Oct. 3, 1967 D. R. ALLEN 3,344,781

MULTI-PURPOSE NEUROLOGICAL DIAGNOSTIC INSTRUMENT

Filed Oct. 23, 1964

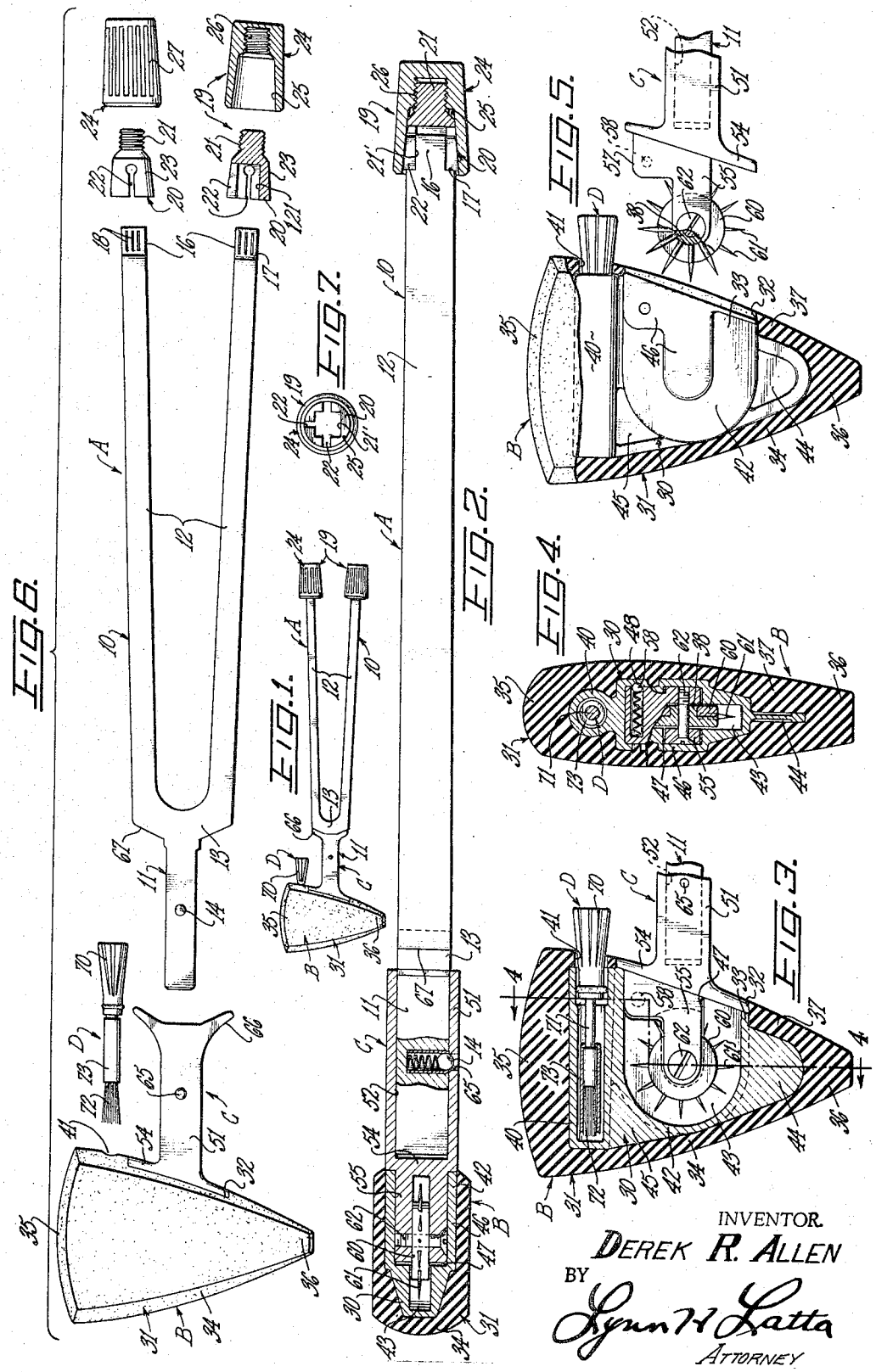


FIG. 6.

FIG. 1.

FIG. 7.

FIG. 2.

FIG. 5.

FIG. 4.

FIG. 3.

