(No Model.) 4 Sheets—Sheet 1.

G. BIRD.

PLANING MACHINE.

No. 513,869. Patented Jan. 30, 1894.

FIG. 2.

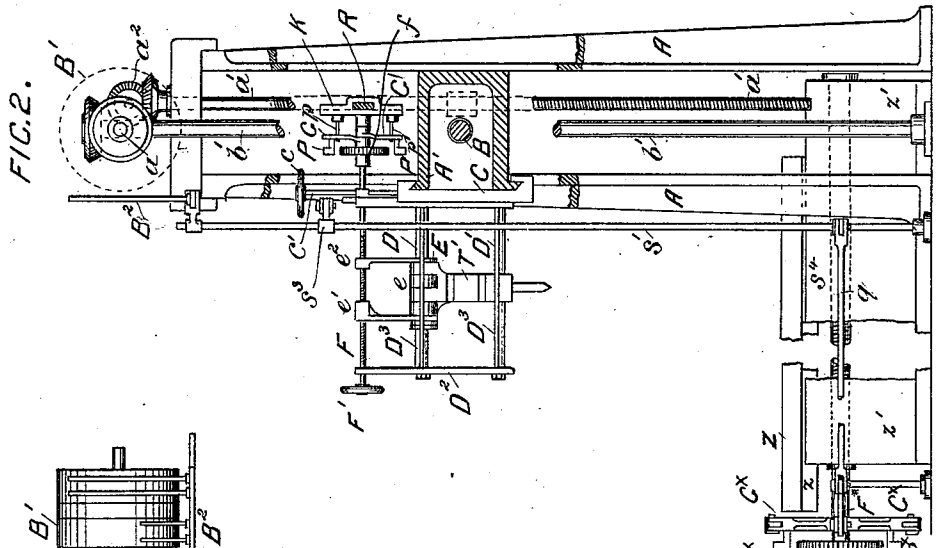
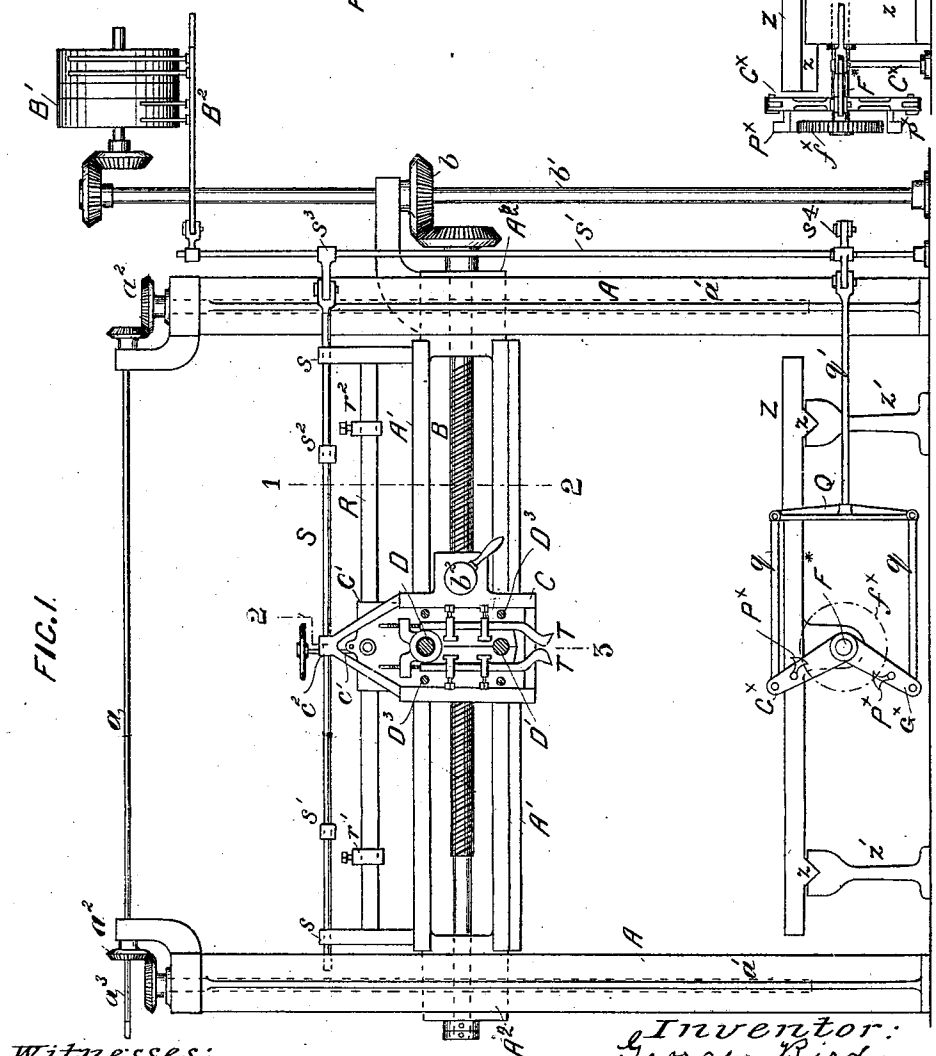


