May 25, 1937. R. E. CONOVER 2,081,738

SIZING DEVICE

Filed June 28, 1933 2 Sheets-Sheet 1

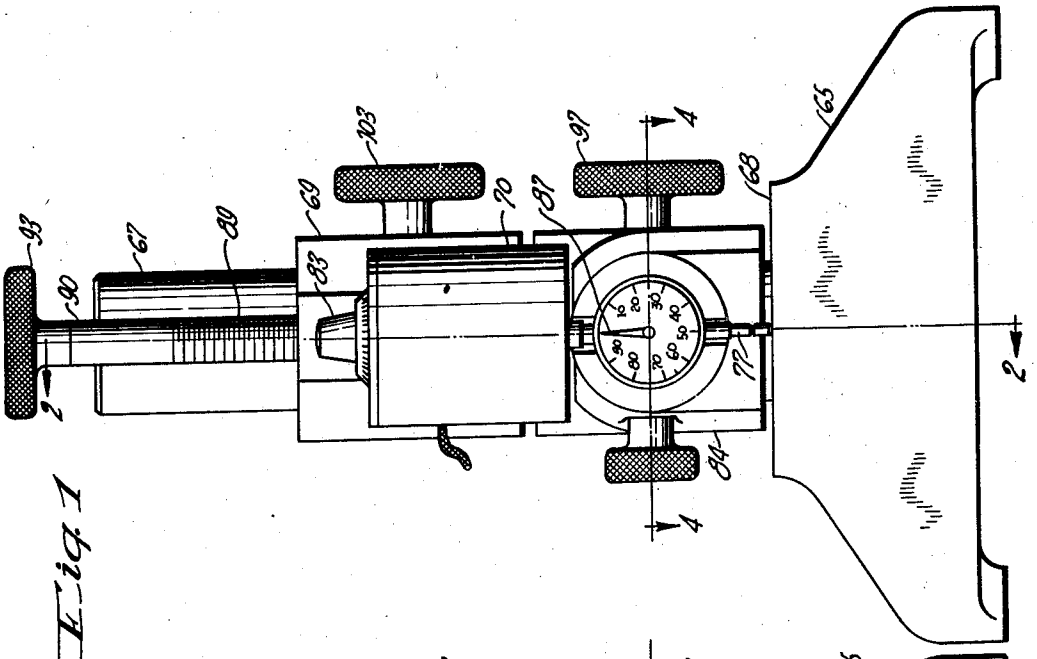

Fig. 1

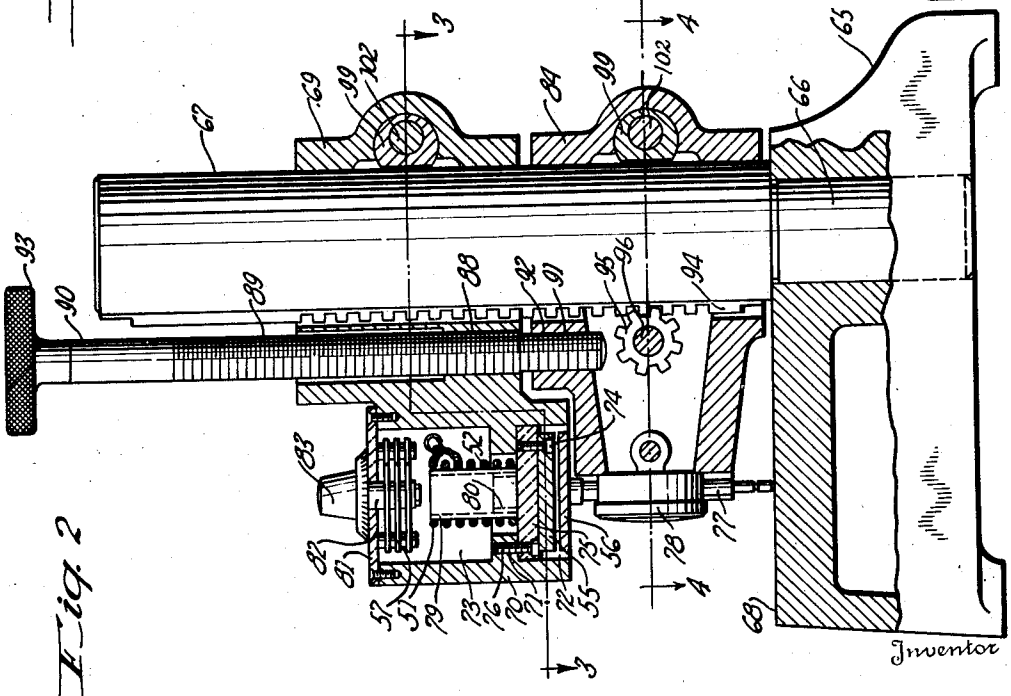

Fig. 2

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May 25, 1937. R. E. CONOVER 2,081,738

