

July 28, 1953

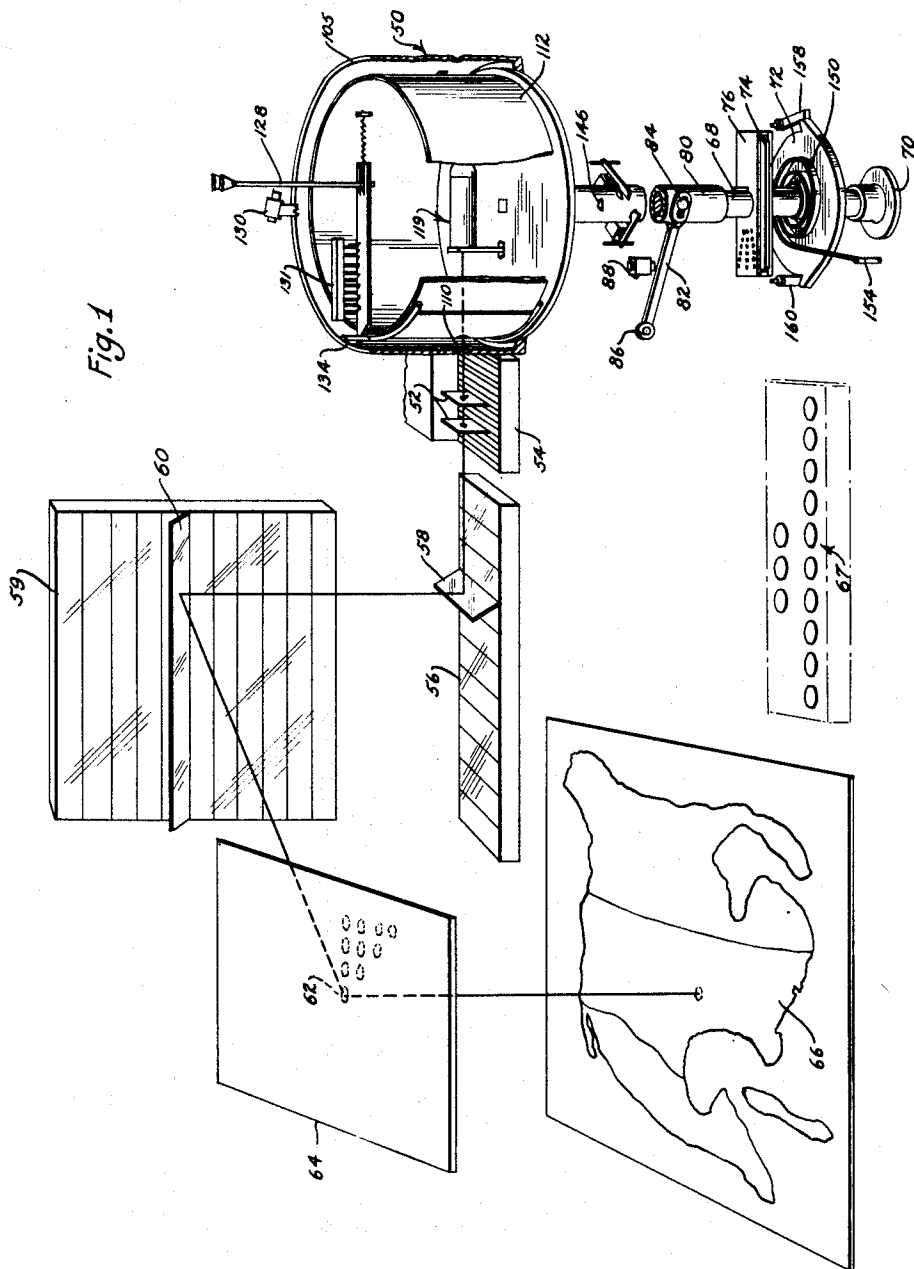
R. E. OFFEMAN

2,646,732

AUTOMATIC WEATHER MAP PLOTTER

Filed Aug. 31, 1951

12 Sheets-Sheet 1



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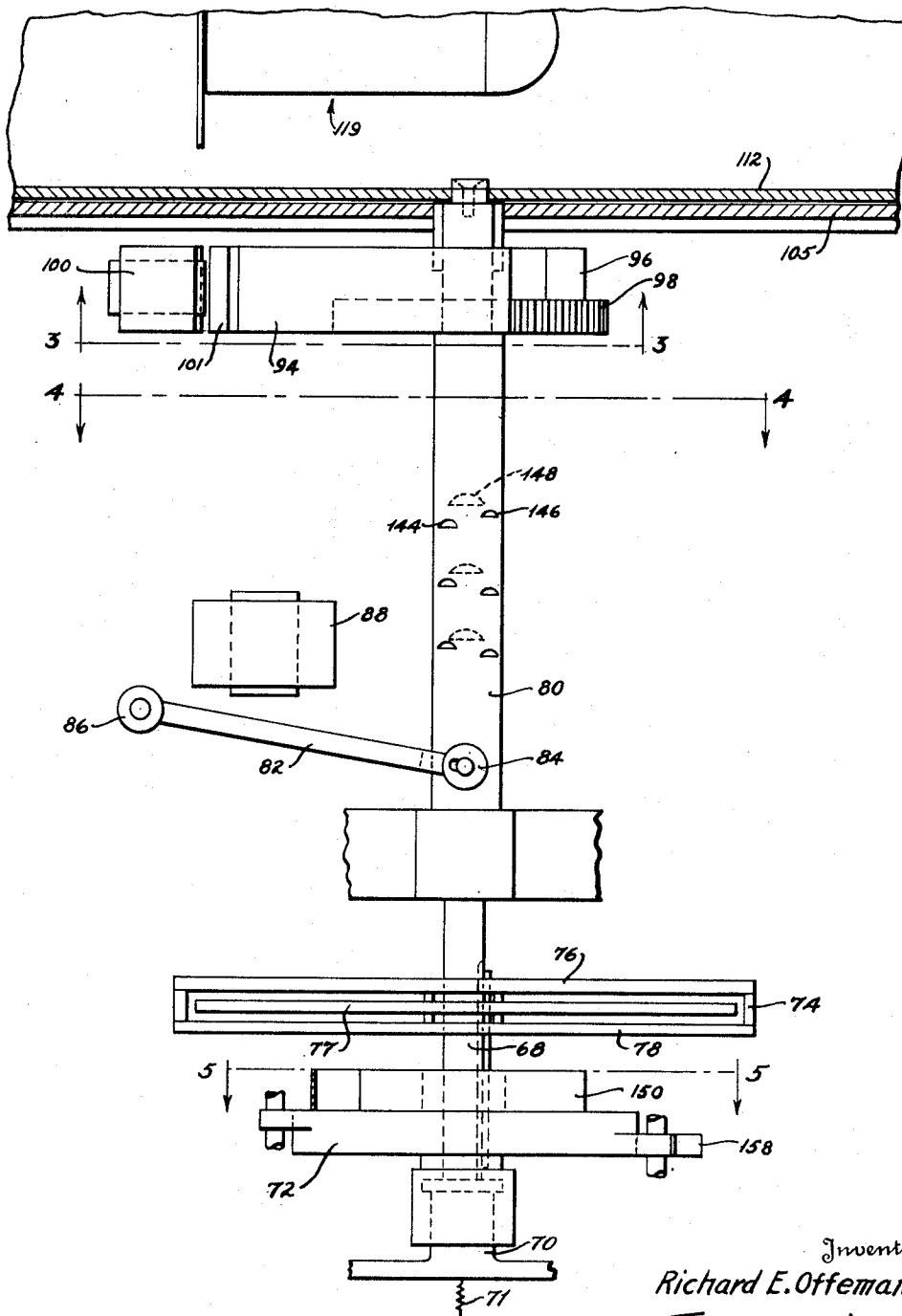
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AUTOMATIC WEATHER MAP PLOTTER

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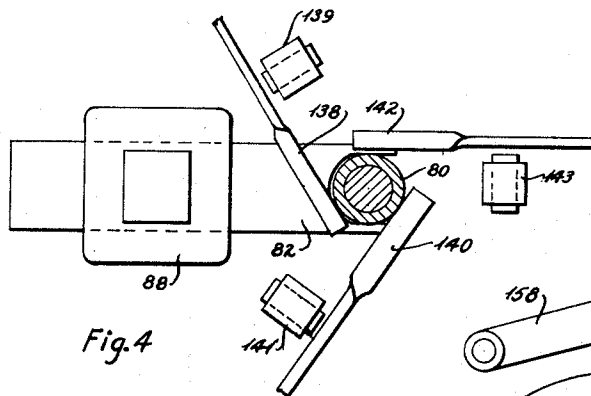


Fig. 4

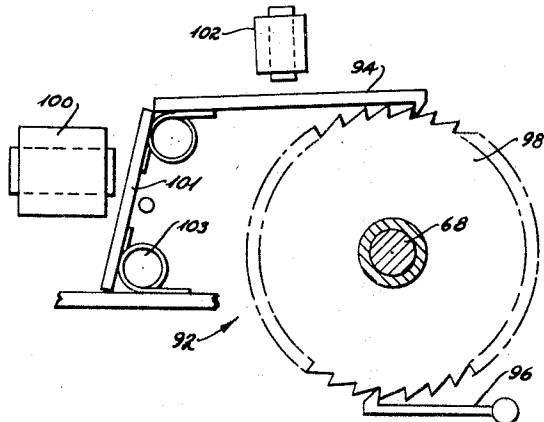


Fig. 3

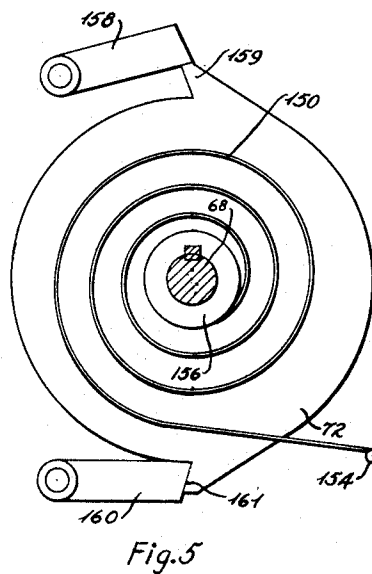


Fig. 5

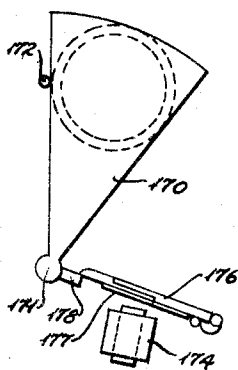


Fig. 7

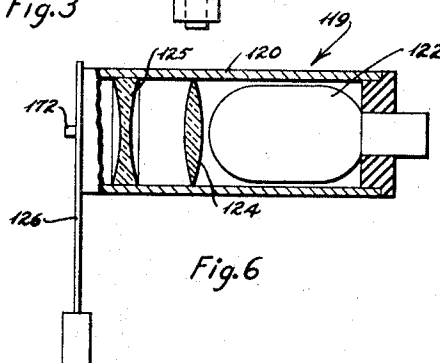


Fig. 6

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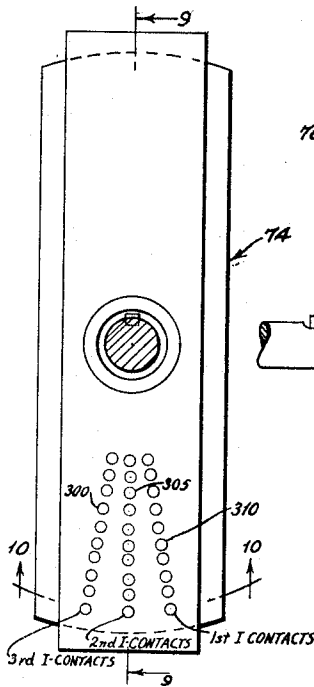


