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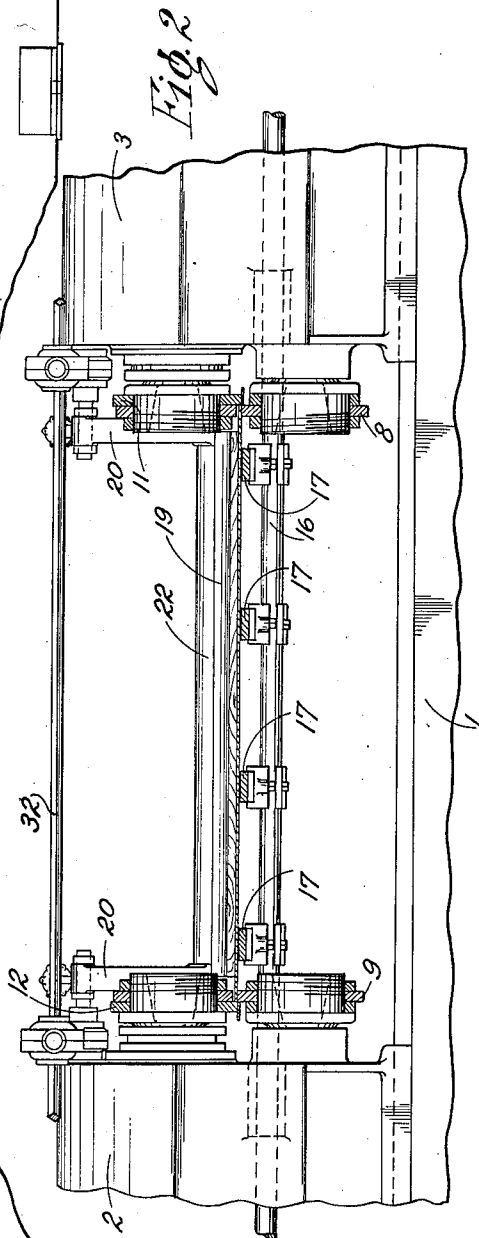
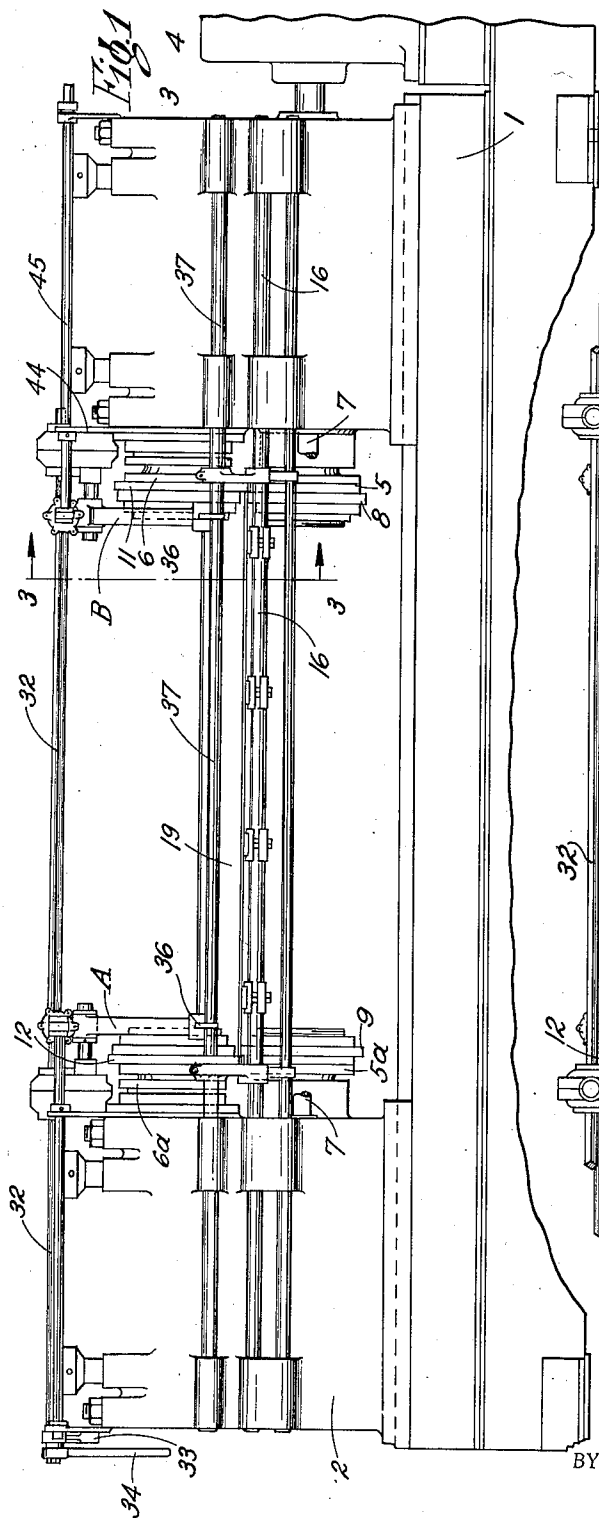
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2,204,904

