(No Model.) 7 Sheets—Sheet 1.

A. C. ESTABROOK.

METHOD OF WORKING BONE INTO BLANKS FOR TOOTH BRUSH HANDLES.

No. 260,374. Patented July 4, 1882.

FIG. 1.

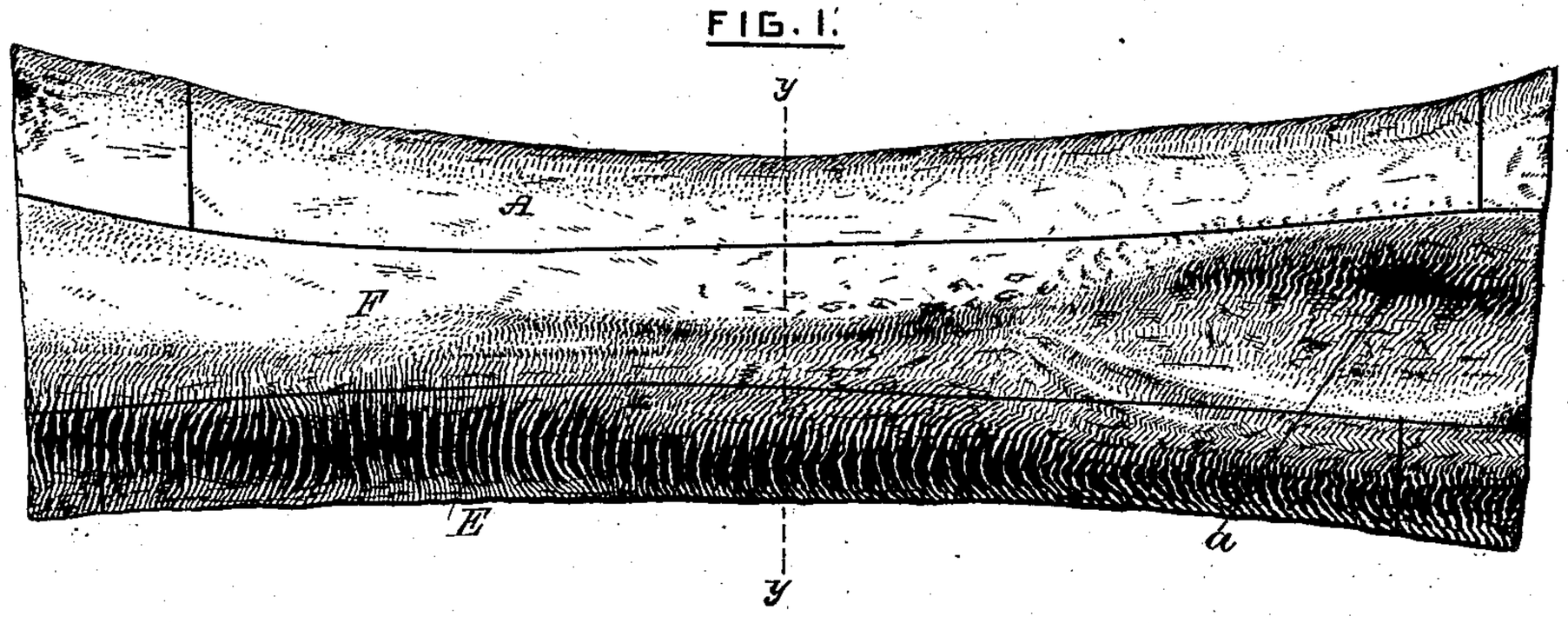


FIG. 2.

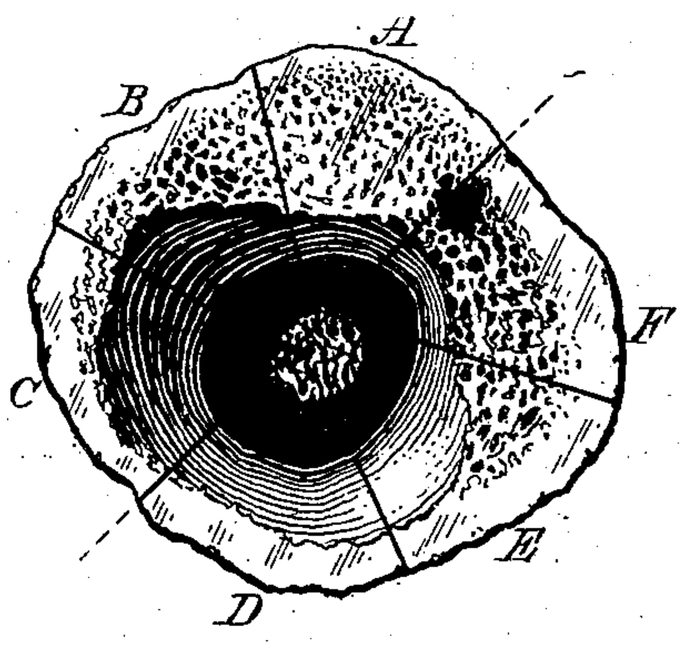


FIG. 3.

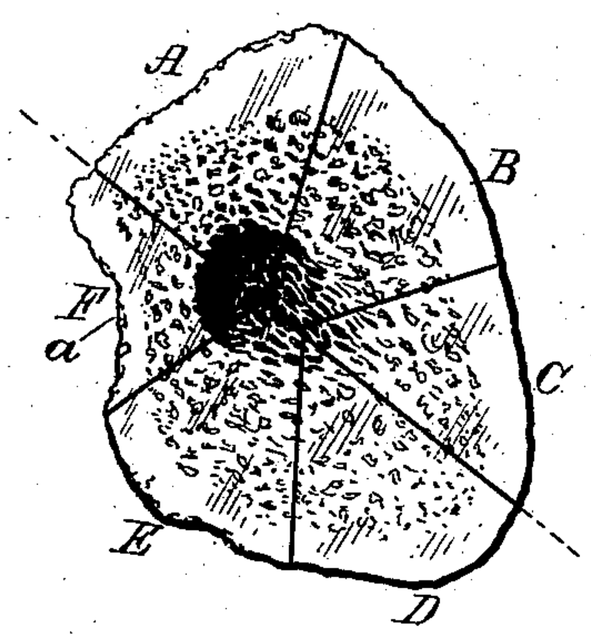
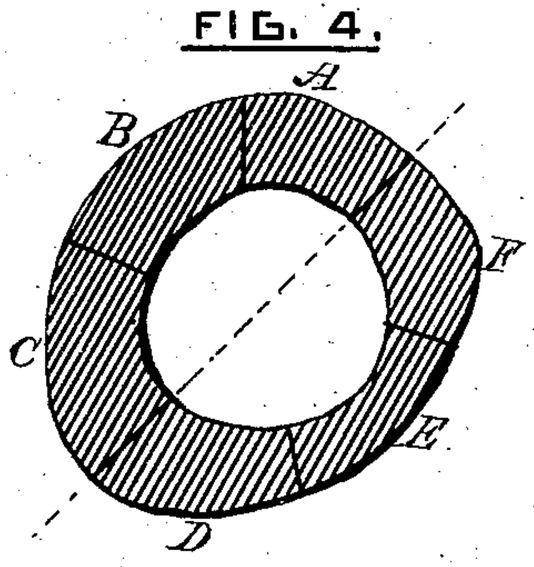


FIG. 4.



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(No Model.) 7 Sheets—Sheet 2.

A. C. ESTABROOK.

METHOD OF WORKING BONE INTO BLANKS FOR TOOTH BRUSH HANDLES.

No. 260,374. Patented July 4, 1882.

FIG. 5.

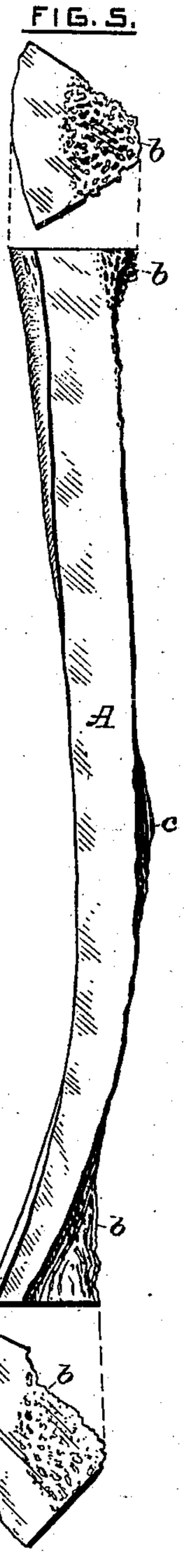


FIG. 6.

