Dec. 9, 1958 W. SCHMID 2,863,363

FEELER ARRANGEMENT FOR AUTOMATIC COPYING MACHINE

Filed March 21, 1957 3 Sheets-Sheet 1

Fig. 2

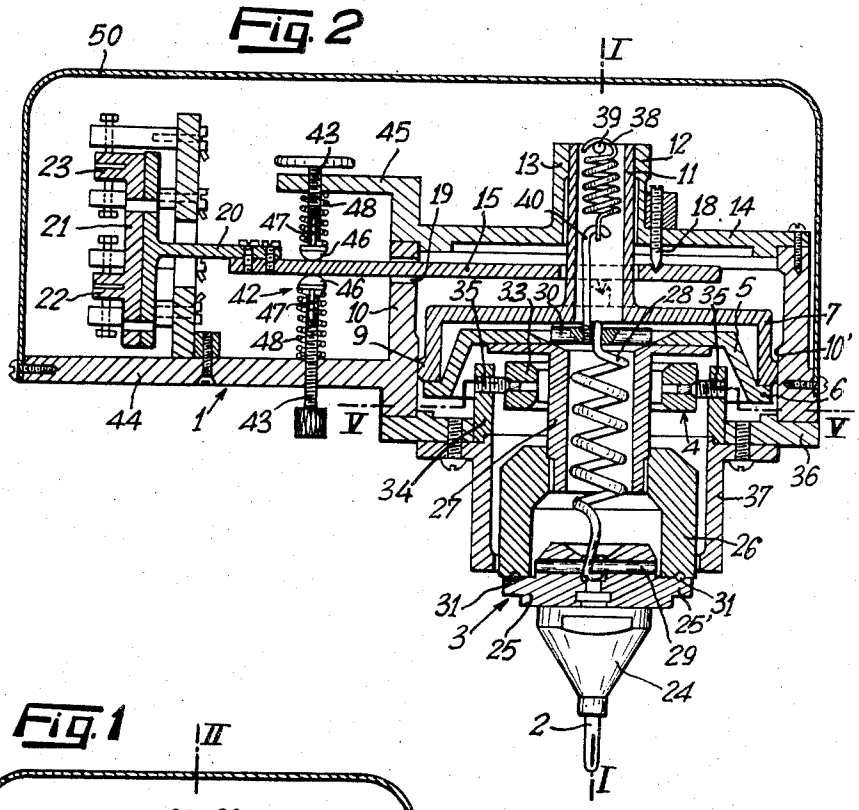
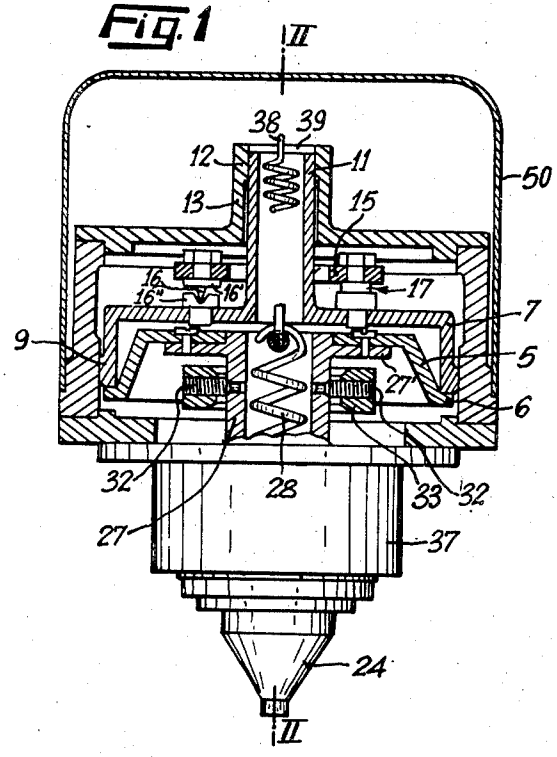


Fig. 1



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Filed March 21, 1957 3 Sheets-Sheet 2

Fig. 3

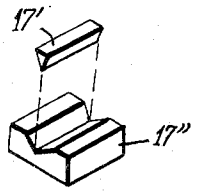


Fig. 4

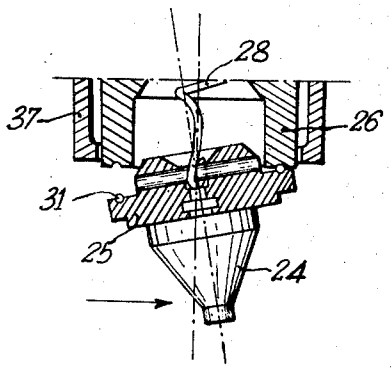
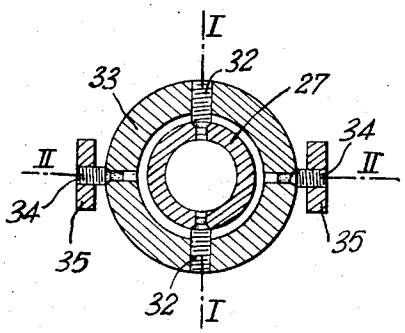