Fig. 8

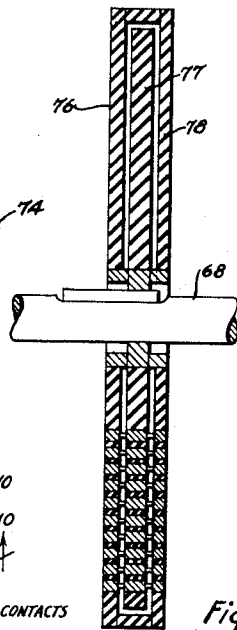


Fig. 9

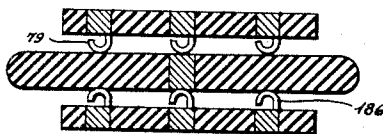


Fig. 10

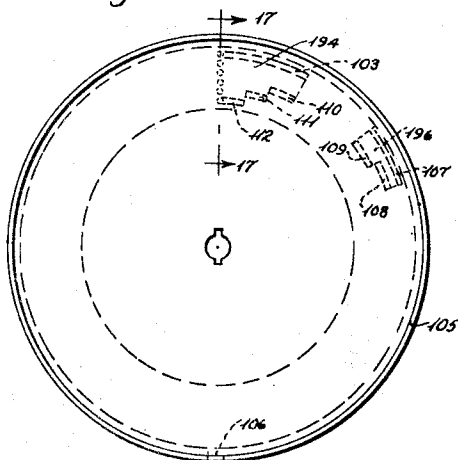


Fig. 16

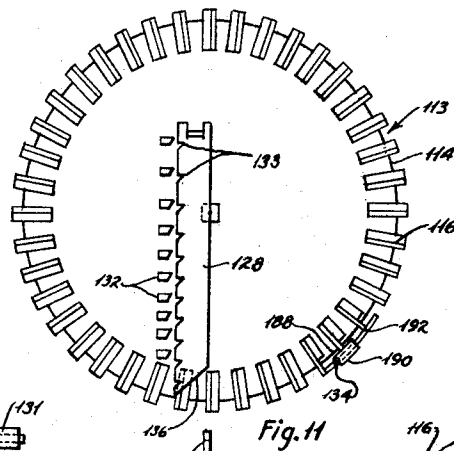


Fig. 11

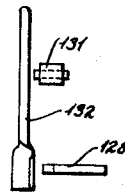


Fig. 14

Fig. 12

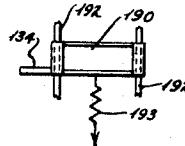


Fig. 13

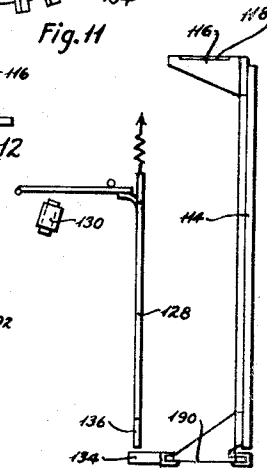


Fig. 15

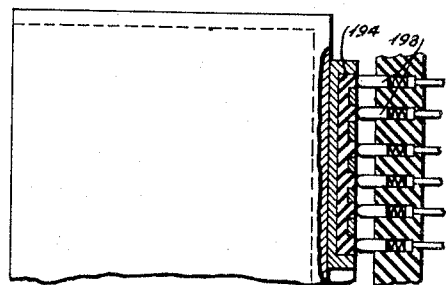


Fig. 17

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Fig. 34

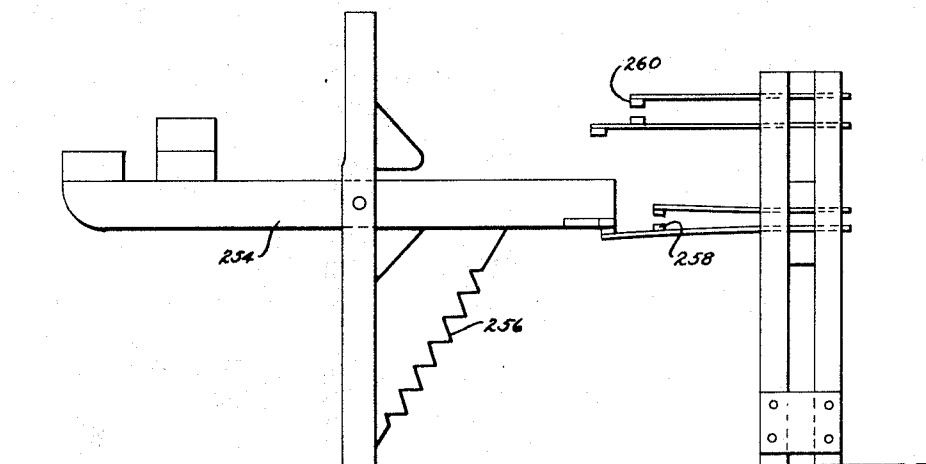


Fig. 36

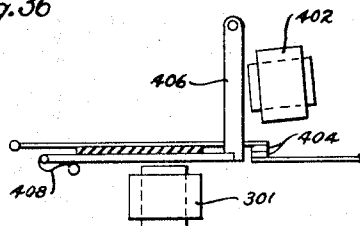
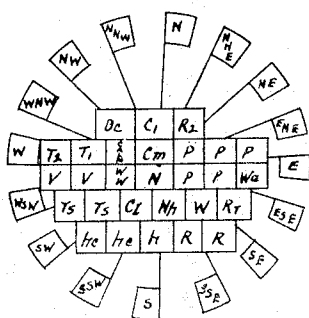


Fig. 18



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Fig. 22

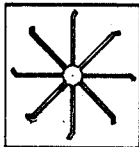


Fig. 23

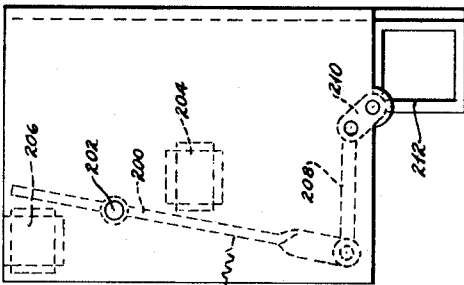


Fig. 21

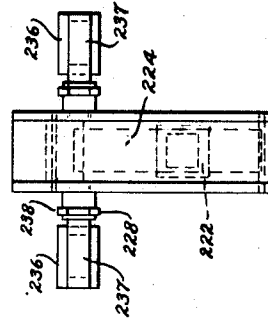


Fig. 25

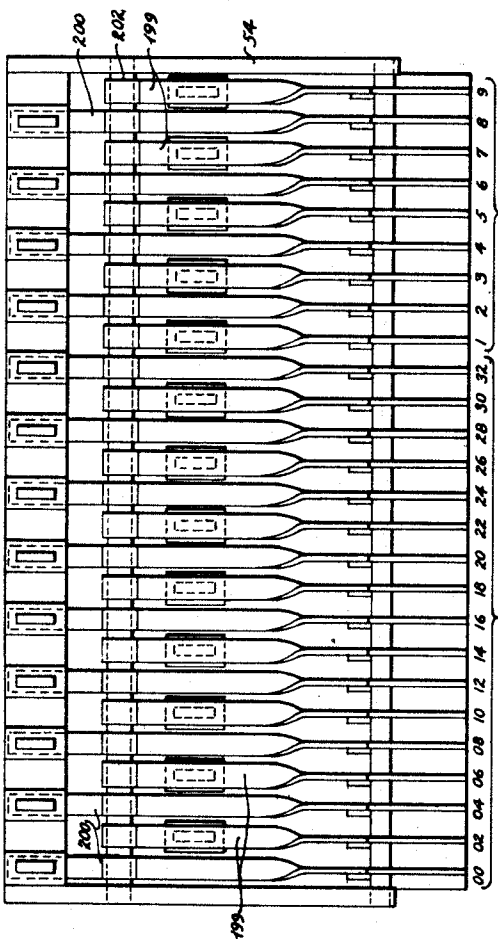


Fig. 20

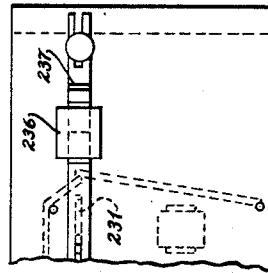
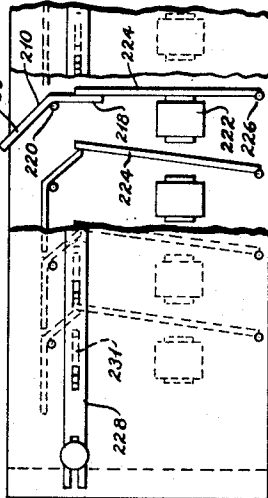


Fig. 24



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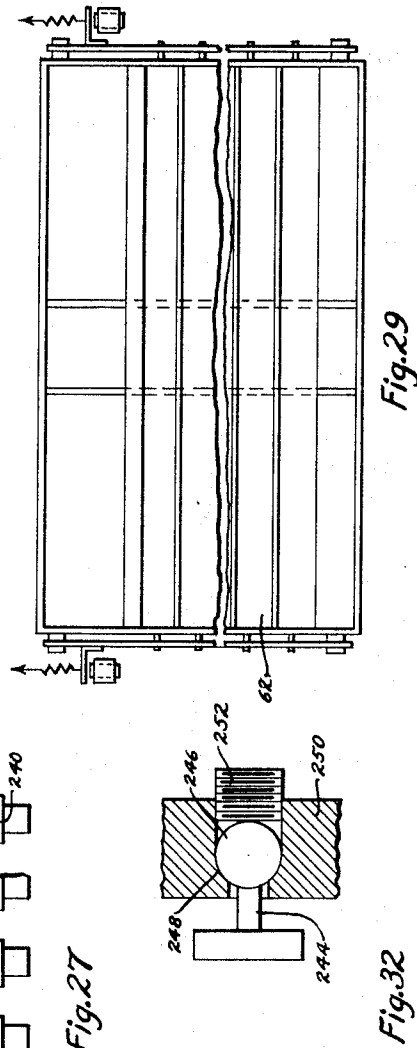
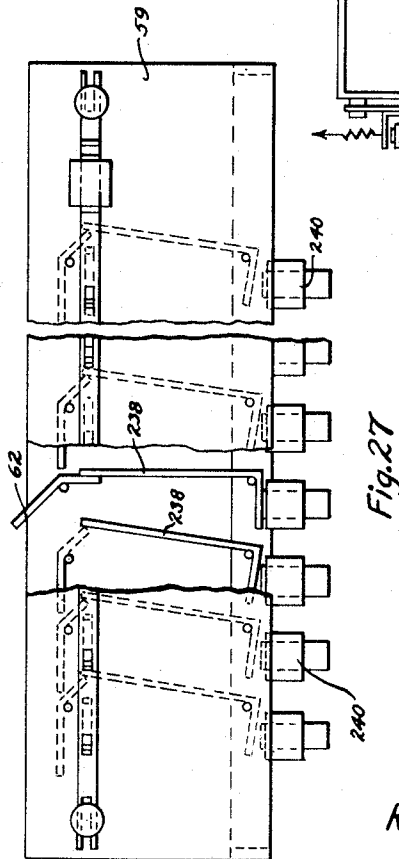
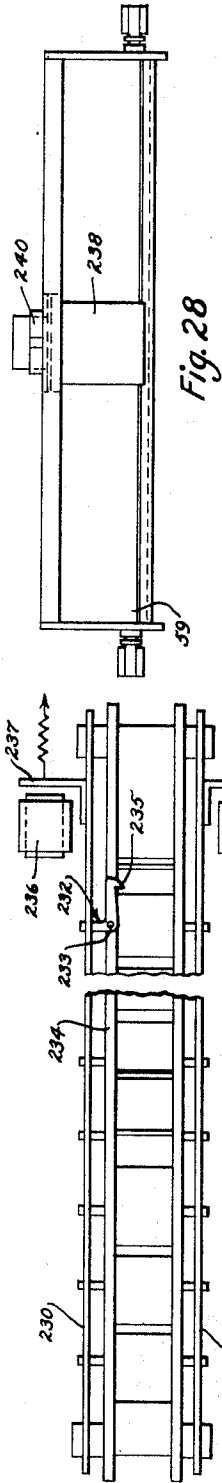
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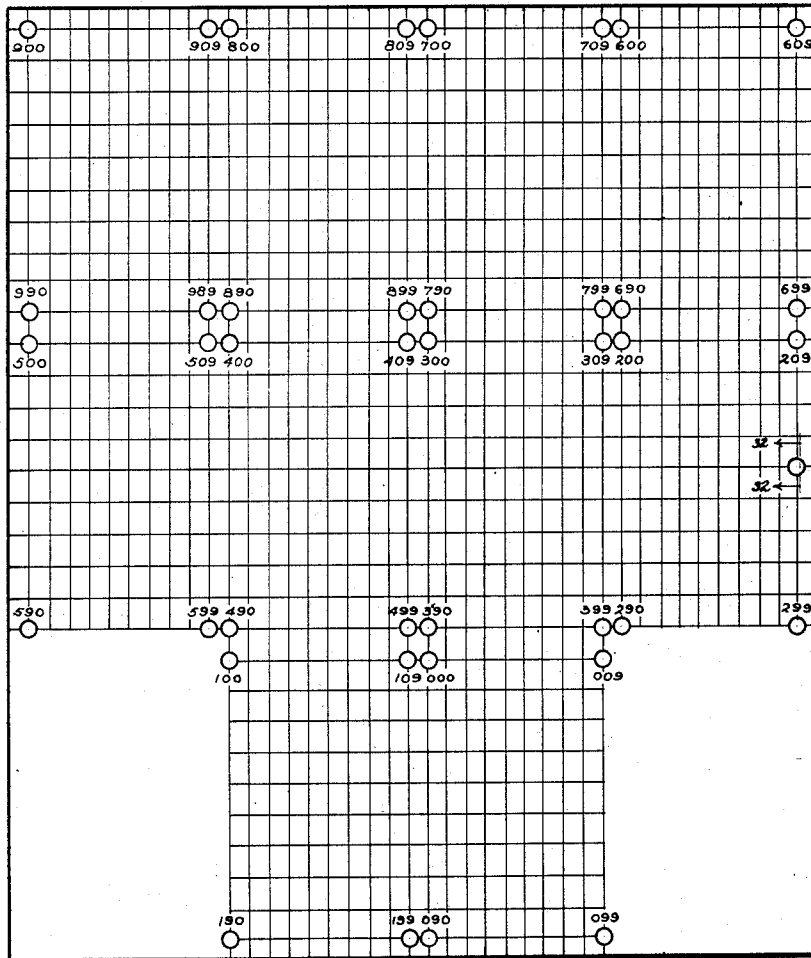


