April 15, 1969 M. MEROLLI ET AL 3,438,317

APPARATUS FOR PROCESSING PHOTOGRAPHIC FILM

Filed Oct. 22, 1965 Sheet 1 of 3

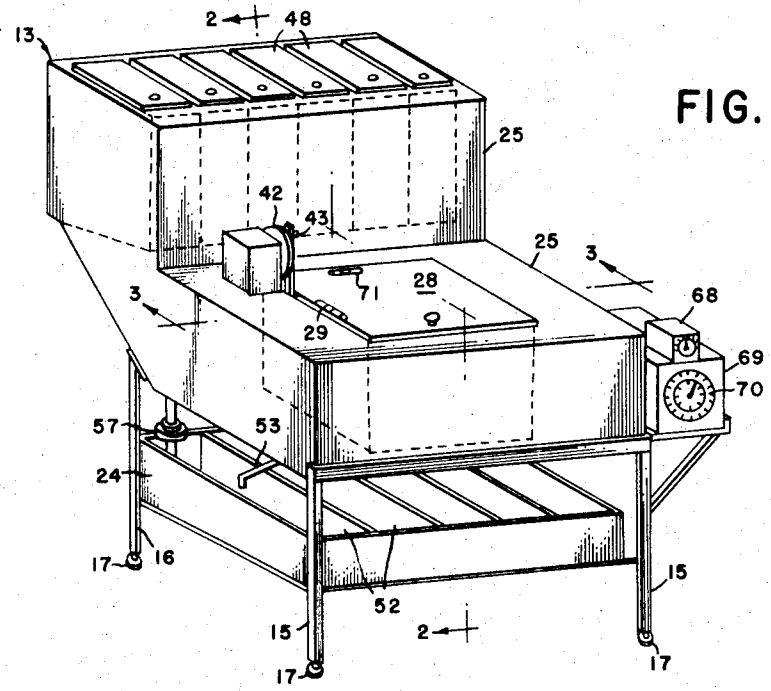
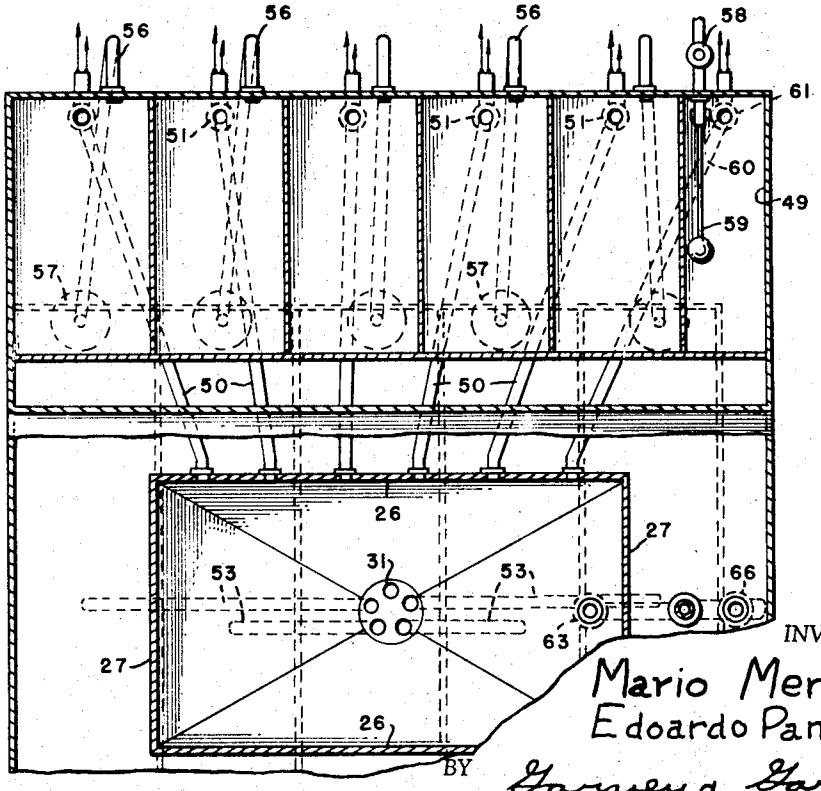


FIG. 1.

FIG. 4.