Fig. 5



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Filed March 21, 1957 3 Sheets-Sheet 3

Fig. 6

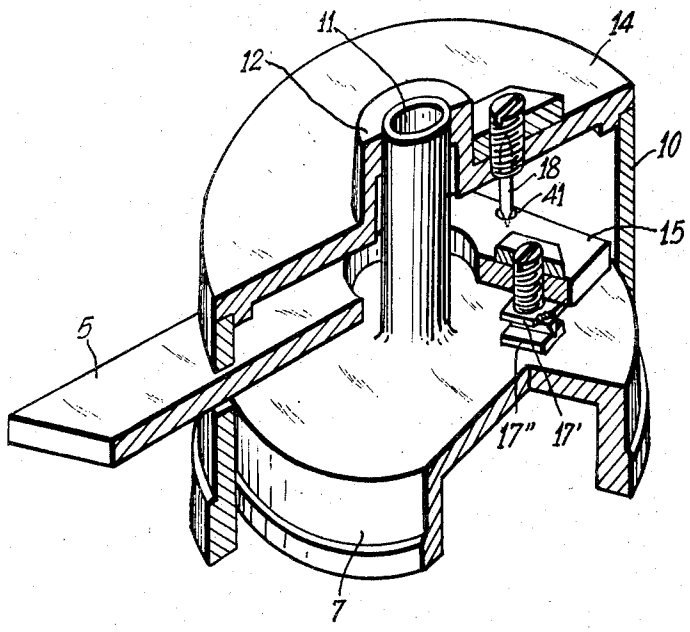
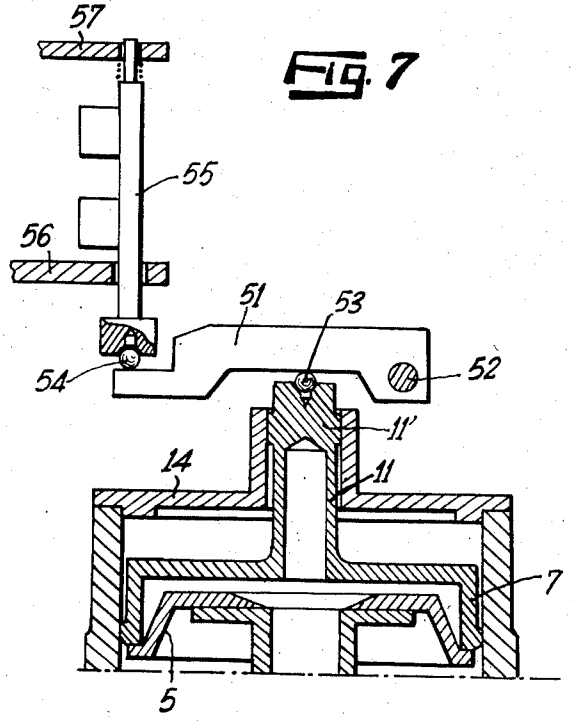


Fig. 7



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2,863,363

FEELER ARRANGEMENT FOR AUTOMATIC COPYING MACHINE

Wolfgang Schmid, Gagny, France

Application March 21, 1957, Serial No. 647,687

Claims priority, application France August 31, 1951

14 Claims. (Cl. 90—62)

The present invention relates to copying machines and more particularly to a feeler arrangement for automatic copying machines, adapted to translate the lateral movements of the feeler into movements of electrical contacts, which in turn control the movements of the copying machine.

It is one object of the present invention to provide for a feeler arrangement or tracing device in which the movements of the feeler are very exactly translated into contact movements and in which the movements of the feeler are also amplified so that relative small feeler movements result in relative large movements of the contacts.

It is a further object of the present invention to provide for such an apparatus which is very compact and sturdy so as to require relatively little space on the copying machine on which the apparatus of the present invention is mounted.

It is another object of the present invention to provide for an apparatus in which the individual elements are properly balanced so that they will automatically return to the starting or zero position when the feeler is not deflected.

It is yet another object of the present invention to provide for such an apparatus which is protected against damage due to faulty operation.

Finally it is an object of the present invention to provide for such an apparatus which is built of relatively few and simple parts which can be constructed at reasonable cost and which will stand considerable wear.