HOLD-DOWN MECHANISM

Filed March 10, 1938

5 Sheets-Sheet 1



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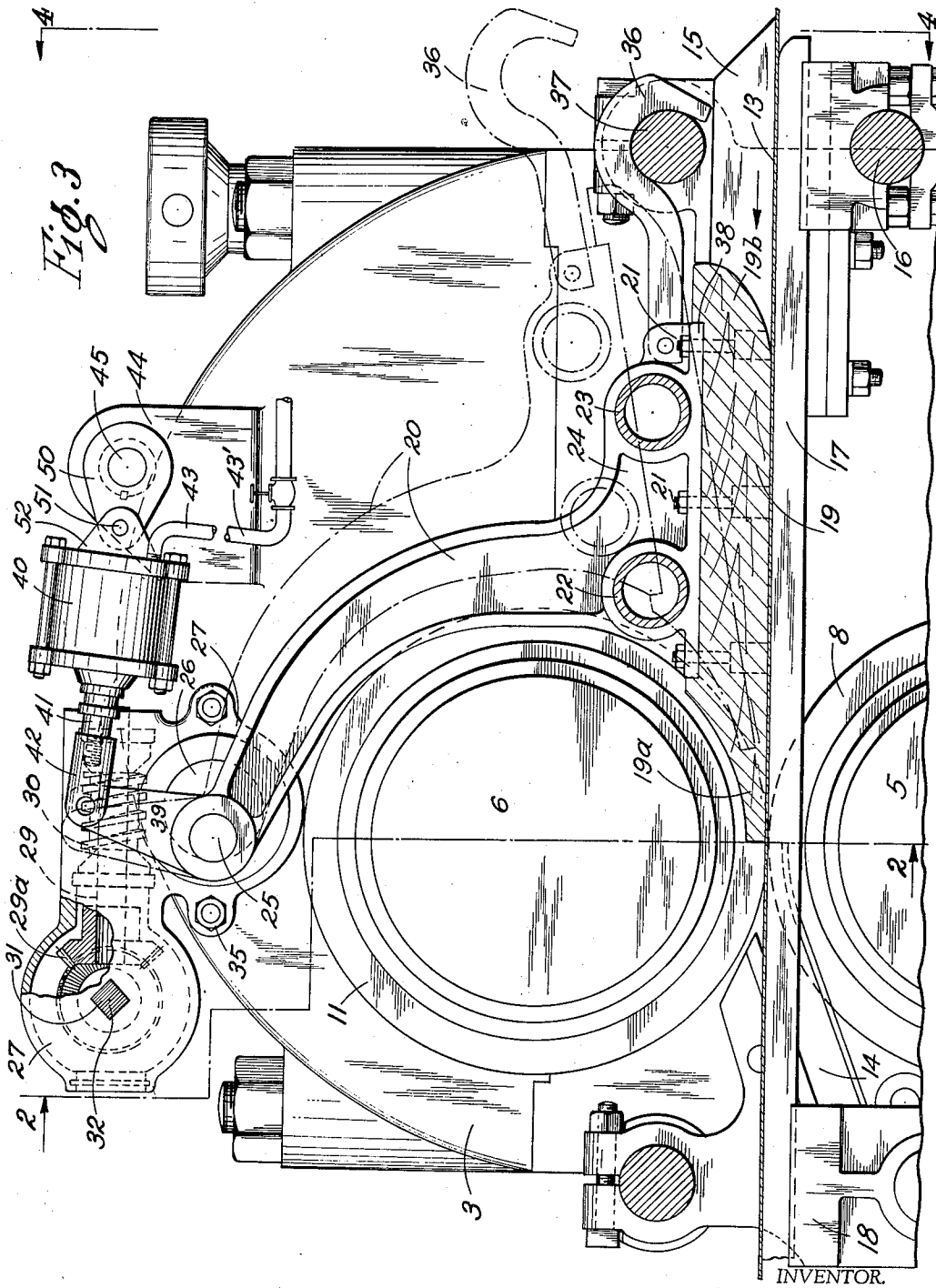
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HOLD-DOWN MECHANISM

