Nov. 15, 1932. W. E. JENSEN 1,887,976

ADJUSTABLE PARTITION MACHINE

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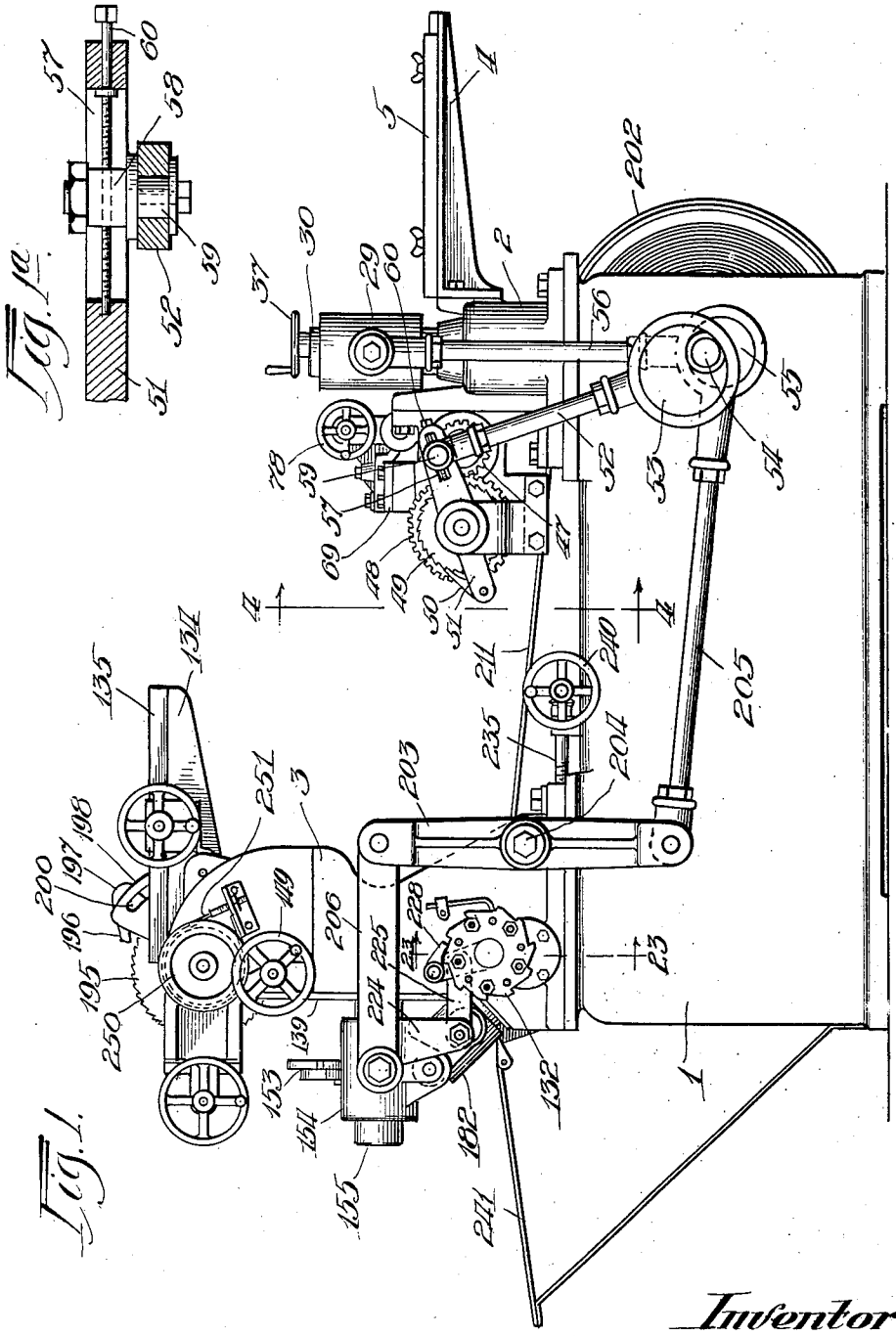


Fig. 1.

Fig. 1a.

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Nov. 15, 1932. W. E. JENSEN 1,887,976

ADJUSTABLE PARTITION MACHINE

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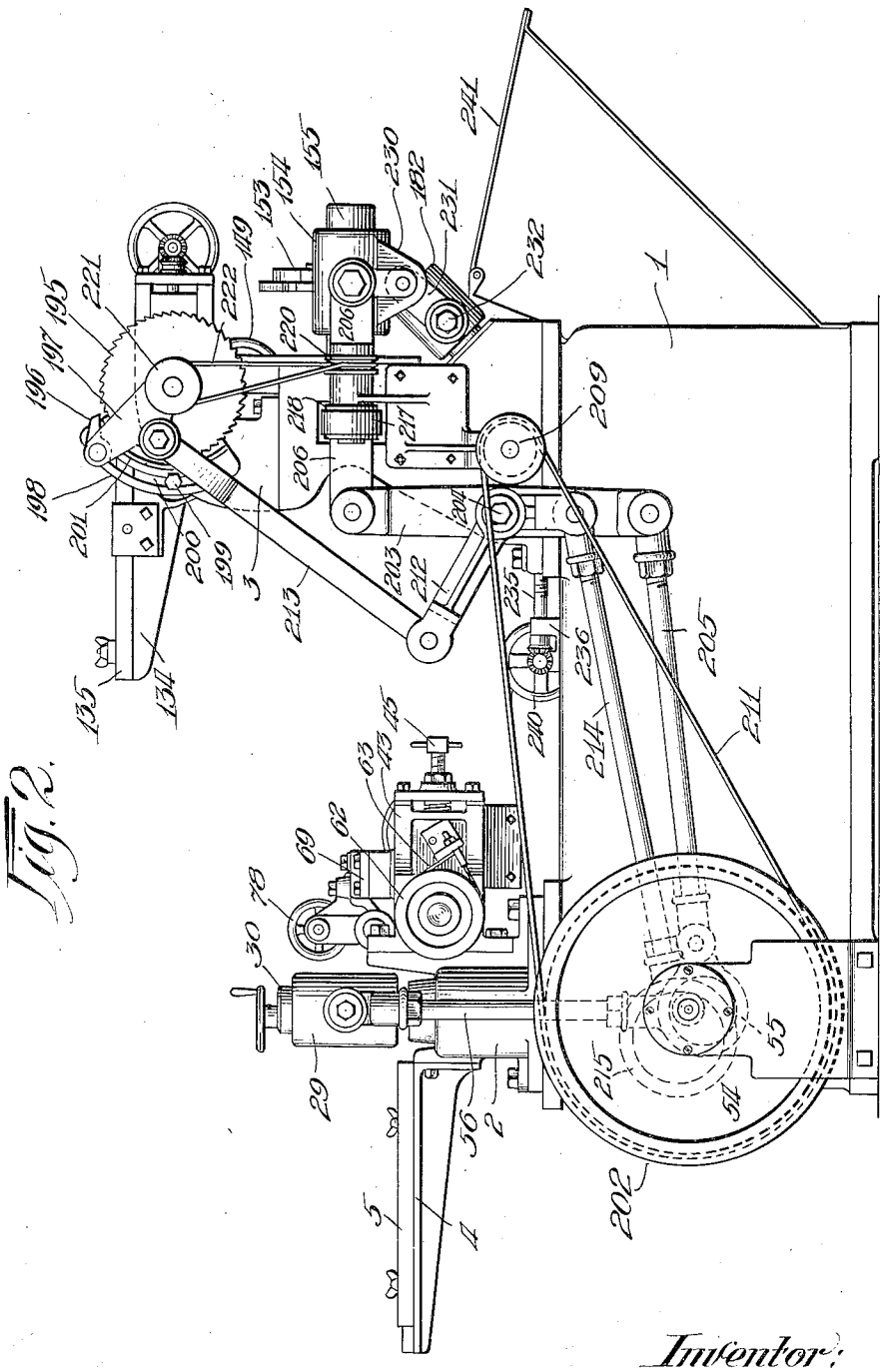


Fig. 2.

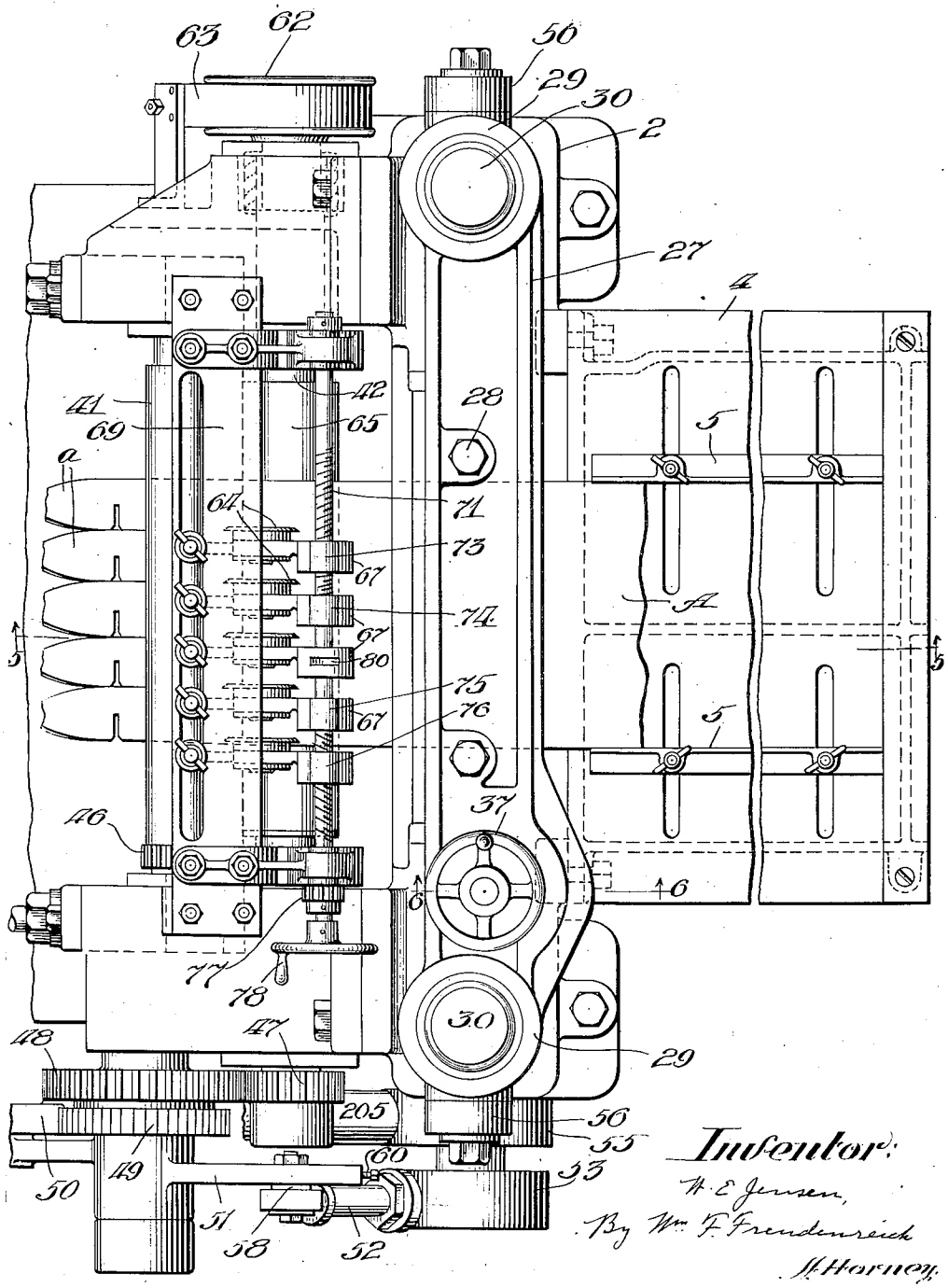
Inventor:
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Nov. 15, 1932. W. E. JENSEN 1,887,976

ADJUSTABLE PARTITION MACHINE

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Fig. 3.



