Aug. 8, 1961 S. J. GARTNER ET AL 2,995,156

AUTOMATIC GRID MACHINE

Original Filed Sept. 3, 1947 5 Sheets-Sheet 1

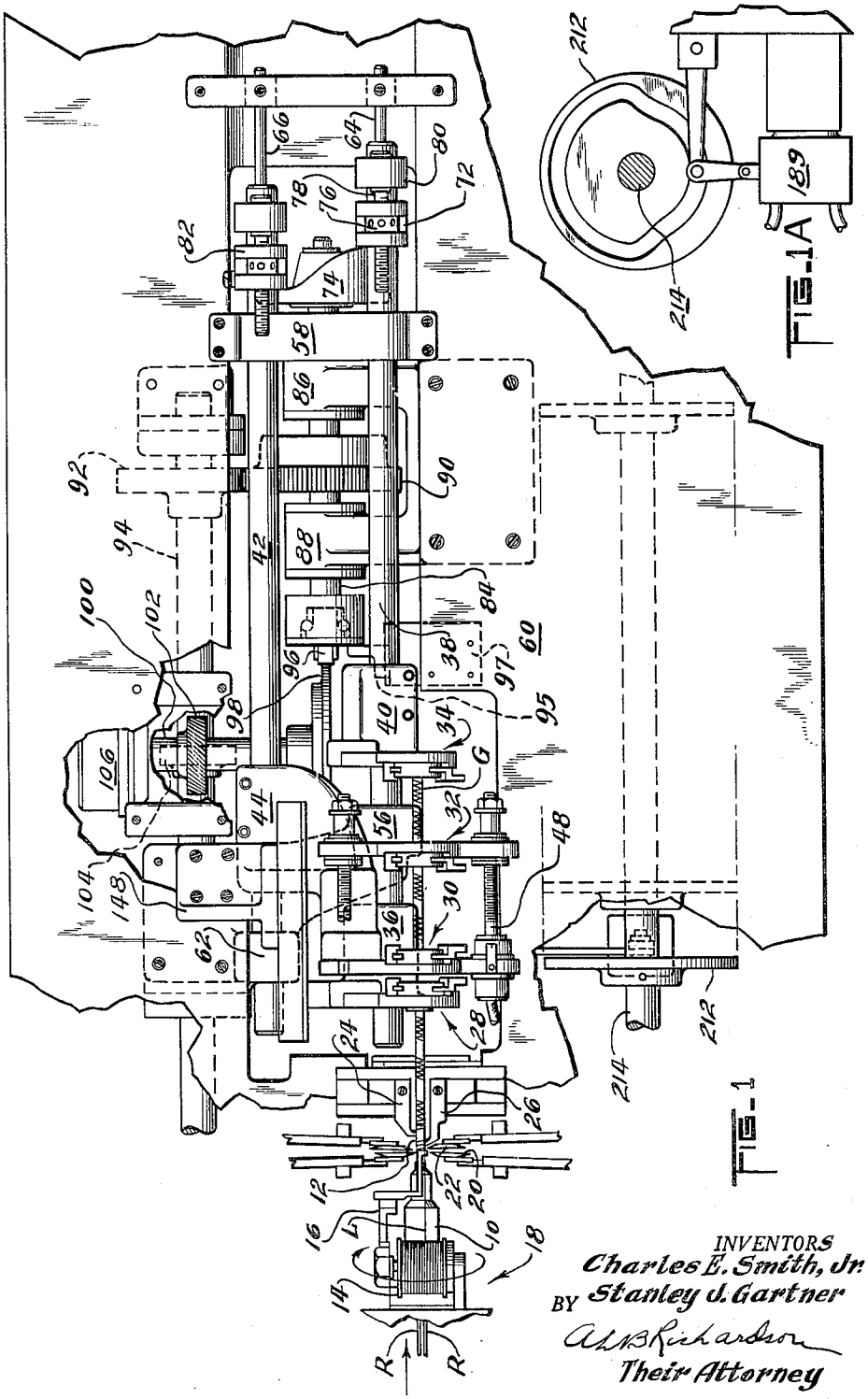

FIG. 1A

FIG. 1

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AUTOMATIC GRID MACHINE

Original Filed Sept. 3, 1947 5 Sheets-Sheet 2

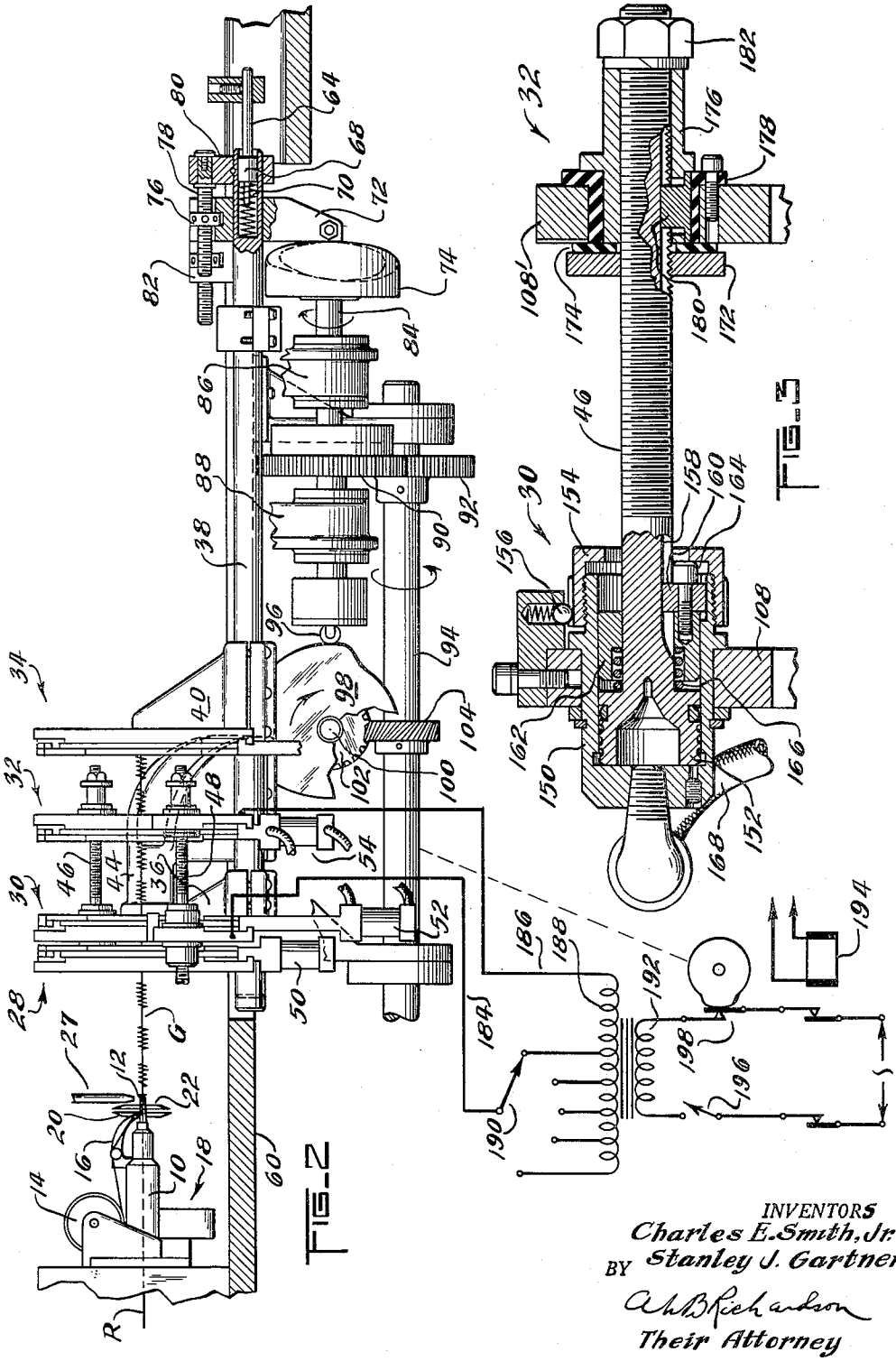

FIG. 2

FIG. 3

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AUTOMATIC GRID MACHINE

Original Filed Sept. 3, 1947 5 Sheets-Sheet 3

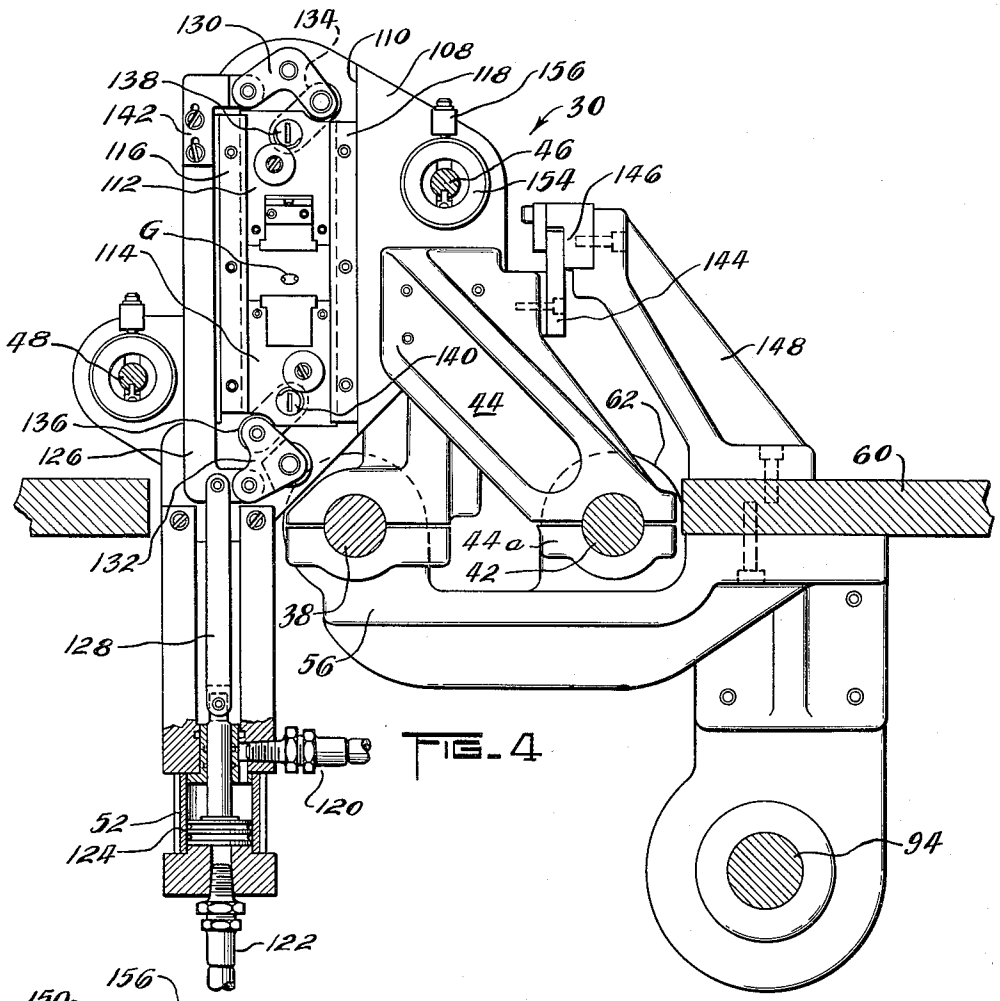

FIG. 4

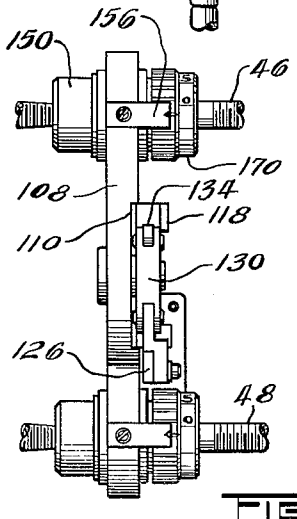

FIG. 5

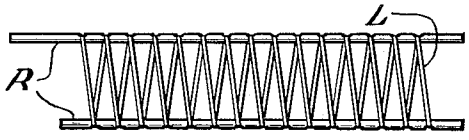

FIG. 6

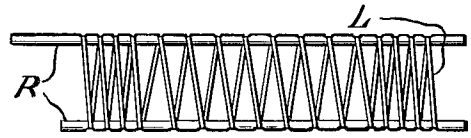

FIG. 7

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AUTOMATIC GRID MACHINE

Original Filed Sept. 3, 1947 5 Sheets-Sheet 4

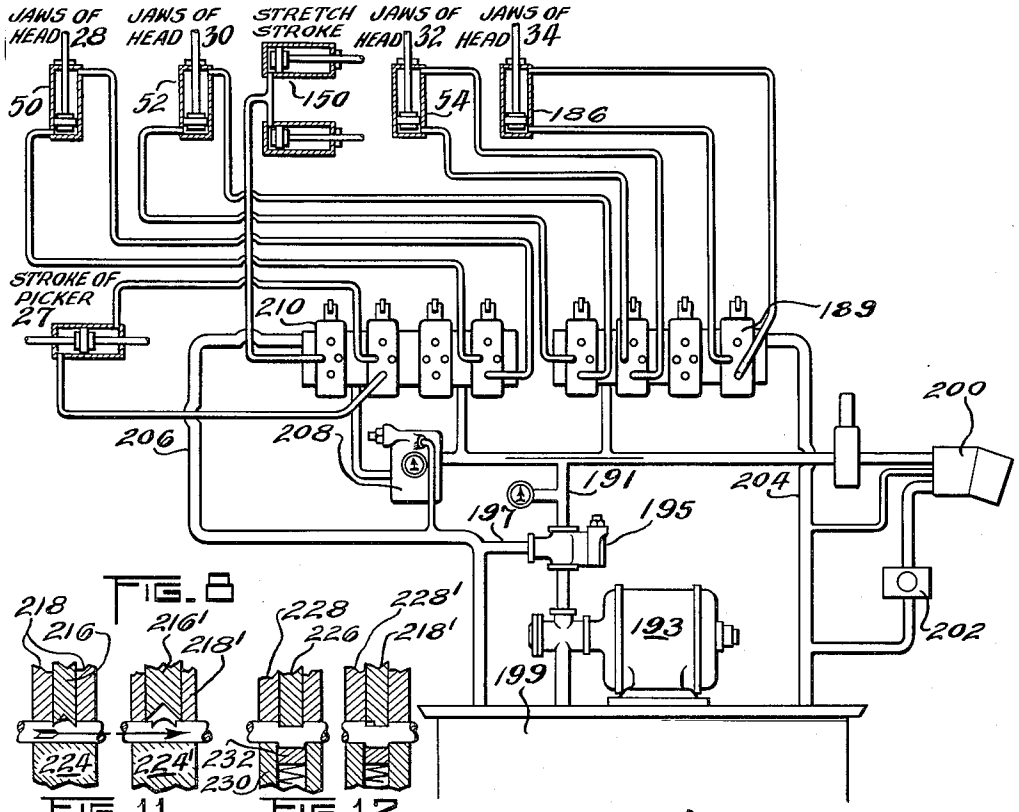

FIG. 8

FIG. 11 FIG. 12

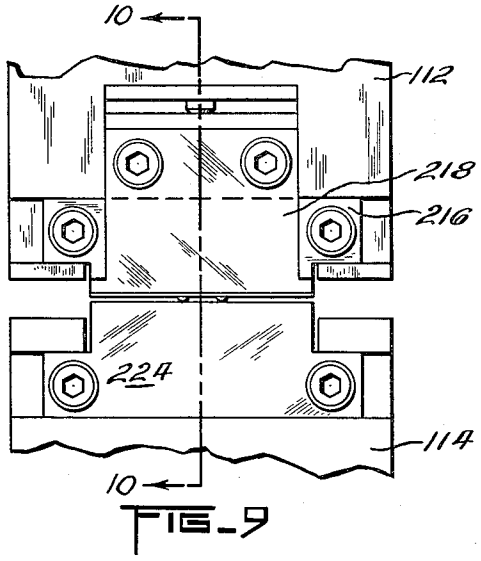

FIG. 9

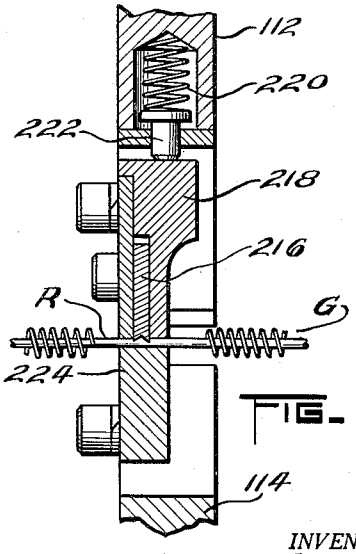

FIG. 10

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AUTOMATIC GRID MACHINE

Original Filed Sept. 3, 1947 5 Sheets-Sheet 5

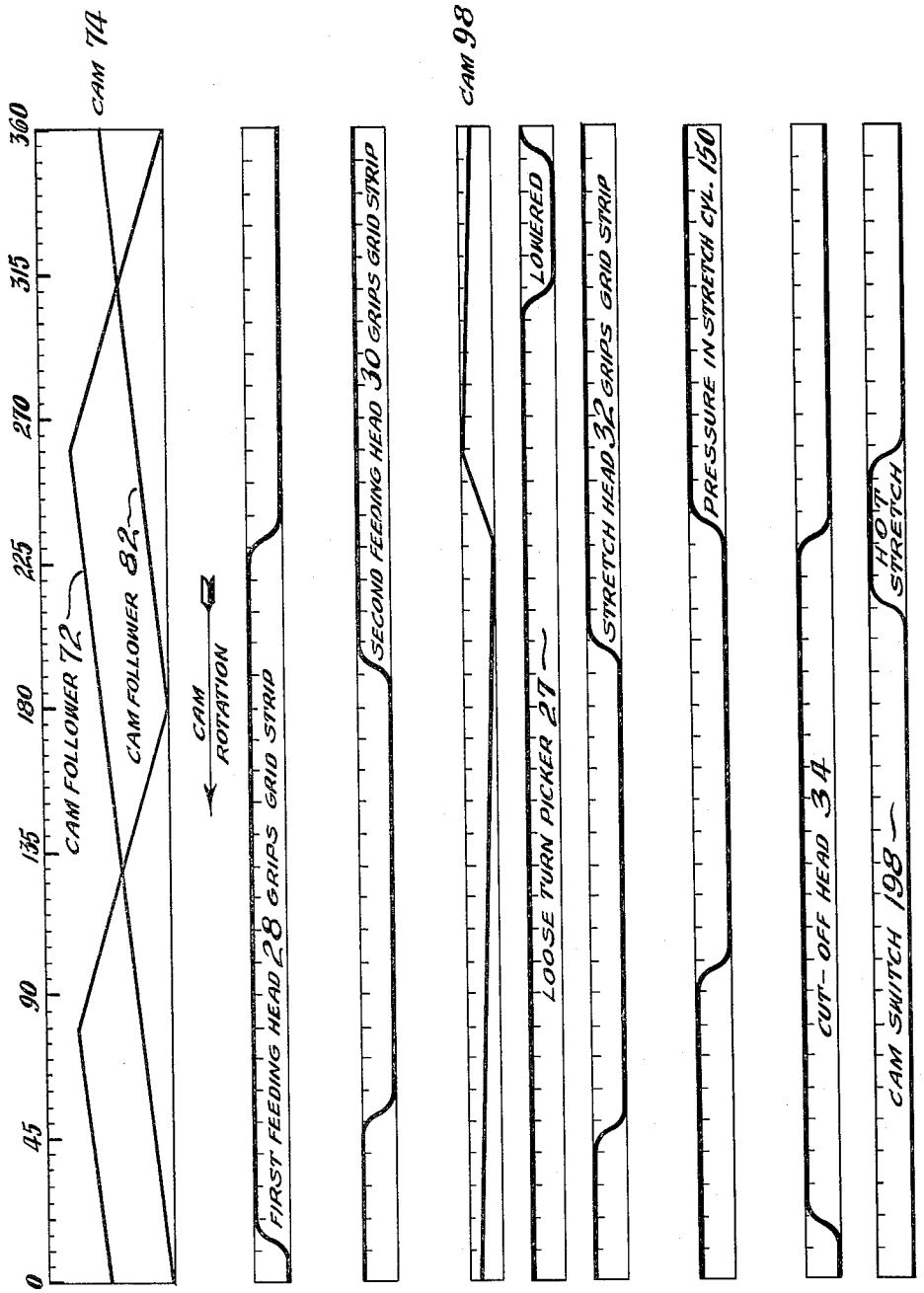

FIG. 17

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United States Patent Office 2,995,156 Patented Aug. 8, 1961

2,995,156

AUTOMATIC GRID MACHINE

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Continuation of application Ser. No. 771,996, Sept. 3, 1947. This application May 21, 1958, Ser. No. 736,925

42 Claims. (Cl. 140—71.5)

This invention relates to machines for making grids for electron discharge devices and the like and to feeding, stretching and severing devices for like machines. This is a continuation of application Serial No. 771,996, filed September 3, 1947, entitled, Automatic Grid Machine.

In a companion application filed concurrently herewith by Stanley J. Gartner, a novel machine for forming a strip of grids in a continuous and automatic fashion is described, with principal emphasis on the forming end of the machine. The form of grid involved includes one or more side rods to which multiple spaced turns of fine wire are secured. The feeding of the grid strip during its formation, accomplished by drawing the side rods past forming devices, should be uniform and reliable to the end that the helical turns of fine wire may be accurately spaced in accordance with design specifications.

It has become accepted practice to stretch the side rods of formed strips of grids, either cold or hot, in order that the grids may be uniform and straight when completed. It is also necessary to divide strips into individual grids. These operations are commonly effected as separate operations, in a discontinuous procedure, following the forming of a strip of grids.