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5 Sheets-Sheet 2



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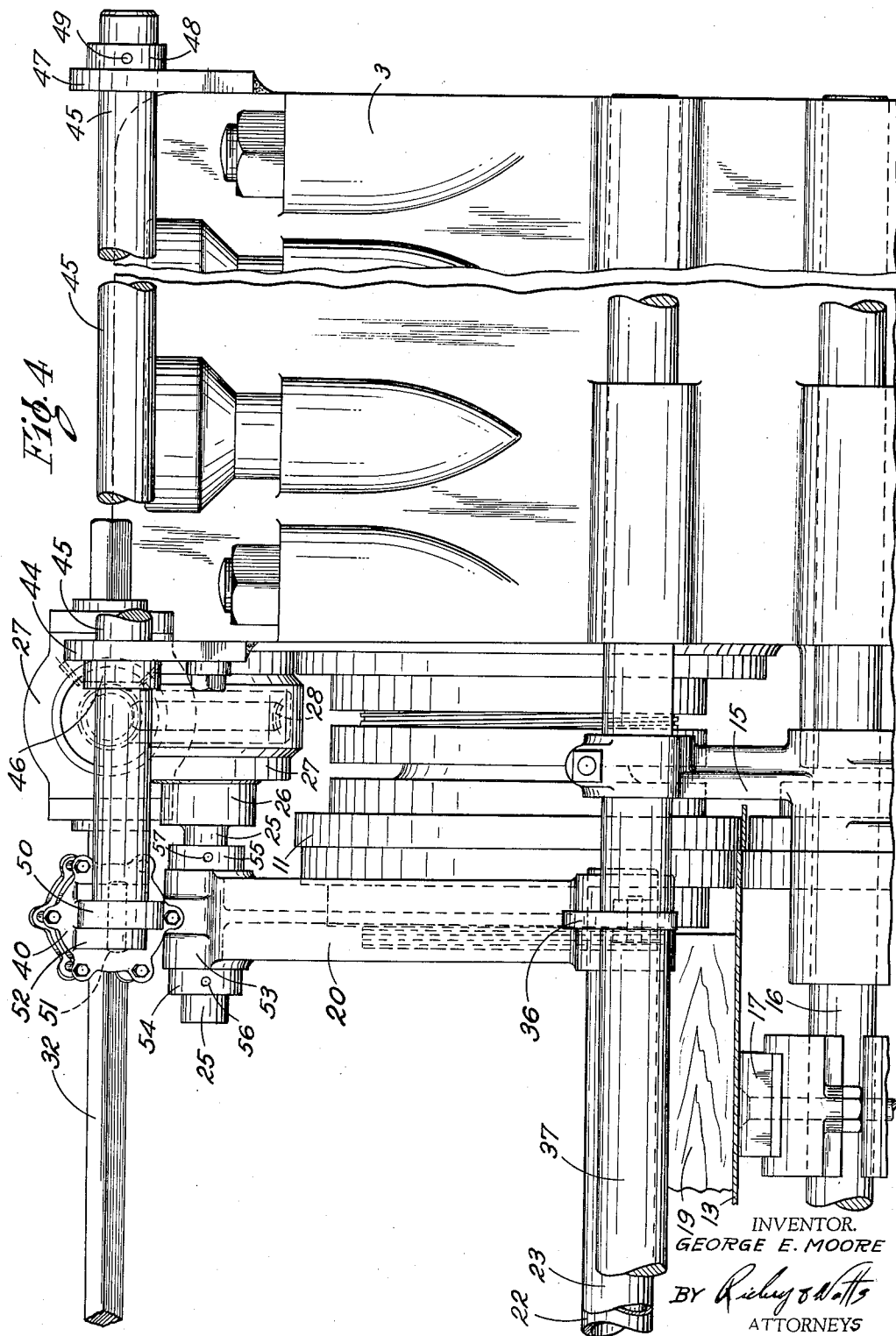
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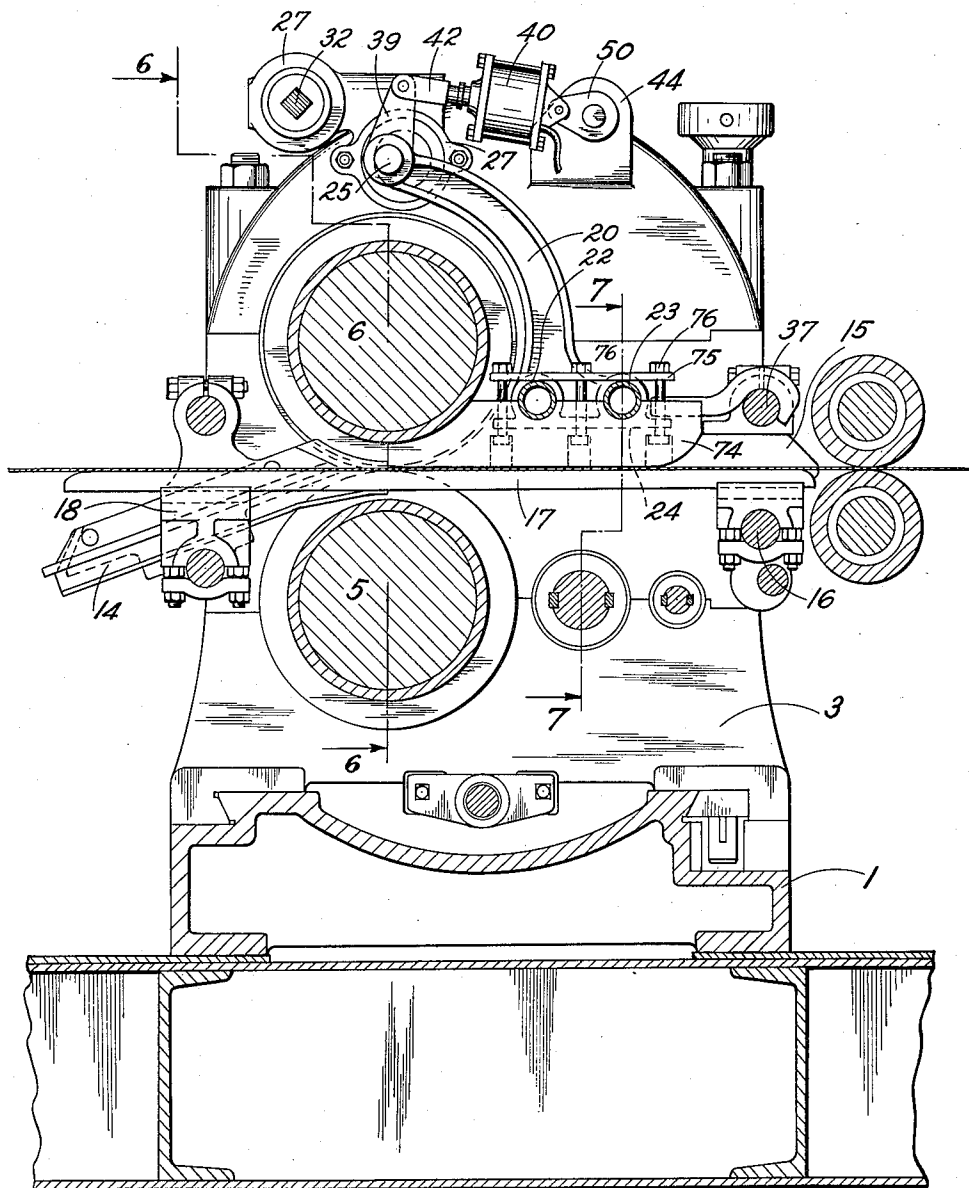