INVENTOR.
DEREK R. ALLEN
BY
Lynn N. Latta
ATTORNEY

United States Patent Office 3,344,781 Patented Oct. 3, 1967

3,344,781

MULTI-PURPOSE NEUROLOGICAL DIAGNOSTIC INSTRUMENT

Derek R. Allen, Glendale, Calif., assignor to Allen Medical Instrument Corporation, Glendale, Calif., a corporation of California

Filed Oct. 23, 1964, Ser. No. 406,101
3 Claims. (Cl. 34—457)

This invention relates to neurological diagnostic instruments used by physicians and surgeons in examining patients, and has as its general object to provide an improved combination instrument combining the functions of a series of tuning forks, a reflex hammer, a "pin wheel," and a sensory brush. Toward the attainment of this general object, the specific invention provides a diagnostic instrument embodying a tuning fork having removable weights on the distal (free) ends of its furcations, either one or both of which can be removed for effecting a change of pitch.

Other objects and advantages will become apparent in the ensuing specification and appended drawing in which:

FIG. 1 is a side elevational view of the instrument fully assembled for use as a hammer;

FIG. 2 is a longitudinal sectional view thereof, the tuning fork being shown in side elevation with the exception of one of its removable weights which likewise is shown in section;

FIG. 3 is a sectional view through the head in a median plane thereof;

FIG. 4 is a transverse section view through the head taken on the line 4—4 of FIG. 3;

FIG. 5 is an exploded view showing the hammer-head partially in section and showing the pin wheel unit detached therefrom;

FIG. 6 is a plan view of the instrument, exploded except for the connection between the pin wheel and the hammer-head and with the parts of one of the removable weights shown in exploded relation and in axial section; and

FIG. 7 is an end view of one of the tuning fork weights.

Referring now to the drawing in detail and in particular to FIGS. 1 and 6, my improved combination instrument comprises, in general, a tuning fork A; a hammer-head B; a pin wheel instrument C functioning as a detachable connection between the hammer head B and the tuning fork A; and a sensory brush instrument D which is normally housed in the hammer-head B.

Tuning fork A comprises a fork body 10 including a shank 11 which may be of square cross section, and a fork portion comprising furcations 12 and a shoulder 13 joining them to the shank 11. Shank 11 is provided with a spring-loaded poppet 14 of well known construction consisting of a small steel ball contained within a transverse bore in shank 11, engaged by a small coil-spring under compression betwen the ball and the bottom of the bore, and caged in the bore by an overhanging lip at the outer end of the bore. Preferably, the bore is defined by a sleeve pressed into a bore in shank 11 as shown in FIG. 2.

The furcations 12 are of rectangular cross section, being of greater width in their side faces as seen in FIG. 6 than thickness as seen in FIG. 2. Furcations 12 are provided with narrow rectangular tips 16, squared shoulders

17 being defined at the bases of tip 16. The side faces of tips 16 are provided with parallel shallow grooves or striations 18 (FIG. 6) indented therein.

To each tip 16 is mounted a detachable weight assembly 19 for weighting the ends of the furcations 12 to produce a relatively low-pitch tone. Removal of weights 19 provides for production of a relatively high-pitch tone. Each weight assembly 19 comprises a collet jaw 20 having at one end a threaded stem 21 which is integral with the bottom of a cup at its other end, defining a rectangular socket 121 dimensioned to snugly receive a respective tip 16. The cup includes a skirt provided with three parallel axially extending slots 22 which collectively define a pair of yieldable quarter-segment jaw teeth on one side of the skirt, and on the opposite side a tooth consisting of a 180° segment. The skirt has a frusto-conical lateral surface 23 of low taper. A collet-closing collar 24, likewise of cup form, has a skirt with a frusto-conical internal wall 25 with a taper slightly less than that of the tapered surface 23, and a head provided with an internally threaded bore 26 adapted to be coupled to the stem 21. Collet collar 24 has a knurled outer surface 27 so that it may be gripped in the fingers and rotated so as to advance the mouth (forward portion of internal wall 25) of the collar against the tapered outer surface 23 of collet jaw 20, whereby to wedge the two quarter-segment teeth of the jaw 20 against adjacent corners of the tip 16 at one side thereof while the opposite side of the tip is wedged against the 180° segmental tooth of the jaw 20. Thus, the weight 19 is tightly clamped to the end of a respective furcation 12 so as to remain firmly anchored thereto throughout a number of soundings of the tuning fork.