Accordingly it is the principal object of this invention to provide a novel grid-making machine having devices to enable grid strips to be formed very accurately, and to be processed into completed grids in a continuous manner in the forming machine. It will be apparent as the description proceeds that the various features of the illustrative machine described herein may be employed according to my invention without others of the features, but when integrated into a single machine, especially with the grid-forming devices in the above companion application, a grid-making machine of notable characteristics is obtained.

In usual machines the grid lateral is helically wound about the side rods at a constant rate. As a result the spacing between the helical turns is determined by the rate of side-rod feed. Usually the turns of a grid are to be uniformly spaced and the side rods are drawn past the forming devices at a uniform rate. It is nevertheless advisable to advance the side rods very rapidly at the end of each grid-winding cycle so that the number of grid-lateral turns left unsecured, between the wound and secured grid laterals, may be held to a minimum to limit the amount of unsecured grid-lateral wire that is waste. Furthermore it is often necessary to vary the mutual spacing between the secured turns and to accelerate the feed during winding of the widely-spaced loose turns. Accordingly a specific object of the present invention is to devise a feeding mechanism that can be made to cyclically vary the rate of feed of grid side rods according to an arbitrary schedule. A further object in this connection is to provide such feed mechanism in the grid machine that the organization is readily susceptible to change for manufacturing grids of different length and different grid-lateral distribution and spacing.

Another feature of the improved grid machine is the incorporation of an automatic stretching arrangement to straighten the grid side rods without disturbing the continuous cyclic operation. Still another feature is the

incorporation of a severing device to divide the strip into separate grids, and to remove the side-rod material deformed by the gripping faces in the feeding and stretching heads. A further feature is concerned with novel feed-jaw construction for reliably engaging the grid strip, without disturbing the feed rate as would be occasioned by elongation of the strip incidental to ordinary deformation by the feed jaw.

The invention will be better understood from the following specific description of an illustrative embodiment of the invention shown in the attached drawings wherein:

FIG. 1 is a plan view of the preferred embodiment with certain parts broken away and others omitted for clarity.

FIG. 1A is the elevation of an operating cam and hydraulic valve detail.

FIG. 2 is an elevation of the structure in FIG. 1 with parts broken away and omitted for clarity, showing a wiring detail in addition.

