

March 7, 1939.

J. E. JACKSON

2,149,440

MAPPING MACHINE

Filed Oct. 3, 1935

6 Sheets-Sheet 1

Fig. 1.

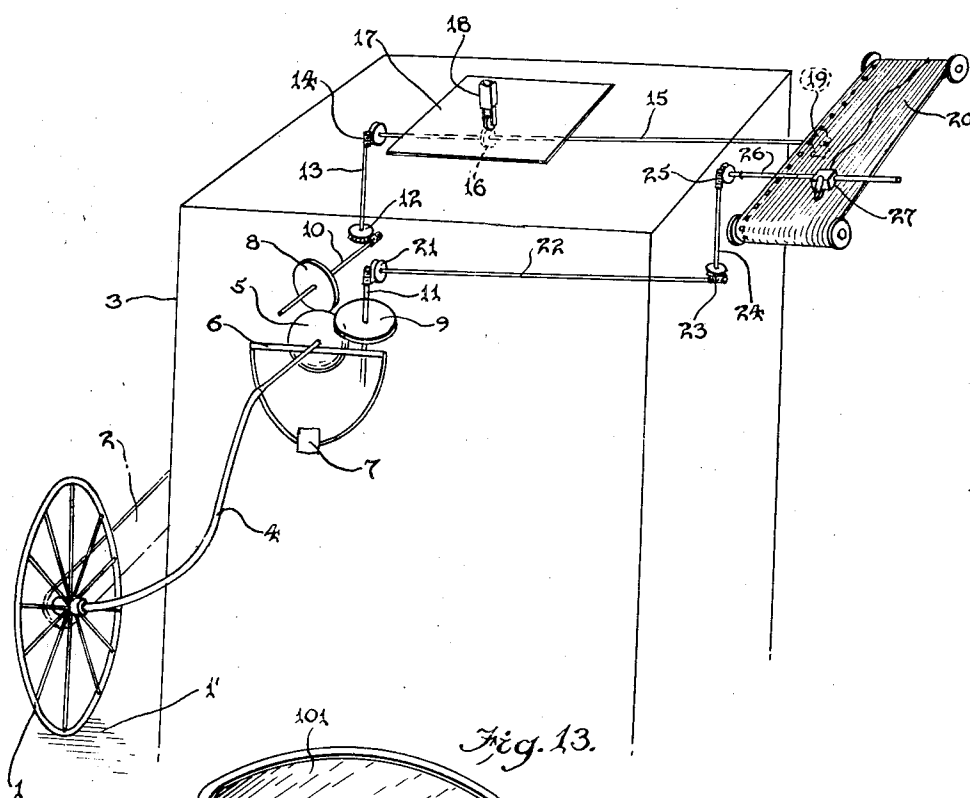
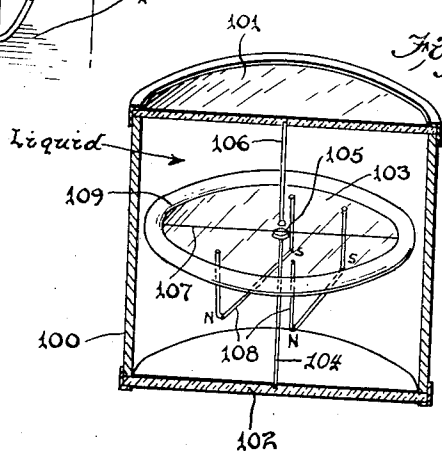


Fig. 13.



