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A. G. STANLEY

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HAND TOOL FOR CUTTING WIRE, AND FOR HOLDING PIECES CUT THEREFROM

Original Filed March 29, 1956

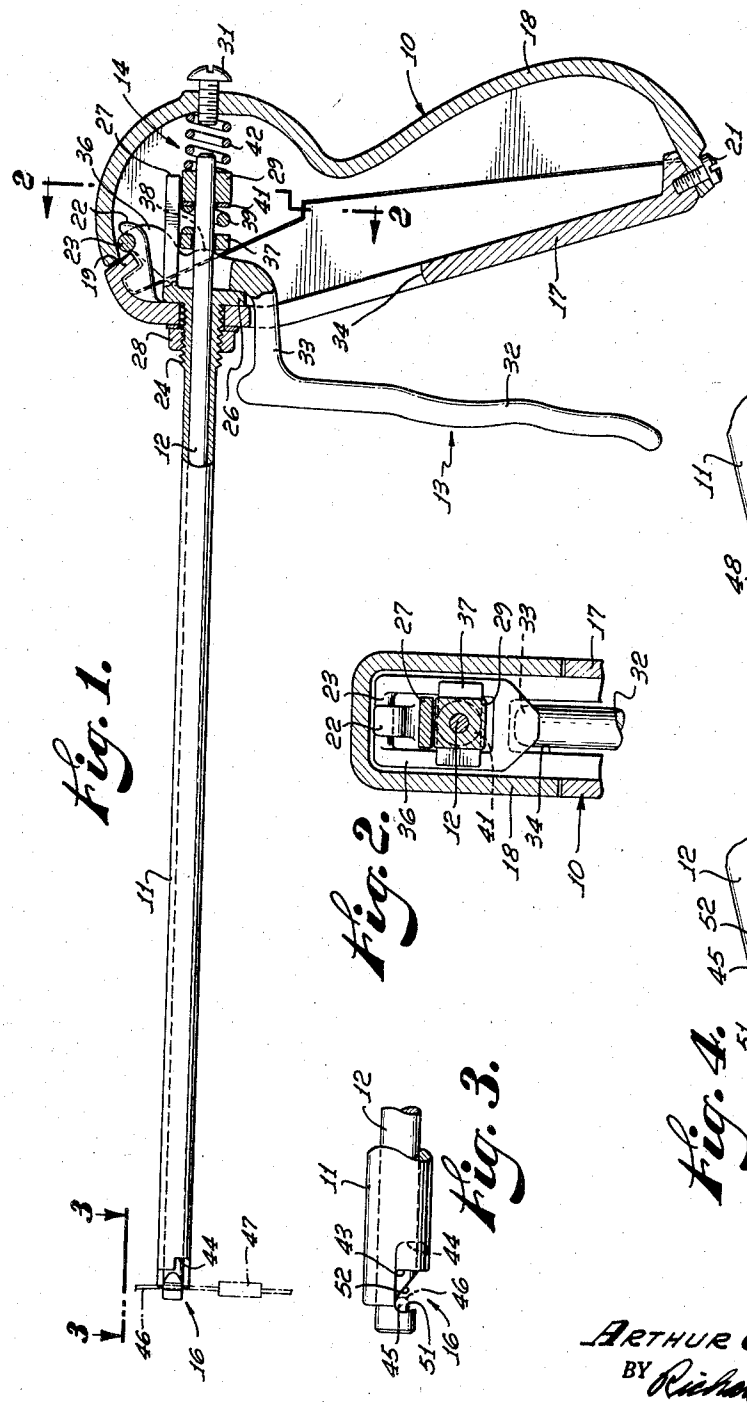


Fig. 1.

Fig. 2.

Fig. 3.

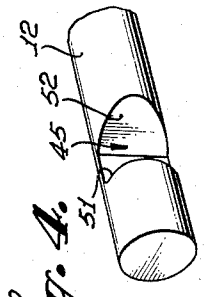


Fig. 4.

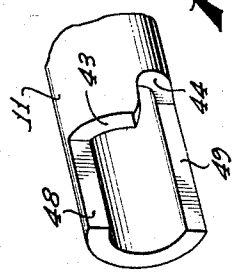


Fig. 5.