With these objects in view the tracing device of the present invention mainly comprises support means, a spindle member having a contact feeler at one end and being mounted at the other end with the support means for universal lateral oscillation relative thereto, a first transverse member at the other end of the spindle member movable therewith and extending transverse the longitudinal axis of the spindle member, and having supporting portions spaced radially from and arranged circumferentially around the spindle member, a second transverse member having bearing portions resting on the supporting portions of the first transverse member and being movable thereby during movement of the first transverse member, and guide means for guiding the second transverse member in a direction along the axis of the spindle member, whereby when the spindle member is laterally deflected, the second transverse member is displaced axially of the spindle member.

The tracing device further includes an elongated motion transmitting member extending substantially normal to the axis of the spindle member and being mounted at one end thereof for movement with the second transverse member and for pivoting relative to the support means. This motion transmitting member is adapted at the other end thereof to actuate the electrical contacts of an automatic control apparatus of the copying machine.

Preferably the tracing device of the present invention includes also motion damping means which engage the elongated motion transmitting member for damping the movements thereof. The contact feeler of the tracing device is preferably connected to the spindle member thereof by a resilient joint so that excessive lateral forces acting on the contact feeler due to faulty operation of the machine are not transmitted to the spindle member. Bending or other damaging of the spindle member is prevented by this arrangement.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 is a partly sectioned end view of the tracing device of the present invention, the section being taken along the line 1—1 of Fig. 2;

Fig. 2 is a partly sectioned side view of a tracing device of the present invention, the section being taken along the line 2—2 of Fig. 1;

Fig. 3 is a perspective exploded view of one of the mounting means for mounting the elongated motion transmitting member;

Fig. 4 is a partly sectioned side view of some of the members shown in Fig. 2, showing these members in deflected position which may occur when excessive lateral stresses are accidentally applied to the feeler or to the member mounting the same, the section in Fig. 4 being taken along the same line as the section in Fig. 2;

Fig. 5 is a sectional view of some of the members illustrated in Fig. 2, the section being taken along the line 5—5 of Fig. 2;

Fig. 6 is a perspective partly sectioned view of a portion of the tracing device illustrated in Figs. 1 and 2; and

Fig. 7 is a partially sectioned side view similar to Fig. 2 and showing another embodiment of the present invention.

Referring now to the drawings and more particularly to Figs. 1 and 2 of the same, it will be seen that the tracing device of the present invention comprises support means 1 which is adapted to be mounted on the copying machine in which the tracing device is used in such a way that the contact feeler or tracing pin 2 mounted on the end of the spindle member 3 may be brought in contact with a template mounted on the copying machine. The spindle member 3 is mounted at its upper end thereof in a gimbal arrangement 4 for universal lateral oscillation relative to the support 1. A first transverse member 5 is fixedly connected in any convenient manner to the upper end of the spindle member 3 so as to be movable therewith. The first transverse member 5 extends transverse to the longitudinal axis of the spindle member 3 and has supporting portions 6 spaced radially from and arranged circumferentially around the spindle member 3. Supported on the first transverse member 5 is a second member 7 having bearing portions 9 resting with the bottom face thereof on the top face of the supporting portion 6 of the first transverse member 5. The annular outer face of the bearing portions 9 is guided on the inner cylindrical face 10' of a housing 10 forming part of the support means 1. The upper end of a tubular extension 11 projecting upwardly from a center portion of the second transverse member 7 is guided in a bearing portion 12 formed in a tubular extension 13 projecting upwardly from a cover member 14 resting on the housing 10. The bearing 12 and the inner cylindrical surface 10' of the housing 10 form therefore guide means for guiding the second transverse member 7 in a direction along the axis of the spindle member 3.

Supported between the cover member 14 of the cylin-

drical housing 10 and the second transverse member 7 is an elongated motion transmitting member 15 for oscillation in a plane including the longitudinal axis of the spindle. The mounting means for the elongated motion transmitting member 15 comprise a point support 16 and a knife edge support 17, located spaced from each other in a plane passing through the spindle axis, and a point support 18 fastened to the cover member 14 and contacting the top surface of the motion transmitting member 15 at a point spaced from the supports 16 and 17 in longitudinal direction of the elongated motion transmitting member 15. The member 15 extends in longitudinal direction through a slot 19 formed in the housing 10 of the support and carries on its end distant from its mounting a T-shaped member 20 to which a fork-shaped member 21 is attached. Member 21 carries the contacts 22 and 23. The specific construction of these contacts 22 and 23 does not form part of the present application. The contact arrangement is fully described in my copending application 311,059, filed September 23, 1952, under the title "Electrical Control for Copying Machines."