INVENTOR
Mario Merolli
Edoardo Paniccia
BY
Garvey & Garvey
ATTORNEYS

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FIG. 2.

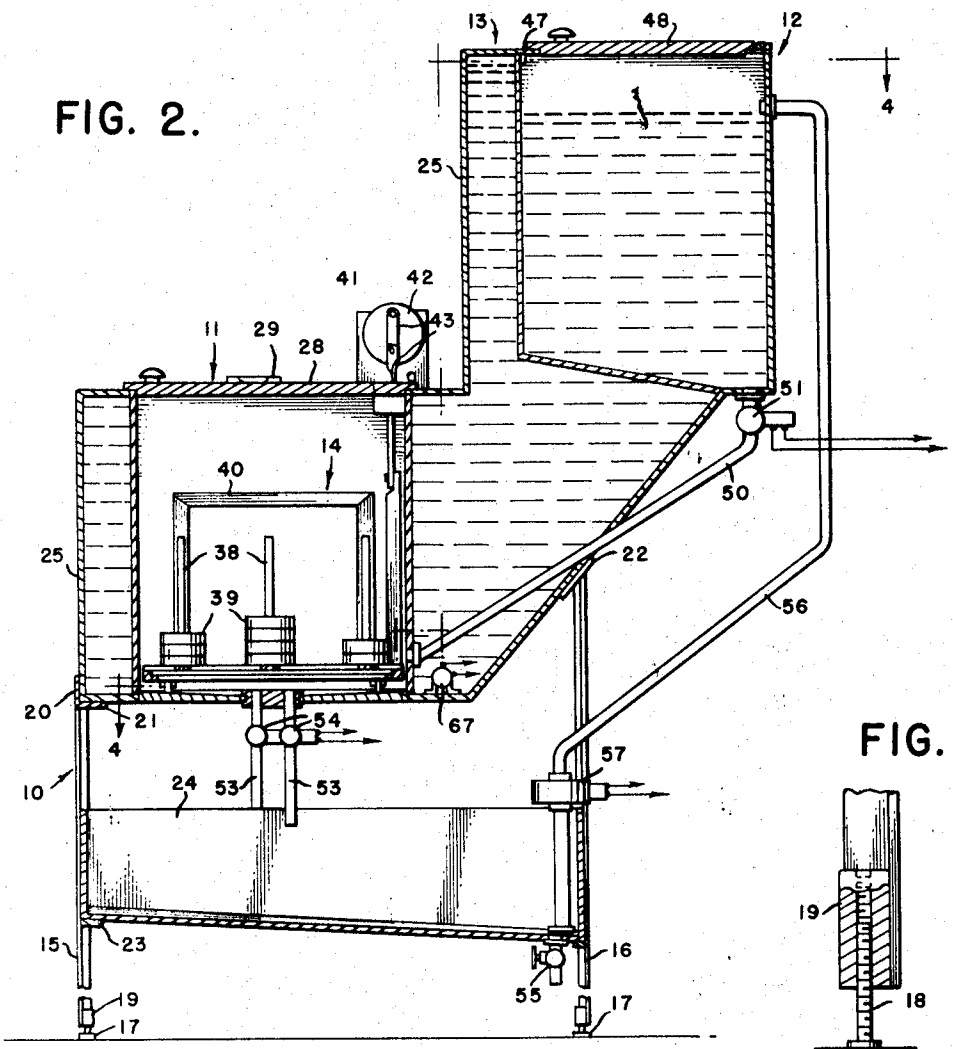


FIG. 6.

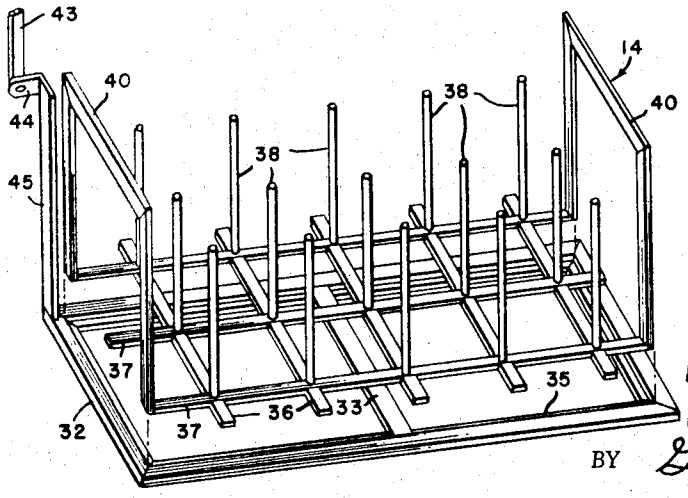


FIG. 5.