FIG. 3 is a longitudinal sectional detail of the mechanism for stretching the side rods.

FIG. 4 is an elevation of the second feed head and operating mechanism, being illustrative of the three other four-motion heads in the machine.

FIG. 5 is a plan view of a portion of the mechanism in FIG. 4.

FIGS. 6 and 7 are alternative forms of grid that can be made with the illustrative machine.

FIG. 8 is a diagram of the hydraulic system for operating various mechanisms in the presently preferred machine.

FIG. 9 is an elevation of the feed jaws of the second feed head, being illustrative of the jaws in the first feed head and the stretch head.

FIG. 10 is a fragmentary sectional view of the feed jaws along the line 10—10 in FIG. 9.

FIGS. 11 and 12 are enlarged sectional detail views of successive feed jaws according to alternative embodiments.

FIG. 13 is a cam chart, corresponding closely to a timing chart of the important operations in the improved grid machine.

GENERAL

Referring now to FIGS. 1 and 2 the side rods R are drawn to the right by the feed mechanism, to be described, through guide tube 10 and laterally supported by mandrel 12 fixed to the end of tube 10. Grid-lateral wire L from reel 14 is directed by guide 16 to the exact point along mandrel 12 where the grid lateral is to be laid. Reel 14 and guide 16 form part of winding head 18 that is rotated about tube 10.

A pair of sharp-edged notching discs 20 are reciprocable in alternation against rods R on mandrel 12 and in advance of the point where guide 16 lays grid lateral L. A pair of blunt-edged peening discs 22 are also reciprocable against mandrel 12, in alternation with each other and in alternation with the adjacent notching disc, to secure the grid-lateral wires in place immediately after they are wound by guide 16 on head 18. Rods R are gradually drawn to the right while the notching, winding and grid-lateral-securing operations take place to form a series of secured turns of grid lateral wire on side rods R, either evenly spaced or unevenly spaced as in the completed grids of FIGS. 6 and 7. At the completion of each sequence of secured turns, the contact between discs 20 and 22 with side rods R is interrupted while the winding of grid-lateral wire continues. During this time the side rods R are advanced to the right more rapidly than usual and several loose turns of grid lateral L are wound. The winding of the loose turns is for the purpose of maintaining continuity of grid lateral L between the sequence of

secured turns that are to form the grid in FIGS. 6 and 7, during those intervals when side rods R are drawn past the grid-forming devices without having grid-lateral wire attached. The rapid side-rod feed provides the necessary lengths of side-rod material for grid terminals and locating extensions, and for deformation incidental to the feeding operations.