FIG. 1.



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E. K. Sturtevant.

Inventor:
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WASHINGTON, D. C.

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G. BIRD.

PLANING MACHINE.

No. 513,869. Patented Jan. 30, 1894.

FIG. 3.

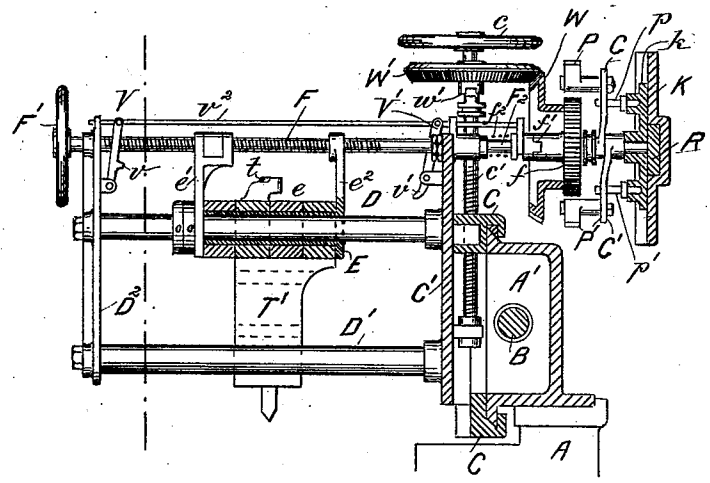


FIG. 4.

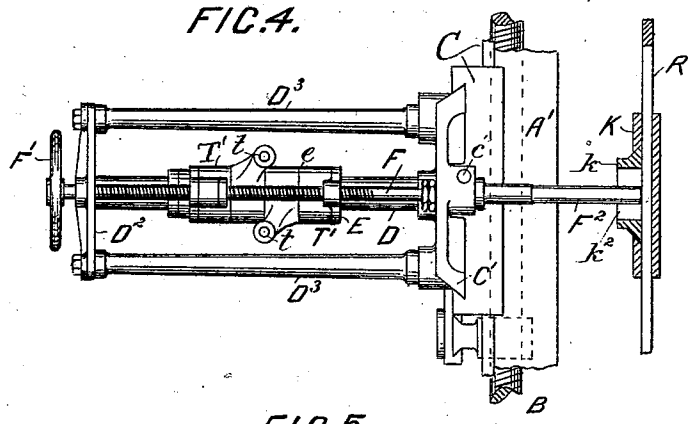
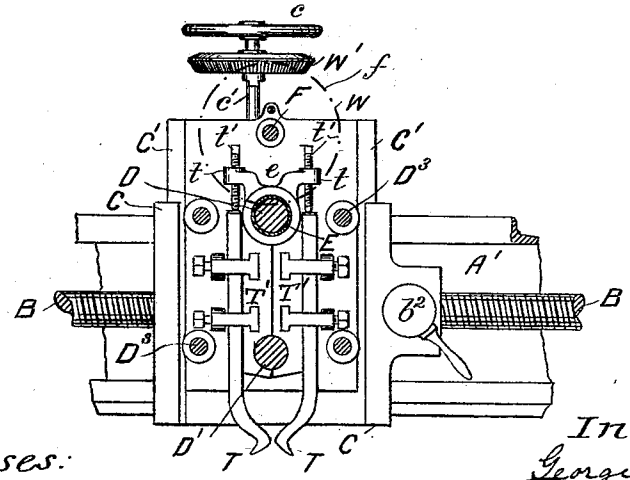


FIG. 5.