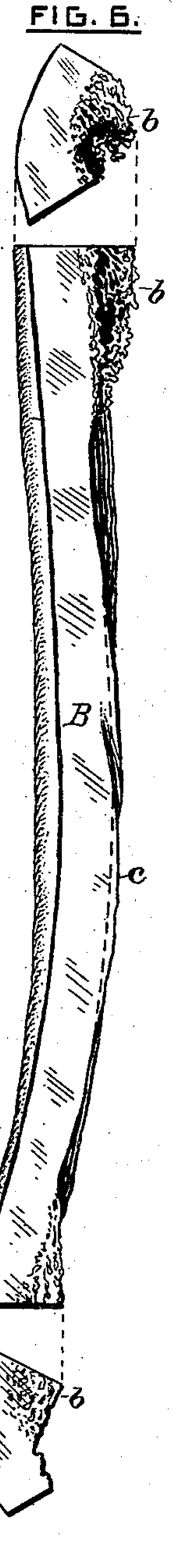


FIG. 7.

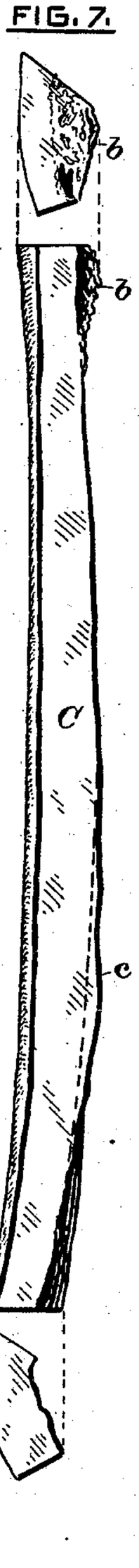


FIG. 8.

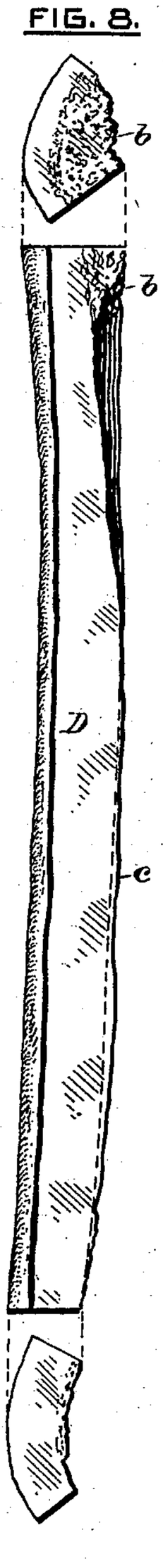


FIG. 9.

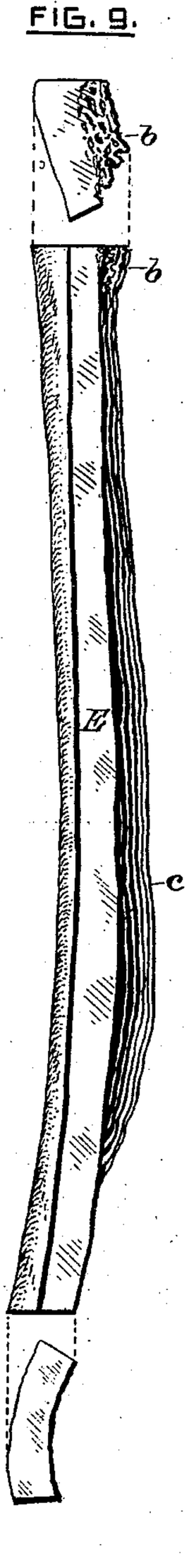
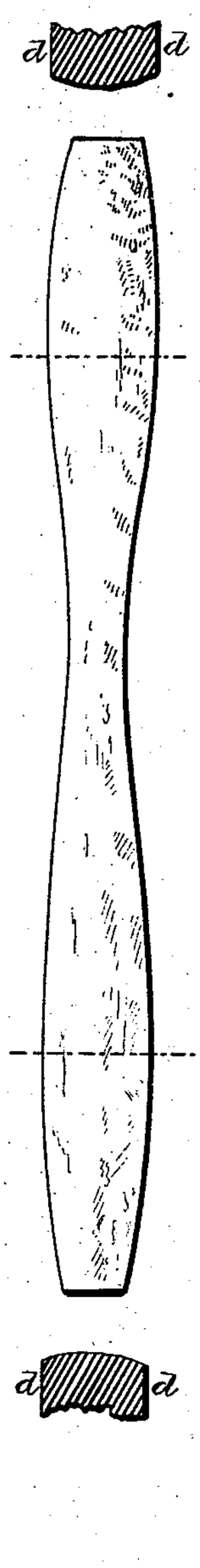


FIG. 10.



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(No Model.) 7 Sheets—Sheet 3.

A. C. ESTABROOK.

METHOD OF WORKING BONE INTO BLANKS FOR TOOTH BRUSH HANDLES.

No. 260,374. Patented July 4, 1882.

FIG. 11.

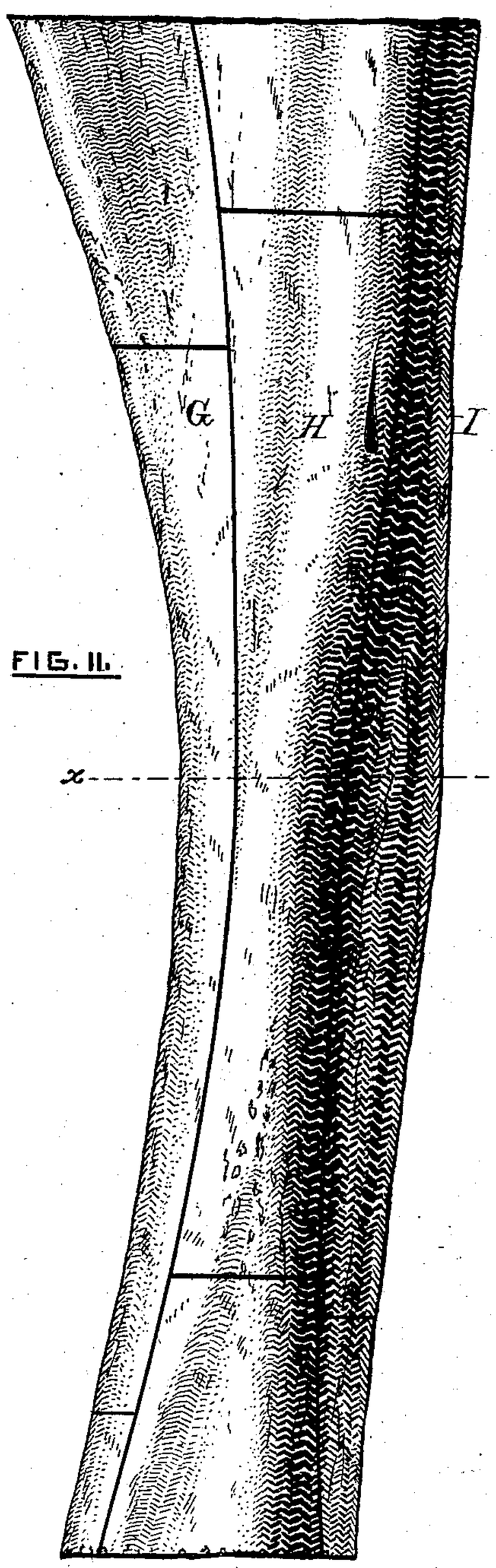


FIG. 12.