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ADJUSTABLE PARTITION MACHINE

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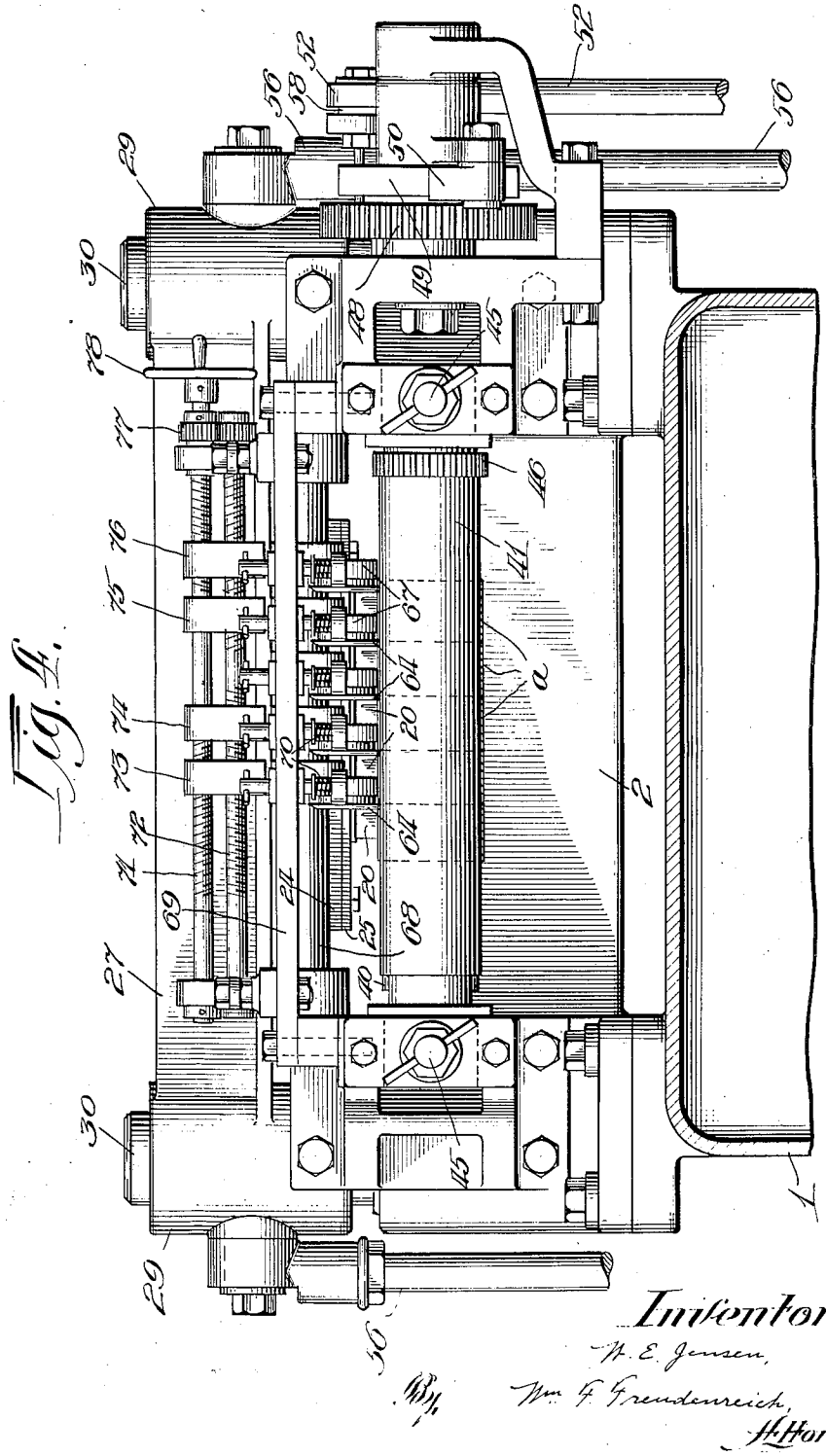


Fig. 4.

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Nov. 15, 1932. W. E. JENSEN 1,887,976

ADJUSTABLE PARTITION MACHINE

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Fig. 5a.

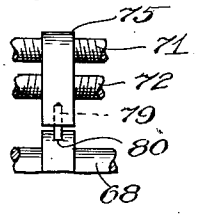


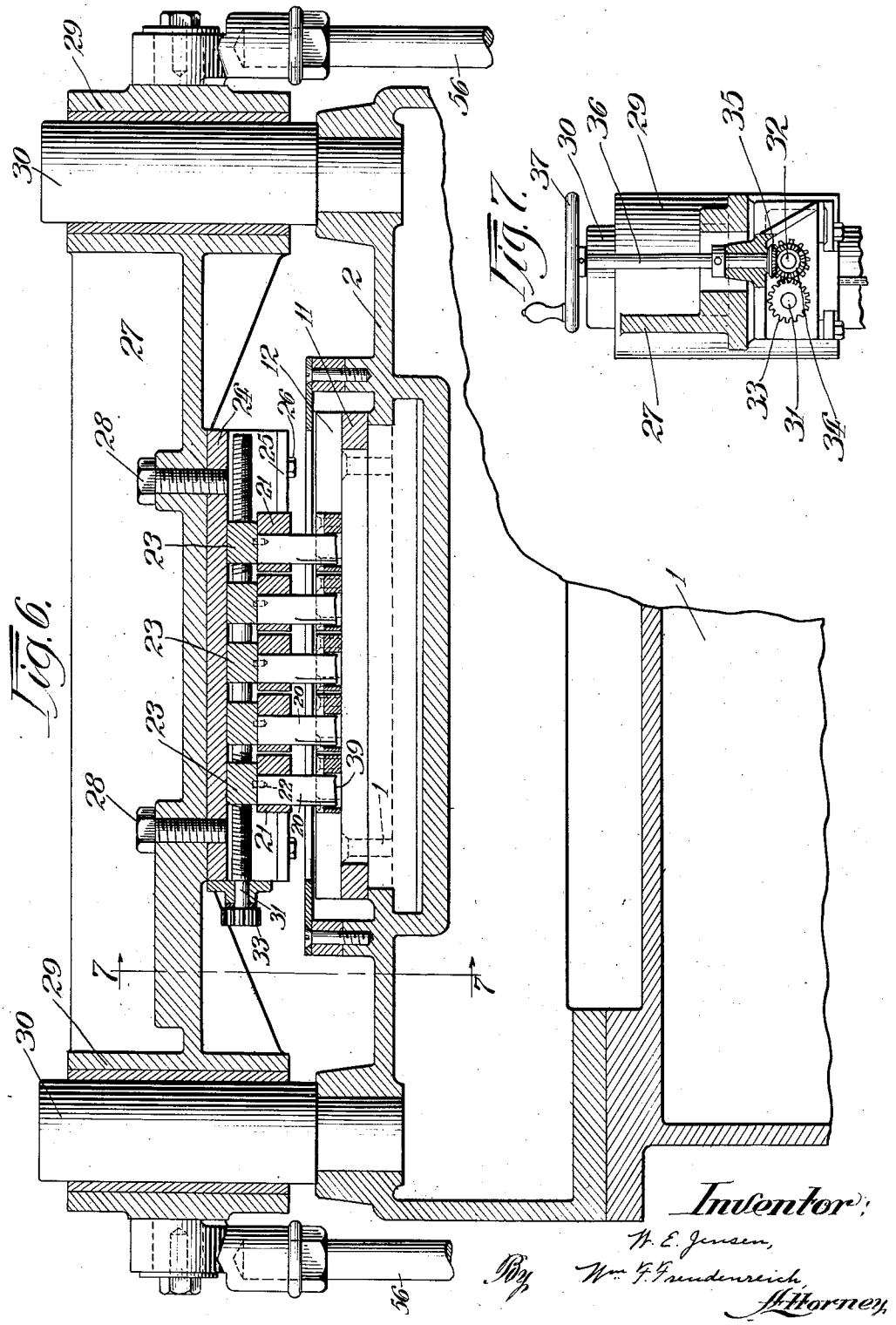
Fig. 5.

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ADJUSTABLE PARTITION MACHINE

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Fig. 8.

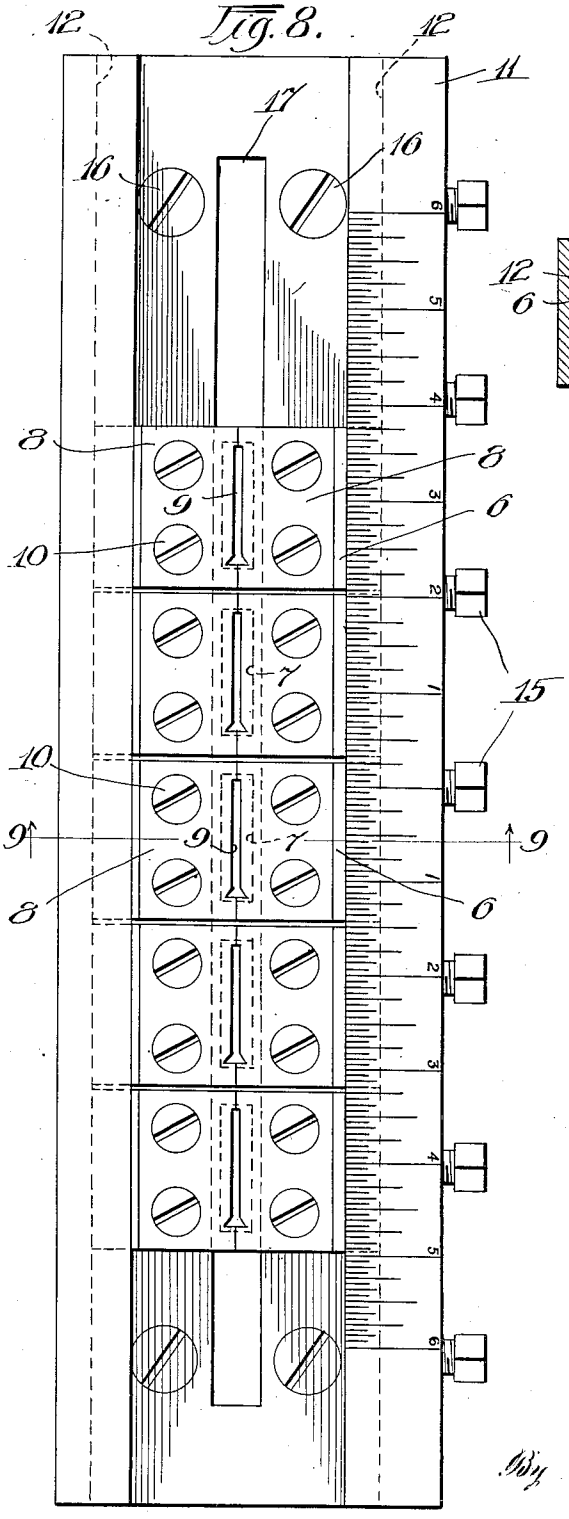
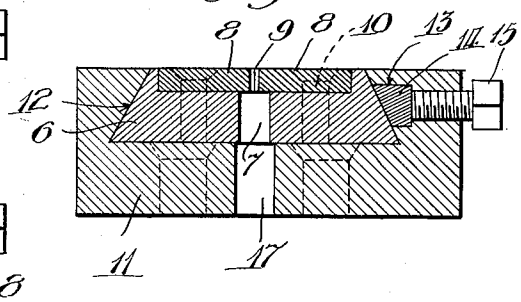


Fig. 9.



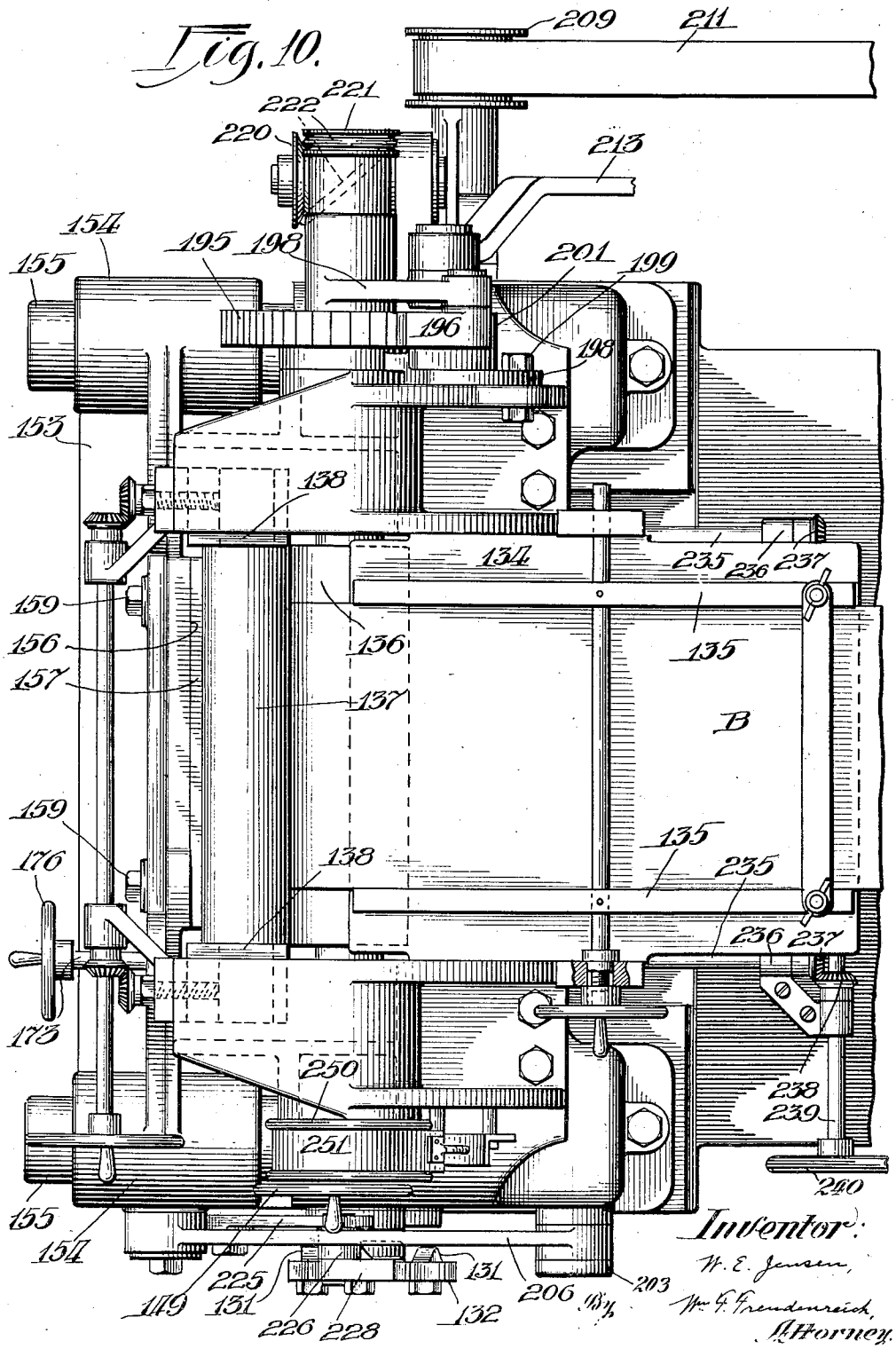
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Nov. 15, 1932. W. E. JENSEN 1,887,976

ADJUSTABLE PARTITION MACHINE

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Fig. 10.



