Nov. 5, 1963 A. B. WILSON 3,109,350

MACHINE FOR EXPANDING METAL

Filed Sept. 30, 1958 5 Sheets-Sheet 1

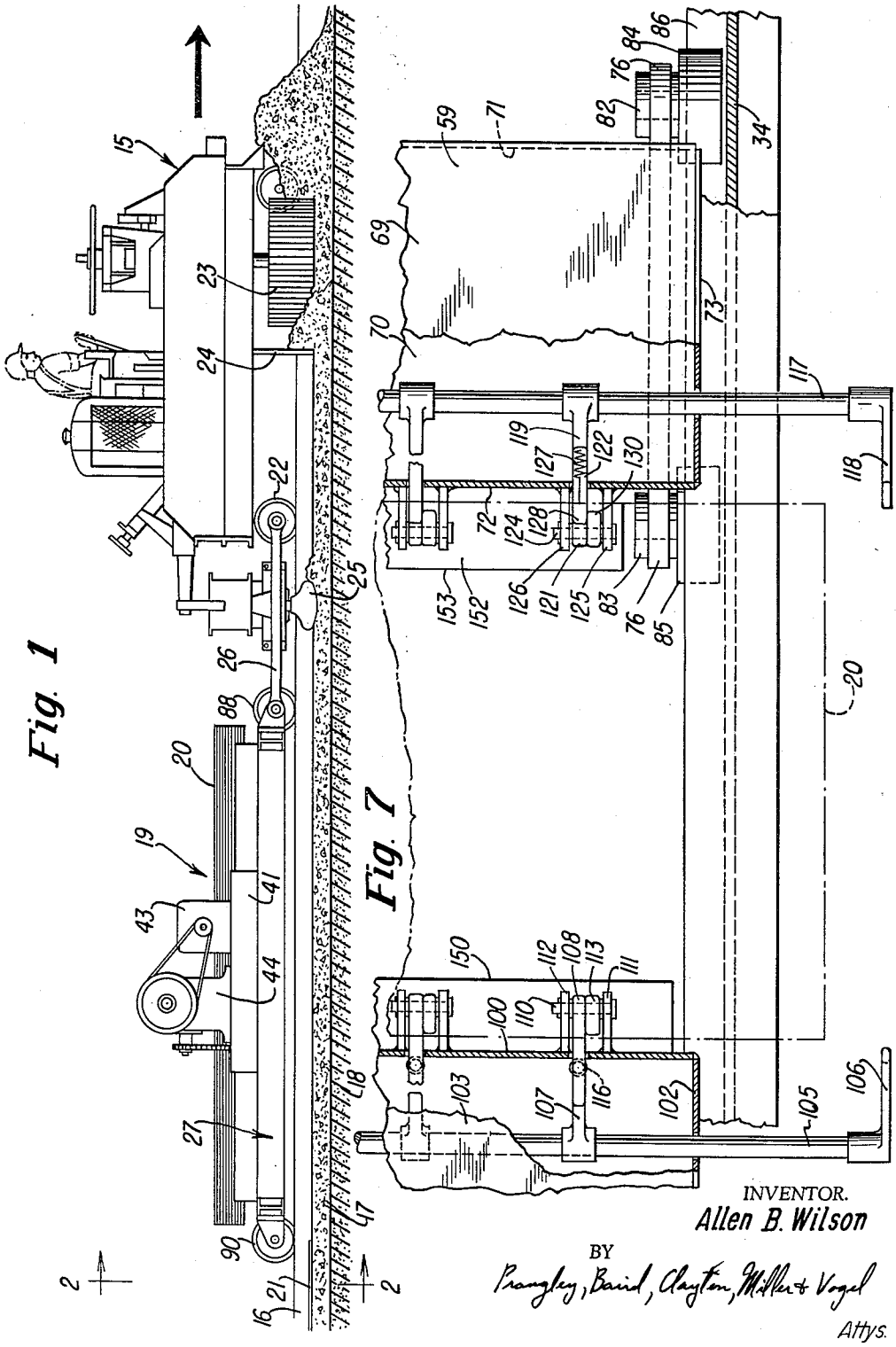


Fig. 1

Fig. 7

INVENTOR.
Allen B. Wilson

BY
Pramley, Baird, Clayton, Miller & Vogel
Attys.