Fig. 5

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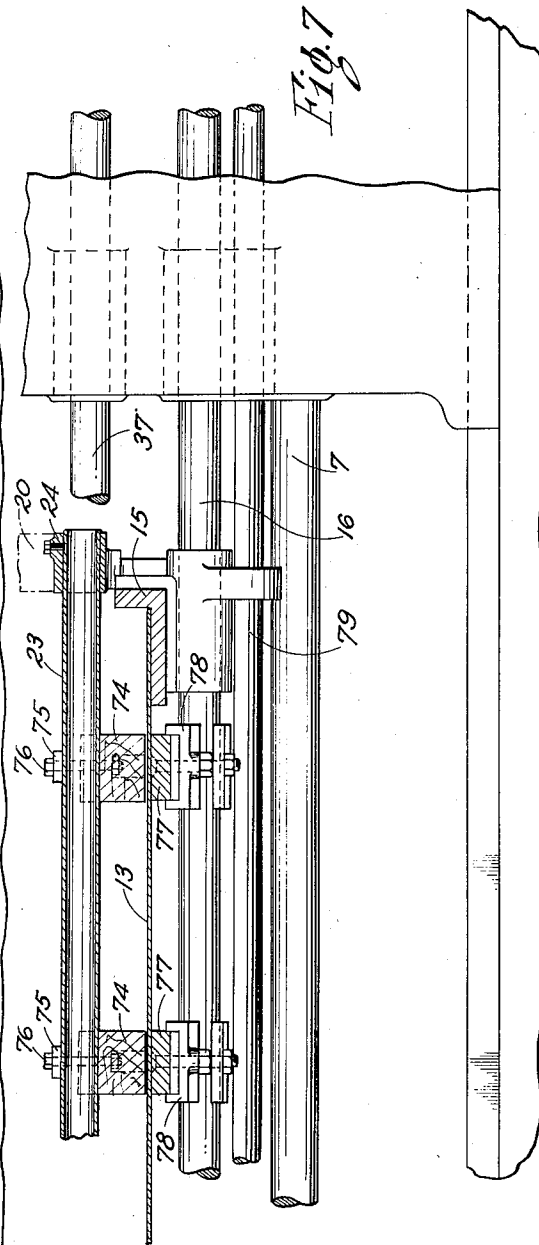
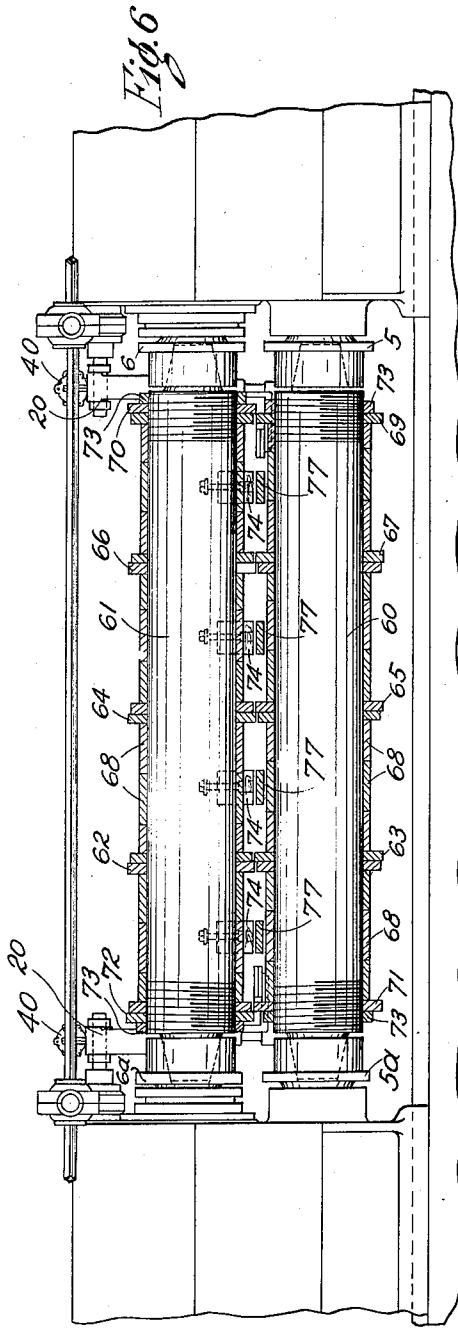
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HOLD-DOWN MECHANISM

Filed March 10, 1938

5 Sheets-Sheet 5



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2,204,904

HOLD-DOWN MECHANISM

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Application March 10, 1938, Serial No. 195,089

17 Claims. (Cl. 164—61)

This invention relates to the manufacture of sheet metal and more particularly to an improved hold-down mechanism which is especially adapted for use in connection with sheet metal slitting or trimming machines.

