Nov. 19, 1940. E. R. TYRRELL 2,222,051

SLITTER

Filed Sept. 9, 1939 3 Sheets-Sheet 1

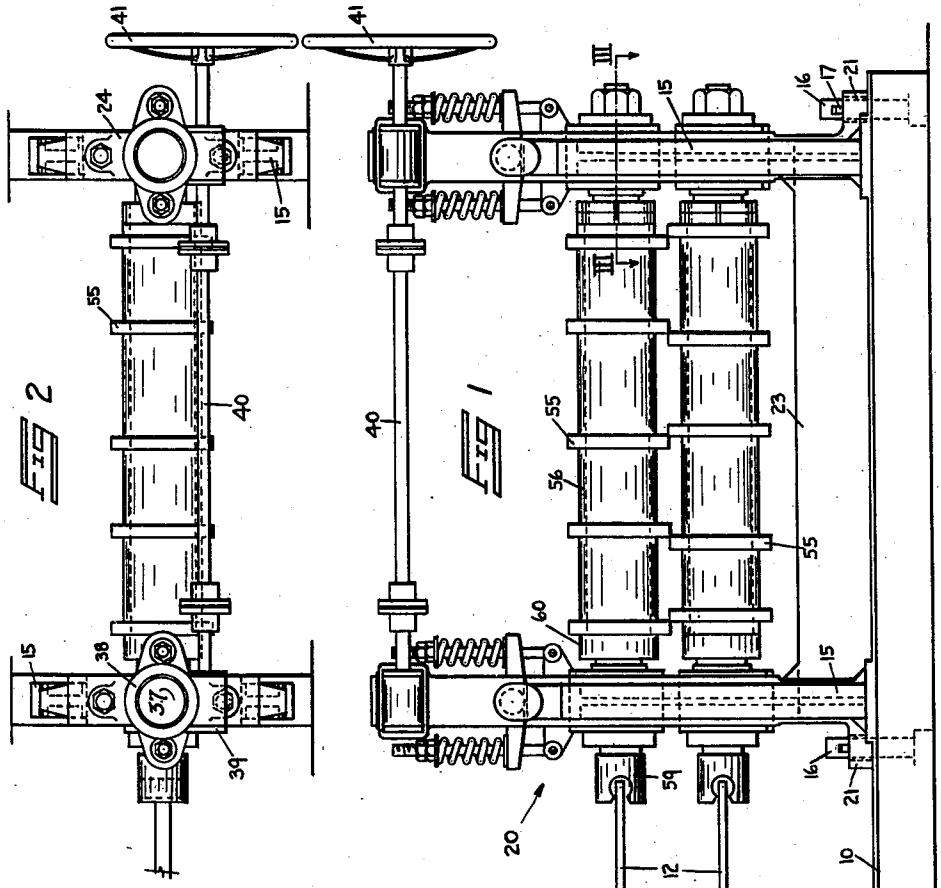


Fig 2

Fig 1

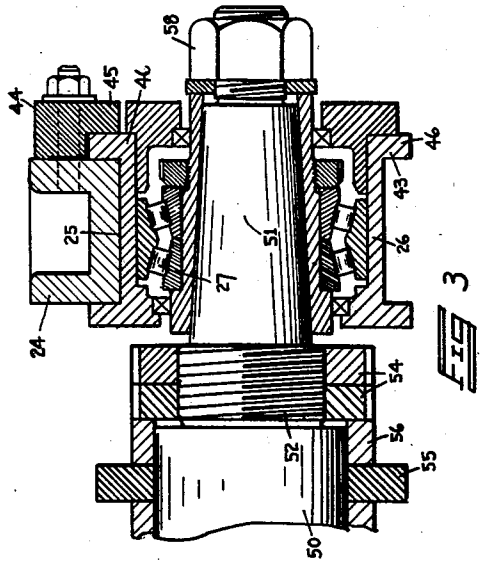


Fig 3

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SLITTER

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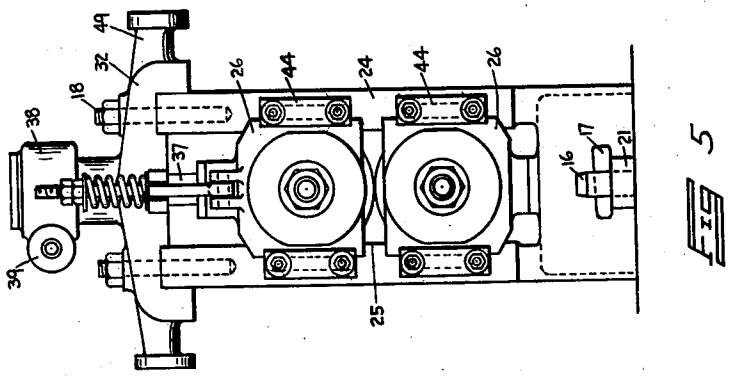


