

P. J. LEAVENS.
 PROCESS OF MAKING ALUMINUM RULES.
 APPLICATION FILED JULY 15, 1915.

1,211,458.

Patented Jan. 9, 1917.
 2 SHEETS—SHEET 1.

Fig. 1.



Fig. 2.

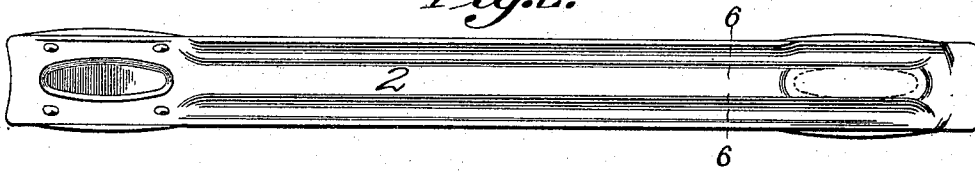


Fig. 3.

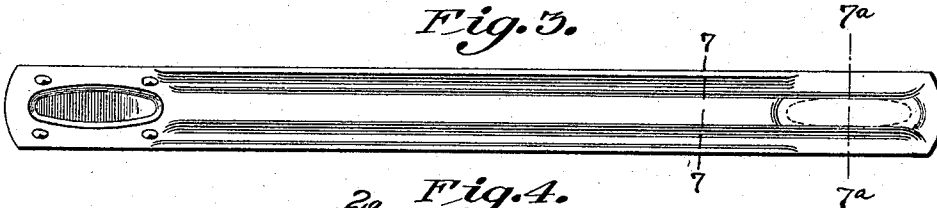


Fig. 4.



Fig. 5.

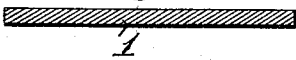


Fig. 7.



Fig. 7a.



Fig. 9.

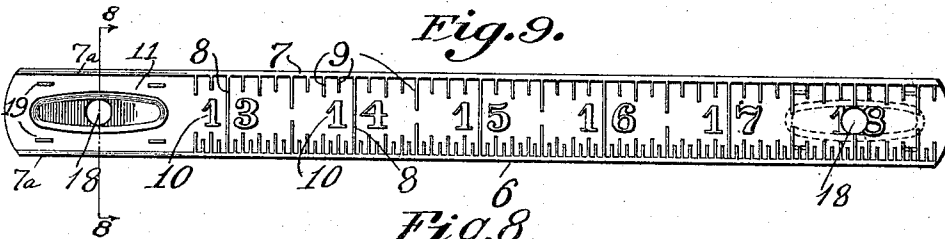
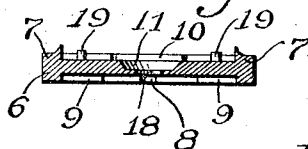


Fig. 8.