In the production of metal sheets it is customary to trim and slit the rolled sheets by means of rotary shears which comprise pairs of coacting disc shaped knives which are positioned to engage and shear the metal of the sheets at the desired places. Suitable rolls or other means are provided for feeding the sheets to the slitter or trimmer and carrying away the sheared product and scrap. To achieve the best results it is desirable to prevent any buckling or upward movement of the sheet relative to the slitting knives immediately ahead of the knives, and it is among the objects of my present invention to provide an improved hold-down mechanism by which the sheets can be accurately located and held in proper relation to the point of cutting or slitting, which can be readily adjusted for wear of the parts or to accommodate different gauge metal sheets and which can also instantaneously be moved out of hold-down or operating position to permit the end of a sheet to be fed up to the cutting point of the knives. Another object of my invention is the provision of a universal hold-down mechanism for sheet trimming or slitting cutters which may be readily adjusted to accommodate sheets of different widths and gauges, which may include any desired number of hold-down shoes all of which may be operated simultaneously, and which is simple to operate and economical to maintain.

The above and other objects of my invention will appear from the following description of one embodiment thereof, reference being had to the accompanying drawings, in which

Figure 1 is an elevational view of a slitting and/or trimming shear which includes my improved hold-down mechanisms, the machine being set up only to trim the edges of a sheet.

Figure 2 is a vertical cross-sectional view taken substantially on line 2—2 of Figure 3.

Figure 3 is an enlarged vertical cross-sectional view taken on line 3—3 of Figure 1 and illustrating the hold-down shoe support and operating mechanism.

Figure 4 is an elevational view of the hold-down shoe and supporting mechanism taken substantially on line 4—4 of Figure 3.

Figure 5 is an enlarged vertical cross-sectional view of a trimming and slitting machine of the type shown in Figure 1 but having the machine

set up not only to trim the edges of the sheet but also to slit the sheet at a plurality of places.

Figure 6 is a vertical cross-sectional view taken substantially on line 6—6 of Figure 6 but on a somewhat reduced scale.

Figure 7 is a fragmentary vertical cross-sectional view taken on line 7—7 of Figure 5.

A slitting and/or trimming shear with which my improved hold-down mechanism may conveniently be used is shown in Figure 1. The apparatus includes a base 1, a pair of housings 2 and 3 which are mounted on suitable ways on said base for movement toward and away from each other, a drive motor 4 which is adapted to drive the spindles 5 and 6 through suitable gearing in the housing 3, and the hold-down mechanism indicated at A B. Similar spindles 5^a and 6^a extend out from the housing 2 and are preferably so supported that they may be adjusted vertically relative to each other. A drive shaft 7 extends across from housing 3 to housing 2 and transmits the driving power from the motor 4 to spindles 5^a and 6^a. The trimming knives 8 and 11 are carried by the spindles 5 and 6 and knives 9 and 12 by spindles 5^a and 6^a and it will be seen that the cutting edges of the pairs of knives 8—11 and 9—12 coact to trim both edges of the sheet 13. Guideways 14 (see Fig. 5) are provided at each of the trimming knives 8—11 and 9—12 to remove the trimmed off edge portions of the sheet and guide them to a scrap cutter or the like (not shown). Adjustable side guides 15 (see Figs. 3 and 5) maintain the strips in proper position relative to the knives.

As the hold-down supporting device A is similar in all respects to hold-down supporting device B and as the spindles 5 and 6 are substantially the same as spindles 5^a and 6^a, it will be necessary to describe in detail only one end of the hold-down mechanism.

In Figures 3 and 4 the device B is illustrated in enlarged scale. Supported on a transversely extending rod 16 on the entering side of the machine are a number of sheet supporting bars 17. These bars 17 extend through between the cutter knives 8 and 11 and support the sheet 13 as it passes through the machine. As is seen in Figures 3 and 5 the bar 17 is also supported on a bracket 18 on the leaving side of the knives. The function of my improved hold-down mechanism is to hold the sheet 13 down firmly against the bottom support bars 17 while the shearing action of the knives 8—11 and 9—12 takes place. One end of a shoe member 19, preferably of wood

or other material which will not scratch or mar the surface of the sheet 13 as it passes therebeneath, is secured to the lower end of a curved supporting arm 29 by means of suitable bolts 21.

5 When in operating position, as is seen in full lines in Figure 3, this shoe 19 rests upon the surface of the sheet 13 and provides just sufficient clearance between its lower surface and the top surface of the bars 17 to permit the sheet 13 to

10 pass to the knives without buckling. The shoe 19 has a forwardly extending nose portion 19^a and the rear end is rounded off as shown at 19^b to facilitate entry of the sheet. A pair of tubular members 22 and 23 extend through suitable apertures in the foot portion 24 of the arm

15 20, and, as is seen in Figures 1 and 4, these tubes 22 and 23 extend across to the other hold-down operating device A where they pass through the corresponding shoe supporting arm of this device. The shoe 19 also extends across to the

20 shoe supporting arm of the unit A and is attached thereto. The tubes 22 and 23 assist in obtaining simultaneous action of both ends of shoe 19 and also provide a support for individual shoes in slitting operations, as will be later explained.

In order to obtain the proper clearance between the sheet supports 17 and the bottom surface of the hold-down shoe 19 and to make possible the handling of different gauge sheets it is necessary to provide means for moving the shoe

30 19 in a substantially vertical direction when it is in operating position as shown in full lines in Figure 3. In order to achieve this result I support the upper end of the arm 20 on a pin or shaft 25 which is in turn eccentrically mounted on a shaft 26. This shaft 26 has suitable bearing in housing 27 and carries, within the housing 27, a worm gear 30. The shaft 29 is also supported

35 by the housing 27 and has a bevel gear 29^a at its end which engages a corresponding bevel gear 31 which has a sliding fit on the square shaft 32. The square shaft 32 extends through the housing 27 and, as is seen in Figure 1, across the span

40 of the machine and through a similar housing in the hold-down unit A and is supported on the housing 2 by means of a bracket 33. A removable wrench or handle 34 is provided which fits over the end of the shaft 32 adjacent the bracket

45 33 and permits rotation thereof when it is desired to adjust the vertical position of the shoe 19.