Fig. 30

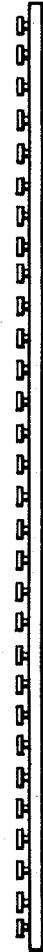


Fig. 31

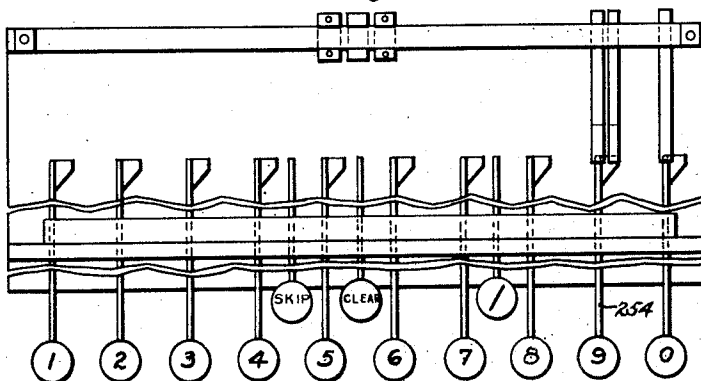


Fig. 33

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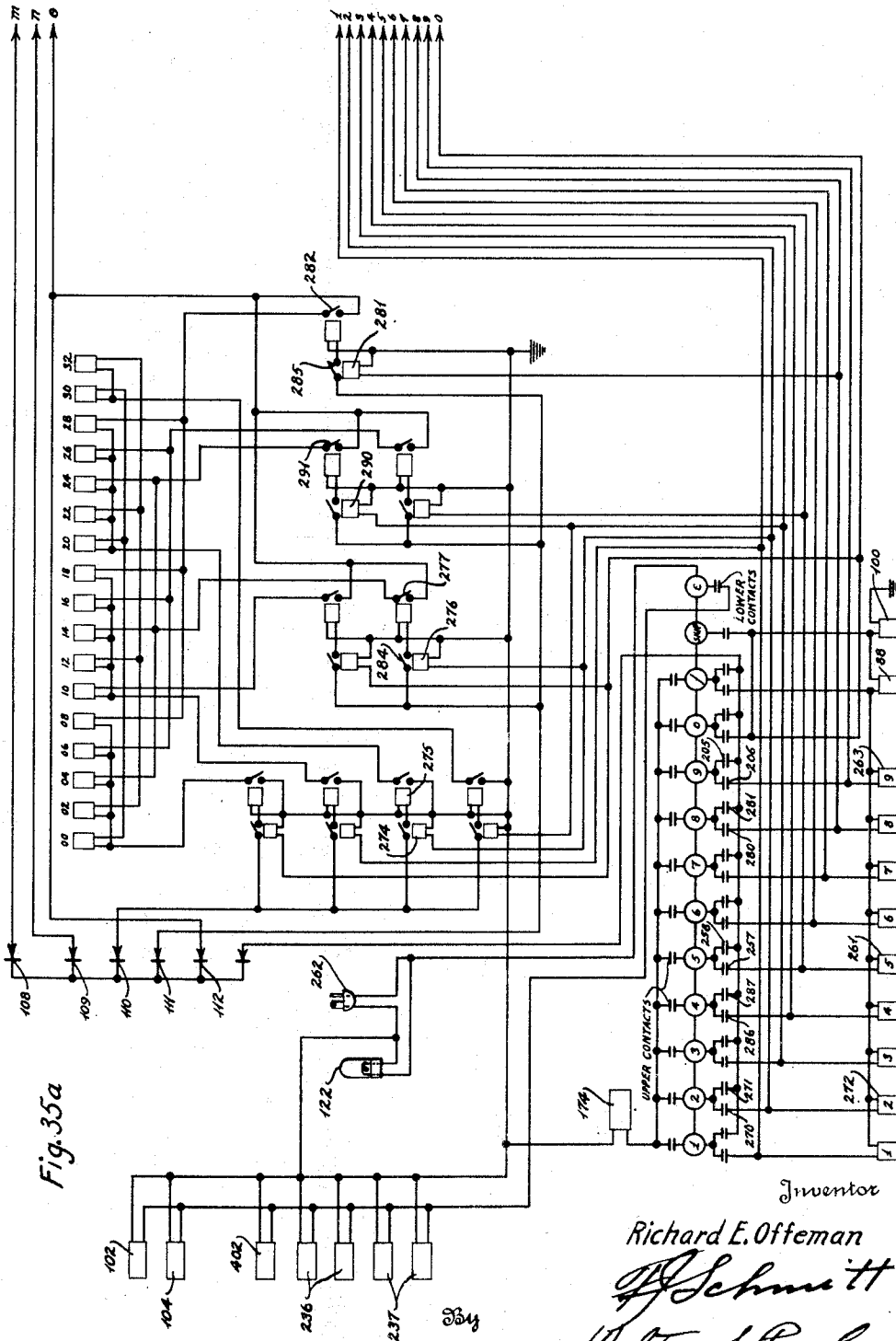
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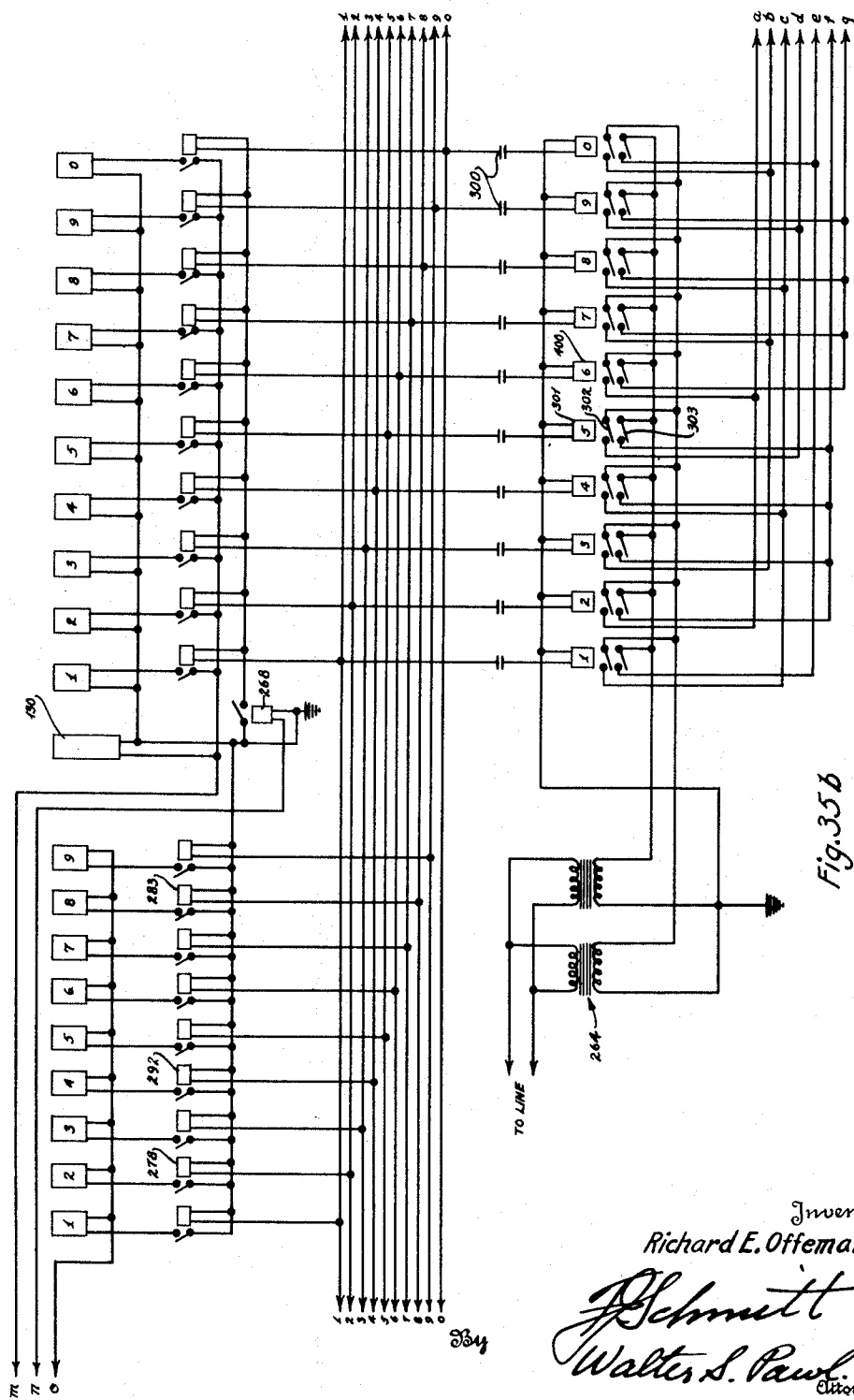


