Jan. 15, 1935. A. C. OAKES 1,988,393

GLASS CUTTING APPARATUS

Filed July 10, 1933 4 Sheets-Sheet 1

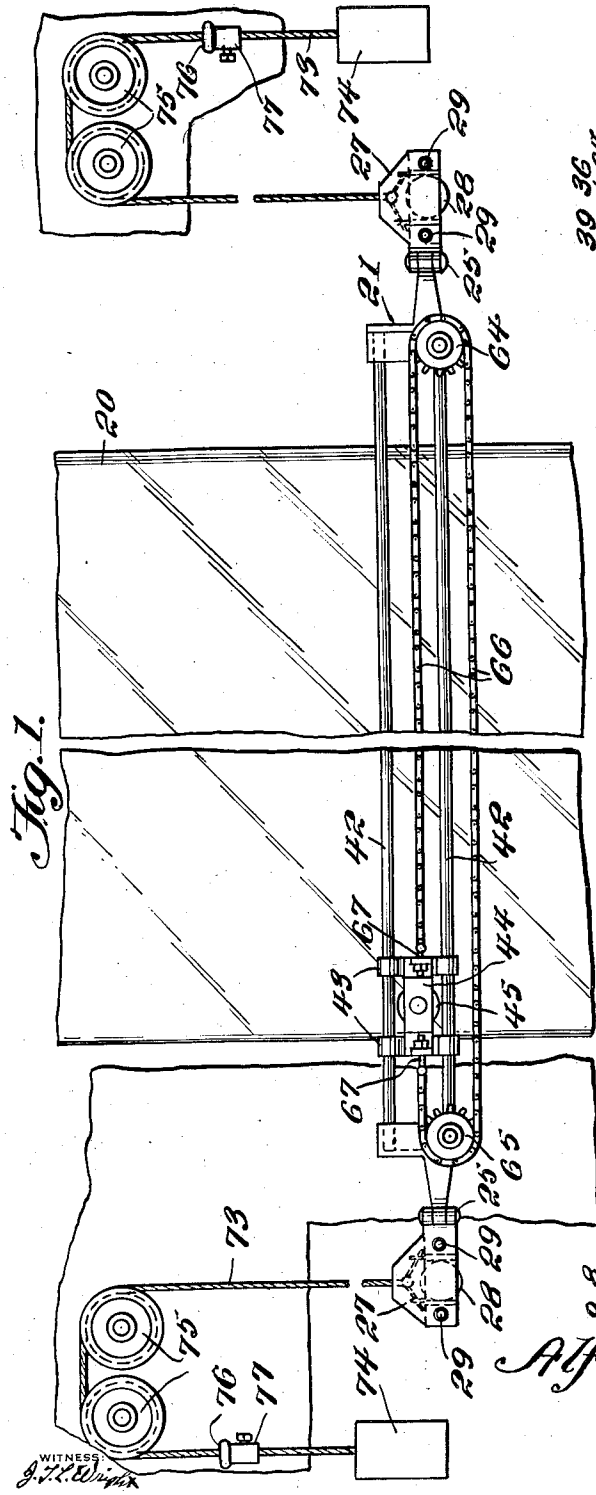


Fig. 1.

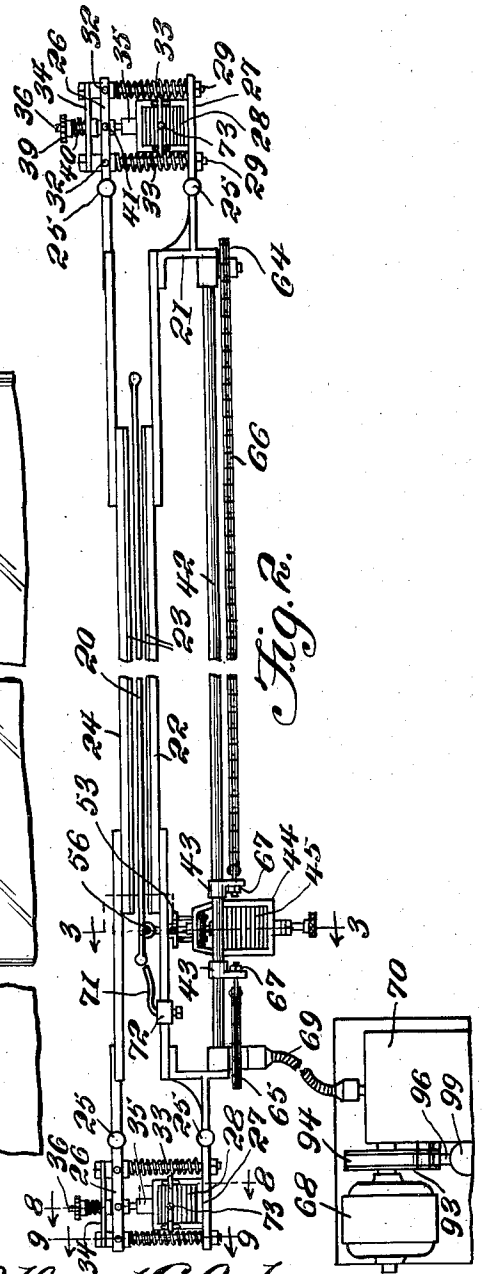


Fig. 2.

