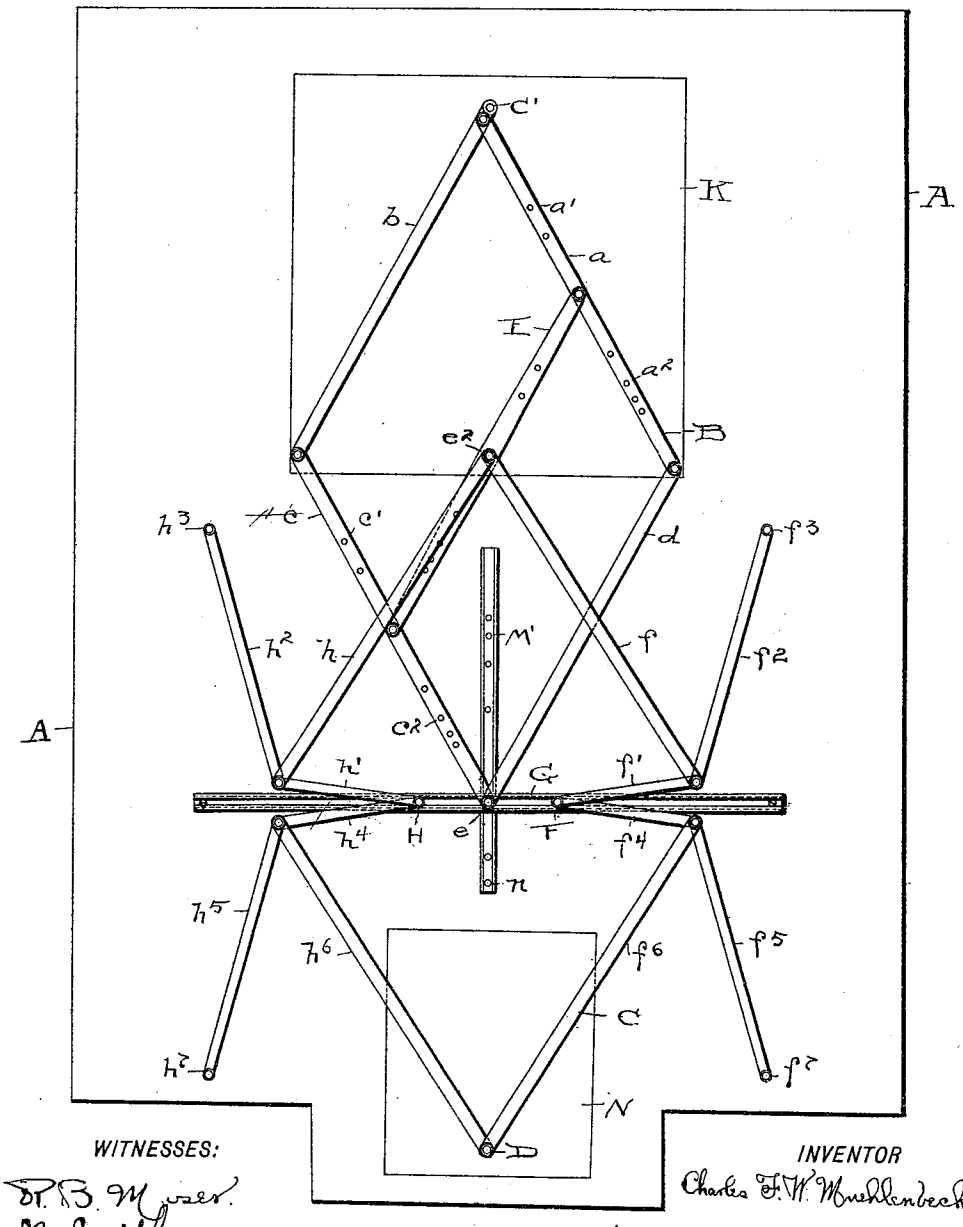
(No Model.) 2 Sheets—Sheet 1.

C. F. W. MUEHLENBECK.

CARTOGRAPHIC MACHINE.