It will be seen that when the shaft 32 is turned the bevel gear 31 will rotate the bevel gear 29^a

55 and the worm 30 will cause the worm gear 28 and the shaft 26 to rotate. This will cause the eccentrically located pin or shaft 25 to be lifted or lowered from the position shown in Figure 3, depending upon the direction of rotation of the shaft 32. Due to the angular location of the

60 eccentric shaft 25 on the shaft 27 the movement of shaft 25 will have a very small horizontal component and thus, by turning the handle 34 in the desired direction, the arm 20 and the shoe

65 19 may be lifted or lowered to provide exactly the desired degree of clearance between the shoe 19 and the supporting bar 17.

The bracket 27 is secured to the housing 3 by bolts 35 and the hold-down unit B is movable with the housing 3 and the hold-down unit A is movable with the housing 2. The only time that these housings are moved is when it is desired to change the spacing therebetween to accommodate a sheet of different width. When such

70 adjustment of the housing is made a longer or

shorter shoe 19 will be secured to the brackets 24 on the arms 20. As the square shaft 32 extends through the corresponding parts of the hold-down mechanisms A and B with a sliding fit this adjustment of the spacing of the housings 2 and 3 can be effected without difficulty.

In order to retain the shoe 19 in proper position relative to the center line of the cutter knives 8 and 11 a hook 36 is pivotally attached to the lower end 24 of the arm 20. This hook, when the shoe 19 is in operating position, engages a transverse bar 37 which extends across from housing 2 to housing 3 and is so supported that relative movement of the housings toward and away from each other can be had. The hook 36 is so formed

15 at its inner end, and a flange 38 is provided on the foot of the arm 20, that the hook will not drop down when the shoe 19 and tubes 22 and 23 are elevated into the position shown in dot and dash lines in Figure 3, thus insuring engagement

20 of the hook with the rod 37 when the shoe is returned to its operating or hold-down position.

When a sheet is to be fed into the slitting and trimming knives it is desirable, in order to permit free entry of the sheet and prevent marring or scratching of the surface of the shoe 19 by any roughness on the entering end of the sheet, to remove the shoe 19 from its operating position. To accomplish this I have provided a bell

25 crank lever 39, which may be integrally formed with the arm 20 and is pivotally supported therewith on the shaft or pin 25. This bell crank lever 39 is connected to a power unit, comprising a suitable piston or diaphragm (not shown) in a cylinder 40, by means of an adjustable piston

35 rod 41 and link member 42. The cylinder 40 may be connected to a source of actuating pressure, such as compressed air, through a pipe or tube 43 and a valve 43' controls the operation of the power unit. A bracket 44 is mounted on

40 the housing 3 and a supporting rod 45 extends through the bracket 44 and is provided with an adjustable collar 46. The other end of the rod 45 is supported by another bracket 47 on the opposite side of the housing 3 and another adjustable

45 collar 48, which may be secured to the rod 45 by means of a set screw or the like 49, permits adjusting movement of the bar 45 relative to the housing 3 and the cutter knives 8 and 11. A crank arm 50 is keyed to the end of the bar 45

50 and has a pivotal connection at 51 to a flange 52 on the base of the cylinder 40.

The above described supporting means permits the cylinder 40, together with the bell crank arm 39, the supporting arm 20 and the shoe 19, 55 to be adjusted transversely of the machine to locate the shoe 19 properly with respect to the cutting edges of the knives 8 and 11. As the housing 27 is rigidly secured to the housing 3 it is necessary that the shaft or pin 25 be made long enough to accommodate the required range of adjustment. Thus, as is seen in Figure 4, the end of the shaft 25 extends out beyond the hub 53 of the arm 20 and locking collars 54 and 55 are provided to maintain the proper adjusted position

65 of the parts. These collars 54 and 55 are secured in position on the shaft 25 by set screws 56 and 57.

When suitable fluid pressure is applied through the pipe 43 to the cylinder 40 the piston therein 70 will be moved, causing pressure to be exerted through the piston rod 41 and link 42 against the upper end of the bell crank lever 39. Rotation of this lever about its supporting pin 25 will elevate the arm 20 carrying with it the shoe 19 and

75

the hook 32 and lifting them into the elevated position shown in dot and dash lines in Figure 3. When in this position a sheet can be fed up to the cutting knives without danger of marring the surface of the shoe 19 or of the sheet and without any restriction due to the close clearance provided between the shoe 19 and the bottom supporting bar 16. After the sheet has been fed up to the knives the fluid pressure is turned off, permitting the shoe to drop back into operating position and the hook 36 to re-engage the bar 37.

I have illustrated my improved hold-down operating mechanisms A and B in Figure 1 as each being provided with fluid pressure cylinders for elevating the shoe 19. These cylinders are preferably connected to the same source of fluid pressure and may be simultaneously controlled by the same valve 43' and, as the devices are interconnected by the tubes 22 and 23, they will be moved simultaneously into and out of operating position.

