Nov. 15, 1949 M. PÉGARD 2,488,324

DEVICE FOR INDICATING THE MOVEMENTS TO BE EXECUTED BY MACHINE TOOLS

Filed Dec. 6, 1945 9 Sheets-Sheet 1

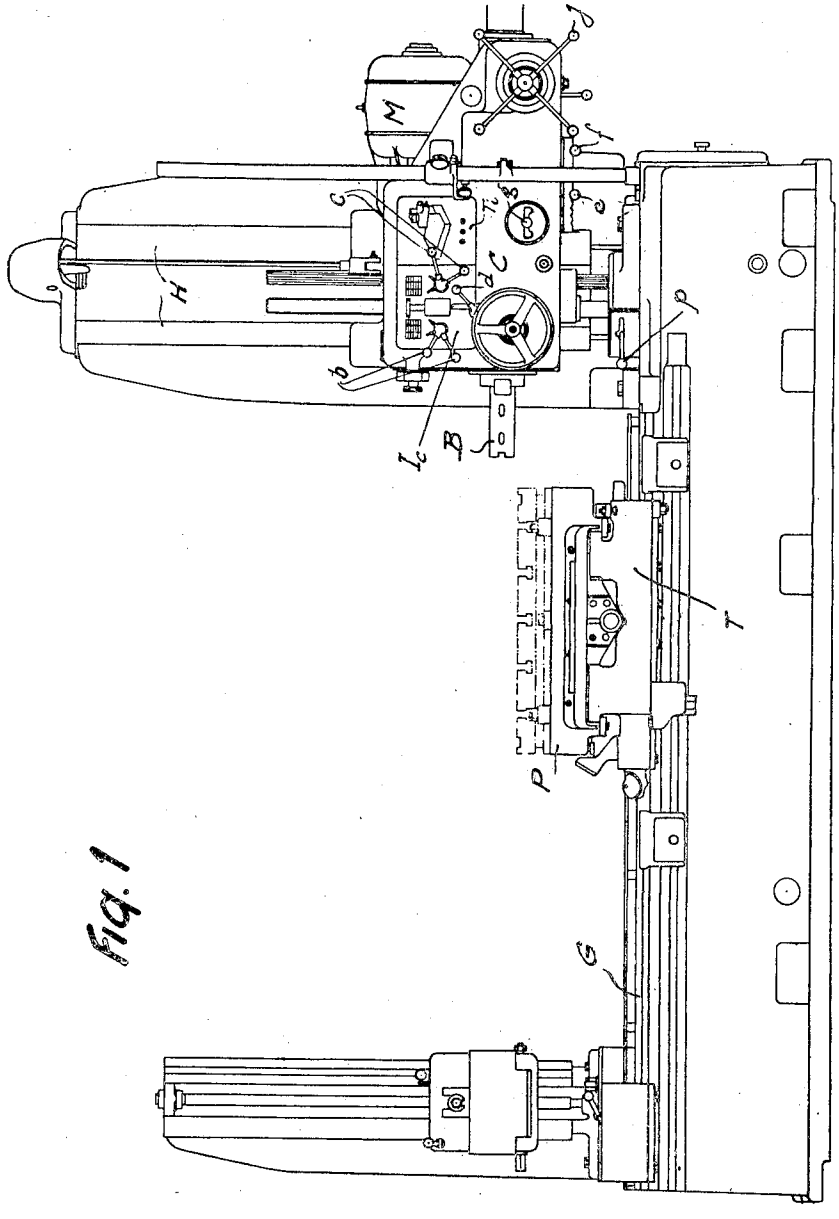

Fig. 1

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DEVICE FOR INDICATING THE MOVEMENTS TO BE EXECUTED BY MACHINE TOOLS

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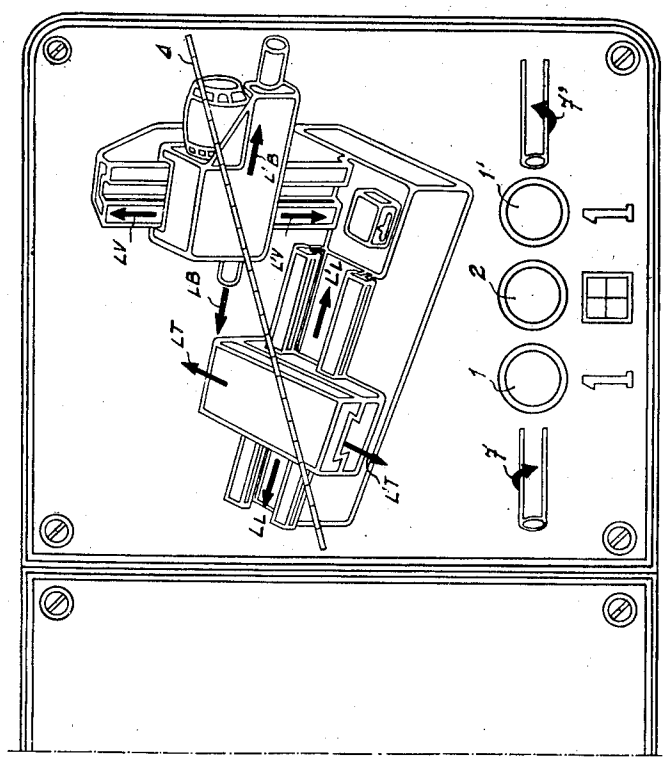
Fig. 2



