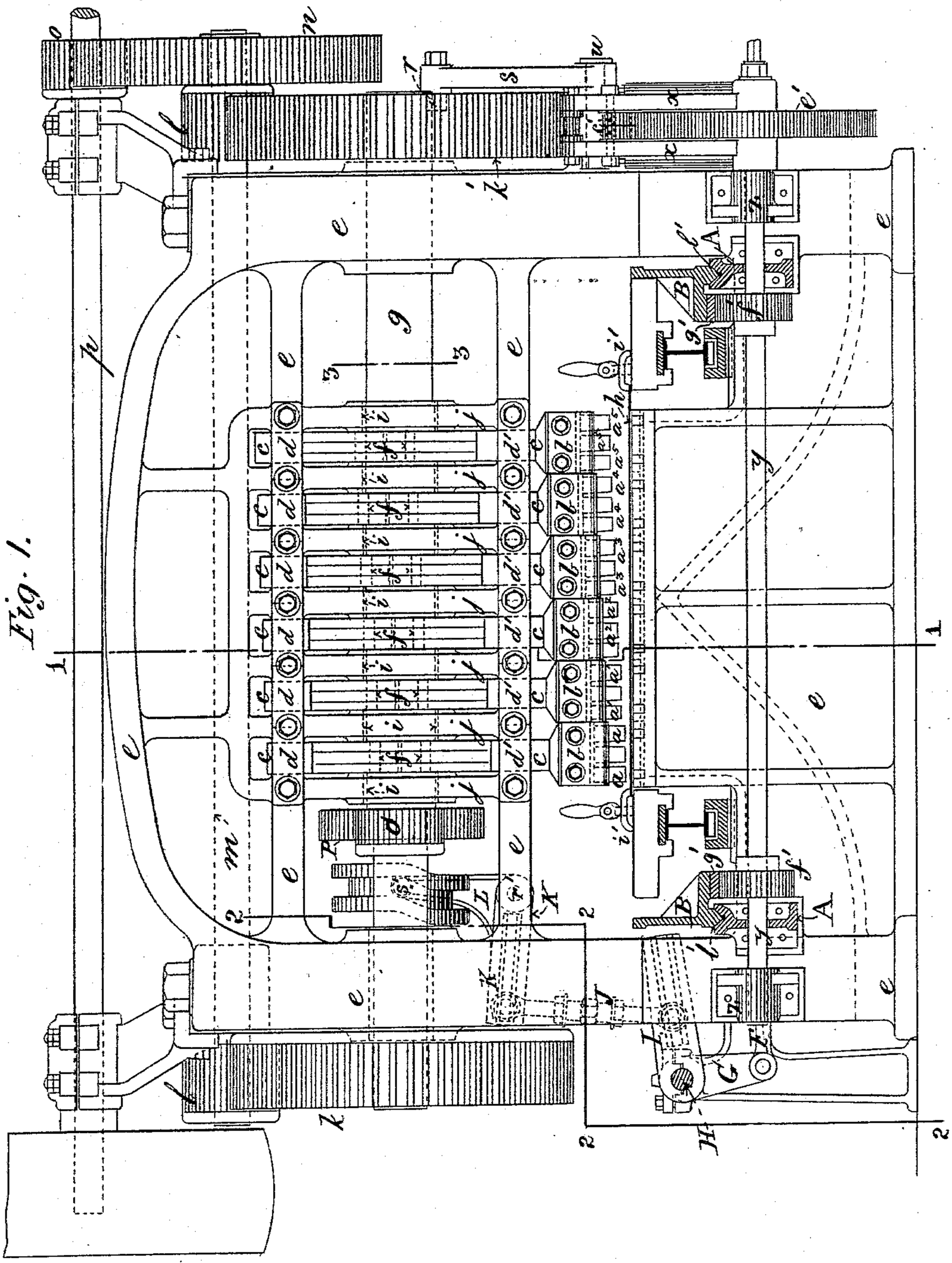

Fig. 1.

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Paul Bakewell, his
attorney.

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GANG PUNCHING MACHINE.

