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DEVICES FOR THE NUMERICAL FIXING OF THE MEASURING FIGURE OF MEASURING INSTRUMENTS, PARTICULARLY OF PAIRS OF SCALES

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Serial No. 291,698

2 Sheets-Sheet 1

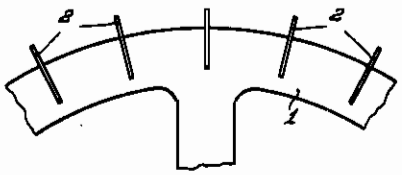


Fig. 1.

Fig. 2.

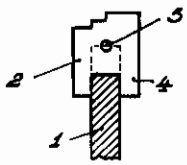


Fig. 3.

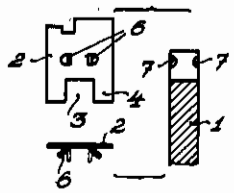


Fig. 4.

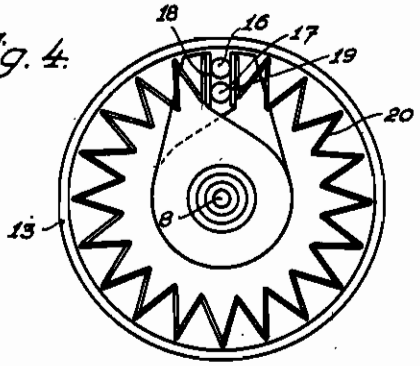


Fig. 5.

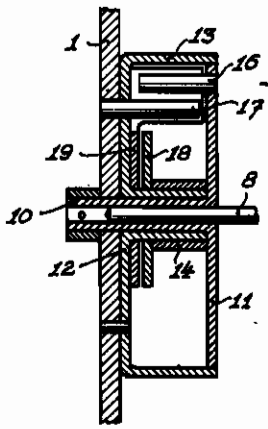


Fig. 6.

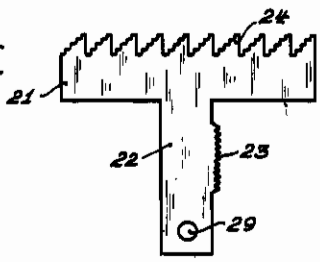


Fig. 7.

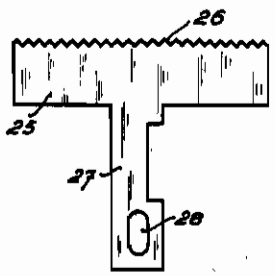


Fig. 8.

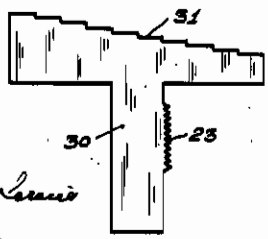
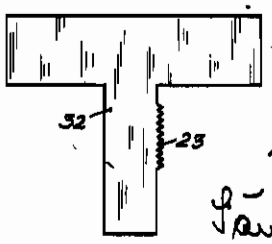


Fig. 9.



Witnesses:

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Sándor Tóth

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2 Sheets-Sheet 2

Fig. 10.

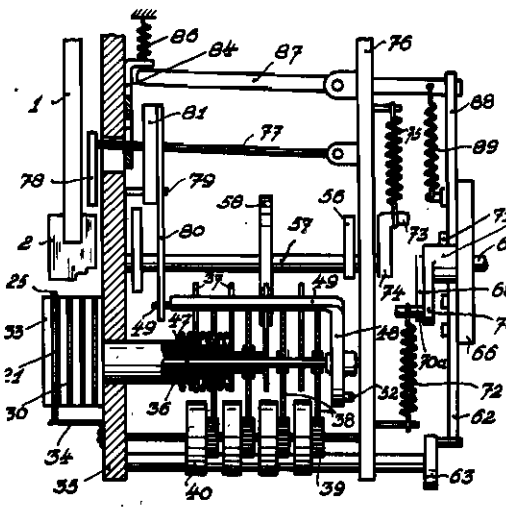
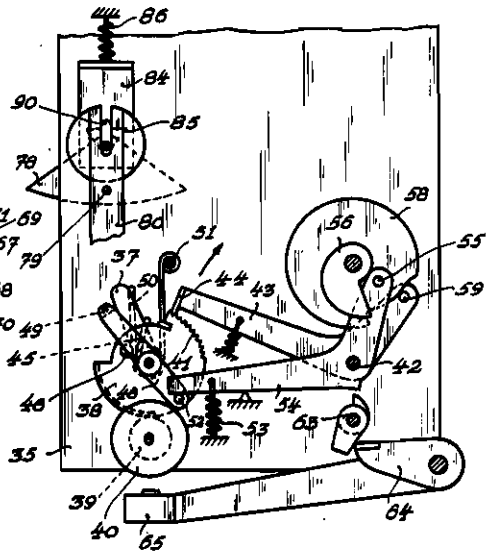


Fig. 11.



