

[54] **INTEGRATED AND FUNCTIONALLY
IMPROVED ELECTRIC ERASING
MACHINE AND ACCESSORY TOOL**

[72] Inventor: **Louis J. Misuraca**, 1359 Romulus
Drive, Glendale, Calif. 91205

[22] Filed: **Sept. 9, 1970**

[21] Appl. No.: **70,710**

[52] U.S. Cl. **74/527**, 15/3.53, 310/47,
310/50

[51] Int. Cl. **G05g 5/06**

[58] Field of Search 74/527; 15/3.53; 310/47, 50;
287/53 R

[56] **References Cited**

UNITED STATES PATENTS

R25,804	6/1965	Misuraca	15/3.53 X
2,600,946	6/1952	Voedisch	287/53 R
2,874,985	2/1959	March	287/53 R
3,021,723	2/1962	Happe	74/527

Primary Examiner—Milton Kaufman
Attorney—Edwin E. Greigg

[57] **ABSTRACT**

The application discloses a hand-held and directed tool, typified herein as an electric erasing machine, embodying an electric motor equipped with a tubular shaft supported in a housing which provides resiliently mounted, preloaded ball bearings therefor, the shaft having precisely concentric, self-holding, tapered end portions forming external, frusto-conical seats upon which to rapidly mount chucks or other tools, either singly or plurally, and having slotted ends or other suitable means engageable by concomitant, restrictive means integral with the housing for holding, or locking the shaft against rotation whenever necessitated for the manual application or removal of tools or accessory devices. The shaft is especially processed to provide precisely concentric (rotational) mounting and operation of any compatible tool or accessory applied thereon; said application (or removal) being accomplished instantly.

