May 10, 1960 W. F. MIDDLESTADT 2,935,981

JOINT CUTTING MACHINE

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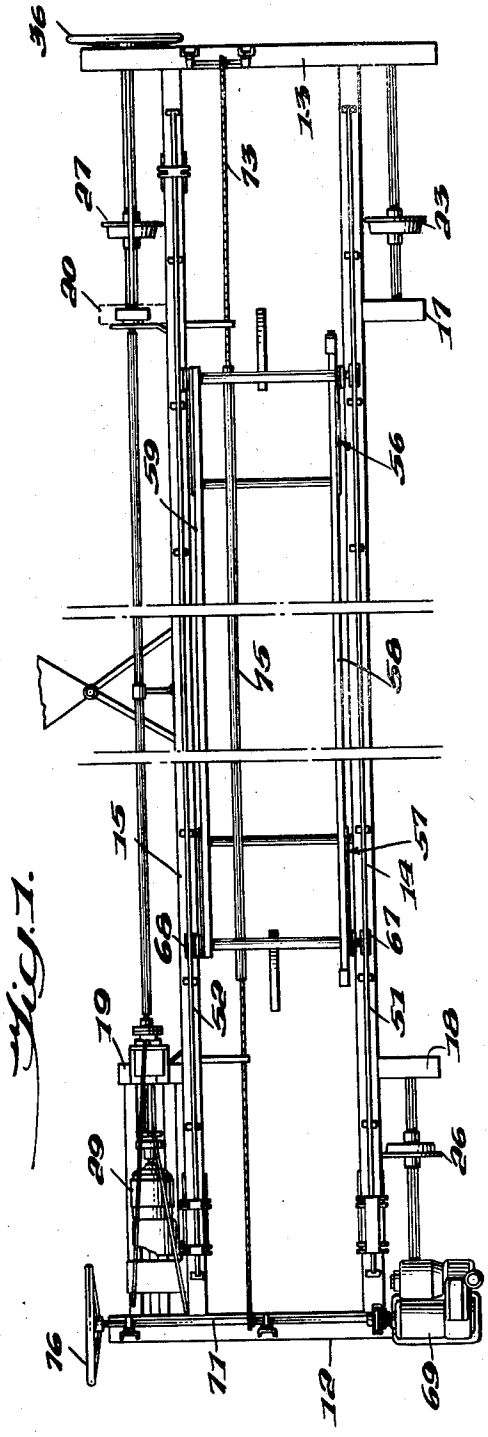


Fig. 1.

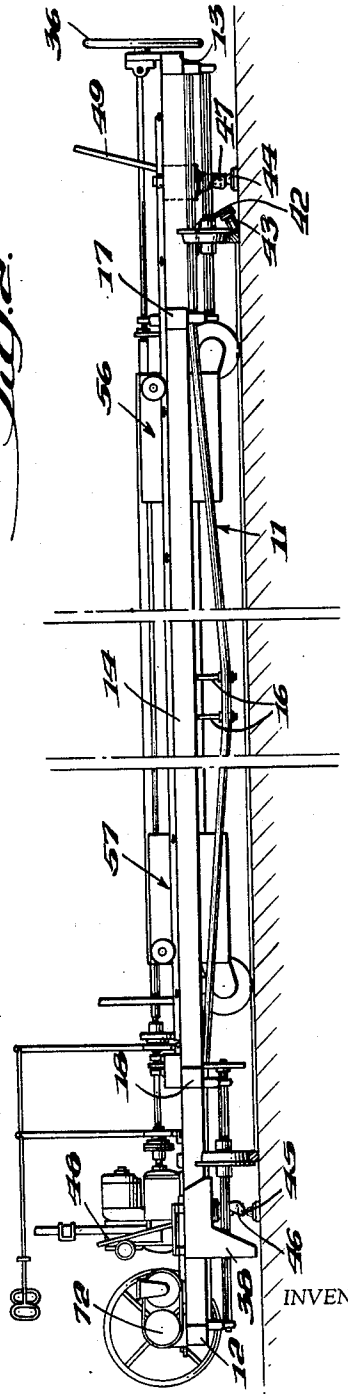


Fig. 2.