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DEVICE FOR INDICATING THE MOVEMENTS TO BE EXECUTED BY MACHINE TOOLS

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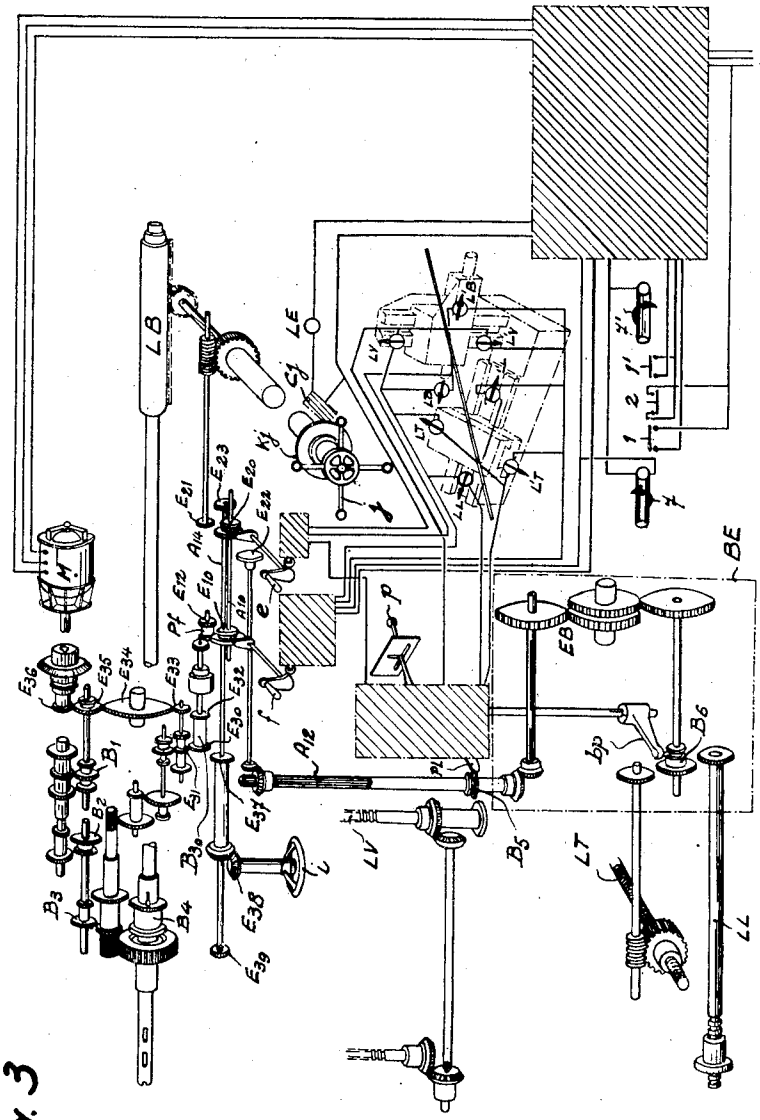

Fig. 3

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DEVICE FOR INDICATING THE MOVEMENTS TO BE EXECUTED BY MACHINE TOOLS

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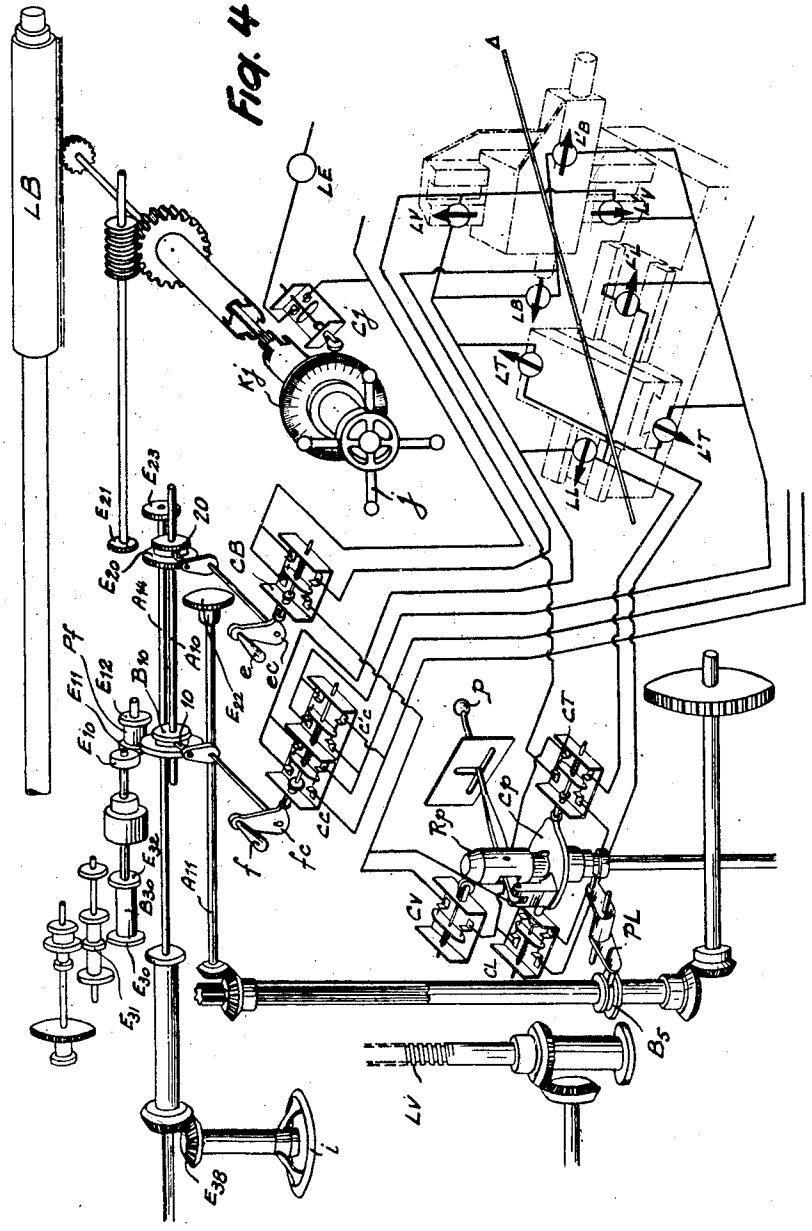
Fig. 4