INVENTOR
Mario Merolli
Edoardo Paniccia
BY Garvey & Garvey
ATTORNEYS

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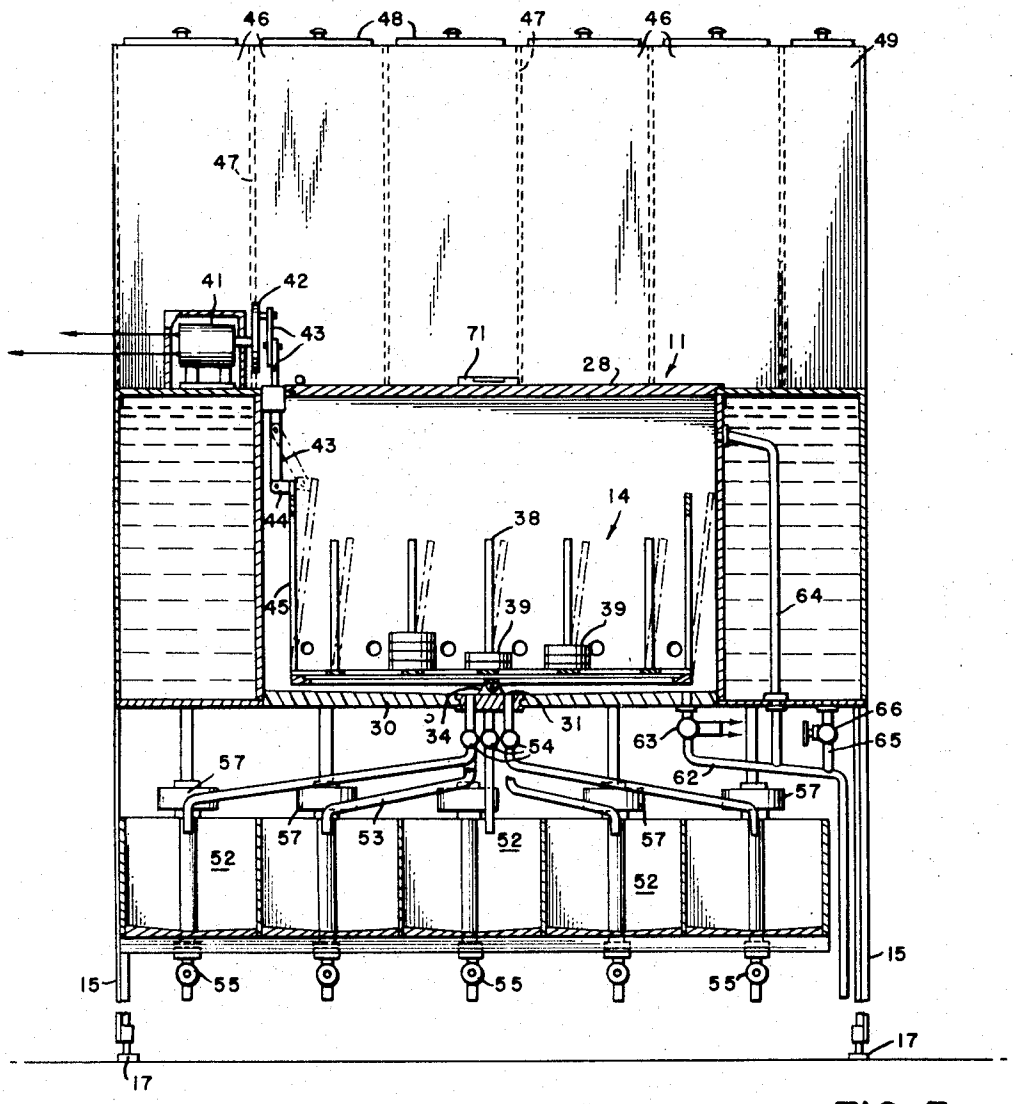


FIG. 3.