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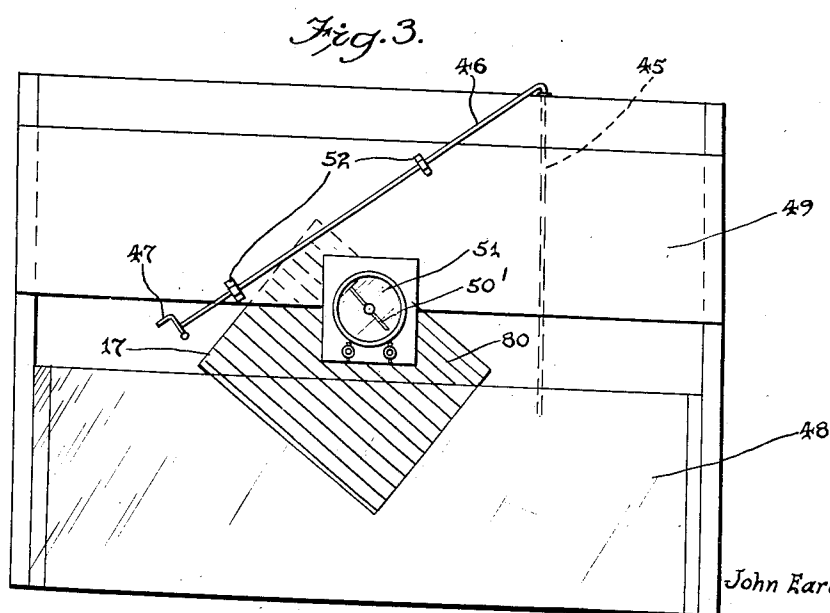
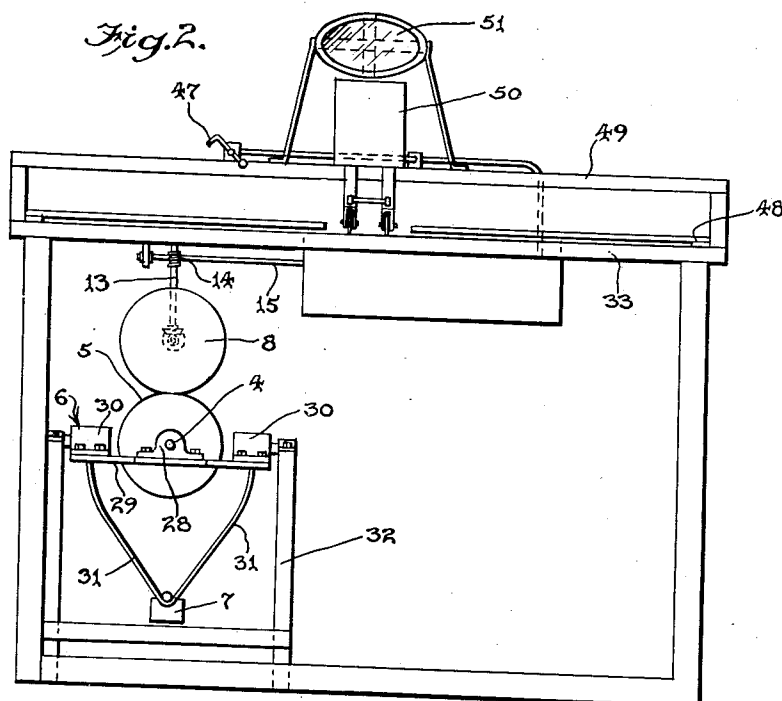
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6 Sheets-Sheet 2