Fig. 35b

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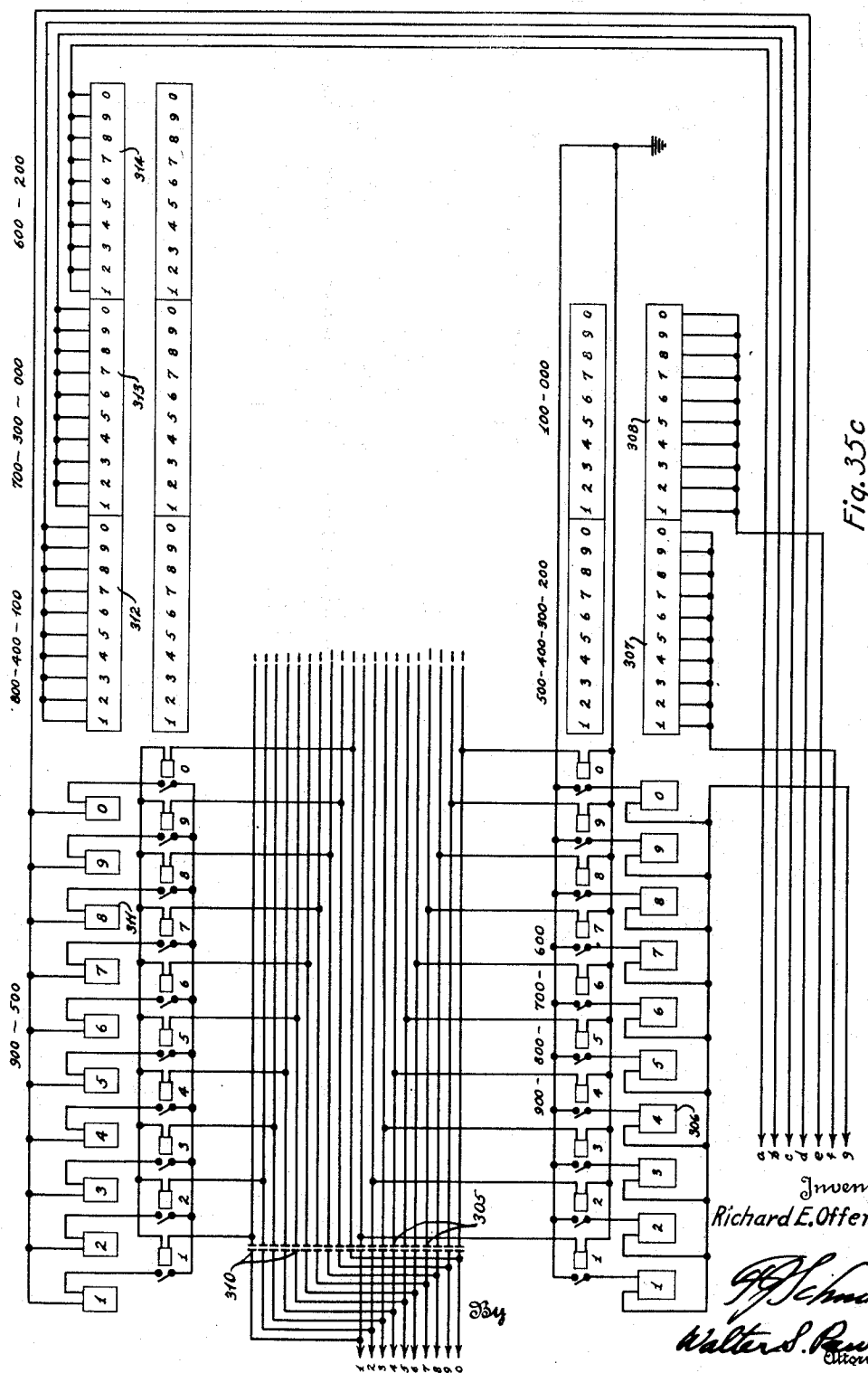
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UNITED STATES PATENT OFFICE

2,646,732

AUTOMATIC WEATHER MAP PLOTTER

Richard E. Offeman, Bellflower, Calif.

Application August 31, 1951, Serial No. 244,683

13 Claims. (Cl. 95—4.5)

(Granted under Title 35, U. S. Code (1952),
sec. 266)

1

This invention relates to photographic apparatus for plotting at particular points on a sensitized map, chart or other form specific data which may be symbolical in nature. In particular the invention, as herein defined and described, relates to apparatus for photographically plotting on a chart or map at the point of observation coded synoptic weather reports as received from various weather observing stations.

Heretofore it has been the practice to manually plot in a standardized form, positioned on a synoptic chart or map at the reporting station, the synoptic reports as they are received at a central control station. The applicant's apparatus in the particular embodiment herein described is designed to plot automatically these synoptic reports in the International 1942 Weather Code on a light sensitized synoptic weather chart. The apparatus is adaptable to any chart and will enter a maximum of one thousand stations in any desired order. The apparatus is not limited to plotting in the International 1942 Weather Code. It can be adapted to plot in any system of symbols or other indicia which may be used.

The numbers or symbols for each element are printed on a sensitized map by means of light beams. As the coded synoptic reports are manually typed or automatically teletyped into the machine, a separate negative for each element of the code is rotated to a position in front of the light source. After passing through the negative, the light beam is directed to a station position by a series of three reflecting mirrors.

This invention therefore deals with the means of selecting the proper mirror for reflecting the incident light beam to the particular station on the sensitized map and with means for positioning the proper negative in front of the light source and in the path of light emanating therefrom.

The general object of the invention is to provide apparatus for plotting data by means of reflected light beams which are modified by passage through a particular negative.

It is a particular object of the invention to provide apparatus for plotting weather code data by means of reflected light beams which are modified through a particular negative.

It is also an object of the invention to provide apparatus for plotting the weather code data by manually controlled means.

It is an additional object of the invention to provide apparatus for automatically plotting the weather code data by means of direct connection to a teletype or other signaling circuit.

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Other objects such as relate to the arrangement and construction of the apparatus will be apparent from the following description, taken in conjunction with the drawings, in which

5 Fig. 1 is an isometric drawing, partly in elevation, partly in section and partly broken away, showing the arrangement of the projector, wind slides, banks of mirrors and sensitized map in operative position;

10 Fig. 2 is an elevational view partly in section, of the rotary shaft of the projector, the rotating mechanism, the lifting mechanism, the rotary switch and the return mechanism;

15 Fig. 3 is a sectional view of the shaft taken along line 3—3 of Fig. 2, showing the rotating mechanism;

Fig. 4 is a plan view taken along line 4—4 of Fig. 2 showing the lifting stop mechanism;

20 Fig. 5 is a view taken along line 5—5 of Fig. 2 showing the shaft return mechanism;

Fig. 6 is a longitudinal section through the light assembly positioned within the shutter drum and showing a collimating lens assembly;

25 Fig. 7 is an elevational view of the shutter positioned in front of the light assembly tube and showing the operating mechanism;

Fig. 8 is a plan view of the contact plates for station selection;

30 Fig. 9 is a sectional view of the contact plates taken along line 9—9 of Fig. 8;

Fig. 10 is a sectional view of the contact plates taken along line 10—10 of Fig. 8;

Fig. 11 is a plan view of the rotary negative holder plate showing the weather stop bar in retarded position;

35 Fig. 12 is a front view of one of the negative holders or guides on the negative holder plate;

Fig. 13 is a front view of a weather slide;

40 Fig. 14 is an elevational view of one set of the electromagnetically actuated stop bars which engage specific notches in the weather stop bar;

Fig. 15 is a diametrical sectional view taken through the negative holder showing the electric magnetic means for the operation of the weather stop bar;

45 Fig. 16 is a top plan view of the rotary shutter drum surrounding the negative holder;

Fig. 17 is an enlarged partial sectional view of the shutter drum, along line 17—17 showing detail of the weather slide contacts;

50 Fig. 18 is a plan view of the station model printed on the synoptic map and in which the reported data are printed by the modified beam of light reflected to particular areas within the model;

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Fig. 19 is a plan view of the negative strip which is carried by the negative holder;

Fig. 20 is a plan view of the assemblage of the wind slides and operating mechanism;

Fig. 21 is an end elevation of the wind slide assemblage showing the electromagnetically actuated operating means;

Fig. 22 is a plan view of wind direction wind slide No. 32 (North);

Fig. 23 is a plan view of wind velocity slide (Beaufort scale) No. 2, and showing the shafts and barbs;

Fig. 24 is a front elevation of the No. 1 bank of reflecting mirrors partly broken away to show the operating mechanism;

Fig. 25 is an end elevation of the No. 1 bank of mirrors;

Fig. 26 is a top view of the No. 1 bank of mirrors;

Figs. 27, 28 and 29 are front elevational, side and top views, respectively, of the No. 2 bank of mirrors;

Figs. 30 and 31 are plan and side views, respectively, of the No. 3 bank of mirrors;

Fig. 32 is an enlarged section taken along line 32-32 of Fig. 30, showing the adjustability of the mirrors in No. 3 bank;

Fig. 33 is a plan view of the control key board which is used in manual operation of the apparatus;

Fig. 34 is an end elevation of the manually operated key board;

Figs. 35a, 35b and 35c show a wiring diagram of the electric circuits used in the operation of the apparatus; and

Fig. 36 is a detail of the hold over switch of the apparatus.

Referring to the drawings in Fig. 1 a preferred arrangement of the apparatus of the applicant's invention is illustrated comprising a projector shown generally at 50 which is adapted to project a collimated beam of light through preselected wind slides 52 mounted in and operated by mechanism in wind slide box 54. Thence, the beam of light passes longitudinally of No. 1 bank of mirrors 56 to a preselected mirror 58 positioned at an angle of 45° to the direction of the beam of light. There may be thirty of these mirrors in No. 1 bank. The incident beam of light is reflected across No. 2 bank of mirrors, which may be 40 in number of a length equal to the length of No. 1 bank of mirrors, to a preselected mirror 60 which is positioned at 45° to the incident light reflected from mirror 58. The beam of light is reflected by mirror 60 to a particular mirror 62 in No. 3 bank of mirrors 64. No. 3 bank of mirrors is positioned at 45° to the plane of No. 2 bank and at 45° to the plane of sensitized synoptic weather map 66. Mirror 62 is positioned to reflect the beam of light incident thereon to a particular reporting weather station and is adapted to reflect this beam of light clearly and sharply to various areas of a form or station model printed on the map at each reporting weather station.

Projector 50 consists essentially of a shaft 68 which is rotatably and slidably journaled in bearing 70, an end spring 71 normally holding the shaft at the bearing limit of extension. Near the hub on bearing 70 and mounted on shaft 68 is a spring return mechanism housing 72. This housing does not rotate with shaft 68 but slides therewith. For detail of this mechanism see Fig. 5. Near housing 72 and on shaft 68 is mounted the station selector switch 74, the housing of which slides but does not rotate with shaft 68.

The outside plates 76 and 78 of the housing carry a series of electrical contacts 79 adapted to engage contacts in the middle or rotor plate 77 of this switch, this plate being keyed to and rotatable with shaft 68. For further detail of this selector switch see description of Figs. 8, 9 and 10.

Surrounding shaft 68 is notched sleeve 80 which constitutes the means for moving the shaft longitudinally along its axis. This sleeve does not rotate with the shaft but is held from rotation by lever 82 which is pivotally connected to sleeve 80 as at 84, fulcrumed as at 86 and actuated by electromagnet 88. The pivot connection 84 is enlarged as shown to prevent binding. Sleeve 80 is exteriorly notched for engagement with electromagnetically operated detents which selectively stop the longitudinal movement of the sleeve and shaft at a particular position required for printing the reported data. At the end of sleeve 80 is located housing 90 of electromagnetically actuated shaft rotating mechanism 92 shown in detail in Fig. 3. In this figure spring biased pawls 94 and 96 are shown engaging the 40 tooth ratchet wheel 98. Pawl 94 is the driving pawl and pawl 96 operates to prevent counterrotation. Pawl 94 is actuated by electromagnet 100. Both pawls are held in disengaging relationship for clearing the apparatus to starting position by electromagnets 102 and 104. Housing 90 slides with shaft 68 but does not rotate therewith. Mounted near housing 90 on shaft 68 is shutter drum 105 which rotates with shaft 68 but does not slide therewith. This shutter drum is provided with a plurality of apertures 110, one for each section of the negative strip and in alignment with the zero of the index scale of that section, to be further described hereinafter. Positioned within shutter drum 105 and mounted on the end of shaft 68 is cylindrical negative holder 112. This negative holder is fixedly attached to shaft 68 rotating and sliding therewith. This negative holder comprises a base disc 114 around the periphery of which may be spaced at about 9° 40 upstanding arms 116 which on their exterior edges are countersunk at 117 to receive and hold negative strip 118. (Cf. Figs. 11 and 12 of the drawings.)

