Jan. 24, 1967 A. TAILLEUR ET AL 3,300,112

MACHINE FOR SEVERING GLASS

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Fig. 1

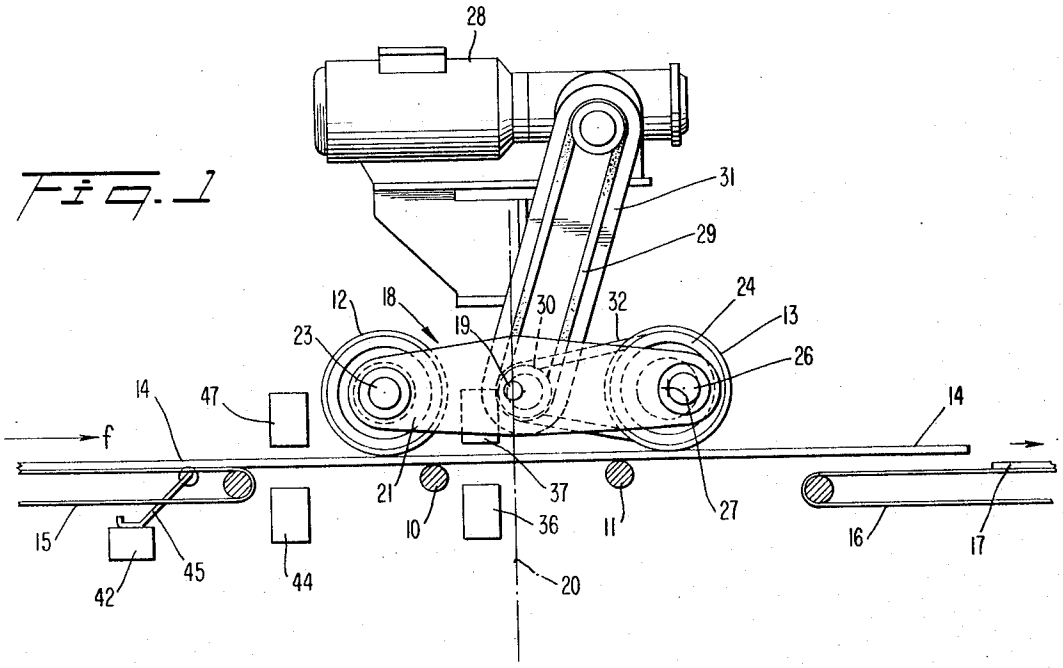
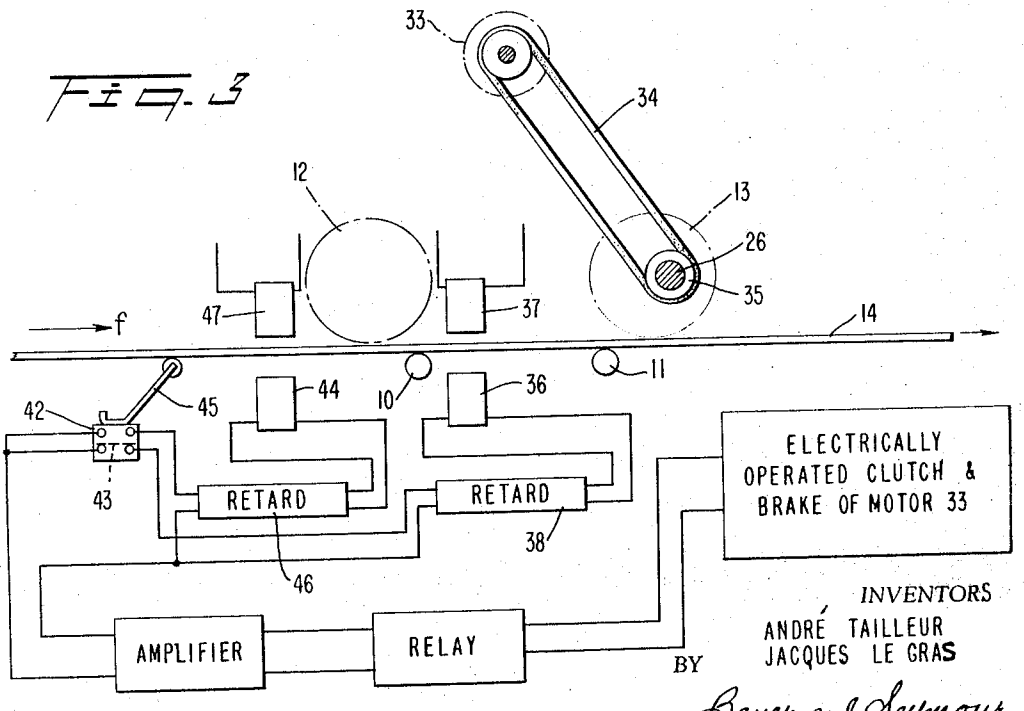