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DEVICE FOR INDICATING THE MOVEMENTS TO BE EXECUTED BY MACHINE TOOLS

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9 Sheets-Sheet 5

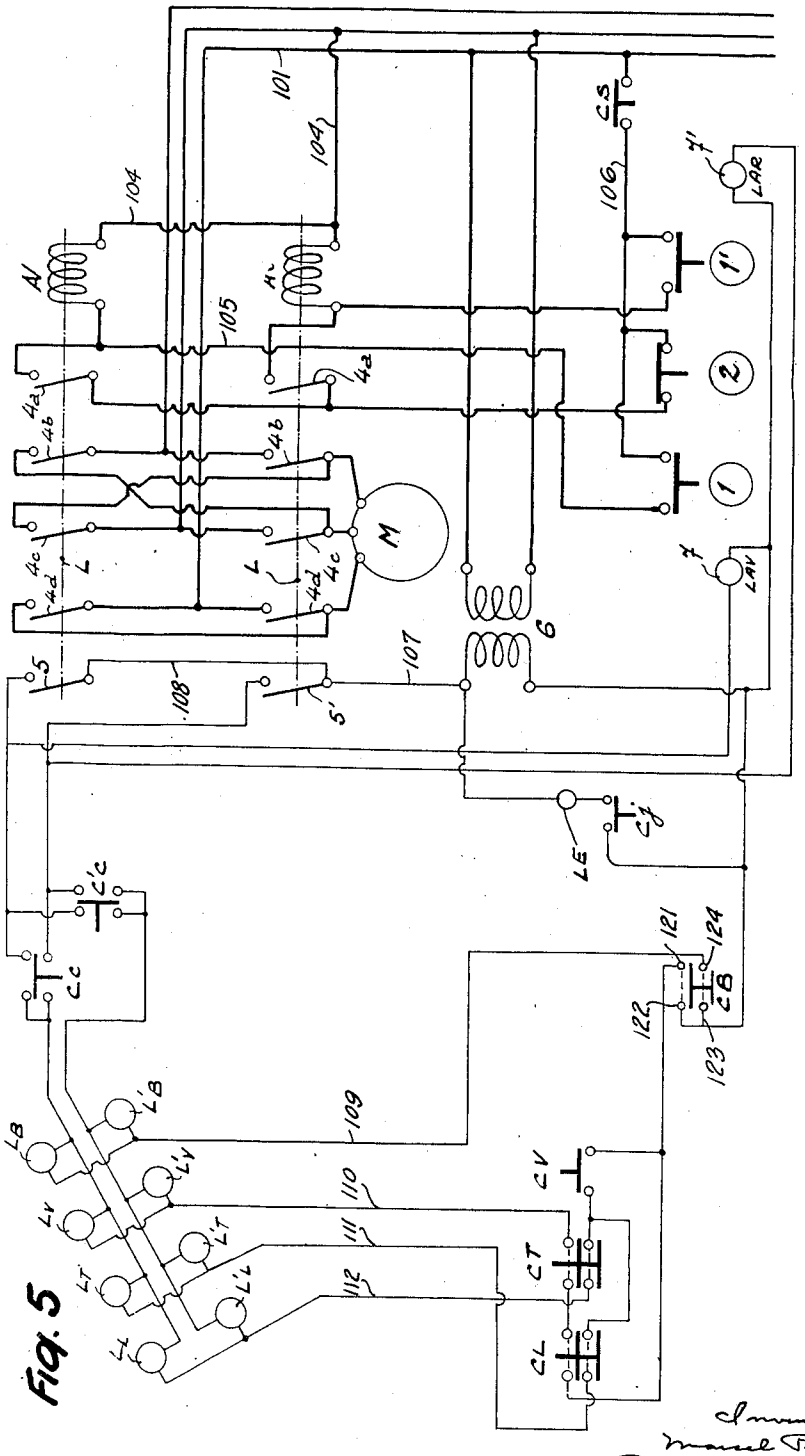

Fig. 5

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DEVICE FOR INDICATING THE MOVEMENTS TO BE EXECUTED BY MACHINE TOOLS

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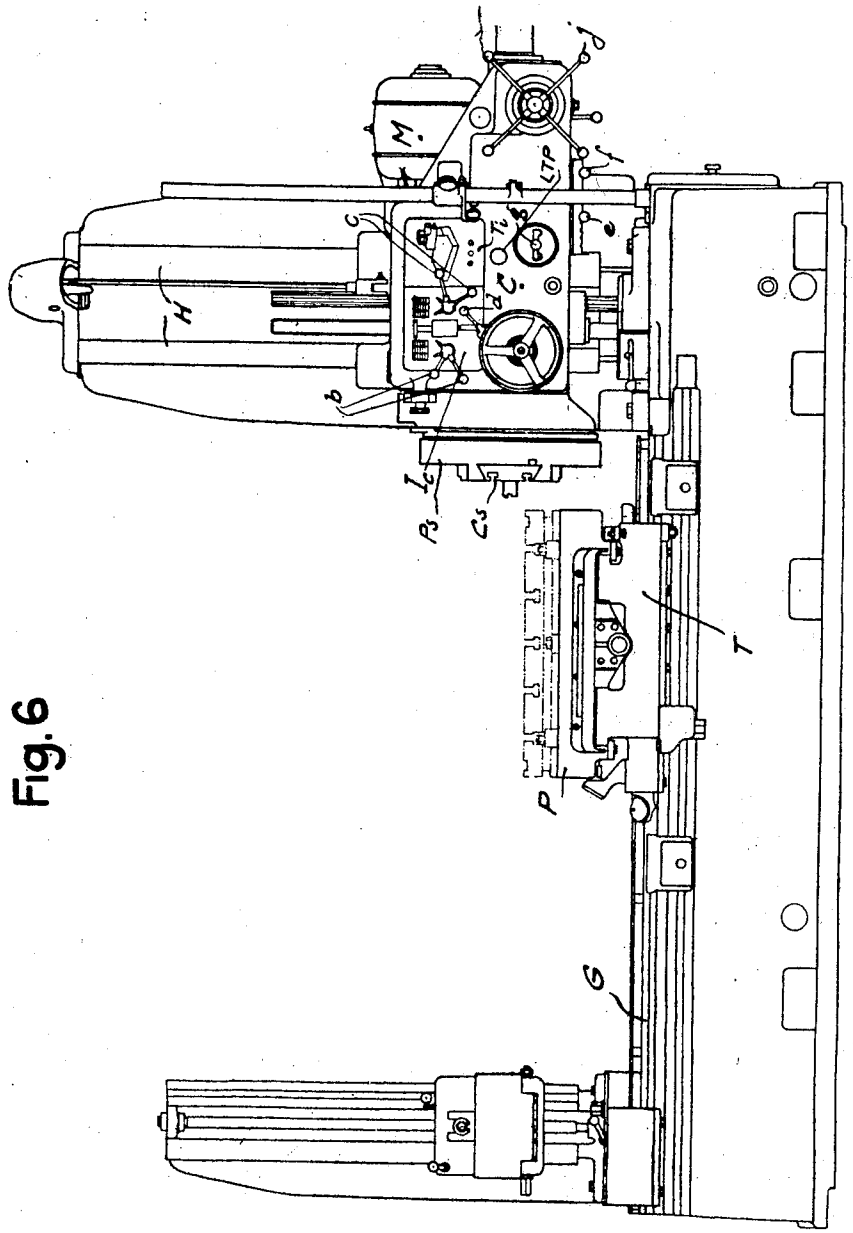

Fig. 6

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DEVICE FOR INDICATING THE MOVEMENTS TO BE EXECUTED BY MACHINE TOOLS

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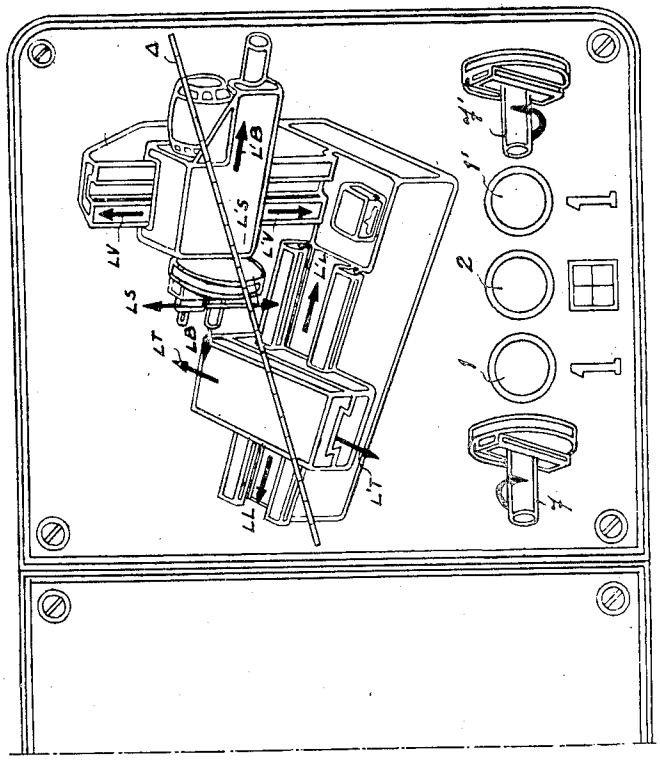
Fig. 7