Hammer-head B comprises a metal core member 30 which may be die cast, and a jacket 31 surrounding the same. Jacket 31 is of soft, resilient, elastic plastic material such as soft rubber. In side elevation, the head B is of approximately triangular form, and the core 30 is of substantially corresponding triangular form, of smaller dimension, and is molded into the jacket 31. Jacket 31 has along one lateral margin a web 37 having therein an elongated opening 32 to receive a neck portion 33 of core member 30. The opposite lateral margin is defined by a relatively thin marginal web 34. At its wider end, jacket 31 embodies a relatively thick, broad butt portion 35 with an arcuate, double-curved end face. At its opposite end, jacket 31 embodies a relatively deep but narrow and pointed apex 36. Thus the jacket 31 is entirely closed except for the opening 32 in the web 37. The relatively wide end portion of core 30 is of cylindrical tubular form and constitutes a scabbard 40 having a closed bottom bore in which the brush instrument D is normally housed, with a handle portion thereof projecting through an aligned circular aperture 41 in the lateral web 37 of jacket 31. The intermediate body portion of core 30, semicircular on one side and trapezoidal on its opposite side (FIG. 5), is in the form of a hollow sheath 42 defining with itself a correspondingly-shaped cavity 43 to receive the head portion of pin wheel instrument C. The narrow tapered end 44 of core 30 is in the form of a thin ear, and a correspondingly thin web 45 joins one end of scabbard 40 to the sheath 42. Sheath 42 has opposite outwardly bulged side portion 46 thereof, of generally L-shape, providing opposed lateral pockets 47 in respective sides of recess 43, to receive the harp portion of pin wheel in-

strument C as hereinafter described. In the outward leg of one of the bulged side portions 46 is a dimple 48 (FIG. 4) to receive a ball poppet in the pin wheel unit C.

Pin wheel instrument C comprises a tubular handle portion 51 having a rectangular socket 52 (FIG. 2) in which tuning fork shank 11 is snugly receivable; a transverse hilt 54 defining a closed end of socket 52 remote from the open end thereof which receives the shank 11, the hilt 54 extending diagonally at an inclination matching that of the lateral margin of jacket 31 defined by web 37 and opening 32; and an integral mounting hub 55 projecting from hilt 54 in alignment with handle portion 51. Hub 55 is of L-shape corresponding to the shape of pockets 47 within the laterally bulged portions 46 of casing 42, embodying a transverse leg 57 which functions to provide a socket for a spring-loaded poppet 58 which is adapted to couple with dimple 48 to latch the hub 55 in the pockets 47. The remainder of hub 55 consist of a pair of longitudinally extending fingers which are spaced by a slot in which is received a rotatable pin wheel comprising a hub 60 and a plurality of needle-point spikes 61 embedded therein and projecting radially therefrom. A screw 62 inserted through an aperture in one of the fingers of hub 55 and threaded into the opposite finger, provides an axle on which the pin wheel 60, 61 is freely rotatable.

The rotatable wheel element embodies an improved construction wherein the hub 60 comprises a pair of circular discs (FIG. 4) having registering radial half-sockets in opposed faces thereof (FIG. 5), the two discs being assembled with the spikes received in the sockets which are cooperatively defined by the opposed half-sockets, and soldered or brazed therein. One of the discs has a tubular hub 38 formed integrally therewith and extended through a central aperture in the other disc, the end of the hub being staked over to temporarily secure the discs and spikes in assembled relation. Assembly of the spikes between the hub discs to provide an accurately balanced wheel (with all spikes set to exactly the same radial depth) is effected by first assembling the full set of spikes in the half-sockets of one of the hub discs, supported on a horizontal surface with its half-sockets facing upwardly; positioning the spikes by a suitable jig element; applying a solder ring (thin washer) upon the assembly of spikes; assembling the other disc on top of the solder washer; and then applying heat and pressure to the assembly so as to flow a film of solder or brazing material around the spikes and onto both discs.

I have found that this procedure solves the very difficult problem of mounting the spikes in the wheel hub accurately at a common radius, and anchoring them securely enough to avoid them becoming loosened and dropping out of their sockets, a difficulty that was frequently encountered in earlier attempts to press the pins into bores in a one piece hub.