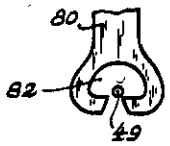


Fig. 12.

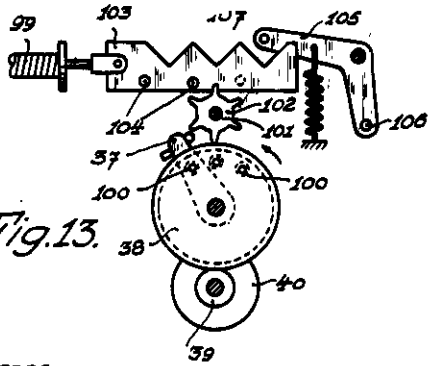


Fig. 13.

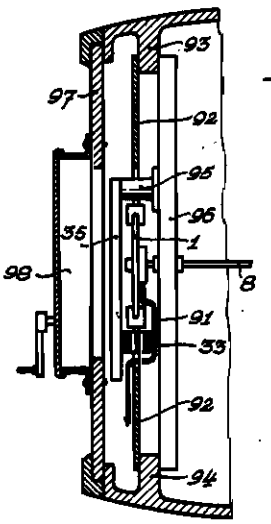


Fig. 14.

Witnesses:

Inventor:
Tivadar Tóth

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ALIEN PROPERTY CUSTODIAN

DEVICES FOR THE NUMERICAL FIXING OF THE MEASURING FIGURE OF MEASURING INSTRUMENTS, PARTICULARLY OF PAIRS OF SCALES

Sándor Tóth, Budafok near Budapest, Hungary; vested in the Alien Property Custodian

Application filed August 24, 1939

The invention relates to a device for the numerical fixing of the measuring figure of measuring instruments, particularly of pairs of scales, in which the measuring figures, subdivided according to orders of magnitude (e. g. single figures, tens, hundreds, etc.) are adjusted by means of mechanical feeler devices on corresponding figure rolls after the measuring instrument has adjusted itself into the position of equilibrium.

The device according to the invention is of much simpler construction as compared to known types of such devices, requires a substantially smaller amount of space, and is also substantially less expensive to manufacture than those known up to now. Another advantage of the apparatus forming the subject of the invention also consists in the fact that those parts of the device which are connected with the measuring instrument are of small size and of very light weight, whereby the load on the instrument shaft is very substantially reduced. Another advantage may be recognized in the fact that provision has been made to prevent the possibility of any incorrect measuring figure being ascertained owing to any external influence being exercised on the device.

Owing to a yielding connection between the measuring instrument and the member on which the feelers are to be operated, any damage being suffered by the device or by the measuring instrument owing to mishandling is excluded.

Further, the figures for all orders of magnitude are according to the invention determined from the same mark on the member on which the feelers are to be operated, which circumstance enables the device to be constructed so as to be of great simplicity. whilst at the same time accuracy can even be increased, as the precise adjustment of a single mark will assure accuracy for all orders of magnitude.

There exists also the possibility that in case of any extension of the measuring range, e. g. in the case of pairs of scales for additional insertion, the figures of additional insertion and the figures ascertained by means of the feelers should be indicated summed-up.

Owing to its small requirements of space, the device can be mounted on the scale side of the head of a pair of scales, whilst at the same time this arrangement does not prevent indication by means of a pointer.

On the accompanying drawing an embodiment shown by way of example of the device according to the invention, as applied to a pair of scales, is shown in a diagrammatical manner, although it is obvious that this device can also be employed in connection with other measuring instruments. Fig. 1 represents one part of the feeler disc in side elevation, Figs. 2 and 3 represent two possibilities of construction of the fixing of the marks on the feeler disc, Figs. 4 and 5 illustrate the yielding connection between feeler disc and pointer shaft, Figs. 6, 7, 8, 9 are representing the various feelers in side elevation, Figs. 10 and 11 represent an assembly of the whole feeler and printing device, Fig. 12 represents a detail, Fig. 13 shows the construction of the device for additional insertion and Fig. 14 illustrates the mounting of the device on the head of a pair of scales.