11 Claims, 11 Drawing Figures

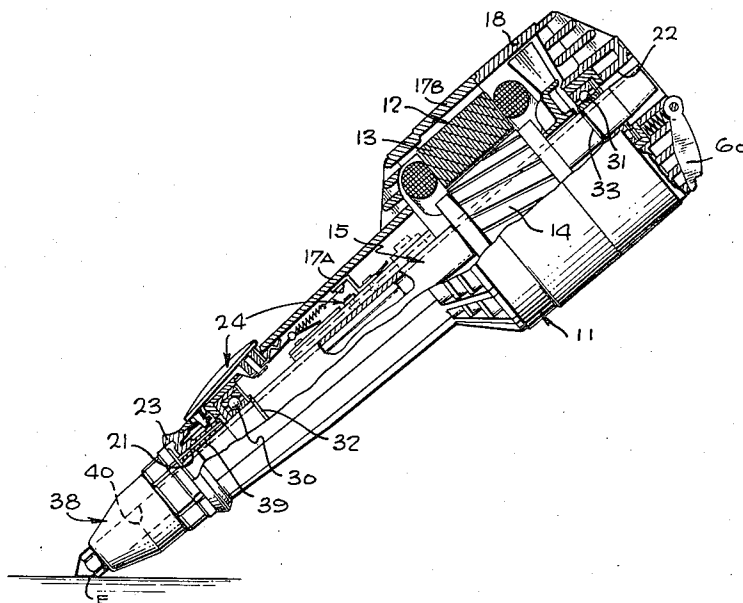


Fig. 1

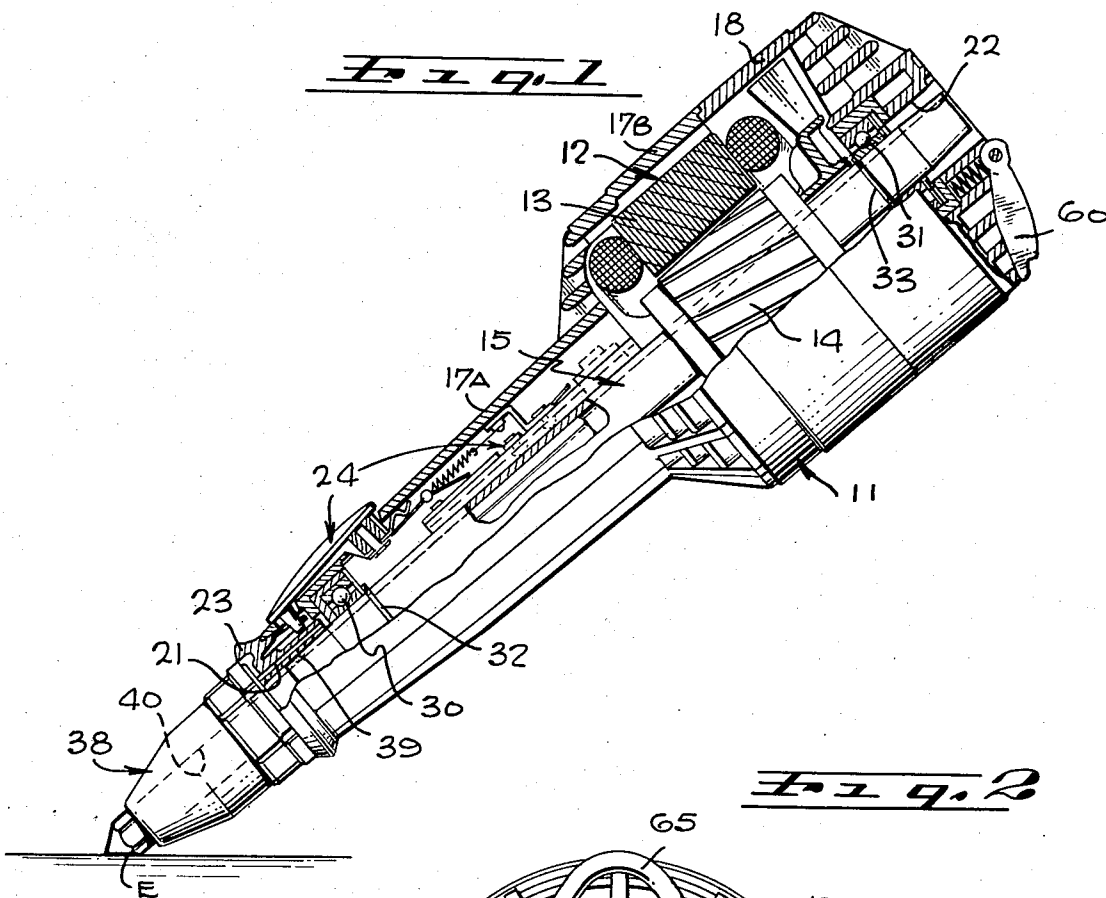


Fig. 2

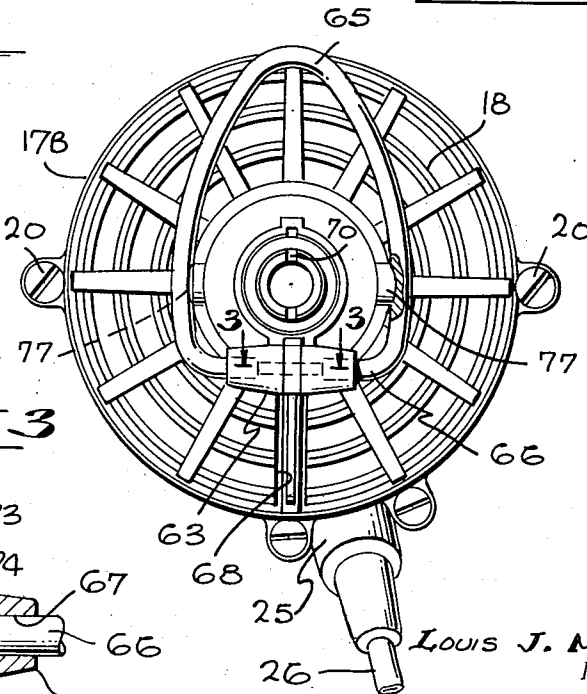
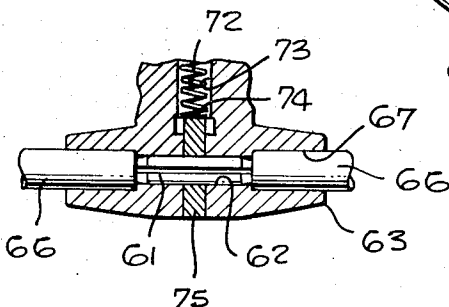


Fig. 3



LOUIS J. MISURACA
INVENTOR.