Fig. 3



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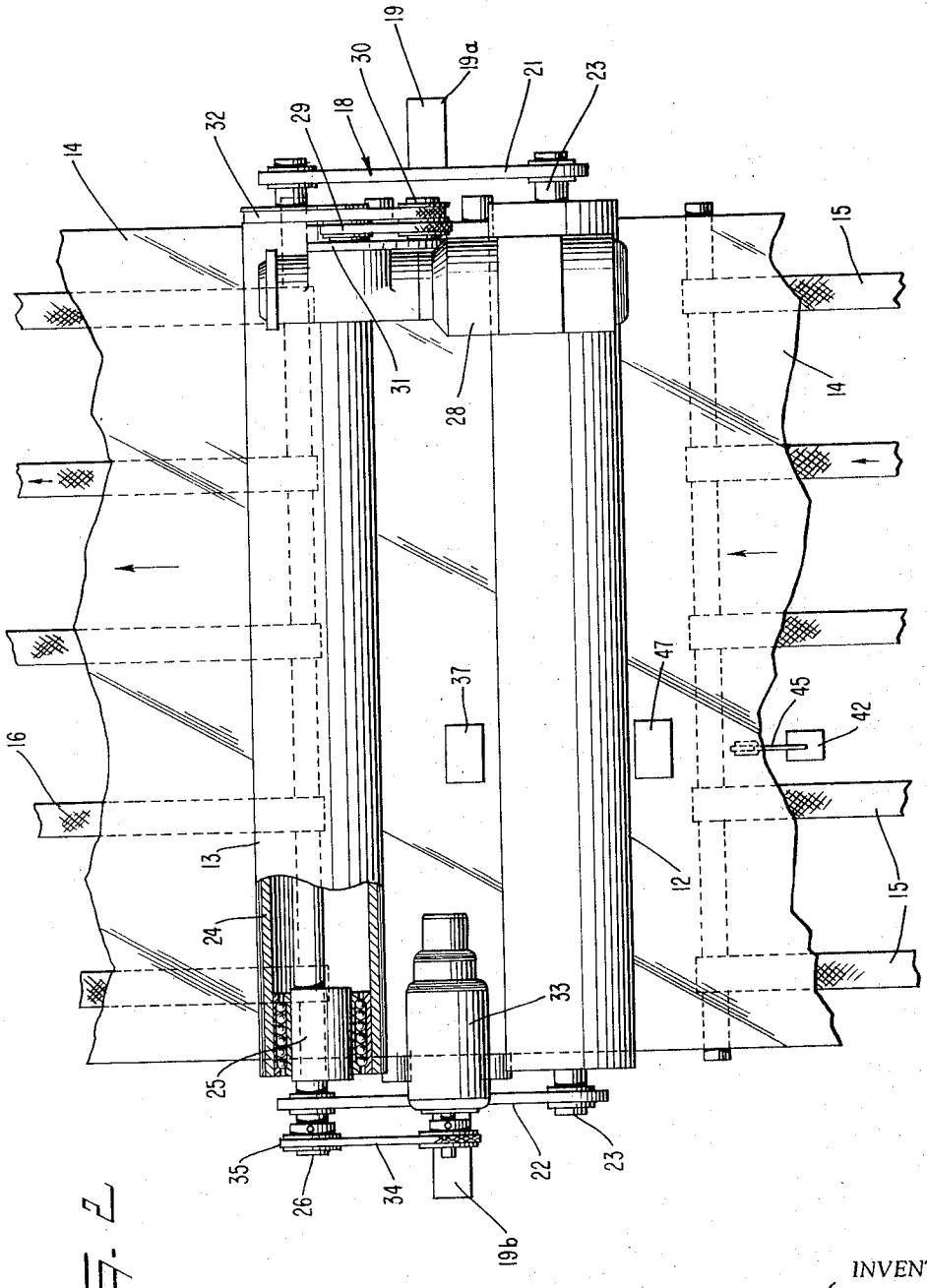

FIG. 2

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MACHINE FOR SEVERING GLASS

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12 Claims. (Cl. 225—93)

The present invention relates to a machine for severing glass. In particular, the invention relates to a machine for severing a continuously moving sheet or ribbon of flat glass transversely into pieces in accordance with severing lines marked on the sheet.