Figs. 1, 2 and 3 show a disc 1 flexibly connected with the shaft of the pair of scales, and the small leaflets 2 inserted into this disc. In order to reduce the load on the instrument shaft and/or the gyratory moment of the moved part, the disc 1 is preferably made of light metal, whereas the members carrying the marks, i. e. the leaflets 2, are made of resisting material, e. g. of steel. As appears from the drawing the periphery of this disc 1 is divided into a certain number of equal divisions and slotted in the radial direction. Into each radial slot there is inserted a thin leaflet 2 preferably made of spring steel, and fastened into the slot. Each of these leaflets presents a recess 3 (Fig. 3) so that if they are inserted into the slots of the disc 1, their legs 4 will project in the radial direction over the slots, so as to prevent any possibility of their becoming shifted in the axial direction. In order to fasten the leaflet 2 in the radial direction also, it is possible to provide in the leaflets, as shown on Fig. 2, a bore-hole 5 within the range of the periphery of the disc 1. After inserting the leaflets, the material of the disc 1 is caulked by means of a pointed caulking tool into this small bore-hole 5 and thereby a safeguard against any displacement of the leaflets in the radial direction is obtained. In the case of the arrangement represented in front elevation, plan view and side elevation on Fig. 3, two flaps 6 are cut out from the leaflets 2 in the vicinity of the periphery of the disc 1, which flaps are, after the leaflets have been inserted into the slots of the disc, bent from the position shown in full lines, into the position traced in dotted lines, i. e. bent into the grooves 7.

Figs. 4 and 5 represent the elastically yielding coupling between the disc 1 and the shaft 8 actuated by the pair of scales, which coupling enables the shaft to continue its deflection, whilst

the disc 1 is held fast. At the end of the shaft 8 a sleeve 10 with disc 11 is fixed. On this sleeve the casing 13 and the feeler disc 1 connected with it are supported by means of a hub 12. The collar 15 secures the casing 13 and the hub 12 running loose on the sleeve 10 against any axial displacement. From the disc 11 there projects a pin 16, whilst from the casing 13 there projects a pin 17, on which pins the impact plates 18 and 18 supported in a rotatable manner on the hub 12 of the casing 13 are leaning on both sides, the said impact plates extending at their ends parallel to the two pins. A spiral spring 20 is under normal conditions pressing the two impact plates against the pins 16 and 17. The sleeve 14 prevents any axial displacement of the impact plates 18, 19.

In case the shaft 8 is rotated, this motion is transmitted by means of the spring tension on the disc and the latter is carried along. If in the case of this motion the disc 1 is held fast, the spring 20 will be compressed and owing to its suitable construction the disc 1 will be able to lag in the rotation up to about 270° relatively to the shaft. If the disc 1 is released again, the spring 20 will again exactly re-establish the normal position as between the shaft 8 and the disc 1, as the pins 16 and 17 are held securely in their position of rest by the tension of the spring.

Instead of this yielding connection between the shaft and the feeler disc, it is also possible to construct the leaflets 2 of so great length that in case of the motion of the disc they will become resiliently bent during the feeling operation and will thereby render deflection without permanent deformation possible.

In what follows we shall, by way of example, describe the feeler device for a pair of scales having a weighing range of 2000 kg and an accuracy of indication of $\frac{1}{1000}$ of the maximum load. In this case the external edges of the leaflets 2 in the feeler disc 1 are preferably situated at a mutual distance of 50 units of indication. In the case of a thousand units of indication, this division must accordingly repeat itself on the periphery of the feeler disc twenty times. In order to ensure that the zero figure and the maximum figure on the scale, and accordingly also on the feeler disc, should not coincide, the periphery of the disc is preferably divided into 21 parts, so that one division will remain free between the zero and the maximum value, and separate leaflets 2 will correspond to the zero value and to the maximum value, respectively.

Figs. 6–9 represent the feelers for the feeler device assumed. In the case of an accuracy of $\frac{1}{1000}$ of the maximum load, 0, 2, 4, 6, 8, . . . kg should be indicated in the lowest order of magnitude. For each order of magnitude (single figures, tens, hundreds, etc.) one feeler should be provided. The feelers for the various orders of magnitude are of T-shape, possess exactly equal dimensions and are presenting on their legs 22 tooth systems 23 to enable them to be driven. In the front surface of the feeler 21 for single figures (Fig. 6) ten times five steps 24 are provided alongside each other. Each step corresponds to one unit of indication for figures repeating themselves from 0 to 8, so that 50 units in all are marked on the whole width of the feeler.