BY *Edwin L. Geigg*
ATTORNEY

Fig. 4

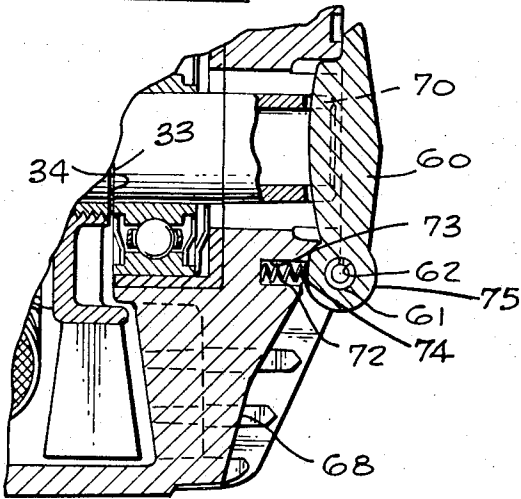


Fig. 5

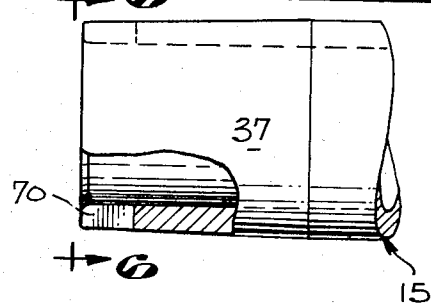


Fig. 6

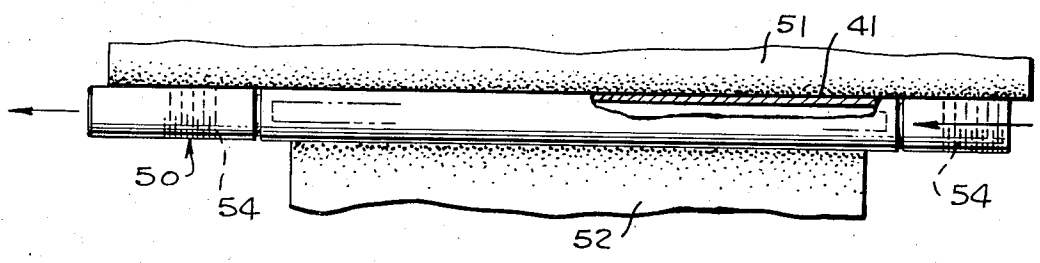
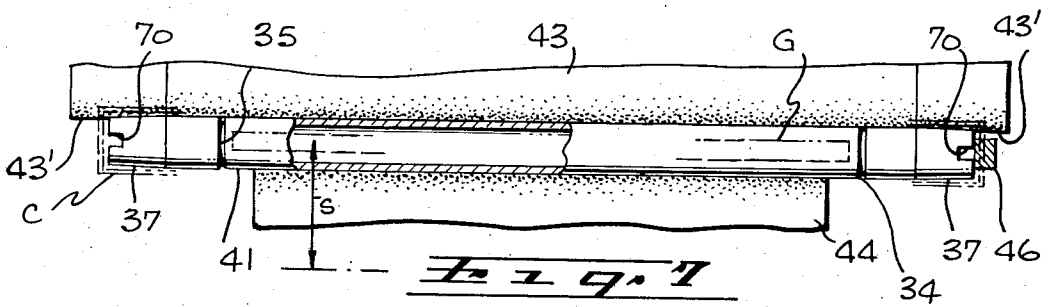
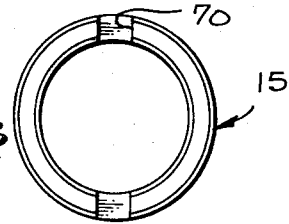


Fig. 8

INVENTOR.
LOUIS J. MISURACA
BY

ATTORNEY

Fig. 9

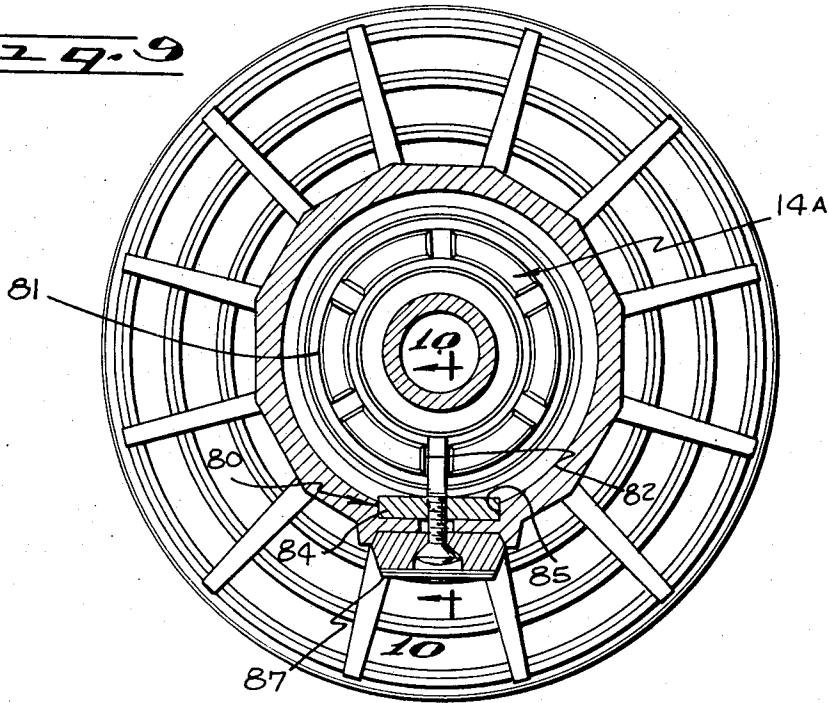


Fig. 10

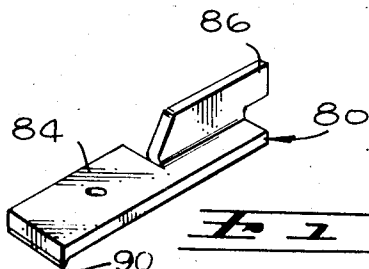
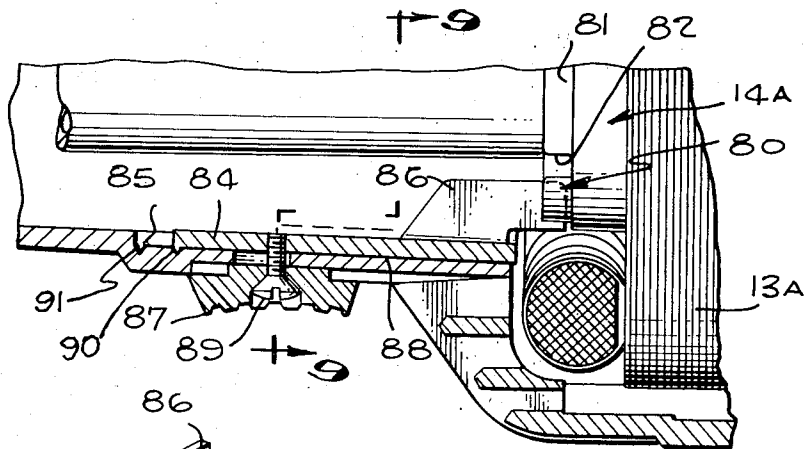


