May 1, 1934. A. KREBS 1,956,581

REPRODUCING APPARATUS

Original Filed April 8, 1932 2 Sheets-Sheet 1

Fig. 1.

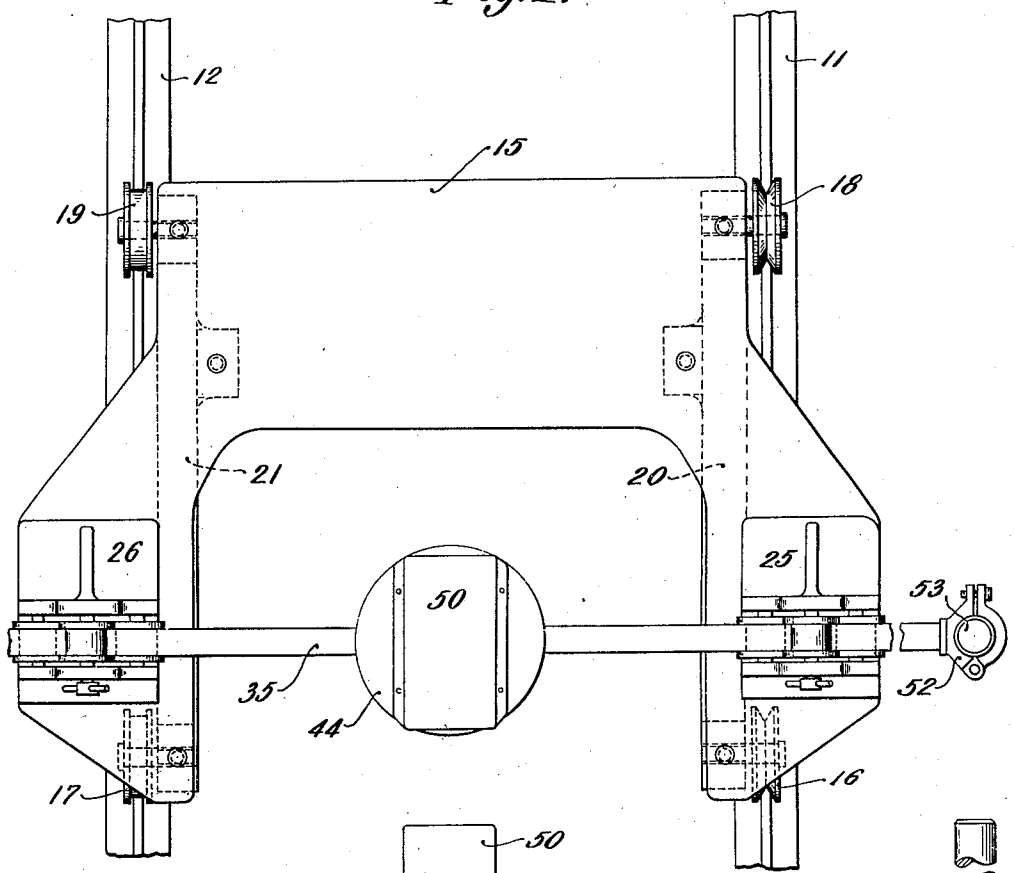
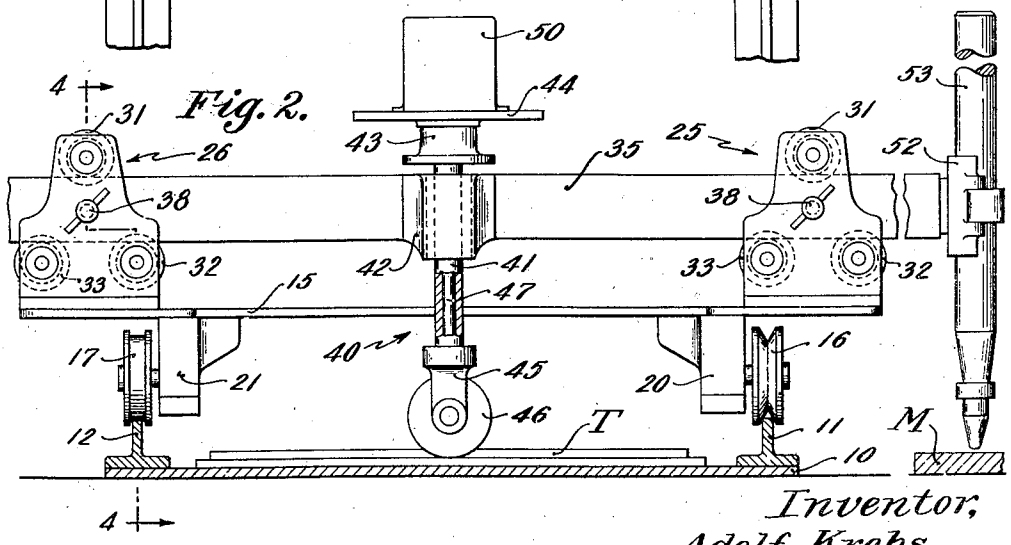