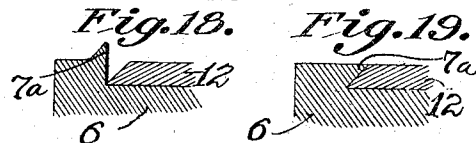
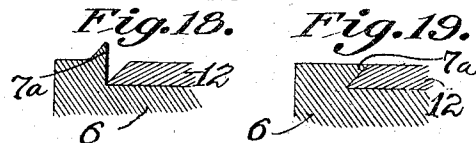
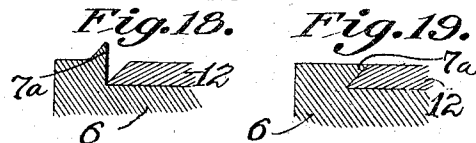
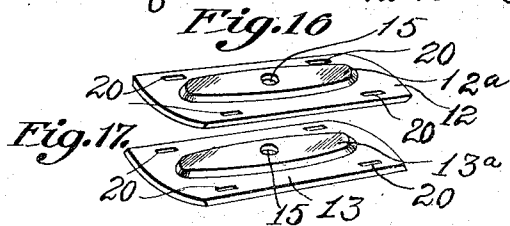
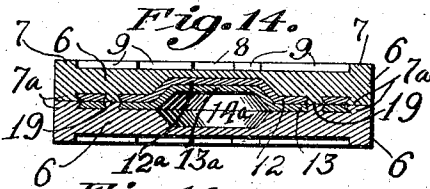
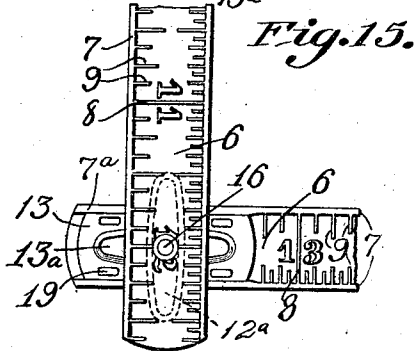
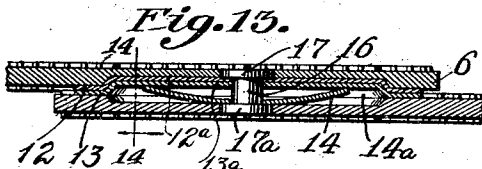
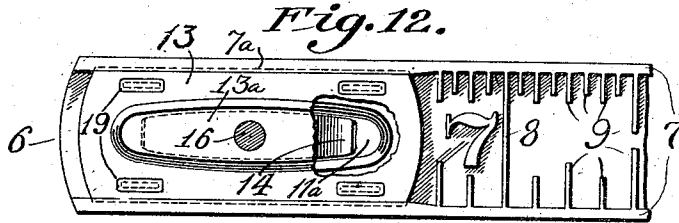
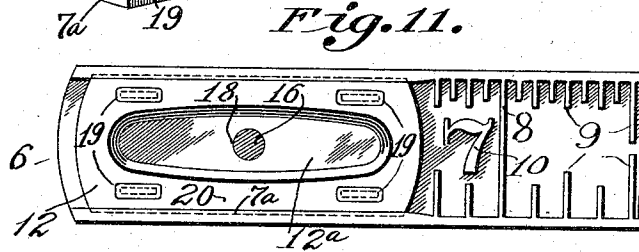
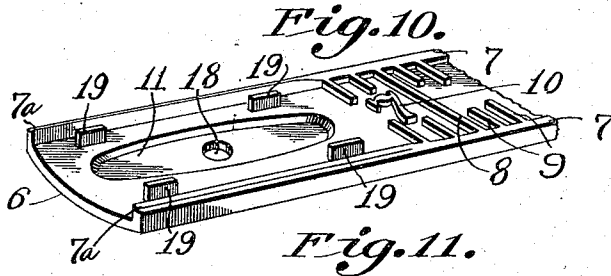
Attest:
W. H. Rockwell

Inventor,
 Philip J. Leavens,
 By *Knight Bros*
 Attys.

P. J. LEAVENS.
PROCESS OF MAKING ALUMINUM RULES.
APPLICATION FILED JULY 15, 1915.

1,211,458.

Patented Jan. 9, 1917.
2 SHEETS—SHEET 2.



Attest:
W. H. Rockwell

Inventor,
Philip J. Leavens,
By *Knight Bros.*
Attys.

UNITED STATES PATENT OFFICE.

PHILIP J. LEAVENS, OF BRIDGETON, NEW JERSEY.

PROCESS OF MAKING ALUMINUM RULES.

1,211,458.

Specification of Letters Patent.

Patented Jan. 9, 1917.

Application filed July 15, 1915. Serial No. 40,091.

To all whom it may concern:

Be it known that I, PHILIP J. LEAVENS, a citizen of the United States, residing at Bridgeton, in the county of Cumberland and State of New Jersey, have invented certain new and useful Improvements in Processes of Making Aluminum Rules, of which the following is a specification.

This invention relates to measuring rules made of metal, and has for one of its objects to produce rules of novel physical form, in that they are provided with raised, longitudinal, strengthening ribs, together with transverse ribs which serve the dual purpose of providing easily readable graduations and assisting the longitudinal ribs in strengthening the structure of the rule, and which rules shall embody a novel, inherent texture in that the metal is cold-worked and has its section distributed by the steps which develop its physical form, in such manner as to greatly increase its limit of elasticity and resistance to permanent bending; all to the end that the goods may be made of metal that is essentially aluminum, and, notwithstanding the normally high ductility of that metal, may be made with sufficiently small transverse dimensions and with fineness of lines that will avail in fullest measure of the inherent lightness of the metal and render the production very compact in form when made up of a number of pivotally connected sections.