Fig. 11

INVENTOR.
LOUIS J. MISURACA

BY

ATTORNEY

INTEGRATED AND FUNCTIONALLY IMPROVED ELECTRIC ERASING MACHINE AND ACCESSORY TOOL

My invention relates generally to small, motorized hand tools of the rotating type, such as electric erasing machines, hand grinders, drilling and polishing machines and the like, embodying an electric motor with a relatively large bore hollow shaft and chucking means for firmly gripping an eraser or other tool element movably received in and accommodated by the shaft for the work in hand.

The first tubular shaft erasing machine was disclosed in my U.S. Pat. No. 2,123,339, issued in 1938. Subsequently, in U.S. Pat. No. 2,242,475 there is disclosed a machine embodying a new configuration for more comfortable and compatible hand support. This machine also provided additional devices for supplementary utility, such as intermittent on-off or lockable "on" switch for less tiring use in extensive work, together with a safety promoting, hang-up ring at the rear. This general configuration and design is now accepted and considered as the "standard" format in the industry. Further improvements of mine to this field have included a completely automatic chuck (to eliminate constant manual re-chucking), keyed to a polygonal, self-driven eraser of absolutely non-slip action, to forestall frequent chuck deterioration and replacement due to slippage and abrasive wear of gripping elements thereof. Said improvements are disclosed in U.S. Pat. Nos. 3,070,379 (Re. 25,804) and 3,224,419.

My present invention includes novel constructive and associated methods whereby to substantially upgrade and further improve rotary hand tools, especially erasing machines, hand grinders and similar devices to achieve more efficient and superior, consumer-aiding products, including lower unit costs.

Present conventional erasing machines with tubular shafts for accommodating the long, seven or eight-inch, extended life erasers of various colors and abrasive grades, and mounting the necessary chuck therefor, almost invariably suffer from induced vibrations, and associated deleterious effects, caused by the eccentricities, or lack of precise axial alignment, in both radial and axial parameters, of the chuck or other tool holding means which currently are detachably joined to the thin tubular shaft by the use of extra fine pitch screw threads, of doubtful concentric and angular integrity, and also by additional eccentric loadings imposed upon the shaft, such as fan and rotor masses, the latter being regularly applied to the relatively delicate shaft by crude, distorting means, such as coarse knurling applied after the shaft has been carefully finish-ground for bearing size and overall straightness, by (through-feed), centerless grinding. These coarse and deteriorating methods not only produce angular diversions and caved-in areas in the tubular shaft (sometimes preventing actual hexagonal eraser acceptance) but in addition, also inevitably destroying the possibility of precise, concentric mounting of chucks and other devices. The almost unfailing result is machine and tool vibration and concomitant loss of efficiency, detracting considerably from both user comfort and smooth, fast work accomplishment.

An object of my invention is to provide a novel motorized eraser so fabricated as to obviate the numerous shortcomings of present machines of this type which employ tubular shafts which are threaded for the mounting of chucks and other attachments, said threading usually resulting in eccentrically affixed and generally misaligned tools, as recited. In this connection it is an object to provide a motorized hand tool with a tubular shaft arranged at one or both ends with a frusto-conical, self-holding, tapered seat upon which to manually mount a chuck or other tool either singly or simultaneously, such as, for example, an eraser chuck at the forward end and a mechanical (pencil) lead pointer at the rear position.

Another object is to eliminate costly, time-consuming, and downgrading second-operation machine work of tubular, hollow shafts used in the art, including turning, grooving, slotting, milling, threading, knurling and similar re-chuckings and reworkings, in order to preserve and not destroy the accuracies inherent in the same after it has been centerless ground in a single operation for its full length; and to replace such detracting means with lower cost, novel concepts and procedures by which exactly concentric and precisely aligned tool operations are permanently achieved and assured thereafter; tool runouts being production held within plus or minus two or three ten thousandths of an inch (.0002 - .0003 inch), as contrasted with present eccentric runouts as high as four to eight thousandths (.004 - .008 inch), *t. i. r.* (total indicator reading), at point of tool application.

Another object of my invention is the total avoidance of all machine operations or processing after the single-grind cycle, and the inflexible execution of all machine work previous to the few seconds of in-feed centerless grinding of the entire O.D. of the shaft in one simultaneous setup, including the long central diameter (for bearing size push fit), and the taper end seats, utilizing a hardened, precision template for dressing the grinding wheel (with follower diamond) and redressing at any required time to establish and maintain the exact contour for repetitive production parts in any required quantity.