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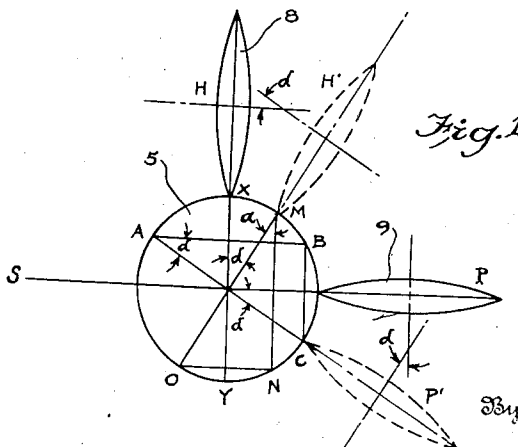
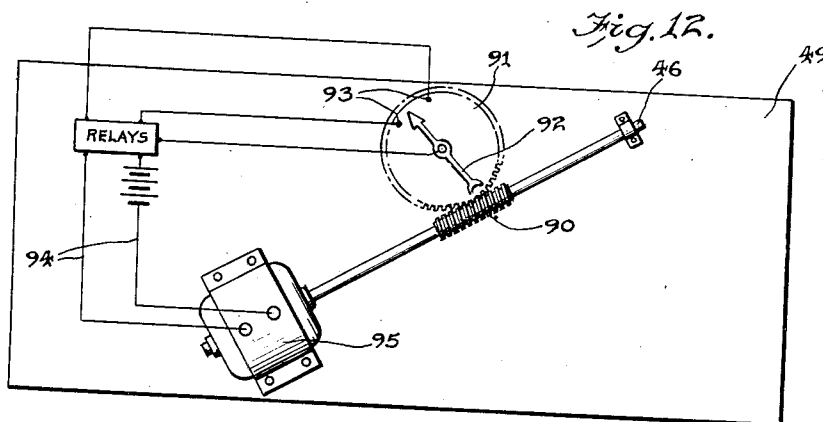
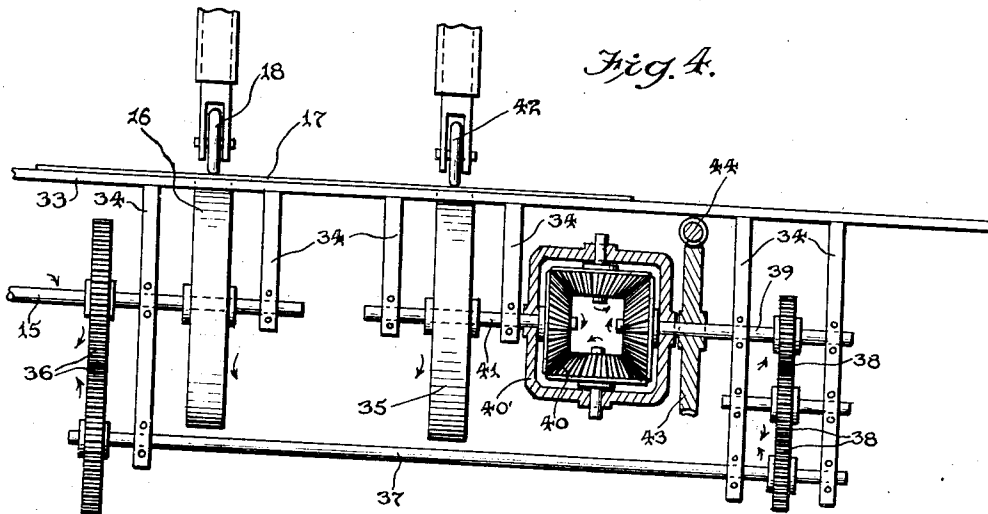
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MAPPING MACHINE

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6 Sheets-Sheet 3



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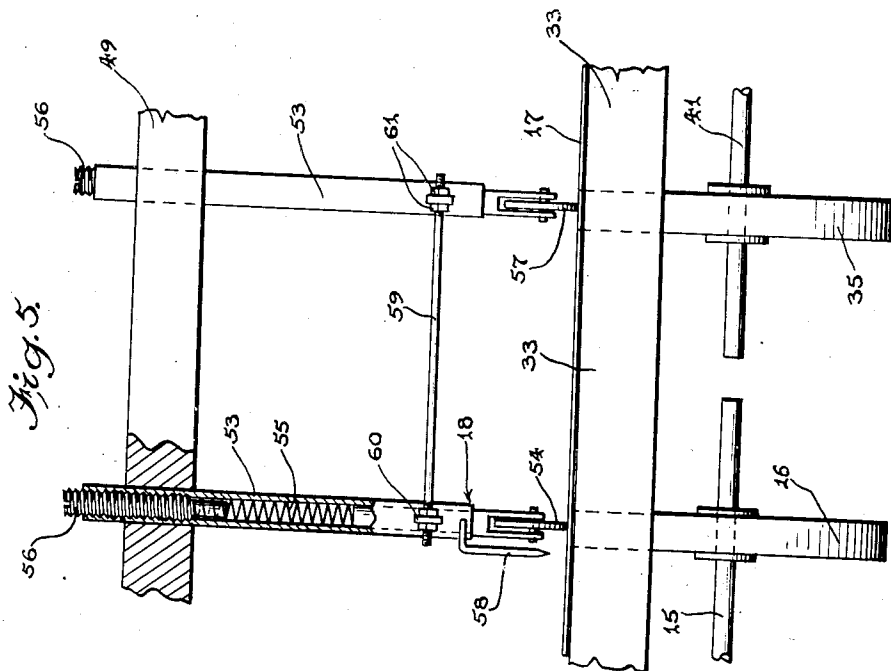
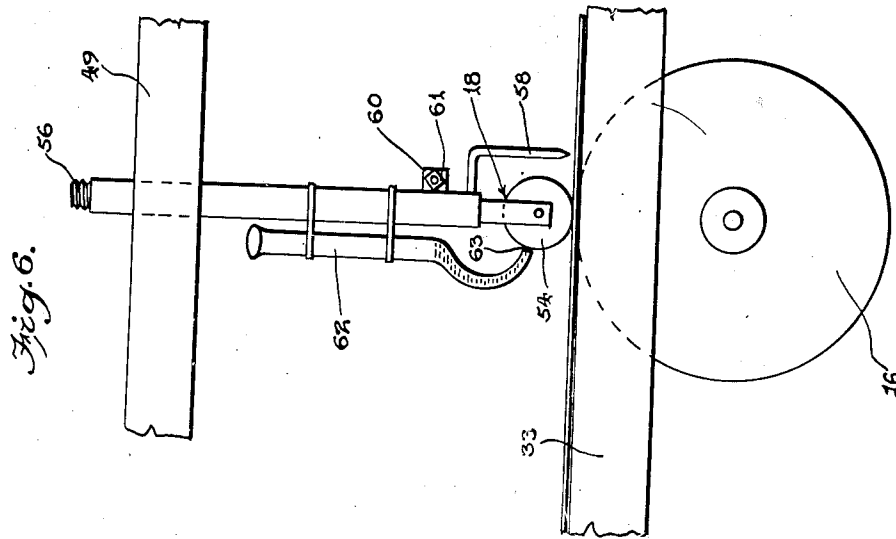
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MAPPING MACHINE