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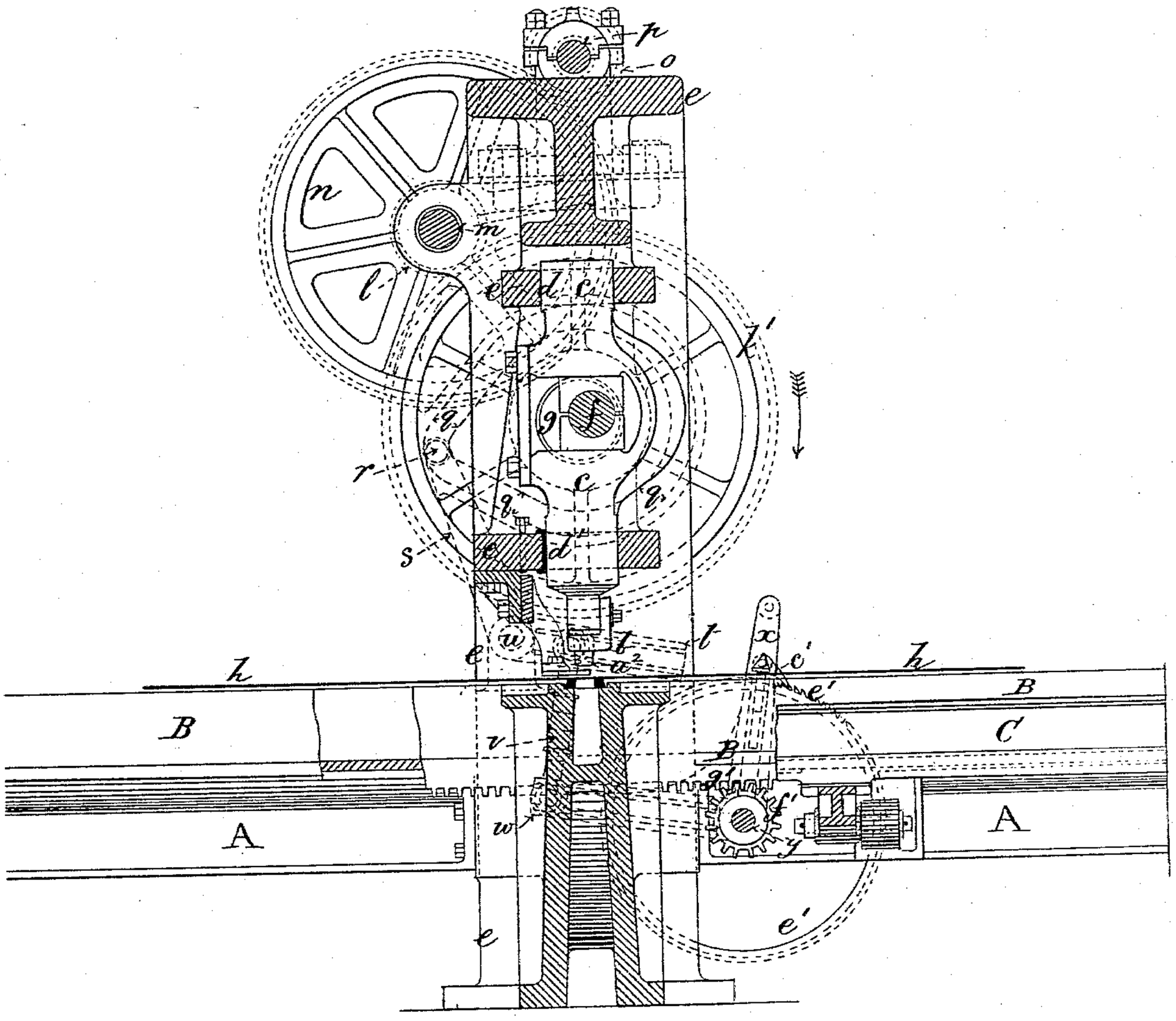
Fig. 2.



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F. KOHLER.

GANG PUNCHING MACHINE.

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Fig. 4.