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DEVICE FOR INDICATING THE MOVEMENTS TO BE EXECUTED BY MACHINE TOOLS

Filed Dec. 6, 1945

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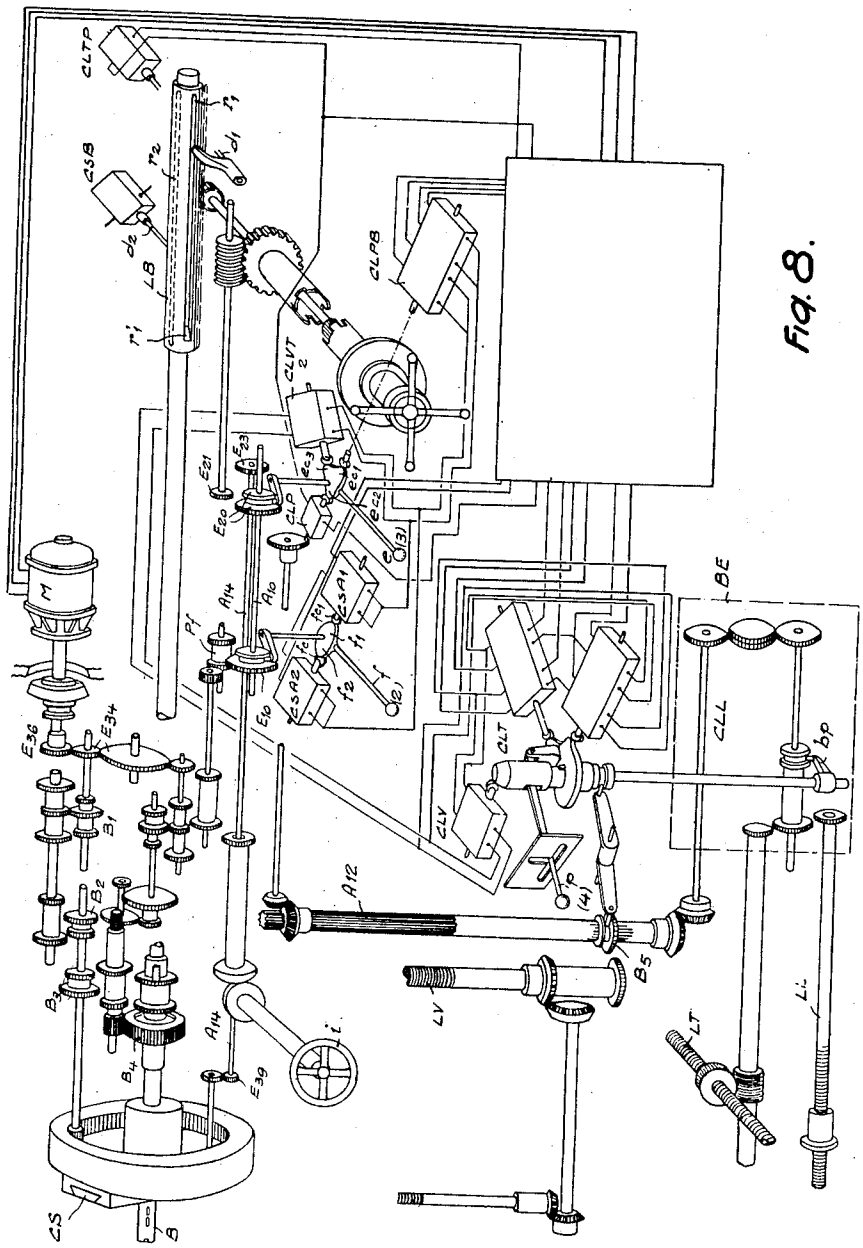

Fig. 8.

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DEVICE FOR INDICATING THE MOVEMENTS TO BE EXECUTED BY MACHINE TOOLS

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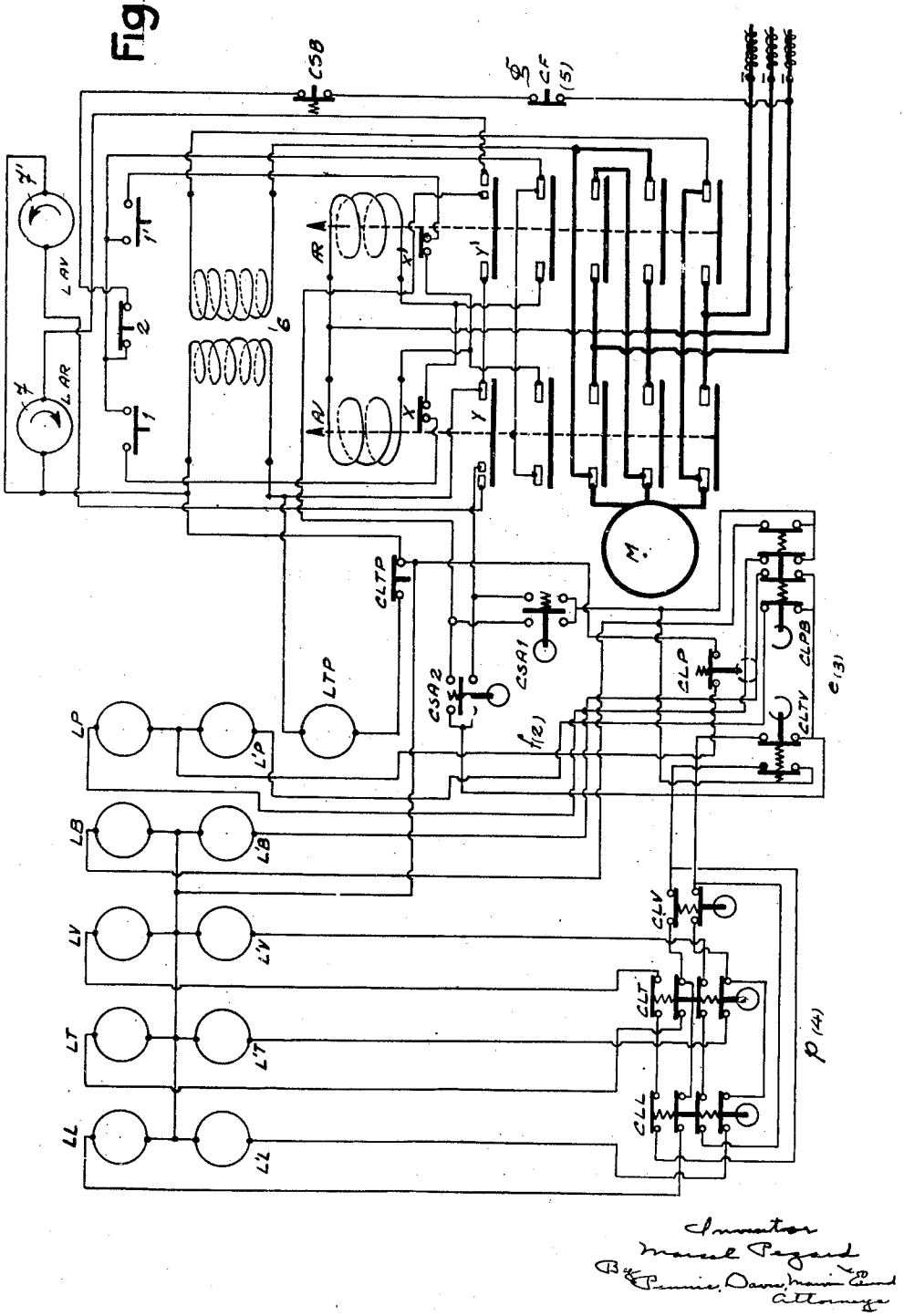
Fig. 9