Another important object of the invention is to utilize certain steps in the process of shaping and cold-working the metal rule members to prepare their ends for receiving and uniting with the pintles and alining bosses; this portion of the work involving, mainly, the forming of the section ends with cavities or depressions and integral dovetailing or doweling projections adjacent thereto, to the end that the pindle mountings are located with greatest uniformity and consequent accuracy in the finished measuring instrument, and yet the cost is greatly reduced both in labor and material employed in production.

In carrying out the invention, a thin, light blank is treated between suitably shaped pressure faces to form upon the blank, raised areas limited to localize the metal of the blank with relation to the raised markings and ribs to be produced, as for instance by flowing the metal toward its

longitudinal middle and edge portions, which is preferably followed by trimming or dressing the partially treated rule member so as to provide it with ultimate edge faces that are adapted to enter into abutment with a suitable confining tool and resist flowing of the metal under the high pressure of the ensuing step; the rule members being then subjected to a stamping operation closely allied to the process of coining, in that the rule member is subjected to high pressure between face dies, while it is confined edgewise; the dies having surface depressions conforming to the raised markings and ribs to be produced, and positioned to act upon the appropriate raised areas of the blank; in other words, being formed to impart to the rule member, the longitudinal stiffening ribs and transverse ridges which reinforce the stiffening ribs and provide graduation marks, and, preferably, denominational marks as well; these ribs, ridges and denomination characters being formed from the surplus metal distributed by the first step. This part of the process is preferably carried on in two stages, of which the former, constituting the third step in the process, forms the intermediately disposed denominational characters as well as the marginal strengthening ribs, while the latter stage, or fourth step in the preferred method of procedure, flows the metal back toward its original position, though in more condensed texture, and in so doing leaves the transversely disposed raised graduations. This method of procedure permits the use of an extremely thin blank, insures very light weight, fine lines and requisite rigidity and strength in the finished rule member, and provides a very compact measuring instrument when a number of rule sections are assembled by overlapping and pivotally uniting their ends.

Incidentally to the production of the rule member with the physical form and inherent texture described, the ends have been treated to form on opposite sides of the respective ends, depressions to receive the hinging accessories, if the rule member is to become a part of a sectional or zig-zag rule of many sections, and with dovetailing and doweling or riveting projections in position to engage with and be swaged down upon the attaching plates of the pivotally connected and interengaging alining bosses.

The invention will be fully understood upon reference to the accompanying drawings, in which—

Figure 1 is a plan view of the stock or initial blank that is to be treated in carrying out the process in producing the new article of manufacture forming the subject of the present invention; Fig. 2 is a plan view of the partially formed rule member; Fig. 3 is a plan view of the same after trimming; Fig. 4 is a view in longitudinal section of the member shown in Fig. 3; Fig. 5 is a cross-sectional view of the stock, as disclosed in Fig. 1; Fig. 6 is a cross section on the line 6—6, Fig. 2; Fig. 7 is a cross section on the line 7—7, Fig. 3; Fig. 7^a is a cross section on the line 7^a—7^a, Fig. 3; Fig. 8 is a cross section on the line 8—8, Fig. 9; Fig. 9 is a plan view of the finished rule member; Fig. 10 is a perspective view of one end of the finished rule section prepared to receive its hinging member and pintle; Fig. 11 is a plan view of the same with the concave hinging member riveted and dovetailed in place and with the pintle in section; Fig. 12 is a view similar to Fig. 11, showing the convex hinging member that coacts with the hinging member of Fig. 11; said convex hinging member being partially broken away to disclose the leaf-spring beneath it that renders the pintle axially resilient; Fig. 13 is a longitudinal section through one of the joints, in the plane of its pintle; Fig. 14 is a transverse section through the same joint in a plane remote from the pintle and beyond the end of the spring; Fig. 15 is a detail view, showing the pivotally connected ends of two rule members; Figs. 16 and 17 are perspective views of two cooperating pintle plates, and Figs. 18 and 19 are sectional detail views showing two steps in the dovetailing of the pintle plate to the rule member.