Filed Oct. 3, 1935

6 Sheets-Sheet 4



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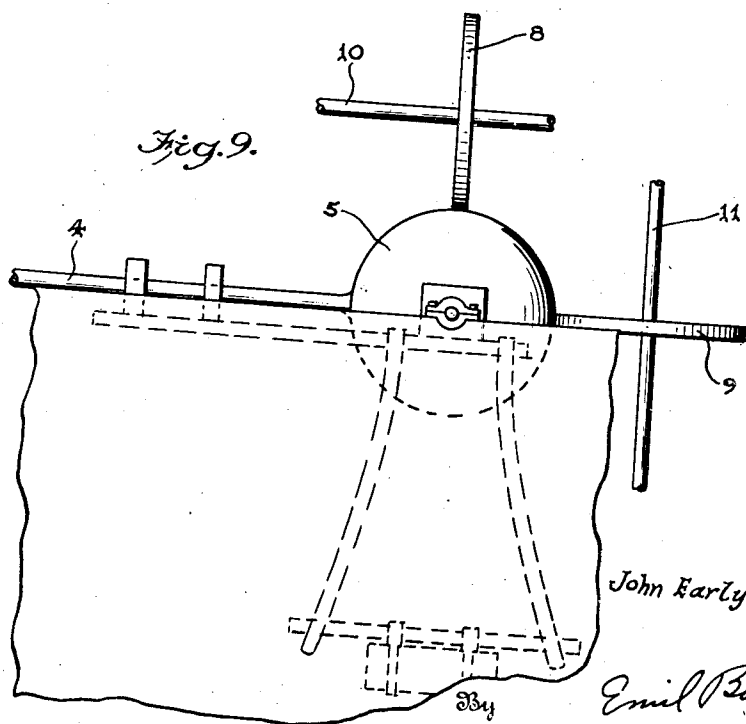
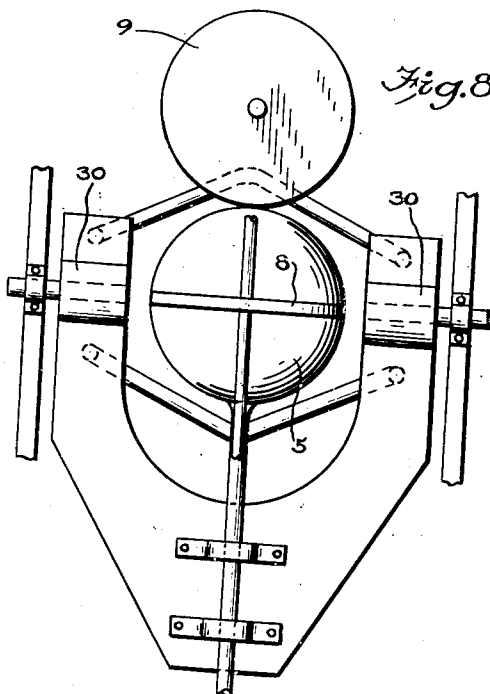
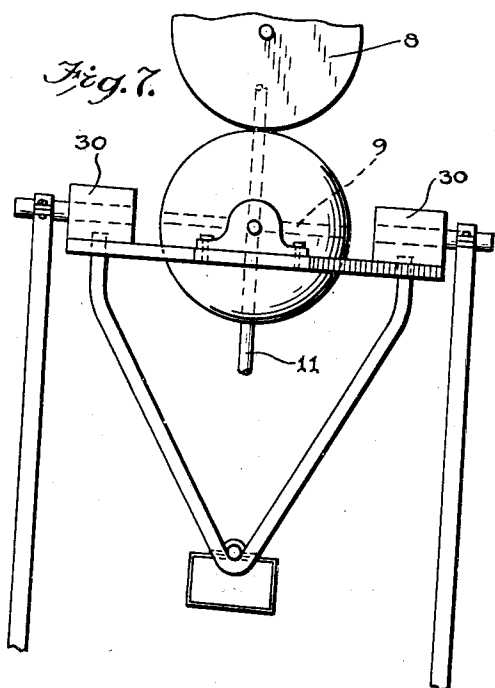
March 7, 1939.