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Patented Nov. 15, 1949

2,488,324

UNITED STATES PATENT OFFICE

2,488,324

DEVICE FOR INDICATING THE MOVEMENTS TO BE EXECUTED BY MACHINE TOOLS

Marcel Pégard, Paris, France

Application December 6, 1945, Serial No. 633,183
In France January 24, 1942

Section 1, Public Law 690, August 8, 1946
Patent expires January 24, 1962

9 Claims. (Cl. 177—311)

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In machine-tools, there exist a certain number of parts or groups of parts which are adapted to move either in one direction or in opposite directions for producing the required advance motions. For instance in a boring machine, the so-called straggler carriage may assume a horizontal displacement over the slideway of the frame; the plate intended to receive the work may assume a horizonal displacement perpendicular to the preceding movement with reference to the straggler; the spindle-carrying carriage may move vertically. The spindle may slide in parallelism with its own axis along this carriage.

These different movements are controlled by means of control levers or flywheels and are transmitted to the parts considered by suitable transmissions actuated by a supply of driving power.

It is very difficult for the operator of the machine to ascertain exactly the nature of the movements which should be executed at any moment according to the position given to the control parts at the moment considered. As a matter of fact, it is necessary to take into account not only these positions but also other data such for instance as the direction of rotation of the motor.

My invention has for its object to remove this difficulty and it covers to this end a luminous signalling device allowing the operator of the machine to ascertain at every moment the direction of the movements produced.

This device consists in principle in a board on which is drawn a diagram of the machine, for instance the boring machine; the parts capable of moving are shown on it and to each of them corresponds a transparent arrow giving out the directions of displacement. Behind said arrows are located electric bulbs, the illumination and extinction of which are determined by the movements of the control parts.

The boring machines, and generally the machine-tools to which the invention is applicable, are provided with a surfacing plate, i. e. with a circular plate carried concentrically with a tool such as a spindle and provided with a slide carrying a tool which slide assumes a radial movement with reference to the axis of the spindle so as to make the tool draw a spiral on the surface worked upon and rectify this surface.

According to my invention two special luminous arrows are adapted to give out the direction of displacement of the surfacing slide. Behind these arrows are placed corresponding lamps which are lit or extinguished at the required moment.

In the same case of machines with a surfacing

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plate, it is useful in order to avoid any faulty operation to provide a signal warning the operator that the slide and the spindle are both operative as it might occur that at the end of the stroke the tool carried by the slide may meet the spindle which would damage both parts. To this end I add to the indicating board, a lamp which has for its object to warn of any risk of meeting between the spindle and the slide on the plate. This lamp is lit under the action of a novel device comprising two longitudinal grooves provided on the sheath of the spindle and engaging projections adapted to actuate contacts when they reach one end of the corresponding groove. One of these contacts sends current into the last mentioned lamp for warning of the danger of meeting between the spindle and the slide on the plate. The other contact breaks the current feeding the motor if the limits of displacement of the spindle in one direction or the other are reached.

Beyond this general principle, the invention shows different features which will appear from the following description of two examples of execution applied to a boring machine.

In accompanying drawings:

Fig. 1 is an elevational view of the boring machine.

Fig. 2 shows on a larger scale the indicating board.

Fig. 3 is a general diagram showing together the mechanical control means and the electric connections, the hatched rectangles corresponding to series of contacts and relays shown in detail in Figs. 4 and 5.

Fig. 4 is a view on a larger scale of the central portion of the diagram of Fig. 3.

Fig. 5 shows separately the diagram of the electric connections.

Fig. 6 shows a modification corresponding to the case of machine provided with a surfacing plate.

Fig. 7 shows the indicating board in said modification.

Fig. 8 a corresponding general diagrammatic view showing the connection of the electric parts with the mechanical parts.

Fig. 9 is a simplified wiring diagram.

Referring to Fig. 1, T designates the straggler adapted to move horizontally over the slideways G of the frame and P the work-carrying table adapted to assume a horizontal movement perpendicular to that of the straggler.

The tool is placed in the spindle holder B carried by the spindle-holder carriage C adapted

to assume a vertical movement along the slideways H.

The indicating board Ti forming the object of the invention is mounted on the spindle-holder carriage C. Next to it lies an indictor Ic controlling the cutting speeds.

At M is located the electric motor actuating the tool, said motor serving also for actuating the different mechanical parts.

b designates the change speed levers of the spindle; in the drawing are shown two levers actuating several sliding gears B_1, B_2, B_3, B_4 (Fig. 4) providing the various possible speeds of the spindle.

c (Fig. 1) designates the levers for adjusting the advance motions, i. e. those which provide for modifications in the magnitude of any one of the advance motions.

d is the change speed and advance motion lever; it allows reducing the speed of the spindle and increasing the advance motion and conversely, increasing the speed of the spindle and decreasing the advance motion.

e (Figs. 1, 3 and 4) is the lever for selecting the advance motion; according to its position, either the spindle holder B is displaced by means of the rack LB (Fig. 3) or else the box BE is started by means of the rod A_{12} or again if required the slide of the surfacing plate is displaced by means of the gear E_{39}.