By eliminating the present method, of first running all shafts through a centerless grinding machine (for bearing size and straightness only), (using the through-feed process), and subsequently following this with numerous second-operation machining procedures, such as threading, grooving, knurling, etc., and substituting my new, improved method, I not only achieve very superior results but do so at lower unit cost. I mention here that any and all machine work operations required in my improved shaft are all completed before the single-cycle, in-feed centerless grinding operation which completes the shaft in its entire length and, by contrast, avoids all deleterious results of present methods.

A further object and accomplishment of my invention is the integral inclusion in my improved machine, of self-contained means for quickly locking the tubular shaft against rotation at any time required (to manually apply or remove a given tool). With the motor deenergized, this is rapidly accomplished without (as is presently the usual case) having to find a screwdriver or other tool to implement this objective. With my self-holding taper-socketed tools and tapered shaft ends,

my new method provides the quickest and simplest means for mounting or removing any tool on or off the shaft, yet devised, and the most positive and accurate. A minor manual twist and simultaneous pull (or push, as the case may be), is all that is needed. In other words, the given tool is wrung on or off the shaft at will whenever the latter is purposely rotationally locked. Contrarywise, no tool so mounted will spin off, fall off, vibrate off or otherwise be displaced, not even with a direct manual pull; only a deliberate wringing action by deliberate operator choice will accomplish this result.

In summary, it is an object to provide a hand tool embodying a housing serving to contain an electric motor with a hollow relatively thin wall, large bore shaft having self-holding, tapered seats at its external ends for mounting one or more chucks, tools or accessory elements thereon, and novel, integral, manually operable means for firmly holding the shaft against rotation to permit the instant manual mounting or demounting of an element on the end of the shaft; together with an improved method for producing such a tool.

These and other objects will become apparent from the drawings and the following description. In reference to the drawings, which are for illustrative purposes only:

FIG. 1 is a longitudinal section view, partly in elevation, of a tool embodying the invention, shown disposed at the approximate angle at which it is normally held by the user;

FIG. 2 is an end elevational view of the rear of the tool of FIG. 1;

FIG. 3 is a fragmentary sectional view on line 3—3 of FIG. 2, but on an enlarged scale;

FIG. 4 is a fragmentary sectional view of the shaft-locking finger and the rear end of the shaft, in the same plane as FIG. 1, but on a larger scale;

FIG. 5 is a fragmentary elevational view of the front end of the shaft, partly broken away, and on a larger scale than FIG. 1;

FIG. 6 is an end elevational view on line 6—6 of FIG. 5;

FIG. 7 is a top plan view of the shaft being ground in a centerless grinding machine using the "in-feed" mode of processing, the view being somewhat diagrammatic as to the machine, the grinding (upper) and regulator (lower) wheels being fragmentarily shown with other parts indicated by broken lines;

FIG. 8 is a view similar to FIG. 7, but showing a conventional shaft being cylindrically ground for bearing size only in a centerless grinding machine using the "through-feed" mode of processing, with grinding and regulator wheels in fixed position, and the shafts being fed through from the right as indicated by arrows, turned and threaded portions being indicated on the shaft for reference only as they are later accomplished;

FIG. 9 is a cross-sectional view through a device similar to that shown in FIG. 1, but showing a modification in the form of an alternate shaft-locking means for use when tool-holding seats are required at both ends of the shaft, the plane of the view being on line 9—9 of FIG. 10;

FIG. 10 is a fragmentary sectional view on line 10—10 of FIG. 9; and

FIG. 11 is an isometric view of a locking plate or slide shown in FIG. 9.

More particularly describing the invention, numeral 11 generally designates a housing which may be of metal or high-impact ABS plastic. This encloses an electric motor 12 including a wound stator 13 and a rotor 14, the latter being mounted on a centrally disposed, generally cylindrical, elongated tubular motor shaft, designated generally by numeral 15, housing an eraser E or other element.

The housing includes an elongated tapering section 17A of gradually reducing diameter and generally of polygonal cross section reducing toward the forward end, and designed for comfortable, non-slip hand support, with a larger diameter section 17B at the rear. An end cap 18 is removably attached by recessed screws 20 to section 17B. Axially aligned openings 21 and 22 are provided in parts 17A and 18, respectively, the former being defined by the bore of the front cap and bezel 23 at the front end of section 17A. The tool has a precision, snap action switch 24 which is connected electrically (not shown) into the stator coil electrical supply circuit of the motor, and the housing has a split, interlocking and rearwardly projecting power cord strain relief extension 25 for fixedly retaining the conventional, end molded electric cord 26 with conductors connected to the motor and switch within the housing and which is provided with the normal two-prong molded plug (not shown) at its outward end, for connection to the regular electrical supply outlet.