WITNESS:
J. F. E. Wright

Alfred C. Oakes INVENTOR

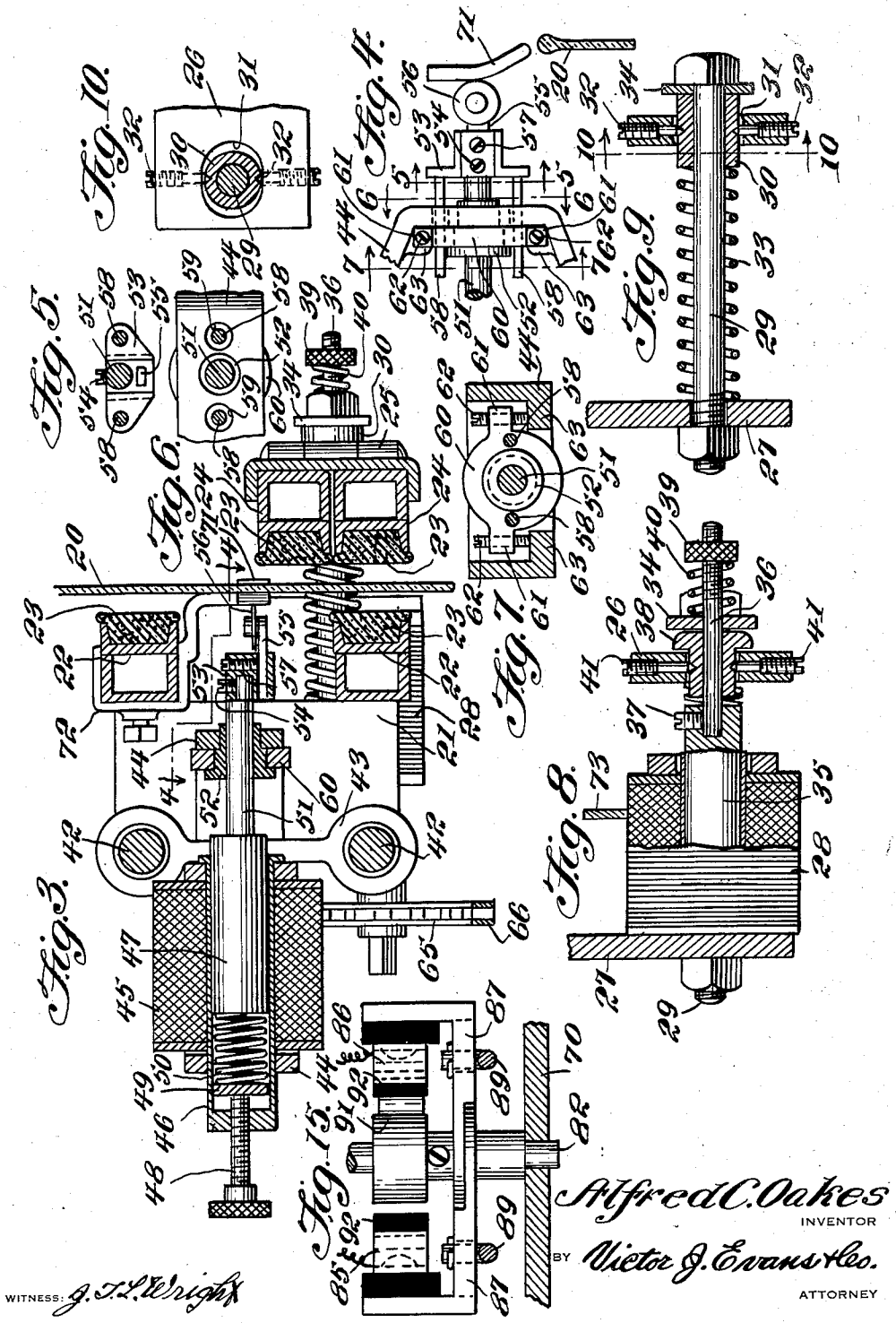
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GLASS CUTTING APPARATUS