SIZING DEVICE

Filed June 28, 1933 2 Sheets-Sheet 2

Fig. 7

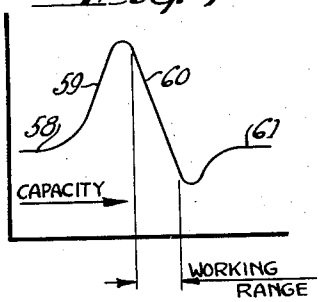

Fig. 3

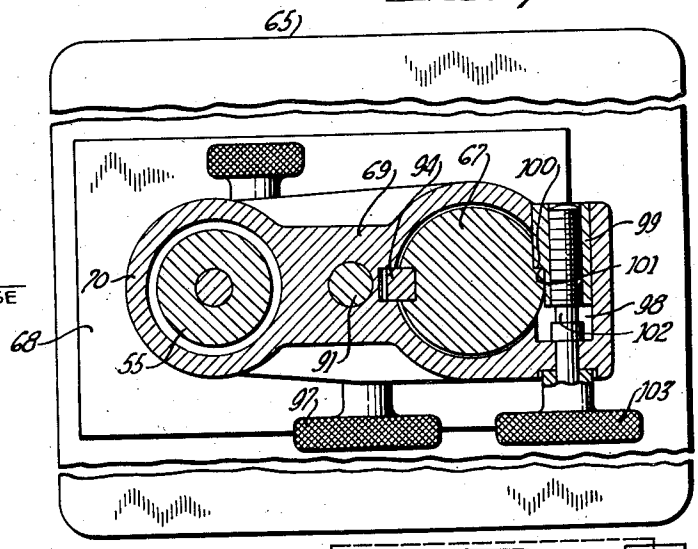

Fig. 5

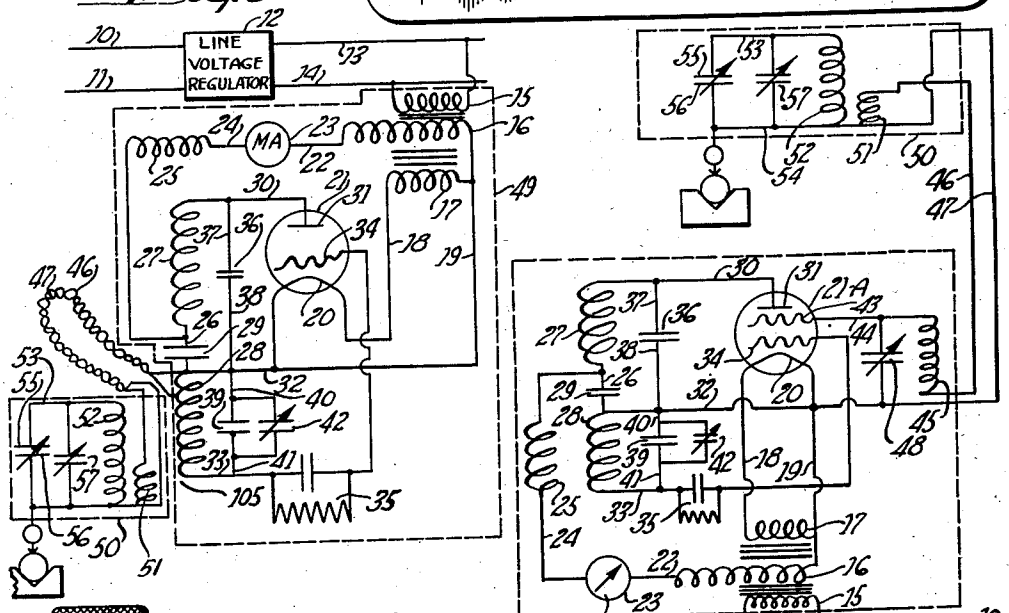

Fig. 4

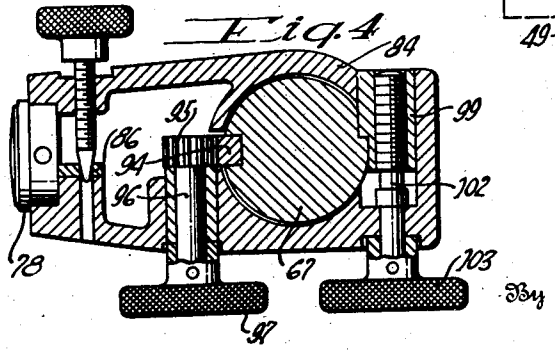

Fig. 6

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UNITED STATES PATENT OFFICE

2,081,738

SIZING DEVICE

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Application June 28, 1933, Serial No. 678,053