The shaft 15 is preferably journaled in the housing by means of preloaded, resiliently mounted, conrad-type, precision ball bearings 30 and 31, which are double shielded and prelubricated, and located at opposite ends of the housing. Spring action, bearing retainer rings 32 and 33 are provided in premachined grooves 34 and 35, respectively, at proper locations on the shaft. The long cylindrical portion of the shaft 15 is of an exact size and is of a ground finish to present a slight interference fit to the inner races of the ball bearings 30 and 31, normally about .3748 inch in diameter.

It is a particular feature of my invention that I provide a hollow or tubular shaft with a self-holding frustoconical seat 37 on at least one end thereof on which I mount a chuck 38 having a matching tapered socket 39 at the rear end of the partially hexagonal bore or passage 40 through the chuck. Preferably a frusto-conical seat 37 is provided at each end of the shaft, as shown, so that another tool or accessory device can be mounted at either or both ends of the shaft as desired. The seats on the shaft are of moderate taper on a side, or in included angle, preferably of about 3° included angle, although a standard Morse, Jarno or other taper may be adopted and used as standard. The seats may be described as providing, in any case, a self-holding taper. The particular taper adopted for this purpose will naturally thereafter be maintained, both in reference to the shaft and for the matching tool sockets. Thus the chuck 38, or any other element, accessory or tool will have a proper socket for mounting on the shaft (or removal therefrom) by being "wrung" on or off, as the case may be. This is readily accomplished at any time by manually turning the chuck slightly (relative to the shaft) while simultaneously pulling or pushing, depending on the objective. Naturally, in order to succeed in this, it is necessary that the shaft be rotationally firmly locked to resist the manual

twisting moment; and also because the chuck or other tool cannot be properly affixed or removed from the shaft by a direct, axial pull or push, it requiring more than 100 lbs. to do this (in the pull instance) in the instance of sizes indicated, but easily achieved with a wringing action, I provide a self-contained means on the housing for locking the shaft against rotation, as subsequently will be described herein.

I assure an exact and precise contour and external finish on the shaft 15, for its entire and full length, in one short pass in a centerless grinding machine, only by utilizing the "in-feed" mode of handling. Diameters and configurations within plus or minus $\frac{1}{2}$ of one thousandths inch are easily held in this processing operation by experienced personnel. The long, central, cylindrical portion of the shaft 41, providing an exact fit for inner races of the ball bearings, and simultaneously, the precision and angularity of taper seats at the ends 37 are assured of absolute concentricity, one to the other, because these are all simultaneously ground at one and the same time and in the same pass in the grinder. While this operation could also be accomplished in one setup, between centers, on a cylindrical grinding machine, there would be little justification for the added manual labor cost entailed in the latter procedure; in fact, the taper accuracies obtained favor my "in-feed," centerless grinding option. Thus in FIG. 7, I diagram a large grinding wheel 43 (of proper grit and structure), and the regulating wheel 44, of a centerless grinding machine grinding one of my novel shafts, using the "in-feed" procedure. The machine is provided with a hardened, precision ground (and doweled), steel template with follower (not shown). This is utilized at any time needed, to diamond dress or re-dress the grinding wheel 43 for processing the production run in hand. Attention is directed to the slightly angled side faces 43' of the wheel, which form grind the seats 37 on the shaft. The total depth of recessing of the wheel for this job is below ten thousandths inch, .010". Nevertheless, a proprietary wheel will likely be retained for this particular job only, and be arbor-mounted and/or demounted as required. Numeral 46 designates a right-hand stop against which parts bear while being ground; shaft pressure is constant against this stop through action of the regulator wheel 44. Letter G indicates, in dotted outline, the carbide guide on which the shaft rotates lightly during the final grinding phase. The broken line C designates the generally vertical, gravity-feed chute fed by a small hand-loaded magazine above (not shown), which drops a single shaft on the lower guide G when the grinder crossfeed retracts the assembly to unload and reload parts each cycle. Arrow S indicates the approximate, short amplitude throw of cross slide movement. In the "in-feed" mode, the cross slide of the grinder carries the regulator wheel 44, the lower guide G, the stop 46, feed chute C, and connected parts. These all advance to the grinding wheel face in unison when an unground part is advanced forward to grind position. Cycle time per piece part in this operation will average about ten seconds, plus or minus.

In conventional motorized erasers, the chuck is mounted on the shaft by a fine threaded connection. The usual shaft thereof is also usually ground in a centerless grinding machine, but by contrast, utilizing the

"through-feed" mode of handling, and only for straightness and one (bearing) diameter, as shown in FIG. 8, wherein a present type of shaft 50 is shown in a centerless grinding machine with grinding wheel 51 and regulating wheel 52, it being understood that rather than the shaft being processed in a definite, fixed position, the shafts are axially pushed through the machine, one following the other, to finish-grind the cylindrical diameter only. The entire purpose, actually, is to achieve a fine finish (the inner race, ball bearing size) and to provide a close, repetitive "chucking surface" for the numerous, second-operation, machining sequences which are to follow.