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MACHINE FOR EXPANDING METAL

Filed Sept. 30, 1958 5 Sheets-Sheet 2

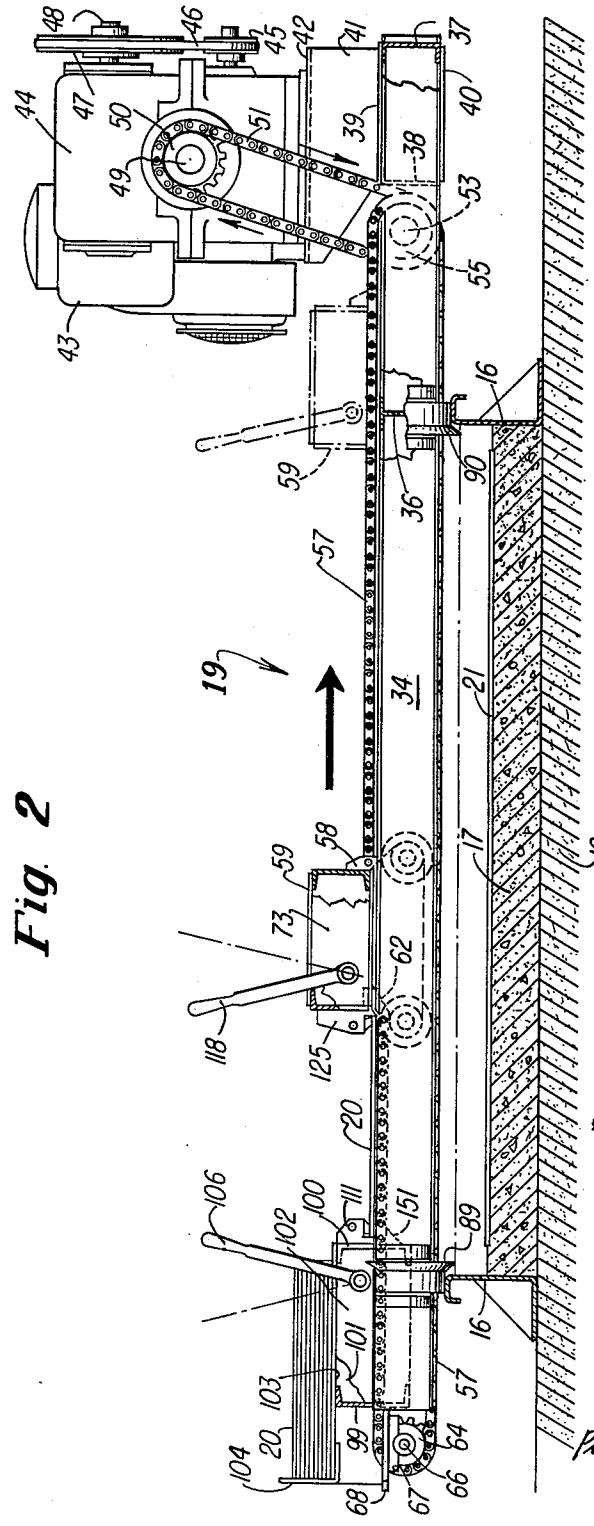


Fig. 2

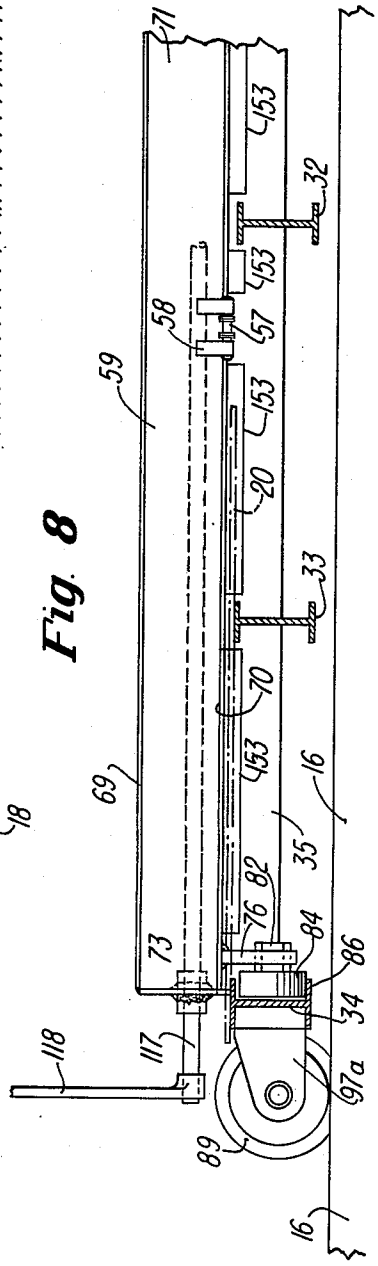


Fig. 8

INVENTOR.
Allen B. Wilson

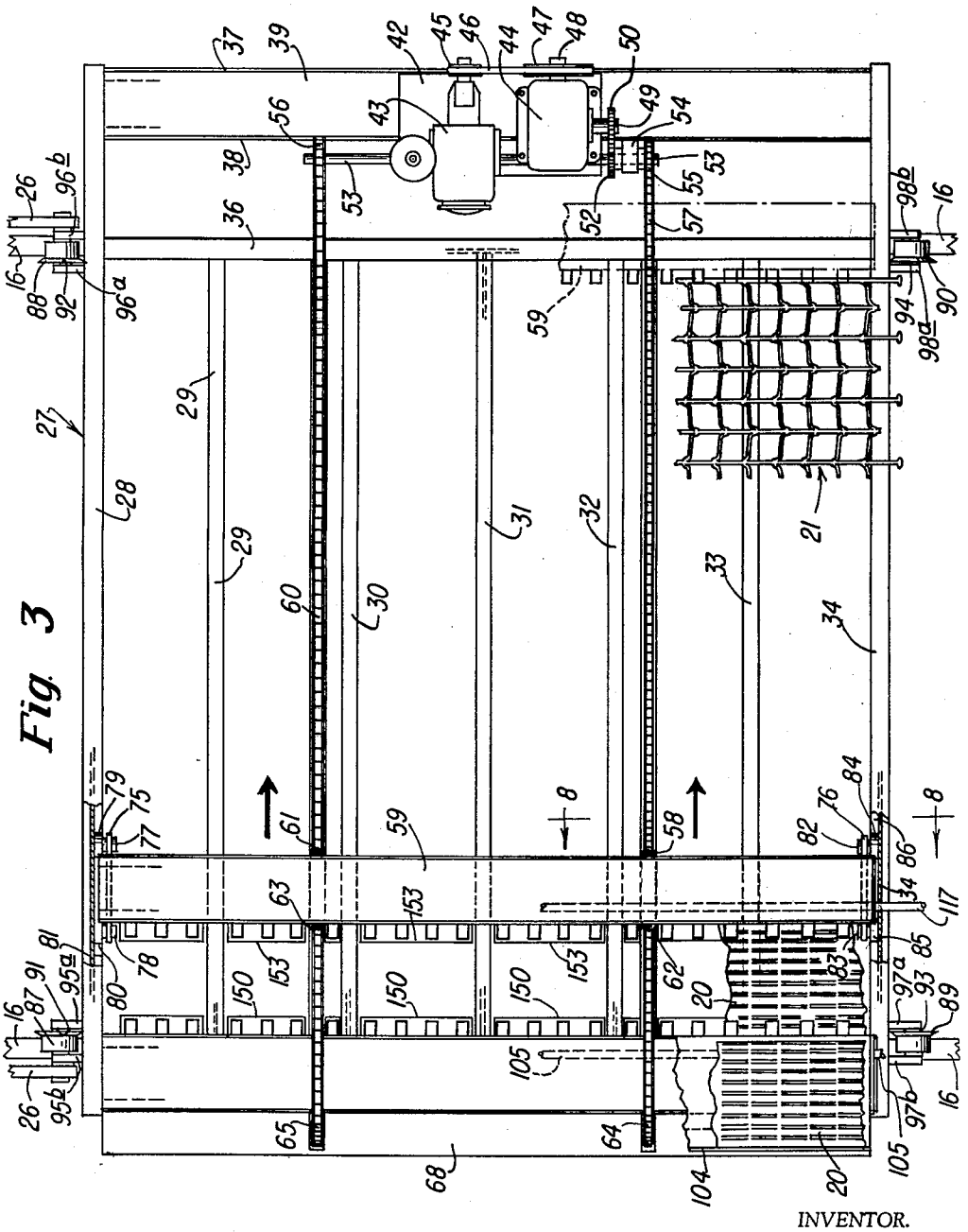
BY Prangley, Baird, Clayton, Miller & Vogel
Attys.

Nov. 5, 1963 A. B. WILSON 3,109,350

MACHINE FOR EXPANDING METAL

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Fig. 3



INVENTOR.
Allen B. Wilson

BY
Cranglay, Baird, Clayton, Miller & Vogel
Attys.