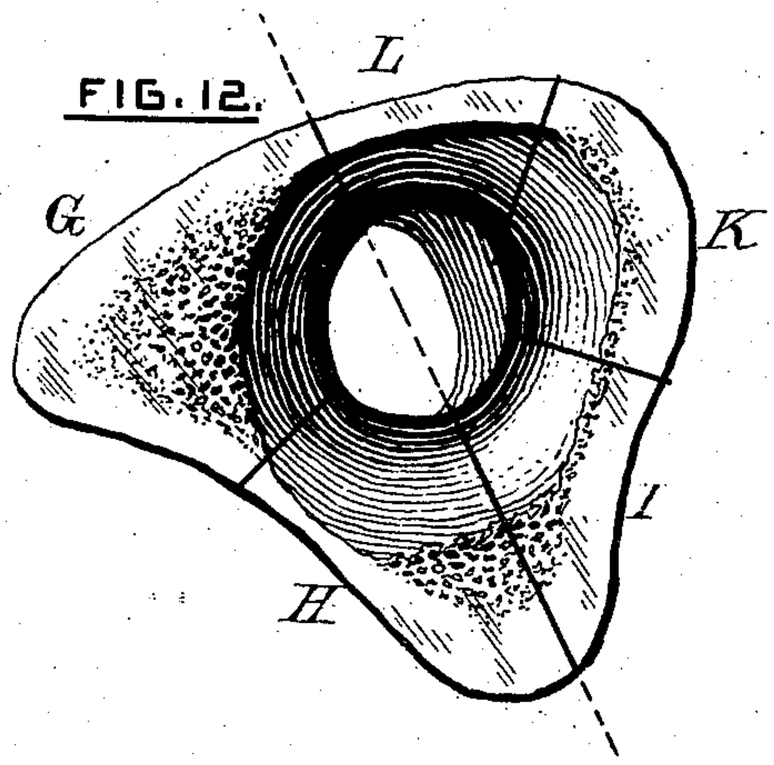


FIG. 14

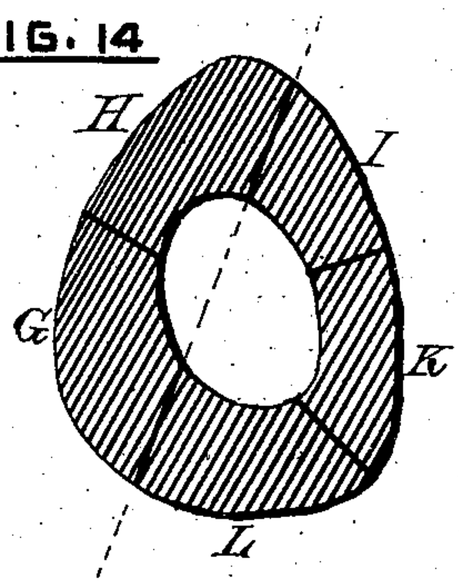
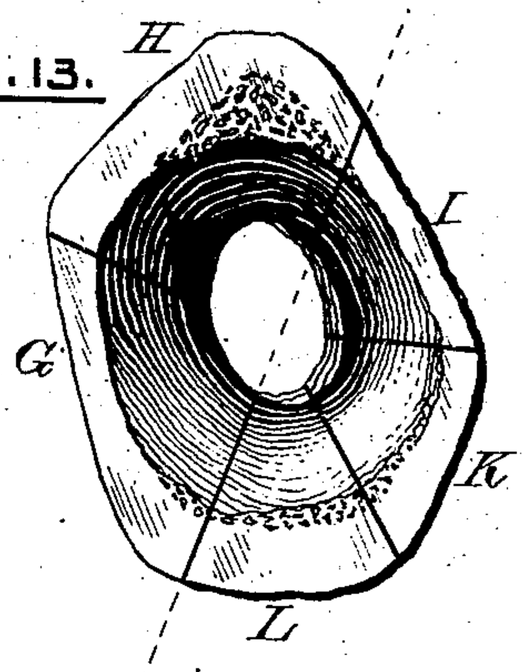


FIG. 13.



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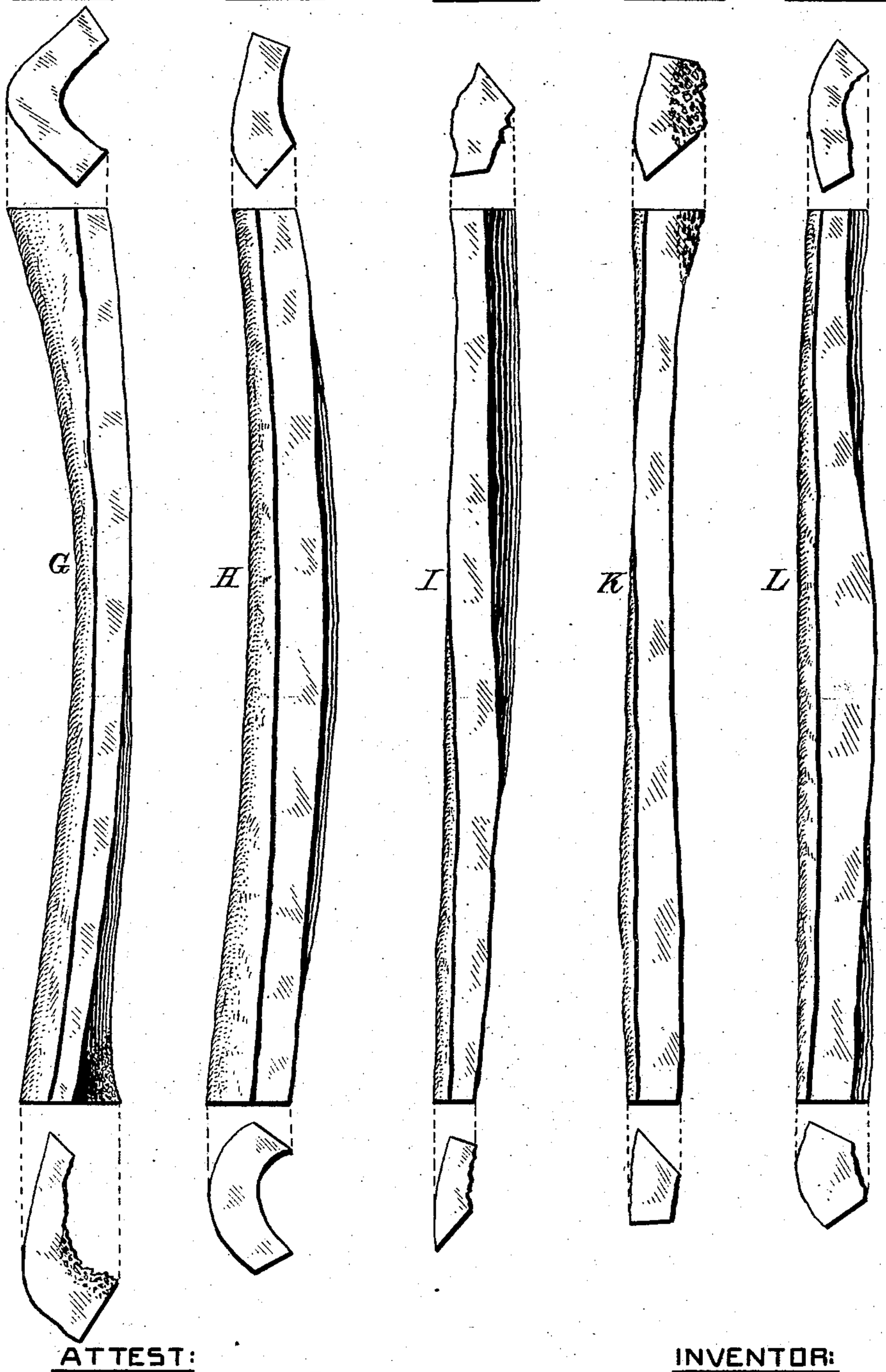
(No Model.) 7 Sheets—Sheet 4.

A. C. ESTABROOK.

METHOD OF WORKING BONE INTO BLANKS FOR TOOTH BRUSH HANDLES.

No. 260,374. Patented July 4, 1882.

FIG. 15. FIG. 16. FIG. 17. FIG. 18. FIG. 19.



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(No Model.)