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PLANING MACHINE.

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FIG. 7.

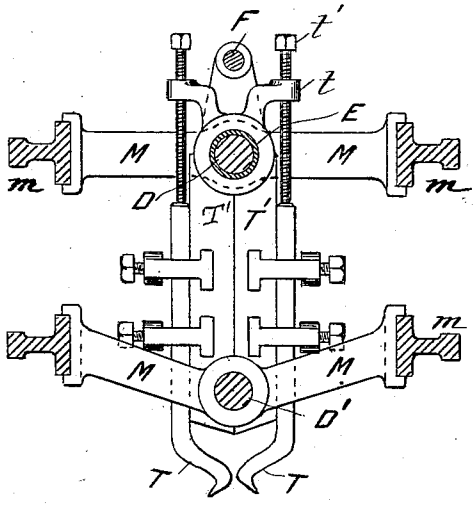


FIG. 6.

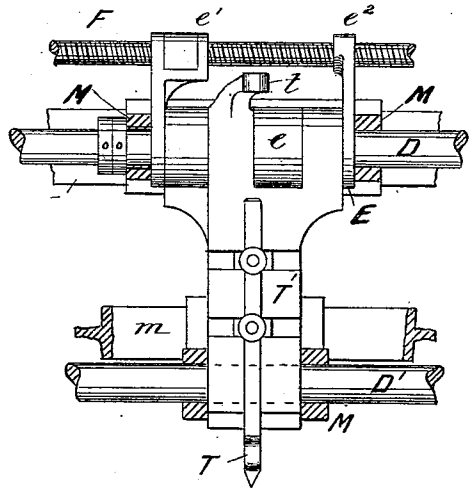
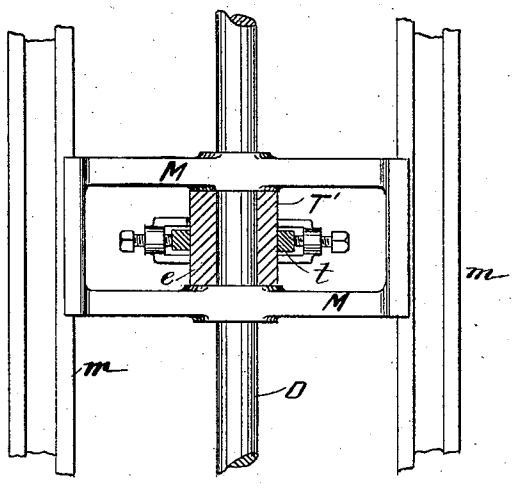


FIG. 8.



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(No Model.)

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G. BIRD.

PLANING MACHINE.

No. 513,869. Patented Jan. 30, 1894.

FIG. 9.

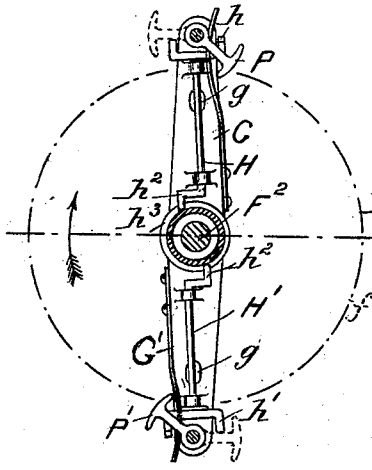


FIG. 10.

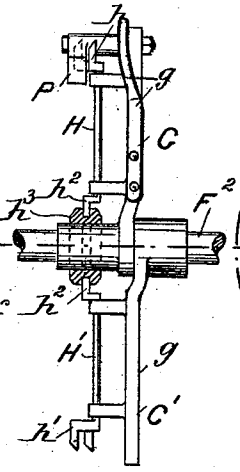


FIG. 12.