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MACHINE FOR EXPANDING METAL

Filed Sept. 30, 1958

5 Sheets-Sheet 4

Fig. 4

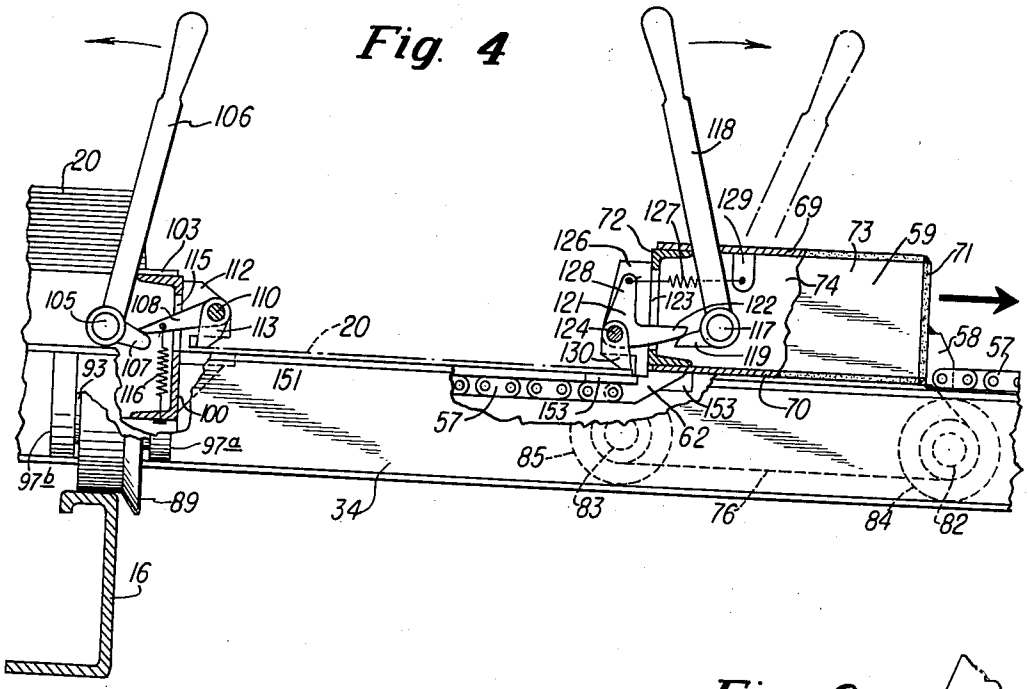


Fig. 5

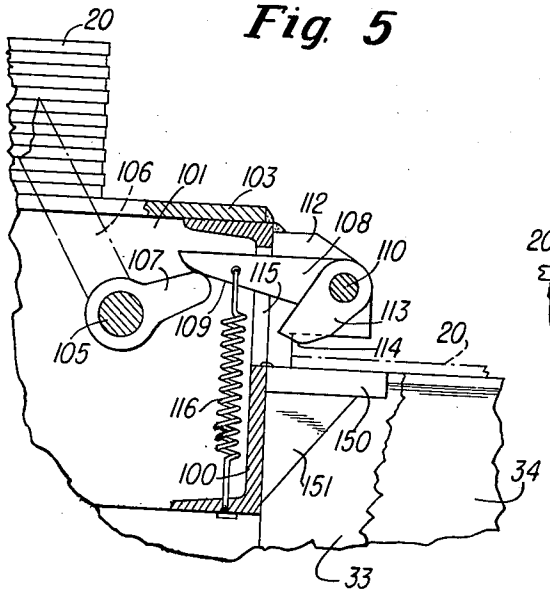
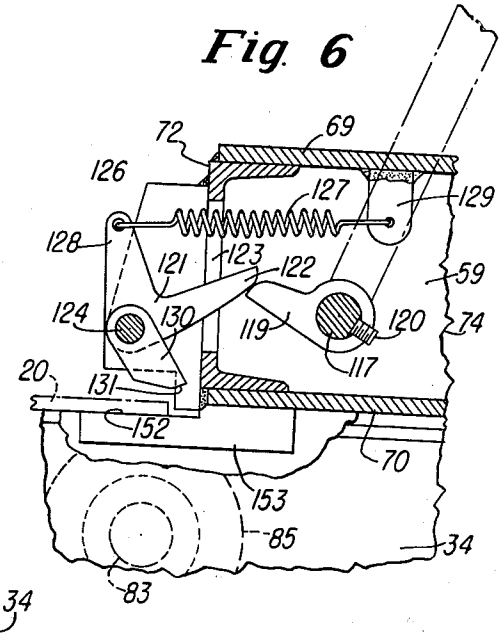


Fig. 6



INVENTOR.
Allen B. Wilson

BY
Brumley, Baird, Clayton, Miller & Vogel

Attys.

Nov. 5, 1963 A. B. WILSON 3,109,350

MACHINE FOR EXPANDING METAL

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Fig. 9

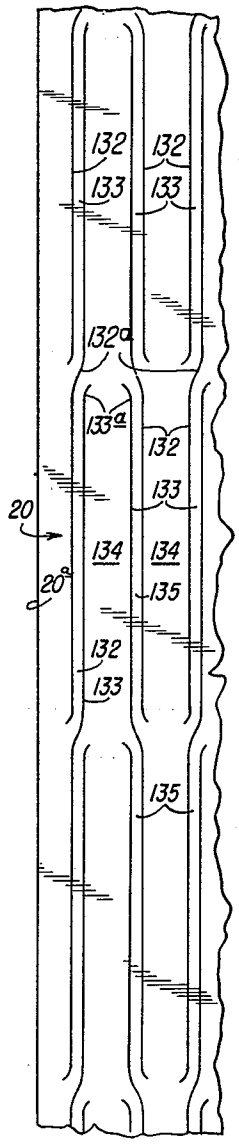


Fig. 10

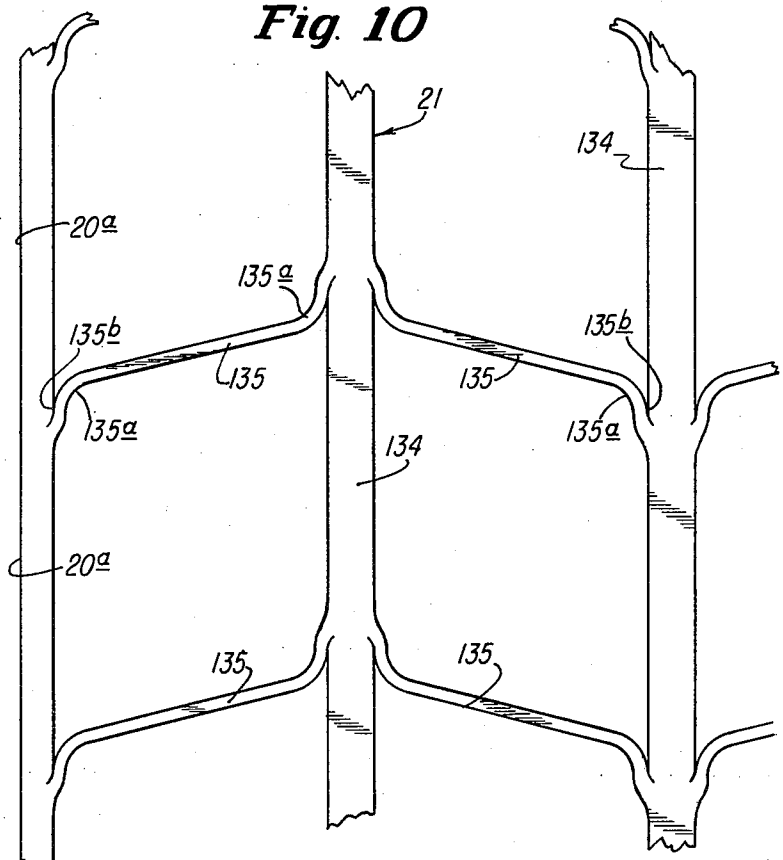
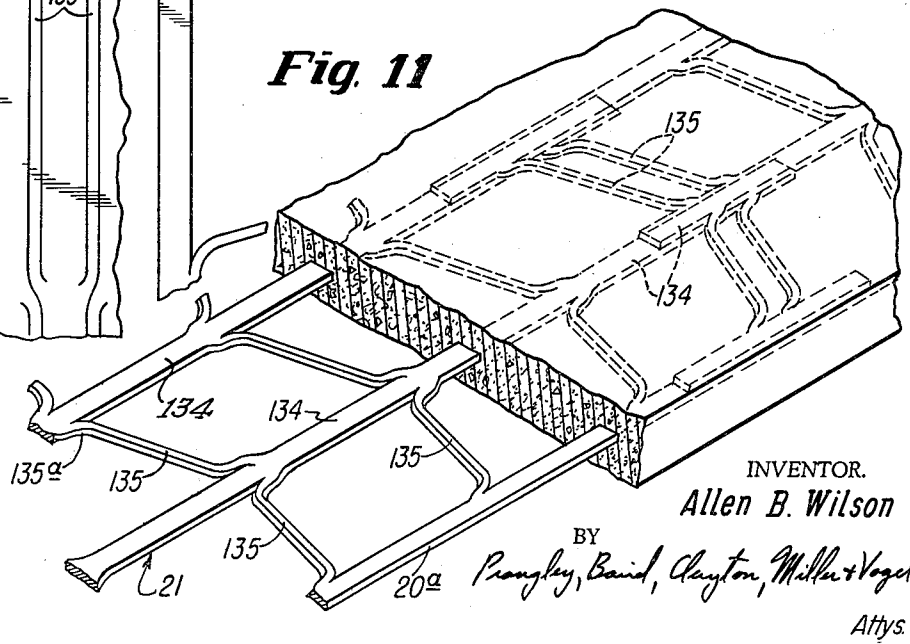