A pair of blades **24** and **26** (FIG. 1) and a mechanical picker **27** (FIG. 2) are jointly effective to separate the loose turns from the secured turns and to remove the separated turns from the machine. As a result the uncompleted strip G of grids is drawn to the right beyond the grid forming tools, having groups of secured turns spaced by lenths of bare side-rod wire R.

The devices described to this point are more fully disclosed in U.S. Patent No. 2,759,499 of August 21, 1956, assigned to the assignee of the present invention.

The strip of grid material G is continuously drawn through the machine by a pair of feeding heads **28** and **30** each of which operates in a four-motion path to grip the material, draw it along the machine, release it, and return for a renewed feeding stroke. The timing of the four-motion strokes is such that there is continuous feeding through the machine without a disturbance such as would otherwise cause erratic spacing of the grid-lateral turns. An additional head **32** is provided for stretching the side rods and, optionally, for heating them electrically during the stretching operation. A fourth head **34** divides the grids from each other to yield individual grids, and to cut out the portions of side-rod material that have been deformed by the feeding and stretching heads.

The first feeding head **28** is carried by bracket **36** on shaft **38** which is axially reciprocated parallel to the travel of grid strip G and completes one cycle of reciprocation for each completed grid. Cutting head **34** is also secured to shaft **38** by bracket **40**. A second shaft **42**, parallel to but laterally spaced from shaft **38**, carries bracket **44** for supporting the second feed head **30**. Stretching head **32** is carried on head **30** by a pair of threaded shafts **46** and **48**, but is cyclically movable along the strip of grids in relation to head **30** by hydraulic pistons described below.

Each shaft **38** and **42** is axially reciprocable by cam mechanism for effecting longitudinal movements of the several heads **28**, **30**, **32** and **34** parallel to the travel of the grid strip and in the restoring direction. Hydraulic actuators are used for effecting gripping and separating motions of the maws within the several heads. Hydraulic cylinders **50**, **52** and **54** for this purpose are shown in FIG. 2. The axially reciprocated shafts and the hydraulic actuators are timed to close the jaws of the head of the grid strip, move with the strip, separate and then return, in a four-motion path.

Head travel

The mechanism to operate shafts **38** and **42** axially for moving the feeding, stretching and cutting heads parallel to the grid-strip will now be described. Shaft **38** is supported in a pair of bearings **56** and **58** which are secured to the bed plate **60** of the machine. Shaft **42** is similarly carried by bed plate **60** in bearings **58** and **62**. At the right extremes of shafts **38** and **42** are a pair of fixed abutment rods **64** and **66** having enlarged ends as **68** on rod **64** (FIG. 2) which is slidable in the bored end of shaft **38**. A spring **70** acts between the end of the bore in shaft **38** and enlargement **68** to urge shaft **38** constantly to the left. A similar enlarged end, bore and spring construction urges shaft **42** constantly to the left. Shaft **38** carries cam follower **72**, maintained in contact with cam **74** by spring **70**. Cam follower **72** is adjustable along shaft **38** by means of capstan nut **76**, threaded and shouldered rod **78**, and abutment **80** which is fixed to shaft **38**. By rotating nut **76** when cam **74** is stationary it is possible to adjust the position of the first feeding head **28** and of cutting head **34** along the grid strip. By virtue of these adjustments the feeding heads can be caused to engage grid strip G accurately between the lengths of side rods R to which the grid lateral L is secured, and each of the heads can be made to register with the deformation formed by the preceding head. Cutting head **34** can be adjusted relative to first feeding head **28** by loosening the bracket by which it is carried on shaft **38**. Cam follower **82** on cam **74**, spaced 180° from cam follower **72**, is adjustably carried by shaft **42** and reciprocates heads **30** and **32** along the grid strip.

Cam **74** is rotated by cam shaft **84** which is supported in split bearing **86**, **88** depending from bed plate **60**. Shaft **84** is rotated once for each complete grid cycle by gear **90** driven in turn by pinion **92** on drive shaft **94**.

At its left extreme, shaft **84** carries a cam follower **96** which is held against rotation with that shaft by an arm **95**, and is provided with a thrust bearing. Arm **95** is slidable in fixed grooved plate **97**. Cam follower **96** is urged against cam **98** by the same springs, as **70**, that maintain cam followers **72** and **82** against cam **74**. Cam **98** on shaft **100** is driven from shaft **94** through spiral gears **102** and **104** to reciprocate shaft **84** axially once each grid cycle. Shaft **100** and gear **102** are carried in housing **106** supported from bed plate **60**.

Operation of jaws in heads

Before considering the effect of cams **74** and **98** on the various feeding, stretching and cutoff heads, the nature of an individual head will first be described. For this purpose the second feeding head **30** shown in FIG. 4 is taken as typical. The other heads have the same type of operating linkage and frame construction, although frame details are varied among the heads in order to meet space requirements.

Second feeding head **30** is supported on shaft **42** by bracket **44** including clamping portion **44***a*. This head comprises a frame **108** having a grooved face-portion **110** for laterally guiding a pair of slides **112** and **114** carrying the maws to grip the strip of grid material G. A pair of gibs **116** and **118** are secured to frame **108** to guide and retain slides **112** and **114** against face-portion **110**.

Slides **112** and **114** have similar operating linkages, and are reciprocated toward and away from each other by a common hydraulic actuator. Hydraulic fluid is alternately admitted to lines **120** and **122** supplying cylinder **52** for reciprocating piston **124**. This reciprocatory drive is transmitted to connector **126** by link **128** to operate a pair of bell cranks **130** and **132** which are pivoted on frame **108**. The operative stroke of connector **126** is transmitted through these bell cranks to links **134** and **136** respectively which are secured by eccentrics **138** and **140** to slides **112** and **114**. The eccentrics can be locked in any adjusted position in a suitable manner.

The strokes of jaws **112** and **114** are enforced cyclically by hydraulic pressure, being limited by the excursion of piston **124** in cylinder **52**. The ultimate positions of slides **112** and **114** in engagement with grid strip G are determined by adjustment of eccentrics **138** and **140** and by fixing the length of connector **126** at adjustable portion **142**.

The second feeding head **30** differs notably from the first head **28** and fourth head **34** in that it supports a pair of cylinders and pistons for supporting and operating the third or stretching head **32**. In addition, because of the long space between shaft **42** which supports head **30** and the center of mass of the head, a plate **144** is provided on head **30** for sliding in guide **146** carried by arm **148** rigidly secured to bed plate **60**. Heads **30** and **32** are guarded by this plate and guide construction against pivoting downward about shaft **42**.

Stretching head

The mechanism for operating stretching head **32** is best shown in FIGS. 3, 4 and 5. The stretching of grid strip G is to be effected while the side rods are cold

or, opitonally, while the side rods are electrically heated. For this purpose the heads are electrically insulated apart, as will appear, and a voltage applied between the heads is impressed on the strip.

In FIG. 3 cylinder **150** is shown supported in frame **108** and carrying a piston **152** at the left end of rod **46**. Frame **108** of stretching head **32** is adjustably secured to threaded shaft **46**. When hydraulic fluid is admitted to cylinder **150**, the stroke of piston **152** carries stretching head **32** away from the second feed head **30** at a time when the jaws of both heads **30** and **32** are closed on grid strip G. Second feeding head **30** actually travels along bed plate **60** in drawing the grid strip past the forming devices including the forming head; but piston **152** moves head **32** faster in the feeding direction and stretches the portion of grid strip gripped between heads **30** and **32**.

The extent of stretch is determined by the mechanical stops limiting the stroke of piston **152** in cylinder **150**. At the left end, the wall of cylinder **50** forms a stop. At the right end, collar **154** limits the stroke. Collar **154** is adjustably screwed on the outside of cylinder **150** and is externally fluted for engagement by ball detent **156** secured to frame **108**. Shaft **46** is provided with a keyway **158** and is held against rotation with respect to cylinder **150** by key **160**. The latter is secured to a plug **162** within cylinder **150** by means of a screw **164** the head of which abuts collar **154**. A compression coil spring **166** reacts between piston **152** and plug **162** to maintain screw **164** in contact with collar **154** in all its positions of axial adjustment.

When hydraulic fluid is admitted to cylinder **150** from line **168**, piston **152** is urged to the right extreme as limited by plug **162** which in turn is arrested by collar **154**. Upon release of the hydraulic pressure in line **168**, piston **152** is restored by spring **166** to its left-hand position as shown. Collar **154** is externally provided with a calibrated scale **170** (see FIG. 5) so that extent of stretch of the grid side rods can be accurately changed without trial-and-error procedure.

The structure for operating the second shaft **48**, parallel to shaft **46**, is identical with that shown in FIG. 3 and both are energized by a common hydraulic supply.