Filed July 10, 1933 4 Sheets-Sheet 2



WITNESS: J. T. L. Wright

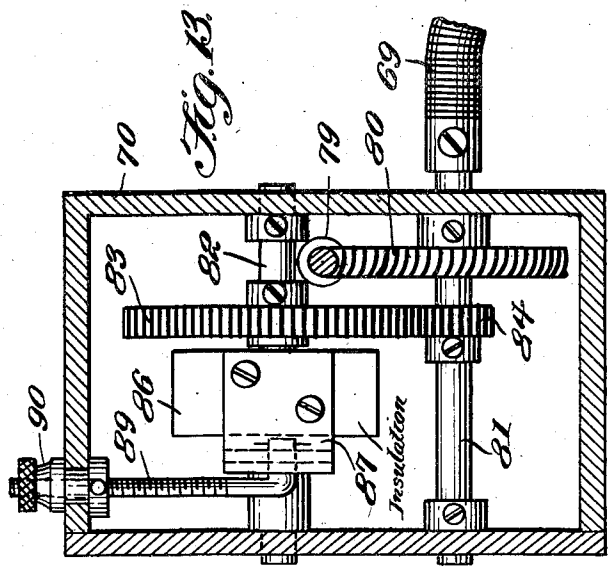
Alfred C. Oakes
INVENTOR

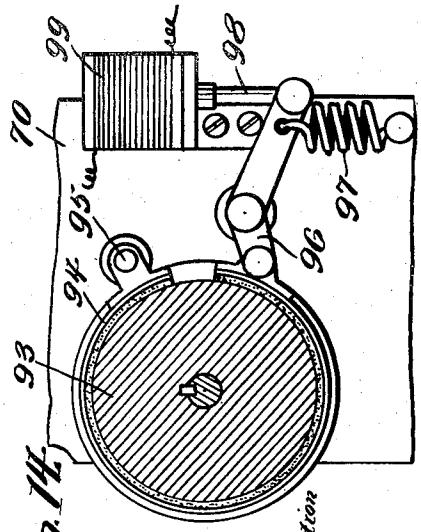
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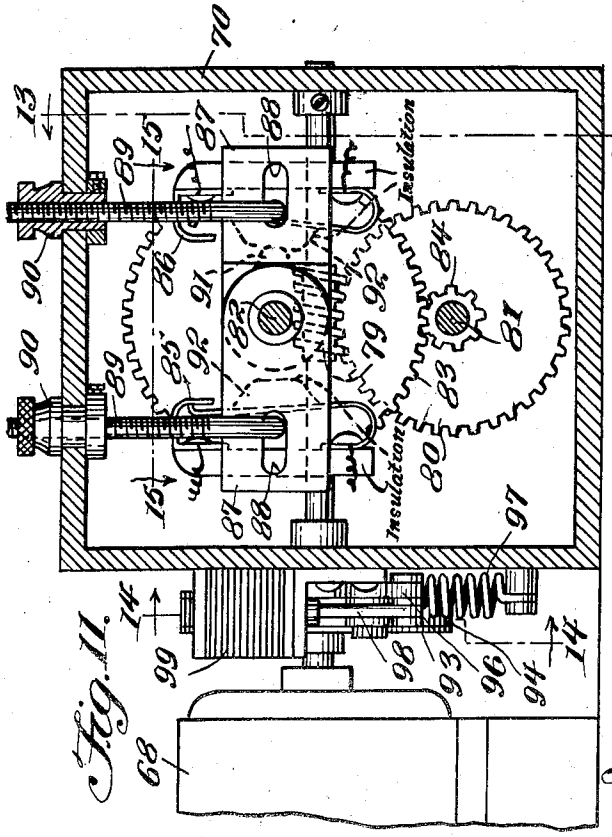
Jan. 15, 1935. A. C. OAKES 1,988,393

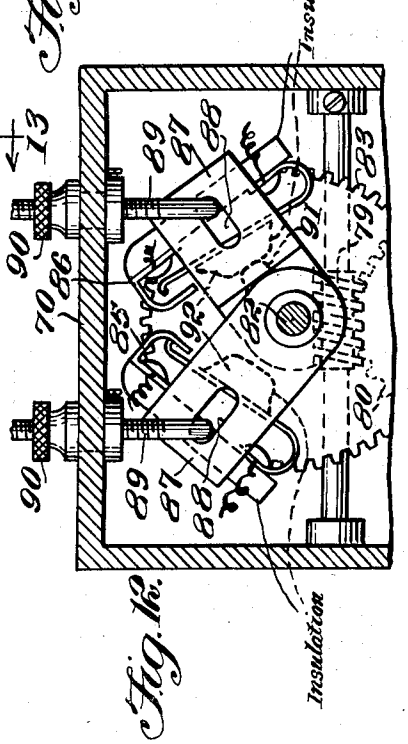
GLASS CUTTING APPARATUS

Filed July 10, 1933 4 Sheets-Sheet 3









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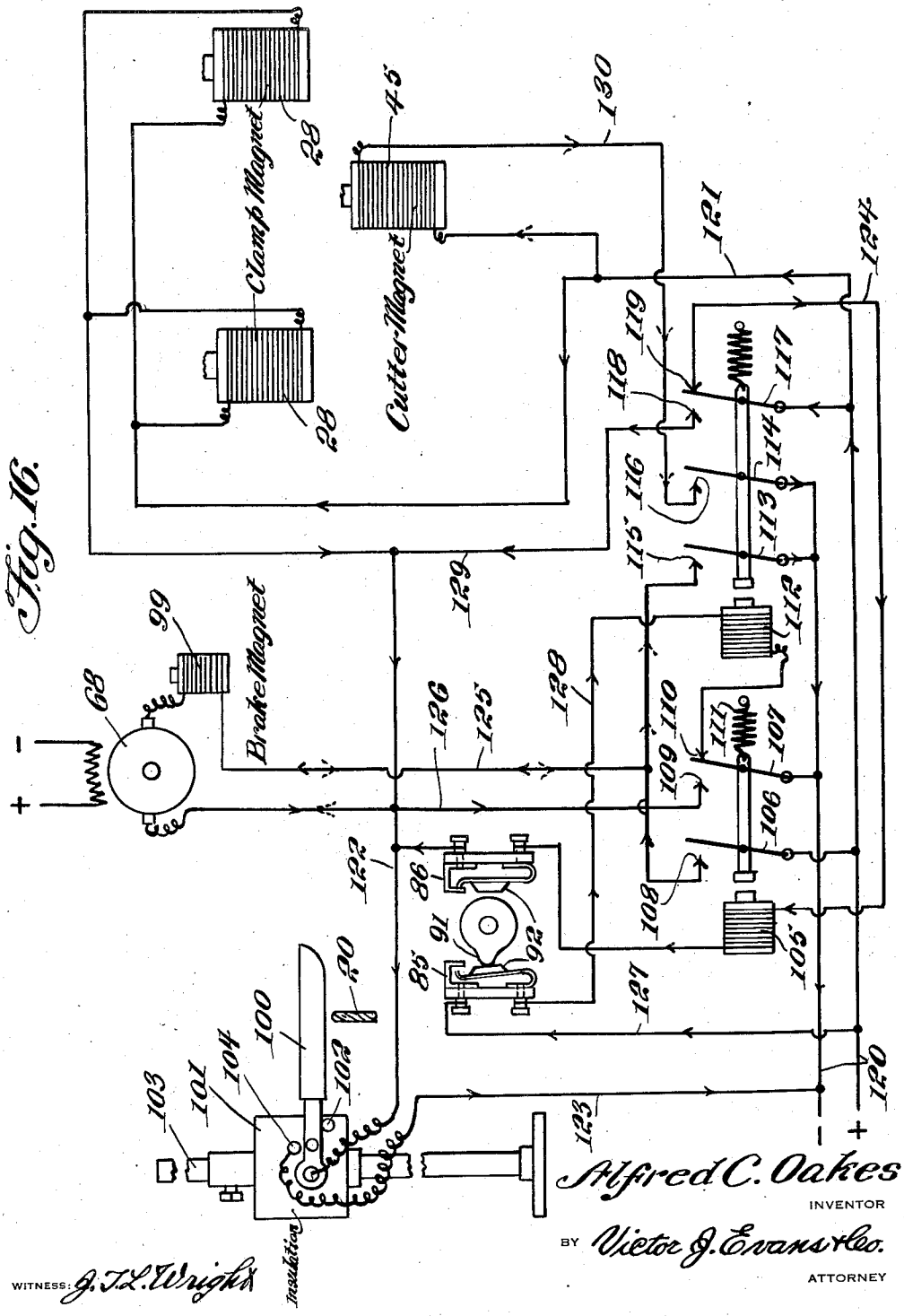
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WITNESS: J. T. Wright