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ADJUSTABLE PARTITION MACHINE

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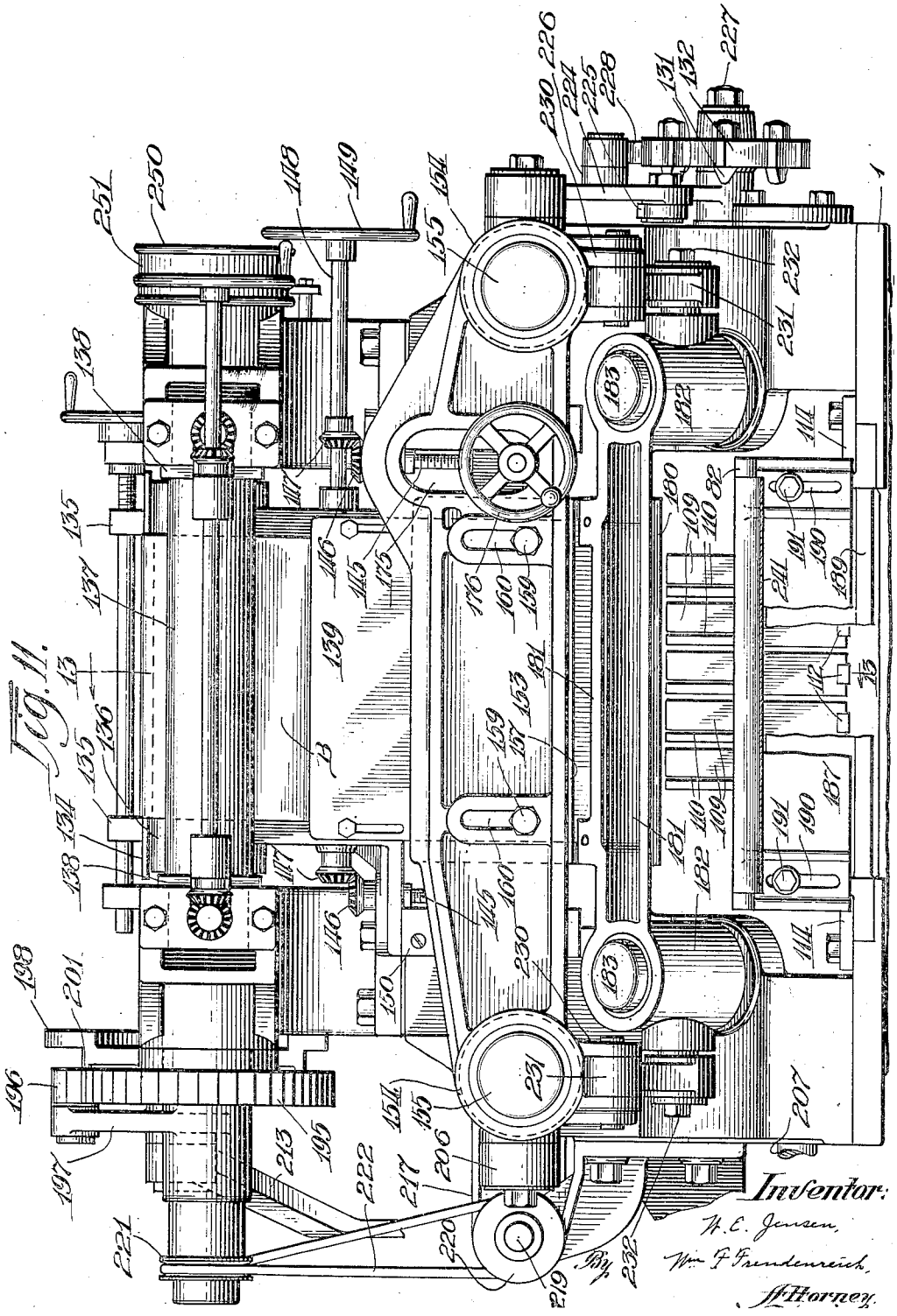


Fig. 11.

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ADJUSTABLE PARTITION MACHINE

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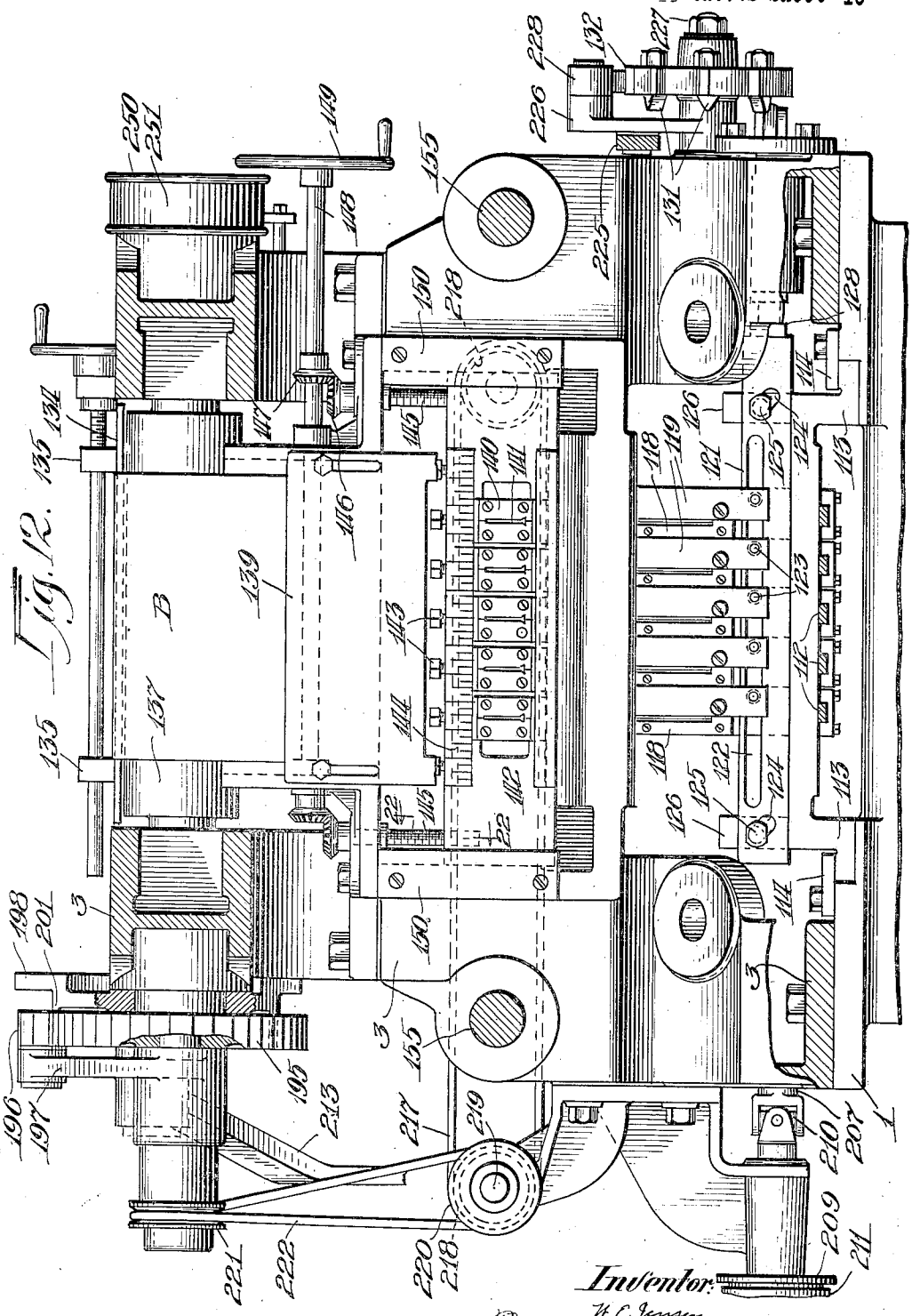


Fig. 12.

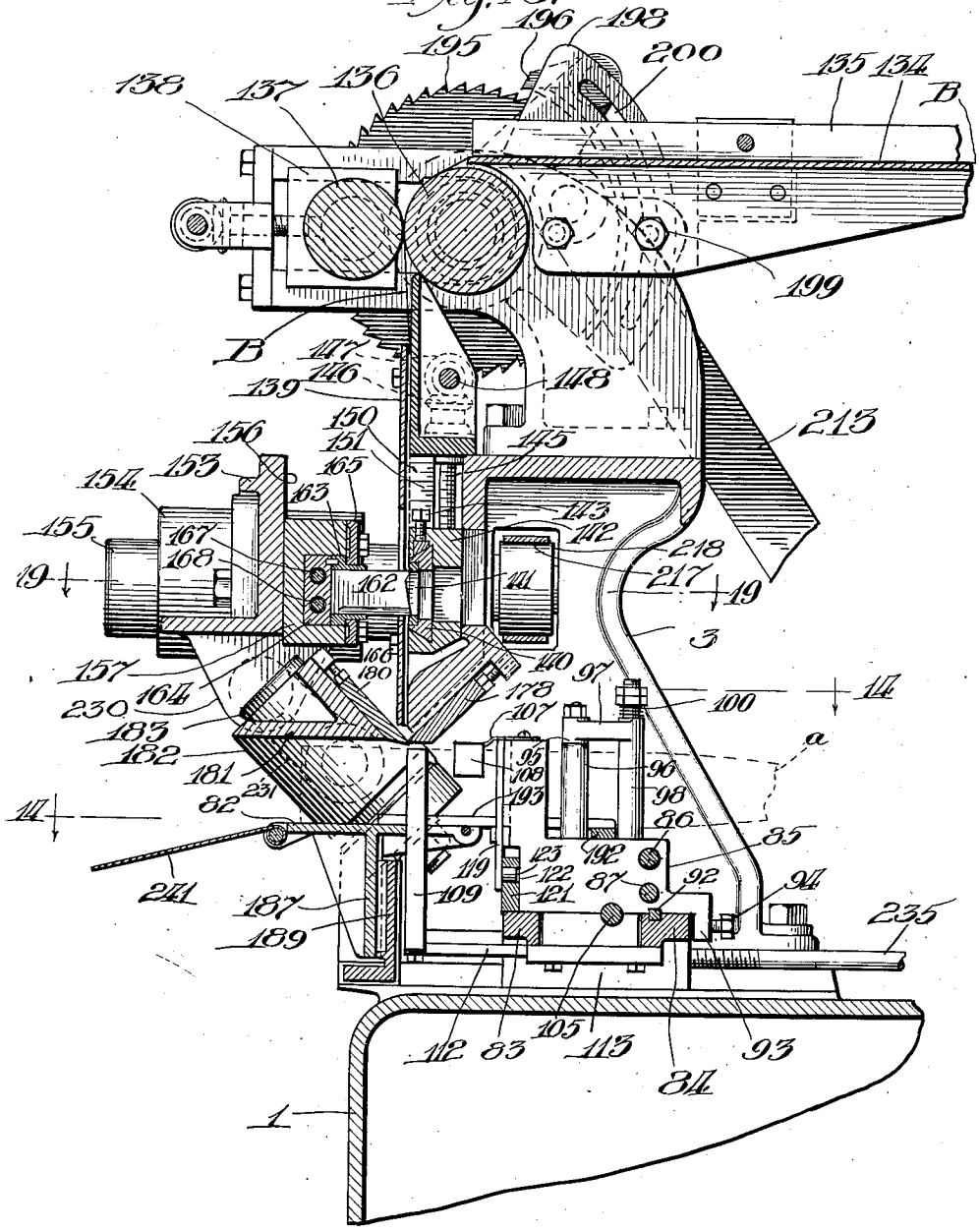
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Nov. 15, 1932. W. E. JENSEN 1,887,976

ADJUSTABLE PARTITION MACHINE

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Fig. 13.



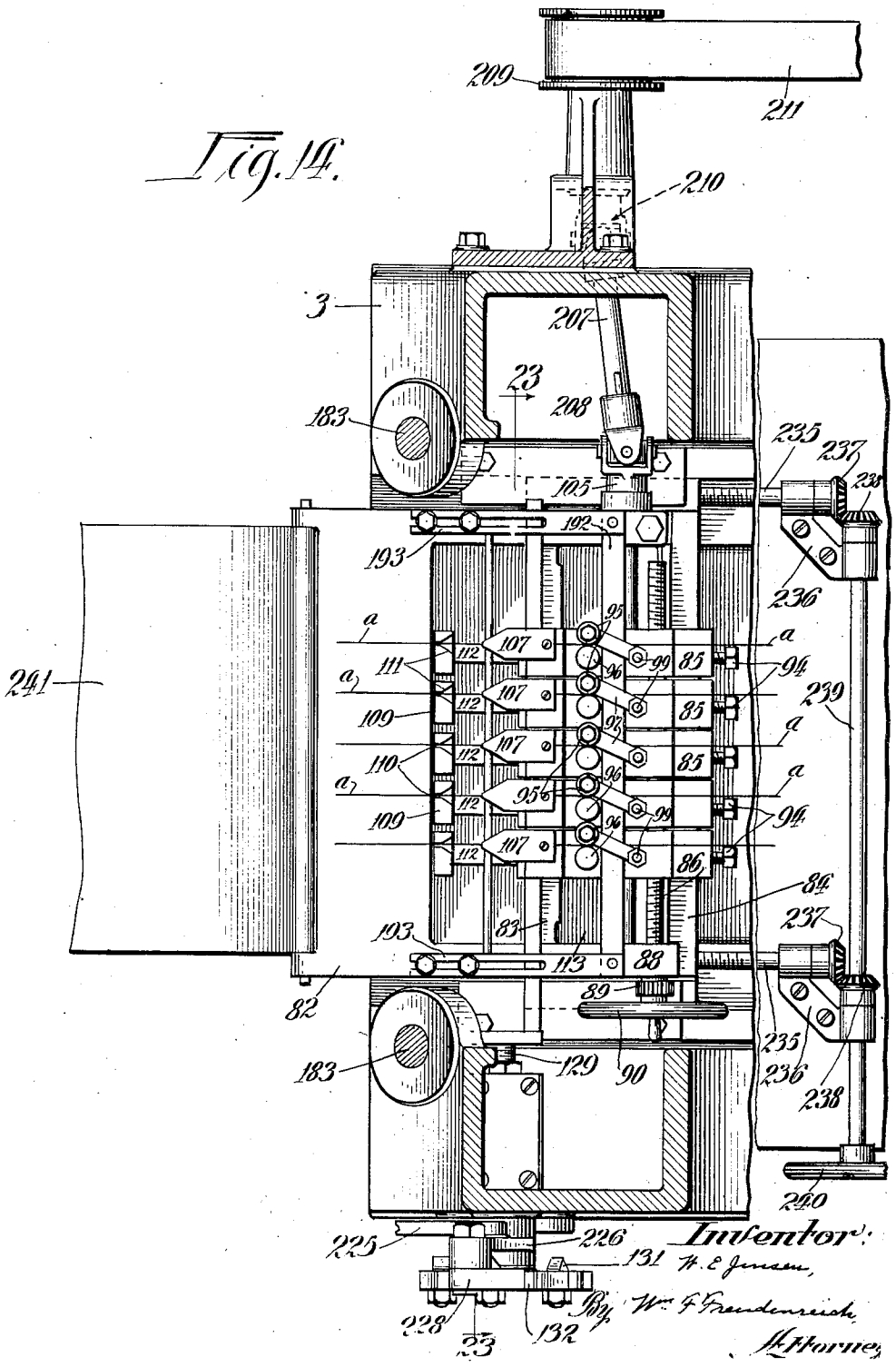
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Nov. 15, 1932. W. E. JENSEN 1,887,976

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Fig. 14.