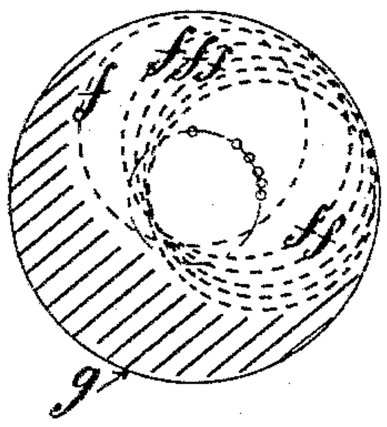
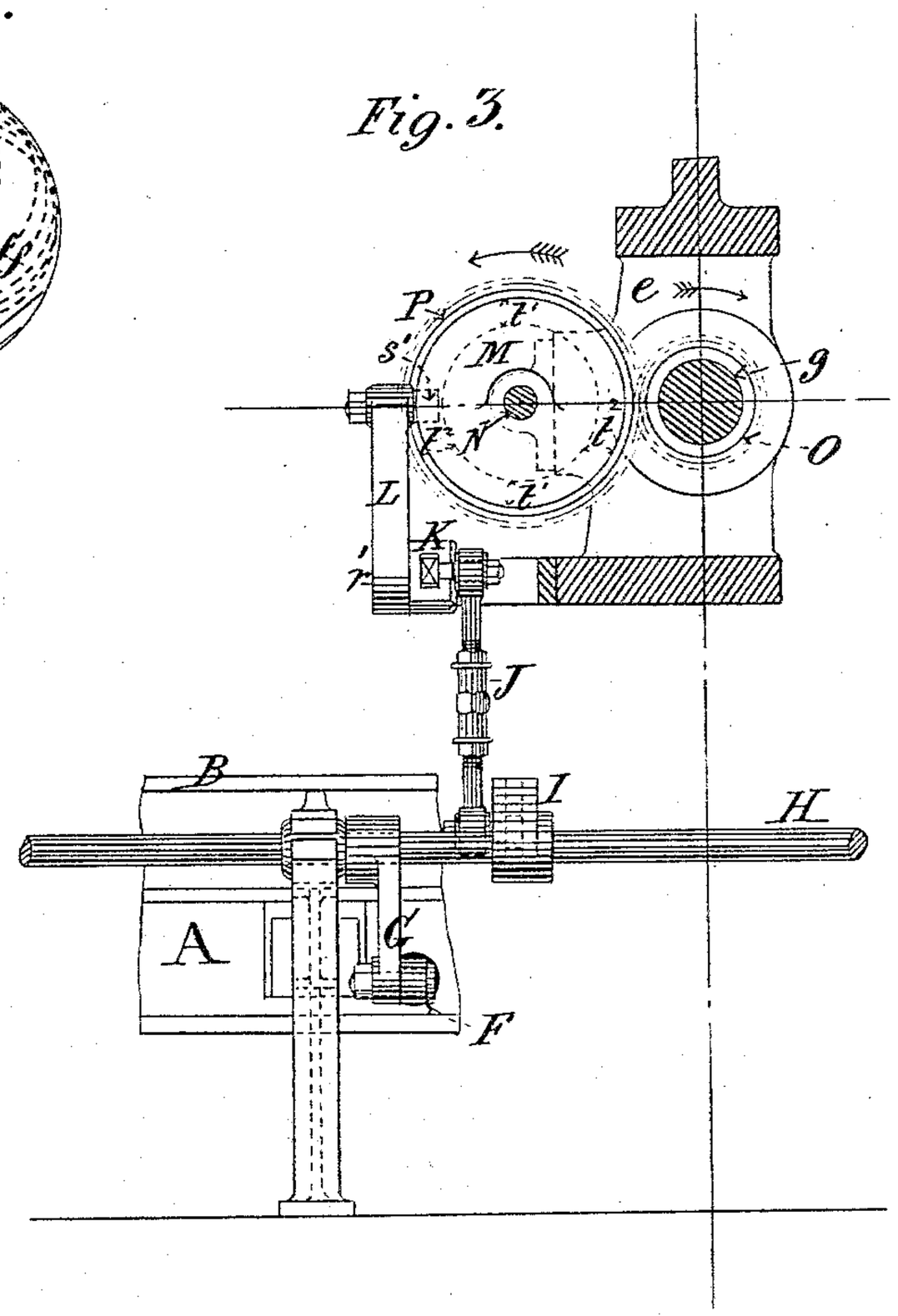


Fig. 3.



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F. KOHLER.

GANG PUNCHING MACHINE.

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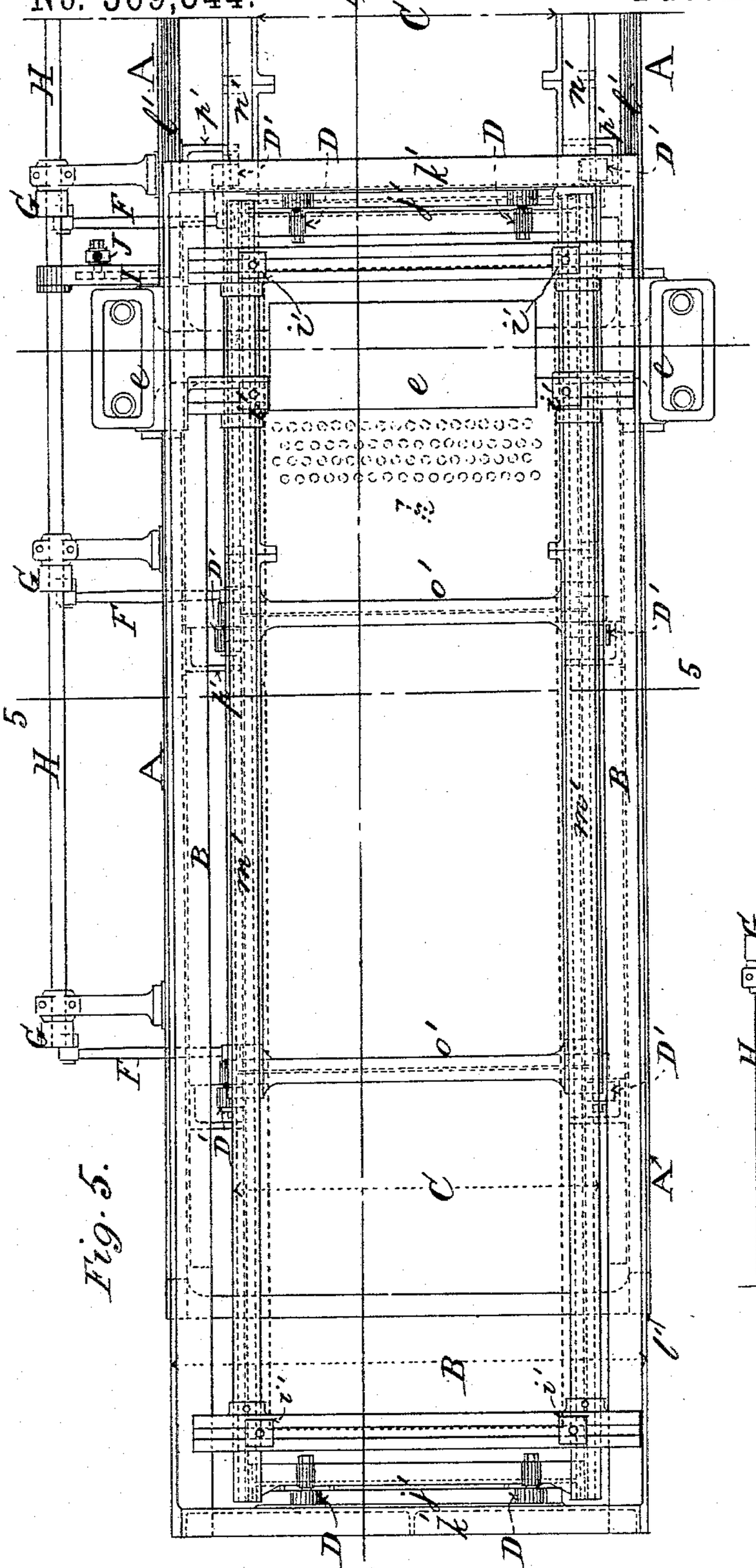