Fig. 2.



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Fig. 3.

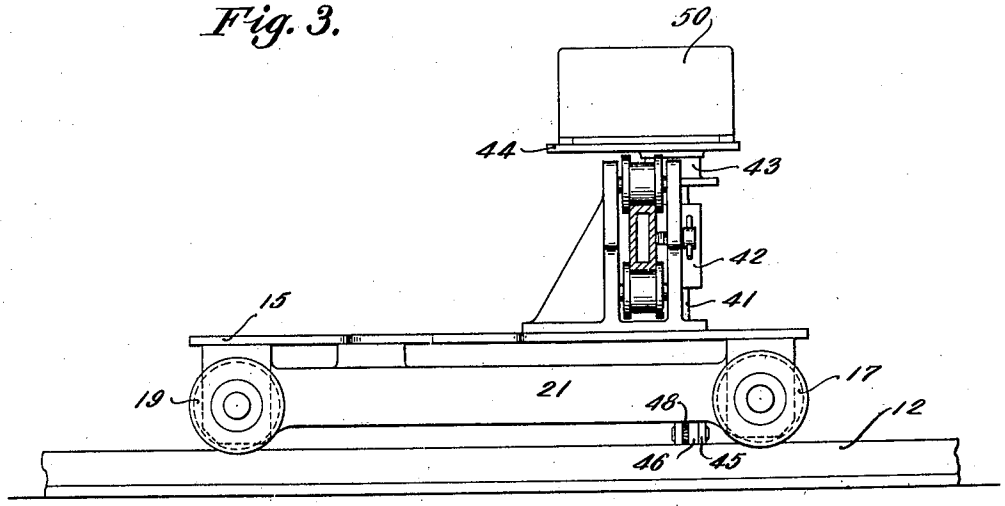
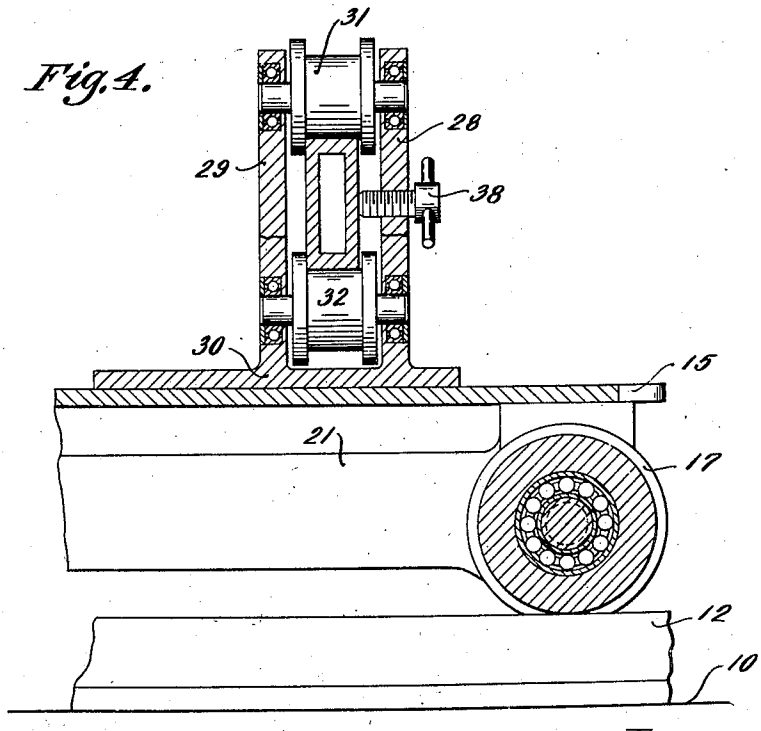


Fig. 4.