INVENTOR.

ARTHUR G. STANLEY

BY Richard L. Sharwitz

ATTORNEY.

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HAND TOOL FOR CUTTING WIRE, AND FOR HOLDING PIECES CUT THEREFROM

Arthur G. Stanley, Los Angeles, Calif.

Continuation of application Serial No. 574,927, March 29, 1956. This application July 8, 1957, Serial No. 673,551

12 Claims. (Cl. 30—131)

This invention relates to a wire cutting tool, and more particularly to a gun-shaped hand tool for cutting and holding wire, and pieces cut therefrom, through use of only one hand and in relatively inaccessible locations. The tool is particularly adapted for cutting wire formed of soft metal such as copper.

This application constitutes a continuation of my co-pending application Serial Number 574,927, filed March 29, 1956, now abandoned for Hand Tool for Cutting, Holding and Bending Wire.

An electronic technician working with the electric wiring in the chassis of a radio or television set, for example, must frequently remove a circuit component such as a small resistor or capacitor. Such removal must frequently take place from a relatively inaccessible area, for example one deep inside the chassis, and is very difficult to perform with conventional equipment.

In the assembly of electronic equipment, particularly where high frequencies are to be employed, it is important that each lead end be cut off short and then covered with a ball of solder. This is because the high frequencies tend to emanate from any exposed lead ends, and result in impairment of the functioning of the equipment. This operation is referred to as lead dressing.

With conventional wire cutting apparatus, it is impractical or impossible to effect such lead dressing without resulting in dropping of the cut-off ends into the equipment. This may result in short circuits or intermittents, with consequent improper functioning of the equipment. It is not only important that the lead ends be cut off and then held by the tool, so that they will not drop into the equipment, but also that they be held by the tool in such manner that they may be readily released from the tool after the same is withdrawn from the equipment being worked upon.

In view of the above factors, it is an object of the present invention to provide an improved hand tool which is operable with only one hand and in relatively inaccessible areas to perform cutting of wires, and holding of severed portions thereof.

An additional object is to provide a hand tool which operates to cut wires by a shearing action and which is adapted after shearing to hold one portion of the wire sheared, whether such portion is long or extremely short, such holding being performed by use of novel spring-action means which operate substantially simultaneously with the shearing action to insure that the cut-off component may not fall away from the tool.

A further object is to provide a hand tool adapted closely to dress the lead ends in electronic equipment, and to hold the severed ends in the tool until it is removed from the equipment.

It is a further object to provide a hand tool adapted to cut off extremely short ends of leads, to hold such lead end loosely in the tool until the same is removed from the equipment, and thereafter to discharge such lead ends from the tool in a highly simple manner.

A further object is to provide a hand tool for cutting

off the ends of leads, thereafter impelling such cut-off ends into a chamber, and thereafter discharging such ends from the chamber after the tool is withdrawn from the equipment being worked upon.

A further object is to provide a tool constructed entirely of metal, as distinguished from rubber, so that it may be used in conjunction with a soldering iron or other heat-producing element.

These and other objects and advantages of the invention will be more fully set forth in the following specification and claims, which are to be considered in connection with the attached drawing to which they relate.

In the drawing:

Figure 1 is a view, partly in side elevation and partly in vertical central section, illustrating one form of the hand tool of the invention;

Figure 2 is a fragmentary transverse sectional view taken on line 2—2 of Figure 1, and looking in the direction of the arrows;

Figure 3 is an enlarged plan view of the tip or barrel end of the tool, as viewed from station 3—3 in Figure 1, showing the relationship between the shearing land and the notch in the end of the actuating rod;

Figure 4 is an enlarged isometric view of the outer end of the actuating rod and the notch therein; and

Figure 5 is an enlarged isometric view of the end of the barrel, illustrating the shearing land and the holding land.

Referring to the drawing, the tool of the invention may be seen to comprise generally a grip handle **10**, which is shaped to be gripped like a gun handle, and a small diameter barrel **11** fixedly secured to the handle **10** in the manner of a gun barrel and extending for a substantial distance from such handle. The tool further comprises an actuating rod **12** mounted within the barrel and slidable relative thereto, trigger or lever means **13** for shifting the rod **12** relative to the barrel to perform a cutting or holding function at the barrel end, and spring means **14** to insure that a desired holding function takes place at the barrel end. The construction of the barrel **11** and actuating rod **12** at their ends remote from the handle **10** is of extreme importance to the present invention, and may be appropriately indicated as shearing and holding means **16** at the barrel end.