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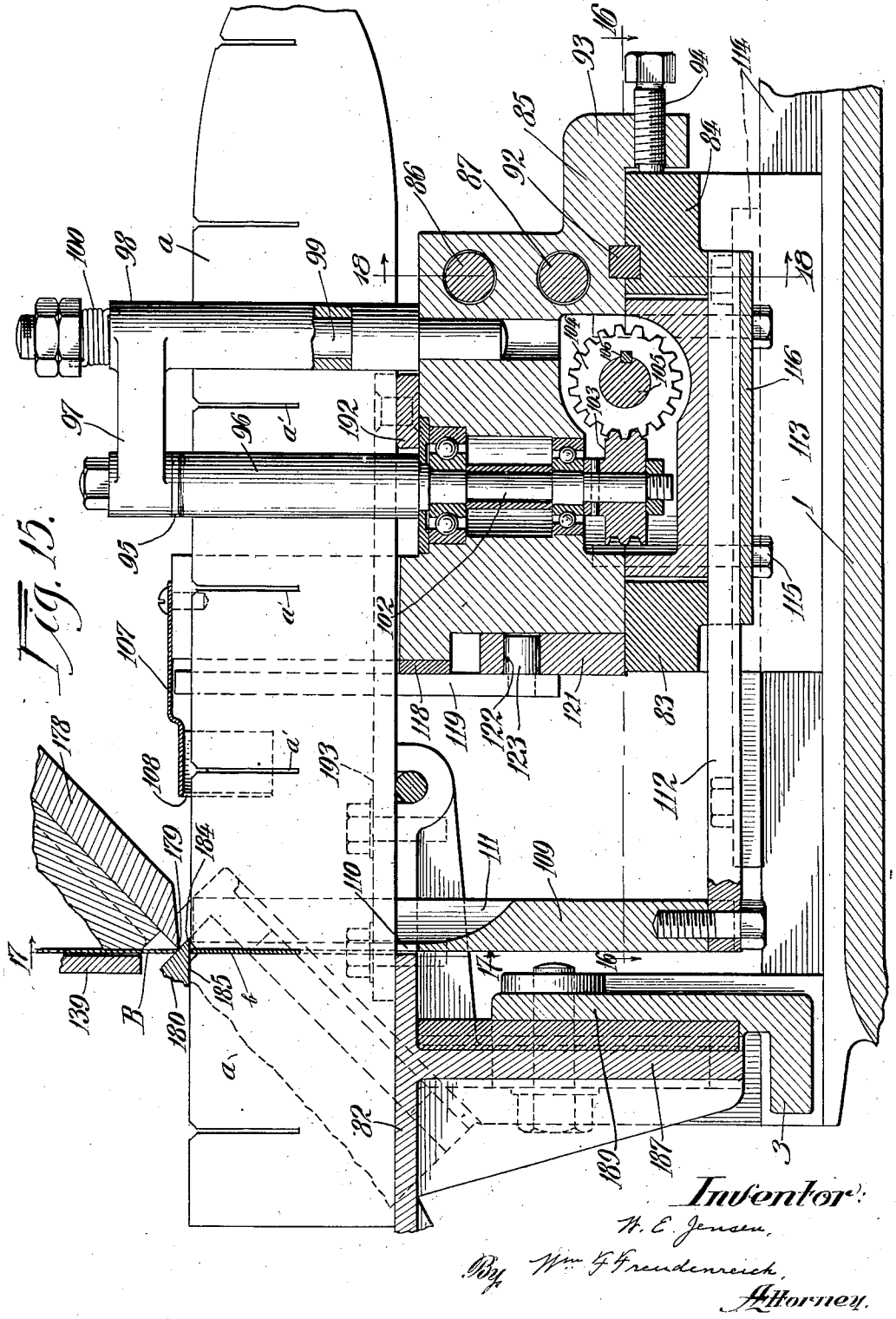


Fig. 15.

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Nov. 15, 1932. W. E. JENSEN 1,887,976

ADJUSTABLE PARTITION MACHINE

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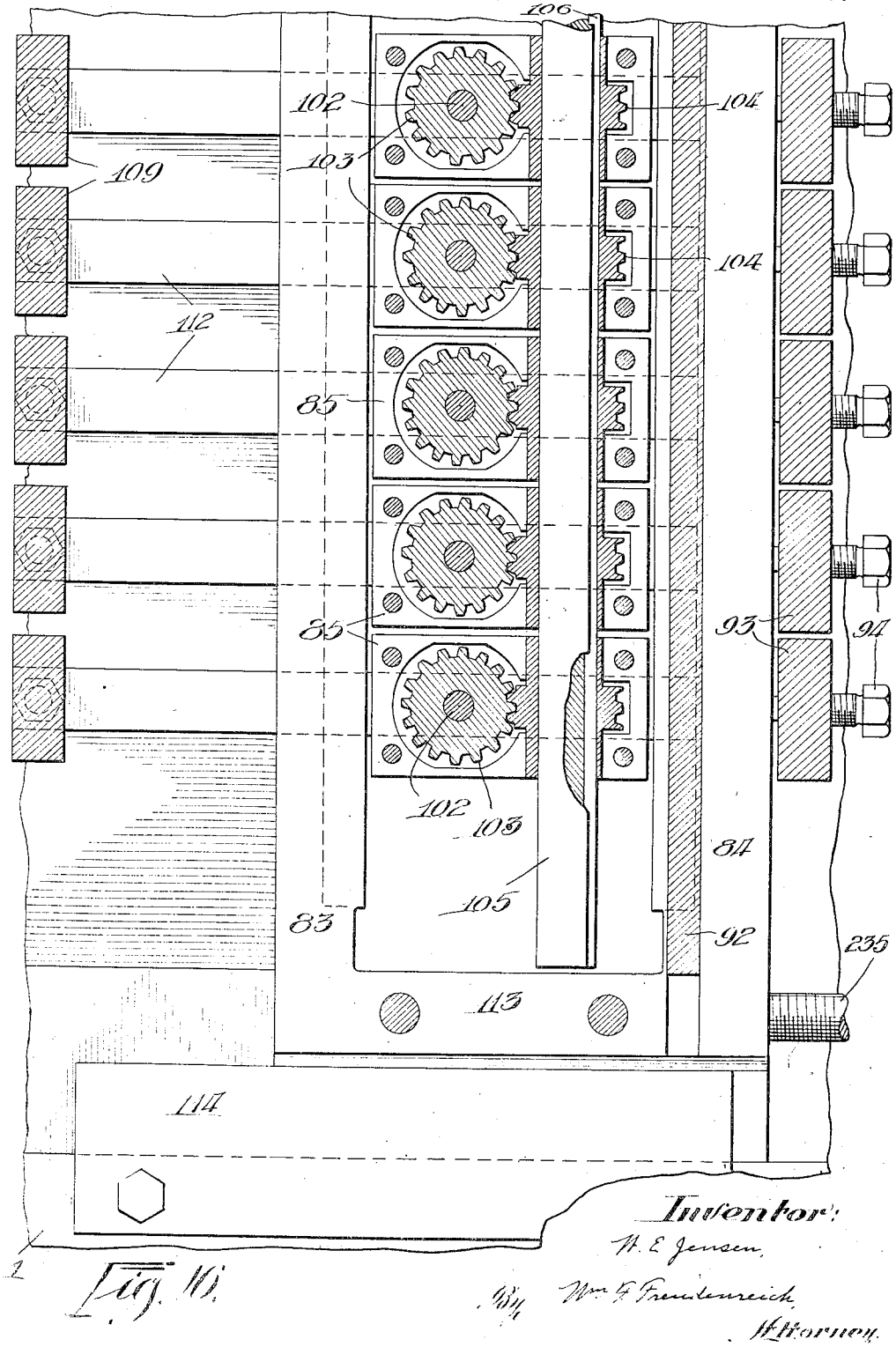


Fig. 16.

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ADJUSTABLE PARTITION MACHINE

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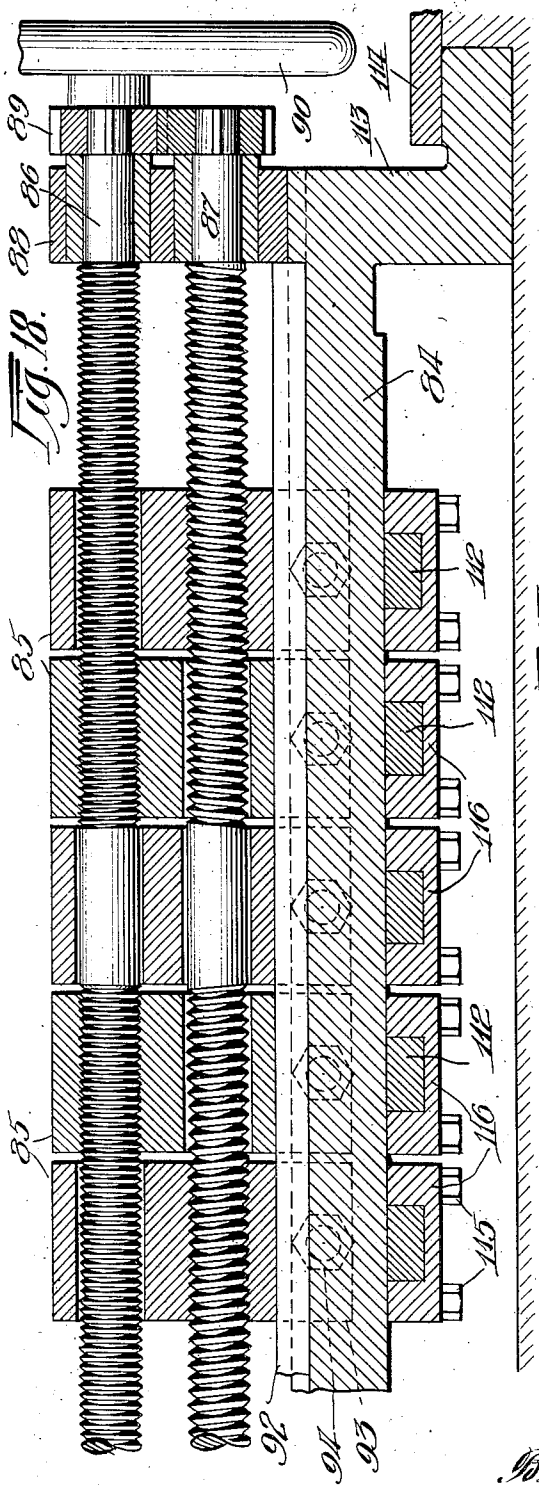


Fig. 18.

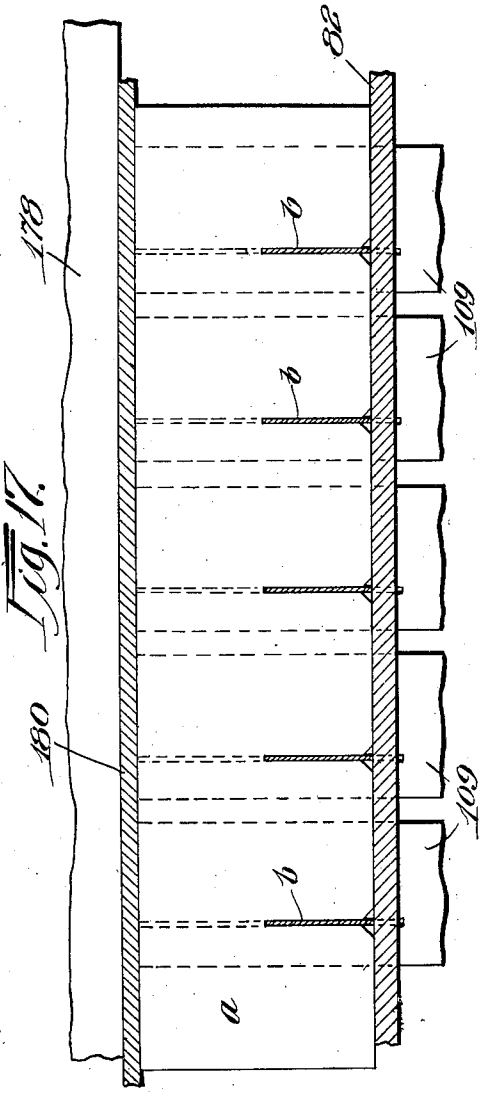


Fig. 17.