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UNITED STATES PATENT OFFICE

1,956,581

REPRODUCING APPARATUS

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Application April 8, 1932, Serial No. 604,053
Renewed July 25, 1933

10 Claims. (Cl. 266—23)

This invention relates to reproducing mechanisms of the type wherein a thermal implement such as a blow torch or an electric arc is mounted for universal movement and is automatically controlled and moved by power actuated driving and guiding elements engageable with a supporting surface or a template member which causes the thermal implement to describe a path accurately corresponding to the pattern to be reproduced.

In operating such reproducing mechanism considerable difficulty has heretofore been encountered in accurately reproducing intricate and irregular shapes. Such inaccuracy in operation is in most instances attributable to the practice of transmitting movement of the template follower or tracer wheel to the cutting instrumentality by the use of links or lever arms. Such arrangements, even though carefully constructed, exhibit a certain degree of lost motion, particularly where the linkage employed comprises a series of pivotally connected parts which are not substantially supported. In such machines the tracer wheel is rigidly mounted on one of the overhanging connecting links and provides a vertical support for that portion of the linkage system to which it is connected; consequently all jolts and vertical movement of the tracer are necessarily transmitted to the entire system.

A further objectionable feature of such machines resides in the fact that the tracer wheel is offset a considerable distance relative to the center of mass of the entire linkage system and the force transmitted thereby in moving the system has a substantial angular component which tends to cause binding and to develop looseness or play in the pivotal connections, thus producing an objectionable wear as well as interfering with the smooth, vibrationless and accurate operation of the machine. Moreover, as the tracer wheel is rigidly secured to the linkage system it must necessarily operate in a fixed horizontal plane in order to maintain a steady and unvarying rate of movement, and the guiding surfaces of the template member must be substantially free from minute irregularities; otherwise a vibration is set up and transmitted to the cutting instrumentality, resulting in an inaccurate reproduction. As great accuracy of contour is, in many cases, absolutely necessary, the inability of such machines to reproduce exact copies of the pattern has been sufficient to exclude their use in many establishments where but for such defects they would be a welcome addition to the mechanical equipment.

Attempts have been made to overcome the objectionable operation of such machines by dispensing with the pivotal linkage mechanism and using a pair of carriages arranged in superposed relation, the lower carriage running on tracks mounted on a suitable base, and the upper carriage running transversely over tracks mounted on the lower carriage. The chief objection to this otherwise satisfactory construction is that the transversely moving element or upper carriage is of considerable weight since it carries the various parts for its automotive movement, the parts for mounting the torch arm, the torch, the driving mechanism, and all the counterweights which keep the overhanging and overextending weights well centered within the upper carriage. With such an arrangement the apparatus can not be transported from one location to another without dismantling the parts.

Furthermore, during the cutting operation more or less weight is continuously shifted and as the upper carriage is not rigidly connected to the lower carriage, it is quite susceptible to vibrations of varying intensity depending upon the shift in weight. Obviously such vibrations are transmitted to the torch arm and cause the cutting jet to vibrate both horizontally and vertically. Although the resulting deflection may be slight, it is nevertheless sufficient to result in an inexact reproduction, and in operating upon thick heavy stock such deflection is apt to cause the cutting jet to jump away from the preignited spots a distance sufficient to impair the cutting action and in some cases even to stop the cutting process. Consequently in order to ensure a clean, smooth cut and an exact reproduction, it is necessary to eliminate all vibration as much as possible. From the foregoing it is evident that the disposition of weights, their substantial support and their fixed position is of vital importance.

The principal object of this invention is to eliminate the defects and objectionable features previously mentioned and to provide a reproducing mechanism which is of utmost stability and rigidity, which is of decreased total weight, of improved arrangement of parts, of material decrease in weight of the transversely moving member, and, in general, a mechanism which is not only correct in design, but also highly immune from vibrations.