Fixedly mounted within negative holder 112 is a light source assembly 119 which comprises a tubular housing 120 containing a source of light 122, and collimating double concave and convex lenses 124 and 125. (See Fig. 6.) In front of tubular housing 120 electromagnetically operated shutter 126 is positioned. Supported independently and diametrically above negative holder 112 is notched stop bar 128. (See Figs. 1, 11, 15.) This stop bar is actuated by electromagnet 130 and is stopped in its outward movement by one of a series of electromagnetically operated stop levers 132 engaging one of the notches 133. The notched stop bar and stop levers are operated only for printing the "present weather" data which are indicated in the second group of the synoptic report and in sections six and seven on the negative. Stop bar 128 stops the negative weather slide 190 (Fig. 11) in proper position by impingement of rod 134 on slant face 136 of the stop bar. Wind slide box 54 containing the directional and wind force slides is positioned directly in front of the light shutter 126 so that the slides may be elevated into the path of the light beam and thereby modify the beam to print the desired directional and force data in the desired area on the sensitized map. The wind slide box and operating mechanism are shown in detail in Figs. 20 and 21. A directional slide 32

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(North) in Fig. 22 and velocity slide 2 (Beaufort scale 4-7 miles per hour in Fig. 23 are also illustrated). Positioned next to wind slide box 54 and in the path of the beam of light emanating from projector 50 is No. 1 bank of mirrors 56. This bank may contain 30 mirrors and is so positioned with respect to the path of the beam of light that any one of the thirty mirrors may be rotated into the path of light at an angle of 45° thereto for reflection of the incident light at right angles thereto across the No. 2 bank of mirrors 59. Details of the structure and operating mechanism of the No. 1 bank of mirrors are shown in Figs. 24, 25 and 26 of the drawings. Details of the structure and operating mechanism of the No. 2 bank of mirrors are shown in Figs. 27, 28 and 29 of the drawings. The No. 2 bank of mirrors is positioned perpendicularly to the plane of the sensitized map and light reflected from the No. 1 bank of mirrors, incident on any mirror 60 in No. 2 bank positioned at 45° to the incident reflected light is reflected in a plane parallel to the plane of the sensitized map to a particular mirror 62 in No. 3 bank of mirrors 64. The plane of the No. 3 bank of mirrors is at 45° to the plane of the No. 2 bank of mirrors and to the plane of the sensitized map. The light incident on any mirror of No. 3 bank such as mirror 62 is reflected to a particular reporting weather station. The mirrors in No. 3 bank are adjustable as shown in Fig. 32 of the drawings so that the beam of light may be reflected to a particular weather station with geographical accuracy on the map.

The keyboard for manual operation of the apparatus is shown diagrammatically at 67 in Fig. 1 and in Figs. 33 and 34.

Having described the general arrangement of the apparatus, the different elements of structure will now be considered in greater detail, reference being made to the various figures of the drawing.

Referring to Fig. 3 ratchet wheel 93 is shown as provided with 40 teeth. These teeth are of uniform pitch thereby rotating a section of the negative into exact position in the beam of light with each stroke of pawl 94, the latter being driven by electromagnet 100. Link 101, resiliently supported as at 103, biased to return said pawl to extreme position and resiliently connected to pawl 94, functions as the armature of electromagnet 100. Electromagnets 102 and 104 function to disengage pawls 94 and 96 from the ratchet wheel 93 thereby permitting shaft 68 to be returned to zero position by clockwise acting pivot spring.

In Fig. 4 is a view showing the arrangement of stop levers and actuating electromagnets for axially positioning shaft 68 and negative strip 118. There are nine sets of pivoted levers spaced in groups along sleeve 80. Those levers are selectively actuated by electromagnets to engage in notches on the outer sleeve surface. Typical levers are indicated at 138, 140 and 142 as actuated by electromagnets 139, 141 and 143 to engage notches 144, 146 and 148. In this figure a sectional view of sleeve 80 is shown together with stop lever 140 and coacting notch 146 in the sleeve.

Fig. 5 is a sectional view through the shaft return housing and mechanism. Here coiled spring 150 is shown anchored to non-rotating housing 72 at 154. The inner end of spring 150 may be attached to shaft 68 by any suitable means such as by bushing 156 which is keyed to the shaft.

Pawls 158 and 160 stop the shaft at zero position. These pawls further coact to adjust the tension on spring 150.

Fig. 7 shows a front elevation of shutter 126 which is spring biased at pivot 171 to bear against stop 172. Electromagnet 174 has an armature 176 provided with a stepped overlap and spring 177 permitting inflexible contact with shutter arm 178 on down movement but flexible contact on up movement to permit reinstatement of armature for lever actuation.

Fig. 8 is a view of the station selector switch 74 showing the two outer contact plates 76 and 78 which do not rotate with shaft 68 and inner plate 77 which does, all three plates moving axially with shaft 68.

Fig. 9 shows the relationship of the three plates to each other.

Fig. 10 shows clearly the brush contacts 186 between these plates. Three groups of contacts are shown, these groups being referred to hereinafter as rotor plate first, second and third I contacts.

Fig. 11 illustrates details of the negative holder. The brackets 116 which hold the negative are forty in number and are spaced around the periphery of base plate 114 at 9° intervals. Notched stop bar 128 is shown in retarded position. Two present weather spaces (W₁ W₂) on the negative holder are indicated at 188. A W₁ W₂ slide is indicated at 190.

Fig. 12 shows the front face of the negative holder 116 recessed as at 117 for holding the negative strip in vertical position.

Fig. 13 shows the structural detail of the present weather slide 190. The stop or positioning post is shown at 134 and the slide carrying rods are shown at 192. Spring 193 permits adjustment of the slide in relation to the drum.

Fig. 14 shows the relationship of electromagnetically operated stop lever 132 to stop bar 128 and to actuating magnet 131. There are ten of these levers each one of which is adapted to coact with a particular notch in stop bar 128.

Fig. 15 shows the relationship of stop bar 128 to the negative holder and in particular to stop post 134. Stop bar actuating magnet is shown at 130.

Figs. 16 and 17 show detail of the shutter drum 105. Contact plates are shown at 194 and 196, plate 194 supporting long contact bar 103 and short contact bars 110, 111 and 112, and plate 196 supporting long contact bar 107 and short contact bars 108 and 109. Spring biased contacts are shown at 198 positioned at 180° to the shutter drum position of the W₁ W₂ and DDF sections of the negative strip. The circuits controlled by these contacts will be explained in the description of the operation of the apparatus.

Fig. 18 shows in plan view the station model or form printed on the sensitized map at each reporting station. The beam of light is reflected to the rectangular areas within this form printing the reported data placed in the beam of light by the particular section of the negative strip.

Fig. 19 is a plan view of the negative strip. This strip is divided into eight groups of five sections each, corresponding to grouping in the synoptic reports of the Weather Code of 1942. The first three sections of group 1 are for reporting station identification. In the code these sections are designated I, I and I. The fourth and fifth sections in this group indicate the forms of the low and the middle clouds respectively in a vertical scale of ten positions. In the second

group the first and second sections indicate the present weather by two integers from 00 to 99. The third section indicates the horizontal visibility in a vertical scale of from 0 to 9. The fourth section indicates the height of lowest clouds in a vertical scale of from 0 to 9 and the fifth section indicates the amount of clouds whose height has been indicated in the previous section. In the third group the first two sections indicate the direction from which the wind is blowing by a series of even numbers from 00 to 32, 00 being the symbol for calm and the other numbers being equally spaced in a clockwise direction around a compass rose at $22\frac{1}{2}^\circ$ intervals, 02 being NNE and 32 being due N. The third section indicates the wind force in a vertical Beaufort scale of from 0 to 9. The fourth section indicates the past weather in a vertical scale of from 0 to 9, and the fifth section indicates the total amount of all clouds in a vertical scale of from 0 to 9. In the fourth group the first three sections indicate the atmospheric pressure in tenths of millibars. Thus a reading of 132 tenths of a millibar indicates an atmospheric pressure of 1013.2 millibars. The last two sections of this group indicate the temperature of the atmosphere in degrees Fahrenheit. In the fifth group the first section indicates the relative humidity in a vertical scale of from 1 to 10; the second section indicates the form of high cloud in a vertical scale of from 0 to 9; the third section indicates the barometric tendency during a three hour period ending at time of observation, in a vertical scale of from 0 to 9 and the fourth and fifth sections indicate the amount of barometric change during the three hour period ending at the time of observation, both sections reading in a vertical scale of from 0 to 9 thereby indicating one hundred steps of .005 inch of water per step. In the sixth group the first two sections may indicate the temperature of the dew point in degrees Fahrenheit; the third section indicates the direction from which the clouds are moving in a vertical scale of from 0 to 9 which indicates the direction on a compass scale at 45° intervals clockwise, 0 being no clouds or calm and 9 being unknown or variable; the fourth and fifth spaces may indicate either the minimum or maximum temperature during a 24 hour period prior to 1:30 p. m., E. S. T. (min.) or during a 24 hour period prior to 1:30 a. m. E. S. T. (max.) both on the date of reporting. Temperatures of two integers are indicated, the tens integer being indicated by section four and the units integer by section five. In the seventh group the first section indicates the group (7); the second and third sections indicate the height of the "ceiling" in hundreds of feet in vertical scales from 00 to 99 and the fourth and fifth sections indicate the horizontal visibility in units and tenths of miles in vertical scales of from 00 to 99, 91 being 10 miles, 92 being 20 miles and up to 99 which is 90 miles or more. The eighth group may be either the eight code group, the ninth code group or the tenth code group. When indicating the eighth code group, the first section indicates the group number (8); the second section indicates the depth of snow in inches in a vertical scale of from 0 to 9, 8 being eight inches or more and 9 indicating less than 0.5 inch; the third section indicates the time precipitation began or ended in a vertical scale of from 0 to 9, 6 being five to six hours ago, 7 six to twelve hours ago, 8 more than twelve hours ago and 9 unknown, and the fourth and

fifth sections indicating the amount of precipitation in hundredths of inches in vertical scales reading from 00 to 99. If the precipitation is more than .99 inch "one," "two," "three" etc. must be prefixed to the indication of these two sections. The last three sections of group eight on the film holder are adapted to hold special slides for the indication of data not included in any of the above groups.

The vertical scales or indices in each section are positioned transversely and longitudinally of the section and in the field of the light beam so that the light passing through the index and the aligned shutter drum aperture is reflected to a particular area in station form or model as indicated in Fig. 18.

In Figs. 20 and 21 the plan view shows the arrangement of the operating mechanism in wind slide box 54. Here a series of levers 199 and 200 are pivoted as at 202. These levers are spring biased to return them to zero position, i. e. to return the wind slide to retracted position. Levers 199 are actuated by electromagnets 204 and levers 200 are actuated by electromagnets 206. All of these levers are spring biased to return position and are pivotally connected to one end of links 208 which at their other ends are pivotally connected to arms 210 of the wind-slides 212. Levers 199 and 200 are actuated by electromagnets 204 and 206 respectively.

Figs. 22 and 23 are plan views of typical wind slides. The slide in Fig. 22 is illustrative of the symbol which may be used for indicating the wind direction from the north. This represents compass direction 32 in the code. Other directions slides have this same symbol position at the proper direction angle. Figure 23 is illustrative of wind force slide Number 2. It shows single barbed radial shafts and indicates a slight breeze of from four to seven miles per hour.

There are at least nine Beaufort scale slides which differ from each other in the number and arrangement of barbs on the shafts.

In Figs. 24, 25 and 26 the elevational view of the No. 1 bank of mirrors is partly broken away to show the structure and operating mechanism in full line. There may be 30 mirrors in this bank which are provided with arms 218 and are pivoted as at 220. The plane of the mirror and its operating arm may be at an exterior angle of 210° so that movement of the arm through an angle of 45° to vertical position rotates its mirror to an angle of 45° above the common plan surface of the mirrors. The mirrors are rotated about their pivot 220 to reflecting position by electromagnets 222 which attract armatures 224 which are pivoted as at 226; and these mirrors are locked into operative position by means of spring biased slotted side bars 228 and 230 which are provided with an elongated slot 231 which is coextensive with each mirror. One arm of bell crank 232 projects into this slot and is pivoted about pivot 233 on frame member 234. The other arm of bell crank 232 is provided with a detent 235 which is provided with a sloping face forward.