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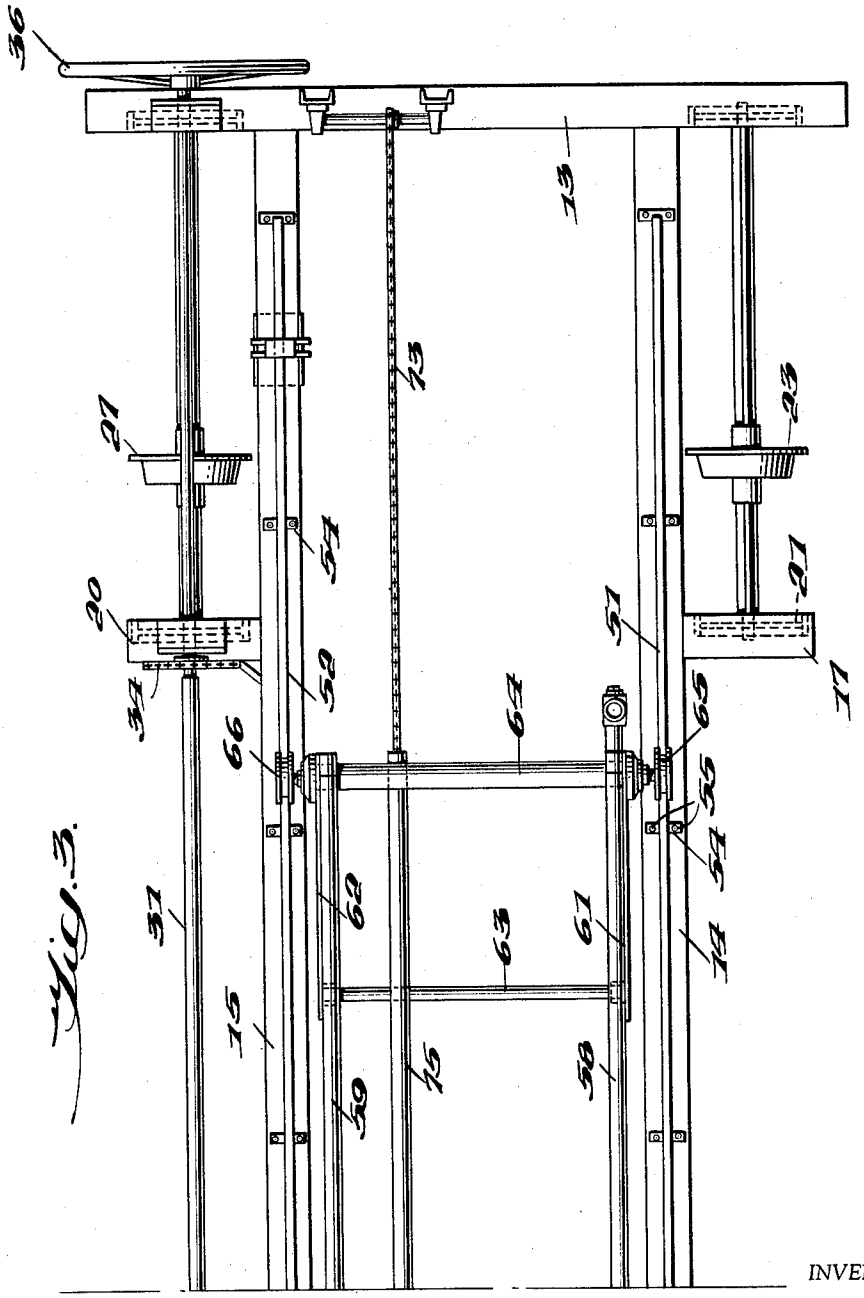


Fig. 3.

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Fig. 5.

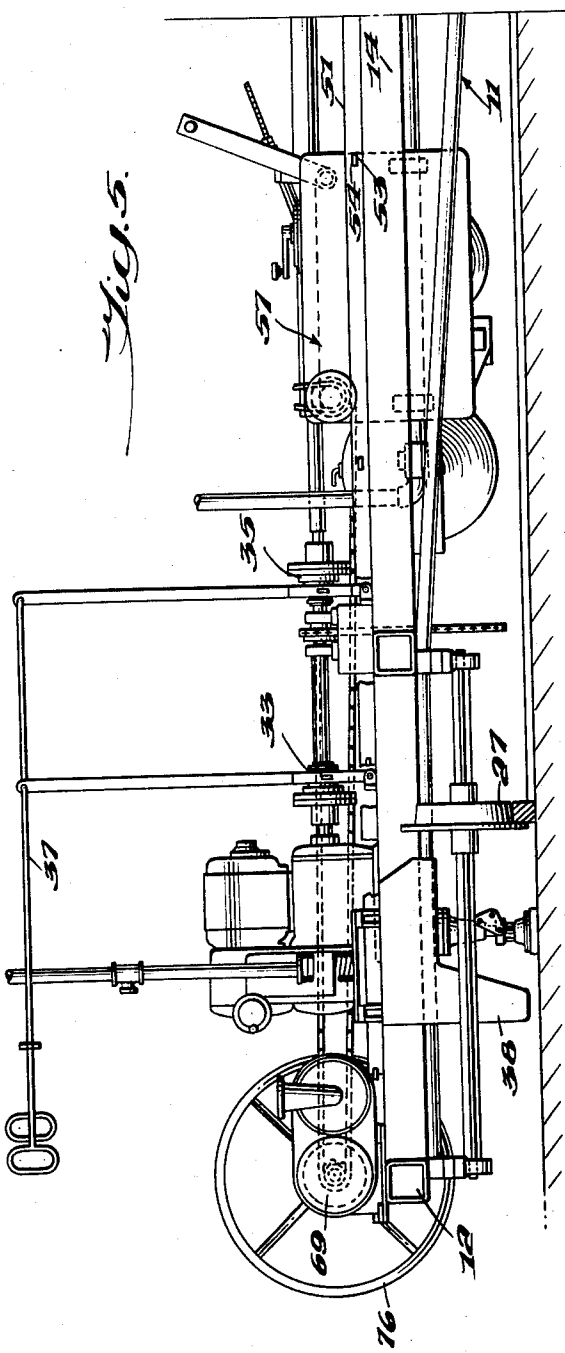
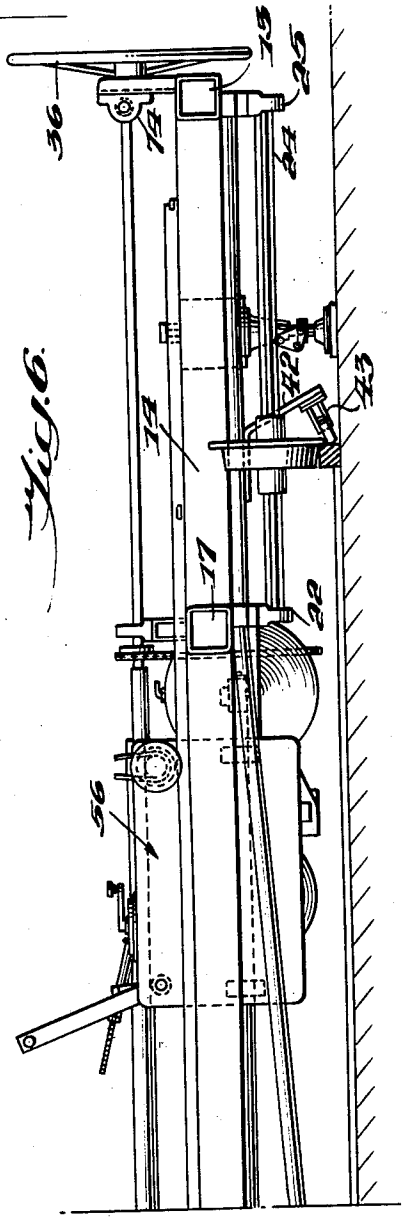