Fig. 11



INVENTOR.
Allen B. Wilson

BY
Pennie, Baird, Clayton, Miller & Vogel
Attys.

United States Patent Office 3,109,350 Patented Nov. 5, 1963

3,109,350

MACHINE FOR EXPANDING METAL

Allen B. Wilson, Chicago, Ill., assignor to Acme Steel Company, Chicago, Ill., a corporation of Illinois

Filed Sept. 30, 1958, Ser. No. 764,430
8 Claims. (Cl. 94—39)

This invention relates to road paving equipment and more especially to apparatus and methods for expanding metal sheets into reticulated metal webbing for use as the reinforcing medium in concrete roadways.

It is well known that it is necessary to reinforce concrete roadways to prevent destruction thereof as a result of the weight and impact forces imparted to the roadway by vehicles rolling thereover, for while concrete is capable of withstanding large compressive forces, it is not able to withstand large tensile strains applied thereto. Traditionally, such reinforcing of the concrete has been accomplished by embedding a webbing therein which comprises a plurality of spaced apart, generally parallel bars of metal, welded or otherwise rigidly secured to transverse cross bars spaced therealong. While webbing of this type has, in general, been quite satisfactory, a number of disadvantages are inherent in the use thereof. In order to obviate these disadvantages, I have developed an expandable metal sheet that when expanded may be used as a reinforcing web. This development is disclosed in my copending patent application, Serial No. 635,207, filed January 22, 1957, now abandoned, and of which this application is a continuation-in-part.

In general, these metal sheets are of generally rectangular configuration, and are provided with longitudinally extending slits that enable the sheets to be expanded transversely to provide a web comprising spaced, longitudinally extending strips connected by intervening bars formed integrally therewith. While the expanded metal sheets provide excellent reinforcing webs for roadways and the like, it is inconvenient to ship the same in expanded condition for they are then awkward to handle, do not lend themselves to stacking, tend to snag each other when stacked, and occupy an excessive amount of shipping and storage space. Further, because the expanded sheets are quite large, it is necessary to drop them in the rows adjacent the roadway being built, which then requires repeated handling thereof. This, in itself, often creates the additional disadvantage that the workers may wait too long before placing the expanded sheets in the roadway, whereby the concrete has hardened to the extent that the sheets do not properly embed themselves therein.

It is apparent that it would be an improvement then, both in the convenience of handling the metal sheets and in the quality of the finished roadway, if the sheets could be shipped and handled in the compressed condition thereof, and expanded immediately prior to being placed in the roadway and in a correlated time relationship with the spreading of the concrete to assure a proper anchorage therebetween; and the provision of apparatus to accomplish these results is one of the objects of this invention.

Another object of the invention is that of providing an improved apparatus and method for expanding metal sheets at a road building site and at the specific locations where each sheet is to be placed in the concrete. Still another object is to provide mobile apparatus that travels along the road forms in conjunction with the concrete spreader equipment, and which supports a stack of metal sheets thereon and expands each sheet when necessary in preparation for depositing the same on a layer of concrete spread between the road forms.

A further object of the invention is in the provision of a metal sheet expanding machine adapted to travel along road forms and the like in conjunction with a concrete

spreader, and which is equipped with means for gripping the longitudinal edges of a metal sheet to anchor the same between a stationary jaw structure and movable jaw structure, whereby the sheet is expanded by the movable jaw as the apparatus travels along the road forms. Yet a further object is that of providing an apparatus of the type described, wherein the movable jaws or grippers are mounted on a power driven frame that moves transversely with respect to the roadway while the apparatus is travelling longitudinally therealong, whereby a sheet is being expanded in preparation for dropping the same into the concrete of the roadway as the apparatus is traversing the section being prepared therefor.

Still a further object of the invention is to provide, sheet expanding apparatus of the character described, in which the jaws are arranged so that the gripping force applied thereby to the sheets during the expansion thereof automatically increases in accordance with the magnitude of the force developed by the sheet in resisting such expansion. Additional objects and advantages of the invention will become apparent as the specification develops.

An embodiment of the invention is illustrated in the accompanying drawings, in which:

FIGURE 1 is a side view in elevation of a typical concrete spreader and a sheet expanding apparatus as both are advancing along the forms for a concrete roadway;

FIGURE 2 is a vertical sectional view taken along the line 2—2 of FIGURE 1;

FIGURE 3 is a top plan view of the sheet expanding apparatus in which portions thereof are shown in section, and wherein a stack of sheets and an expanded sheet are both partially illustrated;

FIGURE 4 is an enlarged, broken vertical sectional view similar to that of FIGURE 2, but in which portions of the apparatus are shown in section;

FIGURE 5 is a greatly enlarged, broken vertical sectional view of the apparatus to more clearly illustrate the stationary jaw or gripper shown in FIGURE 4;

FIGURE 6 is a greatly enlarged, broken vertical sectional view to more clearly illustrate the movable jaws or grippers shown in FIGURE 4;

FIGURE 7 is a greatly enlarged, broken top plan view of the apparatus, and in which portions thereof are illustrated in section;

FIGURE 8 is a broken transverse sectional view taken along the line 8—8 of FIGURE 3;

FIGURE 9 is a broken top plan view of a metal sheet which has been slitted longitudinally in readiness for a subsequent expansion thereof;

FIGURE 10 is a broken top plan view of the metal sheet shown in FIGURE 9 after the expansion thereof; and

FIGURE 11 is a broken perspective view of a portion of a concrete roadway having the expanded metal sheet shown in FIGURE 10 embedded therein.

Referring first to FIGURE 1, it will be seen that this illustration shows a typical spreader **15** advancing along conventional metal road forms **16** between which a layer of concrete **17** has been deposited on a roadbed **18**. Travelling along behind the spreader **15** is a sheet expander **19** carrying a stack of expandable metal sheets **20**. One such sheet, after the expansion thereof, has been deposited on the concrete layer **17**, and for identification is denoted with the numeral **21**. The forms **16** may be completely conventional and, as well known, define a track on which the wheels **22** of the spreader ride. Insofar as concerns the instant invention, the spreader **15** may be conventional, and in the specific illustration is equipped with an automatic transverse spreading blade **23**, a hy-

draulically controlled strike-off blade 24, and a vibrator attachment 25. The spreader advances in the direction of the arrow and functions to spread, level and compact the concrete mass deposited upon the sub-grade or roadbed 18.