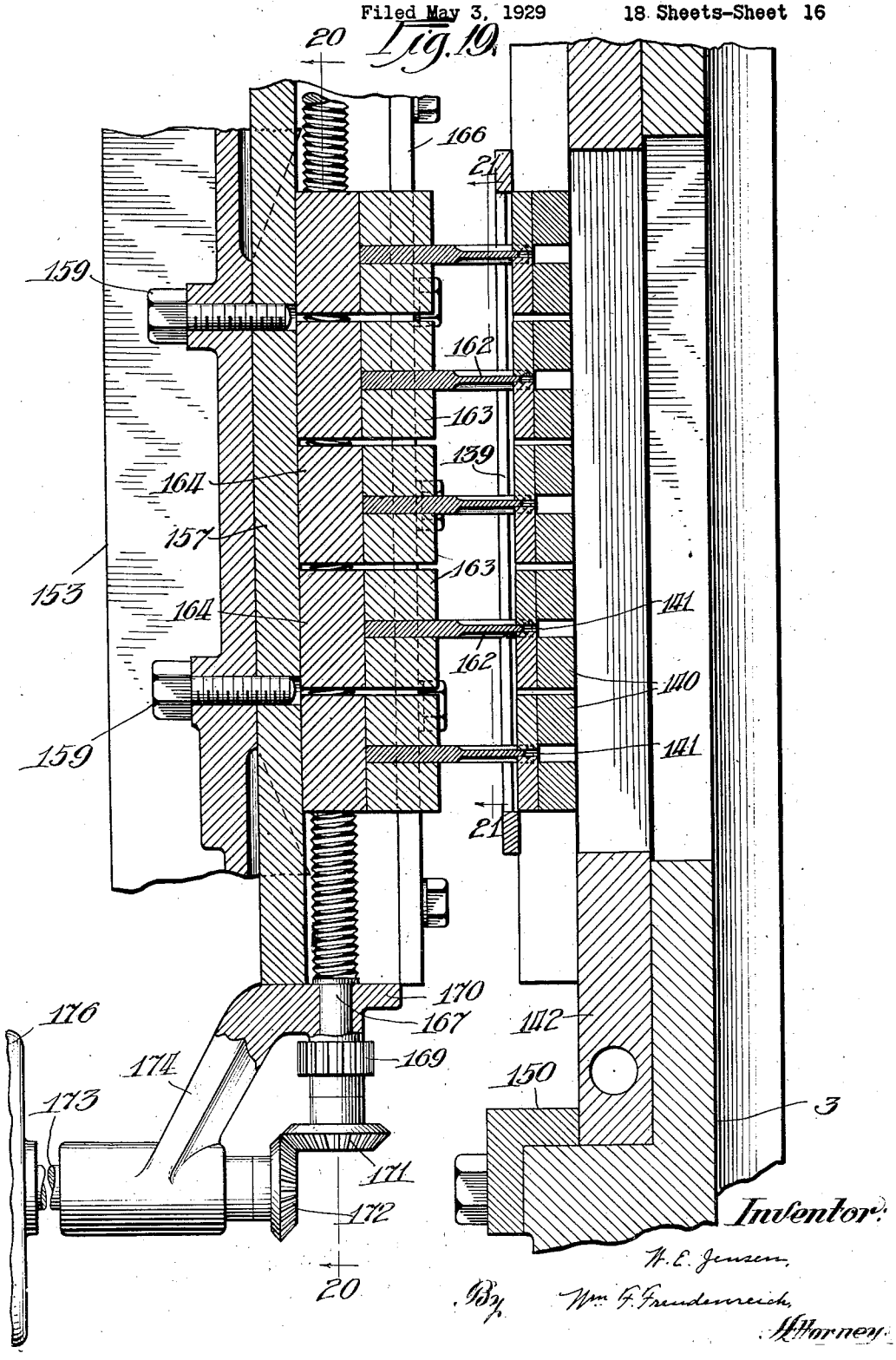
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Nov. 15, 1932. W. E. JENSEN 1,887,976

ADJUSTABLE PARTITION MACHINE

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Fig. 19.

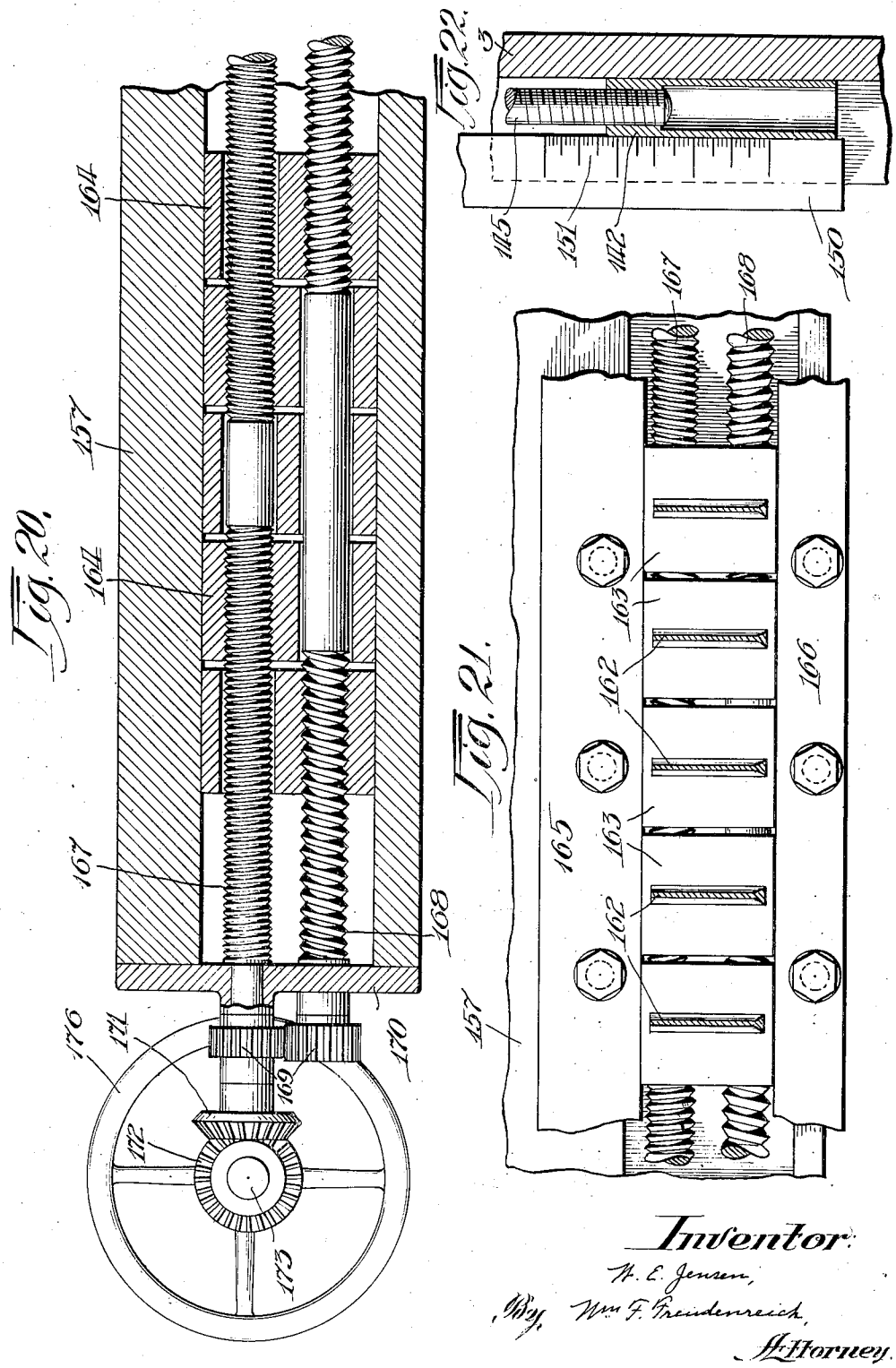


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Nov. 15, 1932. W. E. JENSEN 1,887,976

ADJUSTABLE PARTITION MACHINE

Filed May 3, 1929 18 Sheets-Sheet 17



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Nov. 15, 1932. W. E. JENSEN 1,887,976

ADJUSTABLE PARTITION MACHINE

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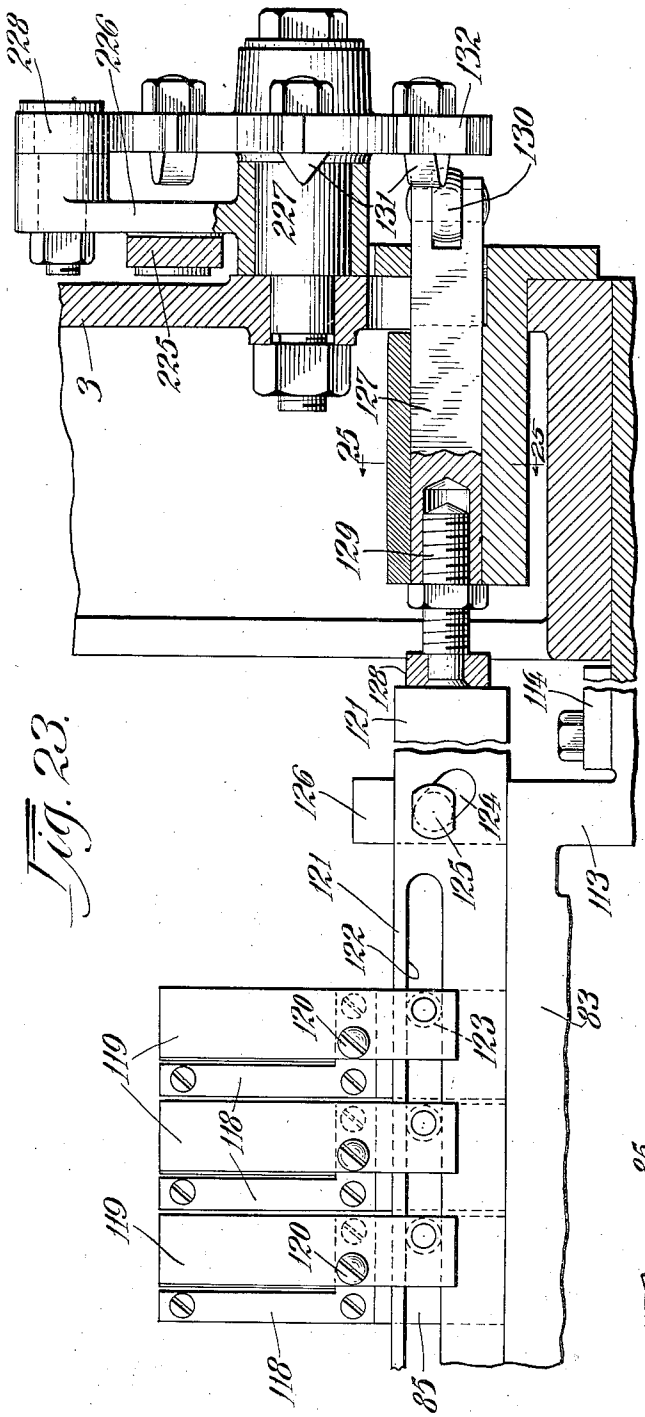


Fig. 23.

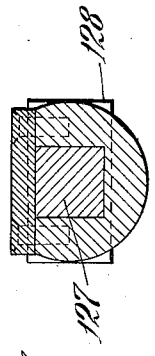


Fig. 25.

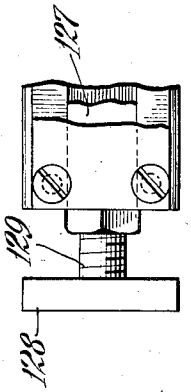


Fig. 24.

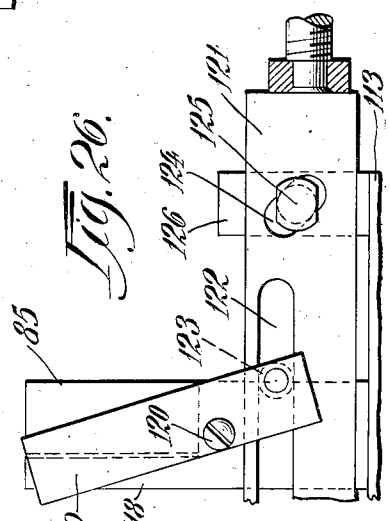


Fig. 26.

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Patented Nov. 15, 1932 1,887,976

UNITED STATES PATENT OFFICE

WALTER E. JENSEN, OF CHICAGO, ILLINOIS, ASSIGNOR TO PARTITION MACHINERY, INC., A CORPORATION OF ILLINOIS

ADJUSTABLE PARTITION MACHINE

Application filed May 3, 1929. Serial No. 360,093.

Cellular devices consisting of two sets of strips of heavy paper stock, crossing each other and interlocked, known as partitions or fillers, are made on automatic machines that punch the required notches into sheet stock, cut the stock into strips, and assemble the completed strips. When it is desired to change the cross dimensions or the height of the cells, it is a tedious operation to adapt the machine to the new size of device, requiring substantially a reconstruction of parts of the machine.

The object of the present invention is to make it possible quickly and easily to effect the necessary changes in the machine for producing devices of various kinds; or, in other words, to make the machine to a large extent, at least, inherently adjustable.