Fig. 6.



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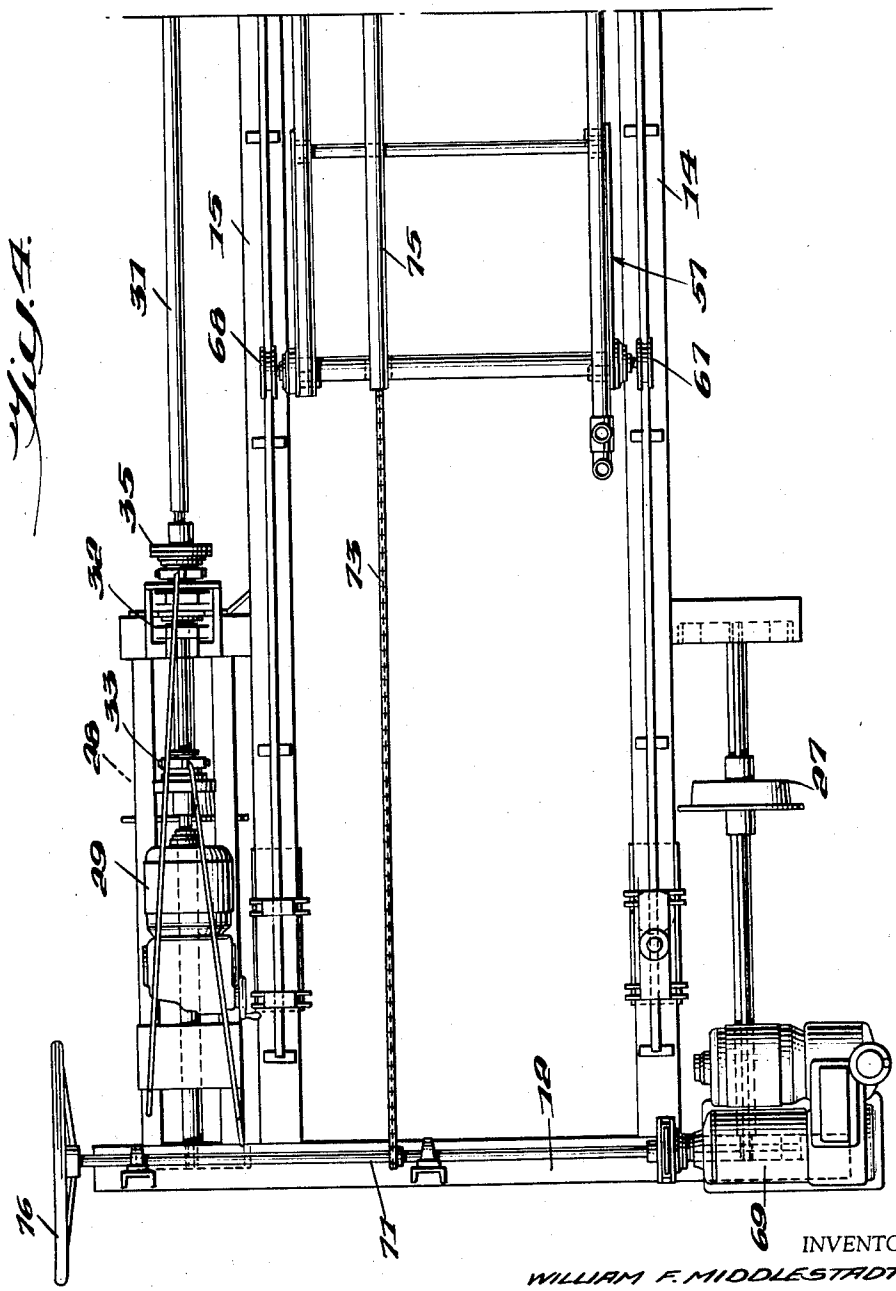
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JOINT CUTTING MACHINE