The handle **10** is preferably formed as two hollow cast components **17** and **18** which fit together in such manner as to define a chamber in which the spring means **14**, and certain other components, are provided. The forward handle casting **17** is formed at its upper end with an inwardly extending hook or flange **19** adapted to be inserted in corresponding notches in the upper end of casting **18** for the purpose of holding the upper casting ends together. Accordingly, when a screw **21** is inserted through the lower casting ends the handle is held in rigid assembled relationship. An upwardly hooked journal element **22** is formed integral with the upper end of casting **17** and is adapted to receive, and form a pivot mounting for, a pivot portion **23** at one end of trigger or lever means **13**.

The barrel **11** is preferably tubular in shape and is formed, at least at its outer end, of a metal such as hardened steel which will not wear appreciably due to the operation of the shearing and holding means **16**. The inner end of barrel **11** is provided with an enlarged threaded portion **24** which is inserted through an opening in the upper part of handle casting **17**. The extreme inner end of the barrel has a radial flange **26** connecting with a projection **27**, the latter being parallel to but radially offset from the main body of the barrel. A nut **28** is threaded over portion **24** on the outside of the handle so as to draw flange **26** against the handle casting and thus effect a firm and rigid mounting of barrel **11** on the handle.

Projection **27** is relatively wide and flat (Figure 2) and

is adapted to ride over a square washer or flange **29** on actuating rod **12**. The washer **29** is rigidly secured to the rod **12**, for example by welding, and its upper surface is disposed sufficiently close to projection **27** that rotation of the rod through any appreciable angle is prevented. This serves to maintain the elements of the shearing and holding means **16** at the barrel end in the desired rotated relationship.

Actuating rod **12** is a solid metal cylinder which fits closely in the tubular barrel **11** but is adapted to slide relatively freely therein, as previously indicated. The rod **12** is formed, at least at its forward or outer end, of a wear resistant metal such as hardened steel. The rear end of the rod **12** extends into the handle and is axially aligned with a screw **31** which is threaded through the rear side of handle casting **18**.

The trigger or lever means **13** is formed with a finger grip portion **32** which extends downwardly beneath barrel **11** forwardly of handle **10** and is adapted to be pivoted toward the handle by the fingers of the operator. The palm and thumb of the operator are grasped around the lower or grip portion of the handle body. Formed integral with the upper end of finger grip portion **32** is a connecting portion **33** which extends rearwardly and generally parallel to barrel **11** through a vertical slot **34** in handle casting **17**. Connector **33** is, in turn, integral with a yoke portion **36** of the trigger means. The yoke extends upwardly on opposite sides of actuating rod **12** and projection **27** for connection to the previously mentioned pivot portion **23**, with which it is integral. It will be seen that the pivot portion **23** may rotate in journal element or portion **22** of the handle casting **17** when the grip of the operator between the handle and finger grip portion **32** is tightened.

Proceeding next to a description of the spring means **14** and closely related elements, a rectangular bar or washer **37** is slidably mounted on rod **12** and has sufficient width that it will be engaged by cam rises or protuberances **38** on the rear edges of the arms of yoke **36**. A strong, stiff helical spring **39** is mounted around actuating rod **12** rearwardly of washer **37** and bears at its rear end against a shim **41** which is slidably mounted on the rod against washer **29**. A helical compression spring **42**, which is much weaker than spring **39**, is seated between washer **29** and handle casting **17**, being held in position by the inwardly projecting end of screw **31** and by the projecting end of rod **12**. Spring **39** is at free length except at certain times while the trigger **13** is squeezed. Spring **42** is preferably under some compression at all times.

When the trigger means **13** is pivoted rearwardly, the cam rises **38** bear against washer **37**, which operates through strong spring **39** to cause rearward shifting of shim **41**, washer **29** and rod **12**. This rearward shifting can continue until the finger grip portion **32** engages handle element **17**, and effects compression of return spring **42** so that upon release of the trigger the parts will return to their illustrated positions. Spring **39**, being much stronger than spring **42**, does not compress substantially unless a wire cutting operation is taking place as will be described below.