Jan. 15, 1935. A. C. OAKES 1,988,393

GLASS CUTTING APPARATUS

Filed July 10, 1933 4 Sheets-Sheet 4



Patented Jan. 15, 1935 1,988,393

UNITED STATES PATENT OFFICE

1,988,393

GLASS CUTTING APPARATUS

Alfred C. Oakes, Mount Vernon, Ohio

Application July 10, 1933, Serial No. 679,801

12 Claims. (Cl. 33—32)

The object of the invention is to provide a glass cutting apparatus particularly adapted for use in cutting a moving ribbon of glass, so that the score line may be maintained at right angles to the longitudinal edge of the ribbon to insure making a straight cut; to provide glass cutting apparatus in which the cutter is mounted for movement along a bodily movable carrier having means to releasably secure it to the moving ribbon; to provide for flexibly supporting the carrier, so that it may return to its original or starting position after each cutting operation; to provide a construction of the kind indicated in which the cutting operations are automatically carried out as the ribbon of glass moves, so that sheets of the desired height may be successively removed; to provide means for varying the time interval in the cutting operation to make for a corresponding change in the height of the glass sheets being cut; and generally to provide a glass cutting apparatus which, for the functions to be performed, is of comparatively simple form and susceptible of cheap manufacture and installation.

With this object in view, the invention consists in a construction and combination of parts of which a preferred embodiment is illustrated in the accompanying drawings but to which embodiment the invention is not to be restricted. Continued use in practice may dictate certain changes or alterations and the right is claimed to make any which fall within the scope of the annexed claims.

In the drawings:

Figure 1 is a side elevational view of the invention.

Figure 2 is a top plan view.

Figure 3 is a sectional view on the plane indicated by the line 3—3 of Figure 2.

Figure 4 is a sectional view on the plane indicated by the line 4—4 of Figure 3.

Figures 5, 6 and 7 are sectional views on the planes indicated by the lines 5—5, 6—6 and 7—7 respectively of Figure 4.

Figures 8 and 9 are sectional views on the planes indicated by the lines 8—8 and 9—9 respectively of Figure 2.

Figure 10 is a sectional view on the plane indicated by the line 10—10 of Figure 9.

Figure 11 is an elevational view, partly in section, of the traveler actuating motor and its attendant gearing and associated switches.

Figure 12 is a view similar to Figure 11 but showing the adjusted or changed position of the switches.

Figures 13, 14 and 15 are sectional views on the planes indicated by the lines 13—13, 14—14 and 15—15 respectively of Figure 11.

Figure 16 is a diagrammatic view showing the wiring connections between the different elements constituting the invention.

Designed particularly as a means for effecting a transverse cut on a ribbon of glass 20 as it is drawn from the drawing chamber of a glass furnace, the invention comprises a carrier composed of a frame 21 on the rear face of which are mounted the clamping jaws 22, these jaws being laterally spaced and each incorporating a channel in which is seated a wire mesh asbestos fabrication 23 which will give the jaw a comparatively soft face for contact with the glass ribbon without damage to the latter and which itself will not be subject to the deleterious effects of the heat from the glass. The two jaws 22 are designed for contact with the front face of the glass ribbon and there are provided companion jaws 24 for contact with the rear face of the ribbon. But these jaws 24 are in closely spaced parallel relation. Operative connection between the jaws 24 and the frame 21 is effected through the instrumentality of jaw actuating devices with which the jaws 24 and frame 21 are connected by means of hinge elements 25 which connect the jaws 24 and frame 21 respectively to the flat bars 26 and 27. Seated upon and secured to each of the bars 27 is a magnet 28 of the long-range or solenoid type and the two bars are connected together for movement toward and away from each other by means of bolts 29 positioned on diametrically opposite sides of the magnet. On each of the bolts 29 there is disposed a sleeve 30 which passes through a clearance opening 31 in the bar 26. A rocking connection is effected between the sleeve 30 and the bar 26 by means of set screws 32 which are passed transversely through the bar 26 and enter the opening 31 in diametrically opposite sides to engage in conical seats in the sleeve. Each of the bolts 29 is surrounded with a compression spring 33, bearing one end on the bar 27 and the other end on the sleeve 30. By reason of the set screws effecting connection between the bar 26 and sleeves 30, a more or less flexible connection is provided. But the bolts 29 are additionally connected by means of a plate 34 through which they extend and which rests on top of the sleeves 30.