The spindle member 3 of the tracing device is preferably made out of several parts as clearly illustrated in Figs. 1 and 2. The contact feeler 2 is removably mounted in the chuck 24, which in turn is threadedly connected or otherwise fastened to a member 25. Resting on the top face of the annular flange 25' of the member 25 is a bell-shaped member 26 to which in turn a tubular member 27, extending from the member 26 upwardly in axial direction of the spindle, is fixedly connected. The member 25 is held against the member 26 by a tension spring 28, which is fastened on its opposite ends to pins 29 and 30. In this way a resilient joint is formed between the members 24, 25 carrying the contact feeler 2 and the remainder of the spindle. If excessive lateral forces are exerted on the feeler 2, the feeler, the chuck 24 and the member 25 may tilt to the remainder of the spindle, that is relative to the members 26 and 27, in the manner as illustrated in Fig. 4. Bending or other damage to the spindle is prevented in this way. It is pointed out that the position of the members 24 and 25 relative to the member 26 shown in Fig. 4 will not occur during normal operating conditions. The members 24 and 25 will tilt relative to the member 26 in the manner indicated in Fig. 4 only if excessive lateral stresses are accidentally applied to the feeler 2 or to the members 24 and 25 mounting the same. Such excessive lateral stresses may, for instance, be applied to the apparatus during careless handling of the same, for instance during cleaning or assembly of the members. If such excessive stresses during careless handling will be applied to the follower 2 or to the members mounting the same, the members 24 and 25 will tilt relative to the member 26, while the spring 28 is stressed, thus avoiding bending of the spindle during careless handling of the apparatus. It is further mentioned that even if the members 24 and 25 are in the position as shown in Fig. 4, the lubricating grease surrounding the balls 31 will still maintain the same in the semi-spherical cavities provided in the end face of the member 25 and if one of the balls should accidentally fall out it can easily be replaced.

For certain applications it is desirable to use instead of a straight contact feeler 2 as shown in Fig. 2 a contact feeler in which the contact end extends laterally from the spindle axis. To avoid excessive torsional stresses in the spindle member 3 during the use of such a contact feeler, the top face of the flange 25' of the member 25 is provided with a plurality of spacedly arranged semi-spherical cavities and corresponding semi-spherical cavities are arranged opposite the cavities in the member 25 on the bottom face of the member 26. Small balls 31 are located in these opposite cavities, which prevent under normal operating conditions turning movement between the members 25 and 26. However, if excessive torsional forces are exerted on the contact feeler 2, the member 25 may turn relative to the member 26, since in this case the balls 31 will act like cams separating the members 25 and 26 against the action of the spring 28. The balls 31 act therefore as stop means for holding the contact feeler 2 and the spindle member 3 against rotation relative to each other about their longitudinal axes under normal operating conditions, while allowing turning of the contact feeler 2 and the members 24 and 25 fixedly attached thereto relative to the other members of the spindle if excessive torsional forces are applied against the feeler 2. It is pointed out that during the turning of the member 25 relative to the member 26 under the influence of excessive torsional forces these two members will still contact the small balls 31 located in the semi-spherical cavities respectively provided in opposing faces of the two members. During application of excessive torsional forces the members 25 and 26 will be separated from each other only such a distance that the balls 31 will slip out of the semi-spherical cavities provided in one of the members, while the balls will still be held in the semi-spherical cavities of the other of the two members.

As mentioned before the spindle member 3 is mounted for universal lateral oscillation relative to the support 1. For this purpose the tubular member 27 of the spindle is mounted for oscillation about the axis of two opposite pivot pins 32 which in turn are fastened to the gimbal ring 33 (Fig. 5). The gimbal ring 33 itself is mounted for oscillation about an axis, normal to the axis of the two pivot pins 32, on pivot pins 34. Pins 34 are carried by and projecting inwardly from brackets 35, which extend upwardly from a cover member 36 closing the bottom of the cylindrical housing 10. Extending downwardly from the cover member 36 and fastened thereto by screws or any other convenient manner is a cylindrical member 37 which surrounds the member 26 of the spindle. Necessary clearance is provided between the outer surface of the member 26 and the inner surface of the members 27 to permit oscillation of the spindle within the member 37.

Fixedly mounted on a lateral extending flange 27' of the member 27, properly centered thereon and connected thereto by screws as best shown in Fig. 1 is the first transverse member 5. The member 5 is dish-shaped and has a rim portion or supporting portion 6 spaced radially and arranged circumferentially around the spindle member 3. The upper surface of the supporting portion 6 is preferably substantially in one plane with the axes of the pivot pins 32 and 34 of the gimbal arrangement 4. It should be noted that the outer annular surface of the supporting portion 6 is properly spaced from the inner surface of the housing 10 so that the dish-shaped transverse member 5 may tilt together with the spindle member 3 about the pivot pins 32 and 34 in any lateral direction.