Filed July 19, 1957 6 Sheets-Sheet 4



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Fig. 7.

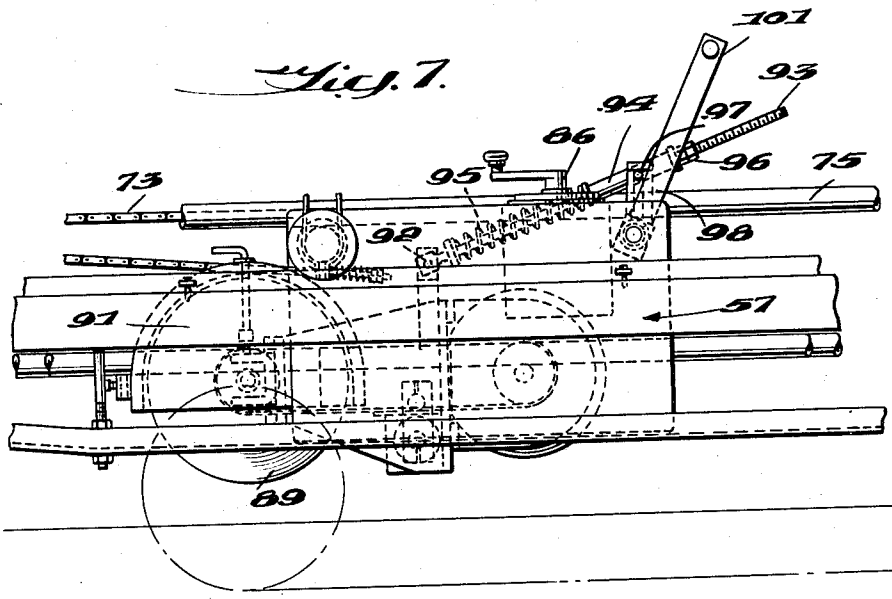
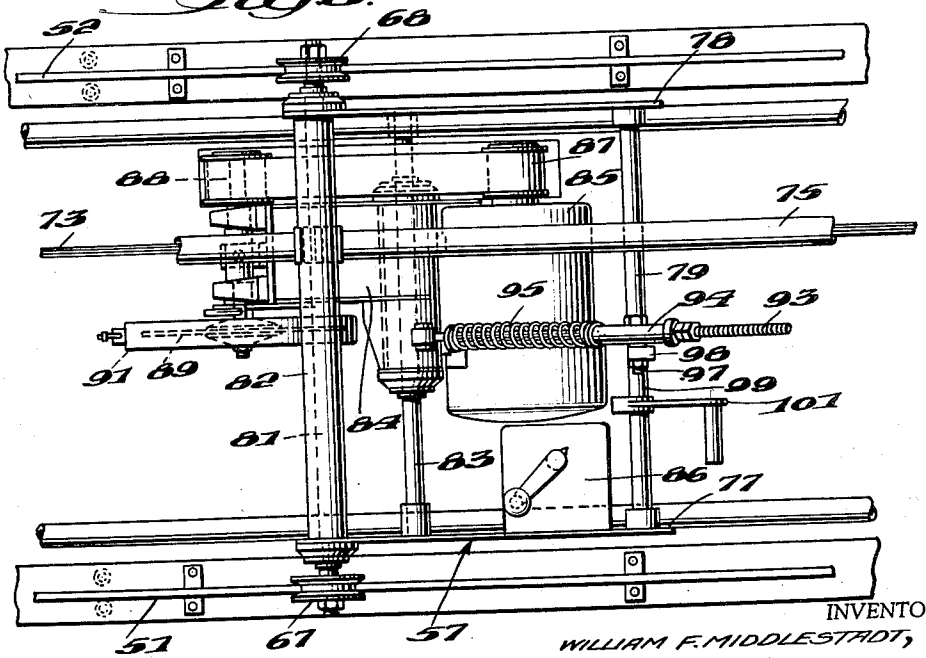


Fig. 8.



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Fig. 9.