For the purpose of heating the side rods electrically during the stretching operation, a controlled voltage is applied between heads **30** and **32**, and for this reason these two heads are electrically insulated apart. The connection of shaft **46** to frame **108'** includes nut **172** spaced from frame **108'** by an insulating washer **174**, and bushing **176** on the opposite side of frame **108'** is spaced from the frame by an insulating bushing **178**. Bushing **176** is held against rotation in relation to insulating bushing **178** by means of key **180** that extends into keyway **158**. Nut **182** on threaded shaft **46** tightens bushings **176** and **178** against frame **108'**, confined by nut **172**. Electrical lines **184** and **186** are connected respectively to heads **30** and **32** and are energized by an appropriate portion of secondary winding **188** of a transformer having a selector tap switch **190**. The primary **192** of this transformer is energized from the usual power supply line through a control relay **194**, switch **196**, and cam switch **198** the purpose of which is to time the start and duration of heating of the side rods. When it is not desired to utilize the hot-stretch provision, switch **196** is opened and grids can then be made according to the cold-stretch procedure. The hydraulic lines feeding cylinders **52** and **54** of heads **30** and **32** are of non-metallic materials and do not short-circuit the hot-stretch electrical circuit.

Hydraulic system and timing chart

From the foregoing, it will be apparent that the longitudinal travel of the first and second feed heads and of the cutting head are effected by cams **74** and **98**. The stretching head **32** travels with head **30**, but is given an augmented excursion by means of hydraulic mechanism including **150**. The jaws in the several heads are all operated, for closing on the grid strip and for opening, by hydraulic mechanism including a cylinder carried by each of the heads and flexible lines leading to them.

The complete hydraulic system for the entire machine is diagrammatically shown in FIG. 8. Cylinders **50, 52, 54** and **186** for operating the jaws of heads **28, 30, 32** and **34** are alternately supplied with high-pressure fluid at opposite ends, and are connected for return of the low-pressure fluid to the supply by means of a series of two-way valves **189**. High-pressure supply line **191** is connected to all of these valves, and it in turn is supplied by pump **193** and pressure regulator **195** which has a return line **197** to sump **199**. Hydraulic motor **200** with its control valve **202** for operating the entire machine is also shown in this diagram. Valves **189** are connected for return of low-pressure fluid through lines **204** and **206** to sump **199**. A second regulator **208** is provided for reducing the available hydraulic pressure to a suitable level for operating the stretching mechanism, including hydraulic cylinder **150**. This mechanism is spring-restored rather than restored by hydraulic pressure. For this reason a slightly different valve **210** is utilized for connecting cylinder **150** alternately for input from regulator **208** and for discharge to return line **206**. Picker **27** is hydraulically operated from the high-pressure lines, as indicated, just as in the case of the jaws in the various heads.

Valves **189** are cam-operated as indicated in FIG. 1A. Plural cams **212** are secured to shaft **214** which is rotated once for each grid cycle, in time with cam-shafts **84** and **100**. Cams are also provided on shaft **214** for operating valve **210** of the stretching head, and for hot-stretch switch **198** shown in FIG. 2. The cam-operated valve detail is naturally subject to wide variation, but the relative timing among the several valves is of importance.

The timing of the various operations will be understood from FIG. 13. While this figure is actually a cam chart it is a close approximation of a timing chart as well. It will be seen from the top section of the chart that cam **74** has portions for causing a gradual uniform forward or feeding stroke of the first and second feeding heads, and a fast return stroke, the division being about 260° and 100° and the return strokes are spaced by 180°. Between zero and 80° and between 180 and 260° both heads move in unison and in the same direction. From the second and third sections of the diagram it is apparent that the jaws of both heads **28** and **30** are in engagement with grid strip G during a part of these concurrent feeding strokes of heads **28** and **30**, and the jaws of one feeding head grip the strip at other times. It therefore follows that the grid strip will be smoothly advanced past the winding and forming devices at the left of FIGS. 1 and 2, and uniform grids will be produced. The lead, or the extent of feed in a grid cycle, is controlled by the extreme limits of cam **74** which is therefore termed the "lead cam."

Cam **98**, it will be seen from the fourth portion of FIG. 13, incorporates a long, very gradual sloping portion and a relatively abrupt return portion. This cam simply varies the feeding rate of the grid strip that would be caused by cam **74**, the abrupt portion serving to impart a fast, long feeding stroke during the winding of the loose turns. The remainder of the cycle of cam **98** modifies the feeding rate of cam **74** during the winding of secured turns. Where this long portion of cam **98** is straight, the pitch of the grids will be uniform from end to end. The spacing between the successive secured turns of the grid can be varied from one end of the grid to the other (FIG. 7) by properly curving cam **98**. Therefore cam **98** is termed the "pitch cam."

When the machine is to be changed from operation on one type of grid to production of another type, cam **74** need not be removed if the length of the new grid is the same as the old one. Cam **98** need not be replaced if

the distribution of the secured turns and the length of the loose-turn zone are not changed.

Comparing the fourth and fifth sections of FIG. 13 it is apparent that the fast-feeding operation that occurs simultaneously with the winding of unsecured turns occurs previous to the stroke of loose-turn picker 27. This is because the grid strip should advance to cutters 24 and 26 before the loose turns are parted from the secured turns. Therefore loose-turn picker 27 is lowered at a later time in the grid cycle, after the winding of a number of secured turns.

Comparing the third and sixth sections of FIG. 13 it can be seen that the jaws of stretching head 32 engage the grid strip shortly after the jaws of head 30 grip the strip. Similarly the stretching-head jaws release the grid strip shortly before the strip is released by the jaws of head 30. The engagement and release of both jaws take place in the region of 190 to 200° and 40 to 50°, respectively. Comparison of the seventh section of FIG. 13 with the sixth section shows that the stretching operation, effected by cylinder 150, takes place after the jaws of streaching head 32 grip the strip and that the piston in cylinder 150 is restored after the jaws of head 32 have released the grid strip. The electrical heating of the side rods is commenced and completed after the grid strip is gripped by both the second feeding head and the stretching head, and the heating is interrupted shortly after pressure is admitted to the stretching cylinders, as 150, after which the strip is supported during cooling.

The operation of cutting head 34 corresponds to that of the first feeding head 28. The cutting head, positioned beyond the stretching head, is not in engagement with the grid strip during the initially effective part of the stretching operation as controlled by cylinder 150. The cut-off head, however, acts to support the end of grid strip G after the previous grid is parted, so that the grid strip will not sag while the jaws of stretching head 32 close to grip the strip.

In FIGS. 9 to 12 there are shown several feed-jaw details which contribute significantly to the excellence of the feeding mechanism. As is apparent from the foregoing, and especially in connection with the overlap in the feeding strokes of the first and second heads, it is desirable that there be no interruption in the smooth travel of the side rods past the forming devices. It is likewise desirable that the feed jaws in the first and second heads do not change the length of those side rods in firmly gripping them, for this would defeat the careful arrangement directed to uniform feeding. One form of feed-jaw detail is shown in FIGS. 1 and 10 as comprising a blade 216 fixed to slide 112 (compare with FIG. 4) and a pressure pad 218 having portions on opposite faces of blade 216. Pad 218 is spring-loaded by compression spring 220 and button 222 to contact grid strip G in advance of blade 216 and to strip the side-rods from blade 216 during the return stroke of slide 112. A positive-acting backup block 224 is secured to slide 114 below grid strip G. As previously mentioned in connection with the mechanism of FIG. 4, slides 112 and 114 are operated to precisely determined end-points, so that blade 216 will penetrate the side rods R of grid strip G to an accurate extent. The jaws of two successively acting heads are shown, enlarged, in FIG. 11. These are illustrative of the first and second feeding heads and of the second feeding head and the stretching head. The surface of blade 216 is formed to cause essentially transverse plastic flow of the side-rod material, thereby causing no elongation of the rod. Similarly shaped blade 216′ is arranged in the following head to take a new bite into the side rod R, still without causing elongation of the side rod. The blades have lateral surfaces that are essentially perpendicular to the side-rods and embody a groove between them for accommodating the lateral flow of side-rod material.

An alternative form of feeding-jaw detail is shown in FIG. 12, wherein a positively operated blade 226, flanked by a pressure pad 228, offsets a portion of the side-rod material without foreshortening or elongating that side rod. The lateral surfaces of blade 226 are essentially perpendicular to the grid strip. The pressure block of FIG. 11 is modified in FIG. 12 to comprise positive-acting portions 230 and a resilient stripping pad 232 between portions 230. This construction also accommodates the lateral flow of side-rod material. The offset formed in the first feed jaw can be reliably used for feeding without further deformation in the arrangement shown by having a narrow positive-acting blade 218 register with the forward edge of the previously formed depression.

The foregoing specification includes a detailed description of an illustrative embodiment of the invention, this embodiment incorporating several closely related features which coact to facilitate and improve the manufacture of grids. However it will be recognized that the particular embodiment is susceptible to a wide latitude of modication and substitution and portions of it are separately useful in improving similar machines. Therefore the following claims should be interpreted broadly, within the spirit of the invention.