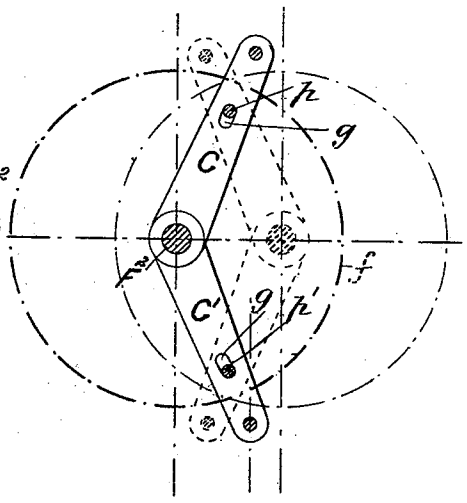


FIG. 11.

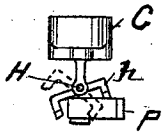
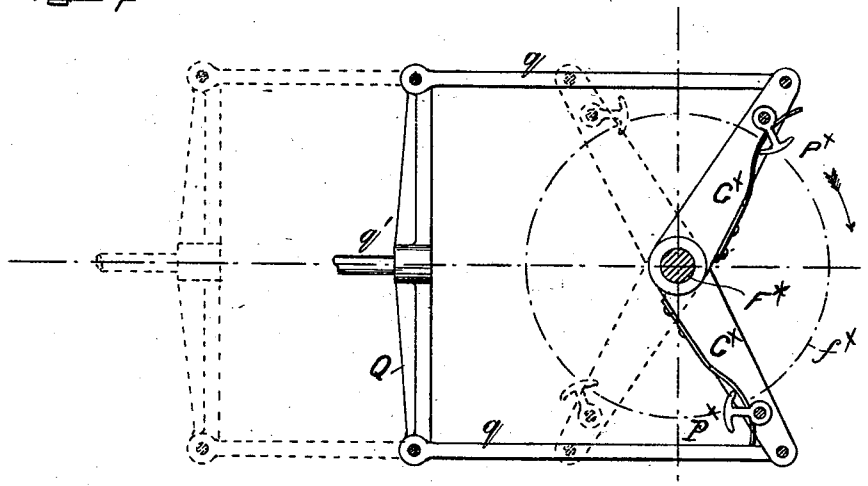


FIG. 13.



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E. K. Shinkward

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THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

GEORGE BIRD, OF LONDON, ENGLAND.

PLANING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 513,869, dated January 30, 1894.

Application filed March 16, 1893. Serial No. 466,234. (No model.)

To all whom it may concern:

Be it known that I, GEORGE BIRD, a subject of the Queen of Great Britain and Ireland, residing at the Western Iron Works, Notting Hill, London, England, have invented new and useful Improvements in and Relating to Planing-Machines for Iron and other Hard Materials, of which the following is a specification.

My invention relates to planing machines for iron and other hard materials in which either the cutting tools are traveled above the work, or the work is traveled beneath the tools, and the objects of my invention are first, to provide a novel arrangement of duplex cutting tools whereby I utilize both forward and return strokes of the tools or the work, as the case may be, instead of idly returning tools or material as is usually the practice; second, to afford facilities for the fine adjustment of said tools in respect to the face of the work; third, to effect automatically the required lateral and vertical feeds of either tools or work, or both as and when required, and to control the same and prevent injury to the parts. I attain these objects by the mechanism illustrated with accompanying drawings in which—

Figure 1 is a front elevation and Fig. 2 an end elevation in section on line 1—2 of Fig. 1, of an entire planing machine, in which either tools or work or both are laterally fed, having my improvements applied thereto. Fig. 3 is an enlarged cross-sectional elevation on line 2—3 of Fig. 1. Fig. 4 is a plan of Fig. 2, partly in section, with feed levers and gear removed. Fig. 5 is a front elevation of the duplex cutting tools and their mounting, operating, and adjusting mechanisms; the tools in the above figures are traveled longitudinally above fixed work and fed laterally. Fig. 6 is a transverse sectional elevation; Fig. 7 a front sectional elevation, and Fig. 8 a sectional plan of the duplex tools, tool holders, adjusting and feeding devices, the work being traveled beneath tools, stationary as regards longitudinal motion but with lateral feed. Fig. 9 is a front elevation showing feed and locking mechanisms. Fig. 10 is an end elevation of same. Fig. 11 is a plan of Fig. 9. Fig. 12 is a diagram illustrating in elevation the lines of motion of mechanisms for feeding the tools laterally; and Fig. 13 is a diagram illustrating in elevation the lines of motion of same for feeding the bed table and fixed work laterally, change of positions being shown in dotted lines.