The expander 19 is connected to the spreader 15 by a tongue 26, and is therefore pulled along the forms 16 by the advancing spreader. However, the expander 19 could be pushed along the forms by a finisher (not shown), it could be provided with its own motive power, or it could be formed integrally with either the spreader or such finisher.

The expander 19 comprises a frame 27 provided by a plurality of longitudinally extending I-beams 28 through 34, there being seven in number. Each of these I-beams is welded or otherwise rigidly secured to transversely extending end beams 35 and 36. For purposes of orientation, it should be noted that the longitudinally extending beams 28 through 34 extend across the roadway and forms 16, while the end or transverse beams 35 and 36 extend along the length of the roadway and are in substantially vertical alignment with the road forms 16. The outer longitudinal beams 28 and 34 extend beyond the transverse frame element 36 and are connected together by a pair of facing, generally U-shaped beams 37 and 38. These latter beams are equipped with top and bottom plates 39 and 40 which extend therealong in covering relation therewith.

Mounted upon the top plate 39 in rigid relation therewith is a standard 41 defining a platform 42 that supports an engine 43 and gear reducer 44. The engine 43 is gasoline powered and thus may be conventional, although it will be apparent that other forms of prime movers may be substituted therefor. The output shaft of the engine 43 is equipped with a pulley wheel 45 having an endless drive belt 46 entrained thereabout that drivingly engages a pulley wheel 47 connected to the input shaft 48 of the gear reducer. The output shaft 49 of the gear reducer is equipped with a drive gear 50 having an endless gear chain 51 entrained thereabout. The gear chain engages a gear 52 to drive a shaft or axle 53 journalled in bearings 54 secured to the U-shaped frame element 38.

The axle or shaft 53 is equipped adjacent each end thereof with gears or sprocket wheels 55 and 56, respectively. The sprocket wheel 55 has a link chain 57 entrained thereabout which has one end thereof anchored to an ear or lug 58 provided by a movable carriage 59. Similarly, the sprocket wheel 56 has a link chain 60 entrained thereabout, one end of which is secured to the carriage 59 by an ear or lug 61. The opposite ends of the chains 57 and 60 are also respectively secured to the carriage 59 by ears 62 and 63. These chains also extend about idler sprockets 64 and 65, respectively, carried by a shaft 66 journalled for rotation in bearings 67 carried by a support plate 68 rigidly secured to end portions of the frame elements 28 and 34 which extend outwardly beyond the transverse frame member 35.

It will be apparent that the gear reducer 44 or engine 43 will be equipped with means for reversing the direction of rotation of the output shaft 49 of the gear reducer and, consequently, the drive shaft 53. Therefore, the carriage 59 may be made to reciprocate along the length of the longitudinal frame elements 28 through 34, as shown by the full and broken line illustrations thereof in FIGURE 2. Such movement is utilized in expanding the metal sheets 20, as will be described in greater detail hereinafter.

As shown most clearly in FIGURES 2, 4 and 8, the carriage 59 has a box-like configuration defined by top and bottom wall members 69 and 70, side wall elements 71 and 72 and end walls 73 and 74. All of these wall members are welded or otherwise rigidly secured to each other. The ears 58 and 61 are affixed to the side wall 71, and the ears 62 and 63 to the side wall 72, the side walls 71 and 72 being of generally U-shaped cross section. The remaining walls are generally planar. Depending from the carriage 59, adjacent the opposite ends thereof and adjacent the inner edges of the longitudinal beams 28 and 34, are brackets 75 and 76 which have end portions that extend outwardly beyond the side walls 71 and 72 of the carriage along the length of the longitudinal beams.

Secured to the respective end portions of the bracket 75 are axles 77 and 78 that rotatably support the respective wheels 79 and 80 which ride on the lower, inwardly extending flange portion 81 of the longitudinal beam 28. In an identical manner, the bracket 76 at its ends is equipped with axles 82 and 83 that rotatably support wheels 84 and 85 that ride on the inwardly extending flange surface 86 of the outer longitudinally extending I-beam 34. Thus, the four wheels with which the carriage 59 is equipped support the same for reciprocatory movement along the length of the frame elements 28 and 34, or transversely of a roadbed disposed thereunder. At the same time, the expander 19 can move longitudinally along such roadbed on flange-equipped wheels 87, 88, 89 and 90 that ride on the road forms 16 which define tracks therefor.

The wheels are rotatably supported, respectively, on axles 91 through 94. The axles are respectively mounted in spaced ears or bracket elements rigidly secured to the longitudinal frame elements 28 and 34. It is apparent that the spaced brackets are arranged in pairs, two for each of the wheels, and for identification are indicated with the numerals 95*a* and 95*b* through 98*a* and 98*b*. As is evident from FIGURE 3, a pair of tongues 26 is utilized for securing the expander 19 to the spreader 15, and these tongues are pivotally secured to the axles 91 and 92.

The rack on which the pre-expanded sheets 20 are stacked is illustrated most clearly in FIGURES 2 through 5, and comprises an elongated, generally box-like structure that extends transversely with respect to the longitudinal frame elements 28 through 34. The rack then has side walls 99 and 100, end walls 101 and 102 and a top wall 103. The top wall extends rearwardly beyond the side wall 99, and is equipped along the longitudinal edge thereof with an L-shaped bracket 104 that defines an abutment against which one edge of the stack of sheets 20 is aligned. The bracket may be welded or otherwise rigidly secured to the top plate 103; and similarly, the side wall 100 (as is shown most clearly in FIGURE 3) is rigidly secured to the ends of the frame elements 29 through 33 and to the sides of the outer frame elements 28 and 34. Preferably, the end walls 101 and 102 of the rack extend rearwardly of the side wall 99 and serve to reinforce the top wall 103, and particularly the L-shaped bracket 104 secured thereto.

FIGURES 2, 4, 5 and 7 illustrate the structural and functional characteristics of the stationary clamp or gripping jaws. This jaw assembly comprises an elongated rod or shaft 105 that extends longitudinally through the rack and is journalled for rotation about its own axis. The rod extends outwardly beyond the end wall 102 of the rack, and is equipped at that end with an upwardly extending handle 106. At spaced apart intervals therealong within the limits of the end walls 101 and 102 of the rack, the shaft 105 has a plurality of actuator fingers 107 secured thereto. The fingers are constrained on the rod so as to prevent relative rotation therebetween, and extend outwardly therefrom toward the side wall 100 of the rack.