7 Sheets—Sheet 5.

A. C. ESTABROOK.

METHOD OF WORKING BONE INTO BLANKS FOR TOOTH BRUSH HANDLES.

No. 260,374. Patented July 4, 1882.

FIG. 20.

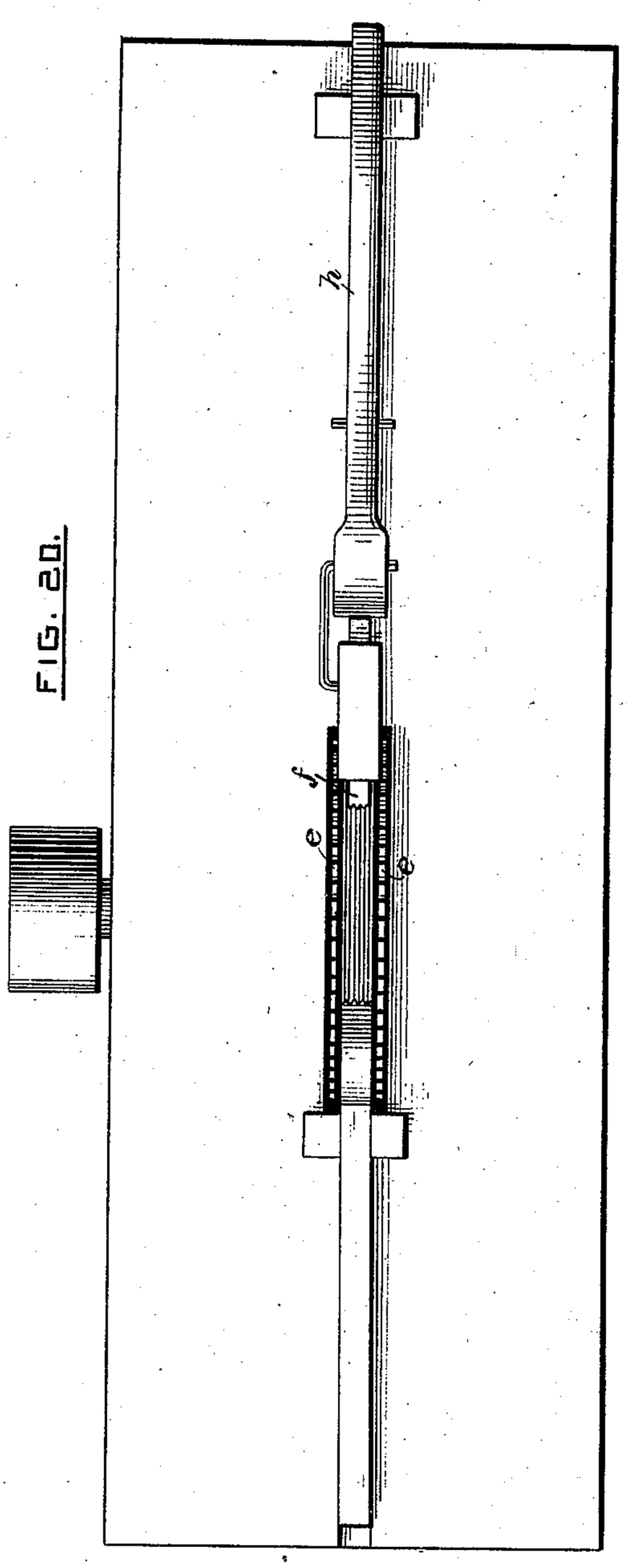
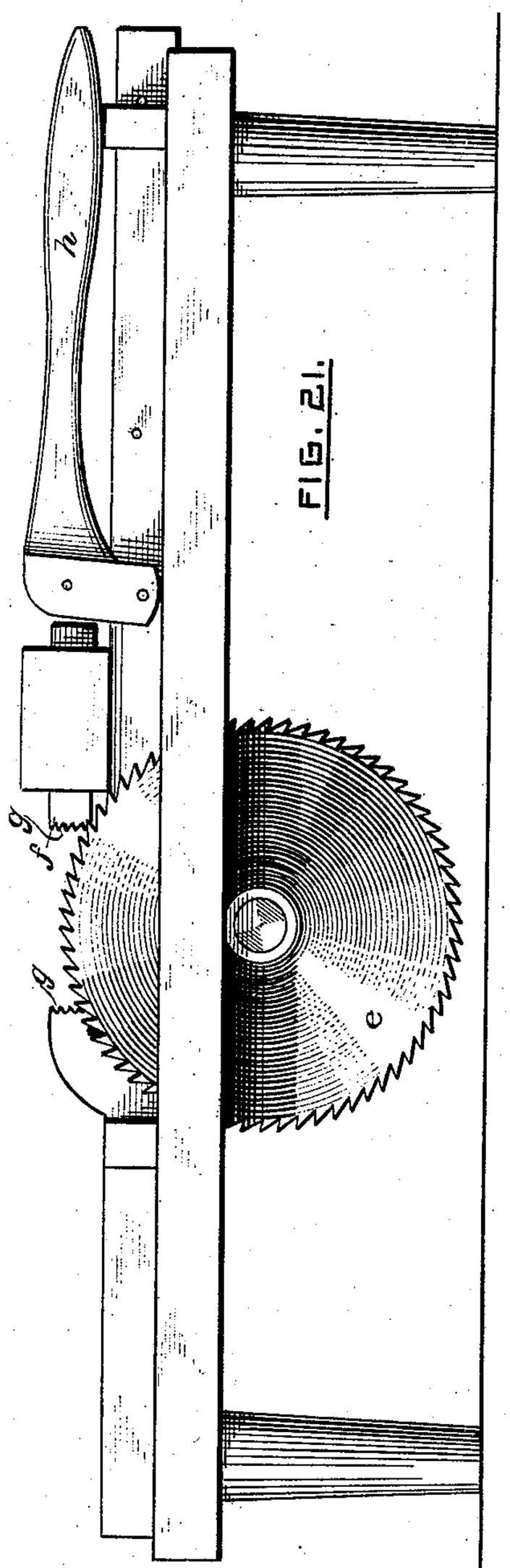


FIG. 21.



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(No Model.) 7 Sheets—Sheet 6.

A. C. ESTABROOK.

METHOD OF WORKING BONE INTO BLANKS FOR TOOTH BRUSH HANDLES.

No. 260,374. Patented July 4, 1882.

FIG. 22.