A further object is to provide a drive and tracer which may be either steered by hand over

a drawing or automatically controlled by a template and which is floatingly arranged to actuate the horizontally moving members without adding to their weight when in operation or transmitting thereto vertical movement when running over an uneven surface, and whose weight is sufficient to ensure ample friction to prevent slippage while being propelled over a drawing or template. Still another object is to provide an apparatus which, without removing or loosening any parts, may be bodily lifted and set on a portable track located on the work-piece itself, and which may be shifted and reshifted to cut up either full-sized plates or shape contours of large dimensions merely by shifting the track and apparatus in order to cut the contour in consecutive sections. In this way an easily portable, small machine may be used conveniently and quickly to cut out the largest shapes.

Further objects relate to the details of construction and to the operation of my improved apparatus, and will be apparent to those skilled in the art from a consideration of the following description and the accompanying drawings, wherein

Fig. 1 is a top plan view of the apparatus;

Fig. 2 is a front elevation;

Fig. 3 is a side elevation; and

Fig. 4 is a section on the line 4—4 of Fig. 2.

The particular embodiment of the invention chosen for the purpose of illustration comprises a base or support 10 provided with a pair of parallel guide rails 11 and 12 which are spaced apart a distance exceeding the transverse travel or operating width of the apparatus. A rigid carriage 15 is arranged to move longitudinally of the rails 11, 12 and is provided with front wheels 16, 17 and rear wheels 18, 19 which are journaled in antifriction bearings carried by frame members 20 and 21, as shown in Figs. 1 and 2. The supporting wheels 16 and 18 are provided with beveled grooves of substantially V-shaped cross section, the width of the grooves being such that their beveled rims engage the top edges of guide rail 11, thus very accurately guiding the carriage 15 in its movement along the rails. The supporting wheels 17 and 19 are provided with double flanges spaced apart a distance slightly greater than the width of the guide rail 12 in order to prevent binding and ensure a smooth vibrationless operation of the carriage.

A pair of horizontally aligned guides 25 and 26 are rigidly secured to the opposite sides of the carriage preferably intermediate the front and rear wheels and spaced apart a distance exceeding the transverse travel of the apparatus. Preferably these guides are disposed in a transverse vertical plane at right angles to the guide rails and in relatively close proximity to the center of mass of the carriage, which in the present embodiment is in a transverse vertical plane adjacent to that passing through the guide members 25, 26.

Each of the guide members 25 and 26 is of similar construction and, as shown more clearly in Fig. 4, comprises a pair of parallel uprights 28 and 29 integral with a base member 30 which is rigidly secured to the carriage 15 in any suitable manner. A plurality of double flanged guide rollers 31, 32, 33, arranged in staggered relation, as shown in Fig. 2, are journaled in antifriction bearing members carried by the uprights 28 and 29, the upper roller 31 being spaced from the lower rollers 32 and 33 a vertical distance accurately corresponding to the depth of the arm 35 which is slidably mounted in these guide members.

The arm 35 has a length which exceeds twice the operating width of the apparatus and is of extremely rigid construction so as to resist both vertical and horizontal flexing. As here shown, the arm 35 is of rectangular cross section having a width accurately conforming to the distance between the flanges of the guide rollers. With this arrangement it is evident that the arm 35 is freely movable transversely of the guide rails in a fixed horizontal plane, and that longitudinal movement of the arm relative to the carriage as well as vertical movement thereof is prevented by the flange guide rollers, thus ensuring a smooth vibrationless operation free from objectionable play and lost motion. Each of the uprights 28 is provided with a threaded aperture which receives a set screw 38 which serves to lock the arm 35 in fixed position, as shown in Fig. 4, when the apparatus is not in use or when the apparatus is being transported.

Mounted between the ends and adjacent to the center of mass of the arm 35 is a floating tracer mechanism designated generally by the numeral 40. This mechanism comprises a sleeve 41 slidably mounted in a vertically disposed bearing member 42 which is rigidly secured to the arm 35 in any suitable manner. The upper end of the sleeve carries a boss 43 which limits the downward movement of the sleeve and provides a support for a plate 44. Secured to the lower end of the sleeve is a yoke 45 which carries a tracer or template follower, here shown as a tracer wheel 46, which is adapted either to follow an outline on a drawing or to engage a template T mounted on a base 10 intermediate the guide rails 11 and 12. A shaft 47 journaled in the sleeve 41 carries a gear (not shown) which engages with a beveled gear 48 (Fig. 3) fixed to the tracer wheel 46. The upper end of shaft 47 projects through an opening in plate 44 and is connected to a suitable speed reduction mechanism driven by a variable speed electric motor, both of which are mounted on plate 44 within a housing 50.