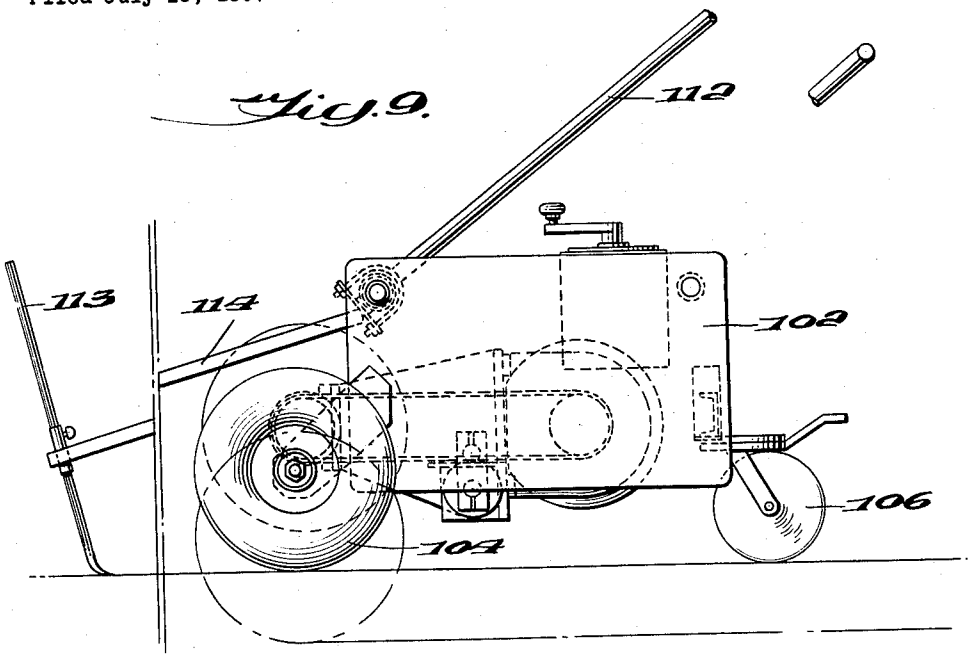
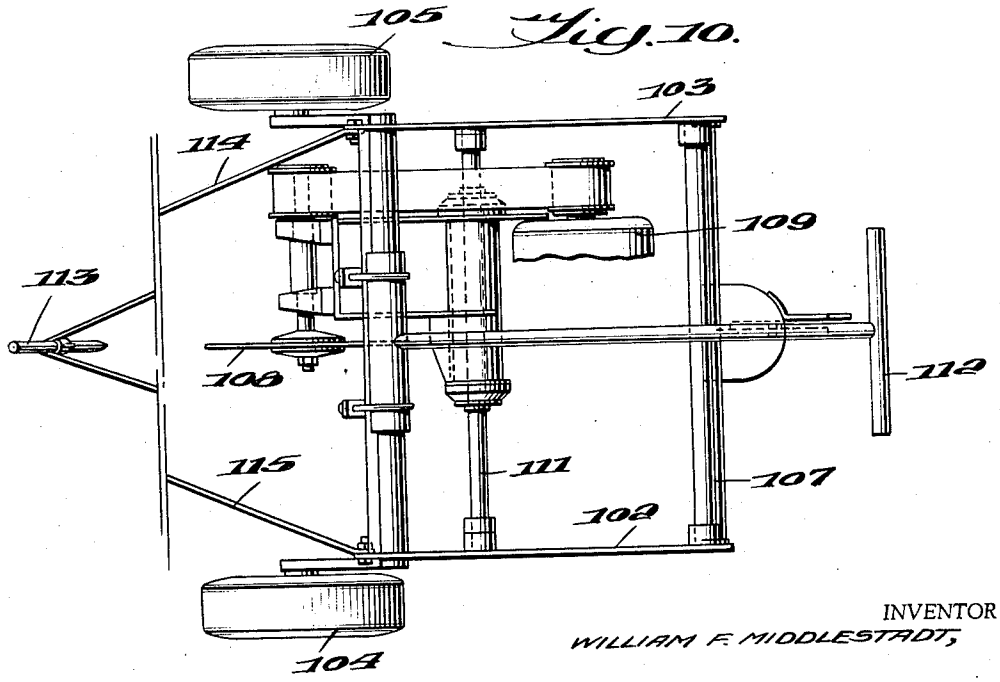


Fig. 10.



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United States Patent Office

2,935,981

Patented May 10, 1960

2,935,981

JOINT CUTTING MACHINE

William F. Middlestadt, Baltimore, Md.

Application July 19, 1957, Serial No. 672,929

5 Claims. (Cl. 125—14)

This invention relates to a joint cutting machine and more particularly to an apparatus which is used to cut joints in concrete strips for highways, airport runways and the like.

In constructing concrete highways it is the usual practice to lay forms for the longitudinal and transverse joints. It can readily be appreciated that the locating and removing of such forms becomes a tedious and time-consuming job. It would obviously be advantageous if a means could be provided whereby the concrete strip could be poured without the joint forming strips and the joints subsequently cut into the set concrete. The presently disclosed apparatus accomplishes this result and, although machines have been devised heretofore for this purpose, such prior art devices did not possess all of the advantages inherent in the presently described joint cutting machine.