While the magnet 28 is secured to the bar 27, it is operatively connected with the bar 26 by

reason of its plunger 35 being provided with a stem 36 (seated in a bore in the end of the plunger and secured in place therein by a set screw 37), which stem passes through a thimble 38, through an opening in the plate 34 and receives on its threaded extremity a nut 39, between which and the plate 34 there is a compression spring 40 disposed in surrounding relation to the stem. The plate 34 bears against the outer end of the thimble and the latter is operatively connected with the bar 26 by means of set screws 41 passing through the latter on opposite sides and entering seats in the periphery of the thimble, the latter passing through a clearance opening in the bar 26.

With this construction, it is obvious that if the magnets 27 be energized, the cores will be drawn in and relative movement of the bars 26 and 27 effected, so that the gripping jaws 22 and 24 are moved towards each other and into gripping engagement with the glass ribbon, when the carrier will be moved along with the ribbon. In this jaw engaging operation, the springs 33 are compressed and the gripping action is cushioned by reason of the movement of the magnet cores being imparted to the bars 26 through the compression springs 40. The compression springs 40 preclude such an impact in the gripping operation as would damage the glass ribbon.

Formed as a part of the frame 21 are the spaced parallel guide rods 42 on which is slidably mounted a crosshead 43 of a traveler by means of which the glass cutter is carried and actuated. There is connected with the crosshead a frame 44 in which is disposed a magnet 45 of the solenoid type having a sleeve 46 in which the plunger 47 is slidably mounted, the sleeve 46 being closed at one end and carrying in this closed end an adjusting screw 48 which interior to the sleeve is provided with a head 49 bearing on one end of a compression spring 50, the other end of which bears on the inner end of the plunger or core 47. The core 47 is formed with a stem 51 which passes slidably through a bushing 52 mounted in the frame 44, the stem at its extremity carrying a cutter head 53 which is removably secured to the stem by means of the set screw 54. The cutter head 53 is designed to receive in a suitably formed socket the arm 55 on which the cutter 56 is rotatably mounted, the cutter being in the form of a rotary disk and the arm being removably secured in the head by means of a set screw 57. Since the core or plunger 47 is subject to angular or turning movement and since the cutter disk must, in order to effectively perform, have its axis perpendicular to the axes of the guide rods 42, means is provided to prevent rocking movement of the cutter head and to adjust it for precise perpendicularity with the guide rods. To this end, the cutter head is provided with parallel arms 58 which pass through clearance openings 59 in the frame 44 and which pass slidably through diametrically disposed holes in an adjusting ring or collar 60 which is mounted on the frame 44 for angular or turning movement on the bushing 52. The collar 60 is provided with lugs 61 on diametrically opposite sides through which pass set screws 62, bearing on the top faces of lugs 63 with which the frame 44 is formed. Obviously, the adjustment of the set screws will function to vary the plane of the arms 58 which, being connected to the cutter head, will vary the axis of rotation of the cutter 56.

When the magnet 45 is de-energized, the plunger 47 is subject to the pressure of the spring 50 and the plunger will be forced toward and the cutter brought into engagement with the face of the glass ribbon, so that if the traveler comprising the crosshead 43, frame 44 and their attendant parts be advanced along the carrier, the glass ribbon will be scored by the cutter.

To provide for movement of the traveler comprising the crosshead and frame 44, the frame 21 is provided at remote ends with the sprockets 64 and 65, a chain 66 being trained over these sprockets and terminally anchored to the traveler as indicated at 67. Movement is imparted to the chain by a motor 68 operatively connected to the sprocket 62 by means of a flexible shaft 69 and a reduction gearing housed in the case 70.

In the operation of the invention the motor 68 is rotated first in one direction and then in the other, so that the gear 62 is thus alternately rotated in opposite directions, the one of which will advance the traveler from the left to the right and the other effect the return to initial position. In the one direction of movement, the plunger 47 of the magnet 45 is subject to the pressure of the spring 50, but in the other direction of movement, the magnet 45 is energized, so that the plunger 47 is drawn in, in which case the cutter is retracted. Thus the glass is scored as the cutter moves in one direction but is uneffected by the cutter in the movement of the traveler in the other direction. As viewed in the drawings, the cutting operation takes place when the traveler moves from the left to the right. In the return movement of the traveler, when the cutter is retracted, the magnet 45 is energized until the traveler completes the return movement, when it is de-energized, leaving the plunger free to the action of the spring 50. Since the traveler will then be in a position where the cutter will be to one side of the glass ribbon, a seat is provided for it to prevent its being forced beyond the plane of the ribbon. This seat consists of a plate 71 connected with a sleeve 72 adjustable along one of the jaw members 22. By this arrangement, the plate may be adjusted to have a position adjacent the edge of the ribbon of glass, so that in starting the cutting operation, when the cutter is under the influence of the spring 50, it may pass off of the seat plate directly onto the glass. The adjusting screw 48 provides the means for varying the intensity of pressure of the cutter on the glass in the cutting operation.