The machine of the invention comprises generally a first or lower pair of parallel rollers to support a sheet of glass and a second or upper pair of parallel rollers, parallel to the first pair. The two pairs of rollers are spaced apart for a sheet of glass to pass between them and the rollers of the upper pair are spaced apart more than the lower pair and are astride the rollers of the lower pair relative to the plane between the pairs. The rollers of the upper pair are mounted and arranged to sever a sheet of glass passing between the pairs by being equally pressed toward the lower pair and against the sheet of glass, to exert a bending pressure on the sheet against the lower rollers and cause the sheet to break transversely at a point between the supporting generatrices of the lower rollers. The pressure of the upper pair of rollers is applied when the desired line of severing is between supporting generatrices of the first pair of rollers, and in a preferred embodiment the severing pressure is triggered by a detecting device which is responsive to a severing line scored on the sheet.

In accordance with another feature of the invention, the detecting device may be timed so that the severing pressure is applied when the scored severing line is at a predetermined point between the lower rollers. For example, when a sheet of glass is to be severed into very short pieces, the severing pressure is generally applied when the severing line is close to the supporting generatrix of the downstream lower roller. However, when the last piece to be severed is a very short piece the severing pressure would be applied when the severing line is close to the supporting generatrix of the upstream roller. In the latter instance a second detecting device is provided to trigger the severing pressure at the alternative point and a switch, actuated by the passage of the rear edge of the sheet past a predetermined point, is provided to activate the second detecting device to trigger the application of severing pressure and to disconnect the first detecting device.

It is an object of the present invention to provide a machine for severing a moving continuous sheet or ribbon of flat glass into pieces of varied desired lengths and more specially into very short ones.

Another object is to provide such a machine which is actuated automatically by severing lines scored on the sheet to sever the sheet at each severing line.

A further object is to provide such a machine with means to vary the point in the movement of the sheet at which the severing pressure is applied when the severing line actuating the severing pressure is the line of the last piece at the end of a sheet.

According to the invention, the severing has the main advantage of being operated without shearing stresses so that it occurs perpendicularly to the sheet plane.

The above and further objects and novel features of the present invention will more fully appear from the following detailed description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only and are not intended as a definition of the limits of the invention, reference for this latter purpose being had primarily to the appended claims.

In the drawings, wherein like reference characters refer to like parts throughout the several views,

FIGURE 1 is a side elevation of a machine in accordance with the invention showing a sheet of glass being conveyed through the machine to be severed thereby and showing a severed sheet being conveyed from the downstream end of the machine;

FIGURE 2 is a top plan view of the machine of FIGURE 1; and

FIGURE 3 is a schematic diagram illustrating the structure and arrangement of detecting devices which are responsive to severing lines on a sheet of glass and illustrating the connections by which the detecting devices automatically actuate a machine in accordance with the invention.

Referring now to the drawings, the machine of the invention comprises two pairs of parallel rollers **10–11** and **12–13** spaced apart for a sheet or ribbon **14** of flat glass to be fed between the pairs of rollers in the direction of the arrow *f* by a conveyor belt **15** that is at a slightly lower level than the rollers **10–11** or preferably equipped at its end **15** with a pair of driving rollers able to yield under vertical forces. The sheet **14** of glass passes through the machine supported by the lower pair of rollers **10–11** of which at least the downstream lower roller **11** is driven by conventional means, not shown, to assist the movement of the sheet **14** through the machine. The driving connection to the roller **11** includes an overrunning clutch so that a piece of glass severed from the sheet **14**, in the manner described more fully below, may be withdrawn over the roller **11** at a speed higher than the sheet is fed into the machine in order to avoid having the sheet **14** ride up on the pieces of glass severed therefrom. For the same purpose, a downstream conveyor belt **16** which carries the severed pieces, such as a severed piece **17** illustrated in FIGURE 1, away from the machine is driven at a higher speed than the upstream conveyor belt **14**, and, as shown, the plane of the supporting surface of the conveyor **16** is below the plane of the sheet **14** passing through the machine over the rollers **10–11**.