The selection of the longitudinal displacement movement of the straggler, of the transversal motion of the table and of the vertical motion of the spindle holder carriage is performed by means of the gear wheels contained in the box BE (Fig. 3) arranged on the bench. The control is obtained by means of a single part A_{12} passing out of the spindle-holder carriage.

f (Figs. 1, 3 and 4) designates the advance-reversing lever which through its transmission P*f* may reverse the direction of movement of all the worms and consequently of the advances.

g (Fig. 1) is the selecting lever for the advances, which allows obtaining slow or rapid advances or hand operated advances.

j (Figs. 1 and 3) designates the cross bar for engaging and operating the spindle, i. e. engages the latter directly and controls the hand operated advance.

p (Figs. 1, 3 and 4) is the selecting device for the parts to be displaced. It acts on the part contained in the box BE. If it is raised, it lowers through the agency of the lever PL a sliding gear B_5 (Fig. 3), which actuates the worm LV. If it is horizontally displaced, it drives through an arm *bp* a sliding gear B_6 which actuates the worm LL for the longitudinal displacement of the straggler or the worm LT for the transversal displacement of the table.

Referring to the detailed view showing the indicating board (Fig. 2) it is apparent that on its front side, is drawn a sketch illustrating diagrammatically the machine. The principal elements given out hereinabove appear in said sketch. To each movable part correspond two transparent arrows LB, L'B—LT, L'T—LV, L'V having opposite directions. A diagonal line Δ subdivides the diagram into two parts; the arrows above this line give out the movements which set the parts further from the operator and the arrow underneath the movements nearing them.

At the lower part of the board are located three knobs **1**, **1'** and **2**; the two former serve for controlling the passage of current into the motor for making it rotate in either direction; the two

arrows **7** and **7'** show through their illumination the direction of operation. The third knob **2** controls the stopping.

The knobs **1** and **1'** when they are depressed close the circuit of the relays shown at AV and AR in the diagram of Fig. 5; when one of these relays receives current, its armature illustrated diagrammatically by the dot and dash line L displaces the row of usual movable corresponding contacts **4***a*, **4***b*, **4***c*, and **4***d* which close different circuits as will be seen hereinafter. It closes also a complementary contact **5** or **5'** arranged in the circuit of a transformer **6** feeding the indicating lamps **7** or **7'**.

The general diagrams of Fig. 3 and Fig. 4 show how the levers described hereinabove act on the electric circuit producing the illumination of the lamps of the indicating board; they show also the kinematic connection between said levers, the power supply and the parts controlled through their agency.

The lever *e* shows a part *ec* (Fig. 4) forming a cam acting on a depressable element of a contact CB inserted in the circuit of the lamps LB, L'B corresponding to the spindle.

The lever *f* acts in a similar manner through a cam *fc* (Fig. 4) on the contacts Cc and C'*c*, one of said contacts being adapted to be opened and the other closed according to the desired series of displacements.

The lever *g* (see Fig. 1) may be brought into three different positions through horizontal displacements thereof. In each of said positions, if it is lowered vertically, it switches the current off the motor by acting on the contact CS (Fig. 5).

The lever *p* which may assume a double movement, as appears clearly in the general diagram, produces the following effects: When this lever is at its dead point, all the kinds of movements which are signalled on one side of the diagonal are possible and all the arrows are illuminated. But if this lever has been placed in a selection position only the corresponding arrow remains illuminated.

When this lever *p* receives an elevational movement, it acts through a slope R*p* and a roller (Fig. 4) on a contact CV. If a horizontal movement is imparted to it, it acts through a cam C*p* on the contacts CL, and CT. The location of these contacts in the electric circuits appears more clearly in Fig. 5.

The control system *j* (Figs. 3 and 4) acts through a cam K*j* on a contact C*j* controlling the lamp LE.

The operation is as follows;

The first step consists in acting on either of the knob **1** or **1'**, which sends current into one of the relays AV or AR. The latter closes its contacts, consequently the motor M is started in either direction according to the knob actuated. For example, if the knob **1** is acted upon the circuit of relay AV is established from the input lead **102** through wire **104**, winding AV, wire **105**, the switch controlled by knob **1**, wire **106**, closed switch CS and line wire **101**.

At the same time, the transformer **6** receives current and it feeds either of the two lamps LAV or LAR of the corresponding arrows **7** or **7'**. The illuminated arrow indicates the direction of rotation of the motor.

The second step consists in placing the lever *f* in a position corresponding to the direction of the desired displacement of the part which is to assume a movement, which part may be the car-

riage, spindle or the like. According to the position given to this lever *f* all the lamps LL, LT, LV, LB (Fig. 5) or all the lamps L'L, L'T, L'V, L'B are illuminated i. e. all the lamps above the diagonal or all those underneath. For instance, if by the action of lever *f*, switch Cc has been closed, the current will flow from transformer 6 through wires 107, 108, contact 5, switch Cc, lamps LB, LV, LT, LL, wires 109, 110, 111, 112, closed switches CB, CV, CL, CT.

At the same time, the lever *f* has by its adjustment and through means of the projection 10 (Fig. 4) caused the sliding gear B_{10} to mesh either with the pinion E_{10} mounted directly on the shaft passing out of the box controlling the variations in the magnitude of the advance motion or with the pinion E_{12} which actuates E_{10} through the agency of E_{11} so as to produce a reversal of motion. Therefore, according to the position of the sliding gear B_{10}, the shaft A_{10} rotates in the corresponding direction and this shaft will control one of the parts to be displaced.

The operator settles then the part to be displaced, a carriage (one of the three carriages of the diagram) or spindle or plate if the machine comprises such a part and he displaces consequently the lever *e* (third operation) for bringing it in front of the required indication carried by an indicating plate arranged in front of said lever.

Said lever *e* as it acts on the contact piece CB provides for the illumination of the lamp LB or L'B corresponding to either direction of operation of the spindle B when the lever considered is called to act on said spindle or else, when it acts on one of the three other members of the machine considered, such as one of the three carriages, said lever *e* provides for the illumination of either of the lamps LL, or L'L, LT or L'T, LV or L'V corresponding to the direction of displacement of the part considered.

Through the finger 20, it displaces the sliding gear E_{20} mounted on the shaft A_{10} which actuates one of the following gearwheels: E_{21} which drives the spindle through the rack LB by means of the clutch of the cross-bar K*j* or E_{22} which drives the group of carriages through the agency of the shafts A_{11} and A_{12} and the gears EB contained in the box BE for selection in the frame, or else the pinion E_{23} which drives through the shaft A_{14} the slide of the plate.

The fourth operative step is subdivided into two according as to whether it is desired to produce the displacement of the spindle or that of the carriages. If the spindle is to receive the movement, the cross-bar K*j* is engaged so as to produce the closing of switch C*j* and the illumination of the lamp LE. In this case lever E will have been operated so as to act upon switch CB breaking contact between contact members 121 and 122 thereby cutting off previously lighted lamps LL, LT, LV (L'L, L'T, L'V) which are thus extinguished, and establishing contact between contact members 123 and 124 thereby allowing current to continue to pass through lamp LB (L'B) and thereby allowing this lamp to remain lighted. In the case of a carriage, the operator should then act on the lever *p*. As the vertical movement of the lever actuates the spindle holder carriage as described hereinabove, it is necessary to give the lever *p* a horizontal displacement to one side or another. This movement extinguishes two luminous arrows as shown with reference to Figs. 4 and 5. There remains only one arrow of the series LL, LT, LV (L'L, L'T, L'V), illuminated which corresponds to the part to be displaced, straggler or carriage. In this case, lever E will have been so actuated as to break the connection between contact members 123 and 124, thus extinguishing lamp LB (L'B), and to close the contact members 121 and 122.