Thus the difficulty and disadvantages of the conventional construction, as compared with my new design, is that after the shaft has been finish-ground, as by the means shown in FIG. 8, several succeeding operations, with concomitant re-chuckings, are required to provide the threaded end portions, shown by broken lines 54, reduced lead diameters, knurlings, etc., (not shown) for the purpose of attaching the chuck and rear holding spool; plus the rotor and later, the fan. These operations are not only expensive and time-consuming but inevitably result in somewhat out-of-round and out-of-concentric parts of the shaft. Knurling alone, being of relative coarseness, creates problems such as caved-in areas, occasionally to the point where hexagonal erasers will not pass through the shaft. In my new process I attach the rotor and later the fan to my shaft only by means of a drop of anaerobic sealant; achieving highly satisfactory results, without attendant problems, particularly related to tubular shafts. An epoxy or other plastic cement might be used to attach the rotor to the shaft, and for the purposes of this description, anaerobic sealant will be considered to be a species of plastic cement.

The surface provided on the shaft 15 and the conical seats 37 is extremely smooth and fine in finish; on the order of 4 to 6 microinches, r. m. s., when using a grinding wheel of fine grit and proper structure. However, in passing, it should be pointed out that with my procedure by the in-feed mode, as contrasted to the present, through-feed method, there is a partial gain in grinding cycle time per part, in favor of the latter; possibly in the neighborhood of 5 or 6 seconds. Nonetheless, this is more than overbalanced by the fact that my new option completely finishes the shaft in one pass through the centerless grinder, and that absolutely no machine work is imposed upon the shaft after grinding, thus achieving a totally superior result and at lower overall unit cost.

I contemplate that the chuck, pencil lead pointer, and other tools which I may mount on the shaft, either singly or in unison, may be of metal or of plastic, and if the latter, preferably of a high-impact ABS formulation, injection molded, with or without glass reinforcement, but certainly non-burning and non-dripping. In this process the taper socket in the tool is formed by an exactly centered and aligned central core in the mold, resulting in part concentricity superior to that of the usual, machined tolerances.

As previously indicated, the chuck or other tool with a frusto-conical socket, complementary to that of the seat 37, is applied to the shaft by a gentle wringing action, that is, as the shaft is held stationary against rota-

tion, the chuck or tool is pressed axially onto the seat while being simultaneously slightly rotated. Once so mounted, it is virtually impossible for the tool to be bumped off, vibrated off, or even pulled off directly with a straight pull; the latter requiring (in actual test) a pull of more than one hundred pounds, in the sizes used; almost impossible in manual context. In order to achieve this objective, the shaft must be firmly locked against rotation (with motor switch in the "off" position), and the chuck or tool slightly turned while pulling thereon. The obverse is the case when a tool is being applied. Thus it becomes an important part of my invention to provide, in conjunction with the tapered seat shaft and taper-socketed tools for mounting thereon, a concomitant, positive, self-contained means of locking the shaft against rotation. One such means is illustrated in FIGS. 1 - 6 and includes a finger 60 on the housing 18 which may be swung into position to engage the shaft 15 and fixedly lock it against turning. This finger is pivotally mounted on a hollow spring pin 61 in bore 62 of a boss 63 molded on the end cap 18 of the housing. The pin is removably retained in place by a spring wire, hang-up ring 65, the ends 66 of which are received in the taper-cored counterbores 67 at ends of bore 62. The housing is suitably recessed at 68 to partly receive the bulk of the finger in the latter's normally, inoperative position.

The end of the shaft 15 is provided with at least two centrally milled, axially extending slots 70 diametrically opposite each other at the end adjacent finger 60 for the reception of the same. When it is necessary to hold the shaft firmly against rotation, the motor is allowed to come to rest, the finger is swung from the position of FIG. 1 to that of FIG. 4, the chuck 38 being slightly rotated by hand, if necessary, to align the slots with the finger so that it can enter the same and thus prevent rotation of the shaft. With the shaft in this state, it is an easy matter to mount or demount the chuck 38 or another element on the front end of the shaft, by wringing it on or off of the seat 37, as previously described.

A light detent spring 72 in a cored hole 73 releasably holds the finger in usually retracted position, bearing against a tangential segment 74 on the otherwise circular hub portion 75 of the finger. Also, the hang-up ring 65 is releasably held in retracted position by indented reliefs 77 on the circular, label receiving portion of the housing.

In some cases I may wish to provide suitable aligned slots 70 at the front end of the shaft, engageable by a suitable hand tool when the chuck 38 is not in place; however, when the machine model specifies mountability of tools at both ends of the shaft, I prefer to eliminate the slots from the shaft entirely, and substitute an alternate method for locking the shaft against rotation as described below. This alternate system recommends itself especially when the chucks and other tools are of softer materials, such as plastics.