Fig. 7 represents a correcting feeler 25 the width of which is exactly the same as that of the other feelers, and which carries on its front side a pointed tooth system 26 comprising fifty teeth. Its leg 27 is of greater length than that of the other feelers, the purpose of this arrangement being explained further below. In the leg of this feeler an oblong hole 28 is provided into which a peg 29 projects from the adjacent feeler for single figures 21.

Fig. 8 represents the feeler for tens 30 which on its front side shows ten steps 31 which are preferably arranged in a direction opposite to that of the steps in the feeler for single figures.

Fig. 9 represents a feeler 32 the front surface of which is, in contradiction to those mentioned before, made straight-lined. Such a feeler is employed for the orders of magnitude of hundreds as well as for those of thousands.

These feelers are, for the purpose of establishing the measuring figure, cooperating with the leaflets 2 of the disc 1 and are mounted one above the other in a common casing 33 in such a manner that their lateral and front surfaces are situated exactly in the same planes. At the same time the feelers are arranged in parallel to each other in the casing and can be driven by means of their tooth system 25 by corresponding gear wheels, independently of each other. In order to ensure that in case of a movement of the disc 1 during the operation of the feelers no deformation of the sensitive parts should take place, it would be possible to support the casing 33 of the feelers so as to be resiliently yielding and rotatable around the gear wheel shaft 36. As visible on the left-hand side of Fig. 10 the feelers are arranged in a radial position and deflected by 90° relatively to the plane of the corresponding leaflets 2. The feelers are moved during the process of their operation towards the disc 1, i. e. towards the leaflets 2. Owing to the arrangement described of the feelers, each feeler will in case of operation of the feelers make impact against the same leaflet 2 or, in the limiting case in which the centre lines of two leaflets 2 are situated exactly opposite to the lateral edges of the feelers, against the same two leaflets. The correcting feeler 25 is of a slightly greater length than the others and is, in the position of rest, kept, by the peg 29 of the feeler for single figures which under the action of the spring 34 (Fig. 10) is supported on the lower edge of the oblong hole 28, in such a position that the tooth system of this feeler will project from the plane of the other feelers. In consequence hereof, when the feelers are operated, it is first the correcting feeler 25 which will come into contact with a leaflet 2 and will bring the disc into such a position as to ensure that a leaflet 2 should always make impact against the middle portion of a step of the feeler for single figures 21. On the places cooperating with the feeler for single figures and the feeler for tens, the upper edges of all leaflets 2 are situated on the same circular periphery, and, in consequence thereof, the adjustment of the figures ascertained by means of the feelers in these orders of magnitude will be effected in accordance with the necessary movement of a feeler until a step makes impact against a leaflet 2. As on the feelers for hundreds and thousands no steps are provided, those places of the leaflets 2 which cooperate with these feelers are fitted with steps.

In view of the fact that the distance between two adjacent leaflets 2 corresponds to 50 units of indication, corresponding to 100 kg, each leaflet will be arranged on the place cooperating with the hundreds feeler, so as to be of greater depth, corresponding to one step depth of preceding feelers, from 0 to 9 in succession. Ac-

cordingly this stepping of the leaflets is repeated twice along the whole periphery.

As the division on the feeler disc corresponds to 100 kg, each group of 10 leaflets for the determination of the thousands figures will possess the same height at the respective cooperating places. Accordingly the first ten leaflets remain maintained in the original height, the next ten will be made lower by one step and the twenty-first one will be made lower by two steps.

In the case of the type of construction described the periphery of the feeler disc has been divided into twenty, that is to say, twenty-one parts. It would, however, also be possible to divide the periphery into ten parts; this would apparently have the advantage that a smaller number of leaflets 2 would have to be accommodated on the feeler disc. The drawbacks connected with this arrangement are, however, preponderating, as, firstly, the feelers would in that case have to be made of double as great width and in the case of a width of feeler of 36° the difference between its arc and its projection in the direction in which the feelers are operated would already cause appreciable differences at the ends of the feeler; it would accordingly no longer be possible to make the front surfaces of the feeler straightlined, they would have to be made arcuate and at the same time the various steps would have to be made of different width. Moreover, the mass of the feelers and therewith the moment of acceleration during their rapid movement would enter into play in a greater extent.

It may appear to be necessary to alter the number of leaflets at different ranges of weighing. Thus it would be necessary for instance in the case of a maximum load of 500 kg to employ, with an accuracy of $\frac{1}{1000}$, 25; that is to say 26 leaflets, as in the case of twenty leaflets one division would correspond to 250 kg, and accordingly the establishment of the measuring figures in decimal order would not be feasible.