The various features of novelty whereby my invention is characterized will hereinafter be pointed out with particularity in the claims; but, for a full understanding of my invention and of its objects and advantages, reference may be had to the following detailed description taken in connection with the accompanying drawings, wherein:

Figure 1 is a side view of a machine embodying the principles of my invention; Fig. 1*a* is a section, on a larger scale than Fig. 1, through the arm that carries the pawl which turns the feed rolls at the front end of the machine; Fig. 2 is a side view, showing the opposite side from that appearing in Fig. 1; Fig. 3 is a top plan view, on a larger scale, of one end of the machine; Fig. 4 is a section on the same scale as Fig. 3, on line 4—4 of Fig. 1; Fig. 5 is a section taken approximately on line 5—5 of Fig. 3; Fig. 5*a* is an elevation of a fragment of the mechanism for shifting the rotary slitting cutters transversely of the machine; Fig. 6 is a section on line 6—6 of Fig. 5; Fig. 7 is a section on line 7—7 of Fig. 6; Fig. 8 is a top plan view, on a still larger scale, of one of the sets of dies; Fig. 9 is a section taken approximately on line 9—9 of Fig. 8; Fig. 10 is a top plan view of the opposite end of the machine from that shown in Fig. 3; Fig. 11 is an end view of the machine, parts being broken away; Fig. 12 may be said to be a view of the same end as Fig. 11, with parts omitted, and other parts shown in section; Fig. 13 is a section taken approximately on line 13—13 of Fig. 11; Fig. 14 is a section taken approximately on line 14—14 of Fig. 13; Fig. 15 is a section on approximately the same plane as Fig. 13, on a much larger scale, and showing a smaller fragment of the machine; Fig. 16 is a section taken approximately on line 16—16 of Fig. 15; Fig. 17 is a section taken approximately on line 17—17 of Fig. 15; Fig. 18 is a section taken approximately on line 18—18 of Fig. 15; Fig. 19 is a section taken approximately on line 19—19 of Fig. 13, on a larger scale, and showing only a fragment of the machine; Fig. 20 is a section taken approximately on line 20—20 of Fig. 10; Fig. 21 is a section taken approximately on line 21—21 of Fig. 19; Fig. 22 is a section taken on line 22—22 of Fig. 12, but on a larger scale; Fig. 23 is a section taken approximately on line 23—23 of Fig. 14, on a larger scale, only a small fragment of the machine being shown; Fig. 24 is a top plan view of a fragment of the pusher bar in Fig. 23, and the support therefor; Fig. 25 is a section taken approximately on line 25—25 of Fig. 23; Fig. 26 is a view similar to Fig. 23, showing only a fragment of what appears in Fig. 23, with the parts in a different position.

The machine illustrated in the drawings comprises a sturdy base 1 upon each end of which is fixed a suitable frame, indicated at 2 and 3. The frame 2, which may be said to be at the back of the machine, supports mechanisms for suitably punching a sheet to form the notches in one set of partition strips, and slitting the sheet into ribbons each of which consists of a series of partition strips arranged end to end. The frame 3 supports mechanisms for punching transverse rows of notches in a second sheet, cutting one partition strip after another from the end of that sheet, and pressing each strip down into interlocking engagement with strips that have been formed at the rear end of the machine and carried forward. The first sheet enters the machine in a horizontal condition and ribbons into which it is slit are twisted so that when they reach the front end of the machine they stand on edge. The second

sheet is carried down from the top at the front end of the machine in a vertical condition, so that each partition strip produced at the front end is in the proper position to be pushed down into engagement with the strips advancing from the rear. This general description applies as well to the old type of machine as it does to my improved machine, but is necessary for an understanding of my invention.

I shall first describe the rear end of the machine. Projecting rearwardly from the frame 2 is a suitable table 4 provided on top with laterally adjustable guides 5, 5 of any usual or suitable construction. The sheet A, properly positioned in the lateral direction by the guides 5, passes over the table and through a punching mechanism. The punching mechanism comprises dies, over which the paper passes, and vertically movable punches above. In the drawings I have disclosed a machine with parts adapted to make partition devices in which there are five strips in each set, but it will of course be understood that partition devices containing any desired number of strips may be formed. The dies, as perhaps best shown in Figs. 8 and 9, comprise flat blocks 6 wider at the bottom than at the top and provided with long wide slots or openings 7 in the center. The actual working faces of the dies are preferably hard steel plates 8. For convenience in manufacture these plates are made in two sections divided along a line that cuts through a slot 9 of the size and shape of the slot or notch to be cut in the sheet. The two sections of each plate may conveniently be secured to the corresponding block by means of countersunk screws 10. The guide blocks are mounted in a suitable bed member 11 having in the top thereof an undercut groove 12 extending from end to end of the same; the groove being of such a size and shape that the die blocks are a sliding fit therein, the upper surfaces of the die blocks being flush with the top of the bed. An auxiliary groove 13, extending the length of the main groove, is cut into the bed from one side of the main groove. In this auxiliary groove is a bar 14 whose inner side is shaped to fit against the adjacent sides of the die blocks. A number of set screws 15 extend through the side of the bed member into engagement with the outer side or edge of the bar. It will be seen that when the set screws are tightened the die blocks will be firmly held in place. Upon loosening the set screws, the die blocks are left free to be moved lengthwise of the bed. The bed is fixed to a part of the frame 2 by means of suitable screws 16, or otherwise. Furthermore, the bed is provided with a long slot 17 underneath and in registration with the slots in the die blocks. The slots 7 are preferably wider than the slots 9. Therefore the little pieces that are punched out of the sheet may drop down freely through the body portions of the die block and through the bed. The bed is provided with a suitable scale 18 along one side of the groove 12, by means of which scale the die blocks may be accurately adjusted relatively to each other.

The punches 20 that cooperate with the dies just described may be of the usual or any desired form. The upper end of each punch extends into and is fixed to a suitable supporting block 21. Above, and pinned to each block 21, by means of one or more pins 22, is a second block 23. When the parts are assembled, each block 21 and the corresponding block 23 act as a single element which is held in a guiding support so as to be slidable in a direction parallel with the sliding movements of the die blocks. In the arrangement shown, the immediate supporting and guiding structure for the punches is a member 24 in the form of an inverted channel of the proper size and shape to receive the blocks 21 and 23. The blocks are held up by means of bars 25 secured by bolts 26 or otherwise to the bottom edges of the flanges of the member 24 and projecting a short distance into the trough of the channel so as to underlie the blocks 21. The member 24 is fastened to the underside of a heavy cross beam 27 by means of bolts 28, or otherwise. At its ends the beam 27 has long vertical journal bearings 29 that fit slidably on stationary vertical posts or columns 30 rising from the frame 2. The beam is moved up and down on these columns, by any suitable mechanism, so as to move the punches up and down. It will be seen that when the punches are down in the dies, as shown in Fig. 6, and the set screws 15 holding the die blocks in place are loosened, any movement of the die blocks from or toward each other will be accompanied by the corresponding shifting of the punches, and vice-versa. Therefore, if means are provided for adjusting either the die blocks or the punches, both may be adjusted at the same time. In the arrangement shown, I have provided means for simultaneously adjusting all of the punches. There are two horizontal shafts 31 and 32 extending through all of the blocks 23. These shafts are geared together by means of suitable gear wheels 33, so that if one rotates the other will rotate at the same speed in the opposite direction. On one of the shafts is a bevel gear 34, meshing with a complementary bevel gear 35 on the lower end of a vertical shaft 36 provided by the beam 27. On the upper end of the shaft 36 is a hand wheel 37 by means of which it may be turned.

Assuming that the punching mechanism is set as illustrated in Fig. 6 and that it is desired to increase the distances between the punching mechanisms, it will be seen that the central punch and die may be left sta-

tionary; the two punches and dies on opposite sides of the center should be moved away from the center in opposite directions; and the endmost punches and dies should be moved outwardly, in opposite directions, but twice as far as the other two. I therefore so construct the parts that the shafts 31 and 32 pass freely through the center block 23; one of the shafts also passing freely through the second and fourth blocks and engaging screwthreads in the first and fifth blocks; the other shaft passing freely through the first and fifth blocks and engaging screwthreads in the second and third blocks. Part of the screwthreads are right hand on each shaft and the others are left hand. Therefore, whenever one of the shafts is turned it will move the two blocks with which it is in screwthreaded engagement in opposite directions. The pitch of the threads on the shaft 31, which are shown as interengaged with the first and fifth of the blocks 23 is twice as great as the pitch of the threads on the other shaft. In other words, if the second and the fourth blocks are moved outwardly say one-half inch, the first and fifth blocks must be moved out a half-inch each to maintain the original spacing with respect to the second and third blocks, and must then be moved another half-inch to bring about the desired greater spacing between the first and second block and between the fourth and fifth block. The screw shafts and their relation to the several punching mechanisms is the same as that at the other end of the machine which is illustrated more in detail, particularly in Fig. 20, and further detailed description thereof is therefore deemed unnecessary.

When the punches rise, after having passed down through the paper, the sheet must be stripped therefrom. To this end I have provided a stationary stripping plate 38, extending across the tops of the dies, for the purpose of holding the sheet down as the punches rise.

If desired, the same dies may be employed in connection with different punches. Ordinarily the punches fit the slots in the dies, but, by so shaping the punches that their lower ends are concave as indicated at 39 in Fig. 6, they will properly cut through the paper even though they be narrower than the length of the slots.

When it is desired to change the settings of the punch mechanisms, the punch carrier is lowered to the position indicated in Fig. 6; the set screws 15 that hold the die blocks are loosened; and then the hand wheel 37 is turned so as to shift the punches laterally and, because the punches and dies are interengaged, the dies move laterally with the punches.

The distance between the punches determines the width of the strips and, in order to vary the distance between the notches or slots cut in each row extending lengthwise of the sheet, means must be provided to vary the timing of the punching mechanism or feed mechanism, or both.

In the arrangement shown, the sheet after it leaves the punching mechanism passes over the top of a horizontal roll 40 and between this roll and a second roll 41 lying in front of the latter. The roll 40 is mounted in suitable stationary bearings, whereas the roll 41 is supported in bearing blocks 42 slidable from and toward the roll 40 in an auxiliary frame 43 fixed to the front side of the frame 2. The roll 41 is pressed against the roll 40 by means of springs 44 arranged between the front sides of the bearing blocks and the rear ends of adjusting screws 45 engaged with the auxiliary frame in front of the rolls. The rolls 40 and 41 are geared together by means of gear wheels 46, so that they will rotate in unison with each other but in opposite directions. On one end of the roll 40, as best shown in Fig. 1, is a pinion 47 meshing with a large gear wheel 48. Fixed to the gear wheel is a ratchet wheel 49. The ratchet wheel is adapted to be turned step by step by means of a pawl 50 on one end of an arm 51 pivoted between its ends. To the other end of this arm is connected an operating rod 52 driven from a suitable eccentric 53, or otherwise. The eccentric is on a shaft 54 that extends through the base from side to side and has thereon, on each side of the base, an eccentric 55. Eccentric rods 56 extend up from the eccentrics 55 to the carrier for the punches. It will therefore be seen that the punches and the feed rolls will be operated in definite time relation to each other. I have made the connection between the arm 51 and the rod 52 such that the angular throw of the arm may be varied, thus permitting the sheet to be fed through steps of different lengths. In the arrangement illustrated, the arm 51 has therein a long slot 57 extending lengthwise of the arm. Fitting slidably in this slot is a block 58 having on one end a trunnion 59. This trunnion extends through the upper end of the eccentric rod 52. A screw device 60, held against endwise movement, extends lengthwise of the lever arm through the slot and through the block 58. By turning the screw the block may be moved from and toward the pivotal axis 61 of the lever arm.

On the end of the shaft for the roller 40 opposite that at which the driving mechanism is located is a brake drum 62 around which extends a brake band 63 anchored to the framework. The drum and band constitute a braking device that will prevent backward movement of the roller while the pawl is making a return stroke.

In the particular machine illustrated, the sheet is slit lengthwise into a series of strips *a*. The cutting may conveniently be accom-

plished by means of rotary slitters 64 that normally rest on the roller 40 which is therefore provided with a peripheral layer 65 of hard steel. Each cutter head, as it may be termed, is separate from the others and consists of the rotary cutter journalled, as indicated at 66, between the ends of a bracket 67. A stationary horizontal shaft 68 passes through one end of each of the brackets 67 and forms a pivotal support for the brackets. Between the free end of each bracket and an overlying stationary frame part 69 is a spring 70 that is under compression so as to tend to force the free end of the bracket down. The parts are so proportioned that the springs hold the cutting elements against the top of the roller 40, slightly forward of a vertical plane containing the long axis of the roller. As the paper is carried by the feed rollers past the cutters it is slit along lines determined by the positions which the supporting brackets occupy along the shaft 68.

When the punch mechanisms are shifted laterally, similar adjustments of the cutters should be made. The means for accomplishing this I shall now describe.

As best shown in Fig. 4 I have arranged, one above the other, and above the shaft 68, a pair of screws 71 and 72 similar to the shafts 31 and 32 by means of which the punches are adjusted. Above the supported end of each of the brackets 67, excepting only the center bracket, is placed a block; these blocks being indicated at 73, 74, 75 and 76. The shafts 71 and 72 extend through all four of these blocks; the shaft 71 having its right and left hand threads engaged with corresponding threads in the blocks 73 and 76, but passing freely through the block 75; and the shaft 72 having its threads engaged with the blocks 74 and 75, but passing freely through the blocks 73 and 76. The pitch of the threads on the shaft 72 is twice as great as that of the threads on the shaft 71. The two shafts are geared together by means of gearing 77. There is a hand wheel 78 on one end of the shaft 71. It will be seen that by turning the hand wheel, the blocks 73 to 76 may be moved from and toward each other. Each of the blocks 73 to 76 is suitably interlocked with one of the swinging brackets so as to be held against relative movements with respect thereto in the direction of the length of the shaft 68. In the arrangement shown, each of the blocks is provided with a pin 79 extending into a groove 80 in the top of that part of the bracket lying above the shaft 68; the groove being in a plane at right angles to the shaft 68, so as to permit the bracket to be swung up and down in order to lift the cutters off the roller while adjustments are being made, but compelling the brackets to move lengthwise of the shaft 68 when the hand wheel 78 is turned.