Fig. 5.

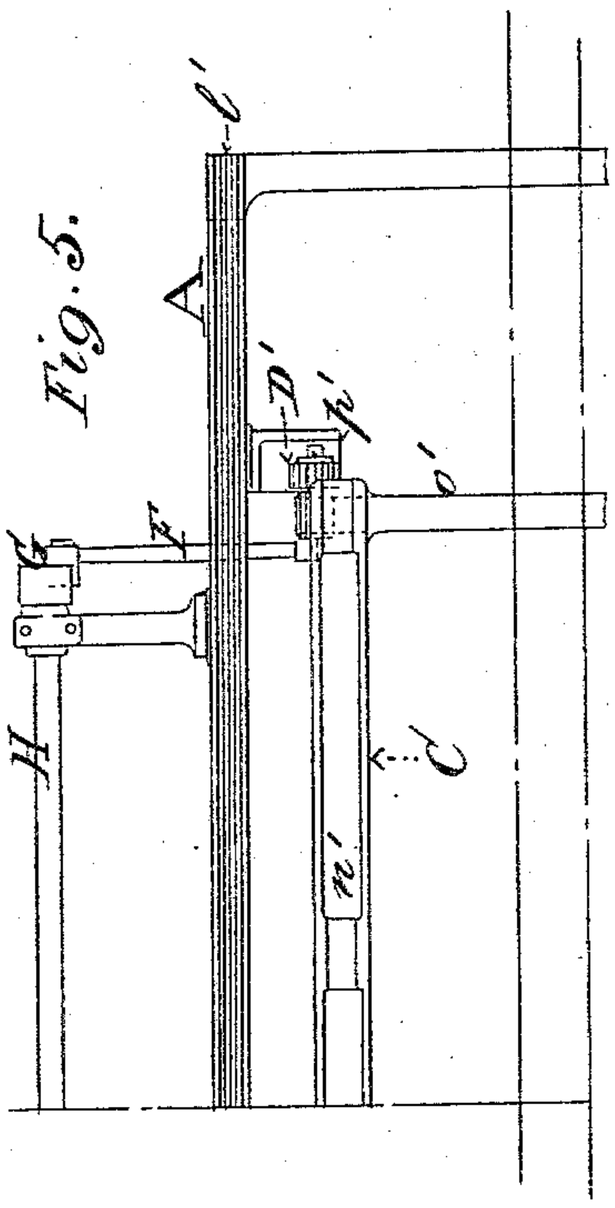

Fig. 6.

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F. KOHLER.

GANG PUNCHING MACHINE.

No. 369,344. Patented Sept. 6, 1887.

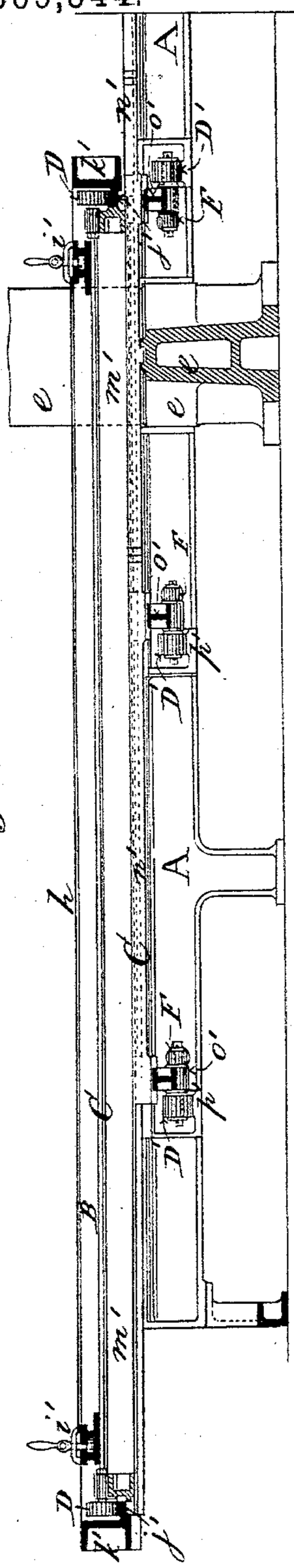

Fig. 6.