Bell crank 232 is spring biased about its pivot to urge the detent inwardly toward the center of the bank of mirrors. When any mirror in the bank is moved into operative position by armature 224, detent 235 is moved outwardly and then inwardly back of armature 234 thereby locking the particular mirror in reflecting position until released by electromagnets 236 which move arms 237 and side bars 228 and 230 to rotate

bell cranks 232 about their pivots and release detents 235 from holding armatures 224, thus allowing the mirror to pivot to closed position.

The No. 2 bank of mirrors in Figs. 27, 28 and 29 has operating mechanism similar to that of the No. 1 bank of mirrors. The armature 238 pivoting the mirrors is bell crank in form. And the mirror operating magnets 240 are positioned to project through the back plate of the housing for accessibility.

Fig. 30 shows the arrangement of 1,000 mirrors in No. 3 bank of mirrors. A circular mirror such as indicated by the numerals in the drawing is located at each intersection of the ordinates and abscissas. There are thirty abscissas, one for each mirror in No. 1 bank of mirrors and forty ordinates, one for each mirror in No. 2 bank of mirrors. Thus the beam passing longitudinally over the No. 1 bank of mirrors may be reflected by a particular mirror in that bank along the abscissa of that mirror across the No. 2 bank of mirrors. Any one of the forty mirrors will reflect the light incident thereon along the ordinate of that mirror to a particular mirror in No. 3 bank. Thus the light incident on the mirrors of No. 1 bank may be reflected to any one of the intersections.

In Fig. 31 the mirrors in No. 3 bank are all shown as lying in the same plane. In practice, however, this is not true as each one of these mirrors must be adjusted to reflect the incident light to a particular restricted area on the sensitized map or chart.

In Fig. 32 the adjusting means of the supporting structure of the mirrors in No. 3 bank is clearly shown. Here the mirror is shown as mounted on a stem 244 which has a ball 246 which is supported by socket 248 in plate 250. Set screw 252 is adapted to lock ball 246 in the desired position.

Fig. 33 shows a plan view of the control keyboard. The key levers are spring biased to inoperative position and when depressed close two sets of contacts the effect of which will be explained in the operation of the apparatus.

Fig. 34 clearly shows the two sets of contacts open but subject to closure on the depressing of any key on the board. Key lever 254 is shown as spring biased at 256 to return position. The double set of electrical contacts 258 and single set 260 are closed in succession when key lever 254 is operated.

The operation of the apparatus is described in printing a coded synoptic report received from the reporting station at Buffalo, New York. Suppose this coded report be in eight groups and read as follows:

52890 95638 28498 13258 00414 57753 70727 80357

The first three integers 528 of group 1 identify the reporting station and the method of selecting station 528 is therefore first described.

Reference is here made to the drawings herewith submitted. Assume machine has been cleared by depressing clear key "C" on the keyboard thereby orienting rotor contact plate, Figs. 33, 34, and 35, for station selection so that 1st I contacts 300 shown in Figs. 2, 8 and 17 are closed. Depress key No. 5 of keyboard, Figs. 33 and 34; this operation manually closes the two lower keyboard contact points and the one upper keyboard contact point. Electric current may now flow, Fig. 35, from power source shown as electric plug 262 to both of the lower keyboard contacts and to the single upper keyboard contact connected to key No. 5.

The current motivates the shutter magnet 174, Fig. 7, thru the upper contact 260 and the current returns to ground. The shutter magnet is operated each time a key is depressed permitting a beam of light to pass thru the shutter aperture. This light beam does not reach the sensitized synoptic map paper until its path is deflected by mirrors 17 banks 1 and 2, Figs. 24 and 27. One of the lower contacts 258 closed by key No. 5 sends current to rotor plate contacts 74 leading to the 1st w, 2nd w, 1st D, 2nd D and F circuits; however, as the rotor plate is oriented over the 1st I contacts 300 only, no current can flow, as yet, to the first w, 2nd w, etc. circuits.

The current motivates also, thru the second lower contact 259, ratchet magnet 100, Fig. 3, selective stop magnet No. 5 used in halting the lifting mechanism at desired elevations, Fig. 4, and a lifting mechanism, 82, 84, 86 and 88 Fig. 2.

The lifting mechanism elevates the drum containing the negative holder, Figs. 19, 12, and 2. The above lifting operation occurs each time a key is depressed but actually has no useful function until the mirror banks 1 and 2 are in place. The ratchet magnet operates each time a key is depressed, thereby rotating the rotor contact points from position for 1st I contact to 2nd I contact, then to 3rd I contact position and so on thru the Cl and Cm groups which have no rotor contact points, thru the 1st w, 2nd w, 1st D, 2nd D and F groups which have rotor contact points on bottom of shutter drum 105 and then thru the rest of the synoptics, which have no rotor contact points.

Simultaneously the drum holding the synoptic negatives is rotated permitting selection of desired elements in the proper synoptic sequence.

Simultaneous with above operations, the electric current passes thru the first I contacts 300, Fig. 8, to the No. 5 "hold over" switch 301 Fig. 35. This switch is of the type shown in Fig. 6 having a contact making magnet 301 and a release magnet 402. When contacts 404 are closed by magnet 301 the notch at the end of release arm 406 locks the contacts in closed position, from which it is released only by energization of magnet 402. A spring 408 normally urges the contacts to open position.

Closing of hold over switch No. 5 (HO No. 5) closes two separate contacts, 302 and 303, as shown in Fig. 35. The closing of the contact 302 closes circuits from the current supply, shown as transformer 264, to all of the selective magnets for the No. 2 bank of mirrors controlling the 900 and 500 groups of fixed mirrors in the No. 3 mirror bank. The selective magnets are numbered from 1 thru 9, and 0. None of these magnets can operate as yet as the current paths to ground are still open thru the electro-magnetic switches shown directly below the selective magnets for the No. 2 mirrors, Fig. 35.

The closing of the contact 303 closes circuits from a second independent power source, as transformer 264, to all of the selective magnets for the No. 1 bank of mirrors, Fig. 26, controlling the 500, 400, 300, and 200 groups of fixed mirrors in the main mirror bank. The selective magnets are numbered 1 thru 9 and 0. None of these magnets can operate as yet as the current paths to ground are still open thru the electro-magnetic switches shown directly below the selective magnets for the No. 1 mirrors, Fig. 35.

Now the operator is ready to depress key No. 2 in the keyboard. During the split second that key No. 5 was depressed all of the above opera-

tions occurred, including the rotation of the rotor plate and negative drum mechanism to a position such that the rotor plate second I contacts are now touching and ready for any electric current that may flow when key No. 2 is depressed. Rotor contact first I is now open but HO No. 5 switch is still closed and will remain closed until the entire synoptic for station 528 is printed and the keyboard key clear (C) has been depressed. Depressing of key No. 2 closes a set of upper and lower keyboard contacts similar to those of key No. 5 and the same procedure as above is repeated except that now the current must flow thru the lower keyboard contacts to the second I contacts 305 oriented into position by the rotation of the rotor contact plate by the ratchet magnet Fig. 3 motivated when key No. 5 was depressed. The circuit from the lower contacts of the key No. 2 of the keyboard, thru the second I contacts, Fig. 8 and Fig. 25, is closed to all three of the electromagnetic switches shown directly below the three No. 2 selective magnets 306, 307 and 308 for the No. 1 bank of mirrors, Fig. 35; this closes to ground only the No. 2 selective magnet 305 for the No. 1 bank of mirrors controlling the 500, 400, 300, and 200 groups of fixed mirrors in the main mirror bank.

The current flows thru the No. 2 selective magnet 305 and the small mirror 58 of the No. 1 bank of mirrors which covers the 520-529, 420-429, 320-329, and 220-229 groups of mirrors in the No. 3 mirror bank, springs into place ready to deflect a light beam from the lamp shown in Fig. 6 to a desired mirror in the No. 2 mirrors of Figs. 27, 28 and 29. The mirror 58 will remain mechanically locked in place until the synoptic for 528 is printed and the clear key is finally depressed.

The operator is now ready to depress key No. 8 in the keyboard. During the above depression of key No. 2 the ratchet mechanism rotated the rotor contact plate 74 to a position such that the rotor plate third I contacts 310 are now touching and ready for any electric current that may flow when key No. 8 is depressed. Rotor contacts I-300 and II-305 are now open. But No. 5 HO switch 301 is closed and mirror 58 in No. 1 mirrors is sprung in place and locked in position. Depression of key No. 8 closes upper and lower keyboard contacts as in keys No. 5 and 2, the ratchet magnet moving the lower contact to close circuit with the rotor plate third I contacts 310. Also, circuits are made to all four of the electromagnetic switches shown directly below the four No. 8 selective magnets for the No. 2 mirrors, 311, 312, 313, 314, Fig. 35. This closes to ground only the No. 8 selective magnet 311 for the No. 2 mirrors controlling the 900 and 500 groups of fixed mirrors in the main mirror bank. The current flows through selective magnet 311, No. 8, and the large mirror 60 of the No. 2 mirrors which covers the 900, 910, 920, 930, 940, 950, 960, 970, 980, 990, 510, 520, 530, 540, 550, 560, 570, 580, and 590 groups of fixed mirrors in the main mirror bank springs into place ready to deflect a light beam from the No. 1 mirror 58 controlling, as stated above, the 520-529, 420-429, 320-329, 220-229 groups of mirrors in the main mirror bank. Thus the mirror 58 along the ordinate of the main mirror bank locates stations 520-529, 420-429, etc., while along the abscissa a mirror 60 locates stations 900, 910, 920, 930, etc., and 500, 510, 520, 530, etc. At the point of intersection, the beam of light is reflected to fixed mirror 62 at station 528, which is the only station common

to both the No. 1 and No. 2 mirrors, selected by depressing in sequence keys No. 5, 2, and 8.

The two selected mirrors in mirror rows No. 1 and No. 2 remain sprung in place ready to receive an image from the Cl and Cm (cloud) group. This group shown in Fig. 19 of the negative strip, is the first synoptic rotated into place on the negative drum holder by the ratchet mechanism. Rotor contacts for first I, second I, and third I are now open and will not contact any further points until Cl and Cm are entered; then upon further rotation of the shutter drum, contact 105 will be made with 1st W, then 2nd W, then 1st D, 2nd D and finally F; the remaining synoptics of W, N, PPP, TT, etc., will, as in the case of Cl and Cm, be controlled entirely thru the negative drum and not by the rotor contact plate which is devoid of contacts for the entering of the latter synoptics.

The depressing of keyboard keys Nos. 5, 2 and 8 motivated three times the ratchet magnet, thereby rotating simultaneously the negative holder, holding the negative strip and the shutter drum so that the cloud group Cl, Fig. 19, is now ready to be rotated and aligned in front of the light source assembly and in front of the lamp shutter Fig. 7 when keyboard key No. 9 is depressed. So far the beam of light has been unable to travel through the shutter drum to the sensitized paper of the weather map as the shutter drum surrounding the negative is opaque for rotating positions III. The shutter drum 105 allows only one symbol or numeral of a synoptic element to be printed at any one setting. This is accomplished by having square holes in the shutter drum in line with each of the zero symbols or numerals of the synoptic elements when the negative is in the down position.

Description of operation of circuit for Cl cloud group: Depress keyboard key No. 9, Figs. 33, 34 and 35; this operation manually first closes the two lower keyboard contact points and then a split second later the upper keyboard contact point. Electric current may now flow, from power source shown as electric plug 262, to both of the lower keyboard contacts 265 and 266 and then to the single upper keyboard contact 267 connected to key No. 9. The current first motivates, simultaneously through one of the lower contact points, the selective stop magnet 263 of the lifting mechanism, the ratchet magnet 100, and the main lifting magnet 83 of Fig. 4. This places in position in front of the lamp the Cl open symbol No. 9 of the cloud group of the negative opposite the square hole opening of the shutter drum.