The carrier comprising the frame 21 and associated jaws 22 and 24 and the means for moving the latter into and out of clamping engagement is flexibly supported on cables 73 terminally anchored to the frames of the magnets 28, the remote ends of the cables being connected to counterweights 74 and the cables being trained over direction pulleys 75. That run of each of the cables connected with the counterweight passes through a guide eye 76, below which is mounted a collar 77 adjustable along the cable but to abut the eye. The collars determine the distance to which the carrier may drop and one or the other of the collars, or both, may be adjusted to insure exact horizontality, so that the carrier will be disposed at right angles to the glass ribbon at the time that its

jaws effect gripping action on the same, so that the movement of the cutter will be in a transverse line at right angles to the edge of the ribbon.

The means for actuating the traveler consists of a motor 68, the shaft of which extends into the case 70 in the walls of which it is journalled, this interior portion of the motor shaft being provided with a worm 79 in mesh with a worm wheel 80, mounted on a shaft 81 in the gear case. The flexible shaft 69 above referred to is connected to the shaft 81. The rotation of the latter shaft obviously imparts rotation to the flexible shaft and consequent rotation to the sprocket wheel 62.

Paralleling the shaft 81 is the shaft 82 also journalled in the walls of the case 70, this latter shaft being provided with a spur gear 83 in mesh with a pinion 84 on the shaft 81. By reason of the worm gear connection between the motor shaft and shaft 81, the latter runs at a greatly reduced speed, but the speed of the shaft 82 is reduced much below the speed of the shaft 81 by reason of the ratio of the gear couple 83—84. The function of the shaft 82 is to periodically open the switches 85 and 86, the latter consisting of fixed and movable contacts of which the latter are yieldingly impelled into engagement with the former. The switches 85 and 86 are mounted in brackets 87 which at one end are swingingly supported on the shaft 82, the brackets being provided with slots 88 in which engage the hooked extremities of adjusting screws 89, the latter having threaded shank portions engaging nuts 90 having swivel mountings in the top of the case 70. The switch brackets may be swung on the shaft 82 as a center toward and away from each other by elevating or lowering the adjusting screws through the rotation of the nuts 90. The shaft 82 carries a cam 91 engageable with the projections 92 on the two switches to effect opening movement of either.

Exterior to the case 70, the motor shaft carries a brake drum 93 surrounding which is a brake band 94 having one end secured, as at 95, to one wall of the case 70, the other end of the brake band being pivotally connected with the brake lever 96 pivotally mounted on the wall of the case 70, with the force arm subject to the pull of the spring 97 or the plunger 98 of a magnet 99. The spring and plunger act in opposite directions and when the force of the spring is applied to the lever, the brake band is seated on the drum, release movement of the brake band being effected when the lever is subject to the pull of the plunger.

Other equipment comprised in the invention than that above mentioned consists of a pilot switch composed of a swinging arm 100 pivoted on a base of insulating material 101 and normally resting on a stop 102, where it is in the path of the glass ribbon 20. The base 101 is adjustable on the standard 103 and carries a contact 104 with which the arm 100 is engageable after being raised a prescribed angular distance. Further equipment comprises relays of which one embodies a magnet 105 and an associated switch of the double-pole variety of which the blade 106 is single-throw for engagement with or disengagement from the contact 108 and the blade 107 for alternate engagement with the contacts 109 and 110. The switch is spring retracted as indicated at 111 to engage the blade 107 with the contact 110, when the blade 106 is disengaged from the contact 108. The other relay embodies a magnet 112 and a triple-pole switch of which the blades 113 and 114 are single-throw and move into and out of operative engagement with the contacts 115 and 116. The remaining blade 117 is alternately engaged with the contacts 118 and 119.

The motor 68 is subject to reversal in rotation. Therefore, the field and armature circuits are separate, the field circuits being energized direct from the supply line 120 which obviously may be equipped with a switch (not illustrated) to cut out the whole equipment.

The clamp magnets 28 are connected in parallel and across the supply line through the pilot switch and through the double-pole switch. The cutter magnet is connected across the line through the triple-pole switch, the relay magnet 105 across the line through the switch 86 and the triple-pole switch and the magnet 112 across the line through the switch 85 and the double-pole switch. The motor armature is connected in on both the double-pole and triple-pole switches and responds to current fed through one or the other, moving in one direction when one switch functions and in the other direction when the other switch functions. The brake magnet may be connected in parallel with the armature or in series as shown.