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MAPPING MACHINE

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2,149,440

6 Sheets-Sheet 5



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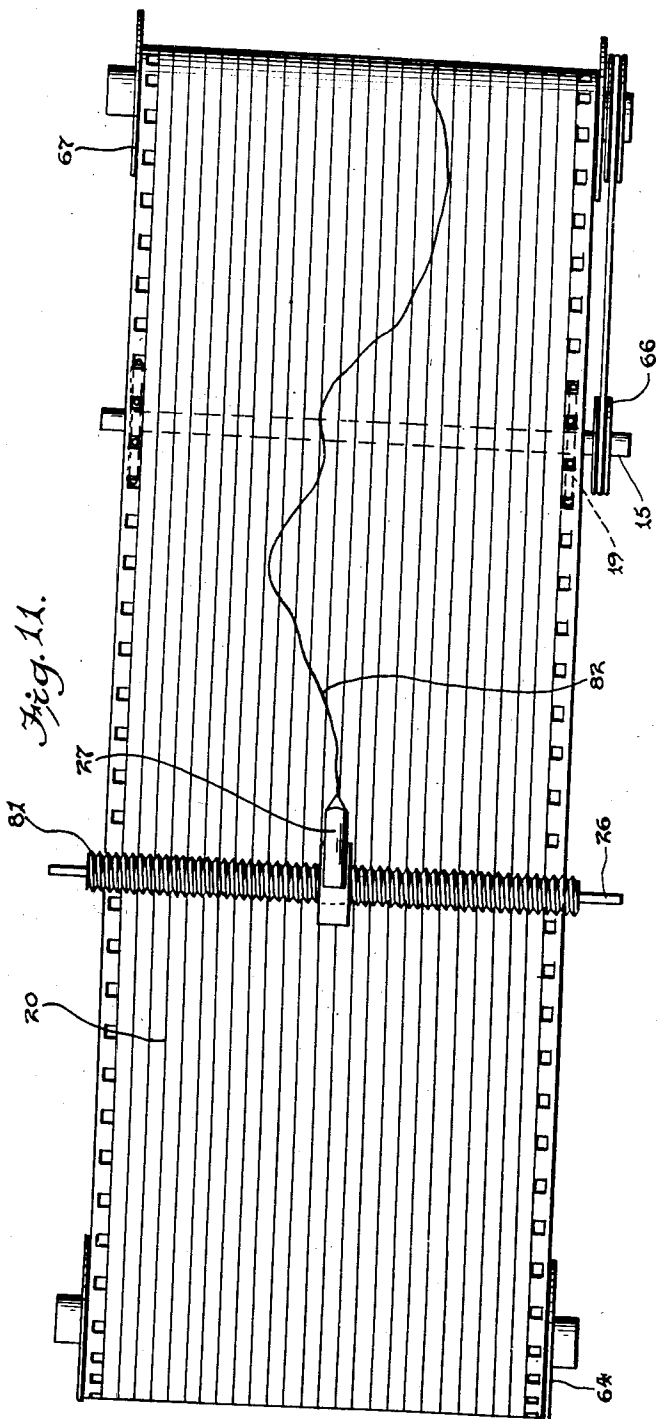
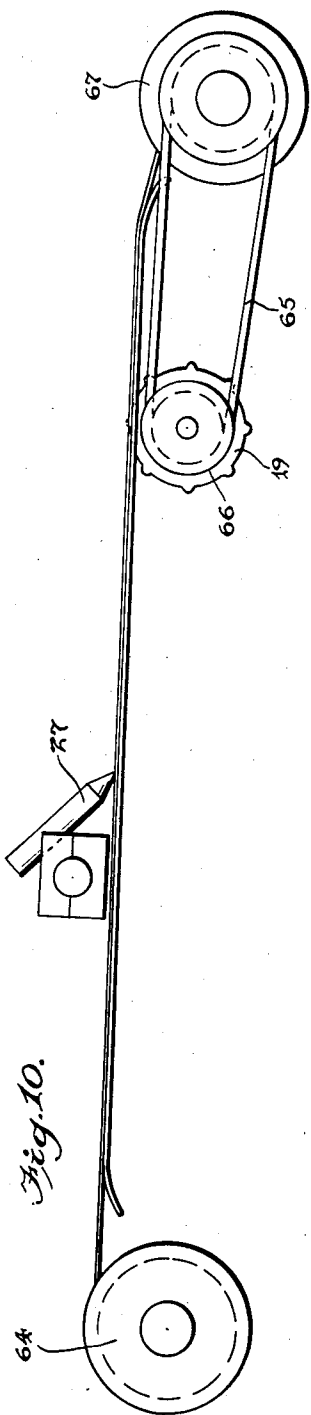
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UNITED STATES PATENT OFFICE