No. 544,367. Patented Aug. 13, 1895.

Fig. 1.



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(No Model.) 2 Sheets—Sheet 2.

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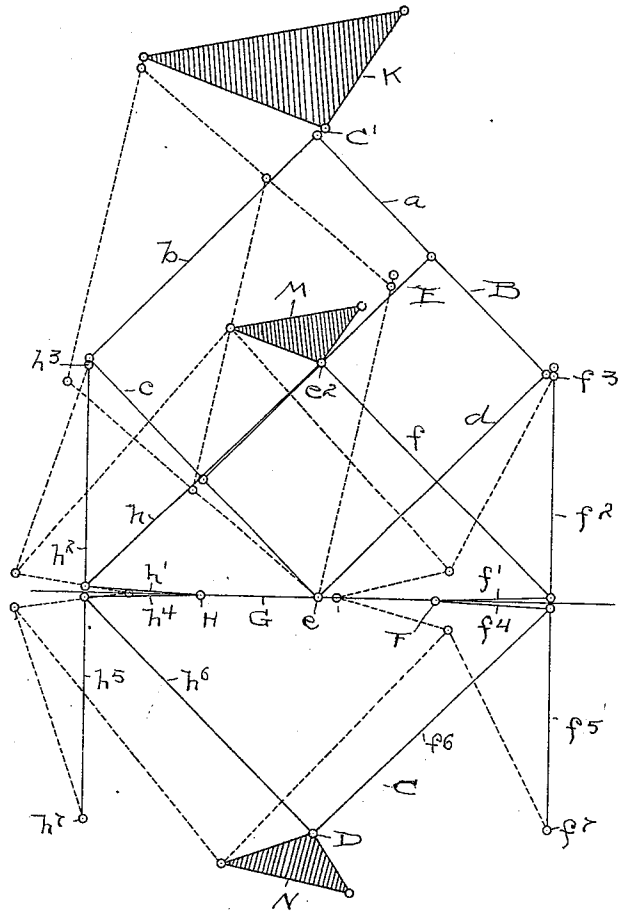
Fig. 2.



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UNITED STATES PATENT OFFICE.

CHARLES F. W. MUEHLENBECK, OF CLEVELAND, OHIO.

CARTOGRAPHIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 544,367, dated August 13, 1895.

Application filed March 26, 1895. Serial No. 543,223. (No model.)

To all whom it may concern:

Be it known that I, CHARLES F. W. MUEHLENBECK, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Cartographic Machines; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to cartographic instruments or apparatus, and the object of the invention is to produce an instrument or apparatus for the purpose of copying any kind of drawings, maps, or other outlined subjects at either the same size as the original or more or less reduced therefrom and in a reversed position, so that a printed impression from the reversed and reduced picture will give the picture or other outline back again in the original position.

The invention therefore consists in an instrument or mechanism constructed and arranged and operated substantially as shown and described, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a plan view of my new and improved instrument or apparatus and of a table upon which it is arranged to operate. Fig. 2 is a purely diagrammatic view of my improved apparatus, showing different positions of the parts, primarily in full lines, as in Fig. 1, and secondarily in moved lines, as shown in the dotted lines, which serve to illustrate one of many different positions which the respective parts may assume in the operation of the machine.

Primarily I have what may be termed a "parallelogram," consisting of the several bars *a*, *b*, *c*, and *d*, pivotally connected at their respective ends, and the bar *b*, for convenience, extended at one end slightly beyond its pivot, and having a tracing-point C′ fixed thereon. At the junction of the bars *c* and *d* the pivot *e* thereof is made in a transverse channel-bar G, and in this instance at the center of said channel-bar. In so far as the mere parallelogram is concerned the channel-bar G is unnecessary and the pivot-point might be directly in the table A or upon any other working base. This parallelogram or section B of the machine also has a bar E, in this instance centrally across between the bars *a* and *c* and pivotally connected therewith at its ends. In the said bar *a* are perforations or pin-holes a' and a^2 and c' and c^2 in the bar *c*. The bar E may be moved into holes a' and c' or into holes a^2 and e^3, according as greater or less reduction of the original picture or map or other figure may be desired, and as hereinafter fully described.