In FIGS. 9 - 11, I illustrate this alternate means for restricting shaft rotation, wherein a lock slide or lock plate 80 is used (in place of the finger 60) to engage a slotted annular ring 81 at the forward end of the rotor. This ring may be of aluminum and part of one of the and collector rings of the die-cast winding of the rotor. Although this winding is technically shorted, it

nevertheless alters polarity of the rotor pole faces (in phase with the changing stator poles), and in unison with the 60-cycle alternating supply current. In any case this annular ring 81 has two or more diametrically opposed slots 82 which extend axially of the ring a limited distance. For use in conjunction with said slots I provide the aforementioned slideable lock plate 80 which includes a main section 84 that moves longitudinally in a recessed guide 85 in the housing, together with an upstanding portion 86 adapted to enter any one of the off-center slots 82 in ring 81. The lock plate is easily manually operated by means of an external button 87 on the underside of the housing riding in an aligned recess 88 therein, the parts being connected by a screw 89. There is purposely a slight spring tension in this assembly and, in addition, a small, spring-action detent 90 and groove 91 to prevent inadvertent engagement of the lock plate 80 and annular ring 81 except by specific desire of the machine operator.

It will be apparent that the lock means shown in FIGS. 9 - 11 is effective to restrain the shaft against rotation when desired for the purpose of installing or removing a chuck or other tool at either end of the shaft 25A. The latter, of course, need not be provided with the slots 70 previously described. It is also obvious that this alternate system, when called for by machine configuration and model type, requires a minimum of machining and/or rework in assembly operations.

I claim:

1. A hand tool comprising a housing having openings at opposite ends, an electric motor mounted in the housing, a tubular shaft journaled in the housing and extending through and fixed to the rotor of the motor, said shaft being in alignment with and extending between the openings in the housing, one end of said shaft being axially slotted, and a finger pivotally mounted at the end of said housing corresponding to said one end of the shaft and manually movable to a position to be received in the slotted end portion of said shaft.

2. The hand tool set forth in claim 1 in which said finger is mounted on the exterior of the end of said housing and in which said housing is provided with a groove extending radially of the shaft for at least partially receiving said finger when the same is retracted.

3. The hand tool set forth in claim 1 in which said shaft is externally tapered at both ends.

4. The hand tool set forth in claim 1 in which said shaft is provided with frusto-conical self-holding tapered seats externally on both ends for application of tools at both ends selectively.

5. The hand tool set forth in claim 1 in which the other end of the shaft has an external frusto-conical seat of self-holding taper, and an element mounted on said seat of the shaft, said element having an internal socket corresponding in taper to that of the seat on said shaft and being attached to the shaft only as the result of simultaneous application of axial and rotary force.

6. A hand tool comprising a housing with openings at both ends, an electric motor mounted within the housing, a tubular shaft with a relatively large bore journaled in the housing and drivingly connected to the motor, said shaft being in alignment with, and accessible through said openings from either end of said housing, and having external, self-holding tapered end portions

of frusto-conical configuration upon which to mount a chuck, either singly or plurally, and normally disengaged manually operable interengaging means on said shaft and said housing effective, when engaged, to restrict rotation of said shaft, said interengaging means comprising a finger pivotally mounted on the housing and a slotted end portion of the shaft for receiving said finger.

7. A hand tool as claimed in claim 6 comprising an electric erasing machine and accessory tool, said shaft being receptive of tools or accessories with internal self-holding taper shanks matching those of the shaft tapered end portions, said tools or accessories being attached thereto, as well as removed therefrom, as a result of manual application or wringing force applied thereto when said shaft is selectively prevented from rotation.

8. A hand tool comprising a housing with openings at both ends, an electric motor mounted within the housing, a tubular shaft with a relatively large bore journaled in the housing and drivingly connected to the motor, said shaft being in alignment with, and accessible through said openings from either end of said housing, and having external, self-holding tapered end portions of frusto-conical configuration upon which to mount a chuck, either singly or plurally, and normally disengaged manually operable interengaging means on said shaft and said housing effective, when engaged, to restrict rotation of said shaft, said interengaging means on the shaft and housing comprising an annular ring fixed to the shaft intermediate the ends thereof and provided with at least one axially extending slot or protuberance at one end and a locking member carried by the housing and selectively movable axially of the

shaft into and out of engagement with said slot or protuberance in the ring.

9. A hand tool as claimed in claim 8 comprising an electric erasing machine and accessory tool, said shaft being receptive of tools or accessories with internal self-holding taper shanks matching those of the shaft tapered end portions, said tools or accessories being attached thereto, as well as removed therefrom, as a result of manual application of wringing force applied thereto when said shaft is selectively prevented from rotation.

10. A hand tool as claimed in claim 9 in which the motor rotor includes a forward part which is integrally die-cast with at least one axially extending slot radially extending relative to its central diameter, and in which said locking member is selectively movable, said locking member being detented.

11. A hand tool comprising a housing having an opening at one end, an electric motor within the housing, a generally cylindrical hollow shaft journaled in the housing and extending through the rotor of the motor, said shaft being in alignment with said opening and having an external frusto-conical seat of self-holding taper at the end adjacent the opening, and an element mounted on said seat of the shaft, said element having an internal frusto-conical socket corresponding in taper to that of the seat on said shaft and being attached to the shaft only as the result of the simultaneous application of axial and rotary force, said motor rotor having a ring at one end presenting at least one axially extending slot open at one end and said housing being provided with a locking member selectively movable axially of the shaft into and out of said slot in the ring.

* * * * *

40

45

50

55

60

65