Similar letters refer to similar parts throughout the several views.

A A are double vertical main standards fixed to any usual foundations and A′ is the head girder or bed, the ends of which A^2 are formed so that the whole slides vertically between the pairs of standards A. The bed A′ carries the traversing or motor screw B which is driven by miter gear *b*, the driving power being applied at B′ as shown or in any convenient manner. The bed A′ is bodily moved up and down by the vertical bed screws *a′* screwed through its ends and operated by miter gears a^2. a^2. and horizontal bar *a*, hand or other power being applied at a^3.

C is the main traversing saddle mounted on the bed A′ and connected to the screw B by a nut in the box b^2 closing thereon after the manner of the nuts used in lathe saddles.

R is the "feed bar" fixed above and parallel to the bed A′ and carrying a feed saddle K and two adjustable "feed stops" r' r^2.

S is the "reversing bar" adapted to slide in its bearings *s*. *s*. and carrying two adjustable "reversing stops" *s′*. s^2. with which a stop c^2 on saddle C engages at the proper times. The reversing bar S is connected by any suitable arrangement of levers such as s^3 to a vertical spindle S′ connected to and operating the bar B^2 for shifting the belts on the driving pulleys.

Z is the bed-table for carrying the work mounted on slides *z* traveling on the standards *z′ z′* and operated to give lateral feed by screw F* as hereinafter set forth.

First, in reference to my novel arrangement of duplex cutting tools. To the saddle C is fitted a strong slide C′ capable of vertical reciprocal motion and carrying two strong spindles D. D′. projecting at right angles to its lines of motion and coupled together at the outer ends by a plate D^2 and made rigid by supplementary bolts such as D^3 or other suitable struts and ties. These two spindles D D′ are in the same vertical plane and parallel to each other, and upon the upper one

D I hang and dispose the two tool flaps T' T' which are made with slots across their faces for ordinary dogs for fixing the two tools T T. A novel feature of this arrangement is that the two flaps T' T' are both hinged upon the same spindle D in such manner as to form a kind of butt-hinge as shown at *e*, and the two tools T T are arranged back to back as illustrated. The lower spindle D' forms the thrust bar which always takes the thrust of that tool which is at work and directs same to the bed of the machine, the other tool following idly.

Second. In order to adjust the tools T T against each other with their cutting edges at the same level I provide a projecting lug *t* at the top and on the center line of each tool flap T'. These lugs are drilled and tapped and fitted with finely-threaded studs *t'* arranged immediately over the tools T and in alignment therewith, so that by screwing them down a very fine adjustment is given to the tools. An important advantage following upon this arrangement is that the necessity for the usual slides and V's is dispensed with, and by hanging the flaps on the same spindle D the horizontal distance between the cutting edges of the tools can be reduced to a minimum, whereby the distance of idle stroke before the second tool commences action is reduced and so time is saved. The required vertical feed may be given to the slide C' of saddle C by hand-gear *c. c.'* of any suitable type, or automatically as hereinafter described. The above described arrangement is for machines wherein the cutting tools are moved longitudinally of the machine, as in Fig. 2, above or upon the face of the work fixed upon the table Z, in order to do the cutting, but in machines where the work is moved beneath the cutting tools which do not move longitudinally for the cutting operation, but only laterally of the machine for the feed, as is often the case, my invention calls for slight modification. This is illustrated in Figs. 6, 7, and 8. The tools, toolholders and adjustments are arranged exactly as above, the tool holders T' being hung upon the one spindle D; but here in order to take the thrusts in either direction from the acting tool the spindles D D' are each fixed in and supported by a strong cross-frame M M, and for the lateral feed the end bearing surfaces of said frame are adapted to slide upon guide bars *m. m.* disposed across the machine between suitable side standards and arranged for vertical reciprocal motion with the tools in any suitable manner. These bars *m. m.* take the whole thrust of the cutting tool and must therefore be made of such strength as is required, and by this arrangement work of practically indefinite length may be undertaken.