6 Claims. (Cl. 177—351)

This invention relates to improvements in sizing devices or sizing mechanisms.

An object of this invention is the provision of a sizing device employing high frequency radio circuits for indicating the size of work pieces.

Another object of this invention is the provision of a sizing device as above referred to for indicating variations in flow of electrical current which is indicative of the size of the work and which sizing is under the control and operation of but a single vacuum tube instead of a plurality of them as has been the past custom.

A further object of the invention is the provision of an electrical device of the above indicated type, that is capable of ready adjustment to adapt it for use with different sizes of work pieces.

Further objects and advantages of the present invention should be readily apparent by reference to the following specification, taken in conjunction with the accompanying drawings, and it is to be understood that any modifications may be made in the exact structural details there shown and described within the scope of the appended claims without departing from or exceeding the spirit of the invention.

In the drawings:

Figure 1 is a front elevation of a sizing device utilizable with this invention.

Figure 2 is a vertical sectional view taken on line 2—2 of Figure 1.

Figure 3 is a horizontal transverse sectional view taken on line 3—3 of Figure 2.

Figure 4 is a horizontal transverse sectional view taken on line 4—4 of Figures 1 and 2.

Figure 5 is a diagrammatic view illustrating the several electrical circuits involved in the invention.

Figure 6 is a view similar to Figure 5 showing a modification of the invention.

Figure 7 is a graph illustrating the electrical current flow through the mechanism.

Throughout the several views of the drawings similar reference characters are employed to denote the same or similar parts.

As was stated above, this invention utilizes electrical circuits through which flow electrical currents oscillating at high radio frequencies. The circuits are roughly divided into a driver or oscillating circuit and a tunable circuit for varying the amplitude of oscillation of the oscillating circuit, which tunable circuit is under the control of the work piece being gaged. The power for the tunable circuit and the oscillation of the oscillator circuit being controlled and effected by a single radio tube.

In operation suitable instrumentalities are chosen for the oscillator circuit to determine or establish the frequency of oscillation of the said circuit and a tunable circuit adjusted to the point where when a work piece is to a desired size the oscillator and tunable circuits are in substantial resonance.

Specifically and referring to Figure 5 there is illustrated the normal house current or supply indicated by reference numerals 10 and 11, which are the main line leads. Across the said leads or main line is a line voltage regulator 12 from which extend the electrical conduits or wires 13 and 14, having across them a definite voltage maintained by the regulator 12. In other words, the conduits 13 and 14 are at all times of the same voltage strength which is maintained by the voltage regulator 12. Connected with the said lines 13 and 14 is a power pack or transformer comprising a primary coil 15 and secondary coils 16 and 17. The secondary coil 17 is adapted to materially reduce the voltage and is utilized for lighting the cathode 20 of the tube 21 for which purpose it has extending from opposite ends thereof the electrical conduits or wires 18 and 19, connected at their other ends with the filament or cathode 20 of the radio tube 21.

The secondary 16 is employed for supplying the plate current for the tube 21 for which purpose it has extending therefrom at one end thereof the wire 22, terminating in a current flow indicating meter 23. From the other side of the meter 23 is a wire 24, including a radio frequency choke coil 25, which terminates in a wire 26 between inductances 27 and 28. In the wire 26 is a capacity or condenser 29 adapted to prevent the flow of high frequencies through the inductance 28. Extending from one end of the inductance 27 is a wire 30, terminating at its other end in the plate 31 of the tube 21. Extending from one end of the inductance 28 or from the wire 26 is a wire 32 that is connected with the cathode wire 19 from the secondary 17 of the power pack. This wire 19 also connects with one end of the secondary 16 of the said power pack. Extending from the other end of the inductance 28 is wire 33 which terminates in the grid 34 of the radio tube 21. Included in this wire 34 is the usual grid leak and grid leak condenser 35.