INVENTOR
Mario Merolli
Edoardo Paniccia

BY Garvey & Garvey
ATTORNEYS

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3,438,317

APPARATUS FOR PROCESSING PHOTOGRAPHIC FILM

Mario Merolli, 40 Ring St., Providence, R.I. 02909, and Edoardo Paniccia, Via Carbonaro 28, Ceprano, Frosinone, Italy

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ABSTRACT OF THE DISCLOSURE

An apparatus for processing photographic film including a developing tank, a plurality of containers for developing solutions in communication with the tank, a feeding mechanism for feeding solutions from the containers to the tank, and a control device for maintaining the liquids in the containers and the tank at a predetermined temperature. The processor has a cradle device including a frame mounted in the bottom of the developing tank for holding the film to be processed, a rack removeably engaged by the frame, and a power source engageable with the cradle for oscillating the same about a point of pivotal engagement with the tank. The removable rack has a plurality of film-supporting elements thereon for holding a plurality of film processing spools at spaced intervals along the rack.

This invention relates to apparatus for processing photographic film, an object of which is the continuous and automatic development of black and white or color film in a predetermined sequence of processing steps.

Another object is to provide apparatus for processing photographic film which is compact and requires a minimum of space, but yet is capable of holding and developing a large quantity of film at one time.

Other objects of the invention are to provide a film processing machine requiring no attention while operating and signals when the operational cycle is completed; to provide a machine in which rolls of film are stacked in superimposed relation in a cradle movably mounted in a processing tank which selectively receives the various processing solutions in which the film is immersed; to provide a plurality of containers for developing solutions in communication with the tank, control means feeding the solutions from the containers to the tank in predetermined sequence; and to provide a machine in which the contents of each container, after use in the tank, is collected and returned to the same container for reuse.

It is also an object of the present invention to provide a machine in which the processing tank is encompassed by a thermostatically controlled heater water jacket to regulate the temperature of the processing solutions and wash water for optimum results.

A further object of the invention is to provide a wash water container provided with automatic supply and cut-off means to maintain the container full for supplying water to the tank to wash the film during the operational cycle.

A still further object of the present invention is to provide an electrical control station which is in circuit with the timing valves, pumps and motor for operating the cradle, the station including a clock to operate the different valves, etc., at predetermined intervals and in predetermined sequence, so that the machine operates until the films are completely processed, including washing, and may then be removed from the processing tank to permit the tank to be re-loaded.

Other objects of the invention will be manifest from the following description of the present preferred form of the invention taken in connection with the accompanying drawings, wherein:

FIG. 1 is a perspective view of a machine constructed in accordance with the present invention;

FIG. 2 is a vertical sectional view of the same, taken along the lines 2—2 of FIG. 1, looking in the direction of the arrows;

FIG. 3 is a transverse sectional view taken along the lines 3—3 of FIG. 1, looking in the direction of the arrows;

FIG. 4 is a sectional view taken along the lines 4—4 of FIG. 2, looking in the direction of the arrows;

FIG. 5 is a perspective view of the processing tank cradle including the rack for supporting the film rolls; and

FIG. 6 is a fragmentary sectional view of one of the legs of the machine, illustrating the manner in which the base or foot is adjustably mounted therein.

The apparatus of the present invention includes a supporting base **10**, on which is mounted a processing tank **11**, and a multi-compartmented cabinet **12**, all of which compartments are in communcation with tank **11**. A water jacket **13** is located around the tank and extends upwardly into engagement with walls of cabinet **12**. A cradle **14**, within processing tank **11**, supports the black and white or color film negatives which are to be developed.

The base **10** of the assembly comprises front and back legs **15** and **16** respectively, each of which carries a discal leveling foot **17** mounted on the lower end of a screw-threaded shank **18** carried by a complemental bearing **19** secured to the lower end of each leg, as shown in FIG. 6. The upper ends of the front legs **15**, are connected by a flat plate **20**, the lower edge of which is bent inwardly at right angles to provide a supporting flange **21** upon which the fore part of the assembly superstructure rests, as shown to advantage in FIG. 2.