The upper contact 267 of keyboard key No. 9 is now closed allowing current to flow to the shutter magnet 174 of Fig. 7, which flips the light shutter 170, Fig. 7, allowing the light beam to pass through the shutter drum square hole opening, through the Cl No. 9 negative cloud symbol to the mirrors of banks 1 and 2 and the main mirror bank 3, and then to the sensitized paper of the weather map. The Cl No. 9 is printed in the position shown in Fig. 18 of the station model.

Description of operation of circuit for Cm cloud group: Depress keyboard key No. 0, Figs. 33 and 35; this operation manually first closes the two lower keyboard contact points and then a split second later the upper keyboard contact point. Electric current may now flow from the power source only to the ratchet magnet 88, Fig. 35, which rotates the shutter drum 105 and negative holder 112 so that the middle cloud group Cm is

in position to be printed. However, the main lifting magnet 88, Fig. 35, was not operated when key No. 0 was depressed and the negative holder 112 did not rise leaving Cm symbol 0 opposite the square hole opening of the shutter drum. The symbol 0 on the negative is opaque, which prevents the light beam from reaching the weather map when the shutter magnet 174 of Figs. 7 and 35 motivates the lamp shutter through the closing of the upper contact of keyboard key No. 0. Thus no symbol is printed when keyboard key No. 0 is depressed and therefore, in this case, the cloud symbol Cm is not entered on the weather map. When the operator releases key No. 9, or any depressed key, the lifting mechanism, Fig. 2, operated by the main lifting magnet 88, is returned to its starting position, zero lift position, by springs 71 and 15 mounted at the end of the lifting shaft and about the rotating axis of the main lifting magnet lever.

Description of operation of circuit for W₁ W₂ weather groups: Depress keyboard key No. 9, Figs. 33 and 35; this is the first number of the W₁ W₂ VhN_h group which close circuits as usual through the lower contact points of the keyboard, key, operating simultaneously, through contact 266, the No. 9 selective stop magnet 263 of the lifting mechanism, the ratchet magnet 100, and the main lifting magnet 88. The operation of the ratchet magnet rotates the shutter drum 195 one notch, thereby closing the first W slide contact 108 of the shutter drum contact plate on the under side of the shutter drum, Figs. 16 and 17. The No. 9 selective stop magnet 263 of the lifting mechanism and the main lifting magnet 88 were operated by depressing key No. 9 but have no useful function as yet in the printing or operation of the WW weather group.

An electric circuit is closed also through the second lower contact point 265 of the keyboard key No. 9, through the first W slide contact 108 on the under side of the shutter drum, thereby operating the electromagnetic switch 238 which closes the circuit leading to ground from one side of the hold over switches leading to the bank selective stop magnets 131 for the weather slide 128, Fig. 35. Current then flows from the first lower contact 266 of the keyboard key No. 9 through hold over switch No. 9 connecting to ground the No. 9 selective stop magnet 131 for the weather slide and the main weather magnet 130, Fig. 35, which operates the weather slide stop lever 128. These magnets however cannot as yet operate as the current leading to them must go through the open 2nd W slide contact 109 on the under side of the shutter drum. The upper contact of keyboard key No. 9 is now closed allowing current to flow to the shutter magnet which flips the light shutter 170; however, no light reaches the sensitized paper of the weather as the first W portion of the negative is opaque. In Fig. 18 of the station model the WW groups are shown one above the other merely to show that two numbers are used to describe a single synoptic entry for WW on the station model.

Description of operation of circuit for W₁ W₂ weather group—continued: Depress keyboard key No. 5, the second number of the W₁ W₂ VhN_h group. This closes a circuit through lower contact 259, the No. 5 selective stop magnet 251 of the lifting mechanism, the ratchet magnet 100, and the main lifting magnet 88, Figs. 2 and 35. The operation of the ratchet magnet rotates the shutter drum one notch, thereby opening the first W slide contact 108 and closing the second

W slide contact 109 of the shutter drum contact plate on the under side of the shutter drum 105, Figs. 16 and 35. The operation of the main lifting magnet 88 raises the negative holder on which is mounted the WW weather group slide 190, Fig. 31 containing as shown in Fig. 19 all of the WW synoptics. The operation of the No. 5 selective stop magnet 251 of the lifting mechanism stops the negative holder at the point where the 5, 15, 25, 35, 45, 55, 65, 75, 85, 95 and M synoptics of the WW group are at the same height as the square hole opening in the shutter drum; the latter can only rotate and cannot move up with the negative holder. The weather group slide may move with respect to the negative holder only about the periphery of the negative holder and only in the space of two notches of the ratchet mechanism as shown in Figs. 19 and 12. A circuit is also closed through lower contact 258 of keyboard key No. 5 through the 2nd W slide contact 109 on the under side of the shutter drum operating the main weather magnet 130 and the No. 9 selective stop magnet 131 for the weather slide, Figs. 15 and 35. The main weather magnet 130 moves the weather slide stop lever 128 until stopped by the selective stop magnet stop No. 9. The weather slide is accordingly stopped in its rotary motion, occurring as the negative holder is rotated by the ratchet mechanism, so that the 91, 92, 93, 94, 95, 96, 97, 98, 99 and M synoptics of the WW group are in vertical alignment with the square hole opening in the shutter drum. Thus, since the lifting mechanism has raised the 5 through 95 and M WW synoptics in position on the weather slide and the main weather stop lever has interrupted the rotary motion of the weather slide so that the 91 through 99 and M WW synoptics are in position, the particular WW synoptic No. 95 is oriented correctly in position opposite the square hole opening of the shutter drum.

The upper contact 260 of keyboard key No. 5 is now closed allowing current to flow to the shutter magnet which flips the light shutter 170, Figs. 7 and 35, permitting the light beam to pass through the shutter drum square hole opening, through the WW No. 95 negative weather symbol to the mirrors of banks 1, 2 and 3, and then to the sensitized paper of the weather map. The WW No. 95 is printed in the position shown in the station model, Fig. 18.

Description of operation of circuits for the V, h and N_h visibility group, height of lower clouds group, and amount of lower clouds whose height is h group: The entering of the remaining portion of the WW, V, h, N_h group, namely V, h, and N_h, Nos. 6, 3, and 8, is done in the same manner as with the Cl group described above.

Description of operation for the DD, F group: Depress keyboard key No. 2, which is the first number of the DD, F, W, N group. Depressing key No. 2 closes circuits through the two lower contact points 270, 271 of the keyboard key operating simultaneously, one of the lower contacts actuating the No. 2 selective stop magnet 272 of the lifting mechanism and the main lifting magnet, which have no function in the working of the DDF groups, and the ratchet magnet. The operation of the ratchet magnet rotates the shutter drum one notch, thereby closing the first D slide contact 110 on the under side of the shutter drum, Figs. 16 and 35. In Fig. 16 the DDF slide contacts are shown about 60° to the left, counterclockwise of the WW contacts. The DDF slide contacts include metal bar 193 and the

three separate short metal bars referenced 110, 111 and 112 includes metal bars 107 and 108 and 109.

Current also flows from lower contact 270 to the electromagnetic switch 274 which connects to the first D contact 110 the grounded hold over switch 275 controlling the No. 20, 22, 24, 26, and 28 wind direction slide magnets, Fig. 35. Also the current flows to the electromagnet 276 which connects the 2nd D contact 111 to the grounded hold over switch 277 controlling the 02, 12, 22, and 32 wind direction slide magnets, the lead going to the F slide contact and the lead going to one side of the wind force slide magnets.

The current also flows to the electromagnetic switch 278 which connects to ground one side of the No. 2 wind force slide magnet. This connection to ground is only temporary as no hold over switches are used in the wind force slide magnets circuit, therefore upon releasing the keyboard key No. 2 the electromagnetic switch is opened and circuit is broken.

Simultaneously with the above operations, current flows from the second lower contact 271 of the keyboard key No. 2 through the 1st D slide contact 110 on the under side of the shutter drum to the hold over switch 275 controlling the No. 20, 22, 24, 26, and 28 wind direction slide magnets Fig. 35, thereby connecting one side of their circuit to ground.

The upper contact of keyboard key No. 2 is then closed permitting electricity to flow to the shutter magnet. This operation has no useful function as the first D negative is opaque and no light can therefore reach the sensitized paper of the weather map.

Description of operation of circuit for the DD, F group—continued: Depress keyboard key No. 8, Figs. 33, 34 and 35; this is the second number of the DD, F, W, N group. Depressing key No. 8 sends current as usual through the two lower contact points 250, 281 of the keyboard key operating simultaneously, through contact 280, the ratchet magnet, the selective stop magnet No. 8 of the lifting mechanism, and the main lifting magnet being energized. The operation of the ratchet magnet rotates the shutter drum one notch, thereby opening the first D slide contact 110 and closing the second D slide contact 111 of the wind direction circuit on the under side of the shutter drum. The operations of the selective stop magnet No. 8 of the lifting mechanism and the main lifting magnet have no function in the working of the DDF group which is controlled entirely by the DDF slide contacts on the under side of the shutter drum through the electric circuits shown as wind circuit, Fig. 35. The entire wind direction and wind force mechanism is mounted in front of and below the light unit external of the shutter drum and does not rotate or rise with the shutter drum. Current also flows from the contact point 280 of keyboard No. 8 to the electromagnet 281 which connects to the 2nd D contact one side of the electric circuit of the hold over switch 282 controlling the 08, 18, and 28 wind direction slide magnets. As explained below this hold over switch is closed by current flow from the 2nd D slide contact on the under side of the shutter drum, Fig. 35. Current also flows from the lower contact point 280 of keyboard No. 8 to the electromagnet 283 which connects to ground one side of the No. 8 wind force slide magnet. This connection to ground is only temporary as no hold over switches are used in the wind force slide

magnets circuit; therefore upon releasing the keyboard key No. 8 the electromagnetic switch is opened and the circuit is broken. Simultaneously with the above operations a circuit is closed from the second lower contact point 281 of the keyboard key No. 8 through the 2nd D slide contact on the under side of the shutter drum through the closed electromagnetic switch 285 closing the hold over switch 282 controlling the 08, 18, and 28 wind direction slide magnets as explained above. The wind direction slide magnets cannot operate, however, as they are not connected to the power source through the F slide contact on the under side of the shutter drum; the latter slide contact will not be closed until the next depressing of key No. 4 for the F group. The upper contact will not be closed until the next depressing of key No. 4 for the F group. The upper contact of keyboard key No. 8 is then closed permitting electricity to flow to the shutter magnet, Figs. 7 and 35. This operation has no useful function as the 2nd D negative is opaque and no light can therefore reach the sensitized paper of the weather map.

Description of operation of circuit for the DDF group—continued: Depress keyboard key No. 4, Figs. 33, 34 and 35; this is the third number of the DD, F, W, N group. Depressing key No. 4 operates the wind direction slide magnets and wind force slide magnets simultaneously. Current flows from the two lower key No. 4 contact points 286, 287, operating simultaneously, through contact 286 operating the ratchet magnet, the selective stop magnet No. 4 of the lifting mechanism, and the main lifting magnet. The operation of the ratchet magnet rotates the shutter drum one notch, thereby opening the 2nd D slide contact 111 and closing the F slide contact 112 of the wind force circuit on the under side of the shutter drum. The operations of the selective stop magnet No. 4 of the lifting mechanism and the main lifting magnet have no function in the working of the DDF group as explained in immediately preceding paragraph.