The inductance or coil 27 has connected in parallel therewith a condenser 36 as by having one side thereof connected by wire 37 with the

wire 30 and the other side thereof connected by wire 38 with the wire 32. Also the coil 28 has connected in parallel therewith a condenser 39 as by connecting one side thereof by a wire 40 with the wire 32 and connecting the other side by a wire 41 with the wire 33. Shunted across the wires 40 and 41 is a variable condenser 42 supplementing the condenser 39.

The plate circuit, as will be evident, includes the secondary 16, wire 22, meter 23, wires 24 and 26, choke 25, inductance or coil 27 in parallel with condenser 36, wire 30, plate 31, filament or cathode 20 and wire 19 back to the secondary 16. The grid circuit, as will also be evident, includes the wire 26, inductance or coil 28, in parallel with condensers 39 and 42, wire 33, grid leak and grid leak condenser 35, grid 34, cathode 20 and wire 32 back to the wire 26.

The system as thus far described is a fundamental tuned plate-tuned grid oscillator circuit. In such a system the oscillating power output is dependent on the closeness of tuning of both the plate and grid circuits with respect to each other. When the two circuits are in exact resonance the output is a maximum. In the circuit of Figure 5 the condenser 36 has a greater capacity than the total capacity of condensers 39 and 42 so that the circuit is purposely oscillating very weakly, thereby drawing very little plate current.

All the parts described up to this time, with the exception of the line voltage regulator 12, may be enclosed in a suitable container as indicated by the broken line 49 and constitute the gaging control mechanism. The container 49 may be set remote from the operator of the gage and is connected with the gage or the gage head thereof by feed lines or wires.

The gaging head is shown structurally in Figures 1, 2 and 3 and diagrammatically in Figures 5 and 6 (in the latter two views as enclosed within the dash line 50) and comprises a transformer composed of primary coil 51 and secondary coil 52. The primary coil 51 has its opposite ends connected by the feed line or wires 46 and 47 with a transformer 105 shown in Figure 5 as a part of the inductance or coil 28. The secondary coil 52 has extending therefrom the wires 53 and 54 terminating at their other ends in condenser plates 55 and 56. The condenser plates 55 and 56 constitute a variable condenser one of which plates is movable by the work to vary the capacity thereof and consequently the capacity of the circuit 53, 54 and 52. Shunted across the lines 53 and 54 is a small capacity variable condenser 57 of the vernier type for accurately and minutely adjusting the said circuit.

Feed line 46 and 47 is at a low voltage potential, the voltage being determined by the ratio of the number of turns of the transformer coil 105 to the number of turns in the coil 28 as a whole. The ratio of the number of turns in the coil 51 to the number of turns in the coil 52 in the gaging head is similar to the effective ratio between the coil 105 and the coil 28.

The measuring condenser plates 55 and 56 and associated shunt capacity 57 are in effect connected in parallel with the condensers 39 and 42 of the grid circuit through a series of two transformers, the first transformer including the coils 52 and 51 and the second transformer including the coils 105 and 28. This causes the change in the measuring capacity or condenser 55—56 to vary the flow in the circuit including condensers 39 and 42 and thus the oscillator output. The total capacity in the head circuit is therefore reflected back so as to effectively vary the capacity of the grid circuit.

Figure 7 illustrates a graph of the current flow through the meter 23 which is calibrated into work size and as there shown the line 58 illustrates the normal current flow when the condenser 55—56 is widely separated, that is, with circuit oscillating very weakly as above described. The line 59 illustrates the gradual increase in current flow as the condenser plates 55 and 56 are adjusted toward one another by the work, thereby more closely tuning the plate and grid circuits. The line 60 represents the decreased current flow caused by the further adjustment of the plates 55 and 56 toward one another and this current flow is had when the head circuit reflects back its greatest sensitivity. The line 61 represents the current flow after the plates 55 and 56 have been adjusted by the work beyond the point of adjusting the grid and plate circuits to resonance. Use is made of the straight portion of the line 60 between its connection with the line 59 and the line 62 for determining the size of the work. In other words that part of the line 60, indicated in Figure 7 as the working range, is the portion of the meter calibrated to indicate the size of the work being gaged, and this line represents the tolerance in size within which the work piece must fall.