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MAPPING MACHINE

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Application October 3, 1935, Serial No. 43,418

3 Claims. (Cl. 33—141.5)

The present invention relates to a mapping machine and specifically relates to a machine for recording the direction (horizontal deviations) of a road and its profile or contour (vertical deviations) while a vehicle in which the machine is mounted is traversed over said road.

The various objects and features will be clearly understood from the following description taken in connection with the accompanying drawings in which:

Figure 1 is a diagrammatic view showing the entire apparatus,

Fig. 2 is a side view of the map making machine,

Fig. 3 is a plan view of the machine of Fig. 2,

Fig. 4 is a front view of the mechanism for the automatic guiding of the map paper,

Fig. 5 is a front detail view of the ink wheel and upper guide wheel supports,

Fig. 6 is a side view of the detail of Fig. 5,

Fig. 7 is a front detail view of the sphere mounting,

Fig. 8 is a plan view of the detail of Fig. 7,

Fig. 9 is a side view of the detail of Fig. 7,

Fig. 10 is a side view of the profile device of the mapping machine,

Fig. 11 is a plan view of the profile device of Fig. 10,

Fig. 12 is a top view with a schematic wiring diagram showing an automatic orientation mechanism,

Fig. 13 is a cross-sectional view of a suitable compass, and

Fig. 14 is a diagrammatic view of the sphere and wheels.

Referring to Fig. 1 the apparatus is adapted to be mounted on a truck, trailer or other vehicle so that the road wheel 1 will contact and run on the road 1' which is to be mapped. The wheel is rotatably mounted on any support or arm 2 secured to the vehicle 3. A flexible shaft 4 conveys the rotary motion of the wheel to a sphere 5 which is mounted on a trunnion 6 counterbalanced at 7 so that the sphere 5 may swing around a horizontal axis in a direction in the longitudinal axis of the vehicle or the direction of the road to be mapped. A pair of friction wheels 8 and 9 contact with the sphere 5. The wheel 8 is mounted on a horizontal axle 10 whereas the wheel 9 is mounted on a vertical axle 11. The axle 10 rotates through gears 12, shaft 13, gears 14 and the shaft 15 on which is mounted the main drive wheel 16 for the map paper 17. Above the paper 17 is the inking device 18. Shaft 15

also rotates a toothed wheel 19 for the sheet or strip of profile or contour paper 20.

The shaft 11 through gears 21, shaft 22, gears 23, shaft 24 and gears 25, operates the screw-threaded shaft 26 on which is mounted the profile pen 27.