The reproducing-point of the section B and the center or determining point of this instrument outside of the said section, and which is shown in the supplemental section C, is at e^2. These two sections are in a sense distinct and separate, because I may use the section B practically as a pantograph having the reproducing-point at e^2, or I may make this an imaginary reproducing-point and go on to the actual reproduction and reversion of the picture at a delineating-point D by using the supplemental section C.

The supplemental part of my invention, or section C, is embodied in the channel-bar G, above referred to, or its equivalent, and the bars *f* and *h*, are pivoted at one end at the determining or centering point e^2 of the parallelogram B, and at their opposite ends to short equalizing-bars h' and f', which at their inner ends are adapted to slide in the channel-bar G, and which serves also as guide or equalizing bars for the said bars *h* and *f*. Then the said bars *f* and *h* further have pivoted connection with the side equalizing-bars f^2 and h^2, respectively, which in turn are pivotally secured to the table at f^3 and h^3. These bars h^2 and f^2 are of exactly the same length, as are also the bars h' and f', before described.

The last-described mechanism, consisting of bars *f* and *h*, and f' and h', and f^2 and h^2, is duplicated in kind and arrangement, but in reverse order by the bars f^6 and h^6, having a pivot at delineating-point D, and are in turn provided with short equalizing-bars h^4 and f^4, pivoted and sliding in the channel-bar G with bars h' and f'. So also are bars f^6 and h^6 pivoted to the free ends of the equalizing-bars f^5 and h^5, which are secured at their opposite ends f^7 and h^7 to the table, the same as are the bars h^2 and f^2 at h^3 and

f^3. The sliding points H and F of the respective bars f' and f^4 and h' and h^4 in the channel-bar G may be connected with sliding pieces in the said channel-bar, or with small rollers, so as to give freedom of movement.

It will be noticed that there are two distinct sections or subdivisions of parts in this apparatus, the parallelogram or section B constituting one section or division, and the reproducing and reversing mechanism, consisting of section C, the other subdivision. I have already stated that the section B may in a fairly satisfactory way be used alone. So also may the second section or subdivision, and with most satisfactory results to simply reproduce a picture, but not to reduce it unless the construction be further modified. For example, suppose I have a figure of a given size, as indicated by the shaded figure marked M, which is drawn as reduced from original K, Fig. 2. If I have this figure M to start with I may entirely dispense with the section B and operate alone with section C, and with the point e^2 as a tracing-point; but having a map or other picture of a size to be reduced the section B and the section C are worked in combination as one machine. In that case the tracing-point C′ becomes the initial working point, the point e^2 the determining and centering point for section C, and D the point of reproduction and reversion. Hence, with all the parts associated together, as shown in Fig. 1, the operator takes hold of the tracing-point C′ and follows the lines of the map or other drawing or figure from which he is working. This movement on his part is made without any further attention to the machine, and works the reduction and reversion at the point D, or in the form shown at N, Fig. 2.

Now, referring again to Fig. 1, I see that the bar E is across the center of the parallelogram B, which makes a half reduction of the original. Then to reduce to one-fourth or to any other size less than one-half, I move the bar E with its reducing-point e^2 away from the tracing-point C′ and nearer to the general pivot-point e; and if the picture is to be reduced above one-half the bar E is correspondingly moved nearer to the tracing-point C′ and secured in the pin-holes a' c'. In case the section B is not employed and the map or picture or other figure is not to be reduced, the tracer C′ is transferred to the point e^2, as already described, and this becomes the initial point of operation. This point and the reproducing-point D are always equally distant from the transverse line or bar G, and since the upper and lower parts of the supplemental section C of the apparatus are exact duplicates of one another in construction and arrangement, and the relationships of said parts is maintained alike throughout, it follows that the action of both parts must be the same and an exact reproduction is made at D of what is produced at e^2, but in reverse position, as described.