An upper transverse dish-shaped member 7 having a downwardly extending annular rim portion 9 rests on the flanged annular rim portion 6 of the lower dish-shaped member 5. It should be noted that an outer annular surface portion of the flanged annular rim portion 9 of the member 7 is in contact with the inner surface 10' of the cylindrical housing 10 so as to be guided thereby, whereas the upper end of a tubular extension extending upwardly from the member 7 is guided in a bearing 12 formed in upwardly extending tubular portion on the cover 14. The bottom face of the upper transverse member 7 is pressed against the top face of the supporting portion 6 of the lower transverse member 5 by a spring 38, one end of which is fastened to a pin 39 carried by the tubular extension 11 of the upper transverse member and the other end of which is fastened by a hook 40 to the pin 30 resting on the upper surface of the member 27. It is understood that the spring 28 is stronger than the spring 38 so that the pin 30 will rest on the top surface of the member 27.

The mounting means for the elongated motion transmitting member 15 comprises three supports, that is the

point support 16, the knife edge support 17 and a needle pivot 18. The point support 16 comprises a hardened needle point 16' fastened to and extending downwardly from the bottom surface of the motion transmitting member 15 at a point laterally spaced from the axes of the spindle member 3. The point 16' of the point support rests against V-shaped hardened insert 16'' mounted on the top surface of the second transverse member 7. The knife-edged support 17 comprises a knife-edge member 17' fastened to and extending downwardly from the bottom surface of the motion transmitting member 15 and supported on a V-shaped insert 17'' mounted opposite the knife-edge of the member 17' on the top surface of the member 7. The shapes of the members 17' and 17'' are most clearly shown in Fig. 3 and the member 17' is preferably adjustable in the direction of the axes of the spindle member as best shown in Fig. 6. The supports 16 and 17 are preferably mounted in a plane through the axis of the spindle and normal to the longitudinal axis of the motion transmitting member 15. Engaging the top surface of the motion transmitting member 15 at a point spaced in longitudinal direction of this member toward one end thereof is a needle pivot 18 which is fastened, adjustable in longitudinal direction thereof, to the cover 14, as best shown in the perspective view of Fig. 6. The hardened point of the needle pivot 18 engages into a conical recess 41 formed in the top surface of the member 15. The member 15 is thus supported at three points and the plane in which the member 15 is located in the undeflected position of the spindle 3 may be adjusted by adjusting the supports 17 and 18. The member 15 extends with the necessary clearance, to allow oscillation of this member, through a slot 19 formed in the housing 10 and the member 15 carries on its end opposite to the end on which it is supported the members 20 and 21 to which the contacts 22 and 23 are attached.

Motion damping means 42 are provided which engage the member 15 intermediate the contacts 22 and 23 and the supporting points of the member 15. The motion damping means 42 comprise a pair of opposite pins 43, respectively screwed for adjustment in a longitudinal direction thereof into the plate 44 of the support means 1 and into a bracket 45 extending laterally from the cover member 14. A pair of buttons 46 having each a central stem 47 slidably mounted in bores formed in the opposite ends of the screw pins 43 engage with spherical surfaces opposite surfaces of the motion transmitting member 15. Helically wound compression springs 48 located about the pins 43 press the buttons 46 respectively against the opposite surfaces of the member 15. These springs 48 will dampen the motion of the member 15, while the clearance provided between the end faces of the pin 43 and the faces of the buttons 46 opposite thereto make oscillation of the member 15 possible. A cover 50 covering the whole device is fastened by means of screws to the support 1 to protect the device from dust.

A modification of the device above described is shown in Fig. 7. This modified apparatus differs from the above described device only by the specific shape and mounting of the motion transmitting member. The spindle member 3, the gimbal arrangement 4 for mounting the spindle 3, the first transverse member 5 and the second transverse member 7 resting thereon are substantially the same as described above. The motion transmitting member 51 however is not supported on a three-point support as the motion transmitting member 15, but the motion transmitting member 51 is mounted adjacent one end thereof on a pivot pin 52, which in turn is supported on brackets (not shown) on the support means, for instance on the cover 14. The pivot pin 52 is arranged laterally spaced from the spindle axis and the upper end 11' of the tubular extension 11, extending upwardly from the upper transverse member 7, contacts by means of a ball 53 the bottom surface of the member 51 at the axis of the spindle. The end of the member 51 opposite to the end on which it is pivotally mounted contacts by means of a ball 54 an elongated member 55, which is guided for motion in longitudinal direction thereof in openings formed in the brackets 56 and 57 which are fastened in any convenient manner, not shown in the drawing, to the support 1. The member 55 carries again contacts similar to the contacts 22 and 23 shown in Fig. 2.