Referring to the drawings, 1 represents a blank which is preferably cut from a sheet of metal that is essentially aluminum and substantially as it comes from the rolls by which the sheet was produced. Sheet aluminum of this quality, while already subjected to sufficient pressure to roll it out from the ingot into sheets, is nevertheless unsuitable for rule purposes unless used in undesirable thicknesses, owing mainly to the fact that its relatively high ductility leaves the metal not materially changed in its capacity to resist bending, and altogether unsuitable for the production of rule sections, notwithstanding the recognized desirability of the metal aluminum for such a purpose so far as concerns its lightness, its resistance to corrosion and other qualities generally recognized as inherent in this particular metal. Where such metal has been used for the production of rules, it has generally been alloyed with other material to give it resisting power, or has been used with such thick-

ness as to make the article comparatively undesirable.

The stock 15 is first subjected to a pair of suitable forming dies, which are so shaped as to reduce the metal along both sides of the center of the blank, and in so doing, cause the metal to flow toward the center and edges and thus produce the second-stage blank 2, as illustrated in Figs. 2 and 6. The second-stage blank will, therefore, include thickened edges 3 and a thickened central portion 4. The spaces intermediate the central portion and edges of the first-stage blank define longitudinally extending grooves or channels 5, the thickness of the metal at these points being less than that of the initial blank 1. The somewhat distorted edges and ends of the first-stage blank are then trimmed, the resulting formation being the piece 2^a disclosed in Figs. 3, 4, 7 and 8, and constituting the third-stage blank, which has the exact external shape and dimensions, edgewise, of the finished article. The third-stage blank is then confined in a rim or frame of sufficient rigidity to resist expansion under very high pressures, and fitting the trimmed edge-faces of the work-piece with sufficient accuracy to prevent expansion of the rule member, and therein subjected to the action of the finishing dies operating under sufficiently high pressure to materially condense the blank throughout the main portion of its area and convert it into a rule section which is hard, dense and resilient; these finishing dies being suitably engraved to simultaneously produce upon the surfaces of the rule section, longitudinal or side marginal strengthening ribs 7, and transverse graduation ridges 8, 9. The ridges 8 preferably abut or extend between both the longitudinal ribs and are integral therewith so as to assist the ribs in rendering the rule section capable of resisting considerable force or bending moment. The ridges 9 are shorter. While likewise integral with ribs 7 and projecting inwardly from opposite ribs, they extend but part way across. But they lend further stiffness to the structure. During this last step in the process of rule formation, the raised reference characters or numerals 10 are impressed upon the center of the blank by flowing or moving the metal, which constitutes the thickened central portion 4, back toward its original position at the sides of the blank, and in so doing, sufficient metal is moved toward the outer edges of the blank to form the raised graduations or ridges 8, 9, and the side marginal flanges or ribs 7. The flowing or moving of the metal, first toward the center and edges for the formation or production of the raised central characters or numerals 10 and the raised graduations and side flanges, and the partial return of such metal to produce the raised

ridges or graduations 8, 9, adjacent the edges of the blank, condenses and compresses the aluminum and converts it into a rule section 6, which is hard, dense and resilient. The particular disposition of ribs and ridges is very effective in resisting those strains to which the sections of a zig-zag rule are unavoidably subjected in opening and closing the rule, namely, torsional strains which result from unavoidable inaccuracies in application of force for swinging the sections to and from their extended positions.

Rule sections produced as above described can be coupled by suitable pintle joints (a preferred type of which is described below), and with this in view, the sections are provided with the oppositely facing depressions 11, 11^a, into one of which, 11, will extend the offset portion 12 of a pintle member 13 (see Figs. 10 to 17), while the other depression 11^a will combine with the hollow side of the co-acting pintle member 13^a and form therewith the housing for the spring 14, which renders the pintle axially resilient. The pintle members 12, 13, are provided with pintle openings 15 having a diameter adapted to fit the shank of the pintle 16, and these pintle members are adapted to nest together or fit one within the other whenever they are in alinement, and thus hold the rule sections in alinement whether extended or folded. The pintle is provided with heads 17, 17^a, of which the former rests directly upon the offset 12^a of pintle member 12, while the latter head 17^a bears indirectly upon the offset 13^a of the pintle member 13, through means of the plate spring 14, which is located in the housing 14^a. In this way, the pintle members may separate sufficiently to permit the turning of one upon the other in shifting the rule sections from folded to extended position.