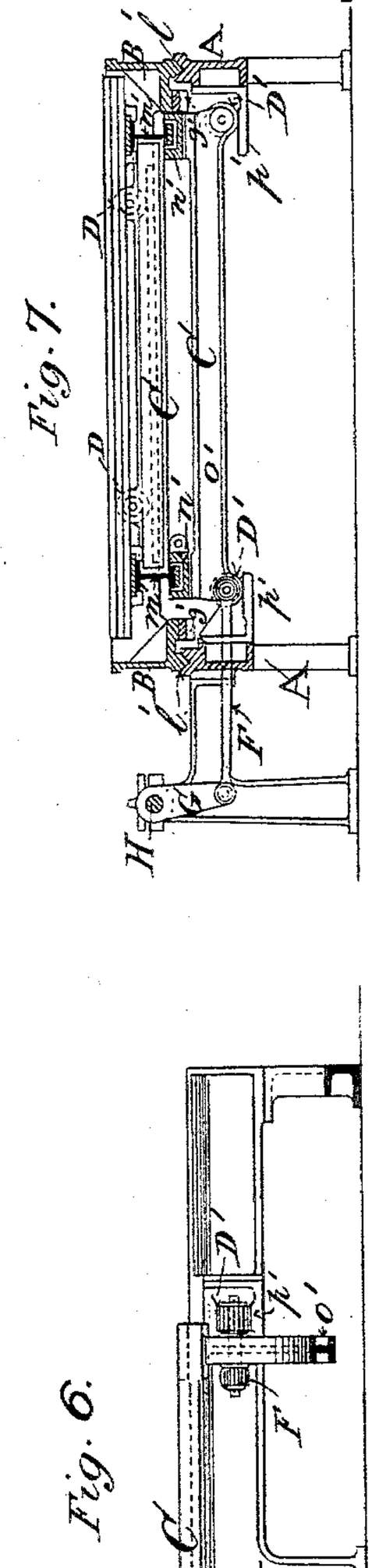

Fig. 7.

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F. KOHLER.

GANG PUNCHING MACHINE.

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Fig. 8.

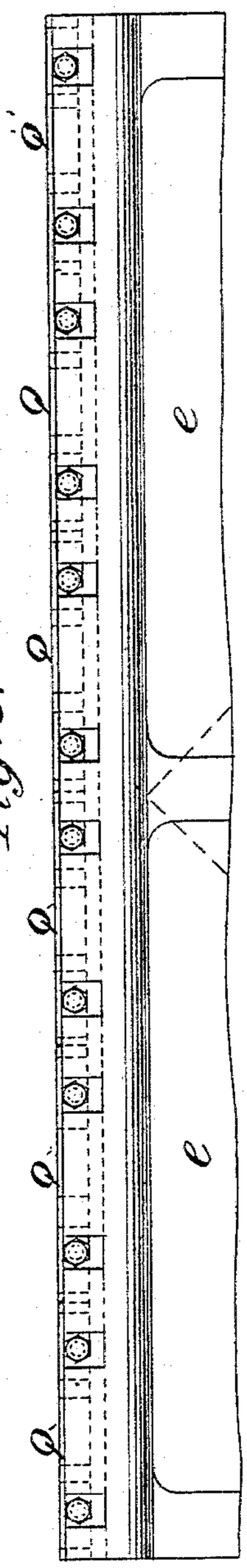


Fig. 9.