The modified disclosure in Figure 6 is substantially identical with that in Figure 5 except that instead of using a radio tube having a single grid, a radio tube of the double grid type is employed. Therefore, disposed within the radio tube 21—A is a second grid 43 connected by a wire 44 with a transformer 45, in turn connected with one wire 46 of the feed line that extends to the gaging head. The second wire 47 of the feed line extends from the filament or cathode wire 19 in the same manner as above described in connection with Figure 5. The wire 44 between the second grid 43 and transformer 45 is connected through a variable capacity or condenser 48 with the feed wire 47 which co-operates with the transformer 45 for adjusting the head circuit. It will be appreciated that the transformer or coil 45 co-operates with the coil 28 to perform the same function as the coils 105 and 28 perform in the circuit of Figure 5.

The double screen tube 21—A may be used in the same manner in the circuit as illustrated in Figure 5, it being only necessary to electrically connect the two grids and then connect said two grids with the wire 33.

One practical application of the mechanism is illustrated structurally in Figures 1 to 4 inclusive, and as there shown, comprises a relatively heavy base 65 receiving the reduced end 66 of a column or standard 67. The base 65 is provided with a platform 68 on which the work is disposed while being gaged. The column 67 supports the gage head which is adjustable relative thereto, depending upon the size of the work to be operated upon.

The gage head comprises a casting 69 substantially encircling the post or column 67, having formed on its forward end a housing 70 enclosing the electrical control mechanism. Extending through the housing is a partition 71 which divides it into two chambers 72 and 73. The adjustable capacity or condenser 55—56 is enclosed within the chamber 72, having the upper plate 55

secured as by screws 74 to an insulating plate 75, in turn secured by screw 76 to the under surface of the housing partition 71. The lower plate 56 of the condenser is secured to a vertical shiftable plunger 77 of a mechanical gage 78, the purpose of which will be described in detail later. From the foregoing it should be noted that as the work is adjusted between the platform 68 and the end of the plunger 77, the plunger is raised or shifted for correspondingly shifting the plate 56 relative to the plate 55 and effecting the operation of the sizing device as above described.

The chamber 73 encloses the remaining parts of the gage head and has disposed therein a tube 79 or other support for the primary and secondary coils 51 and 52, the tube 79 being held in position by encircling a boss 80 projecting upwardly from the insulation plate 75. The upper end of the chamber 73 is closed by a cover plate 81 through which passes a rotary shaft 82 for the vernier condenser 57. The movable plate of this condenser is secured to the rotary shaft 82 while the fixed plates are attached to the cover plate 81 in any approved or accepted manner. In order to adjust the movable plate the rotor 82 projects through the cover plate 81 to receive knob 83 disposed exteriorly of the cover plate.

Below the gage head casting 69 is a casting 84 that encircles the post or column 67 in the same manner that the casting 69 is disposed relative thereto. The casting 84 at its outer end is provided with an opening through which projects the attaching tab or lug 86 of the mechanical gage 78 above referred to. This mechanical gage may be employed for the initial setting up of the parts as, for example, through the medium of a work piece of a known or standard size, utilizing the pointer 87 thereof for the purpose of determining the point of resonance between the plate and grid circuits utilizing simultaneously therewith the vernier condenser 57.

The castings 69 and 84 are adapted to be movable as a unit relative to the standard 67 as well as adjustable independently relative to one another. For this purpose the casting 69 is provided with a threaded bore 88 through which extends the large portion 89 of an adjusting screw 90. The threaded bore 88 is in axial alignment with a threaded bore 91 in the casting 84, receiving the smaller threaded end 92 of the screw 90. The threaded portions 88 and 92 of the screw are of different pitch, thereby effecting a micrometer adjusting mechanism for manually effecting the relative adjustment of the parts. This mechanism, in addition to positioning the castings 69 and 84 relative to one another, also vary the separation between the condenser plates 55 and 56 for effecting the proper range of movement thereof by the work. The screw 90 has secured to its upper end a knob 93 whereby it may be actuated.

In order to shift the castings 69 and 84 relative to the standard 67, the standard 67 has secured to its forward face a rack bar 94 meshing with a rack pinion 95 secured to or formed integral with the inner end of a shaft 96 rotatably journaled in the casting 84, as shown for example in Figure 4. The exterior end of the shaft 96 has pinned or otherwise secured to it a knob 97 whereby it may be actuated, and since the castings 69 and 84 are connected to one another by the screw 90 the said castings are simultaneously shifted with respect to the standard 67.