According to the present invention there is provided a frame which is supported by wheels with means to drive the wheels and frame longitudinally of the concrete strip to be provided with joints. Extending along the frame are guide rails which have wheeled cutter carriers mounted thereon. The one or more cutter carriers are rigidly joined together and are adapted to be driven across the concrete strip to provide the transverse joints. The cutters are pivotally mounted in the carriers and a linkage arrangement is provided for rapidly shifting the cutters between operative and inoperative positions. A spring element is interposed in each linkage so that the cutter is resiliently supported in its operative position and can thus ride up and spend more time cutting through any unusually hard obstruction in the concrete.

Adjacent the midpoint of the frame there is provided an attaching point for one or more wheeled cutter carriers. The cutter in this device is mounted similarly to the cutters previously described and this cutter is adapted to form the longitudinal joint in the concrete strip as the frame is moved longitudinally along the strip. Alternatively, the wheeled carrier may be hand operated and suitable guide means may be utilized to direct the carrier.

A primary object of the present invention is to provide a machine for cutting joints in concrete and the like in which means are provided for cutting both longitudinal and transverse joints.

Another object of the present invention is to provide a concrete joint cutting machine in which the cutter wheels are mounted for movement between operative and inoperative positions and are adjustably and resiliently supported in the operative position.

Still another object of the present invention is to provide a machine which may be used for cutting joints in concrete in which a plurality of cutters are mounted in a single frame for cutting the transverse joints and a plurality of separable wheeled carriers is provided for cutting the longitudinal joints.

Other objects and many of the attendant advantages of the present invention will become apparent upon consideration of the following detailed specification in connection with the accompanying drawings wherein:

Fig. 1 is a top plan view of the joint cutting machine;

Fig. 2 is a side elevation thereof;

Fig. 3 is a top plan of the right-hand end of the machine as viewed in Fig. 1;

Fig. 4 is a top plan of the left-hand end of the machine as viewed in Fig. 1;

Fig. 5 is a side elevation of the left end of the machine;

Fig. 6 is a side elevation of the right-hand end;

Fig. 7 is a side elevation of the cutter and supporting structure therefor;

Fig. 8 is a top plan view of the structure shown in Fig. 7;

Fig. 9 is a side elevation of the separable carrier for the center line cutter; and

Fig. 10 is a top plan view of the device shown in Fig. 9.

Referring now more particularly to the drawings wherein like numerals indicate like parts throughout the several views there is provided a main frame 11 which is shown in Figs. 2, 5 and 6. This main frame comprises elongated side members having the central portions thereof angularly formed with respect to a horizontal plane as is clearly shown in Fig. 2. Adjacent the ends of the elongated side members there are secured as by welding crossarms 12 and 13 as can be seen in Figs. 1 and 2. These crossarms are secured to the upper surfaces of the elongated side members and interconnecting the crossarms 12 and 13 are guide rail supports 14 and 15. As seen in Fig. 2 the guide rail support 14 is connected with the elongated side member forming the frame 11 by means of adjusting bolts 16. The guide rail support 15 is similarly joined to its coextending side member. The adjusting bolts 16 provide means for bowing the guide rail supports 14 and 15 for a purpose which will become more fully apparent hereinafter.

The frame 11 is supported from the ground by means of wheels which may be power driven to move the entire joint cutting machine. The guide rail support has brackets 17 and 18 extending outwardly therefrom as shown in Figs. 1 and 2 and guide rail support 15 has similar brackets 19 and 20. Each bracket has a slot in the under face thereof as shown at 21 in Fig. 3. An axle bearing support such as shown at 22 in Fig. 6 is bolted in the slot in member 17. By providing a slot in the support the axle bearing may be bolted in any selected position along the length of bracket 17. Similar structures are provided for each of the axle bearing supports in brackets 18, 19 and 20 and in the axle bearing supports in the end portions of crossarms 12 and 13. With reference to Fig. 6 it can be seen that the wheel 23 is supported on an axle 24 in the axle bearing supports 22 and 25. The wheel 23 may be moved longitudinally on the axle 24 and similar mounting means is provided for the wheels 26 and 27 and for the wheel 28 shown in dotted lines in Fig. 4. Thus, it can be seen that by shifting the positions of the axle bearing supports in their supporting brackets the wheels may be canted at any desired angle and by shifting the positions of the wheels on the axles the width of the frame between the wheels may be varied.

The drive means for the structure comprises a motor 29 as seen in Figs. 1 and 4 and this motor is provided with a drive shaft 31. A powertakeoff for the wheel 28 is provided by a pulley 32 which drives the wheel 28 through a suitable pulley and belt arrangement (not shown). A clutch 33 provides means for disconnecting the motor 29 from the shaft connecting with the pulley 32. The drive shaft 31 extends through the bracket 20 and is journaled in the end portion of crossarm 13. A

suitable pulley 34 mounted on the drive shaft 31 provides a coupling with the axle mounting wheel 27 so that when the motor 29 drives wheel 28 it also drives wheel 27 through shaft 31. A clutch 35 is provided as shown in Fig. 4 so that the driving connection to wheel 27 may be disconnected. A hand wheel 36 as seen in Figs. 1 and 3 may be used to manually drive wheels 27 and 28 together or by operating clutch 35 the wheel 27 may be driven alone. Operating arms 37 may be mounted as shown for actuation of the clutches 33 and 35.