The upper rollers **12** and **13** are spaced apart more than the lower rollers **10–11**, are rotatably mounted on a carriage **18**, and are positioned astride the lower rollers **10–11** relative to the plane of the sheet **14** between the pairs of rollers. The carriage **18** is pivotally supported about a fixed axis **19** which, as seen in FIGURE 1, is approximately midway between the rollers **12–13** and preferably in a vertical plane at right angles to the sheet **14** above the mid-point between the lower rollers **10–11** as indicated by the dot and dash line **20**.

The upper rollers **12–13** are normally in at least light contact with the sheet **14** passing through the machine, and severing of the sheet is accomplished by pressing the rollers **12–13** against the sheet **14** so as to exert a bending pressure on the sheet around the lower rollers **10–11** which causes the sheet to break transversely at a point between the rollers **10–11**.

If necessary, thin extensible rubber belts run between **15** and **16** over **10** and **11** in order to prevent very narrow strips from falling after being cut.

As shown, the upper rollers **12–13** are arranged symmetrically astride the lower rollers **10–11** so that the forces exerted by the rollers are equal and shearing strains do not exist in the bent sheet in the region be-

tween the rollers **10–11**, the rollers **12–13** being preferentially spaced so that another severing line is not present in both adjacent outer regions.

The upper rollers **12–13** are arranged to be pressed against the sheet **14** to sever it by rotating the downstream roller **13** about an eccentric axis so that, when the largest radius of the eccentric is rotated down and downstream against the sheet, the pressure of the roller **13** against the sheet **14** is increased. This causes the carriage **18** to pivot about its fixed axis **19** thereby increasing the pressure the upstream roller **12** against the sheet and causing both rollers **12** and **13** to press against the sheet **14** with equal increased pressure.

The structural arrangement of the upper rollers **12–13** and carriage **18** and the means for rotating the roller **13** about an ececntric axis to exert severing pressure will now be described with reference to FIGURE 2. As shown, the carriage **18** is formed by two side plates **21** and **22** between which the rollers **12–13** are supported The fixed axis **19** of the carriage **18** is formed by stub shafts **19***a* and **19***b* extending from the side plates **21** and **22** respectively and journalled in suitable frame members, not shown, for the machine.

The upstream upper roller **12** is concentrically mounted for free rotation on a shaft **23** supported between the side plates **21** and **22**. The downstream upper roller **13** comprises a cylindrical shell **24** having concentric bushing elements **25** in its ends with a shaft **26** fixed through the bushing elements.

The cylindrical shell **24** is rotatable concentrically about the bushing elements **25** by means of suitable roller bearings between the bushing elements and the shell, and the shaft **26** is eccentrically fixed through the bushing elements so that the periphery of the roller **13** is eccentric to the shaft **26**. The ends of the shaft **26** project beyond the bushing elements **25** and are journalled in the side plates **21–22** of the carriage **18**.

The roller **13** is continuously driven to rotate about a concentric axis (indicated at **27** in FIGURE 1) by a motor **28** suitably mounted on the frame of the machine and connected through belts to rotate the shell **24** of the roller about the bushing elements **25** thereby to assist the movement of the sheet **14** through the machine. For the severing operation, the roller **13** is rotated by other means, subsequently described, about the eccentric axis defined by the shaft **26**. The driving connection from the motor **28** to the shell **24** of roller **13** must therefore be flexible to allow for the periodic eccentric rotation of the roller. For this purpose the driving connection comprises a belt **29** around a pulley on the motor and a pulley **30** on the lower end of an arm **31** which has its upper end pivotally mounted on the motor under spring tension which urges the arm in a clockwise direction in FIGURE 1. Another belt **32** passes around the pulley **30** and around the shell **24** of the roller **13** in a suitable groove therein. Thus, the arm **31** maintains the belt **32** in driving engagement with the shell **24** and compensates for eccentric rotation of the roller **13** by swinging back and forth under spring tension.

The roller **13** is rotated about the eccentric shaft **26** by a motor **33**, which is suitably mounted on the frame of the machine, connected to rotate the shaft by a belt **34** around a pulley on the motor and around a pulley **35** secured on the end of the shaft **26**. The motor **33** is equipped with an electrically operated brake and clutch so as to rotate the roller **13** once about its eccentric axis (in a counter-clockwise direction) when the motor is actuated for a severing operation and then stop the motor and holding the driving connection in a position in which the largest radius of the roller **13** relative to the eccentric shaft is substantially parallel to the plane of the sheet **14** being fed through the machine. In this position of the roller **13** it is in contact with a sheet **14** in the machine as its peripheral shell **24** is rotated concentrically about the bushing elements **25** by the motor **28**.