Third. In any machine whether the tools be moved or the work it is necessary that a lateral and horizontal motion for feeding either the tools or the work as required shall take place simultaneously at the end of each stroke of the machine, and by my invention this is effected automatically as follows:

(*a*) *For feeding the tools.*—The knuckle joint *e* of the two tool flaps T' T' is mounted upon a sleeve or bush E capable of sliding on the bearing spindle D; at its ends it carries vertical arms e' e^2. The upper end of the one e' embraces a threaded nut working on the feed screw F and the other e^2 is a guide. The feed screw F is mounted in bearings in the plate D^2 and slide C', and may be actuated by a hand wheel F' at the required times. It is extended in the form of a plain rod F^2 upon which is mounted a ratchet wheel *f* with radial teeth, the boss of which is provided with a sliding clutch *f'* constantly pressed into operative position by a spring such as f^2 and the whole is arranged in such manner that any rotation of the wheel *f* will turn the feed screw F, but when the clutch *f'* is out of gear the wheel *f* turns inoperatively on the rod F^2. The required intermittent rotation of the wheel *f* is effected automatically at the required times by means of two double-end pawls P P', the bosses of which are normally pressed upon and held steady by springs P^2 arranged as illustrated in the usual way. The said pawls P P' are carried at the outer ends respectively of a pair of oppositely disposed levers G G' each free to revolve with its boss upon the rod F^2 adjacent to the wheel *f;* and both are automatically moved over at the required times by an arrangement of mechanism such as is shown in Figs. 1, 2, 3 and 9 to 12. Each lever G G' has a slot *g* in which work operating pins *p p'* mounted upon a vertically moving "pinslide" *k* which is itself mounted in a horizontally moving "feed saddle" K, carried by and adapted to slide upon the horizontal "feed bar" R. The feed saddle K is driven normally through its stroke by the engagement of the pins *p p'* of the pinslide *k* with the slots *g* in the levers G G' which being mounted as described on the feed screw rod F^2 are traveled therewith by the main traversing saddle C and screw B. At midstroke the two levers G G' are in the same straight line as in Figs. 9 and 10, and the free end of the rod F^2 engages in the center of a slot k^2 in the pinslide *k* by which the feed action is effected by a compound motion as follows: Toward the end of the stroke and just before the reversing motion commences, the feed-saddle K engages and is brought to rest by one or other of the adjustable feed stops r' r^2 on feed bar R and while the reversing action is taking place, the main saddle C and with it the feed screw F, its extension rod F^2, the wheel *f* and the levers G G' continue their forward travel and so carry the end of rod F^2 along to the end of its slot k^2 in the pinslide *k*. This continued motion of rod F^2 has the effect of causing the levers G G' (at the time held at rest as regards their outer ends by the pins *p p'* of the now stationary feed saddle K), to be turned on their centers in op-