There remains only to be determined the nature of the advances i. e. advance by hand, slow or rapid advance.

To this end, the operator actuates the lever *g* (fifth step) (Fig. 1) for driving the double sliding gear B_{30} (Figs. 3 and 4).

If the sliding gear is displaced towards the left (Fig. 3) so as to engage the pinion E_{30} with the pinion E_{31} the advance is controlled by the slow speed motor through the agency of the pinions E_{36}, E_{35}, E_{34}, E_{33}, E_{31}, E_{30}.

If it is displaced towards the right for engaging the pinion E_{32} with E_{33}, one obtains the rapid advance controlled by the motor through E_{36}, E_{35}, E_{34}, E_{33}, E_{32}.

Lastly if it is displaced toward the left so as to make E_{30} mesh with E_{37}, one obtains a hand operated advance. The latter is produced by means of the hand wheel *i* acting on E_{37} through the agency of the bevel pinions E_{38}.

From the above disclosure, it is apparent that any movement of a control lever has not only for result a mechanical control, but also at the same time, as action on the electric circuits in which are inserted the signalling lamps whereby at each moment the latter give out the selection which has been performed. The indicating board T*i* shows the results already obtained by the operation executed and also the operations which remain possible.

In the case illustrated in Fig. 6, the machine is supposed to be provided with a surfacing plate PS comprising a slide CS.

Referring to Fig. 7 illustrating the corresponding luminous indicating board, it is apparent that the latter comprises the same arrangement as in the preceding form of execution with the addition of two further arrows LS and L'S arranged on either side of the diagonal line δ and indicating the direction of displacement of the surfacing slide.

These arrows LS, L'S are illuminated through two lamps LP and L'P which are illustrated in the wiring diagram (Fig. 9), which is similar to that of the preceding case. These lamps are controlled by two switches CLP and CLPB actuated in their turn by the lever *e* borne by the carriage C for selecting the advance motion (third operative step).

The lever *e* has been modified as shown in Fig. 8 for controlling the two above supplementary lamps. It may assume four positions. Three of these positions are the same as in the preceding case i. e. one of them corresponds to the displacement of the tool carrying spindle B by means of the rack LB, (Fig. 8) while the second produces the movement of the box BE through the rod A_{12} and the third is that which produces the displacement of the surfacing slide by means of the gearwheel E_{39}. The fourth position corresponds to the simultaneous operation of the spindle and of the slide which is obtained by simultaneously engaging the sliding gear E_{20} with the pinion E_{21} controlling the spindle and with the pinion E_{23} controlling the shaft A_{14} and the gearwheel E_{39}.

In Fig. 8, it is apparent that the lever *e* in its different positions acts on different contacts. It carries on its pivotal axis a sort of plate pro-

vided at its periphery with bosses adapted to act on thrust members controlling the contacts. One of these bosses ec^1 acts first on the thrust member of a contact CLPB which, when the lever *e* occupies the position for which the spindle B moves, establishes a circuit lighting the lamp LB or the lamp L'B. By pushing further this lever *e* until it enters the position in which it controls simultaneously the progression of the spindle and the progression of the plate to be surfaced, a boss ec^2 acts on the contact CLP and closes it, the boss ec^1 continuing to hold the contact CLPB closed. The contacts CLPB, CLP and CLTP of Fig. 9 being closed, the lamp LB or L'B is lit at the same time as LP or L'P which reveals the simultaneous progression of the spindle and of the plate.

Another boss ec^3 acts on the thrust member controlling a contact CLVT inserted in the circuit of the lamps LL, L'L, LT, L'T, LV, L'V, which give out respectively the movement of the straggler, of the table or of the vertically moving carriage.

Lastly the boss ec^3 may act only on the contact CLP inserted in the circuit of the lamps LP and L'P indicating the progression of the plate alone when the latter is operative, without the spindle being caused to advance.

The lever *f* for reversing the advances (second operative step) is provided with two bosses f^1f^2 by means of which it acts on the contacts CSA^1 or CSA^2 which lights the lamps above the diagonal or the lamps underneath same.

The lever *p* which is the lever for selecting the parts to be displaced whether straggler, table or carriage (fourth operative step) is manipulated as in the case of Figs. 1 to 5. When it is at its dead point, I may obtain the longitudinal movement of the straggler, the transversal movement of the table or the vertical movement of the carriage. In this position, all the corresponding arrows are illuminated, but if it is placed in a selecting position, only the corresponding arrow remains illuminated. The contact on which it acts when raised is shown at CLV (Figs. 8 and 9). When it is displaced horizontally, it acts on the contacts CLL and CLT (Figs. 8 and 9).

The lamp LE of the preceding case is omitted. But a lamp LTP is added (Fig. 8) in the case of machines with a surfacing plate. This lamp which is of a very apparent colour, for instance red, is illuminated when the slide of the surfacing plate is actuated and the spindle is sufficiently out for it to be possible for the spindle to contact with the slide, which it is necessary to avoid.

The illumination of the lamp LTP is produced in the following manner; the sheath of the spindle shows two grooves *r1* *r2* inside which are engaged projections *d1* *d2*. The groove *r1* is provided at one end with a sloping guideway *r'1*.

When the spindle is pushed back home, the projection *d1* is urged back by the sloping guideway *r'1* of the groove so as to actuate a contact CLTP; in this position, the lamp LTP is not lit. If the spindle advances sufficiently for there to be a risk of meeting the slide, the projection *d1* engages the groove *r1* and actuates the contact CLTP which illuminates the lamp LTP.

The other groove *r2* is not open at its ends; when the projection *d2* reaches either of its ends during an exaggerated displacement of the spindle, this projection actuates the contact CSB which opens the circuit of the motor (Fig. 9).

The lever *g* (fifth operative step) which determines the nature of the advances may as before cut the current of the motor in each of its positions by acting on a contact CF which is shown in Fig. 9.

The operation of the system thus modified is as follows:

The first operation consists in acting on one of the knobs *l* or *l'* (Fig. 9) which starts the motor in either direction as in the preceding case: the corresponding lamp LAV or LAR is lit.

The second operative step consists in operating the lever *f* the position of which determines the direction of the movements of the part to be displaced. This lever acts on the contacts CSA*l* or CSA*2* and lights the lamps LL, LT, LV, or LB, LP or else the lamps L'L, L'T, L'V, or L'B, L'P, according to the position of the lever *e*.