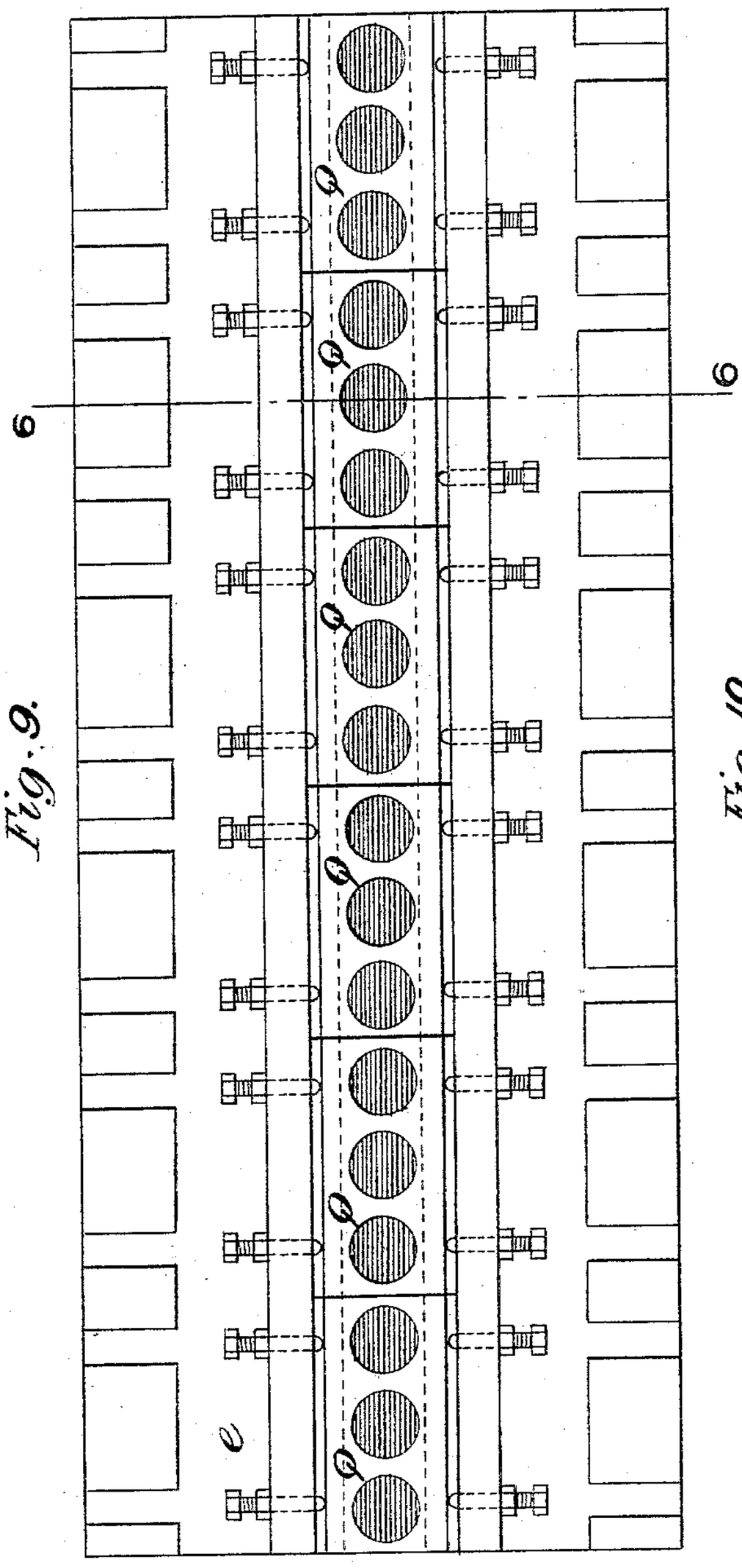
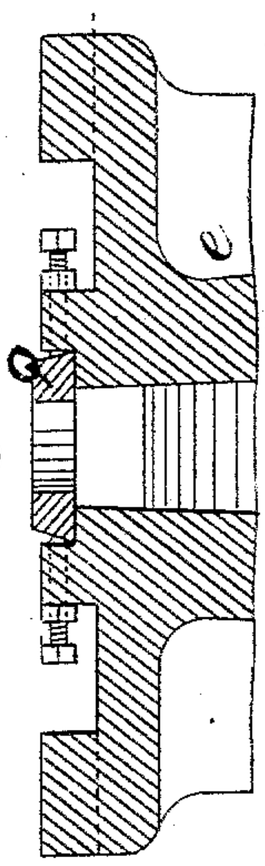


Fig. 10.



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Edwin Sauter

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Frank Kohler by
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UNITED STATES PATENT OFFICE.

FRANK KOHLER, OF ST. LOUIS, MISSOURI, ASSIGNOR TO WM. A. CHAMBERS, OF SAME PLACE.

GANG PUNCHING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 369,344, dated September 6, 1887.

Application filed April 4, 1887. Serial No. 233,560. (No model.)

To all whom it may concern:

Be it known that I, FRANK KOHLER, a citizen of the United States, residing at the city of St. Louis, State of Missouri, have invented a certain new and useful Improvement in Punching-Machines, of which the following is a full, clear, and exact description.

My invention relates to improvements in that class of multiple punching-machines employed for punching consecutive rows or series of holes zigzagwise through iron or other metal plates, and has for its object to reduce the weight of the machine and driving-power required, and to economize time and labor in effecting the transverse movement of the plate necessary for producing the zigzag arrangement of the holes punched therein. Hitherto the several holes of each row or series have been punched through the plate simultaneously at one operation of the machine and the transverse movement of the plate performed by hand.

My invention consists, first, in dividing each row or series of punches into two or more parts or sections, which are caused to descend consecutively upon and perforate the plate in advance of each other, so that while the entire row or series of punches will pass through the plate at one operation of the machine, as heretofore, only the punches of one or two sections will penetrate the plate simultaneously; and, secondly, in causing the plate, on the withdrawal of the punches from each row or series of holes, to be moved automatically transversely to either side alternately and simultaneously with its forward or feed motion, so that the several holes of the succeeding row or series will be zigzag or in line midway with those of the preceding row or series, respectively.

Of the accompanying drawings, Figure 1 is a front sectional elevation of my improved punching-machine; Fig. 2, a longitudinal section thereof, broken away on line 1 1 in Fig. 1; Fig. 3, a side sectional view following line 2 2 in Fig. 1; Fig. 4, a detached cross-section to an enlarged scale of the main shaft, taken on line 3 3 in Fig. 1; Fig. 5, a general plan, partly broken away, of the bed-frame with the traveling and traversing frames for conveying and locating the plate to be punched; Fig. 6, a longitudinal sectional elevation of the same on line 4 4 in Fig. 5; Fig. 7, a transverse section on line 5 5 in Fig. 5; Fig. 8, an enlarged front elevation, partly broken away, of the die-bed and dies; Fig. 9, a plan thereof, and Fig. 10 a section taken on line 6 6 in Fig. 9, like letters of reference denoting like parts in all the figures.