posite directions;—for example, assuming the direction of travel to be from left to right, the levers and parts at the moment of commencement of feed would take the position shown in full lines in Fig. 12, and the dotted lines indicate the position of levers and final position of the wheel f after the feed by the continued advance of rod F^2 as above described. During this advance one pawl P would engage and give a part rotation to the wheel f thereby partly rotating the rod F^2, and the clutch f' being in gear, giving the required feed through the tool flaps T' to the tools T, the other pawl P' during this action travels idly over the teeth of wheel f and assumes the proper position for its own similar operative action at the other end of the next stroke when the same action of the levers, pawls, and parts is repeated and so the feed is automatically given at the end of each stroke. The pinslide is here introduced to counteract the effect of any vertical motion of the slide C', otherwise the feed bar R would require to be raised and lowered in conjunction with the slide C'. Such vertical motions of the pinslide k can be effected through the extension rod F^2 and slot k^2 by the hand gear $c\ c'$ operating the saddle slide C' as and when required as above set forth, but may be automatically effected as follows: Referring to Figs. 3 and 5, W is a miter wheel free to revolve with the wheel f and W' is a corresponding miter wheel free to revolve on the vertical feed screw c', a clutch w' being arranged to connect the two when required. The wheels W W' normally run inoperatively, but when the automatic feed is required the clutch f' is disengaged and the clutch w' is thrown into gear in the usual way, and then the screw c' is driven and so imparts the required vertical feed to the slide C' and thence to the tools T T. With the automatic lateral feed motion above described over-winding might occur owing to the tool carrier E on spindle D being overwound and engaging its rigid end stops. To automatically prevent this I adopt an arrangement shown in Fig. 3 only. V V' are levers of different orders centered respectively as shown upon the end plate D^2 and the main carriage slide C' and having corresponding striking pieces $v.\ v'.$ respectively. They are connected by a light rod v^2 pivoted to them and extended and arranged to operate the before-mentioned clutch f' on the boss of the reversing wheel f, the spring f^2 being applied as shown. By this simple arrangement when the carrier E arrives at either end of its stroke it takes against one or other of the striking pieces $v\ v'$ and pushes over the lever thereof, thereby disengaging the clutch f'; then further motion given to the wheel f by the pawls P P' as above set forth serves only to turn the wheel f inoperatively on its shaft until the tool carrier E has been re-adjusted, the spring f^2 then automatically re-engaging the clutch f' in operative position. A similar arrangement may be applied to the clutch w' of the vertical feed above described.

(*b*) By my above described arrangement of automatic lateral feed for the tools the traversing bed Z may in small machines be dispensed with and the work fixed; but in large machines it is advisable to retain it, and in such cases in order to intermittently rotate the said bed table feed screw at the required times an arrangement similar to the arrangement above described is used consisting of feed wheel $f^\times$, feed levers $G^\times\ G^\times$, pawls $P^\times\ P^\times$, and gear is arranged as shown in Figs. 1 and 2 in position conveniently adjacent to the feed screw F^* of the table Z. The motion of the levers $G^\times\ G^\times$ for giving the feed is here accomplished by connecting them by links $q\ q$, Figs. 1 and 13, to a cross bar Q having a central rod q'. The required reciprocating motion is obtained at each end of the stroke by connecting the rod q' through a system of multiplying levers such as is illustrated at s^4 to the vertical spindle s' before described operating the belt shifting bar B^2. The change of position of parts after the feed is represented by the dotted lines in Fig. 13. Whether the above described automatic feed gear be applied to the tools T or to the bed table Z, or, as is required in some machines, to both tools and bed, to control the action and prevent the possibility of both pawls P P' or $P^\times$ $P^\times$ simultaneously taking the positions in which both of them would operate the wheel f or $f^\times$ at the same time but in opposite directions and thereby cause strain or fracture of some part, in combination with the reversing levers G G' or $G^\times\ G^\times$ I provide an automatic locking mechanism illustrated in Figs. 9, 10, and 11, which mechanism I will describe for convenience in connection with the parts lettered f, G G', P P'. This mechanism consists of a pair of light spindles H H' mounted respectively in bearings on each reversing bar G G'; the outer end of each spindle H H' carries a fork $h\ h'$ and on the inner ends is formed a small crank h^2 adapted to engage in a groove in a collar h^3 free to slide on the boss of one of the levers G G' or on the rod F^2 if desired. By sliding the collar h^3 it follows that the same turning motion will be produced upon both the similarly arranged rotary spindles H H' and their forks $h\ h'$ and hence their action will be the same. For example, when one fork h is turned forward the corresponding one h' of the other spindle H' will also turn forward. At starting, when one pawl, say P, on lever G is put into gear with the wheel f it passes over and forces down the underlying arm of its fork h and elevates the other arm thereof. The cranked end of its spindle H then operates the sliding collar h^3 and this serves to actuate the opposite crank and rotate the corresponding spindle H' on the other lever G' and a corresponding motion is thus given to its fork h', one arm of which (corresponding to the elevated arm

on lever G) then presents a stop effectually holding the other pawl P′ out of gear with wheel *f* (in the opposite direction to the first pawl P) but allowing the second pawl P′ to pass over the depressed arm of its fork *h′* and so gear with wheel *f*. The pawls P and P′ then both necessarily lie in the same direction (viz:—the operative or feeding direction). When neither pawl is in gear the first one to be put in action will push down one side of its own fork and the contact surfaces of both parts are suitably beveled off to prevent a dead stop being presented on both sides and to facilitate the action.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a planing machine the combination of duplex tool holders carrying two cutting tools T T fixed back to back and hinged and hung to swing independently upon the same spindle D, with thrust bars for same, whereby each stroke of the machine is utilized and an idle return saved, substantially as set forth.