It should be added that in the case of some ranges of weighing, e. g. in the case of a range of weighing of 1000 kg and an accuracy of $\frac{1}{1000}$ with twenty, i. e. twenty-one divisions on the feeler disc the stepping of the tens feelers, as well as of the cooperating parts of the leaflets has appeared to be necessary. Notably, in this case one division was equal to 50 units, i. e. to 50 kg. In this range it was necessary to provide five steps on the tens feeler, in view of the fact that the width of the feeler is equal to the distance between two leaflets. Aecordingly, if the cooperating parts of the leaflets 2 in the feeler disc were, as in the case of a maximum load of 2000 kg, made without any stepping, it is only the figures 0, 1, 2, 3, 4 which it would be possible to ascertain in this order of magnitude with this feeler. In order to enable the other figures from 5 to 9 to be obtained; each second leaflet 2 has to be constructed five steps lower at the cooperating places.

It is understood that, instead of twenty-one divisions, it is also possible to select a greater number, and that the combination of steppings, of feelers and leaflets can be selected in the case of each range of weighing in accordance with requirements.

Figs. 10 and 11 represents the whole feeler and control device in front of and side elevation. The feelers are—as already mentioned—arranged in a casing 33 fixed on the base plate 35. The tooth systems 23 of the various feelers are engaging with four gear wheels,—not shown—which are fixed on four hollow shafts 36 mounted one into the other. The other end of each of these hollow shafts carries an arm 37, which arms are rotating together with these shafts. On each hollow shaft a gear wheel 38 is loosely mounted which, through the transmission wheel 39, drives the figure roll 40. Each gear wheel 38 is on one part of its periphery fitted with a pawl tooth system 41 into which a pawl 44 fixed on the end of an arm 43 pivotable around the pivot 42 is able to engage. This pawl reaches over all the four gear wheels 38, in such a manner that it holds fast all the four wheels when coming into engagement. One part of the periphery of the gear wheel 38 is cut away and serves as a support for one end of a spiral spring 45 which by its other end is supported on the arm 37. This arm leans under the action of the spring 45 on the stop 46 of the adjacent gear wheel 38. On the solid internal shaft 47 of the set of hollow shafts 36 there is loosely mounted behind the arms 37 a further arm 48 which is fitted with an axial extension 49 projecting over all the four gear wheels 38 and cooperating with the arms 37. Eaeh arm is subject to the force of a spring 50 which on the one hand leans against a fixed stop 51, whilst on the other hand it is hooked into the arms 37. The spring 50 always endeavours to deflect the arms in the counterclockwise sense and at the same time forces them against the extension 49 of the arm 48. On the lower end of the arm 46 a pin 52 is provided on which one arm of the double arm lever 54 leans under the pulling action of the spring 53. The second arm of this lever 54 is by means of a pin 55 supported on a cam 56 fixed on the shaft 57. The shaft 57 earries a further cam 58 which through the pin 59 cooperates with one of the legs of the double-arm lever 43.

In the plate 66 the shaft 67 is supported, which at one of its ends carries a handle (not shown) and at its other end an arm 68. On the shaft 67 a hub 69 having an arm 70 and a cam 71 is loosely mounted. To a pin 70a of the arm 70 a spring 72 joins on which in the case of the deflection of the arm is tensioned to the extent of 180°. The pin 70a cooperates with a stop 73 provided at the end of the crank 74 of the shaft 57 and is connected with the spring 75. On the plate 65 a rod 62 is guided which at one end is supported on the cam 71 and which with its other end cooperates with one arm 64 of the pressure hammer. The arm 54 is held fast by a pawl 63 which is released by a nose of the arm 54.

In the plate 76 an arm 77 made of tough and thin material is also supported, which at one of its ends carries a triangular plate 78 the width of which is greater than the mutual distance of three marks 2 on the feeler disc 1. On the pin 79 a small light-weight pendulum 80 is mounted, the upper end of which is slotted and fitted with a likewise slotted circular counter-weight 81. This counter-weight serves for balancing the lower longer part of the pendulum 80 which is fitted with a triangular aperture 82. (Fig. 12). In this aperture there is arranged a pin of the extension 49 of the arm 48 in such a manner that in the position of rest of the pendulum the pin can be removed from the aperture 82. The arm 77 passes through an aperture of the baseplate 35 as well as through the slot 85 provided in the slide 84. This slide will under the pressure of the spring 86 become supported on one

end of the lever 87 the other end of which is connected with a guided rod 88 and which pulled by the spring 89 presses the bar on the cam 71.