One end of the sliding arm 35 is provided with a clamp or adjustable collar 52 in which is secured a thermal implement, here shown as a blow torch 53 of any usual construction. If desired, the opposite end of arm 53 may also be provided with a holder and blow torch, preferably of the same weight and construction.

The template T may be of the automatic or semi-automatic type and may be constructed from cheap and easily obtainable materials such, for example, as fiber board, wood, sheet metal strips or the like.

In operating the apparatus the torch is first adjusted so that it is perpendicular to the material M which may be supported in any suitable manner for cutting by the action of the torch flame. The template T is interposed between the guide rails and the tracer wheel is positioned in cooperative relation therewith. The motor is then started and adjusted to the proper operating speed and with the torch lighted the tracer wheel is guided over the prescribed contour. As the weight of the driving mechanism is borne by the tracer wheel, the frictional engagement between the latter and the template is sufficient to prevent slippage between the two at any operating speed, and as both the template follower mechanism and the torch are firmly connected with the arm 35, it is evident that the slightest

movement of the tracer wheel is transmitted without substantial change to the torch. The movement of the latter thus corresponds with great exactitude to that of the tracer wheel and the material is cut to a shape accurately conforming to the contour of the template.

It is to be noted that the vertical component of pressure between the tracer wheel and the template is taken up by the floating follower mechanism and is not transmitted to either the carriage 15 or the sliding arm 35. Thus, regardless of the pressure or weight employed between the tracer wheel and template and regardless of any lack of smoothness in the template surface, both the carriage and sliding arm remain in a fixed horizontal plane throughout the entire operation so that there is no tendency to throw the torch out of proper alignment with the work or in any way to interfere with the proper transmission of movement from the tracer wheel to the torch.

It is also to be noted that the horizontal component of force causing movement of both the sliding arm and carriage always acts at a point closely adjacent to the center of mass of the sliding arm and in relatively close proximity to the center of mass of the carriage. Thus, the force exerted by the follower mechanism acts most efficiently and does not exert any appreciable angular thrust tending to rotate the sliding arm and carriage relative to the base 10 or to develop excessive wear which interferes with a smooth, vibrationless and accurate operation of the apparatus. Moreover, at all times during the operation the sliding arm is substantially supported at points spaced apart a distance exceeding half its entire length and with its center of mass intermediate the supporting points. Likewise, the carriage is at all times supported so that its center of mass lies between the supporting points. With this arrangement the stability and balance of the appartus is maintained without necessity of providing overhanging parts and counterweights. Thus, for any given operating capacity an apparatus constructed in accordance with this invention is of considerably less weight and bulk, less sluggish in movement, and more dependable and accurate in operation than those heretofore used.

By mounting the under-carriage on tracks the apparatus may be readily moved from one location to another; and by interconnecting the transverse slide with the under-carriage, as herein disclosed, accidental displacement of the transverse slide is readily prevented in moving the apparatus, whereas the upper carriage may fall or run off the lower carriage in the prior devices having an upper wheeled carriage, the transversely moving parts (35, etc.) of this improved apparatus can not become accidentally separated from the under-carriage in any position of the apparatus, inverted or otherwise; indeed all movement of the transversely moving parts relatively to the under-carriage may be prevented merely by tightening the set screws 38.

It is to be understood that the present disclosure is for the purpose of illustration and that various changes in shape, proportion and arrangement of parts, as well as the substitution of equivalent elements for those herein shown and described, may be made without departing from the spirit and scope of the present invention as set forth in the appended claims.

I claim:

1. Apparatus of the character described comprising a support having a pair of parallel guide rails thereon, a rigid carriage supported for bodily movement along said rails, a pair of horizontally aligned guides rigidly mounted on said carriage, an arm slidably mounted in said guides and movable transversely of said guide rails, a thermal implement supported by said arm adjacent to one end thereof, and a tracer connected with said arm intermediate its ends.

2. Apparatus of the character described comprising a support having a pair of guide rails thereon, a rigid carriage supported for bodily movement along said rails, a pair of horizontally aligned guides rigidly mounted on said carriage and spaced apart a distance at least as great as the intended transverse travel of a thermal implement of the apparatus, an arm slidably mounted in said guides and movable transversely of said guide rails, a thermal implement supported by said arm adjacent to one end thereof, and a tracer mechanism connected with said arm intermediate said guide rails.