Aligned with each of the actuator fingers 107 is a crank 108 having a cam surface 109 along the underside thereof adapted to be engaged by the actuator finger 107 aligned therewith. Each of the cranks 108 is secured to a pivot pin 110 rotatably carried by a pair of spaced ear elements 111 and 112 welded or otherwise secured to the side wall 100 of the rack and extending outwardly therefrom. Each of the pivot pins is prevented from shifting longitudinally by an enlarged head at one end thereof and a cotter pin or other suitable means at the opposite end

thereof. Also secured to each of the pins intermediate the ears 111 and 112 is a clamp or locking finger 113. The lower edge 114 of each of the locking fingers is adapted to engage a surface portion of an expandable sheet 20 to clamp the same against the upper surface of one of several support plates 150 that are welded in outwardly projecting position on the side wall 100 of the rack and reinforced, if desired, by spaced triangularly-shaped gusset plates 151, as perhaps best seen in FIGURES 4 and 5. The upper surfaces of the several support plates 150 lie in a single plane which may be coincident with, or may be disposed slightly above, the plane defined by the upper surfaces of the beams 28 to 34. The several support plates 150 terminate short of the adjacent beams 28 to 34 so that there will be no interference therewith, and the plates 150 also stand clear of the chains 57 and 60, as illustrated in FIGURE 3. Each of the cranks 108 extends through an opening 115 provided therefor in the side wall 100 of the rack, and is biased in a counter-clockwise direction with respect to the pivotal axis of the respective pins 110 by a helical spring 116 secured at its upper end to the crank, and at its lower end to the horizontal flange of the side wall 100.

The springs 116 urge the cranks 108 and locking fingers 113 in a counter-clockwise direction to frictionally engage a sheet 20 supported on the upper surfaces of the support plates 150, and thereby constrain the sheet against movement. When it is desired to release the locking fingers to dispose a sheet therebelow, or to release an expanded sheet from the grip thereof, the handle 106 is swung in a counter-clockwise direction as indicated by the arrow in FIGURE 4, whereupon the actuator fingers 107 engage the respective cranks to rotate the same in a clockwise direction and thereby enforce release of the locking fingers.

The travelling jaw or gripper assembly is mounted on the carriage 59, and has a construction substantially similar to that of the stationary gripping assembly just described. In this connection, an elongated shaft or rod 117 extends longitudinally through the carriage 59 and is journalled for rotation therein. The shaft projects outwardly beyond the end wall 73 of the carriage and is equipped at that end with a handle 118. Mounted at spaced apart intervals along the shaft 117 in alignment with the respective stationary locking finger assemblies, are a plurality of actuator fingers 119 that may be secured to the shaft 117 by set screws 120 so as to rotate therewith. The actuator fingers 119 each engage the respective bell cranks 121 which are provided with crank elements 122 that extend into the interior of the carriage 59 through openings 123 provided in the side wall 72 thereof. Each of the bell cranks 121 is mounted on a pin 124 journalled for rotation in the spaced ears 125 and 126 rigidly secured to the side wall 72 of the carriage and extending outwardly therefrom. The cranks are biased for rotation in a clockwise direction about the respective axes of the pins 124 by helical springs 127, each of which is secured at one end thereof to an arm element 128 of the bell crank, and at the other end to a lug 129 affixed to the undersurface of the top wall 69 of the carriage. It will be apparent from FIGURE 6 that each spring also extends through one of the openings 123 in the side wall 72.

Also mounted on each of the pins 124 intermediate the ears 125 and 126 is a locking finger 130 having a lower edge 131 adapted to frictionally engage and grip an edge portion of a sheet 20. The locking finger 130 rotates with the bell crank 121, and thus is urged into engagement with a sheet 20 by the biasing force of the spring 127, thereby clamping the edge portion of the sheet downwardly against the upper surface 152 of one of several support blocks 153 that are welded in forwardly projecting position upon the under wall 70 of the carriage 59. Such a condition is illustrated in FIGURE 4. When it is desired to release the locking fingers from the sheet, the handle 118 is swung toward the right (or in a clockwise direction as viewed in FIGURES 4 and 6), whereupon the actuator finger 119 engages the bell crank element 122 to rotate the same in a counter-clockwise direction and therefore swing the locking finger 130 upwardly from the sheet. As in the case of the support plates 150, the upper surfaces 152 of the support blocks 153 lie in a single plane that is coincident with or disposed slightly above the plane of the upper surfaces of the beams 28 to 34. Also like the support plates 150, the support blocks 153 are of a length short enough to avoid interference with the beams 28 to 34 or with the chains 57 and 60 and the brackets 62 and 63 by which the corresponding ends of the chains are secured to the carriage 59.

The characteristics of the sheet 20 are illustrated in FIGURES 9 through 11 which show, respectively, a sheet prior to the expansion thereof, subsequent to the expansion thereof, and embedded in a concrete slab to effect reinforcement thereof. The metal sheet is provided with a plurality of longitudinally spaced, elongated slits 132 and 133, with the slits being spaced by a distance substantially equal to the thickness of the sheet. The slits 132 and 133 are arranged in pairs and are spaced from adjacent pairs thereof by intervening bar elements 134, which are bounded on opposite sides by strips 135 which comprise the portions of the metal lying between the paired slits 132 and 133.

At one end of a series of slits 132 and 133, the slit 132 is curved inwardly as shown at 132*a* and becomes united with a slit 133 of the next adjacent series. Also, the inner slit 133 of any one series is curved inwardly as shown at 133*a*, and terminates adjacent the curved portion 132*a* of the next adjacent slit 132. This slitting procedure is followed throughout the length of the metal sheet 20, which is equipped with a straight longitudinal edge 20*a* along each side thereof.

When the sheets are expanded transversely by the expander 19, the intermediate bars 134 are separated from each other and from the edge portions 20*a* and are interconnected by the strips 135 which are formed in the expanding operation. These strips extend transversely and provide connections between the bars 134, and between the outermost bars 134 and edge portions 20*a* of the sheet. The curved sections 132*a* of the slits 132 define boundaries of the curved portions 135*a* of the strips 135 at the places where those strips are united with the bars 134; and the extremities 133*a* of the slits 133 become the points 135*b* at which the strips 135 are united with the bars 134 or longitudinal edge portions 20*a*.

The curvatures of the portions 132*a* and 133*a* of the respective slits are so formed that the ends of the strips 135 become progressively larger so that when the sheet is expanded, these gradually enlarged end portions bend about changing fulcrums with constantly changing centers of curvatures to produce a resulting curvature of large radius (as shown at 135*a*), with the transverse member having its greatest cross sectional areas at the points of attachment with the longitudinal members, whereby cracking or fracture of the transverse strips at their points of attachment is prevented. Also, the large curvatures 135*a* are effectively anchored in a concrete mass, whereby the strength of the reinforcement under load is greatly increased. By reason of such gradual enlargement of the ends of the strips 135, and the resulting strong connections with the longitudinal bars, it is possible to expand the sheet to the maximum extent—at which point the intermediate portions of the strips 135 extend at substantially right angles to the longitudinal members; and such expansions is accomplished without danger of tearing the strips at the point of connection, and without causing any of the interconnected bars to be moved out of the plane of the original sheet.

In the construction of a roadway, the terrain will first be graded and the road forms 16 properly located therealong, all as is well known. A spreader 15 of conventional type will be positioned upon the forms 16 and will advance longitudinally therealong. As concrete is deposit-

ed between the forms in advance of the spreader 15, the spreader will be effective to level the concrete mass between the forms and to compact the same. The expander 19 will follow behind the spreader 15, and may be pulled thereby (as shown in FIGURE 1) or, as has been brought out hereinbefore, it may be made an integral part thereof, or could be a part of or pushed in advance of a finisher which has not been shown, but which is effective to spread and compact the second or upper layer of concrete which will extend in covering relation over the concrete body 17 shown in FIGURE 1, and will unite therewith to form an integral concrete body from the top to the bottom surfaces thereof.