$a\ a'\ a^2$ represent a row or series of punches, which in the present case are eighteen in number and divided into six sections, each section comprising three punches, which, with their holders *b*, are respectively secured to the lower ends of six yokes or plungers, *c*, arranged at suitable distances apart and reciprocated vertically through upper and lower guide-bearings, *d d'*, in the frame-work *e* of the machine by cranks (or eccentrics) *f*, (seen in Figs. 1, 2, and 4,) which are formed, respectively, circumferentially in advance of each other and along the shaft *g*, so that during a single revolution of the latter, while the entire row or series of punches $a\ a'\ a^2$ will successively descend and penetrate the plate *h*, only one or two sections of the punches *a* will perforate the plate *h* simultaneously—that is to say, while one or two sections of the punches $a\ a'$ are passing through the plate *h* the remaining sections will either be approaching or receding from the plate *h*, according to the relative positions of the cranks *f*. The portions of the shaft *g* between the yokes or plungers *c* and cranks *f* are supported in bearings *i*, formed through the upright connecting-pieces *j* of the frame-work *e*, the faces of the bearings *i* being in contact with the sides of the yokes or plungers *c*, which are thereby steadied. The end portions of the shaft *g* pass through bearings in the sides of the frame-work *e*, and are provided outside the latter with spur-wheels *k k'*, which are geared into by the pinions *l* on the shaft *m*, at one end of which is keyed the spur-wheel *n*, geared into by the pinion *o* on the driving-shaft *p*.

Although the above description has reference particularly to a row or series of eighteen punches divided into six sections of three punches, it is to be understood that the number of sections and of punches in each section may be increased or diminished at pleasure, and the punches either uniformly distributed or relatively and numerically varied in any two or more sections, so as to punch large and

small holes indiscriminately in the same row or series.

In the outer face of the spur-wheel *k'* is a cam-shaped groove, *q*, Fig. 2, which is engaged by a pin, *r*, projecting horizontally from the end of the arm *s* of a bell-crank lever, *s t*, fulcrumed at *u* to the frame-work *e* of the machine, the other arm, *t*, being adjustably coupled by a rod, *v*, to one arm, *w*, of another bell-crank lever, *w x*, having its fulcrum on the shaft *y*, which extends across the machine through the sides of the bed-frame A, and is mounted at each end in a bearing, *z*, secured to the front of the frame-work *e*. To the arm *x* of the bell-crank lever *w x* are pivoted ratchet-pawls *c'*, which engage with the teeth of the ratchet-wheel *e'*, secured to the shaft *y*, on which are keyed spur-pinions *f'*, gearing into the racks *g'*, which are secured to the under sides of the traveling frame B, as seen in Figs. 1 and 2.

On the rotation of the spur-wheel *k'* and shaft *g* in the direction indicated by the arrow in Fig. 2, which causes the successive descent of the entire row or series of punches *a a' a²* through the plate *h*, the pin *r* is constrained inward by the cam-shaped portion of the groove *q*, so as to throw forward the arm *s* and depress arm *t* of the bell-crank lever *s t*, thereby depressing arm *w* and throwing back arm *x* of the lever *w x*. In so doing the ratchet-pawls *c'* move backward over the teeth of the ratchet-wheel *e'* for a certain distance, determined by previous adjustment, according to that required between two rows or series of holes to be punched in the plate *h*. As the punches *a a' a²* are descending and then rising through the plate *h* the plain portion of the groove *q* is passing over the pin *r*, and no further movement of the levers *s t* and *w x* takes place until the punches *a a' a²* are clear of the plate *h*, when the cam-shaped portion of the groove *q* again comes into action, and, forcing back the arm *s*, thereby raises arms *t* and *w* and forces forward arm *x*, which causes the ratchet-pawls *c'* to engage with the teeth of the ratchet-wheel *e'*, and, rotating the latter with the spur-pinions *f'*, propel or feed forward the traveling frame B, and with it the plate *h* beneath the punches *a a'*, the requisite distance for the next row or series of holes.

For effecting automatically a transverse movement of the plate *h* in each direction alternately and simultaneously with its forward motion, as above described, the plate *h* is held by clamps *i'* on the upper part of a traversing frame, C, Figs. 5, 6, and 7, which is provided at its ends with rollers D and mounted horizontally thereon within the traveling frame B, the rollers D resting on inside ledges, *j'*, cast on the ends *k'* of the traveling frame B, which is moved forward in the V-shaped guides *l'* of the bed-frame A by the racks *g'* and pinions *f*, (seen in Figs. 1 and 2,) as before named.