Each of the castings 69 and 84 is adapted to be independently clamped to the standard 67 by similar mechanism illustrated in Figures 3 and 4, and it is deemed sufficient if but one of the clamping mechanisms be described in detail. Accordingly the casting 69 is provided with a counterbore 98, receiving a clamp shoe 99 having formed thereon a shoulder 100 engaging a complementary shoulder 101 formed along the rear side of the standard 67. The clamp shoe 99 has a threaded bore for the clamping screw 102 rotatably but not axially journaled in the casting 69. The screw projects beyond one side of the casting to receive a knob 103 whereby it is actuated.

From the foregoing it will be noted that the improved engaging mechanism of this invention may be adjusted for different sizes of work and includes an adjustable gage head containing the tunable circuit and parts associated therewith. It will also be noted that means are provided for accurately adjusting the position of the main condenser plates of the work actuated condenser, as well as conveniently placing the vertical condenser for more accurately adjusting the said tunable circuit. It will further be noted that the gaging mechanism may be readily shifted from position to position by the inspector or operator since it can be connected by any length of feed line 46 and 47 with the main control mechanism that may be disposed remote therefrom.

It is believed that the operation of this device will be readily understood from the foregoing description.

What is claimed is:

1. A measuring head for use in connection with an electronic indicating circuit comprising a cylindrical casing, a transformer intermediately mounted within the casing and having one side thereof coupled to the electronic indicator, a pair of condenser units forming closures for the respective ends of the cylindrical casing, a shiftable plunger carried by the head in position operatively to react on one of said condensers, and a vernier adjusting device coupled with the other condenser, substantially as and for the purpose described.

2. A measuring head for use in connection with an electronic indicating circuit comprising a cylindrical casing, a transformer intermediately mounted within the casing and having one side thereof coupled to the electronic indicator, a pair of condenser units forming closures for the respective ends of the cylindrical casing, a shiftable plunger carried by the head in position operatively to react on one of said condensers, and a vernier adjusting device coupled with the other condenser, a support for said head, and means for shifting the head and associate parts as a unit with respect to the support whereby the same may be operatively associated with different thicknesses or diameters of work piece.

3. A measuring head for use in connection with an electronic indicating circuit comprising a cylindrical casing, a transformer intermediately mounted within the casing and having one side thereof coupled to the electronic indicator, a pair of condenser units forming closures for the respective ends of the cylindrical casing, a shiftable plunger carried by the head in position operatively to react on one of said condensers, a vernier adjusting device coupled with the other condenser, a support for said head, means for shifting the head and associate parts as a unit with respect to the support whereby the same may be operatively associated with different thicknesses or diameters of work piece, and additional means for shifting the work con-

tacting plunger mechanism with respect to its associated condenser.

4. A measuring head for use in connection with an electronic indicating circuit comprising a cylindrical casing, a transformer intermediately mounted within the casing and having one side thereof coupled to the electronic indicator, a pair of condenser units forming closures for the respective ends of the cylindrical casing, a shiftable plunger carried by the head in position operatively to react on one of said condensers, a vernier adjusting device coupled with the other condenser, a support for said head, means for shifting the head and associated parts as a unit with respect to the support whereby the same may be operatively associated with different thicknesses or diameters of work piece, and a dial and pointer mechanism operatively associated with the plunger for visually indicating the adjustment of the plunger with respect to the remainder of the measuring head.

5. A work engaging unit for employment in conjunction with an electronic measuring circuit including a support and a measuring head unit carried thereby and shiftable relative thereto, said unit including a hollow casing having a stud projecting thereinto, a transformer unit mounted on the stud, a work operable condenser coupled across one side of the transformer, work contacting means carried by the head in position to react on the condenser to an extent determined by the characteristic of the work piece being measured, a second condenser carried by the head and coupled in parallel with the first condenser, means for adjusting said second condenser to vary the characteristic of the transformer circuit, said condensers respectively forming upper and lower closures for the transformer receiving space in the central portion of the case.

6. A work engaging unit for utilization in connection with an electronic measuring circuit or the like, including a base, a support rising from the base, a member adjustable on the support projecting into over-lying relationship with the base, an indicator device including a shiftable plunger carried by the member for engagement with a work piece supported by the base, said plunger having an upwardly projecting portion, and an electronic circuit control mechanism carried by the support in superimposed relation to the plunger, said unit including a casing, means for effecting adjustment of the casing with and with respect to the indicator member, a lower condenser member carried by the unit and movable into operative relation with the projecting portion of the plunger by relative adjustment of the parts, said condenser member forming a closure for the lower portion of the unit, a transformer member coupled with the condenser and superimposed thereon within the unit, and an additional manually adjustable condenser member carried by and forming a closure for the upper portion of said unit substantially as and for the purpose described.

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