2. The duplex tool holders carrying two cutting tools hinged and hung to swing independently upon the same spindle D, and thrust spindles and bars for same, in combination with tool flap lugs *t*, *t*, and screwed studs *t′ t′*, substantially as shown for the purpose specified.

3. The combination in a planing machine with the duplex tool holders and tools hinged and hung on one spindle D, of the sleeve E having nutted arm *e′*, embracing feed screw F F², the wheel *f*, the oppositely disposed feed levers G G′ carrying pawls P P′, adapted to engage said wheel *f*, and means for automatically and simultaneously moving over the said levers G G′ and pawls P P′ at the end of each stroke of the machine, substantially as for the purposes set forth.

4. The combination in a planing machine with the duplex tool holders and tools hinged and hung on one spindle D, the sleeve E with arm *e′*, feed screw F F², wheel *f*, slotted levers G G′ with pawls P P′ adapted to operate the feed wheel *f*, of pins *p p′* fixed on pinslide *k* having slot *k²* for rod F² and adapted to move vertically in feed saddle K on feed bar R provided with adjustable stops *r′*. *r²*. whereby the feed is automatically effected at each end of the stroke, substantially as shown for the purposes specified.

5. In a planing machine the combination with the bed table Z and its lateral feed screw F* of a feed wheel $f^{\times}$, levers $G^{\times}$ $G^{\times}$ provided with pawls $P^{\times}$ $P^{\times}$ adapted to engage said feed wheel $f^{\times}$, the links *q q*, cross bar Q, connecting rods *q′* and *s′* and belt shifting and reversing bar B² whereby feed is automatically given to the said bed Z at each end of the stroke, substantially as set forth.

6. In a planing machine the combination with main traversing saddle C carrying vertical slide C′ having screwed spindle *c′* and carrying the spindle D, tools T, and thrust bars of miter gear W W′, clutch *w′*, feed wheel *f*, feed screw F and spring clutch *f′*, whereby a vertical feed is automatically effected, substantially as set forth.

7. In combination with feed screw F and rod F², feed wheel *f*, levers G G′ provided with pawls P P′ of locking spindles H H′, forks *h h′*, cranks *h²* and sliding collar *h³* whereby one pawl only can give the feed in the proper direction at one time and the other is locked, substantially as and for the purpose set forth.

8. In combination with the sleeve E carrying the tool holders, its arms *e′ e²* and the feed screw F, of stop levers V V′, rod *v²*, spring clutch *f²*, and wheel *f*, operated by pawl levers G G′, whereby overwinding is automatically prevented, substantially as set forth.

9. The combination in a planing machine of the main traversing saddle C, having a vertical slide C′ carrying spindle and tools, and provided with a stop C², of sliding rod S furnished with two adjustable reversing stops *s′*. *s²*, the connecting lever *s³* and belt shifting bar B², substantially as shown for the purpose set forth.

10. In a planing machine the combination with duplex tool holders and tools hung on one spindle D carried in frame M, adapted to slide laterally, and a bed table Z on transverso slides, of feed screws F F* carrying wheels *f*, $f^{\times}$, levers G G′, $G^{\times}$ $G^{\times}$ pawls adapted to engage said feed wheels and mechanism for operating same, substantially as above set forth, whereby lateral feed is automatically given to the tools, or the bed table, or both at each end of the stroke.

In witness whereof I have hereunto set my hand in presence of two witnesses.

GEORGE BIRD.

Witnesses:

JOSEPH C. CHAPMAN,

HENRY A. PRYOR,

Both of 70 *Chancery Lane, London.*