I actuate then the lever *e* for selecting the advances (third operative step) which, as described herein above may assume four positions according as to whether I wish to displace the spindle B or else one of the three parts controlled by the mechanism of the box BE i. e. straggler T, or table P or vertical carriage C or else the spindle alone or the slide of the surfacing plate or lastly together both the spindle and the slide of the plate.

This lever acts on the contacts CLP, CLVT and CLPB; there remains only then as lighted lamps one of the lamps LB, L'B or else the two lamps LB and LP or L'B, L'P or else the three lamps LL, LT, LV or L'L, L'T, L'V.

The fourth lever, i. e. the selection lever *p* carried by the frame acts on the contacts CLL; CLT, CLV, and leaves as the only lit lamp that corresponding to the straggler T or to the table P or to the carriage C.

It will be noticed on the diagram of Fig. 9 that when the lever *e* (third lever) is in the position required for the movement of the plate alone, and the spindle is out without advancing, the contact CLPB is open while CLP and CLTV are closed; the lamp of the plate LP or L'P is lit together with the safety lamp LTP because there cannot be any meeting between the slide and the spindle when out.

If, on the contrary, the spindle is withdrawn, the contact CLTP is open and the lamp LTP is extinguished.

As apparent from the preceding, all the possible operations of the parts are signalled at each moment and the supplementary safety lamp warns the operator of the risk of the slide tool meeting the spindle.

Although the invention has been described with reference to a boring machine, it should be well understood that it is applicable in a general manner to all machine-tools.

What I claim is:

1. In a machine tool of the type described, a luminous board carried by the machine itself and carrying a diagrammatic illustration of the machine, arrows located on the board near the illustration of the movable members of the machine, means for selecting the members of the machine to be operated and for illuminating said arrows, means for operating said members, an electric motor, an electric circuit for controlling the operation of said motor, two control knobs adapted to act on said electric circuit for starting the motor in either direction, two of the arrows on the board corresponding to the two possible directions of operation of the motor and means for illuminating said last-mentioned arrows selectively according to the circuit controlling knob that is actuated, and a control part for operatively connecting said electric motor to said

means for operating said members after said motor has been started and after said members have been selected for operation by said selecting means.

2. In a machine tool of the type described, a luminous board carried by the machine itself and carrying a diagrammatic illustration of the machine, arrows located on the board near the illustration of the movable members of the machine, means for selecting the members of the machine to be operated and for illuminating said arrows, means for operating said members, an electric motor, an electric circuit for controlling the operation of said motor, two control knobs adapted to act on said electric circuit for starting the motor in either direction, two of the arrows on the board corresponding to the two possible directions of operation of the motor, a relay for each control knob including a contact, illuminating means for said last-mentioned arrows, an electric circuit for controlling said last-mentioned means, means whereby each relay contact is adapted to connect said last-mentioned circuit with the corresponding arrow illuminating means, and a control part for operatively connecting said electric motor to said means for operating said members after said motor has been started and after said members have been selected for operation by said selecting means.

3. In a machine tool of the type described, a luminous board carried by the machine itself and carrying a diagrammatic illustration of the machine, arrows located on the board near the illustration of the movable members of the machine, means for illuminating said arrows, selecting levers for selecting a movable member which it is desired to operate, means for operating said member after it has been so selected, means controlled by said levers for actuating the means illuminating the arrows corresponding to the selected member, and a control part for rendering effective the means for operating said selected member after the selecting levers have been operated to select said member and after said levers have operated the means for actuating the illuminating means.

4. In a machine tool of the type described, a luminous board carried by the machine itself and carrying a diagrammatic illustration of the machine, arrows located on the board near the illustration of the movable members of the machine, means for illuminating said arrows, selecting levers for mechanically selecting a movable member which it is desired to operate, means for operating said member after it has been so selected, means controlled by said levers for actuating the means illuminating the arrows corresponding to the selected member, and a control part for rendering effective the means for operating said selected member after the selecting levers have been operated to select said member, and after said levers have operated the means for actuating the illuminating means.

5. In a machine tool of the type described, a luminous board carried by the machine itself and carrying a diagrammatic illustration of the machine, arrows located on the board near the illustration of the movable members of the machine, means for illuminating said arrows, selecting levers for mechanically selecting a movable member which it is desired to operate, means for operating said member after it has been so selected, electric switches controlled by said levers for actuating the means illuminating the arrows corresponding to the selected member, and a control part for rendering effective the means for operating said selected member after the selecting levers have been operated to select said member and after said levers have operated the electric switches for actuating the illuminating means.

6. In a machine tool of the type described, a luminous board carried by the machine itself and carrying a diagrammatic illustration of the machine, arrows located on the board near the illustration of the movable members of the machine, means for illuminating said arrows, selecting levers for mechanically selecting a movable member which it is desired to operate, means for operating said member after it has been so selected, cams carried by said levers, electric switches controlled by said cams for actuating the means illuminating the arrows corresponding to the selected member, and a control part for rendering effective the means for operating said selected member after the selecting levers have been operated to select said member and after said levers have through their cams operated said electric switches to actuate the illuminating means.

7. In a machine tool of the type described, the combination of a frame, an upright on said frame, a tool-carrying carriage adapted to move vertically along said upright, control levers carried by said carriage for determining which members of said machine are to be operated, and the direction of operation, means for operating said members, a board illustrating diagrammatically the various members of the machine, transparent arrows located near the illustration of the different movable members of the machine, means for the selective illumination of said arrows, means whereby movement of the control levers controls the illuminating means, and a control part for rendering effective the means for operating the members of the machine after the control levers have been moved to determine which of said members are to be operated.

8. In a machine tool of the type described, the combination of a frame, an upright on said frame, a tool-carrying carriage adapted to move vertically along said upright, control levers carried by said carriage for determining which members of said machine are to be operated and the direction of movement of said members in such operation, a board illustrating diagrammatically the various members of the machine, transparent arrows located near the illustration of the different movable members of the machine, a line substantially dividing the board into two portions and separating the arrows into two groups corresponding respectively to the movements of said members in either direction, means for the selective illumination of said arrows, means whereby movement of the control levers controls the illuminating means, and a control part for rendering effective the means for operating the members of the machine after the control levers have been moved to determine which of said members are to be operated.

9. In a machine tool of the type described, the combination of a frame, an upright on said frame, a tool-carrying carriage adapted to move vertically along said upright, control levers carried by said carriage for determining which members of said machine are to be operated and the direction of operation, a board illustrating diagrammatically the various members of the machine, transparent arrows located near the illustration of the different movable members of the machine, means for the selective illumination of said ar-

rows, electric circuits connected to the arrow-illuminating means and including electric contacts for opening and closing said circuits, cams carried by the control levers for controlling said contacts to open and close said circuits, whereby the movement of the control levers controls the operation of said illuminating means, and a control part for rendering effective the means for operating the members of the machine after the control levers have been moved to determine which of said members are to be operated.

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