Referring now to FIGURES 1 and 3, a severing operation of the machine shown is triggered automatically by a detecting device which suitably comprises an electric eye **36** and light source **37** on opposite sides of the glass sheet **14** at a point in the path of the sheet between the lower rollers **10–11** and adjacent the upstream roller **10**. The electric eye **36** is connected to a switch on the motor **33** for a single severing operation when the light beam from the light source **36** is interrupted. Thus, as a sheet **14** moves into the machine and a severing line previously marked on the sheet interrupts the light beam from the light source **37**, the electric eye **36** actuates the motor **33** after a slight time delay to permit the sheet **14** to move the additional distance to carry the severing line to a definite point between the supporting generatrices of the rollers **10–11**. The time delay is provided by a time delay switch **38** in the electric operating circuit by the electric eye **36** to control the severing operation of motor **33**. As indicated in FIGURE 3, this operating circuit includes the electric eye **36**, the time delay switch **38**, an amplifier and a relay which is connected to actuate electrically operated clutch and brake mechanism of the motor **33**. As previously described, when the motor **33** is thus actuated, it operates to rotate the roller **13** one revolution counter-clock wise about its eccentric axis, defined by shaft **26**, to press the rollers **12–13** against the sheet **14** and sever the sheet.

The sereving line marked on the glass sheet **14** is scored to facilitate the severing of the sheet. The severing pressure of the rollers **12–13** may be applied when the scored severing line is at any point between the supporting generatrices of the rollers **10–11** and the point at which the pressure is applied may be varied by changing the time lapse provided by the time delay switch **38**. When it is desired to sever very short pieces of glass from the sheet **14**, the severing lines are scored and the severing pressure is adjusted to be applied when the severing line is adjacent the downstream lower roller **11**.

When the last piece at the end of a glass sheet **14** is to be very short, the severing pressure is applied when the scored severing line is closer to the upstream lower roller **10** and for this purpose an alternative detecting arrangement is provided. This alternative arrangement comprises a switch **52** adjacent the path of a glass sheet **14** being fed to the machine and having a contact **43** movable alternatively to connect the electric eye **36** or another electric eye **44** to actuate the moor **33**. When a continuous sheet **14** is being fed to the machine an arm **45** of the switch **42** is in contact with the sheet **14** and depressed thereby under spring tension to connect the electric eye **36** to actuate the motor **33** when a severing line on the sheet **14** passes the light beam between light source **37** and electric eye **36** in the manner previously described. Then when the rear end of the sheet **14** passes the switch **42**, the arm **45** of the switch is released and moves the contact **43** to disconnect the electric eye **36** and time delay switch **38** from the motor **33** operating circuit and to connect the electric eye **44** and is associated time delay switch **46** into the circuit instead.

The circuit changing switch **42** is located in the path of a glass sheet **14** upstream from the alternative electric eye **44** a distance greater than the maximum length of the last piece of glass it is desired to sever from the sheet. When the rear edge of sheet **14** passes over the switch **42** so that the electric eye **44** is connected to actuate the motor **33**, a severing line on the sheet passing between the electric eye **44** and its associated light source **47** causes the connection from the electric eye **44** and time delay switch **46** to actuate the motor **33** to apply severing pressure when the severing line passes over and is adjacent the upstream lower roller **10**.

When a piece of glass has been severed by the bending

pressure applied by the upper rollers **12–13**, the forward edge of the severed piece drops to the conveyor belt **16**, which, as previously mentioned, is travelling at a speed higher than the glass sheet **14** is fed through the machine. The motor **28** has a flat couple-speed curve; thus the peripheral shell **24** of the roller **13** is rotated by the motor **28** following the feeding speed of the sheet **14**, but, as the sheet is being severed thereby decreasing the pull on the severed part, the speed of the motor increases.

The lower downstream roller **11**, which is driven at the feed speed, is provided with an overrunning clutch to permit a severed piece to move over it at a higher speed. Thus the roller **13** with the cooperation of roller **11** pushes the severed piece of glass out from the machine and onto the conveyor **16** at a higher speed than the glass sheet is moved into severing position so as to avoid having the sheet **14** overlap the severed pieces.