3. Apparatus of the character described comprising a support having a pair of guide rails thereon, a rigid carriage having front and rear wheels engaging said rails, a pair of horizontally aligned guides rigidly mounted on said carriage intermediate the front and rear wheels, an arm slidably mounted in said guides and movable transversely of said guide rails, a thermal implement supported by said arm adjacent to one end thereof, and a tracer mechanism connected with said arm intermediate said guides.

4. Apparatus of the character described comprising a support having a pair of guide rails thereon spaced apart a distance exceeding the intended transverse travel of a thermal implement of the apparatus, a rigid carriage having front and rear wheels engaging said rails, a pair of horizontally aligned guides rigidly mounted on said carriage intermediate the front and rear wheels and spaced apart a distance at least as great as that between said rails, an arm slidably mounted in said guides and movable transversely of said guide rails, a thermal implement supported by said arm adjacent to one end thereof, and a floating tracer mechanism connected with said arm intermediate said guides.

5. Apparatus of the character described comprising a support having a pair of guide rails thereon, a rigid carriage having front and rear wheels engaging said rails, a pair of horizontally aligned guides rigidly mounted on said carriage intermediate the front and rear wheels and spaced apart a distance at least as great as the intended transverse travel of a thermal implement of the apparatus, an arm slidably mounted in said guides and movable transversely of said guide rails, a thermal implement supported by said arm adjacent to one end thereof, a vertical shaft journaled in said arm intermediate said guides, said shaft having a free axial movement, and a tracer wheel carried by said shaft.

6. Apparatus of the character described comprising a support having a pair of guide rails thereon, a rigid carriage having front and rear wheels engaging said rails, a pair of horizontally aligned guides rigidly mounted on said carriage intermediate the front and rear wheels and in a transverse vertical plane in close proximity to the center of mass of said carriage, an arm slidably mounted in said guides and movable transversely of said rails, a thermal implement supported by said arm adjacent to one end thereof, and a tracer mechanism connected with said arm intermediate said guides.

7. Apparatus of the character described comprising a support having a pair of guide rails thereon, a rigid carriage supported for bodily movement along said rails, a pair of horizontally aligned guides rigidly mounted on said carriage in a transverse vertical plane in close proximity to the center of mass of said carriage, said guides being spaced apart a distance at least as great as the intended transverse travel of a thermal implement of the apparatus, an arm slidably mounted in said guides and movable transversely of said rails, a tracer mechanism mounted on said arm intermediate said guides and at a point adjacent to its center of mass, and a thermal implement mounted on said arm adjacent to one end thereof.

8. Apparatus of the character described comprising a support having a pair of guide rails thereon spaced apart a distance exceeding the intended transverse travel of a thermal implement of the apparatus, a rigid carriage having front and rear wheels engaging said rails, a pair of horizontally aligned guides rigidly mounted on said carriage intermediate the front and rear wheels and in a transverse vertical plane in close proximity to the center of mass of said carriage, said guides being spaced apart a distance at least as great as that between said rails, an arm slidably mounted in said guides and movable transversely at right angles to said rails, a floating tracer mechanism mounted on said arm intermediate said guides and at a point adjacent to its center of mass, and a thermal implement mounted on said arm adjacent to one end thereof.

9. Apparatus of the character described comprising a support having a pair of guide rails thereon, a rigid carriage having front and rear wheels engaging said rails, a pair of horizontally aligned guides rigidly mounted on said carriage intermediate the front and rear wheels and in a vertical plane in close proximity to the center of mass of said carriage, said guides being spaced apart a distance at least as great as the intended transverse travel of a thermal implement of the apparatus, an arm slidably mounted in said guides and movable transversely at right angles to said rails, a thermal implement supported by said arm adjacent to one end thereof, and a tracer mechanism connected with said arm intermediate said guides.

10. Apparatus of the character described comprising a support having a pair of parallel guide rails thereon, a rigid carriage supported for bodily movement along said rails, transverse guide members rigid with said carriage, an arm slidably mounted in said guide members and freely movable transversely of seaid guide rails, and a thermal implement and a pattern tracer mounted on said sliding arm in spaced relation to each other.

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