In the operation of the invention, when the sheet of glass is initially started from the drawing chamber of the furnace below, it passes through the customary feed rolls and the upper edge will first engage the arm 100 of the pilot switch, moving it into engagement with the contact 104. There will then be a flow of current from the positive side of the line 120 over the conductor 121, through the clamp magnets 28 in parallel, then over the conductor 122, through the pilot switch and then over the conductor 123 to the supply line. The clamp magnets being thus energized, the jaws 22 and 24 will be moved into engagement with the glass ribbon and the carrier will thus be clamped to the ribbon and since the latter is moving at a continuous speed, it will move along with the ribbon, the counterbalancing weights 74 preventing any undue strain on the ribbon by reason of the weight of the carrier. But the moving ribbon finally moves the arm 100 to a point past the contact 104, when no further current can pass through the pilot switch. But when the pilot switch closed the circuit across the supply line (the motor for the traveler being then in a position where the cam 91 engaged and held the switch 85 in an open position), there was provided in addition to the circuit through the clamp magnets 28, a circuit through the relay magnet 105, current passing from the positive side of the supply line to the switch blade 117, to the contact 119, over the conductor 124, through the magnet 105, switch 86 and conductors 122 and 123 to the negative side of the supply line. With the energization of the magnet 105, the double-pole switches moved to engage the blades 106 and 107 with the contacts 108 and 109, shifting the blade 107 away from the contact 110. This establishes a circuit on the motor armature, current flowing from the positive side of the line over the switch blade 106 and contact 108 to the conductor 125 through the brake magnet and motor armature and back over the conductor 126 to the switch blade 107 and thence to the negative side of the supply line. Thus the brake is released and the arma-

ture energized with the result that movement will be imparted to the traveler and it will be advanced across the carrier with the cutter in contact with the glass, since the plunger 47 of the magnet 45 will then be subject to the pressure of the spring 50. But the carrier will be moving with the ribbon of glass, so that the only relative movement between the ribbon and the cutting mechanism is between the traveler and the ribbon, the traveler moving transversely of the ribbon. But with the operation of the traveler, the cam 91 is set in operation, leaving the switch 85, so that that is shifted to closed position. While the switch 85 controls the magnet 112, this magnet cannot be energized at this time, because its circuit is open by reason of the separation of the blade 107 from the contact 110. When the traveler shall have moved all the way across the glass ribbon, the cam 91 will be brought into engagement with the switch 86, thus opening that switch and consequently opening the circuit on the magnet 105, so that the spring 111 will return the double-pole switch to its normal position, opening the circuit on the motor armature but closing the circuit on the magnet 112 by reason of the blade engaging the contact 110, so that current may flow over the conductor 127, through the switch 85, the conductor 128, the magnet 112 and the switch blade 107 back to the negative side of the supply line. But energizing the magnet 112, results in shifting the position of the triple-pole switch, engaging its several blades with the contacts 115, 116 and 118 and separating the blade 117 from the contact 119. In this position of the triple-pole switch, the clamp magnets will be short-circuited by the conductor 129, but current will flow from the positive side of the supply line over the switch blade 117 and the conductors 129 and 122 to the conductor 126, thence through the motor armature and brake magnet, in a reverse direction than formerly, thus imparting reverse movement to the motor, the current returning to the supply line over the conductor 125 and the switch blade 113. The brake which was set on opening the motor circuit is released by the brake magnet 99 on reverse movement being imparted to the motor. The traveler will thus be moved back along the carrier in the reverse direction than formerly and the direction of rotation of the cam 91 will be reversed. But in this reverse movement, the cutter retracting magnet 45 is energized, current flowing to it from the positive side of the supply line over the conductor 121 and then back to the supply line over the conductor 130 and the switch blade 114. When the cam starts its reverse movement, it releases the switch 86 to permit the latter to close, but this does not result in closing the circuit on the magnet 105, because continuity of that circuit is dependent on the blade 117 being in engagement with the contact 119 when the magnet 112 is energized.

After the glass ribbon is scored and the sheet removed, the pilot switch may drop down over the exposed end to be operated by the then edge of the ribbon, the several series of operations recited above being repeated. When the clamp magnets are deprived of current, as in the return movement of the traveler, the carrier drops by gravity until the collars 77 abut the eyes 76 and remains in this position until the clamp magnets are again energized.

The adjustment of the switches 85 and 86 angularly toward and away from each other provides for varying the time element of their operation by the movement of the cam 91 and thus provides for varying the height of the sheet of glass cut from the ribbon when the ribbon is moved at a constant linear speed.

The invention having been described, what is claimed as new and useful is:

1. Glass cutting apparatus comprising a carrier having means to effect a gripping action on a ribbon of glass to fixedly secure it with respect to said ribbon, a traveler mounted on the carrier, automatic means for effecting movement of the traveler in one direction along the carrier when the gripping means is active, and a cutter carried by the traveler to score the glass in the movement of such traveler.

2. Glass cutting apparatus comprising a carrier having means to effect a gripping action on a ribbon of glass to fixedly secure it with respect to said ribbon, a traveler mounted on the carrier, automatic means for effecting movement of the traveler in one direction along the carrier when the gripping means is active, a cutter carried by the traveler to score the glass in the movement of such traveler, and means to yieldingly impel the cutter towards the ribbon of glass.

3. Glass cutting apparatus comprising a carrier having means to effect a gripping action on a ribbon of glass to fixedly secure it with respect to said ribbon, a traveler mounted on the carrier, automatic means co-ordinated with the gripping means for effecting movement of the traveler along the carrier in one direction when the gripping means is active and in the other direction when the gripping means is inactive; a cutter carried by the traveler, means for yieldingly impelling the cutter towards the ribbon of glass to score the latter, and automatic means for retracting the cutter from contact with the glass ribbon except when the gripping means is active.

4. Glass cutting apparatus comprising a carrier having gripping jaws for disposition on opposite sides of a ribbon of glass, means for effecting movement of the jaws toward and away from each other to cause gripping action on the glass ribbon or release therefrom, a traveler mounted on the carrier, means for effecting movement of the traveler along the carrier, a cutter carried by the traveler to score the glass in the movement of the traveler, means to retract the cutter in the return movement of the traveler, and operative connections between the cutter retracting means and the clamp jaw moving means to effect jaw releasing movement when the cutter is retracted.