In Figures 5, 6 and 7 I have illustrated the machine shown in Figure 1 set up to trim the edges of the sheet and also to slit it into a number of strips. When slitting operations are carried out intermediate the edges of the sheet arbors 60 and 61, having tapered ends engaging the spindles 5, 6, 5^a and 6^a and driven thereby, are employed. The slitting knives 62, 63, 64, 65, 66 and 67 are spaced and located on the arbors 60 and 61 by suitable spacing rings 68. In the set up illustrated the side edge trimming operations are performed by the knives 69, 70, 71 and 72 which are disposed at the ends of the arbors 60 and 61. The entire assembly of knives and spacers are held in position on the arbors 60 and 61 by suitable nuts 73 which are mounted on the threaded end portions of the arbors. It will be understood that the knives are preferably keyed to the arbors in any suitable manner to prevent relative rotation thereof. With this arrangement a plurality of individual hold-down shoes 74 are employed. As is clearly seen in Figures 5, 6 and 7, these shoes 74 are supported on the tubes 22 and 23, the top surface of the shoes being grooved to accommodate the tubes, and clamping plates 75 and bolts 76 hold the shoes 74 firmly in position on the tubular cross members 22 and 23 which are supported on the bottom brackets 24 of the supporting arms 20 of the hold-down operating devices A and B. Sheet supporting bars 77, which are similar to the bars 17 shown in Figures 1 to 4, are supported on the transversely extending rod 16 by means of the brackets 78 and one of these supporting bars is located directly below each hold-down shoe 74.

As illustrated the hold-down shoes are disposed substantially midway between the cutting knives but it will be understood that they may be moved along the supporting tubes 22 and 23 to any desired location by merely loosening the clamping bolts 76. The edge guide 15 is supported on the rod 16, as shown in Figure 7, and is also guided by the transversely extending rod 79.

Any number of intermediate shoes 74 may be employed and when the mechanisms A and B are operated to lift or lower the tubes 22 and 23 vertically the clearance between each of the shoes 74 and their corresponding seat supports 77 will be varied. In like manner when the air power units are operated to swing the supporting arms 20 back away from the arbors 60 and 61 the tubes 22 and 23 will carry all of the inter-

mediate shoes out of hold-down position. This arrangement provides an exceedingly flexible mechanism for holding down the sheet during all kinds of slitting and trimming operations. By my combined vertically adjustable shoe supports and means for moving the supports and shoes completely out of the path of the entering sheet, which mechanisms may be adjusted toward and away from each other with the main driving housings 2 and 3 in order to accommodate different sheet widths, I have provided a simple, quickly adjustable and instantaneously operable hold-down mechanism which can be easily set up to accommodate various sizes and gauges of sheets.

Although I have described the illustrated embodiment of my invention in considerable detail as applied to a slitting and trimming shears it will be understood by those skilled in the art that my improved hold-down device is applicable to other uses and that its form and structural features may be modified from those shown and described herein without departing from the spirit of my invention. I do not, therefore, wish to be limited to the specific forms herein shown and described but claim as my invention all embodiments thereof coming within the scope of the appended claims.

I claim:

1. In apparatus of the type described, a pair of coacting circular cutting knives, a sheet supporting member positioned to support a sheet in cutting position relative to said knives, a hold-down shoe disposed above said sheet support, means for supporting said shoe, means for adjusting said shoe and supporting means toward and away from said sheet support, and independently operable means for lifting said shoe and supporting means away from its hold-down position above said sheet support to permit free entry of a sheet to said cutting knives and returning said shoe and support to hold-down position without changing the adjustment of said adjusting means.

2. In apparatus of the type described, a pair of coacting circular cutting knives, a sheet supporting member positioned to support a sheet in cutting position relative to said knives, a hold-down shoe disposed above said sheet support, a support for said shoe, means for adjusting said shoe toward and away from said sheet support, independent means for lifting said shoe and shoe support away from hold-down position above said sheet support, without changing the adjustment of said shoe adjusting means, to permit free entry of a sheet to said cutting knives, and anchoring means for retaining said shoe in hold down position.

3. In apparatus of the type described, a sheet support, a hold-down shoe, a supporting arm for said hold-down shoe, a pin providing a pivot on which said arm is rotatably mounted, means for lifting and lowering said pin relative to said sheet support to provide adjustment of the clearance between said hold-down shoe and said sheet support, and means for moving said arm about said pin to swing said hold-down shoe out of and into hold-down position.

4. In apparatus of the type described, a pair of coacting circular knives, means for supporting and driving said knives, a sheet support, a hold-down shoe, a supporting arm for said hold-down shoe, a pin providing a pivot on which said arm is rotatably mounted, means for lifting and lowering said pin relative to said sheet support to

provide adjustment of the clearance between said hold-down shoe and said sheet support, and means for moving said arm about said pivot pin to swing said hold-down shoe out of and into hold-down position, said last named means including a fluid pressure actuated motor and operating connections therefrom to said arm.

5. In apparatus of the type described, the combination of a pair of coacting knife members, a work supporting member, a hold-down shoe adjacent said work support, means for adjusting said shoe toward and away from said support, and fluid pressure actuated means for moving said shoe completely out of hold down position independently of said adjusting means.

6. In apparatus of the type described, a plurality of spaced pairs of circular cutting knives, means for supporting and driving said knives, said supporting means including housings adjustable toward and away from each other to permit variation in the spacing between pairs of knives, a work supporting member positioned to support the work in cutting relation to said knives, a hold-down shoe disposed above said work support, and means mounted on said housings for supporting said hold-down shoe, said last named means including a supporting arm, an eccentric pin on which said arm is rotatably mounted, an operating shaft, and gear connections for translating rotation of said shaft into movement of said eccentric pin whereby said shoe may be moved toward and away from the work support.