What we claim is:

1. In a machine of the type described including means for modifying a strip of material, a feeding mechanism for moving the strip of material past said modifying means according to a cyclic feed-rate schedule, comprising a pair of four-motion feeding heads operable to grip the strip alternately, lead cam mechanism reciprocating said heads along said strip in an alternating relationship through a predetermined stroke, and additional cam mechanism operatively connected to said lead cam mechanism for cyclically modifying the feeding rate that would otherwise be effected by said lead cam.

2. In a machine of the type described including means for modifying a strip of material, a feeding mechanism for moving the strip of material past said modifying means according to a cyclic feed-rate schedule, said feeding mechanism comprising a pair of four-motion feeding heads, a first cam, a pair of spaced cam followers on said cam, one of said followers being operatively connected to each of said feeding heads for reciprocating said feeding heads, and a second cam for cyclically adjusting said first-mentioned cam to modify the feeding rates that would normally be caused by said first cam.

3. A grid-making machine having devices for winding and securing grid-lateral wire about one or more side rods, said machine including a first feeding head and a second feeding head, means for operating each of said first and second feeding heads in alternation in a four-motion path to grip and advance the strips past the winding and forming devices to effect continuous feeding, a cutting head having grid strip engaging jaws, and means for actuating said cutting head in substantial synchronism with the first feeding head to bring said jaws into engagement with the formed grid strip for dividing the formed grid strips into individual grids, the actuating means for said cutting head maintaining said jaws in engagement with the formed grid strip during the return stroke of said second feeding head for supporting the grid strip against deflection during the return stroke of said second feeding head, said second feeding head being positioned between said first feeding head and said cutting head.

4. A grid-forming machine having forming devices for winding and securing grid-lateral wire about one or more side rods, said machine including a feeding mechanism having a four-motion feeding head, means operatively connected to said feeding head for reciprocating said feeding head in a path parallel to the travel of the formed grid strip, and a stretching head carried by said feeding head, means for engaging said stretching head with the grid strip during feeding thereof by said feeding head whereby said stretching head is reciprocable parallel to the travel of the formed grid strip and means for recipro-

cating said stretching head through a longer stroke than said feeding head during feeding for stretching the side rod material.

5. A grid-forming machine having first and second four-motion feeding heads, forming devices for winding and securing grid-lateral wire about one or more side rods, said side rods being continuously advanced past said forming devices by said feeding heads, and a four-motion stretching head located beyond said heads in the feeding direction and carried by one of said heads and means for cyclically operating said four-motion stretching head generally in the same sequence as one of said feeding heads and at a greater rate during its engagement with the formed grid strip to stretch the side-rod material.

6. A grid-making machine comprising devices for winding and securing grid-lateral wire about one or more side rods to form a strip of grid material, a first and a second four-motion feeding head reciprocable to draw the grid strip continuously at predetermined rates past the grid-forming devices, and a four-motion stretching head carried by said second feeding head and means for reciprocating said stretching head at a rate relative to said second feeding head for stretching the grid strip during engagement of the second feeding head and the stretching head with the grid strip.

7. Apparatus according to claim 6 wherein piston and hydraulic cylinder are operatively connected to said stretching head to effect relative travel between said second feeding head and said stretching head.

8. A grid-making machine having devices for forming a helical grid about one or more side rods, said machine having a feeding mechanism including first and second four-motion feeding heads reciprocable parallel to the travel of the formed grid strip and each arranged to engage the grid strip during the respective feeding strokes thereof, hydraulic actuating mechanisms including flexible fluid lines respectively connected to said heads, a stretching head for engaging the grid strip during the feeding thereof by said second feeding head, and hydraulic actuating mechanisms including a flexible fluid line for causing the stretching head to operate through a longer stroke than said second feeding head for stretching the side rods.

9. A grid-making machine comprising devices for winding and securing grid-lateral wire about one or more side rods to form a strip of grid material, first and second four-motion feeding heads reciprocable to draw the grid strip continuously at a cyclic rate schedule past said grid-forming devices, a four-motion stretching head carried by said second feeding head, means for moving said stretching head away from said second feeding head and through a prescribed stroke for stretching the grid-strip during engagement of the second feeding head and the stretching head with the grid strip, means electrically insulating said stretching head from said feeding head, an electrical supply connected to said second head and said stretching head for heating the portion of the grid strip gripped between the latter heads, and hydraulic mechanism including electrically non-conducting fluid supply lines for causing at least one of said latter heads to grip said strip.

10. A grid-making machine including devices for winding and securing helical turns to one or more side rods with predetermined spacing between the turns controlled by the feed-rate of the side-rods past said devices, said machine having a pair of sequentially effective four-motion feeding heads for reliably feeding the side rods according to a predetermined rate schedule, the first head comprising jaws having parallel surfaces with edges arranged to penetrate the side-rod material substantially perpendicularly, said jaws incorporating a recess between said edges for accommodating the transverse flow of side-rod material, and a pair of jaws in the second head for engaging the side rods in registry with the zone previously penetrated.

11. A machine adapted to modify strip material passed through said machine, and including means past which said strip progresses and where operations are performed upon said material, a first and a second gripping head, means operatively connected to said first and second gripping heads to alternately reciprocate said heads back and forth along the path of travel of said strip material, each of said heads having jaws to engage said strip material, means to alternately operate said jaws to continuously draw said material through said machine, and a stretching head carried by the second of said heads, means for mounting said stretching head for movement relative to said second head, said stretching head having jaws to engage said material, means to engage the jaws of said stretching head when the jaws carried by said second head are closed, and means for increasing the spacing between said second head and said stretching head, while the jaws carried by said heads are closed whereby said material is stretched.

12. A machine having strip material feeding means including a pair of sequentially effective four-motion feeding heads reciprocable along the line of travel of said material through said machine, the first of said heads having material clamping jaws with parallel surfaces and edges arranged to penetrate said material perpendicularly, and a recess between said edges for accommodating transverse flow of said material, the second of said heads including material clamping jaws with parallel surfaces and edges arranged to penetrate said material perpendicularly at each side of the points of penetration of said first jaws, the flow of material caused by the clamping of said second jaws taking place into the depressions formed by said first jaws without causing a change of length of said strip material.

13. A grid making machine comprising devices for winding and securing grid lateral wire about one or more side rods to form a strip of grid material, first and second four-motion feeding heads, means for alternately reciprocating said feeding heads to draw said grid strip material continuously at a cyclic rate schedule past said grid forming devices, a four-motion stretching head carried by said second feeding head and having gripping means arranged to clamp said grid strip simultaneously with said second head, means for engaging said gripping means during feeding by said second head, means for reciprocating said stretching head relative to said second head whereby said grid strip is stretched, a cutting head beyond said stretching head and carried by said first head, and means to operate said cutting head to engage said strip simultaneously with said first head to sever the portion of said grid material beyond said cutting head and to support the grid strip between said first feed head and said cutting head.

14. A machine of the type described including means for modifying a strip of material, and a feeding mechanism for moving the strip of material past said modifying means according to a cyclic feed rate schedule, comprising a pair of feeding heads disposed one after the other along the path of travel of said strip of material, lead cam mechanism for reciprocating said heads along said strip in an alternating relationship through a predetermined stroke, clamping jaws on each head, means operatively connected to the respective jaws to close the jaws at one end of each stroke and to open the jaws at the other end of said stroke, and additional cam mechanism operating on said lead cam mechanism for cyclically modifying the rate of travel of said heads.

15. A machine of the type described including means for modifying a strip of material, and a feeding mechanism for moving the strip of material past said modifying means according to a cyclic feed rate schedule, comprising a pair of feeding heads disposed one after the other along the path of travel of said strip of material, a cam follower for each of said feeding heads, a lead cam engaging said cam followers for reciprocating said heads along said strip in an alternating relationship

through a predetermined stroke, clamping jaws on each head, means operatively connected to the respective jaws to close the jaws at one end of each stroke and to open the jaws at the other end of said stroke, and additional cam mechanism operating on said lead cam for cyclically modifying the rate of travel of said heads, said cam followers being mutually spaced about said lead cam.

16. A machine of the type described including means for modifying a strip of material, and a feeding mechanism for drawing a strip of material cyclically past said operating means according to a predetermined feed rate schedule, said feeding mechanism comprising a pair of feeding heads disposed one after the other along the path of travel of said strip of material, each feeding head having a cam follower for reciprocating it along the path of the strip and lead cam mechanism having a cylindrical cam engaging said cam followers for reciprocating said heads along said strip in an alternating relationship through a predetermined stroke, clamping jaws on each head, means operatively connected to the respective jaws to close the jaws at one end of each stroke and to open the jaws at the other end, and additional cam mechanism operating on said lead cam for cyclically modifying the rate of travel of said heads.

17. A machine of the type described including means for modifying a strip of material, and a feeding mechanism for moving the strip of material past said modifying means according to a cyclic feed rate schedule, comprising a pair of feeding heads disposed one after the other along the path of travel of said strip of material, lead cam mechanism for reciprocating said heads along said strip in an alternating relationship through a predetermined stroke, clamping jaws on each head operated to close at one end of each stroke and to open at the other end of said stroke, and additional cam mechanism operating on said lead cam mechanism for cyclically modifying the rate of travel of said heads, one of said heads carrying a set of stretching clamp jaws, means for cyclically causing said stretching jaws to grip said strip while the clamping jaws on said one head are closed, and means for moving said stretching jaws with relation to the clamping jaws on said one head to stretch said strip of material.