In any event, an expanded metal sheet will be interposed between the layers of concrete, and will become an integral part of the unitary concrete mass after the hardening thereof, as shown in FIGURE 11. It will be apparent that to assure a proper anchorage between the expanded sheet and the concrete, the sheet must be deposited on the concrete layer 17 before the upper surface thereof has hardened to any appreciable extent; and further, the concrete layer disposed above the sheet 21 will be placed thereon before the bottom layer 17 has hardened in order to effect an integration therebetween.

The expander 19, in being interposed between the spreader 15 and the finisher (not shown), assures a proper placement of the expanded sheets along the concrete layer 17 in a time relationship and thereby effectively contributes to the quality of the roadway, for the sheets are formed as rapidly as required as the expander travels over a concrete section which is ready to receive a reinforcing sheet, and therefore the sheet may be placed on such section as soon as the expander has travelled therepast. Since the expander is equipped with the flanged wheels 87 through 90 in alignment with the road forms 16, it travels therealong at a rate enforced by the spreader 15. A stack of sheets 20 are carried on the rack provided by the expander, and thus are immediately available for use. The rack may be replenished as frequently as necessary—either from stores deposited at appropriate intervals along the roadway, or from a centralized source thereof.

When it is necessary to expand a sheet 20, one such sheet is taken from the rack and is placed across the expander bed defined by the longitudinal I-beams or frame elements 28 through 34. In effect, the topmost sheet in the stack is simply pulled forwardly therefrom and is dropped onto the bed adjacent the rack. The handle 106 of the stationary jaw assembly may be swung in the direction of the arrow illustrated in FIGURE 4, to release the locking fingers 113 as shown in FIGURE 5. Thereafter, a longitudinal edge portion of the sheet (namely, 20*a*) may be placed below the locking fingers 113, and when the handle 106 is released, the coil springs 116 pull the locking fingers 113 downwardly and into engagement with the edge portion of the sheet. Similarly, the opposite end portion of the sheet is disposed beneath the locking fingers 130, with which the carriage 59 is equipped, after the handle 118 has been rotated in the direction of the arrow shown in FIGURE 4, to release the locking fingers as illustrated in FIGURE 6. When the handle is returned to its initial position, the coil springs 127 force the locking fingers 130 into engagement with the sheet so as to grippingly engage the same.

It will be apparent that before the sheet can be gripped by both the stationary and travelling locking finger assemblies, the carriage 59 must be moved into adjacency with the rack, as shown in FIGURES 2 and 3. It may be noted that because of the functioning of the locking fingers 113 and 130 and the crank elements respectively associated therewith, such locking fingers can have the longitudinal edges of a sheet 20 disposed thereunder without first releasing the fingers or moving them into the positions shown in FIGURES 5 and 6. For example, if a sheet 20 is placed on the bed of the apparatus and the carriage 59 moved toward the rack, the locking fingers 130 will ultimately engage an edge of the sheet, whereby the inertia of the sheet will tend to cause the locking fingers to rotate in a counter-clockwise direction (as viewed in FIGURES 4 and 6) against the resistive force applied thereto by the coil springs 127; and if movement of the carriage is continued, either the sheet will be moved or the edge thereof will slide under the locking fingers and will be engaged by the carriage, whereupon it will necessarily be moved toward the stationary locking fingers 113, and will rotate the same in a clockwise direction (as seen in FIGURES 4 and 5) against the force of the various coil springs 116, and insert the longitudinal edge of the sheet therebelow.

Though the sheet may have its longitudinal edges engaged by the stationary locking fingers 113 and travelling locking fingers 130 without having first moved the locking fingers into release positions, the sheet cannot be withdrawn therefrom without first releasing the fingers. The reason for this is that the frictional engagement between the stationary locking fingers 113 and the sheet will tend to rotate the fingers in a counter-clockwise direction if the sheet is moved toward the right, as viewed in FIGURES 4 and 5, whereby the gripping force of the fingers will increase. Similarly, when the carriage 59 is moved toward the right as seen in FIGURES 4 and 5, with the locking fingers 130 in engagement with a sheet, the locking fingers will tend to be rotated in a clockwise direction and the gripping force thereof will thus be increased. Thereafter, once a sheet is gripped by the stationary and travelling locking fingers, the sheet may be expanded transversely by moving the carriage 59 toward the right and into the position shown by broken lines in both FIGURES 2 and 3. A sheet so expanded is designated with the numeral 21 in FIGURE 3, and is also shown in both FIGURES 10 and 11.

A sheet 21 is released from the locking fingers 113 and 130 simply by moving the respective handles 106 and 118 in the direction of the arrows shown in FIGURE 4, to elevate the locking fingers from the sheet. It can then be displaced from the bed of the expander apparatus and positioned on the concrete layer prepared therefor. The expansion of a sheet is effected by reciprocatory movement of the carriage 59 as the expander apparatus is being advanced along the forms 16, and thus there is no delay between the time that the concrete layer is formed and a reinforcing sheet placed thereon. Further, expanded sheets need not be stored and repeatedly handled, for they are readied only as rapidly as the need therefor arises.

The carriage 59 is reciprocated by the engine 43 through the gear reducer 44 and drive arrangement comprising the link chain 51, chains 57 and 60 and various sprocket wheels and gears interconnecting the same, as heretofore described. It will be apparent that the carriage is moved in opposite directions by reversing the direction of rotation of the shaft 53, and this may be accomplished by a suitable reversing arrangement which may be a part of the gear reducer. It will be appreciated, of course, that the carriage may also be reciprocated by worms that might be substituted for the chains 57 and 60 and, if desired, the power for driving the carriage may be obtained from the power plant or engine of the spreader 15, by suitable shafts or chains and the like, rather than from an engine carried by the expander itself.

While in the foregoing specification one embodiment of the apparatus of the invention has been disclosed in considerable detail for the purpose of making a full and clear disclosure of both the apparatus and the method of the present invention, it will be apparent to those skilled in the art that numerous changes may be made in the apparatus and in the method without departing from the principles or spirit of the invention.

I claim:

1. In apparatus of the character described for expanding slitted metal sheets into reticulated webs for use as reinforcing in a concrete roadway or the like, a wheel-equipped frame adapted to straddle such roadway and to move longitudinally therealong, said frame defining a bed adapted to extend transversely of such roadway for supporting such sheet during the expansion thereof, a stationary jaw assembly supported by said frame adjacent an end of said bed and having a plurality of spaced locking fingers movable between a release position spaced from said bed and a locking position adjacent the bed for frictionally engaging the longitudinal edge portion of a sheet supported thereon, a carriage supported by said frame for reciprocatory movement along said bed toward and away from said stationary jaw assembly, power means for reciprocating said carriage, and a travelling jaw assembly supported by said carriage and comprising a plurality of spaced locking fingers extending across said bed in generally parallel alignment with the aforesaid locking fingers, said last mentioned locking fingers being selectively movable between a release position remote from said bed and a locking position adjacent said bed to frictionally grip the opposite longitudinal edge portion of such sheet supported thereon and extending between said stationary and travelling jaw assemblies, said locking fingers on respective said assemblies being rotatable in opposite directions towards and away from the center of such supported sheet, respectively into and out of said locking positions thereof, said locking fingers on said assemblies thereby being rotatable out of said locking positions by abutting engagement with opposite longitudinal edge portions of a sheet disposed between said assemblies when the assemblies are moved together, and returning to said locking positions in frictional engagement with said edge portions when said assemblies are moved apart for expanding the sheet; whereby a slitted sheet is expanded across such roadway as said apparatus travels longitudinally therealong to prepare such sheet for placement in a section of such roadway immediately traversed by said apparatus.