Further additional mechanical details are included than have been referred to in the foregoing and which are shown in Fig. 1, but such further elements are illustrated in the detailed views which will now be referred to.

In Fig. 2, the sphere 5 is rotatably mounted in bearings 28 mounted on a frame 29. This frame 29 has two bearings 30 and the counterweight 7 is suspended by the fork 31 from below the bearings 30 so that the sphere and frame 29 together with the fork 31 and weight 7 will pendulously swing about the bearings 30 in a direction parallel with the longitudinal axis of the vehicle. The bearings 30 are suitably mounted in a frame 32 mounted on the vehicle.

The drive shaft 15 leads into the automatic guiding mechanism for the map paper which is shown in detail in Fig. 4. In this figure, the mechanism is suspended from the table 33 by means of hanging supports 34 which act as bearings for the various shafts. Shaft 15 drives the main drive wheel 16 for the paper sheet 17. A second wheel which is a guide wheel 35 is driven by shaft 15 through gears 36, shaft 37, gears 38, shaft 39, differential gear 40 and shaft 41 on which the wheel 35 is mounted. The differential gear 40 is for the purpose of revolving guide wheel 35 either faster or slower than wheel 16 in order to orient the map paper 17. 18 is the inking wheel and 42 is the idler wheel for the map paper 17. On the differential housing 40', a worm gear 43 is secured thereto meshing with worm 44 which latter is rotated by a shaft 45, suitable bevel gears or flexible shaft, rod 46 and crank handle 47 on the top of the table as shown in Fig. 3.

As seen in Figs. 2 and 3, the table top 33 may be provided with a front plate glass 48 provided over the table and raised approximately one-fourth of an inch above the table, and a rear board 49 approximately three inches above the table for mounting and supporting thereon the compass 50 and the mirror 51. As seen in Fig. 3, there is a space between the plate glass 48 and the board 49 through which the inking wheel 18 and the idler wheel 42 project. The shaft 46 may also be mounted over and on top of the board 49 by bearings 52, or brought to any other position convenient to the operator.

The inking device is shown in Figs. 5 and 6 wherein tubes 53 are secured in the board 49. One tube carries the inking device 18 and this comprises an inking roller 54 which is adjustably spring pressed on the paper 17 by means of spring 55 in tube 53 and adjustable screw 56. The other roller is the upper guide wheel 57 similarly mounted in its tube 53. The tube with the inking roller has a fixed reference pointer 58 secured in the end of its tube 53 for conveniently marking the starting and stopping points on the paper 17. The spaced distance between the inking roller 54 and the upper guide wheel 57 may be adjusted by means of a rod mounted in brackets 60, one on each tube 53 and held in adjusted position by lock nuts 61, through rod 59 which tends to maintain the roller 54 and wheel 57 in rigid positions relative to lateral movements. This is particularly important for automatic operation by means of a repeater compass.

As seen in Fig. 6, a capillary tube 62 is filled with ink and is provided with a nozzle 63 adjacent to and in contact with the periphery of the inking roller 54. However, any suitable inking device may be used such as a pad saturated with ink which is suitably mounted and contacts with the wheel 54.

Figs. 10 and 11 show the profile or contour recording device in which the paper is rolled from spool 64 to spool 67. Spool 67 is driven by a spring belt 65 from the pulley 66 driven by the shaft 15 and winds up the paper. The toothed wheel 19 is also mounted on shaft 15 and drives the profile paper.

Fig. 14 shows the operation and accuracy of the sphere and friction wheels in which as indicated on the other figures of the drawings 5 is the sphere rotating about axis S, 8 is the horizontal friction wheel, and 9 is the vertical or profile friction wheel.

Assume friction wheels and sphere of equal diameters: then, if road is level the ratio of drive between sphere and horizontal friction wheel is 1:1, as this wheel H, rides on a diameter XY, of sphere. The profile friction wheel P rides on an axis of rotation of the sphere and therefore does not turn at all.

If the machine goes up some grade, α , the sphere's axis of rotation remains level due to its counterweight, while the friction wheels are moved about the sphere through the angle, α , to the new positions H_1 and P_1 .

Wheel H now rides on a circle on the sphere whose diameter is MN and therefore turns proportionally less than when on a great circle.