The reproducing-point D may be a pencil or any other suitable marking device, and when working on stone or metal or other hard surface a diamond, steel, or other cutting-point may be employed, if desired.

If, as before described, the picture is to be reduced to less than one-half and the bar E is moved down to any of the holes a^2 c^2, the reducing-point e^2, as shown here, will come out of alignment with the tracing-point C′ and pivot-point e, and this is in no case allowable. Hence the point e^2 is moved to the left of its present position the same distance exactly as the bar E is moved downward. Then to restore point e^2 to the same relative position substantially as before, the frame B is moved up correspondingly into one of the holes M′, the object being to work as nearly as possible always in the normal position, as shown. If reduction is to be above half size a corresponding adjustment of point e^2 is made, in proportion to the proposed reduction, and pivot e is moved down below bar G into one of the holes n, thereby bringing e^2 again to normal position. The instrument thus shown and described may be slightly suspended by cords from a frame or ceiling above, or travel upon small wheels upon the table, any supporting means that will afford perfectly free movement and keep it about half an inch from the table being sufficient. The point e^2 is referred to herein as the reducing-point of the instrument or apparatus, and the delineating-point D as the reproducing and reversing point; but the latter alone is real and the former or point e^2 is imaginary when the entire apparatus is used, unless a reduced picture at e^2 is also wanted. The part e^2 therefore becomes rather the determining or measuring point or center for delineating-point D, to determine the size of the reproduction and the center or point from which the reproducing and reversing section of the apparatus is separated. It will be observed that there are two similar figures in the section C at either side of the median line or bar G, which latter may be said to form the axis of the abscissas of rectangular co-ordinates. By this construction the absolute values of the co-ordinates of the corresponding points are always equal to each other.

There are many modifications of this invention almost evident or at least easily worked out on the principles above specified, but the rectangular co-ordinates of the corresponding points are either equal to each other or in a desired proportion.

The dotted lines in Fig. 2 show the relation the corresponding parts have to one another when moved to the left. This is done as follows: When the tracing-point C′ moves, say, to the left, it will pull bar f and push bar h to the left through their pivot-point e^2, and the bars f' and f^2 being pivoted to the other end of the bar f, it will cause the bar f' to push slide F to the left along bar G. The bar f^2 being pivoted at f^3 allows the other end to

swing on its radius, giving an easy and free movement. The bars h and h' and h^2 and slide H perform this same movement in moving to the left, and the construction and arrangement of the bars f^4, f^5, f^6 and h^4, h^5, and h^6 being exactly similar, the movement will be conveyed to the reproducing-point D—that is, if the tracing-point C′ moves to the left reproducing-point D also moves to the left, but when the tracing-point C′ moves down or toward slide-bar G the reproducing-point D moves up and also toward slide-bar G. This action gives a reversed position of the map or drawing, and when engraved on stone or other suitable printing-plate the impression therefrom will give an exact but reduced copy of the map or drawing.

Fig. 2 shows the machine somewhat elongated, with the map K in position and the copy N reduced and reversed.

I claim—

1. Two similar figures represented by bars —f—, —h—, —f'—, —h'—, —f^2—, —h^2—, and —f^4—, —h^4—, —f^5— —h^5—, —f^6— and —h^6— and transverse bar —G— forming the axis of the abscissas of rectangular co-ordinates whereby the absolute values of the co-ordinates of the corresponding points are either equal to each other or in a desired proportion, and whereby in the latter case the possible parallel change of the line of the abscissas does not make any difference, substantially as set forth.

2. The apparatus described, comprising two similar figures composed of bars —f— and —h—, —f'— and —h'—, —f^2— and —h^2— in one figure, and bars —f^4— and —h^4—, —f^5— and —h^5—, and —f^6— and —h^6— in the other figure and the median line bar —G— between said figures and the reproducing point, in combination with the actuating frame —B— having a tracing point, substantially as set forth.

Witness my hand to the foregoing specification this 22d day of March, 1895.

CHARLES F. W. MUEHLENBECK.

Witnesses:
H. T. FISHER,
N. M. THOMAS.