After the sheet has been slit into strips, these strips pass forward under the roller 41 and are led to the front end of the machine which I shall now describe.

As best shown in Figs. 13, 14 and 15, the strips *a* are twisted into vertical positions as they approach the front end of the machine and, in such positions, are fed across a table 82. Before reaching the table the strips pass through suitable guide and feed devices that are adjustable in the same way as the punches and the slitters at the other end of the machine, so as to position the strips at any desired distance apart preparatory to bringing down the crossing strips. In rear of the table and below the same is what may be termed a transverse bed having two parallel transverse guides or supporting bars 83 and 84. Resting on these bars are a series of blocks 85 equal in number to the strips *a*. Two transverse screws, 86 and 87, similar to the shafts 31 and 32 previously described, extend through all of the blocks 85, being journalled in a stationary frame member 88. The details of this construction are best shown in Fig. 18 from which it will be seen that the shaft 86 runs freely through the two endmost blocks and through the center block and is in screwthreaded engagement with the other two blocks; whereas the shaft 87 is in screwthreaded engagement with the two endmost blocks and extends freely through the other three blocks. Furthermore, the pitch of the threads on the shaft 87 is twice that of the threads on the shaft 86. The two shafts are geared together by means of suitable gearing 89, and one of the shafts has thereon a hand wheel 90. By turning the hand wheel four of the blocks, unless otherwise held, may be moved from and toward the center block. Between the blocks 85 and the guiding and supporting member 84 is a long key 92 which serves as the actual guiding means when the blocks are shifted. Each block has a flange or skirt 93 extending down behind the supporting bar 84, and is provided with a set screw 94 passing through this flange and engaging the rear face of the bar. When the set screws are tightened, the blocks are locked in place; but, when the set screws are loosened, the hand wheel 90 may be turned so as to shift the blocks from or toward each other. On top of each block are two vertical rollers 95 and 96 between which the corresponding strip *a* passes. The rollers 96 revolve about stationary axes while the rollers 95, which are idlers, each depend from the free end of an arm 97 extending laterally from a long vertical sleeve 98 rotatable about an internal stationary shaft or post 99. There is a torsion spring 100 between the top of the post and the sleeve, this spring exerting a force in the direction to press the corresponding roller 95 against the companion roller. Each of the rollers 96 is fixed upon a shaft 102

extending down into a chamber 103 in the corresponding block 85. On the lower end of the shaft 102 is a spiral gear wheel 103 meshing with a complementary gear wheel 104 loose on a transverse shaft 105. A key 106 extends along the shaft 105 through all of the gears 104; thus compelling the gears 104 to revolve with the shaft, but permitting them to slide freely along the same. Therefore, assuming that the set screws of all of the blocks except the central block are loosened, and that the hand wheel 90 is turned, not only will the blocks be shifted along their support, but the gears 104 will be likewise shifted, so that the shaft 105 will always have a driving connection with the rollers 96. The shaft 105 rotates continuously, as will hereinafter be explained. The purpose of the rollers 95 and 96 is simply to keep the strips moving ahead as they are fed forward by the main feed rollers; the rollers 96 slipping on the strips while the latter stand still, and exerting an effective tractive effort only when the feed rollers at the rear are advancing the work.

At the front end of each of the blocks 85, high enough up to permit a strip to pass underneath the same, is a light plate 107, V-shaped at the front end, and having depending flanges 108. These flanges consequently stand at an angle to each other, providing a flaring mouth toward the rear into which the advancing end of a strip may readily be entered. There is a final guide for each strip, in the form of a vertical bar 109 lying directly behind the table 82 and having therein a vertical slot 110 wide enough to permit the passage of the strip. The bar is cut away on the back side, as indicated at 111, to provide a flaring mouth leading to the narrow slot. Each bar is carried on the outer end of a horizontal bar 112 extending rearwardly beneath and fixed to the corresponding block 85. I may say that in the arrangement shown, each block 85 is made in two parts divided on a horizontal plane passing through the gear chamber.

The strips *a* must be cut off to the proper lengths. This is done when a sufficient length of each strip has been fed across the table to produce one of the partition strips. The parts of the finished product extending behind the table at the instant of completion constitute projecting ends or buffers whose length may be varied. The knife mechanism to cut the strips is carried by the blocks, and therefore it is desirable that the blocks be adjustable from front to rear. To accomplish this, the member 113, of which the supporting bars 83 and 84 form a part is mounted in a suitable longitudinal guideway 114 on top of the base of the machine, so that the bars 83 and 84 and all of the parts carried thereby may be moved from and toward the table. For this reason, also, the bars 112 are detachably connected to the blocks 85, being preferably held in place by means of bolts 115 and plates 116 that may be loosened to permit the bars to be moved in and out.

On the front side of each of the blocks 85 is a suitable shearing mechanism. In the arrangement shown, as best illustrated in Figs. 15 and 23 to 26, there is fixed to the front end of each of the blocks 85 a stationary shearing blade 118 that extends up past the upper edge of a strip or ribbon *a* passing beside the same. Cooperating with the stationary flat is a pivoted blade 119. The blade 119 is pivoted to the block, as indicated at 120, close to the shearing edge, and close to the stationary shearing blade. The lower ends of the movable shearing blades extend down in front of a transverse sliding bar 121 having a long slot 122 extending lengthwise thereof. Each movable shearing blade has a pin or roller 123, of the same diameter as the width of the slot 122, fitting into the slot. The rollers are spaced apart laterally from the pivotal axes of the shearing blades, so that an upward push on the rollers causes the blades to swing past the cooperating stationary blades in a shearing motion. The bar 121 is also provided with short slots 124 arranged near the ends thereof and arranged at an acute angle to the vertical. Stationary pins 125 pass through the slots 124 into a stationary post or arm 126 rising from the bed member 113. Consequently, if the bar 121 is moved endwise, it also gradually rises, swinging the movable shearing blades from the positions illustrated in Fig. 23, to the positions illustrated in Fig. 26; in other words, causing the movable shearing blades to swing past the stationary blades so as to sever each of the ribbons or strips *a*.

The immediate operating means for the bar 121 is a laterally sliding plunger 127 aligned with one end of the bar. The plunger is provided with a wide head 128 having a stem 129 screwthreaded into the end of the plunger. The head is the part of the plunger that engages with the bar and, because of its width, it will maintain such engagement even though the entire bed 113 is moved backward or forward. On the outer end of the plunger is a cam roll 130, adapted to engage successively with a series of cam lugs 131 detachably secured to a rotatable wheel 132 and projecting from one side thereof. Assuming that the wheel 132 revolves, it will be seen that as each cam reaches the cam roll, it causes the plunger to be forced inwardly, producing a corresponding movement in the bar 121, and bringing about a shearing action of the shears.

While the strips that have been fed forwardly from the rear end of the machine are on the table 82, the cooperating transverse strips are interlocked therewith, one at a

time. The sheet B for making the transverse strips is fed forwardly along an elevated table 134 at the top of the forward frame 3, passing between suitable adjustable guides 135. The sheet passes down between two transverse rollers 136 and 137; the axis of rotation of the roller 136 being stationary, and the roller 137 being mounted in adjustable bearing blocks 138, so that it may be moved from and toward the cooperating roller. From the rollers 136 and 137, which constitute the feed means, the sheet passes down behind a stripper plate 139 to punching and cutting means. The punching means is substantially like that previously described, except that the dies are vertical and the punches horizontal. The dies, as best shown in Figs. 12, 13 and 19, are in the form of blocks 140, slotted as indicated at 141, all of the blocks being slidably mounted in a suitable bed 142. The blocks are held in place by means of set screws 143. A scale 144 on the front side of the bed permits the blocks to be accurately adjusted. The bed is supported on the lower ends of two vertical screws 145, whose upper ends extend through a stationary part of the frame 3, being rotatable in such part, and being held against lengthwise movement with respect to the latter. On the upper end of each screw is a bevel pinion 146. These pinions mesh with complementary pinions 147 on a transverse shaft 148. On one end of the shaft 148 is a hand wheel 149 by means of which the shaft may be turned. It will be seen that when the hand wheel is operated, the screws are turned, raising the bed carrying the die blocks, or lowering the same, depending upon the direction in which the hand wheel is operated. The bed for the die blocks is, of course, arranged in suitable stationary vertical guides 150, so that it will be accurately held in any position of adjustment. As shown in Fig. 22, one of the guides 150 is provided with a graduated scale 151 by means of which the vertical position of the die blocks may at any time be definitely determined.

The punches are carried on a heavy cross beam 153 at the front end of the machine. At the ends of this beam are long heavy hubs 154 slidable on stationary horizontal posts or columns 155. The beam is therefore movable in a horizontal direction longitudinally of the machine. The beam has a vertical rear face 156 against which rests the flat front side or face of a bed 157 by which the punches are carried. The bed is adjustable along the face 156. In the arrangement shown, the bed is held to the beam by means of bolts 159 passing from the front side of the beam through long vertical slots 160, in the latter, into the bed. When the bolts are loosened, the bed may be moved up or down and then be again locked securely in place by tightening the bolts.

The punch devices are substantially the same as those at the other end of the machine. In other words, each punch 162 is fixed in a block 163 that is interlocked with another block 164 lying in front of the same; the bed being in the form of a channel with the open side directed toward the rear; and there being holding plates 165 and 166 detachably fastened to the free edges of the flanges of the channel and overlapping the blocks 163. Two screw shafts 167 and 168, as best shown in Figs. 19 to 21, extend transversely of the machine through the series of blocks 164. The two shafts are geared together by gearing 169, so that when either rotates the other rotates at the same speed but in the opposite direction. The shaft 167 passes freely through the first, third and fifth blocks, and is screwthreaded through the second and fourth blocks. The shaft 168 is screwthreaded through the first and fifth blocks and passes freely through the second, third and fourth blocks. There are both right and left hand threads on the two shafts, and the pitch of the threads on the shaft 168 is twice that of the threads on the other shaft. Consequently, when the shafts are rotated in one direction, the central block, and therefore the corresponding punch, will remain stationary; the second and the fourth blocks will be moved in opposite directions away from the central block; and the first and the fifth blocks will be moved outwardly twice as far as the second and fourth blocks. The two screw shafts pass through and are journalled in an end plate 170 on the bed, and are held against relative endwise movements with respect to this end plate. The shaft 167 extends beyond the gear wheels 169 and has thereon a bevel gear 171 that meshes with a complementary gear 172 on the rear end of a shaft 173 that is mounted in a bracket 174 projecting forwardly from the end plate 170. This shaft extends forwardly through a wide deep window 175 in the beam that carries the punches, and has on its front end a hand wheel 176 by means of which it may be turned.

It will therefore be seen that when the punches are engaged with the dies and the hand wheel 176 is turned, the punches and the dies may be simultaneously adjusted to change their spacings, in the same manner as at the other end of the machine. Furthermore, the punches and the dies, being engaged with each other, both the punches and the dies may be raised or lowered, upon turning the hand wheel 149 by means of which the dies are raised and lowered.

The punch mechanism, having been properly adjusted, punches a transverse row of slots across the sheet B so that there remains only the cutting off of the proper length at one end of the sheet to produce a partition strip that lies above and at right angles to the strips of the other set resting on the table 82.

The mechanism for cutting off the partition strip from the lower end of the sheet B is arranged below the punching mechanism and far enough above the table 82 to permit the highest or deepest strips *a* to pass under the same. In the arrangement shown, there is a stationary shearing cutter 178 extending downwardly and forwardly and having a transverse cutting edge 179 in position to engage the rear side of the sheet as the sheet moves down. Cooperating with the stationary blade is a movable blade 180 lying in front of the stripper plate and arranged approximately at right angles to the plane of the stationary cutter. The movable cutter is carried upon a heavy transverse beam 181 having at the ends hubs 182 fitted slidably on stationary inclined posts or columns 183 whole long axes are parallel with the blade 180. The parts are so proportioned that when the beam is moved down, the cutting edge 184 on the blade 180 passes in close proximity to the stationary cutting edge. Consequently, if the sheet has been fed down into the space between the cutting edges while the movable cutter is in its retracted position, the lower end of the sheet will be cut off when the movable cutter is forced down. Furthermore, the punching mechanism having formed notches extending inwardly from the free lower edge of the sheet, and the sheet having been fed down far enough to interlock the notched lower end with the longitudinal strips on the table, the piece cut off by the knives will constitute a transverse partition strip *b*, as indicated in Figs. 15 and 17. The bottom, or what may be termed the heel of the movable cutter, is at all times approximately horizontal, as indicated at 185. The parts are so proportioned that the cutting edge on the movable cutter travels a material distance past the stationary cutting edge. The heel of the movable cutter during this time moves not only toward the rear but also in a downward direction. The result is that the partition strip *b* that has just been cut off is brought under the heel of the movable cutter as the latter moves rearwardly, and is forced down by the downward movement of the heel, so as to bring it into its final position in the partition device.

Since the movable knife always stops at a predetermined height with respect to a point on the base of the machine, it is necessary that the partition strips *a* be raised up so that their upper edges will always be approximately in the plane of the heel or underface of the movable cutter, when the latter is down, regardless of the depth or height of the strips. I have therefore made the table 82 adjustable in the vertical direction. As best shown in Figs. 11 and 15, it will be seen that the table 82 has on its underside a deep depending web or flange 187 fitting against and slidable upon a vertical part 189 of the stationary frame 3. The web and flange has therein long vertical slots 190. Bolts 191 pass through these slots and into the part 189. Upon loosening the bolts, the table may be raised or lowered. In order to prevent the long ribbon-like strips *a* from buckling, the supports for the same on the blocks 85 should always be at the same elevation as the top of the table. I have therefore placed above the blocks 85 a transverse bar 192 that is fixed to the rear ends of a pair of bars 193 extending rearwardly from the table 82. Consequently as the table is raised or lowered, the bar 192 is also raised or lowered and therefore supports the lower edges of the longitudinal strips at the same elevation as the table.