18. A machine of the type described including means for modifying a strip of material, and a feeding mechanism for moving the strip of material past said modifying means according to a cyclic feed rate schedule, comprising a pair of feeding heads disposed one after the other along the path of travel of said strip of material, each feeding head having a cam follower associated therewith, a lead cam engaging said cam followers for reciprocating said heads along said strip in an alternating relationship through a predetermined stroke, clamping jaws on each head operated to close at one end of each stroke and to open at the other end of said stroke, and additional cam mechanism operating on said lead cam for cyclically modifying the rate of travel of said heads, said cam followers being mutually spaced about said lead cam, one of said heads carrying a set of stretching clamp jaws, means for cyclically causing said stretching jaws to grip said strip while the clamping jaws on said one head are closed, and means for moving said stretching jaws with relation to the clamping jaws on said one head to stretch said strip of material.

19. A grid forming machine having first and second feeding heads disposed one after the other along the path of travel of said grid, clamping jaws on each head, means connected to said clamping jaws to close at one end of each stroke and to open at the other end, forming devices for winding and securing grid lateral wire about one or more side rods, means for reciprocating said feeding heads such that said side rods are continuously advanced past said forming devices by the alternate reciprocating action of said feeding heads, and a stretching head located beyond said heads in the feeding direction and carried by one of said heads and including clamping jaws, means for cyclically operating said clamping jaws of said stretching head in the same sequence as the jaws of one of said feeding heads, and means for moving said clamping jaws of said stretching head with respect to said one of said feeding heads.

20. A machine of the type described including means for modifying a strip of material, and a feeding mechanism for moving the strip of material past said modifying means according to a cyclic feed rate schedule, comprising a pair of feeding heads disposed one after the other along the path of travel of said strip of material, cam mechanism for reciprocating said heads along said strip in an alternating reltaionship through a predetermined stroke, clamping jaws on each head, means operatively connected to the jaws on the respective heads to close the jaws at one end of each stroke and to open the jaws at the other end of said stroke, said jaws having lateral surfaces substantially transverse of said strip of material and incorporating a recess between said surfaces for accommodating transverse flow of said material.

21. A machine of the type described including means for modifying a strip of material, and a feeding mechanism for moving the strip of material past said modifying means according to a cyclic feed rate schedule, comprising a pair of feeding heads disposed one after the other along the path of travel of said strip of material, cam mechanism for reciprocating said heads along said strip in an alternating relationship through a predetermined stroke, clamping jaws on each head, means operatively connected to the jaws on the respective heads to close the jaws at one end of each stroke and to open the jaws at the other end of said stroke, the jaws of the first of said heads including a blade for deforming the strip of material laterally while maintaining its length constant, and the second of said heads having jaws registering with the deformation previously affected by jaws of said first head.

22. A machine of the type described including means for modifying a strip of material, and a feeding mechanism for moving the strip of material past said modifying means according to a cyclic feed rate schedule, comprising a pair of feeding heads disposed one after the other along the path of travel of said strip of material, cam mechanism for reciprocating said heads along said strip in an alternating relationship through a predetermined stroke, clamping jaws on each head, means operatively connected to the jaws on the respective heads to close the jaws at one end of each stroke and to open the jaws at the other end of said stroke, the jaws of the first of said heads having parallel surfaces with edges arranged to penetrate a strip of material substantially perpendicularly of the length of said strip, said jaws incorporating a recess between said edges for accommodating transverse flow of said material, and the jaws in the second of said heads engaging the strip of material in registry with the zone previously penetrated by the jaws of said first head.

23. A machine of the type described including means for modifying a strip of material, and a feeding mechanism for moving the strip of material past said modifying means according to a cyclic feed rate schedule, comprising a pair of feeding heads disposed one after the other along the path of travel of said strip of material, cam mechanism for reciprocating said heads along said strip in an alternating relationship through a predetermined stroke, clamping jaws on each head operated to close at one end of each stroke and to open at the other end of said stroke, the clamping jaws on each head including a blade mounted transversely of the strip of material gripped thereby, the blade of the clamping jaws of the first of said heads acting to offset a portion of the strip of material gripped thereby and the blade in the clamping jaws of the second of said heads being adjusted

to clamp said strip of material in the offset formed by the blade in the first of said heads, the blade in the second of said heads being narrower than the blade in the first of said heads to prevent the clamping operation from modifying the length of said strip of material.

24. A machine of the type described including means for modifying a strip of material, and a feeding mechanism for moving the strip of material past said modifying means according to a cyclic feed rate schedule, comprising a pair of feeding heads disposed one after the other along the path of travel of said strip of material, lead cam mechanism for reciprocating said heads along said strip in an alternating relationship through a predetermined stroke, clamping jaws on each head operated to close at one end of each stroke and to open at the other end of said stroke, one of said heads carrying a set of stretching clamp jaws, means for cyclically causing said stretching jaws to grip said strip while the clamping jaws on said one head are closed, and means for moving said stretching jaws with relation to the clamping jaws on said one head to stretch said strip of material.

25. A machine of the type described including means for modifying a strip of material, and a feeding mechanism for moving the strip of material past said modifying means according to a cyclic feed rate schedule, comprising a pair of feeding heads disposed one after the other along the path of travel of said strip of material, lead cam mechanism for reciprocating said heads along said strip in an alternating relationship through a predetermined stroke, clamping jaws on each head, means operatively connected to the jaws on the respective heads to close the jaws at one end of each stroke and to open the jaws at the other end of said stroke, one of said heads carrying a set of stretching clamp jaws, means for cyclically causing said stretching jaws to grip said strip while the clamping jaws on said one head are closed, and means for moving said stretching jaws with relation to the clamping jaws on said one head to stretch said strip of material, means for insulating said stretching clamp jaws from the one of said heads carrying said stretching clamp jaws and means for applying an electrical potential difference between said one of said heads and said stretching clamp jaws.

26. In a machine having a feeding mechanism operable for moving a strip of material through said machine, said feeding mechanism including a pair of heads each having material gripping jaws constructed and arranged to firmly grip said material in succession at the same point, the first one of said gripping jaws being recessed whereby a portion of said material strip is deformed into said recess, the second one of said jaws being arranged to engage said strip of material at each side of the zone of engagement of the first jaws.

27. A grid-forming machine having devices for forming a helical grid about side rods as a grid strip, said machine having a feeding mechanism for drawing said side rods past the forming devices at a predetermined feed rate, a stretching device arranged along the path of said grid strip and having gripping means selectively engageable with said grid side rods, operating means engaging said gripping means with said side rods, said stretching device cooperating with said feeding mechanism for imparting stretch to said side rods, and means for moving said stretching device with said gripping means engaging said side rods along said path at a rate in excess of said predetermined feed rate, whereby a stretching and straightening action is exerted on said side rods.

28. In a grid-forming machine, means for performing an operation on a grid, and a feeding mechanism for moving said grid according to a cyclic feed-rate schedule, said feeding mechanism including a pair of four-motion feeding heads, a first cam, a pair of cam followers engaging said cam, one of said followers being operatively connected to each of said feeding heads for reciprocating said feeding heads, a second cam, and a cam follower engaging said second cam and operatively connected to said first cam for cyclically shifting said first cam.

29. In a grid-making machine, means for winding and securing grid-lateral wire about one or more side rods in a grid strip, a first feeding head, a second feeding head, means for moving each of said feeding heads in a four-motion feed path having a forward stroke for gripping and advancing said grid strip and a return stroke, means for moving said feeding heads in alternation to effect continuous feeding, a cutting head, means for operating said cutting head in substantial synchronism with said first feeding head for dividing said grid strip into individual grids, said cutting head being operative to support said grid strip against deflection during the return stroke of said second feeding head.

30. A grid-forming machine including means for modifying a strip of material, and a feed mechanism for moving the strip of material past said modified means according to a cyclic feed rate schedule, said feeding mechanism comprising a pair of heads disposed along the path of travel of said strip of material, mechanisms for moving said heads along said path of travel in alternate relationship and through a predetermined stroke, feeding clamp jaws on each of said heads arranged to close at a predetermined point along said stroke, a set of stretching clamp jaws, means for mounting said stretching clamp jaws on one of said heads for normal movement therewith and for movement relative thereto, means for cyclically causing said stretching clamp jaws to grip said strip while said feeding clamp jaws on said one head are closed, and means for moving said streching clamp jaws with relation to said feeding clamp jaws on said one head to stretch said strip of material.