The aft part of said superstructure is supported by enlargements **22** which are bent to conform to the angularity of the part of the superstructure with which they are engaged, as also shown to advantage in FIG. 2. The lower ends of the legs **15** and **16** are connected by narrow flat plates **23** which extend transversely and longitudinally in the frame to support a multi-compartment collector vat **24**.

The superstructure of the assembly embodies an outer shell **25** which extends upwardly from the base **10** and encases the processing tank **11**, and forms the front, back and end walls of cabinet **12**, as well as the outer wall of water jacket **13**. The inner wall of the jacket, as shown advantageously in FIGS. 2 and 3, also constitutes the side walls **26** and end walls **27** of processing tank **11**.

Tank **11** is provided with a top or cover **28**, hinged thereto at **29**, a portion thereof extending into the tank to exclude light and air. The bottom wall of the tank is indicated at **30**, which wall is inclined from the central part thereof to the side and end walls of the tank, to permit gravitation of liquids towards a central outlet **31**.

Cradle **14** includes a horizontally-disposed rectangular frame **32** which is shown to advantage in FIG. 5 and further embodies a cross piece **33** extending transversely of the central portion thereof. The lower face of cross piece **33** is pivotally connected at **34** to tank bottom **30**, to support the cradle above the tank bottom and allow oscillatory motion of the same. The members of frame **32** are provided with inwardly directed flanges **35** adapted for supporting engagement with spaced transverse supports **36** and spaced longitudinal supports **37** of the film rack. Vertical spindles **38** are mounted on the supports for holding conventional film processing spools **39** of a type to provide spacing between adjacent film surfaces, to permit

passage of developing solutions therebetween for engagement with both faces of the film. Inverted U-shaped members **40** are engaged with the terminals of lateral longitudinal members **37**, thereby permitting the rack to be readily removed from and deposited on the frame **32** in the tank, in the manner illustrated in FIG. 5.

Oscillation or rocking of cradle **14** about pivot point **34** is effected by means of an electric motor **41**, the shaft of which carries a disc **42**, to which are eccentrically connected articulate levers **43**, the lowermost lever being pivoted to a lug **44** engaged with a terminal of an operating arm **45**. The lower terminal of arm **45** is fixedly secured to frame **32**.

Cabinet **12** comprises a plurality of compartments **46**, formed by spaced vertical partitions **47** extending between the upper and lower walls of the cabinet. Each compartment **46** is accessable by means of a hinged lid **48** which excludes light and air when the latter is closed. At one end of cabinet **12**, there is provided a compartment **49** which is adapted to store wash water which rinses any chemical solutions from the processed film at the conclusion of the developing cycle. Compartment **49** is preferably in communication with water jacket **13** to permit water to be fed into the water jacket.

The chemical solutions are permitted to gravitate from each compartment **46** into tank **11**, through pipes **50** at preselected time intervals, the flow of the chemical solution being controlled by an electrically operated valve **51**. From tank **11**, the chemical solution is permitted to gravitate into its own compartment **52** of collector vat **24**, by means of pipes **53**, electrically operated valves **54** being provided in each pipe for directing the flow of the chemical solution into the proper compartment.

The bottom wall of each compartment **52** is inclined downwardly from front to rear, and a manual valve **55** is provided at the lowermost point to permit the solution to be drawn off when it is desired to discard the same.

The apparatus of the present invention is further provided with a recirculation pipe **56**, which extends upwardly from each vat compartment to its respective cabinet compartment. A pump **57** in recirculation pipe **56** is operable to return the chemical solution in vat compartment **52** to the originating compartment **46**, thereby permitting use of the respective solutions in succeeding developing cycles. Wash water compartment **49** is provided with a valved inlet line **58** which is controlled by a float **59** for automatically filling the compartment when the water is permitted to gravitate through a feed line **60** to tank **11**. An electrically operated valve **61** controls the egress of water from the compartment. A water drain pipe **62** is located in the bottom of tank **11** for permitting the wash water to flow therethrough for discarding, after rinsing the film on spools **39**. An electrically operated valve **63** controls the flow of water through drain pipe **62**. As shown in FIG. 3, tank **11** is provided with an overflow pipe **64** which is joined to drain pipe **62** at a point below valve **63**. Additionally, there is provided in the bottom of tank **11**, a drain conduit **65** in which is located a manually operated valve, the drain conduit also being in communication with drain pipe **62** to permit water to be drained from water jacket **13**.