The wheels 23, 26, 27 and 28 are provided with removable flanges and the flanges are adapted to ride on the upper surfaces of the side formers as shown in Fig. 2.

There is provided means for locking the frame in any selected position. Such means comprises feet 44 and 45 as shown in Fig. 2 and these feet are linked to the frame by bell crank levers 46 and 47. Operating arms 48 and 49 are connected with the links 46 and 47 and are pivoted to the frame so that by shifting the position of the operating arms the feet members may be raised or lowered. Rollers 43 are mounted upon brackets and secured to the frame. These rollers bear against the outer vertical faces of the frame members as shown and provide additional guide means for the frame.

Secured to the upper surface of guide rail supports 14 and 15 are guide rails 51 and 52 respectively. The guide rails are slotted as at 53 in Fig. 5 and these slots are adapted to receive a bracket arm 54 which has the ends thereof secured to the guide rail support as shown at 55 in Fig. 3. A plurality of such brackets are provided along the length of the guide rail and it can be appreciated that by loosening the bolts 55 the corresponding guide rail may be shifted with respect to the guide rail support.

Slidably supported on the guide rails 51 and 52 is the structure which cuts the transverse joints in the concrete strip. Such structure comprises cutter supports or carriers 56 and 57 which are rigidly connected together by means of bars 58 and 59. Each cutter carrier comprises side plates 61 and 62 as shown in Fig. 3. These side plates are rigidly connected together by means of connecting bars 63 and 64. Connecting bar 64 has extensions thereon which are journaled grooved wheels 65 and 66 which ride on guide rails 51 and 52 respectively. The cutter carrier 57 is provided with similar grooved wheels 67 and 68 and it can be seen that the entire assembly including the cutter carriers 56 and 57 will ride on the guide rails 51 and 52 along the length of the frame 11.

There is provided means for driving the cutter carriers across the frame. Such means includes a motor 69 provided with a drive shaft 71. Drive shaft 71 has a sprocket 72 (Fig. 2) mounted thereon and this sprocket has a chain 73 passing thereover across the frame and over a similar sprocket 74 (Fig. 6) which is mounted on a shaft on crossarm 13. The chain 73 passes through a pipe 75 secured to the cutter carriers and the ends of the chain are secured to the ends of the cutter carriers. Thus, it can be seen that rotation of drive shaft 71 will drive chain 73 and accordingly will move the cutter carriers along the frame. A hand wheel 76 is provided for manual operation.

For the sake of clarity the details of the cutter mechanism have been omitted from Figs. 1 to 4 as the details of such structure are believed adequately shown in Figs. 7 and 8 wherein there is shown a side elevation and top plan view of the mechanism of cutter carrier 57. There are provided side plates 77 and 78 which are rigidly joined by means of a connecting bar 79. There is provided a shaft 81 upon which wheels 67 and 68 are mounted and this shaft has a sleeve 82 journaled thereon which sleeve interconnects the plates 77 and 78. A pivot bar 83 is journaled in the side plates adjacent the lower edges thereof. Mounted on pivot bar 83 is a supporting plate 84 having strengthening flanges on the sides thereof. At one end of the plate is mounted a motor 85 which is controlled from switch box 86 rigidly mounted on side plate 77. The motor 85 has a pulley and belt 87 connecting it with a shaft 88 journaled on the opposite end of plate 84. There is mounted on the opposite end of shaft 88 a cutter 89 which may have a diamond edge to provide a sufficiently abrasive surface to cut concrete and the like. A shield 91 covers the upper portion of the blade and this shield may be lined with rubber to prevent the shield from being damaged by stones and the like brought up by the cutting blade. It can be seen that the motor 85 and cutter 89 with the interconnecting drive means are mounted for pivotal movement with respect to the cutter carrier 57. There is provided means for shifting the cutter between operative and inoperative positions and for resiliently supporting the cutter in the operative position thereof. Pivoted on the supporting plate 84 as at 92 is a link 93 having screw threads on the outer end thereof. A sleeve 94 is slidably mounted on the link 93 and a spring element 95 is interposed between this sleeve 94 and a flange on link 93, so that the sleeve 94 is normally maintained in its outer position against nuts 96. There is provided on sleeve 94 a pin 97 which engages a slot in a link 98. Link 98 is in turn rigidly connected with a sleeve 99 rotatable on connecting bar 79 and the opposite end of this sleeve is rigidly connected with a hand crank 101. By pushing the handle 101 to the left as viewed in Fig. 7 the cutter will be shifted to the lower position shown in dotted lines. The cutter is balanced in the up position and in the down position the linkage is over center so that the cutter is retained in position. In the event that an unusually hard obstruction is encountered by the cutter 89 it may move upwardly against the force of the spring 95 and in this manner damage to the blade is prevented.