5. Glass cutting apparatus comprising a carrier having means to effect gripping action on a ribbon of glass to fixedly secure it with respect to said ribbon, a traveler mounted on the carrier, automatically reversible driving means operatively connected with the traveler, a cutter carried by the traveler, means for yieldingly impelling the cutter towards the glass ribbon in one direction of movement of the traveler, means for retracting the cutter in the other direction of movement of the traveler, and means operatively connecting the driving means with the two last said means to co-ordinate the cutter controlling functions of the latter in the forward and reverse movements of the driving means.

6. Glass cutting apparatus comprising a carrier, clamping jaws for disposition on opposite

sides of a ribbon of glass and movable toward and away from each other to effect clamping action on or release from said ribbon, a traveler mounted on the carrier, means for effecting movement of the traveler in opposite directions along the carrier, means for effecting clamping action and release of said clamping jaws, a cutter carried by the traveler, means yieldingly impelling the cutter towards the glass ribbon in one direction of movement of the traveler, means for retracting said cutter in the other direction of movement, and operative connections between the traveler driving means, the clamping jaw actuating means and the cutter retracting means to effect retraction of the cutter during the intervals of release position of the jaws.

7. Glass cutting apparatus comprising a carrier having means to effect a gripping action on a ribbon of glass, release devices for said means, a traveler mounted on the carrier for movement in opposite directions along the latter, means for effecting movement of the traveler, a glass cutter carried by the traveler, means yieldingly impelling the cutter towards the glass ribbon in one direction of movement of the traveler, means for retracting the cutter in the other direction of movement of the traveler, and operative connections between the release devices and the means for effecting traveler movement whereby the release devices will be operative during that traveler movement in which the cutter is retracted.

8. Glass cutting apparatus for cutting into sheets a moving ribbon of glass comprising a flexibly suspended carrier, gripping members carried by said carrier for securing it to the glass ribbon, a traveler mounted on the carrier for movement in opposite directions thereon, means for effecting movement of the traveler, a glass cutter carried by the traveler and yieldingly impelled into contact with the glass ribbon in one direction of movement of the traveler, retracting means for the cutter during the other direction of movement of the traveler, and operative connections between the gripping members and the means for effecting traveler movement to insure operation of the gripping members when the cutter is in contact with the ribbon and release of said members when the cutter is retracted.

9. Glass cutting apparatus for cutting into sheets a moving ribbon of glass comprising a flexibly suspended carrier, gripping members carried by said carrier for securing it to the glass ribbon, a traveler mounted on the carrier for movement in opposite directions thereon, means for effecting movement of the traveler, a glass cutter carried by the traveler and yieldingly impelled into contact with the glass ribbon in one direction of movement of the traveler, retracting means for the cutter during the other direction of movement of the traveler, and operative connections between the gripping members and the means for effecting traveler movement to insure operation of the gripping members when the cutter is in contact with the ribbon and release of said members when the cutter is retracted, the carrier supporting means comprising cables connected to the traveler at opposite ends, pulleys over which the cables are trained, and weights carried at the remote ends of the cables.

10. Glass cutting apparatus for cutting into sheets a moving ribbon of glass comprising a flexibly suspended carrier, gripping members carried by said carrier for securing it to the glass ribbon, a traveler mounted on the carrier for movement in opposite directions thereon, means for effecting movement of the traveler, a glass cutter carried by the traveler and yieldingly impelled into contact with the glass ribbon in one direction of movement of the traveler, retracting means for the cutter during the other direction of movement of the traveler, and operative connections between the gripping members and the means for effecting traveler movement to insure operation of the gripping members when the cutter is in contact with the ribbon and release of said members when the cutter is retracted, the carrier being provided with spaced guide rods and the traveler having a frame slidably mounted on said rod, sprockets at the remote ends of the traveler, one of said sprockets being connected with the means for effecting traveler movement, and a chain trained over the sprockets and terminally connected with the traveler.

11. Glass cutting apparatus for cutting sheets from a moving ribbon of glass comprising a carrier having means to effect a gripping action on said ribbon to releasably secure the carrier thereto, a traveler mounted on the carrier for movement in opposite directions therealong, means for effecting movement of the traveler, a cutter carried by the traveler and yieldingly impelled towards the glass ribbon in one direction of movement of the traveler, retracting means for the cutter, releasing devices for the gripping means, and flexible supporting means for the carrier to permit bodily movement thereof, and operative connections between the cutter retracting means and the means for effecting traveler movement and the last said means and the releasing devices to effect operation of the last during the period of retraction of the cutter when the traveler is moving in one direction along the carrier.

12. Glass cutting apparatus for cutting sheets from a moving ribbon of glass comprising a carrier having means to effect a gripping action on said ribbon to releasably secure the carrier thereto, a traveler mounted on the carrier for movement in opposite directions therealong, means for effecting movement of the traveler, a cutter carried by the traveler and yieldingly impelled towards the glass ribbon in one direction of movement of the traveler, retracting means for the cutter, releasing devices for the gripping means, and flexible supporting means for the carrier to permit bodily movement thereof, and operative connections between the cutter retracting means and the means for effecting traveler movement and the last said means and the releasing devices to effect operation of the last during the period of retraction of the cutter when the traveler is moving in one direction along the carrier, said operative connections embodying adjustable means to vary the time element of their operation.

ALFRED C. OAKES.