FIG 5

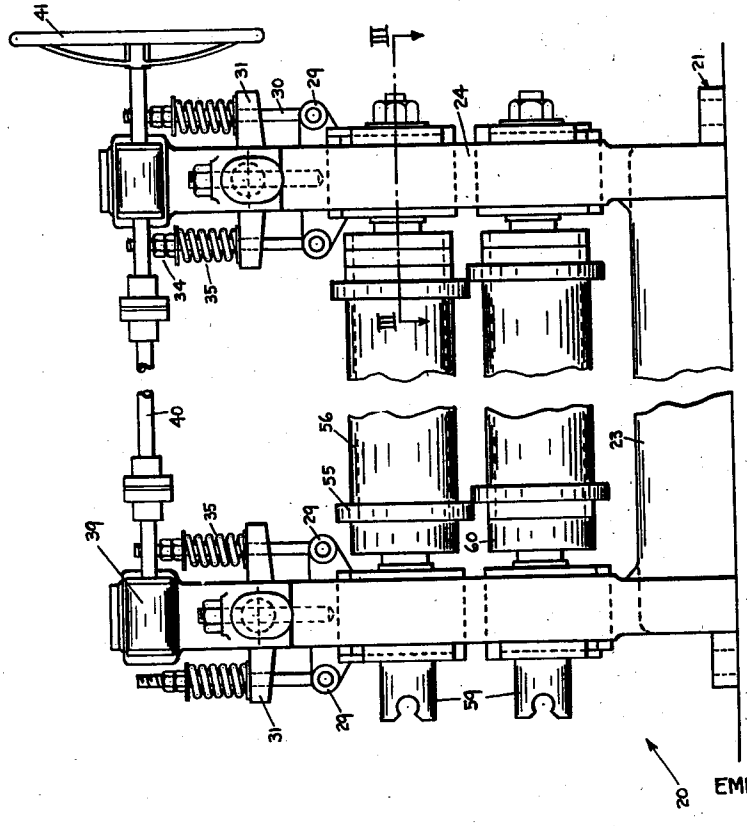


FIG 4

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Fig 7

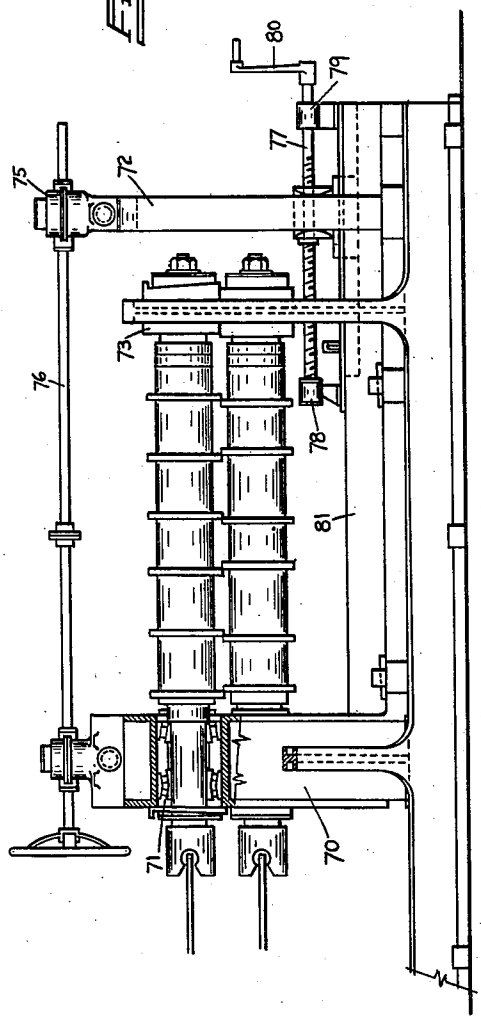
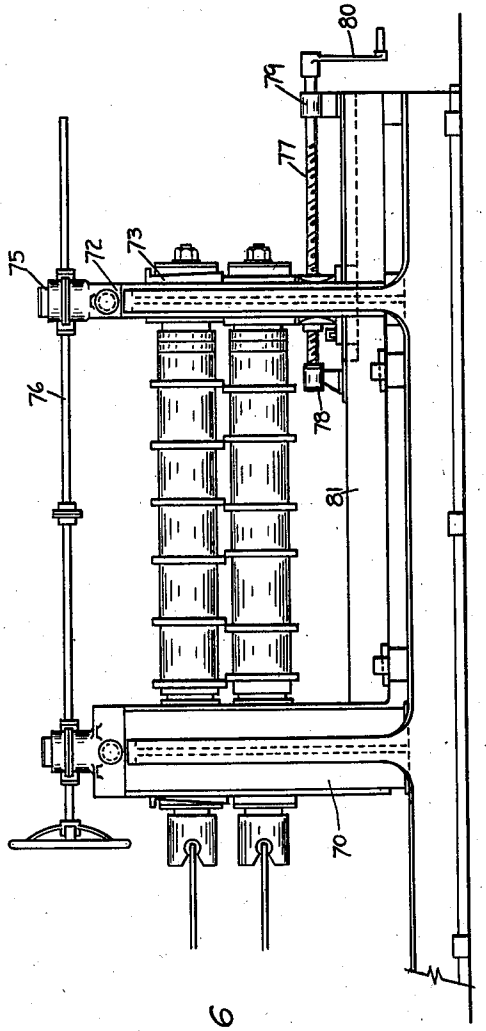


Fig 6



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UNITED STATES PATENT OFFICE

2,222,051

SLITTER

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Application September 9, 1939, Serial No. 294,139

12 Claims. (Cl. 164—60)

The present invention relates to improvements in metal strip slitting assemblies and more particularly to new and useful improvements in the construction of such slitters and in the method and means employed to mount the same in material production and fabrication lines.

Modern practice in steel sheet and strip production and utilization demands continuity of operation of equipment and processes and for maximum plant efficiency the unproductive time required for resetting the various constituent elements of the plant for the production of different products or, in the case of a steel strip manufacturing plant, for the production of strip of different widths and thicknesses must be kept to a minimum. Thus, in a plant of the kind specifically mentioned, where the strip may be more economically formed basically in relatively large widths, the means subsequently employed to divide the wide strip into a plurality of strips of the desired width, i. e., the slitter, should be capable of being changed over very quickly to cut strips of different finished widths as the demand dictates. This is particularly important inasmuch as the demand for strip steel embraces an infinite variety of cross-sectional sizes and as the policy of steel producers is now to rely considerably on a larger number of relatively smaller orders for strip of designated sizes for a substantial part of their business.

Heretofore, in the operation of strip slitter assemblies, the practice has been to provide a pair of housings in fixed position in the production line and in fixed relation to other machines thereof and to assemble the cutters on arbors or rolls which would be interchanged in the housings as the needs arose. It was found, however, that although the cutters on each particular roll could be very accurately spaced and aligned with relation to each other, difficulty was encountered when the rolls were assembled in the housings since inaccuracies in the bearings, bearing mountings, and housings often resulted in initial error in the lateral positional relationship required between the mating cutters in the upper and lower rolls. Therefore, in addition to the screw adjustment necessary to give the proper vertical interval between the cutter rolls it was often necessary to align the rolls longitudinally and as these adjustments must be precise, a lengthy period of time was required for their proper execution. It should also be noted that the decree or absence of overlap given to the mating cutters is determined by the thickness of the stock to be operated on and this adjustment must be very accurately made if a clean cut is to be had. The difficulty of quickly affecting this fine adjustment in the above mentioned housings should be apparent.