Current also flows from the same lower contact point 286 of the key No. 4 to the electromagnet 290 leading to the hold over switch 291 controlling wind direction slide magnets 04, 14, and 24. This hold over switch cannot close, however, as its source of current must come from the 2nd D slide contact which is now open. Thus the above wind direction slide magnets circuit have no function in the sequence of depressing the keyboard keys 2, 8, 4 of the DDF group. Current also flows from the same lower contact point of key No. 4 to the electromagnet 292 which closes to ground the wind force slide magnet No. 4. At the same time current flows from lower contact point 287 of key No. 4 through the F slide contact to the 294 wind force slide magnet 288 which snaps into position wind force slide negative No. 4, Figs. 20, 21, 22 and 23. This slide is now positioned opposite the square hole opening in the shutter drum, and consists of a negative showing Beauforte force 4 for every position of the compass required by the weather code, i. e., 02, 04, 06, through 32. A picture of Beauforte force 2 for 8 compass positions is shown in Fig. 25. Current also flows from the F slide contact through closed contact 282 of the hold over switch leading to the 08, 18, and 28 wind direction slide magnets. The current can operate however only wind direction slide magnet No. 28 which is the only one of the 08, 18, and 28 group

connected to ground through the hold over switch 275 leading to the 20, 22, 24, 26 and 28 wind direction slide magnets. The above current flow motivates wind direction slide magnet No. 28 which snaps into position wind direction slide negative No. 28. This slide is now positioned opposite the square hole opening of the shutter drum in line with the wind force slide negative No. 4. The wind direction slide negative No. 28 consists of a negative showing only wind direction 28, and is opaque except for the wind direction flag No. 28 and thereby allows only that portion of the wind force slide negative No. 4 consisting of a Beauforte force No. 4 barb for compass direction 28 to be seen through the square hole opening of the shutter drum. The upper contact point of keyboard key No. 4 is now closed allowing current to flow to the shutter magnet, Fig. 35, which flips the light shutter, Fig. 7, allowing the light beam to pass through the aligned shutter drum square hole opening, the wind direction slide negative No. 28, and the wind force slide negative No. 4 to the mirrors of banks 1 and 2 and the main mirror bank, and then to the sensitized paper of the weather map. The wind direction 28 with a Beauforte force 4 is printed in the position shown as NW or 28 in Fig. 18 of the station model.

Description of operation of circuits for W, N group PPPTT group, etc.: The entering of W, N, PPP, TT, etc., is done in the same manner as with the CL group described above.

The invention is therefore seen to reside in arrangement of apparatus for photographically printing symbolical data at particular points on a sensitized chart. While the disclosure has been limited to apparatus for printing synoptic weather reports in a particular form geographically located at the reporting station, it is apparent that the apparatus may be used for printing any type of symbolical data at a particular location on any sensitized chart, map or other form and it is not desired to be limited to the particular disclosure herein beyond the definition of the herewith appended claims.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

What is claimed is:

1. Apparatus for printing photographically symbolical data at a preselected station on a light sensitized receiving form, comprising a light source, means for projecting the light from said source to form a beam, three banks of reflecting mirrors for guiding said beam from the source to said receiving form, means for selecting individual mirrors from each of said mirror banks to direct the light beam to a preselected area on said receiving form, each mirror of the first bank being normally free of said projected beam but on selection being movable to intercept the light beam and reflect the same to the selected second bank mirror where it is reflected to the selected third bank mirror and to the receiving form area, support means for a group of light film symbols, means for interposing a selected symbol in said light beam, after said beam has been directed to said station, shutter means for exposing said film to the light beam, and means for restoring said mirror and symbol interposing means to initial positions after the symbols have been printed at said station.

2. Apparatus for printing photographically

symbolical data at a preselected station on a light sensitized receiving form, comprising a light source, means for projecting the light from said source as a beam, at least three banks of reflecting mirrors for guiding said beam from the source to said receiving form, means for moving individual mirrors in said mirror banks from said bank to a position at which said light beam may be intercepted and reflected, means for moving a selected mirror in said second bank to intercept the light beam reflected from the first bank mirror and reflect it to a mirror in said third bank for further reflection to a preselected area on said receiving form, support means for a group of symbols, means for interposing a selected symbol in said light beam, and means for selecting a station on said receiving form and a symbol to be printed at said station.

3. The apparatus of claim 2 with said station and symbol selection means arranged to select a symbol only after a prior selection of a station.

4. The apparatus of claim 2 with additional means for restoring said mirrors and symbol support to initial position after a station and symbol selection, whereby the steps of station and symbol selection may be repeated indefinitely.

5. In a weather map printing apparatus, a light sensitive map surface including a group of stations for symbol printing, a base, light source mounted on said base, means for projecting light from said source as a beam, a first bank of mirrors, means for adjusting each of said mirrors to reflect a light beam, a second bank of mirrors, means for adjusting each mirror of said second bank to an angular reflecting position with reference to beams reflected from said first bank mirrors, a third bank of mirrors, means for adjusting each of said third bank of mirrors for reflecting a light beam from the second bank mirrors to a selected form area, a movable support on said base for present weather symbols, a movable support on said base for wind direction and force symbols, a movable support on said base for miscellaneous weather symbols, separate means for moving each of said supports to intercept said light beam when projected to a selected map station, and means for initiating movement of said supports and at least three of said mirrors into said light beam in a prearranged sequence, whereby said symbols are printed at the selected station.

6. In a weather map printing apparatus, a light sensitive map surface including a group of station for symbol printing, a base, a light source mounted on said base, means for projecting light from said source as a beam, mounted on said base, a first bank of mirrors, means for adjusting each of said mirrors to reflect a light beam, a second bank of mirrors, means for adjusting each mirror of said second bank to an angular reflecting position with reference to beams reflected from mirrors of said first bank, a third bank of mirrors, means for adjusting each of said third bank mirrors for reflecting a light beam from the second bank mirrors to a selected form area, a movable support on said base for present weather symbols, a movable support on said base for wind direction and force symbols, a movable support on said base for miscellaneous weather symbols, separate means for moving each of said supports to intercept said light beam when projected to a se-

lected map station, means for initiating movement of said supports and at least three of said mirrors into said light beam in a prearranged sequence, whereby said symbols are printed at the selected station, and means for restoring said mirrors to their initial positions after completion of the symbol printing.

7. In apparatus for photographic printing on the light sensitive surface of a receiving form, a light source, means for projecting a light beam from said source, a bank of individual substantially coplanar mirrors arranged in rows, a support for said mirrors, means for adjusting each of said mirrors to direct a light beam to a different point on said form, a second bank of mirrors placed in parallel formation, means for moving at will any one of said second bank of mirrors to an angular reflecting position in relation to said light beam, a third bank of mirrors in parallel formation, means for moving at will any one of said third bank of mirrors to an angular position in relation to the light beam emanating from a mirror in said second bank, whereby a light beam from said source is reflected successively from mirrors in said first, second and third banks to a selected area on said receiving form.

8. In apparatus for printing photographically on a light sensitive surface of a receiving form, a negative drum mounted for rotational and axial movement, a symbol carrying film strip fixed to the periphery of said drum, a shutter drum enclosing said film drum, said shutter drum having a plurality of spaced apertures thereabout, a light source within said film drum, means for projecting a light beam from said source through said film and shutter drum aperture, a shutter pivotally mounted between said light source and film for controlling the passage of light, means for rotating said film drum, and means for stopping said drum rotation at preselected points, said stopping means comprising a post projecting from the negative drum edge at one end thereof, an L-shaped bar having a pivotal fixed support in line with the drum axis at one end and at the other end a slanted camming edge adapted to contact with said post, means for moving said cammed bar end outwardly toward said post, and additional means for stopping said outward bar movement at selected points whereby the drum rotation is controlled for symbol projection.

9. Apparatus for photographically printing symbolical data at a particular area on a light sensitized form comprising a light projector for casting a collimated beam of light of definite cross-sectional area, means for inserting at a particular area within said cross-sectional light beam area symbolical opaque data, a series of three banks of mirrors so positioned with respect to each other, to the beam of light and to the light sensitized form that the beam of light from said projector, modified by said inserted symbolical data and incident upon a selected mirror of the first bank of mirrors, is reflected to a selected mirror of the second bank of mirrors, to a particular mirror in the third bank of mirrors, and thence to a particular area on said light sensitive form, means for selecting a particular mirror in said first bank and moving the same to intercept the light beam from the first bank and reflect it to the third mirror bank, means for adjusting a particular mirror in said third bank to intercept the light beam from the second bank and reflect it to the de-

sired area on the light sensitive form, means for selecting a particular mirror in said second bank, and means for operating said projector to project said beam of light modified by said opaque symbolical data in a series of steps and in a predetermined order successively to said selected first bank, second bank and third bank mirrors and thence to the elected area on said sensitized form.

10. Apparatus for photographically printing symbolical data at a particular area on a light sensitized form comprising a light projector for casting a collimated beam of light of definite cross-sectional area, means for inserting at a particular area within said cross-sectional area symbolized opaque data, a series of a plurality of banks of mirrors so positioned with respect to each other, to the beam of light and to the light sensitized form that the beam of light from said projector modified by said inserted symbolical data and incident upon selected mirrors of said banks of mirrors is reflected to a particular area on said light sensitive form, means for selecting particular mirrors in at least two of said banks of mirrors and moving them into angular consecutive reflecting relationship to each other whereby the light beam is reflected from the source to the light sensitized form, and means for operating said projector to project said beam of light modified by said opaque symbolical data in a series of steps and in a predetermined order successively to said selected first bank, second bank and third bank mirrors and thence to the selected area on said sensitized form.

11. The light projector as defined in claim 9 comprising a shaft rotatably and axially movably mounted in bearings, a negative holder securely attached to said shaft at one end thereof for rotary and axial movement therewith, a negative strip divided into sections having symbolical data developed thereon mounted on said holder, a shutter drum of greater diameter than said holder mounted on said shaft, said drum being rotatable but not axially movable with said shaft, the sidewalls of said shutter drum being coextensive with the negative strip on the negative holder when said shaft is in retracted position, a plurality of apertures positioned in the sidewalls of said shutter drum in alignment with certain of the symbolical data on said negative strip when said shaft is in projecting position, a source of light fixedly mounted within said negative holder and adapted to cast a collimated beam of light through said negative strip and aligned aperture in said shutter drum, a shutter pivotally mounted between said source of light and said negative holder for controlling the passage of light between said source and said negative strip, sleeve means freely mounted on said shaft for axially positioning said shaft and said negative holder, power driven ratchet means mounted on said shaft for step rotation thereof in coincidence with the said sections on said negative strip, spring biased pawls mounted with respect to said shaft for limiting the forward and return revolution of said shaft to approximately one revolution and spring biased means mounted on said shaft for returning said shaft to the initial position when the latter is released by said power driven ratchet means.

12. Apparatus for printing photographically symbolical data at a preselected station on a light sensitized receiving form, comprising a light

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source, means for projecting the light from said source to form a beam, three banks of reflecting mirrors for guiding said beam from the source to said receiving form, means for selecting individual mirrors from each of said mirror banks to direct the light beam to a preselected area on said receiving form, support means for a group of light film symbols, means for interposing a selected symbol in said light beam, after said beam has been directed to said station, shutter means for exposing said film to the light beam, and means for restoring said mirror and symbol interposing means to initial positions after the symbols have been printed at said station, said symbol support means comprising a shafted drum mounted for rotational and axial movement in relation to said light source, and said interposing means including a ratchet device and an axially slidable sleeve on said shaft having detents for selective positioning.

13. In apparatus for photographic printing on the light sensitive surface of a receiving form, a light source, means for projecting a light beam from said source, a bank of individual substantially coplanar mirrors arranged in rows, a support for said mirrors, means for adjusting each of said mirrors to direct a light beam to a different point on said form, a sec-

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ond bank of mirrors placed in parallel formation with the axes of the mirrors of said second bank at right angles to the mirror axes of said first bank, means for moving at will any one of said second bank of mirrors to an angular reflecting position in relation to said light beam, a third bank of mirrors in parallel formation, means for moving at will any one of said third bank of mirrors to an angular position in relation to the light beam emanating from a mirror in said second bank, whereby a light beam from said source is reflected successively from mirrors in said first, second and third banks to a selected area on said receiving form.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,893,158	Chireix	Jan. 3, 1933
2,019,764	Ogden	Nov. 5, 1935
2,211,320	Efron	Aug. 13, 1940
2,355,268	Bryce	Aug. 8, 1944
2,600,168	Klyce	June 10, 1952

FOREIGN PATENTS

Number	Country	Date
711,918	France	July 8, 1931