2. The structure of claim 1 in which said stationary jaw assembly comprises a handle-equipped rod rotatably carried by said frame and extending transversely thereof, a plurality of actuator fingers secured to said rod at spaced intervals therealong so as to rotate therewith, a crank for each of said actuator fingers and rotatably supported by said frame, a locking finger for each of said cranks and respectively connected therewith, and means for resiliently urging said locking fingers into clamping engagement with the longitudinal edge portion of such sheet disposed therebelow, said handle-equipped rod being movable to urge said actuator fingers into engagement with the respective cranks to shift said locking fingers to the release position thereof remote from an edge portion of such sheet disposed therebelow.

3. The structure of claim 1 in which said travelling jaw assembly comprises a handle-equipped rod rotatably supported by said carriage and extending along the length thereof, a plurality of actuator fingers secured to said rod at spaced intervals therealong so as to rotate therewith, a crank for each of said actuator fingers and rotatably supported by the carriage, a locking finger for each of said cranks and respectively connected therewith, and means for resiliently urging said locking fingers into clamping engagement with the longitudinal edge portion of such sheet disposed therebelow, said handle-equipped rod being movable to urge said actuator fingers into engagement with the respective cranks to shift said locking fingers to the release position thereof remote from an edge portion of such sheet disposed therebelow.

4. In apparatus for expanding slitted metal sheets into reticulated webs for use as reinforcing in a concrete roadway or the like, a frame equipped with wheels for straddling such roadway to support said apparatus thereover for lonigtudinal movement therealong, said frame being equipped with a rack offset from the wheels along one end of the apparatus for supporting a stack of sheets thereon laterally of such roadway, a carriage supported by said frame for reciprocatory movement intermediate the ends thereof, a stationary jaw assembly supported by said frame adjacent the inner edge of said rack for gripping a longitudinal edge portion of each such sheet to prevent movement thereof, a traveling jaw assembly mounted on said carriage for gripping the opposite longitudinal edge portion of each such sheet to enforce movement thereof as the carriage travels along said frame in a direction away from said rack, and a prime mover supported by said frame for reciprocating said carriage to successively expand sheets so gripped by said jaw assemblies, said stationary jaw assembly and said traveling jaw assembly each comprising a rotatable handle-equipped rod extending traversely of said frame, a plurality of actuator fingers secured to each of said rods at spaced intervals therealong so as to rotate therewith, a rotatable crank for each of said actuator fingers, a locking finger for each of said cranks and respectively connected therewith, and means for resiliently urging said locking fingers into clamping engagement with a longitudinal edge portion of such a sheet disposed therebelow, said handle-equipped rods being respectively movable to urge said actuator fingers associated therewith into engagement with the respective cranks to shift said locking fingers to a release position thereof remote from an edge portion of such sheet disposed therebelow.

5. In apparatus of the character described, a frame comprising a plurality of spaced apart, generally parallel beams defining a bed along the upper surface thereof and being equipped with wheels adapted to roll along paving forms with said bed extending therebetween, a stationary jaw assembly disposed adjacent one end of said bed and comprising a plurality of spaced locking fingers selectively movable between a release position remote from said bed and a locking position adjacent said bed for frictionally gripping an edge portion of an expandable metal sheet to constrain said edge portion against movement, means for moving said locking fingers between the aforesaid positions thereof, a carriage equipped with wheels engaging certain of said beams to support said carriage for reciprocatory movement along said bed toward and away from said stationary jaw assembly, a traveling jaw assembly mounted upon said carriage and comprising a plurality of spaced locking fingers movable between a release position remote from said bed and a locking position adjacent said bed for frictionally engaging the opposite edge portion of such a sheet for moving the same with said carriage, means for selectively moving said last mentioned locking fingers between the release and locking positions thereof, power means supported by said frame for reciprocating said carriage, said power means including a drive assembly interconnecting said power means and said carriage and comprising a reversely rotatable drive shaft journalled in said frame and equipped with a pair of spaced drive sprockets, a pair of idler sprockets rotatably supported by said frame, and a pair of link chains respectively entrained about said drive and idler sprockets and secured at the ends thereof to said carriage, said means for moving said first mentioned locking fingers comprising a handle-equipped rod rotatably supported by said frame and extending transversely thereof, a plurality of actuator fingers secured to said rod at spaced intervals therealong so as to rotate therewith, said actuator fingers being respectively aligned with said first mentioned locking fingers, a crank for each of said actuator fingers rotatably supported by said frame and respectively connected with said first mentioned locking fingers to effect movement thereof, and means for resiliently biasing each of said cranks in a direction urging said first mentioned locking fingers into clamping engagement with such sheet disposed therebelow, said handle-equipped rod being movable to urge

said actuator fingers into engagement with the respective cranks to shift said locking fingers to the release position thereof.

6. The apparatus of claim 5 in which said means for moving the locking fingers of said traveling jaw assembly comprises a handle-equipped rod rotatably supported by said carriage and extending along the length thereof, a plurality of actuator fingers secured to said last mentioned rod at spaced intervals therealong in respective alignment with said second mentioned locking fingers, a bell crank for each of said last mentioned actuator fingers and rotatably supported by said carriage and respectively connected with said second mentioned locking fingers to enforce movement thereof, and means for resiliently urging said bell cranks in a direction to urge said second mentioned locking fingers into clamping engagement with the edge portion of such sheet disposed therebelow, said second mentioned handle-equipped rod being movable to urge said second mentioned actuator fingers into engagement with the respective bell cranks to shift said second mentioned locking fingers to the release position thereof.

7. The apparatus of claim 6 in which said first and second mentioned locking fingers are rotatable in opposite directions into the locking positions thereof, and in which said first mentioned locking fingers swing downwardly and toward said carriage in their movement from the release to the locking positions thereof.

8. The apparatus of claim 7 in which spring means are employed for resiliently urging all of said locking fingers into the clamping positions thereof.

References Cited in the file of this patent

UNITED STATES PATENTS

585,262	Edwards	June 29, 1897
602,969	Williams et al.	Apr. 26, 1898
864,069	Blome et al.	Aug. 20, 1907
940,575	Bambauer	Nov. 16, 1909
949,483	Kane	Feb. 15, 1910
980,638	Hill	Jan. 3, 1911
1,424,169	Koehring	Aug. 1, 1922
1,509,602	Maloney	Sept. 23, 1924
1,607,546	McCrery	Nov. 16, 1926
1,805,602	Shafer	May 19, 1931
2,121,470	Ballard et al.	June 21, 1938
2,175,240	Arthur	Oct. 10, 1939
2,197,431	Johnson et al.	Apr. 16, 1940
2,277,203	Boult	Mar. 24, 1942
2,303,335	Day	Dec. 1, 1942
2,439,620	Faber	Apr. 13, 1948
2,505,209	Russell	Apr. 25, 1950
2,692,019	Zalkind	Oct. 19, 1954
2,707,995	Bibby	May 10, 1955
2,948,049	Wilson	Aug. 9, 1960