The principal object of the present invention is the provision of a method and means whereby all the critical adjustments, subsequently required in a slitter, may be made at a place removed from the location of the slitter whereby the slitter may be changed over to operate on different stock or to produce strips of different cross-sectional dimensions in a very expeditious manner. This is accomplished, in accordance with the preferred embodiment of my invention, by providing a number of sub-assemblies having housings, cutter arbors or rolls, adjusting screws and means to maintain the housings in fixed spaced relation, which sub-assemblies are adapted to be interchangeably inserted in and secured to a base fixed in proper relation to other equipment of the production line. The arrangement is such that all critical adjustments, including cutter diameters, spacing and overlap, are made beforehand on the sub-assemblies and when a new sub-assembly is placed on the base it is only necessary to fasten it thereto and to connect the drive to the arbors to again place the slitter in operating condition. Thus the change-over may be accomplished in a very short time and by persons not particularly skilled in the details of operation of the machine.

Another important object of the invention is the provision of a method and apparatus for slitting strip steel whereby improved results in the cuts effected may be obtained in a more rapid and economical manner. Considering the basic structure of the slitting machine and the expansive forces exerted by the material being operated on, it is apparent that heavy stock requires the cutter carrying arbors to be of large diameter to keep deflection thereof within reasonable bounds. Thin stock exerts less expansive force against the arbors and consequently the diameters of the arbors are not critical for strength purposes. However, due to the nature of the cutting action, the mating cutters, which are overlapped in this instance, must have a very small lateral interval and such interval must be uniform throughout the entire peripheral range of the respective cutters. In the manufacture and assembly of the cutters and arbor units errors in the cutting face of the cutters unavoidably creep in and such inaccuracies are multiplied in large diametered units because of the greater radii and it is therefore very desirable

to employ small diametered arbors and cutters for thin stock. By providing an arrangement whereby cutting units of optimum dimensions and proportions may be employed for stock of different thickness and whereby such units may be quickly interchanged, definite economies and improved results are attained in the slitting process.

For purposes of illustration, the invention will be described as embodied in certain preferred structural arrangements; and in the accompanying drawings:

Figure 1 is an elevational view of an assembled slitter embodying the principles of my invention;

Figure 2 is a top view of a portion of the apparatus of Figure 1;

Figure 3 is an enlarged sectional view taken along the line 3—3 of Figure 1;

Figure 4 is an elevational view of a subassembly of the apparatus of Figure 1;

Figure 5 is an end view of the subassembly of Figure 4;

Figure 6 is an elevational view of a modified subassembly of the apparatus of Figure 1; and

Figure 7 is a view of the modified subassembly broken away in part to show the fixed support for the arbors, and showing the outer movable housing in retracted position.

Referring now more particularly to the apparatus shown in Figures 1 to 5, inclusive, the completely assembled machine consists of a suitable base 10, the slitter subassembly indicated generally at 20, a gear box 11, couplings 12 extending between the cutter arbors and the gear box, and a motor 13 for driving the arbors through the gears housed in box 11. Motors 13 in the gear drive assembly 11 are supported on the base 10 and the couplings 12 are of any suitable quick detachable type whereby the driving connections between the assembly 20 and the motor and gear drive may be readily broken and reestablished. Base 10 is adapted to be permanently fixed to the floor of the plant in which the machine is to be operated and so positioned and oriented that when the subassembly 20 is positioned thereon, the material passed through the subassembly will be in alignment with the material passes of other machines and equipment used in conjunction with the slitter.

Extending upwardly from the outer edges of the base 10 and preferably integral therewith are four stanchions 15 arranged in rectangular relation and provided with vertical parallel inner surfaces to slidably receive the edges of the housings of the interchangeable slitter subassembly 20. To provide means to quickly secure the subassembly to the base 10 between the stanchions 15 a pair of pins 16 extend upwardly from the base 10 immediately outside of the stanchions 15, which pins are adapted to be received in and extend through lugs 21 extending outwardly from the lower end of the housings of the assembly 20. Pins 16 are each provided with a diametrical slot adjacent their upper ends to receive a wedge 17 which when tightly inserted clamps the lugs 21 and consequently the assembly 20 to the base 10.