31. A grid-forming machine including means for modifying a strip of material, and a feed mechanism for moving the strip of material past said modifying means according to a cyclic feed rate schedule, said feed mechanism comprising a pair of heads disposed along a path of travel of said strip of material, feeding clamp jaws on each of said feed heads operated to periodically close for gripping said strip of material, one of the feeding clamp jaws of the first of said heads having a notch therein transverse of said strip of material, said one of the feeding clamp jaws of the first of said heads acting in clamping to provide notches transverse to the length of said strip of material, the feeding clamp jaws of the second of said heads having a notch therein transverse to the length of said strip of material, said notch being broader than the notch in said first named feeding clamp jaws whereby the feeding clamp jaws of the second of said heads in clamping on said strip of material deforms the material of said strip into the notches formed by the first named feeding clamp jaws.

32. In a grid-making machine, means along a predetermined path for modifying a grid strip, and feeding mechanisms operative along said predetermined path for moving said grid strip past said modifying means according to a cyclic feed-rate schedule, said feeding mechanisms including first and second heads each mounted for reciprocating movement along said predetermined path, strip-engaging means on each of said heads, means operative at selected intervals in said feed-rate schedule for moving said strip-engaging means into gripping engagement with said grid strip, a first cam, first and second cam followers under control of said first cam, means connecting said first follower to said first head, means connecting said second follower to said second head, and means including a second cam operatively connected to said first cam for cyclically adjusting said first cam in relation to said first and second cam followers to modify the feeding rates of said first and second heads as normally determined by said first cam.

33. In a grid-making machine, means along a predetermined path for modifying a grid strip, and feeding mech-

anisms operative along said predetermined path for moving said grid strip past said modifying means according to a cyclic feed-rate schedule, said feeding mechanisms including first and second heads each mounted for reciprocating movement along said predetermined path, strip-engaging jaws on each of said heads, means operative at selected intervals for moving said jaws toward each other and into engagement with said grid strip, a first cam, first and second cam followers mutually spaced about and under control of said first cam, means connecting said first follower to said first head, means connecting said second follower to said second head, said first cam and said first and second cam followers being arranged to time the reciprocation of said first and second heads whereby during the return stroke of one head, the other head is driven through its feed stroke, and means including a second cam operatively connected to said first cam for axially shifting said first cam to modify the feeding rates of said first and second heads as normally determined by said first cam.

34. In a grid-making machine, means along a predetermined path for winding and securing a grid lateral about side rods in a grid strip, feeding mechanisms operative along said predetermined path for moving said grid strip past the winding and securing means according to a cyclic feed-rate schedule, said feeding mechanisms including first and second feeding heads each mounted for reciprocating movement in alternation along said predetermined path, strip-engaging jaws on each of said feeding heads, means operative during the forward feeding stroke of the respective feeding heads for closing said jaws into engagement with said grid strip, respective drive means operatively connected to said first and second feeding heads for moving said first and second feeding heads in alternation, a cutting head operatively connected to said first feeding head for reciprocation therewith, cutting jaws on said cutting head, means operative in substantial synchronism with the closing of the jaws of said first feeding head for closing said cutting jaws on said grid strip to divide said grid strip into individual grids, said cutting jaws remaning closed during the return stroke of said second feeding heads to support said grid strip against deflection, a stretching head operatively connected to said second feeding head for reciprocation therewith, stretching jaws on said stretching head, means operative in substantial synchronism with the closing of the jaws of said second feeding head for closing said stretching jaws on said grid strip, and means operatively connected to said stretching head for moving said stretching head away from said second feeding head during the forward feeding stroke of said second feeding head.

35. A grid-forming machine including means along a predetermined path for modifying a strip of material, and a feed mechanism for moving said strip past said modified means according to a cyclic feed rate schedule, said feeding mechanism comprising a pair of feeding heads disposed along the path of travel of said strip, driving mechanisms for moving said feeding heads along said path of travel in alternate relationship, strip-engaging means on each of said feeding heads arranged to close on said strip, a stretching head operatively connected to one of said feeding heads, strip-engaging means on said stretching head arranged to close on said strip, means for closing the strip-engaging means of said stretching head on said strip while said strip-engaging means on said one feeding head is closed on said strip, and means for moving said stretching head through a longer stroke than said one feeding head while the respective strip-engaging means are closed to stretch said strip of material.

36. In a grid-making machine, means along a predetermined path for modifying a grid strip of the type including side rods and a grid lateral wound about said side rods, and feeding mechanisms including at least one head operative along said predetermined path for moving said grid strip past said modifying means according to a cyclic feed-rate schedule, strip-engaging jaws on said head movable into engagement along the length of said side rods of said grid strip, said strip-engaging jaws being constructed and arranged to cause transverse flow of the material of said side rods within the limits of said strip-engaging jaws whereby said side rods are reliably gripped without elongation of said side rods, said strip-engaging jaws having lateral surfaces extending substantially transverse of said side rods, there being a recess formed between said lateral surfaces for accommodating said transverse flow of the material of said side rods.

37. In a grid-making machine, means along a predetermined path for modifying a grid strip of the type including side rods and a grid lateral wound about said side rods, and feeding mechanisms operative along said predetermined path for moving said grid strip past said modifying means according to a cyclic feed-rate schedule, said feeding mechanism including first and second heads each mounted for reciprocating movement along said predetermined path, strip-engaging means on each of said heads movable into engagement along the length of said side rods of said grid strip, the respective strip-engaging means being constructed and arranged to deform said side rods and to cause transverse flow of the material of said side rods within the limits of the strip-engaging means whereby said side rods are reliably gripped without elongation of said rods, the strip-engaging means on said first head including a blade deforming the material of the side rods laterally, the strip-engaging means on said second head including jaws registering with the deformation caused by said blade.

38. In a machine for modifying a strip of material passing along a path of travel through said machine, means along said path for performing operations on said strip, first and second gripping heads, means operatively connected to said gripping heads for alternately reciprocating said gripping heads back and forth along said path, movable jaws on each of said gripping heads for gripping said strip, means operatively connected to said jaws for alternately operating said jaws to continuously draw said strip through said machine, a stretching head carried by said second gripping head, means mounting said stretching head for movement relative to said second gripping head, movable jaws on said stretching head, means operatively connected to the jaws of said gripping head for closing same when the jaws of said second gripping head are closed, means operatively connected between said second gripping head and said stretching head for increasing the spacing between said second gripping head and said stretching head when the jaws on the respective heads are closed whereby said strip is stretched, and means for passing a current through said strip during stretching, the jaws of each of said heads being constructed and formed to grip said strip without changing the length of said strip.

39. In a machine for modifying a strip of material passing along a path of travel through said machine, means along said path for performing operations on said strip, first and second gripping heads, means operatively connected to said gripping heads for alternately reciprocating said gripping heads back and forth along said path, movable jaws on each of said gripping heads for gripping said strip, means operatively connected to said jaws for alternately operating said jaws to continuously draw said strip through said machine, a stretching head carried by said second gripping head, means mounting said stretching head for movement relative to said second gripping head, movable jaws on said stretching head, means operatively connected to the jaws of said gripping head for closing same when the jaws of said second gripping head are closed, means operatively connected between said second gripping head and said stretching head for increasing the spacing between said second gripping head and said stretching head when the jaws on the respective

heads are closed whereby said strip is stretched, and means for heating said strip as said strip is stretched.

40. A machine comprising strip material feeding mechanisms including first and second feeding heads each mounted for reciprocating movement along the line of travel of said strip material through said machine, each of said feeding heads including a movable jaw having a blade provided with lateral surfaces substantially perpendicular to said line of travel and pressure pads flanking said blade and abutting said lateral surfaces, and a fixed jaw including a back-up member cooperating with said pressure pads and a spring-mounted stripper member depressible to accommodate lateral flow of said strip material, the blade of said second feeding head being arranged to register in the depression formed in said strip material by the blade of said first feeding head.

41. A machine comprising strip material feeding mechanisms including sequentially effective first and second feeding heads each mounted for reciprocating movement along the line of travel of said strip material through said machine, each of said feeding heads including a movable jaw having a blade provided with lateral surfaces substantially perpendicular to said line of travel and edges arranged to penetrate said strip material, said blade being formed with a recess between said edges for accommodating transverse flow of said strip material, pressure pads flanking said blade and abutting said lateral surfaces, and a fixed jaw including a back-up member cooperating with said movable jaw, the edges of the blade of said second feeding head being arranged to penetrate said strip material at points outwardly of the points of penetration of the edges of the blade of said first feeding head whereby the transverse flow of strip material brought about by gripping of said second feeding head takes place into depressions formed by said first feeding head.

42. In a grid-making machine, means along a predetermined path for modifying a grid strip, feeding mechanisms operative along said predetermined path for moving said grid strip past said modifying means according to a cyclic feed-rate schedule, rotary lead cam means in a normal operative position, driving connection including cam followers between said lead cam means and said feeding mechanisms for moving said feeding mechanisms, means for mounting said rotary lead cam means for movement relative to said normal operative position, additional cam means, and additional driving connections between said lead cam means and said additional cam means whereby said additional cam means shifts said lead cam means for cyclically modifying the feed rate that would otherwise be affected by said lead cam means.

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