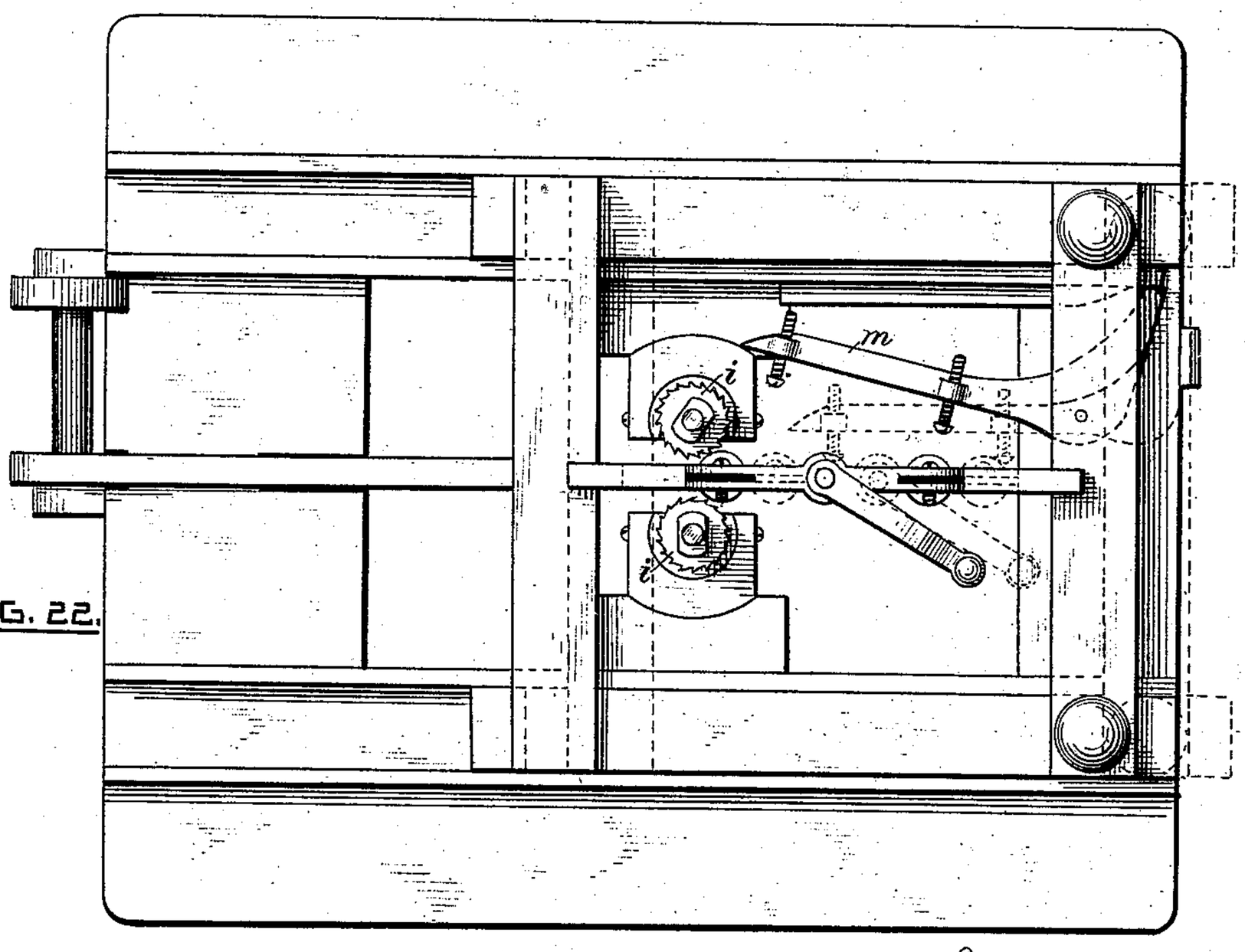
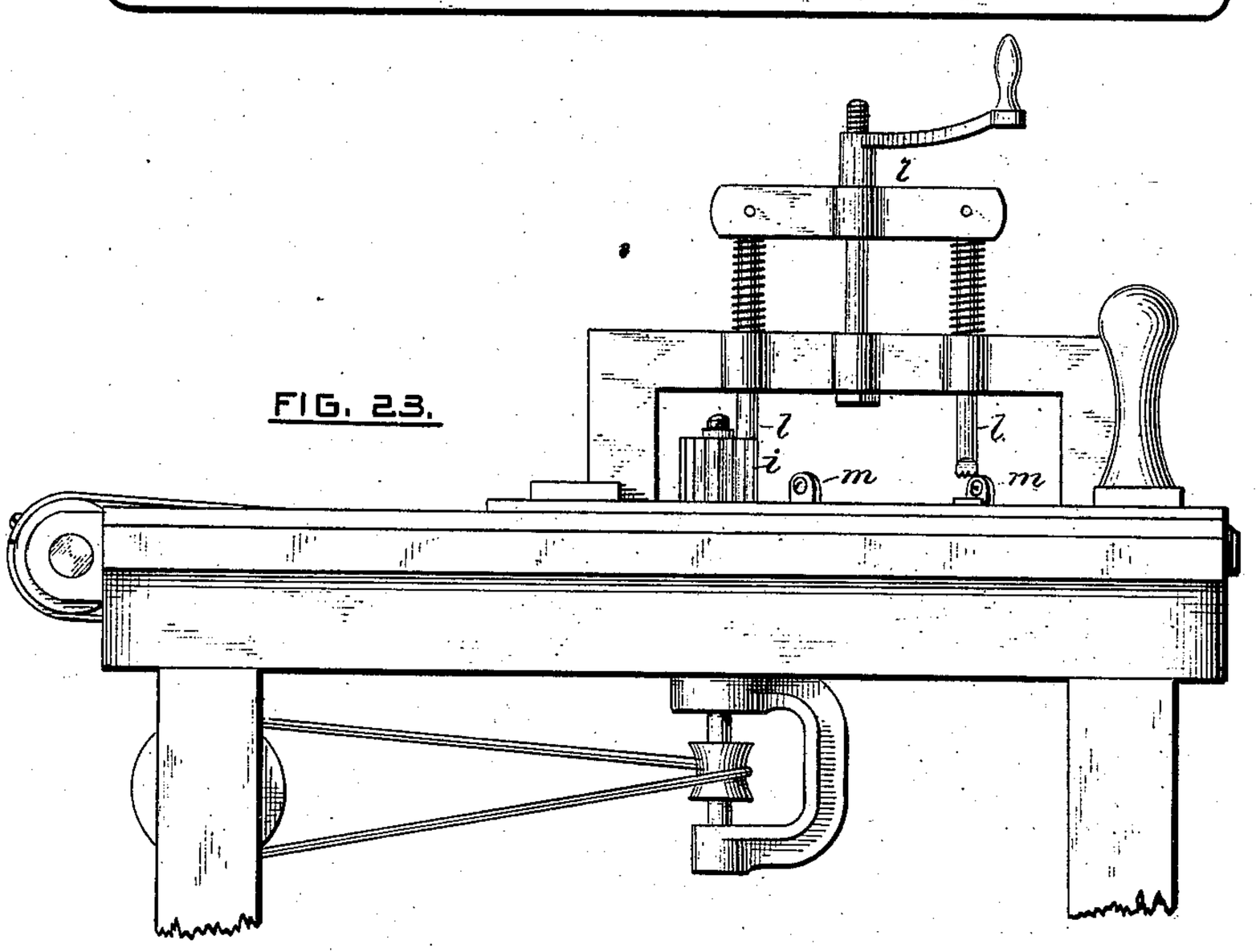


FIG. 23.



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(No Model.) 7 Sheets—Sheet 7.

A. C. ESTABROOK.

METHOD OF WORKING BONE INTO BLANKS FOR TOOTH BRUSH HANDLES.

No. 260,374. Patented July 4, 1882.

FIG. 24.

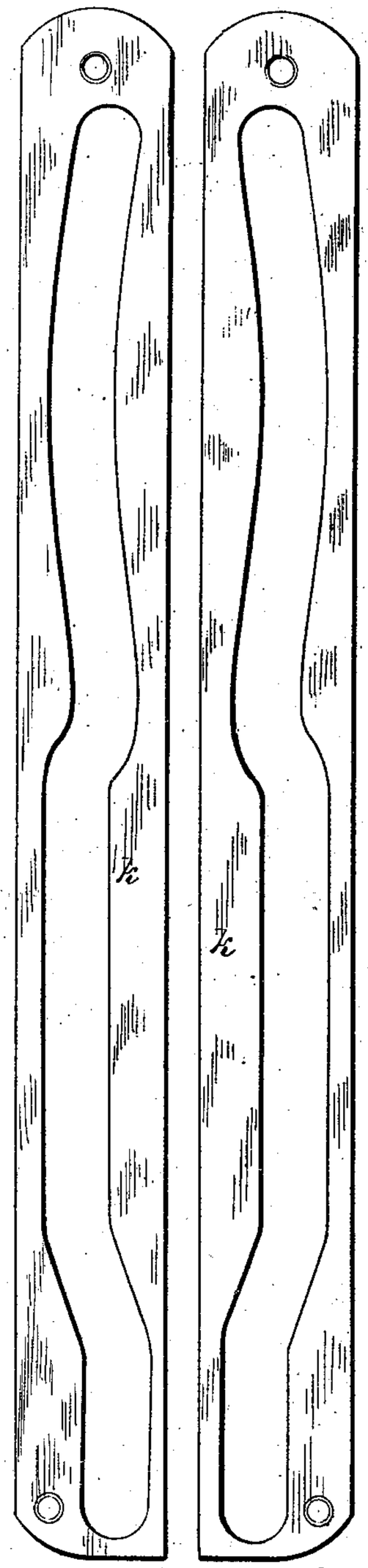


FIG. 25.