The subassembly indicated generally at 20, and shown more clearly in Figures 3, 4 and 5, consists of a base 23 having a rigidly secured housing 24 extending upwardly from each end thereof. The housings 24 are each provided with the usual windows 25 to slidably receive the journal boxes 26 housing bearings 27 which rotatably support the cutter carrying arbors. In accordance with usual practice the lower journal boxes 26 supporting the lower arbor are supported and fixed in the lower ends of the windows 25. The upper bearing boxes 26 are provided with outwardly extending spaced ears 29 between the pairs of which are pivotally attached upwardly extending rods 30 which extend up through aperture lugs 31 of the housing caps 32 and are threaded at their upper ends to receive the spring compression nuts 34. A coil spring 35 extends about each of the rods 30 between the adjacent lug 31 and nut 34 to exert a resilient upward force on the upper journal boxes 26. A hold-down and adjustment screw 37 is fixed to the upper end of each of the upper journal boxes 26 and extends upwardly through a worm wheel housing 38 carried by each of the housing caps 32. In accordance with established practice, a worm wheel (not shown) having a threaded bore to receive screw 37 is mounted in each of the housings 38 and are adapted to be rotated by worms journaled in the contiguous housings 39 and coupled by a shaft 40 spanning the housings and actuated by hand wheel 41. It should be apparent that rotation of the shaft 40 results in vertical movement of the screws 37 and consequently vertical adjustment of the upper journal boxes 26. The screws provide the positive moving force in the downward direction while the springs 35 exert an upwardly moving force on the boxes.

As shown more clearly in Figure 3, the sides of the boxes 26 are each provided with a wide groove 43 to slidably receive the inwardly directed edges of the housings 24. To securely lock the journal boxes 26 in adjusted position an off-set plate 44 is bolted to the housing 24 along each outer edge of the journal boxes 26, the shape of the plates 44 providing flanges 45 which overlap the flanges 46 of the boxes 26 to securely clamp the later flanges to the housings 24. The housing caps 32 are securely fastened to the housings 24 by the stud bolts 18. When it is desired to remove the cutter arbors and consequently the journal boxes 26 from the housings, the bolts 18 are unfastened and the caps 32 are removed, suitable crane hooks 49 being provided on the caps 32 to facilitate such removal, and thereafter the boxes 26 may be slid vertically out of the housings upon release of the pressure exerted by the plates 44.

In the apparatus illustrated in Figures 1 to 5, the cutter carrying arbors each consists of a shaft having a center portion 50 of uniform diameter and a tapered end portion 51 adapted to receive the inner race of the bearing 27. Intermediate the central and tapered portions are screw-threaded sections 52 adapted to receive the cutter retaining and locking nuts 54. The cutters, consisting of ring-like elements 55 are spaced from each other and from the nuts 54 by suitable spacing sleeves 56 which may either be solid or built up from shim stock in a manner well known in the art. The cutters and spacers are abutted against the flanges 60 of the arbors adjacent the center portions 50 but opposite the screw-threaded sections 52. Locking nuts 58 screwed onto the outer ends of the arbors retain the adjacent bearing races in position. The ends of the arbors opposite the nuts 58 are provided with couplings 59 adapted to cooperate with the members 12 to provide a rotative drive for the rolls.

In the normal use of the apparatus thus far described the subassembly 20 may be bodily removed from the fixed base 10 and positioned

on a suitable support removed from the area of production operations. It is then available as a completely assembled unit which may be readjusted or modified as the needs require. For the purpose of altering the diameters of the arbors and cutters the housing caps 30 are removed after removing nuts 18 and, with the clamping plates 44 loosened, the arbor and cutter assemblies may thereafter be lifted out of the top of the housings 24. Different arbors may then be assembled in the bearings 27 and bearing blocks 26 and the arbor assemblies may then be reinserted into the housings and all necessary adjustments made before the subassembly is repositioned on the base 10. As stated above, a number of these subassemblies may be provided and while one is in use one or more others may be prepared for subsequent operations. With this arrangement it is possible to have one assembly set up for cutting thin stock and another set up for cutting heavy stock and as the thickness of the material being produced or utilized is varied the slitting assembly may be very quickly changed over to satisfactorily effect the slitting phase of the production or utilization process.