The device described above will operate as follows:

During the operation of the copying machine the contour of a template, not shown in the drawing, is moved against the bottom end of the contact feeler 2 and causes thereby a tilting of the contact feeler 2 and the oscillation of the spindle member 3 connected thereto. Oscillation of the spindle member 3 will cause tilting of the first transverse member 5. The second transverse member resting with its bottom surface against the supporting portions 6 of the first transverse member 5 and guided by the guide means 9 and 12 for movement in a vertical direction will thereby shift in this direction during the tilting of the spindle. This movement of the member 7 in vertical direction is transmitted to the motion transmitting member through the supports 16 and 17. Therefore, the member 15 will oscillate or pivot about the stationary needle pivot 18 which contacts the upper surface of the member 15. During this oscillation of the member 15 the contacts 23 and 22 will be deflected to various extent and these contact deflections are translated in an automatic control apparatus, not forming part of the present application, into movements of the elements of the copying machine. Since the distance between the contacts 22 and 23 and the supports 16 and 17 at one hand is considerably greater than the distance between these supports and the needle pivot 18, it is evident that the vertical motion of the member 7 results in a considerably greater motion of the contacts 22 and 23.

The modified apparatus shown in Fig. 7 will work in a similar manner. During vertical movement of the transverse member 7 the motion transmitting member 51 will pivot about the pivot pin 52 and cause thereby shifting of the member 55 in longitudinal direction thereof. This again deflects the contacts connected to the member 55 to a greater or lesser degree.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of tracing devices differing from the types described above.

While the invention has been illustrated and described as embodied in tracing device for actuating a system of electrical contacts in an automatic control apparatus, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

This application is a continuation-in-part of my patent application Serial No. 306,988 filed Aug. 29, 1952 now abandoned.

What is claimed as new and desired to be secured by Letters Patent is:

1. A tracing device, comprising in combination, a support means; a spindle member having a contact feeler at one end and being mounted at its other end on said support means for universal lateral oscillation relative thereto; a first transverse member at said other end of said spindle member movable therewith and extending transverse the longitudinal axis of said spindle member, and having supporting portions spaced radially from and

arranged circumferentially around said spindle member; a second transverse member having bearing portions resting on the supporting portions of said first transverse member and being movable thereby during movement of said first transverse member; and guide means for guiding said second transverse member in a direction along the axis of said spindle member, whereby when said spindle member is laterally deflected, said second transverse member is displaced axially of said spindle member.

2. A tracing device, comprising in combination, a support means; a spindle member having a contact feeler at one end and being mounted at its other end on said support means for universal lateral oscillation relative thereto; a first transverse member at said other end of said spindle member movable therewith and extending transverse the longitudinal axis of said spindle member, and having an annular supporting portion spaced radially from and arranged circumferentially around said spindle member; a second transverse member having an annular bearing portion resting on the supporting portion of said first transverse member and being movable thereby during movement of said first transverse member; and guide means for guiding said second transverse member in a direction along the axis of said spindle member, whereby when said spindle member is laterally deflected, said second transverse member is displaced axially of said spindle member.

3. A tracing device, comprising in combination, a support means; a spindle member having a contact feeler at one end and being mounted at its other end on said support means for universal lateral oscillation relative thereto about a center of oscillation; a first transverse member at said other end of said spindle member movable therewith and extending transverse the longitudinal axis of said spindle member, and having an annular supporting surface spaced radially from and arranged circumferentially around said spindle member; a second transverse member having an annular bearing surface resting on the supporting surface of said first transverse member and being movable thereby during movement of said first transverse member, said supporting and bearing surfaces and said center of oscillation lying in substantially the same plane; and guide means for guiding said second transverse member in a direction along the axis of said spindle member, whereby when said spindle member is laterally deflected, said second transverse member is displaced axially of said spindle member.

4. A tracing device, comprising in combination, a support means; a spindle member having a contact feeler at its lower end and being mounted at its upper end on said support means for universal lateral oscillation relative thereto; a lower transverse dish-shaped member at said upper end of said spindle member movable therewith and extending transverse the longitudinal axis of said spindle member, and having a downwardly extending, outwardly flanged annular rim portion spaced radially from and arranged circumferentially around said spindle member; an upper transverse dish-shaped member having a downwardly extending annular rim portion resting on said flanged annular rim portion of said lower dish-shaped member and being movable thereby during movement of said lower transverse dish-shaped member; and guide means for guiding said upper transverse dish-shaped member in a direction along the axis of said spindle member, whereby when said spindle member is laterally deflected, said upper transverse dish-shaped member is displaced axially of said spindle member.