7. In apparatus of the type described, a plurality of spaced pairs of circular cutting knives, means for supporting and driving said knives, said supporting means including housings adjustable toward and away from each other to permit variation in the spacing between pairs of knives, a work supporting member positioned to support the work, a hold-down shoe disposed above said work support, and means mounted on said housings for supporting and operating said hold-down shoe, said last named means including a supporting arm, an eccentric pin on which said arm is rotatably mounted, an operating shaft, gear connections for translating rotation of said shaft into movement of said eccentric pin whereby said shoe may be moved toward and away from the work support, a fluid pressure actuated motor and connections therefrom to said arm whereby said arm may be swung about its pivotal support on said eccentric pin to lift said shoe completely out of said hold-down position.

8. In apparatus of the type described, a plurality of spaced pairs of circular cutting knives, means for supporting and driving said knives, said supporting means including housings adjustable toward and away from each other to permit variation in the spacing between pairs of knives, a work supporting member positioned to support the work, a hold-down shoe disposed above said work support, and means mounted on said housings for supporting and operating said hold-down shoe, said last named means including a supporting arm, an eccentric pin on which said arm is rotatably mounted, an operating shaft and gear connections for translating rotation of said shaft into movement of said eccentric pin whereby said shoe may be moved toward and away from the work support, a fluid pressure actuated motor and connections therefrom to said arm whereby said arm may be swung about its pivotal support on said eccentric pin to

lift said shoe completely out of hold-down position, said operating shaft and fluid pressure motor being operable independently of each other to carry out their respective functions.

9. In combination with a pair of coacting circular disc knives and supporting and driving means therefor, a work support and a hold-down device, said hold-down device including a shoe, a supporting arm for said shoe, a pin on which said arm is pivotally mounted, a rotatable shaft on which said pin is eccentrically supported whereby rotation of said shaft will adjust said arm and shoe toward or away from said work support, means for rotating said shaft, and means for moving said arm and shoe about said pivot pin.

10. In combination with a pair of coacting circular disc knives and supporting and driving means therefor, a work support and a hold-down device, said hold-down device including a shoe, a supporting arm for said shoe, a pin on which said arm is pivotally mounted, a rotatable shaft on which said pin is eccentrically supported whereby rotation of said shaft will adjust said arm and shoe toward or away from said work support, means for rotating said shaft, means for moving said arm and shoe about said pivot pin, and means for limiting such movement of said arm and shoe about said pivot pin in a direction toward said support.

11. In apparatus of the type described, a plurality of pairs of circular cutting knives, means for supporting and driving said knives including housings adjustable toward and away from each other, a hold-down shoe and means for supporting and operating said hold-down shoe including operating units mounted on said housings and each having a pivoted arm, a member connecting said arms, means for simultaneously lifting or lowering said arms and means for simultaneously swinging said arms about their pivots to lift said shoe out of hold-down position.

12. In apparatus of the type described having disc knives and spaced housings for supporting same, a hold-down mechanism including a pair of operating units mounted one on each housing, means for interconnecting said units, a plurality of hold-down shoes adjustably supported on said interconnecting means, means for simultaneously operating said units to lift or lower said shoes and independently operable means for simultaneously operating said units to move said shoes out of hold-down position.

13. In apparatus of the type described, the combination with a slitting and trimming machine having spaced movable housings, of a hold-down mechanism comprising a pair of operating units mounted one on each of said housings, said units having pivoted arms, a transversely extending member connecting said arms, a hold-down shoe supported by at least one of said arms, means for lifting or lowering said arms in a substantially vertical direction, an operating shaft for effecting said lifting or lowering of said arms, said shaft extending between said housings and being adapted to slide through one of said operating units when one of said housings is moved relative to the other, and means for simultaneously swinging said arms on their pivots to move said shoe out of hold-down position.

14. In apparatus of the type described, the combination with a slitting and trimming machine having a plurality of spaced pairs of circular knives and adjustable housings containing driving means for said knives, of a hold-down

mechanism comprising a plurality of spaced hold-down shoes, a member to which said shoes are adjustably secured, said member being disposed between said housings, operating units mounted on each of said housings, each unit having a pivoted arm, the ends of said shoe supporting member being secured to the ends of said arms, means for lifting and lowering said arms without substantial pivotal movement thereof to adjust the vertical location of said shoes, and means for swinging said arms on their pivots to lift said shoes out of hold-down position.

15. In apparatus of the type described, the combination of a work supporting member, a hold-down shoe adjacent said work support, means for adjusting said shoe toward and away from said support, and fluid pressure actuated means for moving said shoe completely out of hold-down position independently of said adjusting means.

16. In combination, a work support and a hold-down device, said hold-down device in-

cluding a shoe, a supporting arm for said shoe, a pin on which said arm is pivotally mounted, a rotatable shaft on which said pin is eccentrically supported whereby rotation of said shaft will adjust said arm and shoe toward or away from said work support, means for rotating said shaft and means for moving said arm and shoe about said pivot pin.

17. In apparatus of the type described, a pair of coacting circular knives, means for supporting and driving said knives, a sheet support, a hold-down shoe, a supporting arm for said hold-down shoe, a pin providing a pivot on which said arm is rotatably mounted, means for lifting and lowering said pin relative to said sheet support to provide adjustment of the clearance between said hold-down shoe and said sheet support, and means for moving said arm about said pin to swing said hold-down shoe out of and into hold-down position.

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