Figures 6 and 7 illustrate a modified form of subassembly corresponding generally to the assembly 20 of the first form described but in which the inner housing designated 70 is of greater width to accommodate a pair of spaced axially aligned bearings 71 for the support of each of the cutter carrying arbors. The outer housing 72 is adapted to be moved outwardly while the cutter carrying arbors remain in position and for this purpose the outer bearing boxes 73 are adapted to be laterally moved through the window in housing 72 and a slidable connection is provided between the worm wheel (not shown) housed in the housing cap 75 and the worm operating shaft 76. For the purpose of effecting such outward movement of the housing 72 a screw 77 supported adjacent its ends in the blocks 78 and 79 extends in threaded relation through a threaded opening in the housing 72 and is adapted to be rotated by suitable crank or other means 80. Blocks 78 and 79 are suitably secured to a base 81 supporting the housings 70 and 72. It should be apparent that with the housing 72 moved to its outer position the arbors will remain in extended horizontal position because of the spaced bearings 71 in the housing 70 and in this relative position of the parts the cutter and spacers may be readily removed and interchanged on the arbors with the removal of the arbors from the subassembly. Thus the time and labor required for general readjustment or change in the intervals, spacing and size of the cutters on the arbors may be further reduced and further economies effected in the normal operation of the apparatus.

It should now be apparent that the present invention provides a method and apparatus which accomplishes the objects set out above. Since all the critical adjustments for a slitter required in subsequent operations may be made at a place removed from the operating location of the slitter, very precise and accurate adjustments may be made which may subsequently be bodily placed in use in the production line and the interruption of the complete facilities of such line may be kept at a minimum. Further, by providing a system whereby correctly designed cutter elements may be practically employed for strip of varying thickness, improved results may in general be obtained, thus further adding to the economies effected by the use of the invention.

The above specifically described embodiments of the invention should be considered as illustrative only as obviously many changes may be made therein without departing from the spirit or scope of the invention.

What I claim is:

1. In apparatus for slitting metal strip the combination of a base, a motor mounted on said base, power transmission means mounted on said base and operatively connected with said motor, a plurality of stanchions extending upwardly from said base, a subassembly comprising a pair of spaced housings, means to maintain said housings in spaced relation, a pair of cutter carrying arbors journaled in said housings, means to adjust the interval between said arbors and means on said arbors to maintain the cutters carried thereon in adjusted position longitudinally along said arbors, said subassembly being adapted to be positioned on said base and between said stanchions; quick detachable couplings between said power transmission device and said arbors, and quick detachable means to secure said subassembly to said base.

2. In apparatus for slitting metal strip the combination of a fixed base, a power transmission device mounted in fixed relation to said base, means to drive said power transmission device, a plurality of stanchions extending upwardly from said base, a subassembly comprising a pair of spaced parallel cutter carrying arbors journaled in relatively fixed housings adapted to be supported on said base and between said stanchions, quick detachable couplings between said power transmission device and said arbors, and quick detachable means to secure said subassembly to said base.

3. In apparatus for slitting metal strip the combination of a base adapted to be fixed in relation to other equipmept of a strip production or utilization line, power transmission means adapted to be mounted in fixed relation to said base, means to drive said power transmission device, a subassembly comprising a pair of spaced parallel cutter carrying arbors journaled in spaced relatively fixed housings adapted to be supported on said base, quick detachable couplings adapted to connect said power transmission device with said arbors and quick detachable means adapted to secure said subassembly to said base.

4. In apparatus for slitting metal strip the combination of a base adapted to be fixed in relation to other equipment in a strip production or utilization line a plurality of stanchions extending upwardly from said base a subassembly comprising a pair of spaced parallel cutter carrying arbors journaled in spaced relatively fixed housings adapted to be supported on said base and between said housings quick detachable means to secure said subassembly to said base, and means to drive said arbors.