The sides of the upper part of the traversing frame C are composed of double T or I irons *m'*, the lower flanges of which are bedded and capable of moving longitudinally (as the traveling frame B and plate *h* are propelled forward or backward) in correspondingly-shaped grooved guide-bars *n'*, which extend parallel with the sides of the bed-frame A to a suitable length, according to that required for the forward and backward movement of the traveling frame B. The guide-bars *n'* are secured to lower cross-bars, *o'*, mounted at their ends on rollers D', which rest on brackets *p'*, secured to the insides of the bed-frame A. To one side of the lower part or framing, *n' o'*, of the traversing frame C are jointed the ends of connecting-rods F, which are located at suitable distances apart along the traversing frame C, and, extending through the side of the bed-frame A, are jointed at their other ends to levers G, which are of equal length and fulcrumed to a shaft, H, mounted in suitable bearings, and on which is keyed a slotted lever, I, the latter being connected by an adjustable rod, J, Figs. 1, 2, 3, and 5, to the slotted arm K of a bell-crank lever, K L, which is fulcrumed at *r'* to the framing *e* of the machine. The end of the arm L of lever K L carries a horizontally-projecting pin, *s'*, which engages in a groove, *t' t²*, having opposite curved portions *t²*, and formed in the periphery of a wheel, M, which is fixed on a counter-shaft, N, driven by a pinion, O, keyed to the main shaft *g*, and gearing into a spur-wheel, P, on the counter-shaft N, the ratio between the diameters of the pinion O and spur-wheel P and between the plain and curved portions of the groove *t' t²* in the wheel M being such that when, on the rotation of the spur-wheel *k'*, the groove *q* in the latter for the forward motion of the plate *h* is commencing to constrain the pin *r* of the lever *s t*, so as to propel the plate *h* forward, one of the curved portions *t²* of the groove *t' t²* will commence to constrain the pin *s'* and arm L of the bell-crank lever K L outward toward the side frame, *e*, of the machine, thereby depressing arm K and slotted lever I, which, partially rotating shaft H and throwing outward the lever G, causes the traversing frame C, with the plate *h* thereon, to be pulled over on the rollers D D' (along the ledges *j'* and brackets *p'*, respectively) transversely to the traveling frame B.

During the remainder of the revolution of the spur-wheel *k'* the plain portion *t'* of the groove *t' t²* in the wheel M will prevent any further movement of the levers and traversing frame C until the groove *q*, controlling the forward motion, is again in position to push forward the plate *h*, when the other cam-shaped portion, *t²*, of the groove *t' t²* will constrain the levers K L I G, so as to cause the traversing frame C and plate *h* to move an equal distance transversely in the opposite direction. By this means a uniform zigzag formation is given to the rows or series of holes punched in the plate *h* without the loss of time and expense of sliding back and resetting the plate *h* by hand, as heretofore.

By means of the slots in the lever I and arm

K of the bell-crank lever K L, the ends of their connecting-rod J can be adjusted, respectively, to any point along the said levers, so as to adjust the throw or vibration of the latter to the amount of transverse movement required for the plate *h*.

In combination with the first part of my invention, in lieu of using one die only for the entire row or series of punches, as generally the case, separate dies Q, (see Figs. 8, 9, and 10,) according to the number of sections in the row or series, are used, by which means the dies Q are interchangeable for varying the number of punches in each section, and are easily removable when required to omit one or more dies to suit various widths of plates to be punched.

I claim—

1. In a machine for punching multiple holes during one operation through iron or other metal plates, the combination of separate sets or sections of punches, *a a' a²*, secured, respectively, to yokes or plungers *c*, with cranks (or eccentrics) *f*, formed consecutively in advance of each other on operating-shaft *g*, substantially as shown, and for the purpose described.

2. In a machine for punching multiple holes during one operation through iron or other metal plates, the combination of separate sets or sections of punches, *a a' a²*, secured, respectively, to yokes or plungers *c*, with cranks *f*, formed to act consecutively in advance of each other on operating-shaft *g* and dies Q, substantially as shown, and for the purpose described.

3. In a punching-machine, the combination of the traveling frame B and bed-frame A with traversing frame C, mounted on rollers D D' and carrying the plate to be punched, substantially as shown, and for the purpose described.

4. In a punching-machine, the combination of the traveling frame B, bed-frame A, having guides *l'* and brackets *p'*, and traversing frame C, having rollers D D', with connecting-rods F, levers G, shaft H, slotted lever I, adjustable rod J, bell-crank lever K L, having projecting pin *s'*, wheel M, formed with groove *t' t²*, counter-shaft N, spur-wheel P, pinion O, and operating-shaft *g*, substantially as shown, and for the purpose described.

5. In a punching-machine, the combination of the traveling frame B, bed-frame A, having guides *l'* and brackets *p'*, traversing frame C, mounted on rollers D D', connecting-rods F, lever G, shaft H, slotted lever I, adjustable rod J, bell-crank lever K L, having pin *s'*, wheel M, formed with groove *t' t²*, counter-shaft N, spur-wheel P, pinion O, and operating-shaft *g*, with the mechanism, substantially as described, for effecting the forward movement of the plate to be punched, substantially as shown, and for the purpose described.

In testimony whereof I affix my signature, in presence of two witnesses, this 31st day of March, 1887.

FRANK KOHLER.

Witnesses:
S. L. SCHRADER,
EDWIN SAUTER.