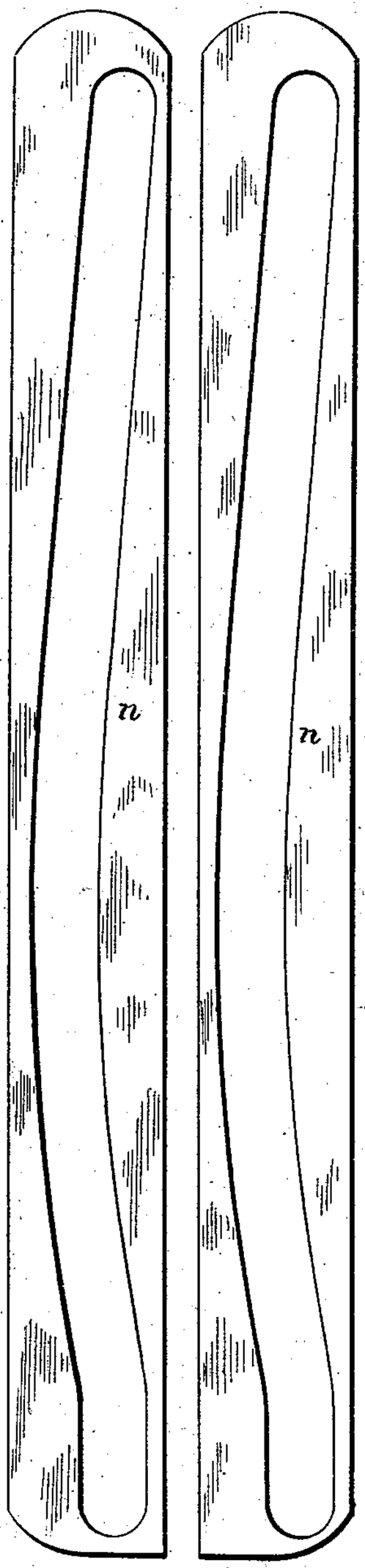
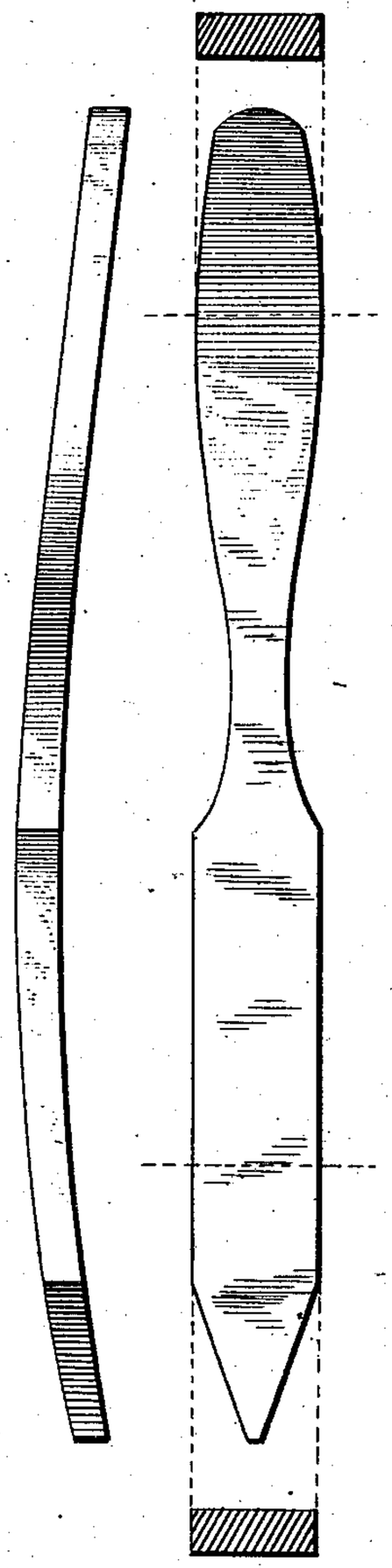


FIG. 26.



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UNITED STATES PATENT OFFICE.

ALANSON C. ESTABROOK, OF FLORENCE, MASSACHUSETTS, ASSIGNOR TO THE FLORENCE MANUFACTURING COMPANY, OF SAME PLACE.

METHOD OF WORKING BONE INTO BLANKS FOR TOOTH-BRUSH HANDLES.

SPECIFICATION forming part of Letters Patent No. 260,374, dated July 4, 1882.

Application filed December 10, 1881. (No model.)

To all whom it may concern:

Be it known that I, ALANSON C. ESTABROOK, of Florence, in the town of Northampton, county of Hampshire, and State of Massachusetts, have invented a certain new and useful Method of Working Bone into Blanks for Tooth-Brush Handles; and I do hereby declare that the following specification is a clear, true, and complete description of my invention.

The main objects of my invention are to more economically produce tooth-brush handles from bone than has heretofore been possible, and to enable the production of handles of absolute uniformity in contour or outline, and in the various styles into which the several variable sections of bone employed are susceptible of being worked.

The importance of having blanks of such uniform character as will insure uniformity of contour in the finished handles is of great practical importance, not only in the neatness of the finished goods, but also during the performances of certain operations involved in making the handles—as, for instance, it is of special value while boring and graving the heads for the bristles, because both edge lines of the head being exactly alike and symmetrically located with reference to the central line of the handle renders said edges reliable for use as gaging-surfaces, whereby to truly locate the graving lines or slots at the back of the head, so that they will be in exact coincidence with the rows of holes with which said slots communicate. In boring and graving as heretofore conducted the eye of the workman has alone been relied upon for describing curves for slotting and boring, and also for spacing the slots and rows of holes, and in these terminal operations more losses occur from bad work than from all failures in preceding operations. I obviate these losses by providing, in accordance with my present invention, blanks so uniform in contour that in finishing no substantial departure therefrom need ever occur, and therefore the edge-lines are absolutely reliable for gaging-surfaces.

Heretofore, so far as my knowledge extends, the working of bone in this branch of the art has mainly been effected by hand—as with a vise, hand-plane, and hand-rasp—so far as relates to developing each rough-sawed section of bone into the forms desired. It has, however, heretofore been proposed, and to some extent practiced in developing the edges of handles, to employ a single milling-tool and a form the character of which and its mode of operation will be hereinafter fully described, it being only necessary to here state that neither the economy nor the important results as to uniformity sought by me could be practically attained therewith. The bones deemed most practicable for the purpose are those from neat cattle, and each animal affords four bones which are deemed practically available for the purpose—viz., the right and left buttock-bones and the right and left leg or thigh bones—and each of these affords five cuts or sections suitable for making into handles. Neither of these bones can be wholly utilized. From both bones the enlargements at each end are cut as waste. The buttock-bones have one entire longitudinal cut or section of waste; but the leg-bones, although of less diameter than the buttock-bones, are of greater length, and waste occurs at one or both ends of each longitudinal cut or section. These longitudinal cuts or sections in both bones partake of irregularities in form more or less common to both of the original bones with reference to longitudinal and peripheral lines, and also with reference to thickness. These irregularities have largely precluded any method of working other than by hand, it having heretofore been the custom, with the exception hereinbefore noted, to take up at random each cut or section of bone and to plane and rasp it into a form which, in general outline of its back and front, would substantially correspond with the general longitudinal outline of the section, some of them being straight and others curved to a greater or less degree. In thus working the bone the eye and skill of the workman are alone relied upon for developing the form to which each section of bone is best adapted, and handles from the same workman developed from the same particular sections of bone largely vary in their symmetrical character, although belonging to the same style of handle; and even if any one workman in a factory should closely approximate to uniformity in the character of

work produced by him there would be noticeable variations between his products and those from others employed with him, each workman having more or less varying capacities as to accuracy of eye and skill in the use of hand-tools. The cost of sufficiently skilled labor to properly perform this work in this country is so great as to result in unsatisfactory margins of profit in this line of goods in competition with goods imported from countries wherein cheaper labor is available.

In the practice of my method an important saving in labor is effected, not only enabling highly-skilled workmen to turn out upward of twice as much work as by hand, but it also permits the performance of substantially the same work, as regards quantity and quality, by workmen of lower grades.