5. A tracing device for actuating a system of electrical contacts in an automatic control apparatus, comprising in combination, a support means; a spindle member having a contact feeler at one end and being mounted at its other end on said support means for universal lateral oscillation relative thereto; a first transverse member at said other end of said spindle member movable therewith and extending transverse the longitudinal axis of said

spindle member, and having supporting portions spaced radially from and arranged circumferentially around said spindle member; a second transverse member having bearing portions resting on the supporting portions of said first transverse member and being movable thereby during movement of said first transverse member; guide means for guiding said second transverse member in a direction along the axis of said spindle member, whereby when said spindle member is laterally deflected, said second transverse member is displaced axially of said spindle member; and an elongated motion transmitting member extending substantially normal to the axis of said spindle member and mounted at one end for movement with said second transverse member and for pivoting relative to said support means, and being adapted at its opposite end to actuate the electrical contacts of the automatic control apparatus.

6. A tracing device for actuating a system of electrical contacts in an automatic control apparatus, comprising in combination, a support means; a spindle member having a contact feeler at one end and being mounted at its other end on said support means for universal lateral oscillation relative thereto; a first transverse member at said other end of said spindle member movable therewith and extending transverse the longitudinal axis of said spindle member, and having supporting portions spaced radially from and arranged circumferentially around said spindle member; a second transverse member having bearing portions resting on the supporting portions of said first transverse member and being movable thereby during movement of said first transverse member; guiding means for guiding said second transverse member in a direction along the axis of said spindle member, whereby when said spindle member is laterally deflected, said second transverse member is displaced axially of said spindle member; an elongated motion transmitting fork member extending substantially normal to the axis of said spindle member; and mounting means mounting said fork member at one end on said second transverse member for movement of said fork member therewith and for simultaneous pivoting of said fork member relative to said support means, whereby said fork member is adapted at its opposite end to actuate the electrical contacts of the automatic control apparatus.

7. A tracing device for actuating a system of electrical contacts in an automatic control apparatus, comprising in combination, a support means; a spindle member having a contact feeler at one end and being mounted at its other end on said support means for universal lateral oscillation relative thereto; a first transverse member at said other end of said spindle member movable therewith and extending transverse the longitudinal axis of said spindle member, and having supporting portions spaced radially from and arranged circumferentially around said spindle member; a second transverse member having bearing portions resting on the supporting portions of said first transverse member and being movable thereby during movement of said first transverse member; guiding means for guiding said second transverse member in a direction along the axis of said spindle member, whereby when said spindle member is laterally deflected, said second transverse member is displaced axially of said spindle member; an elongated motion transmitting fork member extending substantially normal to the axis of said spindle member; and mounting means mounting said fork member at one end on said second transverse member for movement of said fork member therewith and for simultaneous pivoting of said fork member relative to said support means, said mounting means comprising a point support and a knife-edge support for mounting said fork member on said second transverse member and comprising a needle pivot extending from said support means about which said fork member is pivotable, whereby said fork member is adapted at its opposite end to actuate the electrical contacts of the automatic control apparatus.

8. A tracing device for actuating a system of electrical contacts in an automatic control apparatus, comprising in combination, a support means; a spindle member having a contact feeler at one end and being mounted at its other end on said support means for universal lateral oscillation relative thereto; a first transverse member at said other end of said spindle member movable therewith and extending transverse the longitudinal axis of said spindle member, and having supporting portions spaced radially from and arranged circumferentially around said spindle member; a second transverse member having bearing portions resting on the supporting portions of said first transverse member and being movable thereby during movement of said first transverse member; guide means for guiding said second transverse member in a direction along the axis of said spindle member, whereby when said spindle member is laterally deflected, said second transverse member is displaced axially of said spindle member; an elongated motion transmitting member extending substantially normal to the axis of said spindle member and mounted at one end for movement with said second transverse member and for pivoting relative to said support means, and being adapted at its opposite end to actuate the electrical contacts of the automatic control apparatus; and motion damping means engaging said elongated motion transmitting member for damping the movements thereof.

9. A tracing device, comprising in combination, a support means; a spindle member having a contact feeler at one end and being mounted at its other end on said support means for universal lateral oscillation relative thereto; resilient joint means connecting said contact feeler to said spindle member; a first transverse member at said other end of said spindle member movable therewith and extending transverse the longitudinal axis of said spindle member, and having supporting portions spaced radially from and arranged circumferentially around said spindle member; a second transverse member having bearing portions resting on the supporting portions of said first transverse member and being movable thereby during movement of said first transverse member; and guide means for guiding said second transverse member in a direction along the axis of said spindle member, whereby when said spindle member is laterally deflected, said second transverse member is displaced axially of said spindle member.