The method of operation of the apparatus described is the following:

As soon as the pair of scales has adjusted itself into the position of equilibrium, the handle and thereby the shaft 67 is rotated in the direction indicated by the arrow (Fig. 11). The arm 68 will immediately make impact against the arm 70 and will accordingly set the latter and the cam 71 into rotation and will tension the spring 72. During the rotation of the cam 71 the rod 62 is pressed down and thereby the arm 64 and the hammer 65 are deflected against the effects of a spring (not shown) until the pawl 63 drops on the stop of the arm 64 and keeps the latter fixed in this position. After the shaft 67 will have become deflected by 180°, the pin 70a will come into contact with the stop 73 of the arm 74. In the case of a slight further rotation beyond 180°, the crank 70 will pass the dead centre position and will from this point onward return automatically in the same direction under the action of the spring 72 into its initial position. The spring 72 is dimensioned in such a manner that during its release it is able to tension the spring 75 as well as all other springs of the apparatus. During this second period, the handle may remain standing still or it may be moved further, but it will not be possible to exert any influence on the further process by its means. This measure, that during driving by the crank the process taking place is not influenced and that it is only by the release of the spring 72 that the operation of the apparatus is started, serves the purpose of preventing any possibility of wilfully interrupting the process of feeler operation by holding the handle fast in an intermediate position in which the feelers are in contact with the feeler disc. During the release of the spring 72 it is at first the rod 88 which is lifted by means of the cam 71 and in consequence hereof the slide 64 is led down by means of the lever 87. During this motion of the slide 84 the prefeeler 77, 78 lifted to a high level, descends until it comes into contact with the internal edge of the leaflets 2 in the disc 1. Should the pair of scales be in a position of rest at this moment it will be possible for the further processes to take place undisturbed as follows:

Simultaneously with the movement of the preliminary feeler 77, 78 the shaft 57 is set into rotation by the cooperation of the stops 70a and 73 and the spring 75 is tensioned. During this motion of the shaft 57 the lever 43 will immediately at the beginning be swung out by the cam 71 and the pawl 44 will be lifted from the teeth 41 of the gear wheels 38 against the action of the spring 61. After a deflection of about 30°, i. e. after the preliminary feeler 77, 78 has made impact against the feeler disc, the bell-crank lever 54 will in accordance with the elevation of the cam 56 be lifted around the pivot 42 against the action of the spring 53, so as to enable the arm 48 to be deflected under the pressure of the arm 37 driven by the four springs 50. At the same time the arms 37 are on the one hand moving the feelers through the set of hollow shaft 36 against the feeler disc and on the other hand the figure rolls 40 will be deflected through the gear wheels 39. The deflection of each arm 37 will be effected in such an extent until the feeler driven by that arm makes impact against a leaflet 2. The arm 54 is lifted by the cam 58 in such an extent as to enable each feeler to be moved unhindered until the lowest step. During this motion it is the correcting feeler 25 which will first get into engagement under the action of the spring 37 and will bring the leaflet in question into the central step position. It is only after the completion of this process that the other feelers will come into contact.

After the figure rolls have been adjusted in accordance with the feeler motions, the stop 99 will reach a recess on the cam 58 and the pawl 44 will under the action of the pulling force of the corresponding spring catch into the tooth system 41 of the four gear wheels 38 and will thereby bring the figures on the figure rolls 40 into the central position. Notably, it might otherwise happen, owing to the large ratio of transmission between a step height (about 0.3 to 0.4 mm) and a figure size (3–4 mm), that in the case of the smallest difference in the height of the steps or of the leaflets the figures would not be in alignment. This correction is rendered possible by the connection between feeler and figure rolls established by the spring 45. As accordingly, the feeler figure adjusted has been held fast, the pin 55, will, after a small further rotation of the shaft 57 drop into the cam 56 and the arm 54 will be pulled down by the spring 53 and will during this motion return, through the arm 48, 49, the arms 37 i. e. the feelers in a positive manner into the initial position. As the gear wheels 38 are held fast by the pawl 44, this movement will cause the spring 45 to become tensioned. Simultaneously with the drawing-back of the feelers, the nose of the arm 54 will come into engagement with the pawl 83 and will deflect the latter until the pawl jumps off from the nose. During this motion the arm 64 i. e. the hammer 65 will be released and pressure will be exerted under the effect of a spring (not shown). The arrangement according to which the pressure hammer i. e. its spring is wound up direct by the handle, and not, as the rest of the control gear, by the spring 72, has the purpose of ensuring that the parts 68, 70a, 72, 73, 75 should be released of the substantial force of the pressure spring. The adjusted figure can also be read on another counter mechanism connected with the pressure device, e. g. through an inspection hole provided in the casing. Therewith the whole procedure is completed and the device is ready for a new feeler operation. The feeler figures remain adjusted for the purposes of remote transmission or the like until at the beginning of the next procedure of operation of feelers the pawl 44 is lifted out from the tooth system 41 and the figure rolls are, under the action of the tensioned spring 45, returning into the zero position.