I will now describe the several steps of the process as practiced by me, referring to the accompanying sheets of drawings, and will designate as I proceed wherein occur the departures and variations from the method or methods heretofore practiced.

On Sheet 1, I illustrate at Figures 1, 2, and 3 a trimmed buttock-bone, in side and end views; at Fig. 4, a midway-section thereof on line *y*, Fig. 1; and at Figs. 5, 6, 7, 8, and 9 the several available cuts or sections of bone are shown in edge and end views.

As heretofore, by means of a suitable saw, an initial cut is made, dividing the bone longitudinally. Said initial cut in this bone is located at the points indicated in dotted lines in the end views of Figs. 2 and 3, and also in Fig. 4. The exact location of the initial cut is not material, and it may, with substantially the same results, be located between the sections A and B and C and D, these sections being slightly varied at their edges because of the difference in the angle of said cut. As a rule, the initial cut should pass through or adjacent to a certain nerve-hole common to all bones. Next, as heretofore, each half is divided by sawing the same longitudinally into three pieces, and of these six one is waste, because of the presence at one end thereof of a deep rough concavity common to buttock-bones. The pieces, cuts, or sections A, B, C, D, and E are all suitable for use, but the piece F, because of the defect at *a*, is considered waste in this connection.

It is obvious that the marrow-cells or inner spongy portions, *b*, of each section should be removed in the most expeditious manner—as by sawing, for instance—and this operation has been usually performed preliminary to subsequent operations as heretofore practiced. The inside wany edges, *c*, may in like manner be sawed off, care being taken to not cut too deeply.

The next step taken by me is a novel one, specially considered in this connection. As uniformity in outline and symmetrical proportions are sought by me, I deem it important to provide for the ready location of a central longitudinal line in each section, from which to work, and this cannot be practically located in each piece as sawed from the bone, because, as is indicated in the drawings, each piece varies in width, and the sawed edges occupy in cross-section lines which are radial from the center of the bone or approximating thereto. This step referred to consists in reducing each piece to a uniform width and the edges thereof to exactly parallel planes, and this is preferably done by sawing, the inner side of the piece being preferably uppermost on the saw-table. In hand operations it has been customary to laboriously straighten these edges and to remove extraneous portions by the use of a coarse-set hand-plane, but when reduced to the proper width the edges, except by the merest accident, would not be truly parallel either longitudinally or in cross-section, the object heretofore being merely to remove the extraneous bone and to so straighten the edges that the section can be clamped laterally in a vise, while the rasp is applied first to one side of the section and then to the other. Having thus provided each piece with exactly uniform paralled edges, the central longitudinal line is readily determined, even by a comparatively unskilled eye, because the adjacent extraneous portions of bone have been removed.

The next step is also novel, in that, instead of working up the edge outline of the blank guided only by the eye—as with the hand-rasp and vise—I mill the edges into the desired longitudinal contour, with due reference to the central line of the piece and corresponding to a predetermined form, which varies according to the edge outline required in the finished handle, a desired form of which is indicated in Fig. 10, which illustrates a piece as at the end of the step now under consideration.

It will be seen that the edges *d* are exactly parallel, while the outer and inner sides maintain the variations in surface substantially the same as in the original bone, and differing therefrom only so far as is due to the removal of the extraneous portions *b* and *c*, previously referred to.

The prior milling operation hereinbefore briefly referred to was performed in such a manner and by such means as rendered it practically impossible to secure edge surfaces in parallel planes, as will be more fully explained in connection with the description of milling mechanism devised by me for performing this portion of the work. This parallelism of the edge surfaces, *d*, as illustrated, is of great importance in connection with the succeeding mechanical step. At this stage of the operation I assort the sections according to their natural characteristics with reference to longitudinal curvature. This assorting is essential for the best results; but considered with reference to its sequential order in the series of steps it is immaterial, so long as it is done prior to the mechanical step next to be described. It may be done next after sawing the sections from the original bone, or after the parallel sawing or the milling of the edge outline, which latter I prefer.

On Sheet 3 I show, at Figs. 11, 12, 13, a trimmed leg-bone in side and end views, and at Fig. 14 a central section on line *x*, and at Figs. 15 to 19, inclusive, in edge and end views, the several sections cut therefrom and trimmed at the ends. This bone is longer than the buttock-bone, but usually of less diameter, and although in this bone there is no worthless longitudinal section, waste does occur at one or both ends of each section, each being reduced to the requisite length by trimming or "cropping" from one end only, as with one section, and from both ends with the others, varying according to their longitudinal configuration. The leg-bones are divided longitudinally, as before described, into two parts, as on the dotted line, Figs. 12 and 13, one part affording two and the other three sections. Considered with reference to their natural longitudinal characteristics, the sections from both varieties of bones may be best classified as follows: first, such as will only make a straight handle, of which section K is a type, but sections I, D, and L may also be worked straight because of their thickness; second, such as will only make handles of minor curve, of which sections C and E are types, but sections I, D, H, and L may also be worked with them; third, such as will only make handles of medium curve, of which sections B are types, but sections H may also be worked with them; fourth, such as will only produce handles of full curve, of which sections A and G are types. Such of the sections as are interchangeable in this classification may be variably assigned from time to time, according to the demand for particular styles.

Having been assorted substantially as indicated, I proceed with the next and terminal step, which consists in reducing the sides of the sections of each assorted series to surfaces which are at right angles to the edges and have a longitudinal contour governed by the longitudinal characteristics of each particular section or assorted series of sections of bone, thus completing bone-blanks for tooth-brush handles which may each thereafter be finished up in any of the various special styles to which said blanks may be best adapted—as, for instance, with beveled or with rounded edges, or with flat or rounded sides full on one or both sides—and in these finishing operations no material variations in the outlines of the blank need ever occur. The prior milling operation herein referred to has always been confined to the alternate development of the edges of a bone-section, and, so far as my knowledge extends, I am the first to mill the sides of the blanks or handles, and that result is based upon my idea of assortment and classification of the bone-sections with reference to their natural longitudinal characteristics, with a view to working the sides of the handles or blanks by means of machinery as distinguished from hand-tools.

There is of course that regular variation in the character of both classes of bone which is due to their being "right" or "left;" but this does not involve any substantial difference in the several sections cut therefrom, and therefore the sections are readily recognized and their classification, as hereinbefore indicated, readily accomplished.

The mechanism requisite for practicing my method may be largely varied; but I will describe so much of certain novel mechanism devised by me as is deemed necessary for the purposes of this specification, it being understood that I do not herein limit myself thereto, and that said mechanism is to be made the subject of separate Letters Patent.

The preliminary trimming and sawing of the bones into sections are performed at an ordinary saw-table, the saw being of conrse specially adapted to the purpose. The reducing of the edges of the sections to parallel planes may be done on any saw-table provided with a carriage upon which the section being firmly held may be carried to and past the saw; or the latter may be of the swinging variety to operate upon the section while held stationary. The first cut having been made on one edge, the section may then be turned over, and while evenly held against a gage on the sliding bed the second or finishing cut may be made. As economy in time and labor is of special importance, however, I have devised a sawing apparatus illustrated in Figs. 20 and 21, respectively in plan and side views.

Two saws, *e*, with teeth of the cross-cut variety, are truly mounted side by side, with an intervening space equal to the width of section desired at this stage of the operation, which for best results should be but a trifle wider than the widest portion of the blank desired. A sliding clamp, *f*, occupies the space between the saws, but sufficiently below their peripheries to provide for a good cutting effect on the section. This clamp has two serrated faces, *g*, which engage with the ends of the section, and one of said faces is upon the end of a sliding bar controlled in its movements by a hand-lever, *h*, thus enabling the section to be held firmly when presented to the saws. This endwise holding of the section also enables it to be firmly held, regardless of its irregularity in contour. The simultaneous reduction of the edges of the sections to parallel planes is of great practical value, although in the performance of this step in accordance with my invention I do not limit myself thereto, except as will be indicated in the claims hereunto annexed.