The feed of the sheet B is determined by the movement of the feed roll 136. In the arrangement shown, there is fixed to one end of this feed roll a ratchet wheel 195. Cooperating with this ratchet wheel is a pawl 196 pivoted on the free end of a swinging arm 197. When the arm is moved in one direction, the pawl engages the ratchet wheel and turns the same. The width of each of the transverse strips *b* is determined by the angular distance through which the ratchet wheel is turned through each forward movement of the pawl. Assuming that the arm carrying the pawl always swings through the same angle, the feed of the paper may be varied by causing the pawl to be held clear of the ratchet wheel during any desired portion of the forward or working stroke. In the arrangement shown, I have provided a pawl lifter in the form of a segmental plate 198 secured to the frame 3 beside the ratchet wheel by means of a bolt or bolts 199 passing through a slot 200 in the lifter plate; which slot is concentric with the ratchet wheel. On the outer side of the plate, and also concentric with the ratchet wheel, is a ledge 201 that projects out underneath the pawl. During a part of its stroke the pawl rides on this ledge and is held clear of the ratchet teeth. When the pawl drops off the front end of the ledge, it engages the teeth and, during its continued forward movement, turns the ratchet wheel. It will be seen that by adjusting the lifter plate angularly, the point in its stroke at which the pawl clears the ledge may be varied, thus varying the distance through which the sheet B is fed during each working stroke of the pawl.

The various mechanisms that have heretofore been described may be driven in any desired way. In the arrangement shown, the shaft 54, at the rear end of the machine, is the main shaft. It carries not only the eccentrics, previously referred to, but also a heavy fly wheel 202. The eccentrics 55, which operate the punches at the rear end of the machine, also drive those at the front end. As best shown in Figs. 1 and 2, there is on each side of the machine, near the rear of the

frame 3, a vertical lever 203 pivoted between its ends, as indicated at 204. The lower end of each lever is connected to the eccentric strap on the eccentric 55 by means of a rod 205. The upper end of each lever is connected to one of the hubs 154 on the punch carrying beam by a link 206. The two sets of punches are therefore operated in unison with each other. The shaft 105, that drives the auxiliary feed rollers 96 near the front end of the machine, is connected to a driving shaft 207 through a universal joint 208. The shaft 207 is connected to another shaft having on one end a driving pulley 209, by a universal joint 210. A belt 211 passes over a drum on the fly wheel and over the pulley 209, so that the feed rollers 96 are constantly driven. The pawl arm 197 is driven from a bell crank lever 212 through a connecting rod 213. One end of the bell crank lever is actuated by an eccentric rod 214 extending to a suitable eccentric 215 on the main shaft.

For the purpose of carrying away the chips punched out of the sheet at the front end of the machine, I have arranged behind the bed that carries the die blocks an endless horizontal belt 217. As best shown in Fig. 2, the belt 217 runs over a pulley 218 on the outside of the frame 3. This pulley is on a short longitudinal shaft 219 provided with a belt pulley 220. The shaft for the feed roll 136 is extended beyond the pawl and ratchet operating mechanism and is there provided with a small belt pulley 221. A belt 222 passes around the pulleys 220 and 221, whereby the belt for carrying away the chips is moved step by step whenever the machine is in operation.

The cam wheel 132 for operating the swinging shear blades 119, is shown as driven in proper time relation to the other mechanisms in the following manner: As best seen in Fig. 1, one of the links or connecting rods 206 that operates the forward punches has an arm 224 projecting down from the same in front of the wheel 132. This arm is connected by a link 225 to a pawl arm 226 (see Figs. 12 and 23) loose on the stub shaft 227 on which the wheel 132 rotates. The wheel 132 has ratchet teeth on its periphery, and the arm 226 carries a pawl 228 that is adapted to engage with the ratchet teeth.

The carrier 181 for the cutting knife 182 is operated directly from the beam or carrier 153 on which the forward punches are mounted. This is accomplished by providing each of the hubs 154 with a heavy downwardly projecting ear 230 to which is pivotally connected one end of a link 231, whose other end is pivotally connected to the corresponding hub 182 on the knife carrier, as indicated at 232. Therefore when the punches are moved forward, that is retracted, the knife is moved forwardly and upwardly. When the punches move through a working stroke, the knife travels downwardly and rearwardly as previously described.

I have also illustrated means whereby the bed or carrier 113 for the small feed rolls 96 and the vertical shears may conveniently be moved back and forth. As perhaps shown best in Figs. 13 and 14, there are two screw shafts 235, 235 extending lengthwise in rear of and in screw-threaded engagement with the bed or carrier 113. These shafts have bearings in suitable stationary brackets 236 that prevent them from moving lengthwise. On the rear end of each shaft is a bevel gear 237 meshing with a complementary gear 238 on a transverse shaft 239. The shaft 239 has on the end thereof, at the side of the machine, a hand wheel 240 by means of which it may be rotated. By turning the hand wheel, the shears, guides and feed rolls carried by the member 113 may be moved bodily backward or forward.

The table 82 may be provided with a forward extension 241, downwardly inclined or otherwise, to receive the finished partition devices after they have been pushed forward off the table 82.

The end of the feed roller 136, opposite that on which the ratchet wheel 195 is mounted, is also preferably provided with a brake drum 250 around which extends a brake band 251 that prevents the feed roller from turning backwards while the pawl is making a retracting stroke.

It will be seen that when the machine, with the parts properly adjusted, is running, both sheets of paper will be fed ahead in proper time relation to each other; the sheet A being cut into long ribbons having notches or slots entering the same from the edges that are at the top when the ribbons are turned in the vertical positions; these longitudinal ribbons or strips being moved ahead step by step and being arrested with corresponding slots or notches in the path of a descending transverse strip; the sheet B being fed in proper time relation to cause individual transverse partition strips to be formed and separated from the advancing end; each transverse partition strip having its slots or notches in the bottom edge, and being forced down into interlocking engagement with the longitudinal partitions which are always properly partitioned to receive them. If it is desired to make partition devices with larger or smaller cells, the parts may readily be adjusted to accomplish this. If the width or height of the partition strips is to be varied, at least one set of punches should be replaced by another set so that the combined length of a slot in a transverse partition and a slot in a longitudinal partition is equal to the height or width of one of the partitions. The same die block may be used in connection with punches of different widths, so that it is not necessary always to substitute different die blocks. This

follows from the peculiar construction of the cutting ends of the punches that permit a comparatively sharp point to enter the paper at a considerable distance from one end of the slot in the die while the opposite edge of the punch is at the opposite end of the slot. It is not even necessary to change the punches if the upper edges of both sets of the partitions are not required to be in the same plane; in which case the machine is fully adjustable to vary the length, width and height of the cells in cellular partition devices. When the number of partitions is varied, punch mechanisms are added or subtracted, and the proper number of cam projections are mounted on the ratchet wheel that operates the machine to cut partition strips from the end of the longitudinal ribbons formed at the rear end of the machine.

Further variations in the character of the finished product may be produced by substituting for the ratchet wheel 49 a ratchet wheel in which the teeth are so disposed that some of the notches in the strips *a* will be farther apart than others, thus making it possible to produce cellular devices in which some of the cells will be wider or longer than others.

It will of course be understood that I have illustrated and described in detail simply a single preferred embodiment of my invention and that wide variations may be made in the various mechanisms without departing from the principle of my invention. I therefore do not wish to be limited to the details thus illustrated and described; but intend to cover all forms and arrangements coming within the definitions of my invention, constituting the appended claims.

I claim:—

1. In a machine of the character described, means to feed and punch a sheet and cut it into longitudinal strips, a stationary guide extending transversely of the strips, a plurality of carriages on and movable lengthwise of said guide, means to lock the carriages to the guide, feed rollers on each carriage to engage one of the strips and feed it ahead, shears on each carriage in advance of the rollers to sever the corresponding strip, means to operate the feed rollers and the shears in all positions of the carriage, and means to punch a second sheet and cut it into transverse strips and feed such strips into interlocking engagement with the longitudinal strips.

2. In a machine of the character described, means to feed a sheet and cut it into longitudinal strips, a stationary guide extending transversely of the strips, a plurality of carriages on and movable lengthwise of said guide, means to lock the carriages to the guide, feed rollers on each carriage to engage one of the strips and feed it ahead, shears on each carriage in advance of the rollers to sever the corresponding strip, a slide projecting forwardly from each carriage, means to adjust the slides in the lengthwise direction, guides for the strips at the forward ends of the slides, means to operate the feed rollers and the shears in all positions of the carriage, and means to produce transverse punched strips and feed them down into interlocking relation to the longitudinal strips in the vicinity of the aforesaid guides for the longitudinal strips.

3. In a machine of the character described, mechanism for punching a sheet, feed rolls to draw a sheet through said mechanism, a shaft parallel to and near one of the feed rolls, brackets mounted on said shaft for rocking movements thereon and sliding movements along the same, a slitting cutter on each bracket in position to engage with the latter feed roll and cut the sheet into longitudinal strips, springs to hold the cutters against the cooperating feed roll, means to guide said longitudinal strips and set them on edge at distances apart corresponding to the distances between the slitting cutters, means to punch a second sheet at points spaced transversely thereof to correspond to the spacing of said slitting cutters, and means to cut said second sheet into transverse strips and force the transverse strips edgewise into interlocking engagement with the longitudinal strips.

4. In a machine of the character described, mechanism for punching a sheet, feed rolls to draw a sheet through said mechanism, a shaft parallel to and near one of the feed rolls, brackets mounted on said shaft for rocking movements thereon and sliding movements along the same, a slitting cutter on each bracket in position to engage with the latter feed roll and cut the sheet into longitudinal strips, means to swing the brackets to raise the cutters, springs to hold the cutters against the cooperating feed roll, means to guide said longitudinal strips and set them on edge at distances apart corresponding to the distances between the slitting cutters, means to punch a second sheet at points spaced transversely thereof to correspond to the spacing of said slitting cutters, and means to cut said second sheet into transverse strips and force the transverse strips edgewise into interlocking engagement with the longitudinal strips.

5. In a machine of the character described, mechanism for feeding a sheet lengthwise step by step, a transverse series of punch devices positioned across the path of the sheet, means simultaneously to adjust said punch devices from and toward each other, mechanism to operate said punch devices between successive feeding steps, cutting devices to cut the sheet into longitudinal strips, means simultaneously to adjust said cutting devices from and toward each other, means to guide said longitudinal strips and set them on edge at distances apart corresponding to the dis-

tances between the slitting cutters, means to punch a second sheet at points spaced transversely thereof to correspond to the spacing of said slitting cutters, and means to cut said second sheet into transverse strips and force the transverse strips edgewise into interlocking engagement with the longitudinal strips.

6. In a machine of the character described, mechanism for feeding a sheet lengthwise step by step, a transverse series of punching devices positioned across the path of the sheet, means to adjust said punch devices from and toward each other, mechanism to operate said punch devices between successive feeding steps, cutting devices to cut the sheets into longitudinal strips, means to adjust the cutting devices to space them to correspond with the spacings of the aforesaid punch devices, means to guide said strips and set them on edge, means to feed a second sheet edgewise toward said longitudinal strips, means to cut from the lower end of said second sheet transverse strips and interlock them one at a time with the longitudinal strips, punch devices distributed transversely of said second sheet, means to adjust the latter punching devices from and toward each other, and means to adjust the latter punching devices bodily in the direction of the length of the second sheet.

7. In a machine of the character described, mechanism for punching a sheet, feed rolls to draw a sheet through said mechanism, a shaft parallel to and near one of the feed rolls, supports mounted on said shaft for rocking movements thereon and sliding movements along the same, a slitting cutter on each support in position to engage with the latter feed roll and cut the sheet into longitudinal strips, springs to hold the cutters against the cooperating feed roll, means to guide said longitudinal strips and set them on edge, means to punch a second sheet at points spaced transversely thereof to correspond to the spacing of said longitudinal strips standing on edge, and means to cut said second sheet into transverse strips and force the transverse strips edgewise into interlocking engagement with the longitudinal strips.

8. In a machine of the character described, mechanism for punching a sheet, feed rolls to draw a sheet through said mechanism, a shaft parallel to and near one of the feed rolls, supports mounted on said shaft for rocking movements thereon and sliding movements along the same, a slitting cutter on each support in position to engage with the latter feed roll and cut the sheet into longitudinal strips, means to rock the supports to raise the cutters, springs to hold the cutters against the cooperating feed roll, means to guide said longitudinal strips and set them on edge, means to punch a second sheet at points spaced transversely thereof to correspond to the spacing of said longitudinal strips standing on edge, and means to cut said second sheet into transverse strips and force the transverse strips edgewise into interlocking engagement with the longitudinal strips.

9. In a machine of the character described, mechanism for feeding a sheet lengthwise step by step, a transverse series of punch devices positioned across the path of the sheet, means to adjust said punch devices from and toward each other, mechanism to operate said punch devices between successive feeding steps, cutting devices to cut the sheet into longitudinal strips, means simultaneously to shift said cutting devices, means to guide said longitudinal strips and set them on edge, means to punch a second sheet at points spaced transversely thereof to correspond to the spacing of said longitudinal strips standing on edge, and means to cut said second sheet into transverse strips and force the transverse strips edgewise into interlocking engagement with the longitudinal strips.

In testimony whereof, I sign this specification.

WALTER E. JENSEN.