5. In apparatus for slitting metal strip the combination of a base adapted to be fixed in relation to other equipment of a strip production or utilization line, a subassembly comprising a pair of spaced parallel cutter carrying arbors journaled in spaced relatively fixed housings adapted to be supported on said base, and means to detachably secure said subassembly to said base.

6. In apparatus for slitting metal strip the combination of a base adapted to be fixed in re-

lation to other equipment of a strip production or utilization line, said base having spaced upwardly extending restraining elements, a subassembly comprising a pair of spaced parallel cutter carrying arbors journaled in spaced relatively fixed housings adapted to be supported on said base and to be detachably secured thereto, the arrangement of the parts being such that certain surfaces of said upwardly extending restraining elements will be engaged by certain vertical surfaces of said housings, when parts are in assembled relation, whereby said housings will be restrained from movement in a horizontal direction.

7. In apparatus for slitting metal strip the combination of a base adapted to be fixed in relation to other equipment of a strip production or utilization line, a subassembly comprising a pair of spaced parallel cutter carrying arbors journaled in spaced relatively fixed housings adapted to be detachably secured to said base, a rigid strut connecting said housings, a screw carried by the upper end of each of said housings, windows in said housings, journal boxes supporting said arbors and positioned within said windows, and means responsive to the rotation of said screws to vary the interval between said arbors.

8. In apparatus for slitting metal strip the combination of a base adapted to be fixed in relation to other equipment of a strip production or utilization plant, a subassembly comprising a pair of spaced parallel cutter carrying arbors journaled in spaced housings adapted to be detachably connected with said base, a rigid strut connecting said housings, a detachable cap on the upper end of each of said housings, a vertical window in each of said housings extending up to said caps, journal boxes supporting said arbors and provided with recesses adapted to receive portions of said housings peripheral of said windows, means to detachably secure said caps to said housings and a screw carried by each of said caps, said screws being operative when the caps are in assembled position, to vary the interval between said arbors, the journal boxes being slidable up out of the housings when said caps are removed.

9. In apparatus for slitting metal strip the combination of a base adapted to be fixed in relation to other equipment of a strip production or utilization plant, a subassembly comprising a pair of spaced parallel cutter carrying arbors journaled in spaced housings adapted to be detachably secured to said base, each of said arbors consisting of a shaft having means at one end to detachably connect with a rotating device, a center portion of substantially uniform diameter adapted to receive an assembly of cutters and spacers and means to clamp said cutters and spacers in adjusted position on said center portion.

10. In apparatus for slitting metal strip the combination of a base adapted to be fixed in relation to other equipment in a strip production or utilization plant, a subassembly adapted to be detachably secured to said base and comprising a support, a pair of upwardly extending housings carried by said support and adapted to rotatably support a pair of spaced parallel cutter carrying arbors, and means carried with said support to move one of said housings outwardly from the other.

11. In apparatus for slitting metal strip the combination of a support, a housing extending upwardly from said support, a pair of spaced parallel cutter carrying arbors journaled in said housing in bearing surfaces spaced axially along the axes of said arbors, a second housing extending upwardly from said support and adapted to rotatably receive the outer ends of said arbors, means on said support to move said second housings outwardly from said first housing and said arbors whereby the ends of said arbors adjacent said second housing will be exposed, a plurality of cutting and spacing members on said arbors adapted to be received thereon over the said adjacent ends and means at said adjacent ends of said arbors to clamp said cutters and spacers on said arbors.

12. In apparatus for slitting metal sheets or strip the combination of a base adapted to be fixed in relation to other equipment of a sheet or strip production or utilization line, said base having two pairs of spaced parallel stanchions extending upwardly therefrom, a subassembly comprising a member adapted to overlie the upper face of said frame between said stanchions and carrying adjacent either end thereof an upwardly extending housing adapted to be slidably received between said stanchions and to be restrained thereby throughout a major part of their heighth when said subassembly is applied to said base, means to detachably secure said member to said base, a pair of spaced parallel cutter carrying arbors journaled in said housing, and quick detachable couplings adapted to connect said arbors with a driving means.

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