If, at the beginning of the feeler operation, when the preliminary feeler 77, 78 makes impact against the feeler disc, the latter is in motion, the preliminary feeler will be carried along by the leaflets 2 and the arm 77 of the preliminary feeler will swing out the pendulum 80, so that when operating the driving mechanism the axial extension 49 of the arm 48 which drives the feelers will be unable to find its way into the slot of the aperture 82 in the lower end of the pendulum 80 (Fig. 12) and this arm will therefore be unable to continue its movement. The feeler operation is accordingly prevented. The

rest of the procedure can be performed unhindered, only the hammer **64** will not print any figure weight but will print special symbols, e. g. crosses or the like, for indicating an erroneous operation.

If the feeler disc has been in a position of rest at the beginning of the feeler operation and if an impact takes place during the feeler operation, this will not influence the result of feeler operation, as the correcting feeler **25** will hold the feeler disc fixed and the impact will be absorbed exclusively by the yielding coupling (Figs. 4 and 5) provided between the feeler disc and the shaft of the pair of scales.

If the arcuate edge of the preliminary feeler **76** is constructed so as to contain the tooth system of the correcting feeler **25**, the preliminary feeler will be able to replace the latter also at the same time. For this purpose it is necessary that the recess **85** provided in the slide **84** (Fig. 11), which under other circumstances is constructed as a triangle placed on its apex, should be fitted, in addition, with a vertical slot **90** at the stop. The method of operation would in that case be the following: the preliminary feeler is, in the position of rest, kept in the central position by the arm **77** becoming supported in the apex of the triangular recess **85**. When letting down the preliminary feeler, the wider part of this recess **85** will, in case the feeler disc is moved, render a lateral movement of the feeler **77** possible. In case, at the moment when the preliminary feeler makes impact, the feeler disc is at rest, the arm **77** will in case of a further movement of the slide **84** be situated exactly below the recess **90**, or, if the leaflet **2** on which the feelers are to be operated is not in the central step position, slightly sideways thereof. The recess **90** is dimensioned in such a manner, that in the case of this position slightly sideways of the central step position, the arm **77** will still be gripped by it and thereby the feeler disc will, similarly as by means of the correcting feeler **25**, be brought into the central step position.

It would of course also be possible to employ, instead of the mechanical drive by means of the handle, electrical operation e. g. by means of a motor or magnet, in which case it is, instead of the arm **74**, the cam **71** that will be mounted on the shaft **57**, and this shaft will be driven direct by means of the motor or magnet. In the case of this arrangement it is possible to provide for the pendulum **80**, instead of mechanically holding fixed the extension **49** of the arm **48**, to operate a highly sensitive electric contact e. g. thin wires dipping into mercury, which contact will in case of the slightest deflection of the pendulum **80** cut-out the electric drive i. e. prevent the feeler operation, or will return the arms **37** by means of a magnet e. g. with the aid of the arm **48**, **49** into the initial position.

As appears from the foregoing description, the whole process of feeler operation takes place under the action of wound-up springs in a perfectly automatic manner and within a very short time, within about a few tenths of a second, this being rendered possible by the fact that the mass of the parts moved during the operation of the feelers is extremely small and the paths covered are extremely short, so that the feelers can be operated rapidly, and can be stopped without any substantial shocks. In order to control the speed, it is possible to combine with the shaft of the crank **73** a damping device per sê known in connection with pairs of scales.

Fig. 13 illustrates a device which in the case of so-called "additional insertions" makes it possible that the indicating device should indicate and/or print the total result of weighing i. e. the additional insertion plus the weight indicated by the pointer of the pair of scales. The additional insertion is effected in the usual manner by the operation of a hand-wheel or handle. A part driven by the motion represents one part of a coupling yielding in both directions, as illustrated on Figs. 4 and 5, whereas the other part is connected with a Bowden train **99**. This equipment can be built-on to the mechanism described. For this purpose the connection between the arm **37** and the gear wheel **38** at the highest order of magnitude is amplified by a coupling. This coupling consists on the one hand of small countersunk holes **100** provided in the gear wheel **38**, and, on the other hand, of a pointed peg fixed in the resilient arm **37** made of sheet steel. This peg will under the action of the resilient arm **37** project with its point into the countersunk hole **100** and will, in case the arm is moved, carry along the gear wheel **38**. This connection must be sufficiently strong to prevent its being disconnected by the spring **45**. By way of new equipment the following is added: a shart **101**, on which a gear wheel (not shown) engaging with the wheel **38** and connected therewith a cam wheel **102** is mounted. These wheels should only be mounted on the gear wheel **38** of the highest order of magnitude. Further, a plate **103** connected with the Bowden **99**. In accordance with the possibilities of additional insertion, the plate carries a plurality of pegs **104**, whilst its upper edge is fitted with a tooth system. The pawl **105** is supported by means of its stop **106** on a cam (not shown) of the driving shaft **57** of the feelers, whilst its other end projects by means of the pin **107** into the tooth system of the plate **103**.