No special novelty is claimed for the pintle and pintle members *per se*, but the method of combining them with the rule sections constitutes an important feature of the present invention, since it insures absolute accuracy in the built-up rule by producing the attaching means simultaneously with the calibration of the rule members, and thereby insuring a positive and uniform relationship between the graduations and the pintles on each section, and consequently between the graduations of the several sections. To thus accurately inter-relate the sections of a zig-zag or folding rule, pintle openings 18 are formed in the rule members by dies to which the rule member, preferably in the condition shown in Fig. 9, is presented, with accuracy, through means of a jig that utilizes an adjacent raised graduation 8, so that the location of all pintles must bear a constant relationship to the graduations. By this method of procedure, deviations are wholly avoided, whereas in

rules having no raised graduations available for positioning the templet, and in which the pintle opening is located with reference to the rule end, for instance, inaccuracies are unavoidable. Moreover, these pintle openings bear a definite relationship to the depressions 11 and 11^a, which receive the convex portions 12^a and 13^a of pintle members 12 and 13, and also a definite relationship to integral riveting projections formed simultaneously with the graduations and with the pintle depressions. Heads 17, 17^a of the pintles 16 fit in the openings 18, while attaching plates of the pintle members 12 and 13 are stamped with perforations 20 to receive the projections 19. Hence the pintle members and pintles are located with absolute accuracy. To firmly hold the pintle members against lateral displacement upon the rule members, the latter are provided with dovetailing flanges 7^a which constitute continuations of the strengthening rib 7. Pintle members are secured in position by placing them between the flanges 7^a and over the studs 19, while these parts are in the condition shown in Figs. 10 and 18, and then carefully pressing the rule member until the dovetailing flanges and rivets are brought to the condition illustrated in Figs. 11, 12, 14 and 19.

Not only does the above described method of pivoting the rule members together, insure accuracy, but it is very much more economical in cost of material as compared with forming the pintle members with embracing flanges that overlie the edges of the rule sections; moreover, the novel construction of pintle connections adds little or nothing to the thickness of the joint.

I claim:—

1. The method of producing rule sections having markings and ribs raised above the general surface thereof; said method consisting in subjecting a suitable strip of soft metal, such as aluminum, to the action of a blanking die, having its pressing surface shaped to form a blank with raised areas limited to localize the metal of the blank with relation to the raised markings and ribs to be produced; and thereafter subjecting the blank so formed to the action of a finishing die with surface depressions conforming to the raised markings and ribs to be produced, and positioned to act upon the appropriate raised areas of the blank.

2. The method of producing sections for rules made up of a plurality of members hinged together at their ends, and with raised markings and ribs upon the sections; said method consisting in subjecting a suitable strip of soft metal, such as aluminum, to the action of a die shaped to form a blank with raised portions upon its surface limited to localize the metal with relation to the raised markings and ribs to be formed, and

to provide metal for integral means for attaching hinges; and thereafter subjecting the blank so formed to the action of a finishing die having surface depressions conforming to the raised markings and ribs to be produced and to hinge-attaching lugs definitely located with relation to said markings, and positioned to act upon the appropriate raised portions of the blank.

3. The method of producing rule sections having markings and ribs raised above the general surface thereof; said method consisting in subjecting a suitable strip of soft metal, such as aluminum, to the action of a blanking die, having its pressing surface

limited to localize the metal of the blank with relation to the raised markings and ribs to be produced; and thereafter subjecting the blank so formed to the action of a finishing die with surface depressions conforming to the raised markings and ribs to be produced, and positioned to act upon the appropriate raised areas of the blank; the metal being confined against edgewise expansion while being pressed, and thereby condensed in structure.

The foregoing specification signed at Bridgeton, New Jersey, this twenty-fourth day of June, 1915.

PHILIP J. LEAVENS.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."