As many apparently widely different embodiments of the present invention may be made without departing from the spirit and scope thereof, it is to be understood that the invention is not limited to the specific embodiments.

What is claimed is:

1. A machine for severing sheets of glass comprising a first pair of parallel rollers to support a sheet of glass, a second pair of parallel rollers parallel to the first pair, said pairs being spaced apart for a sheet of glass to pass between, the rollers of one pair being astride the rollers of the other pair and means to bring the sheet of glass into pressing engagement against one pair in an equilibrated manner through the other pair thereby bending said sheet to sever it.

2. The machine of claim **1** where the first pair are upper rollers and are more widely spaced than the lower ones.

3. The machine of claim **1** where the downstream rollers exert substantially equal forces in opposite directions normal to the sheet.

4. The machine of claim **1** including means to convey a sheet of glass, which has a transverse severing line scored thereon, longitudinally between the pairs of rollers in a direction transverse to the axes of the rollers, and means responsive to movement of the severing line to actuate said conveying means to press one pair of rollers toward the other pair when the severing line is between the rollers of the said other pair.

5. The machine of claim **1** including an upstream conveyor to carry a sheet of glass longitudinally between said pairs of rollers, and a downstream conveyor to carry severed pieces of said sheet away from said rollers, the plane of the support surface of the downstream conveyor being below the plane of a sheet of glass between the pairs of rollers, said downstream conveyor being driven to carry said pieces away from the rollers at a speed greater than said sheet is conveyed between the rollers.

6. The machine of claim **5** in which the rollers of both pairs are in contact with a sheet of glass conveyed between them and which includes drive means for driving the downstream rollers of both pairs to move said sheet between the pairs, and overrunning clutch means associated with the downstream roller of the first pair whereby a severed piece of glass may be moved over said roller at a speed greater than the speed at which the roller is driven.

7. A machine for severing sheets of glass comprising

a first pair of parallel rollers to support a sheet of glass, a second pair of parallel rollers parallel to the first pair, said pairs being spaced apart for a sheet of glass to pass between in contact with the rollers, the rollers of the second pair being spaced apart more than the first pair and being astride the first pair relative to the plane between the pairs, the rollers of the second pair being rotatably mounted on a carriage which is pivotally mounted on a fixed axis, the axis of the carriage being parallel to and between the rollers of the second pair, one of the rollers of the second pair being mounted for rotation about an eccentric axis on said carriage, and drive means to rotate said roller about said eccentric axis at timed intervals whereby both rollers of the second pair are pressed toward the first pair and against a sheet of glass between the pairs to sever said sheet.

8. The machine of claim **7** in which the axis of said carriage is approximately midway between the rollers of said second pair and in a plane approximately midway between the rollers of the first pair.

9. The machine of claim **7** including means to convey a sheet of glass, which has a transverse severing line scored thereon, longitudinally along a predetermined path and between the pairs of rollers in a direction at right angles to the axes of the rollers, detecting means adjacent said path responsive to the movement of the severing line past it to actuate said engaging means when the severing line is between the rollers of the first pair.

10. The machine of claim **9** including second detecting means adjacent said path connectable to be responsive to the movement of the severing line past it to actuate said engaging means when said severing line is at a predetermined point between the rollers of the first pair, a switch adjacent said path actuated by the passage past it of the end edge of said sheet of glass to connect said second detecting means and disconnect the first mentioned detecting means so that the second detecting means and not the first is responsive to said movement of the severing line.

11. The machine of claim **7** including means to feed a sheet of glass longitudinally between the pairs of rollers, downstream conveyor means to carry severed pieces of glass from said rollers, the plane of the support surface of said conveyor means being below the plane of a sheet of glass between the pairs of rollers, and second drive means to rotate the downstream roller of the second pair about an axis concentric thereto to move said sheet between the pairs of rollers.

12. The machine of claim **11** including third drive means to rotate the downstream roller of the first pair in the direction to move said sheet between the pairs of rollers, and overrunning clutch means associated with said roller so that a severed piece of glass may move over said roller at a speed greater than the speed at which it is driven.

References Cited by the Examiner

UNITED STATES PATENTS

3,072,308	1/1963	Oakes et al.	225—96.5
3,137,425	6/1964	Arnaud	225—96.5 X
3,142,427	7/1964	Brand	225—104

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