The milling of the edges of the sections to the desired longitudinal contour may be performed, one edge at a time, provided said contour be assured by means of a predetermined form or its equivalent, which will make both edges of the section exactly alike and practically parallel when considered with reference to the cross-section of the bo e, as shown in Fig. 10 at *d*.

With a view to the greatest economy in time and labor, I have devised a milling apparatus

illustrated in Figs. 22 to 25, inclusive, which simultaneously operates on both edges of a section of bone.

For the purposes of this specification it is believed to be only necessary to state that the rapidly-revolving milling-heads *i* are located side by side, are movable toward and from each other, and controlled in said movements by means of right and left hand forms *k*, Fig. 24, one for each head, said forms being connected to a slide which is moved to and fro and carries a clamp, *l*, located between the milling-heads, and in which the section of bone is securely held with due reference to the proper location of its central line, that being assured by means of a gage, *m*, in contact with one of the truly-parallel edges of the section previously provided for. When the slide, with a bone-section thus held, is moved forward, the milling-heads rapidly perform their work simultaneously and with exact uniformity. The working-faces of the milling-heads are practically parallel with each other throughout their work; but this is not absolutely essential, provided they are enabled to make the edges *d*, Fig. 10, at the widest portions of the bone, practically parallel, that being essential for obtaining the best results by affording a true bed-bearing to serve as a gage for properly working the two rectangular sides of the section during the terminal operation in forming the blank.

As a step preparatory to this edge-milling operation, the importance of the truly-parallel edges of the sections will be seen when it is considered that each milling-head has precisely the same amount of work to perform, and therefore they practically balance each other with reference to lateral pressure upon the section, and neither is liable to spring the section or tend to displace it laterally in the clamp. The proper location of the central line of the section with reference to both cutters might be effected by the gage *m*, if only one edge of the section had been squared; but that would cause the head adjacent to the gage to always perform a certain degree of work in cutting away a limited quantity of extraneous bone, and the opposite head to perform a variable degree of work, because it would then have to cut away the variable quantity of surplus bone from the opposite side of the section. It is clearly advantageous, however, that the milling-heads be relied upon for service only after the removal of as much of the extraneous bone as possible.

I will now describe the prior milling-machine to which I have referred, and its operation, and set forth wherein its results differ from those produced by me during the step last mentioned.

In said prior machine the milling-head is carried on a horizontal shaft and mounted in a frame fitted to side guides, and free to rise and fall. Beneath said milling-head is a horizontal sliding carriage, to which a horizontal one-sided "form" is attached, the frame having a projecting stud and roller extending over and resting upon the surface of said form, which therefore supports the milling-head, its shaft, and frame. On the sliding carriage is a clamp, by which the bone-section is held in an edgewise position by lateral pressure. So far as the operation of milling is concerned, that performed in this prior machine differs from that performed in the machine shown, in that in my machine the milling-head must work fully up to the line of the form, while in the old machine it would vary more or less therefrom, according to the thickness and hardness of each bone or various portions thereof, and also according to the sharpened condition of the milling-head, and as a result the edge lines produced in said machine are not absolutely uniform, nor are the edges of bone-sections cut thereby truly parallel with each other in cross-section, and they could not therefore be safely relied upon as gage-surfaces during the succeeding step or operation as performed by me. This parallelism of the edge surfaces is practically beyond the capacity of said machine for many reasons, as follows: The clamp engages laterally with surfaces of the bone which are so irregular as to render it impossible, after milling one edge, to turn the other edge upward, and so clamp it as to enable said edge to be so milled that the two edge surfaces would be parallel, because, although one edge was already milled, the section of bone could not rest thereon, because the irregular sides of said section will cause it to tilt one way or the other when clamped laterally.

The simultaneous development of the longitudinal contour at both edges of the section is of great practical value on the score of economy; but I do not limit myself thereto, except as will be indicated in the claims hereunto annexed.

The terminal step in the production of the blank for reducing the sides of the sections, so that they will be rectangular to the edges, involves the use of a second milling-machine of the character already described; or the same machine may be employed, provided the forms for controlling the milling-heads be removed and suitable forms substituted; but, as before herein indicated, I am the first, as I believe, to mill the sides of these bone blanks or handles.

As a rule, throughout the various styles the heads of brush-handles wherein the bristles are mounted need not materially differ in thickness. The variations in the handles proper, so far as relates to the upper and lower side surfaces, may be quite entensive—as, for instance, in a straight handle a uniform thickness may be desired throughout, in which case the milling-heads are not moved with relation to each other; or the handle may be straight on one side and curved or bellied outward on the other side at the widest portion; or this outward curve may be present on both sides, as in a straight round handle; or a full or a medium curved handle may be of uniform thickness throughout; but these are preferably of varying thickness—as, for instance,

quite thin at the end, and thicker at the widest portion than at the head. These various conditions involve of course forms of varied outline, although in forming the blank for the straight handle of uniform thickness no specially-devised form is required, because, the sliding clamp being limited in its movements by its guides to a straight line, and to a path exactly equidistant between the heads, the guides of the clamp carriage or bed operate as forms which predetermine the character of the sides of the handle, and said guides may be relied upon with one head incapable of other than a rotative movement for developing a straight surface, and employed with a head controlled by a form for developing an opposite curved surface on the same handle.

I have deemed it necessary, for purposes of illustration, to show but one set of side forms, *n*, as in Fig. 25, which are adapted for the production of blanks of medium curve, of the character shown in Fig. 26 in side, top, and sectional views. The variations in these forms will of course be governed by the particular longitudinal side lines desired in the blank. The blanks, of whatever variety they may be, being absolutely uniform enables them to be readily worked throughout the various subsequent finishing operations without liability of affecting the uniformity of the finished handles—as, for instance, in chamfering or beveling the edges of the handle or in rounding them they can, while held by the head, be passed each edge at a time in contact with a milling-head formed for effecting the finishing-cuts desired, and thereby develop a uniform cut on both edges, and the same is true of the subsequent grinding operations, because whatever extraneous bone there may be in the blank is distributed with uniformity throughout when it has been developed at the sides and edges in accordance with my invention, with due reference to its true central line, and said line having been located with due reference to the main bulk of each section all wany edges and imperfections in the bone are assuredly worked out with the extraneous portions.

A bone-blank for tooth-brush handles as produced in accordance with my invention differs from a piece of bone worked as heretofore into the same general form, in that its sides and edges are truly rectangular, and also in that the longitudinal contour of either edge is the exact reverse counterpart of the other, and so far as I know blanks substantially of this character have never been heretofore known as an article of manufacture, but have only occurred during the working of each section of bone into its ultimate condition.

Under my method it will be practicable to produce my blanks with comparatively unskilled labor in localities relied upon largely for the bone-supply, and thus obviate much of the cost in transportation, especially from remote localities beyond the range of cheap transportation. Moreover, blanks may be very cheaply produced by my method directly from comparatively green bone, and, being treated with any suitable preservative not detrimental to their color, they can be seasoned with great rapidity and with less liability of injury in seasoning than the original bone.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The method of producing bone blanks for tooth-brush handles, substantially as hereinbefore described, which consists in, first, sawing trimmed bones into longitudinal sections; secondly, reducing each section to parallelism, and both edges thereof to parallel planes for determining its central line; thirdly, milling the edges to the desired contour with reference to said central line; and, finally, milling the sides of the previously-assorted sections rectangular to their edges, and to a longitudinal contour limited by the natural longitudinal characteristic of each section or assorted series of sections, as set forth.

2. The method of producing bone blanks for tooth-brush handles, substantially as hereinbefore set forth, which consists, first, in sawing trimmed bones into longitudinal sections; secondly, in simultaneously reducing both edges of each section to parallel planes; thirdly, in simultaneously milling both edges to the desired contour with reference to the central line of each section; and, finally, in simultaneously milling both sides of each section for developing lateral surfaces rectangular to the edges, with longitudinal contour limited by the natural longitudinal characteristic of each section, as set forth.

3. As an article of manufacture, a bone blank for tooth-brush handles, rectangular in cross-section, and having edges of corresponding longitudinal contour, substantially as described.

ALANSON C. ESTABROOK.

Witnesses:
PHILIP F. LARNER,
HOWELL BARTLE.