If now the weighing range of the pair of scales is increased by additional inserted weights and the hand-wheel or handle is rotated by Bowden **99** will move the plate **103** in the direction of the arrow (Fig. 13) until the right-hand peg **104** gets into the position shown in dotted lines and thereby rotates the cam wheel **102** by one tooth division. Accordingly the gear wheel **38** will become turned in the counter-clockwise sense. During this motion the pointed peg of the arm **37** held fast will jump out from the original recess **100** and will drop into the next one. This will cause the gear wheel **38** and the figure roll belonging to it to be rotated—according to the magnitude of the additionally inserted weight by one or more figures, according to what corresponds to the weighing range of the pair of scales. Thereby the figure corresponding to the additionally inserted weight is adjusted on this figure roll. During the next following feeler operation the gear wheel **38** i. e. the figure roll is deflected further in accordance with the feeler figure from this pre-adjusted position, so that in the print on this roll the figure of the additional insertion plus the feeler operation is obtained.

It is understood that the additional insertion should be effected before operating the feeler device. In order, however, to render any mishandling impossible, the possibility of damaging or influencing the apparatus by simultaneous operation is prevented. For this purpose the pawl **105** will in case of the deflection of the shaft **57** immediately engage into the tooth system of the

plate 103. If at the same time the lever for additional insertion is moved this movement is not transmitted on the plate 103, but absorbed by the described coupling between the lever for additional insertion and the Bowden train.

Nor can the feeler figure be influenced by holding the handle for additional insertion fixed in the middle position, as owing to the pointed teeth of the plate 103 the pawl 105 will always, in a positive manner, produce a correct position. The motion of the plate caused by an additional insertion is chosen in such a manner that the pegs 104 will in each position of rest permit an unhindered rotation of the cam wheels 102.

For the usual weighing ranges of one, two or five hundred or one, two or five thousand kg, it would be necessary that in the case of an additional insertion the figure roll for the highest order of magnitude should be rotated by one, two or five figures. In order to keep this motion uniform, a distance of one or more figure divisions is left for one or more additional insertions between the consecutive figures. In consequence hereof the motion for additional insertion will for each weighing range always amount to one figure and the figures will run, e. g. in the case of 5000 kg and two additional insertions, as follows: 0, 5, 10, 1, 6, 11, 2, 7, 12 . . . etc.

Up to now all indicating and printing devices of this kind were mounted at the rear on the head of the pair of scales, and in consequence thereof the simultaneous observation of the scale and the operation of the feeler device was hardly possible. The apparatus according to the invention only takes up a so small amount of room that it can be fixed without any difficulties on the scale side of the head of the pair of scales. In Fig. 14 the assembly of the apparatus on the scale side of the head of a pair of scales is shown diagrammatically. On the front end of the pointer shaft 6 there is fixed the feeler disc 1 according to the invention which preferably also carries the pointer 91. The pointer is constructed in such a manner, that it is not hindered by the feeler device during this motion. It is not absolutely necessary that the pointer 91 should be fixed on the feeler disc, it may just as well be fixed on the pointer shaft 9 behind the figure disc. The main point is only that the pointer should during its rotation not collide against the feeler and indicating device, this being ensured by the bending shown on the drawing. The pointer 91 moves in front of the scale 92 fixed on a frame 93 of the casing 94. As a certain part remains free on the scale between the zero position and the maximum load—in the example described 1/21st part of the periphery—in front of which the pointer will never pass, it is possible to use this space for the suspension of the feeler and indicating device. At this place a block 95 is fixed on the frame 96 and carries in front the base plate 35 of the whole device. The scale is covered in the usual way by a glass plate 97 which has at its centre a sufficiently large aperture for the feeler and indicating device. On this base plate the cover 98 is fixed from which the handle projects and in which an opening or a slot is provided for the cards to be inserted.

SÁNDOR TÓTH.