A heating arrangement **67** is suitably located in water jacket **13** for maintaining the water at a predetermined, uniform temperature, in order to maintain the chemical solutions at a constant temperature for optimum results in processing. A thermostat **68** controls operation of a heating element **67**. The present invention further includes an electrical timing control station **69** for operating the various electrical valves, pumps and motor of the apparatus in predetermined sequence and for predetermined periods. Timing control station **69** is of conventional structure, including a moving arm **70** adapted for engagement with electrical contacts for completing circuits in which the various valves and pumps are located.

In order to maintain processing tank **11** in a horizontal plane for the proper operation of the present apparatus, there is provided, a spirit level **71** mounted in or on the top **28**. Leveling of the unit is effected in a well known manner by adjustment of feet **17** attached to legs **15** and **16**.

In use, the present apparatus is placed in a dark room and the exposed film is loosely convoluted on spools **39** which are placed on vertical spindles **38**, following which the rack is placed in the tank on supporting frame **32** in the manner illustrated in FIGS. 2 and 3, and hinged top is then closed, to exclude light and air. The chemical solutions required for developing either black and white or color film is poured into compartments **46**, following which hinged lids **48** are closed. Operation of timing station **69** is then initiated for starting the operational cycle by admitting the first chemical solution into tank **11**. Timing control station **69** also initiates motor **41** to oscillate cradle **14** to effect complete surface contact of the chemical solution with both sides of the film wound on each spool. The first chemical solution is then permitted to drain from tank **11** by operation of selected valve **54** which is also controlled by timing station **69**. This permits the chemical solution to be deposited into preselected compartment **52** of collector vat **24**, the timing station further serving to actuate selected pump **57** for returning the solution through conduit **56** to its original container **46**. This same procedure is successively followed for each of the chemical solutions in the various compartments **46** until the processing of the film is completed. In the case of black and white film, processing takes approximately fifteen minutes, and in the case of color film, the process takes approximately forty-five minutes. At the end of the developing cycle, timing station **69** is equipped to give a signal such as the ringing of a bell, to indicate completion of the processing, following which the rack holding the film is removed from the tank. The present apparatus is immediately available to repeat the operational cycle upon placement of undeveloped film on the rack and placement in tank **11**. Therefore, a minimum of time is required between processing cycles, so that a large quantity of film can be processed within a given period of time.

It is of course to be understood that the assembly herein shown and described is a preferred form of the invention which has been used advantageously in the manner herein described. However, it is to be understood that various changes may be made therein, within the scope of the claims hereto appended.

We claim:

1. Apparatus for processing photographic film including:

(a) a developing tank,

(b) a plurality of containers for developing solutions in communication with said tank,

(c) control means for feeding solutions from the containers to the developing tank in predetermined sequence,

(d) collectors subjacent the tank,

(e) valved outlet pipes running from the bottom of the tank to each of said collectors for receiving the solutions from the tank after use,

(f) a wash water container in communication with said tank,

(g) means for admitting and cutting off the flow of water from said container to said tank,

(h) automatic supply and cut-off means for maintaining the wash water container full,

(i) a cradle in said developing tank for holding the film, the cradle including,

(j) a horizontally disposed rectangular frame,

(k) a cross piece extending transversely of the central portion of said rectangular frame,

(l) pivot means connecting the lower face of said cross piece to the bottom of said developing tank, for

supporting the rectangular frame above the tank bottom and allowing oscillatory motion,

(m) said cradle further including a film rack comprising interconnected spaced transverse and longitudinal supports,

(n) vertical spindles mounted on said supports for holding film spools,

(o) inverted U-shaped members engaged with the terminals of the lateral longitudinal members, thereby permitting the rack to be removed from, and deposited on, said rectangular frame and

(p) power means engaged with said cradle for oscillating the latter about said pivot means.

2. The apparatus of claim **1**, with the addition of

(a) a conduit connecting each of said collectors to a container for returning the solutions to the containers for reuse.

3. The apparatus of claim **1**, with the addition of

(a) time control means operatively connected to said valved outlet pipes for opening the latter at predetermined intervals.

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NORTON ANSHER, *Primary Examiner.*

F. L. BRAUN, *Assistant Examiner.*

U.S. Cl. X.R.

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