Wheel P rides on the circle whose diameter is BC and begins to turn in proportion to the length of BC.

Now from the figure it is evident that triangles MNO and ABC are identical and that MN equals OM cos α , while BC equals AC sine α .

The two wheels are, therefore, turned proportionally to the road distance times the cosine and sine respectively of the angles of ascent, α , and will record the true horizontal and vertical distances which are the required map and profile distance, respectively.

The shaft 46 may be operated by a compass repeater to orient the paper automatically and thus eliminate the manual control. In this case, it will be necessary to use suitably designed gears or other means to eliminate any back lash in the orienting mechanism. An automatic operator is shown in Fig. 12 in which a worm gear 90 is mounted to rotate with the shaft 46. A gear

91, having as many teeth as gear 43, has the compass and repeater mounted thereon and the arrow 92 is the equivalent in operation to the needle 50' of Fig. 2. A pair of contacts 93 are mounted on the gear which are closely spaced apart and a circuit leads to a motor 95 (through suitable relays) to orient the paper so that the lines 80 on the paper 17, Fig. 2 will always coincide with the compass direction.

The operation of the entire apparatus is as follows.

The vehicle 3 in which the apparatus is mounted is started along the road of which it is desired to chart its course and its profile or contour. The road wheel 1 begins to rotate which causes rotation of the sphere 5. Assuming that the vehicle is passing over a level road for the time being which causes only rotation from the sphere 5 to be transmitted through shaft 10, gears 12, shaft 13, gears 14 and shaft 15. It is understood that upon starting, the sheet 17, Fig. 3, which preferably has parallel ruled lines 80 thereon, is so placed on the table 33 that the lines are in alignment with the needle 50' of the compass and during the mapping course the sheet 17 is always maintained in such aligned position. If the vehicle should make any turn, the sheet 17 is manually (or automatically, by a compass repeater) adjusted to align the lines 80 with the compass needle 50', such manual adjustment comprising the turning of the crank 47 to rotate the guide wheel 35. Thus an accurate record is made on sheet 17 of the course of a road.

The wheel 8, Fig. 1, also advances the sheet 20 as the vehicle travels over the rod. When starting the recording, the pen 27, Fig. 11, is set on any line of the profile paper 20 and the elevation above sea level may be calculated for that point. As long as the road is level a straight line will be recorded on sheet 20 parallel with the ruled lines thereon, but when reaching a grade or a decline in the road the profile wheel 9 is moved off the center of the axis of rotation of the sphere 5 so that said wheel 9 commences to rotate, Fig. 13. This causes rotation of the shaft 26 and the screw-threaded rod 31 to move the pen to one side or the other of the initial point as indicated by line 82, Fig. 11, which records the contour of the road.

It is of course understood that any type of compass—magnetic or otherwise—can be used if it is sufficiently free from turning errors due to inertia effects, and is mounted so it can be easily compared with the parallel lines on the map paper.

A compass constructed similar to a standard Navy type compass, but having a transparent card bearing an index line and a transparent top and bottom through which the map paper can be viewed, is satisfactory for use with this mapping machine. A suitable compass is illustrated in Fig. 13 which shows a casing 100 having a top glass plate 101 and a bottom glass plate 102. A transparent card 103 is mounted on the pivot pin 104 on bearing 105, the latter maintained on the pivot pin by retaining pin 106. The card 103 has an index line 107 and suspended from the card are two substantially parallel needles 108 which are magnetic needles so arranged that the moments of inertia about all the horizontal axes are equal. The card is also provided with a circular float 109.

I claim as my invention:

1. A paper guiding and driving mechanism for

mapping machines comprising a double set of drive wheels and idler wheels between which a sheet of paper is adapted to be gripped on which the directions and curvatures of the highway are to be recorded, means for driving both drive wheels uniformly to advance the paper during the mapping operation, and means for turning one drive wheel non-uniformly with respect to the other for positively orienting the paper without the introduction of sliding friction.

2. A paper guiding and driving mechanism ac-

ording to claim 1, in which the last-mentioned means is operated by external guide means with the aid of a compass.

3. A paper guiding and driving mechanism according to claim 1, in which the last-mentioned means includes a differential mechanism for one of the drive wheels and connected with the drive means to permit non-uniform motion of one wheel for guiding the paper.

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