In Figs. 9 and 10 there is shown the device used for cutting the center line joint. This device comprises side plates 102 and 103 upon which are mounted wheels 104 and 105 adjacent the front ends of the side plates. A caster wheel 106 is rotatably mounted on a connecting rod 107 at the rear end of the frame. The blade 108 is connected with a motor 109 in a manner similar to that described with respect to the cutters shown in Figs. 7 and 8. The motor, blade and connecting drive structure may be pivotally mounted on rod 111 and provided with a means for shifting the blade between operative and inoperative positions similar to that previously described. A handle structure 112 is provided for manual operation of the center line cutter and in the event the device is used in this way a guide 113 is connected to the front of the cutter structure by means of rods 114 and 115.

The joint cutting machine described herein is used in the following manner. The wheeled frame is brought to the point where the joints are to be cut and is locked in that position. The blades in the cutter supports 56 and 57 are moved to the operative positions and the motor 69 is energized to move the rotating cutter blades back and forth across the transverse frame. The adjusting screws 16 may be set so that the guide rails will assume the curvature of the concrete strip. After the transverse joints are cut the cutting blades are moved to the inoperative positions and motor 29 is energized to cause the entire frame to move forwardly to the next location. During the forward movement of the frame the center line joint cutter shown in Figs. 9 and 10 may be attached at the midpoint of the frame as shown at Fig. 1 by means of a ball hitch so that the longitudinal joint is cut as the structure moves to the next location. Obviously, the ball hitch can be attached to the main frame at any desired point so that a longitudinal joint may be cut along any selected line. Alternatively, the device shown in Figs. 9 and 10 may be used separately and hand operated to cut the joint. It is readily apparent that a guide means other than that shown at 113 in Figs. 9 and 10 may be used to guide this cutter. For example, a wheeled struc-

ture engaging the outer forms of the concrete strip could be used to maintain the cutter at the center of the strip.

It is essential that a cooling medium be supplied to the cutter blades as they are forming the joints. A constant water supply must be maintained or the blades will rapidly become useless. A suitable valve structure should be employed such that the motor 69 or cutter blade motors cannot be actuated until a water supply has been brought to the blades. Similar means should be provided to insure that the cutter blades be removed from the cut if the water supply is inadvertently cut off.

Obviously, many modifications and variations of the present invention are possible in the light of the above teachings. What is claimed as new and desired to be secured by Letters Patent is:

1. A joint cutting machine for concrete comprising a frame, means for supporting said frame in spaced relation to a surface, means including rollers mounted on said frame for positioning said frame, said rollers being inwardly turned to engage a vertical edge portion of a concrete form, a foot adapted to engage a surface to lock the frame in a fixed position and means connecting said foot to said frame for vertical movement with respect thereto.

2. A device for cutting concrete joints comprising a frame, wheels supporting said frame from the outer edges of a concrete strip, guide rails mounted on said frame, means mounting said guide rails for angular adjustment with respect to said frame, cutter supports mounted for slidable movement on said guide rails, means mounted on said frame for driving said cutter supports along the guide rails, cutter wheels rotatably mounted in said supports for cutting transverse joints in the concrete as the support moves along the guide rails and means supporting said cutters in the supports for movement between operative and inoperative positions, said last named means including a resilient element which is partially compressed when the cutter is moved to operative position whereby the cutters will ride up and over obstructions in the set concrete.

3. A machine for cutting longitudinal joints in a concrete strip comprising a frame, flanged wheels mounted adjacent the ends of said frame and supported on rails on the outer edges of the concrete strip, drive means for driving said wheels whereby the frame moves over the concrete strip substantially perpendicularly with respect to the outer edges thereof, a cutter carrier, wheels supporting said cutter carrier, a cutter and drive means therefor mounted on said cutter carrier, means for shifting said cutter between operative and inoperative positions, means for pivotally mounting said cutter carrier on one side of said frame whereby the cutter carrier is moved over the concrete strip as the frame is moved thereover, said cutter carrier being free to swing about an axis perpendicular to the plane of movement of said frame.

4. A machine for cutting joints in concrete comprising a frame, a plurality of cutters mounted for slidable movement on said frame, linkage means for shifting said cutters between operative and inoperative positions, said linkage means including a resilient element whereby said cutter is adapted to move up and over an obstruction when in an operative position, pairs of extension members mounted on each end and side of said frame, said members extending perpendicularly with respect to the longitudinal edges of the frame, axles mounted in said pairs of extension members, said axles normally extending substantially parallel with respect to the longitudinal edges of said frame, means for varying the angular relationship between the axles and the longitudinal edges of said frame, flanged wheels mounted on said axles, said flanged wheels adopted to engage rails on the sides of a concrete strip and support the frame over the concrete strip, and means for selectively driving said wheels to move the frame over said concrete strip.

5. A machine for cutting longitudinal joints in a concrete strip comprising a frame, wheels mounted adjacent the ends of said frame and supported on the outer edges of the concrete strip, a cutter carrier, wheels supporting said cutter carrier, means for shifting said cutter between operative and inoperative positions, means for pivotally mounting said cutter carrier on said frame whereby the cutter carrier is moved over the concrete strip as the frame is moved thereover, said cutter carrier being free to swing about an axis perpendicular to the plane of movement of said frame, and means for driving said frame and cutter over the concrete strip while the frame maintains a position substantially perpendicular with respect to the outer edges of the concrete strip.

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