In one side wall member of handle 51 is a circular aperture 65 which is positioned to receive the ball poppet 14 of tuning fork shank 11, thereby to latch the shank 11 within the socket 52. The open end of handle 51 is provided with a yoke 66 comprising flaring shoulder fingers which are adapted to seat against correspondingly flaring shoulders 67 of the shoulder element 13 of the fork A. The hilt portion 54 of pin wheel instrument C is adapted to seat snugly against the diagonal outer side of pin wheel casing 42 and to be received in a portion of the recess 32 as best shown in FIG. 3.

Sensory brush D comprises a handle 70, a stem 71 projecting axially from handle 70, a brush 72 of camel's hair bristles suitably anchored to the end of stem 71 and projecting axially therefrom; and a cylindrical sleeve 73 slidable on stem 71 and adapted to confine a selected portion of the length of bristles 72 so as to regulate the stiffness of the projecting portion of the brush. Sleeve 73 also functions to confine the bristles for facilitating insertion of the brush into the scabbard 40, as suggested in FIG. 3.

Operation

In using the instrument as a hammer, all components thereof may remain fully assembled as in FIG. 1. The tuning fork furcations 12 will then function as a handle for the hammer of a suitable width to be easily retained in the hand. Either the broad head 35 or the narrow apex 36 of soft rubber jacket 35 may then be utilized for directing a blow against a selected portion of anatomy to test for deep tendon reflexes.

To use the instrument as a tuning fork, the handle portion 51 of pin wheel C is firmly grasped in one hand, the furcations 12 are grasped in the other hand and the shank 11 is pulled from the socket 52. The tuning fork may then be handled by grasping the shank 11 between the fingers and flipping the distal end of one of the furcations 12 against a solid body to cause the fork to ring. For a low note, the weights 19 may be removed. With the fork ringing, the shank 11 may be placed against a selected portion of anatomy for audio testing for air and bone conduction (e.g. at approximately 260 cycles per second) when the weights are removed; or for vibration sensation (e.g. at approximately 130 c.p.s.) with the weights attached. By utilizing different proportions in the furcations, and different weights, other frequencies can be provided.

In removing a weight 19, its collar 24 is given one complete turn and then pulled axially so as to pull the collet jaw 20 off of the tip 16 to which it is clinging.

The pin wheel instrument C is used for testing the level of skin sensation by rolling the points of spikes 61 along the patient's skin. In order to use the pin wheel instrument, the handle 51 is grasped firmly in one hand, the hammer-head B is grasped in the other hand with fingers exerting pressure adjacent opposite ends of opening 32, and the two components are then firmly pulled apart to remove the pin wheel head and its hub 55 from the confining recess 43. To return the pin wheel into the recess 43, it is firmly pushed into the recess until ball poppet 58 snaps into dimple 48. Preferably, the tuning fork is likewise detached from the instrument C, and the handle 51 is grasped for manipulating the instrument.

Sensory brush D is withdrawn from head B for use, and its bristle stiffness is adjusted by sliding sleeve 73 along stem 71.

I claim:

1. A medical diagnostic tuning fork embodying opposed furcations having respective tips at their free ends; and a pair of weights detachably connected to said free ends to provide for vibration at relatively low pitch in the range for testing vibration sensation, said tuning fork being vibratable at relatively high pitch in the range for audio testing for air and bone conduction when said weights are detached, each of said weights conprising a collet jaw having at one end a socket proportioned to snugly receive a respective furcation tip and having at its other end a threaded stem, and a collet-closing collar having an internally-threaded head for threaded coupling to said stem, and a skirt portion having a frusto-conical internal wall cooperable with said collet jaw to wedge the same into tight clamping engagement with said tip.

2. A tuning fork as defined in claim 1, wherein each of said tips is of reduced width and including a pair of transverse shoulders at the base of said tip at opposite sides of the furcation; and wherein said collet jaw comprises a cup including a slotted skirt consisting of circumferentially spaced teeth collectively defining said socket said slotted skirt being positioned against said shoulder, and said threaded stem projecting from the bottom of said cup and threaded into one end of said collar, said skirt portion of said collar encircling said teeth and engaging them with a wedging action.

3. A tuning fork as defined in claim 2, wherein said collet jaw cup has a frusto-conical outer wall flaring outwardly away from said stem, and wherein said collar has a frusto-conical inner wall of slightly less taper than

the taper of said outer wall when said teeth are unstressed.

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RICHARD A. GAUDET, *Primary Examiner.*

R. E. MORGAN, *Examiner.*

K. L. HOWELL, *Assistant Examiner.*