10. A tracing device, comprising in combination, a support means; a spindle member having a contact feeler at one end and being mounted at its other end on said support means for universal lateral oscillation relative thereto, said contact feeler and said spindle member engaging each other along substantially circular bearing surfaces; spring means resiliently pressing said contact feeler and said spindle member together at said substantially circular bearing surfaces; a first transverse member at said other end of said spindle member movable therewith and extending transverse the longitudinal axis of said spindle member, and having supporting portions spaced radially from and arranged circumferentially around said spindle member; a second transverse member having bearing portions resting on the supporting portions of said first transverse member and being movable thereby during movement of said first transverse member; and guide means for guiding said second transverse member in a direction along the axis of said spindle member, whereby when said spindle member is laterally deflected, said second transverse member is displaced axially of said spindle member.

11. A tracing device, comprising in combination, a support means; a spindle member having a contact feeler at one end and being mounted at its other end on said support means for universal lateral oscillation relative thereto, said contact feeler and said spindle member engaging each other along substantially circular bearing surfaces; spring means resiliently pressing said contact feeler and said spindle member together at said substantially circular bearing surfaces; stop means for holding said contact feeler and said spindle member against rotation relative to each other about their longitudinal axes; a first transverse member at said other end of said spindle member movable therewith and extending transverse the longitudinal axis of said spindle member, and having supporting portions spaced radially from and arranged circumferentially around said spindle member; a second transverse member having bearing portions resting on the supporting portions of said first transverse member and being movable thereby during movement of said first transverse member; and guide means for guiding said second transverse member in a direction along the axis of said spindle member, whereby when said spindle member is laterally deflected, said second transverse member is displaced axially of said spindle member.

12. A tracing device, comprising in combination, a support means; a spindle member having a contact feeler at one end and being mounted at its other end on said support means for universal lateral oscillation relative thereto, said contact feeler and said spindle member engaging each other along substantially circular bearing surfaces; spring means resiliently pressing said contact feeler and said spindle member together at said substantially circular bearing surfaces; stop means comprising complementary recesses in said substantially circular bearing surfaces and ball members arranged in said complementary recesses for holding said contact feeler and said spindle member against rotation relative to each other about their longitudinal axes; a first transverse member at said other end of said spindle member movable therewith and extending transverse the longitudinal axis of said spindle member, and having supporting portions spaced radially from and arranged circumferentially around said spindle member; a second transverse member having bearing portions resting on the supporting portions of said first transverse member and being movable thereby during movement of said first transverse member; and guide means for guiding said second transverse member in a direction along the axis of said spindle member, whereby when said spindle member is laterally deflected, said second transverse member is displaced axially of said spindle member.

13. A tracing device for actuating a system of electrical contacts in an automatic control apparatus, comprising in combination, a support means; a spindle member having a contact feeler at one end and being mounted at its other end on said support means for universal lateral oscillation relative thereto, said contact feeler and said spindle member engaging each other along substantially circular bearing surfaces; spring means resiliently pressing said contact feeler and said spindle member together at said substantially circular bearing surfaces; a first transverse member at said other end of said spindle member movable therewith and extending transverse the longitudinal axis of said spindle member, and having supporting portions spaced radially from and arranged circumferentially around said spindle member; a second transverse member having bearing portions resting on the supporting portions of said first transverse member and being movable thereby during movement of said first transverse member; guide means for guiding said second transverse member in a direction along the axis of said spindle member, whereby when said spindle member is laterally deflected, said second transverse member is displaced axially of said spindle member; an elongated motion transmitting fork member extending substantially normal to the axis of said spindle member; and mounting means mounting said fork member at one end on said second transverse member for movement of said fork member therewith and for simultaneous pivoting of said fork member relative to said support means, whereby said fork member is adapted at its opposite end to actuate the electrical contacts of the automatic control apparatus.

14. A tracing device for actuating a system of electrical contacts in an automatic control apparatus, comprising, in combination, support means; a spindle member having a contact feeler at one end and being mounted at the other end thereof on said support means for universal lateral oscillation relative thereto; a first transverse member fixed to said other end of said spindle member and extending transversely to the longitudinal axis of said spindle member, said first transverse member having supporting portions spaced radially from and arranged circumferentially around said spindle member; a second transverse member having bearing portions resting on the supporting portions of said first transverse member and being movable thereby during movement of said first transverse member; first guide means for guiding said second transverse member in the direction of the axis of said spindle member, whereby when said spindle member is laterally deflected, said second transverse member is displaced axially of said spindle member; a motion transmitting member extending substantially normal to the axis of said spindle member and being mounted adjacent one end thereof for tilting movement about an axis substantially normal to and spaced from the axis of said spindle member; a rod member abutting with one end thereof against the other end of said motion transmitting member so as to be supported thereby and extending therefrom substantially parallel to the axis of said spindle member; second guide means for guiding said rod member for movement in axial direction, and said second transverse member contacting said motion transmitting member at a point intermediate the ends thereof so that during axial displacement of said second transverse member said rod member is also axially displaced, whereby said rod member is adapted to actuate the electrical contacts of the automatic control apparatus.

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