The outermost position of the rod **12** may be adjusted by using shims **41** of different thicknesses. This is because shim thickness is a factor in holding the rod **12** in a certain position, when trigger **13** is released, despite forward pressing by return spring **42** which urges the yoke portion **36** of the trigger against barrel flange **26**, the latter then acting as a stop.

The shearing and holding means **16** at the outer end portion of barrel **11** and rod **12** will next be described. Generally stated, these means comprise a shearing land **43** at the end of barrel **11**, a holding land **44** also at the barrel end but substantially closer to handle **10**, and a shearing and holding notch **45** in actuating rod **12**. Notch **45** is shaped to fit over a wire, such as the one

46 shown in phantom in Figures 1 and 3, and move it against first the shearing land and then the holding land so that a resistor element **47** connected to the wire will not drop away from the tool when shearing occurs.

In greater detail, one side of the barrel tip is cut off so as to form upper and lower longitudinal edge faces **48** and **49** (Figure 5) which lie in a common plane containing the axis of the barrel and rod and also containing the axis of handle **10**. Face **48** extends rearwardly until it meets one end of the shearing land **43**, the latter lying in a transverse plane perpendicular to the barrel axis. Shearing land extends approximately 90° away from face **48** where it meets the holding land **44**. The holding land curves rearwardly and then forwardly again to merge with face **49**, so that the holding land comprises a notch in the barrel tip as best shown in Figures 3 and 5. The primary portion of holding land **44** is the portion parallel to shearing land **43**, and closest to handle **10**. This portion will hereinafter be referred to as the holding land, unless otherwise indicated.

The notch **45** in the end of rod **12** is cut vertically on the same side of the barrel as the shearing and holding lands, and extends at its bottom to the plane of faces **48** and **49**. The forward or outer wall **51** of the notch is generally transverse or perpendicular to the barrel axis, but the rear wall **52** thereof is inclined or tapered rearwardly.

Operation

In the operation of the hand tool, let it be assumed first that it is desired to remove a resistance element **47** from a maze of wires and circuit components deep inside of the chassis of an electronic device. The operator then grasps the handle **10** and trigger **13** with one hand, and inserts barrel **11** into the chassis. The bottom wall of notch **45** in the rod end is then pressed against wire **46** on one side of resistor **47**, such positioning being facilitated due to the presence of the sloping notch wall **52**. The trigger **13** is then squeezed to effect rearward shifting of rod **12** until wire **46** is subjected to a shearing action between shearing land **43** and the tip of rod **12** adjacent the upper side of notch wall **51**. As the trigger is further squeezed, the strong spring **39** will be compressed or loaded due to the fact that the wire prevents a further rearward movement of rod **12**. However, as soon as sufficient squeezing pressure is exerted, the wire **46** will shear off much in the manner of a blank in a punch press. The spring **39** will then release and operate substantially instantaneously to shift rod **12** rearwardly and cause shifting of one severed wire end against holding land **44**. The engagement of trigger portion **32** with handle portion **17** occurs sufficiently soon that a shearing action may not take place at holding land **44** regardless of the amount of pressure exerted by the operator upon the trigger or lever **13**. The operator then releases the trigger and performs the same operation on the other side of component **47**, but in this instance he does not release the trigger until the component **47** and connected wire have been removed from the chassis. Of course, in the last-mentioned operation the tool is so turned that the held wire end will be the one connected to resistor **47**.

The tool is also adapted to cut pieces of wire from the end of a length of wire, and to hold such pieces until the trigger is released by the operator. This takes place during the above-described lead dressing operations.

Where the end to be severed has a length greater than the internal diameter of barrel **11**, the operation is the same as above described. In such instances the severed end is held between holding land **44** and notch wall **51**. There will next be described the operation of the tool in situations where the end to be severed is shorter than the internal barrel diameter.

When an extremely short end is to be cut off, such end is disposed in the notch **45** forwardly of shearing land **43**, there being no portion of the wire disposed for-

wardly of holding land 44. Trigger portion 32 is then squeezed to effect first the loading of strong spring 39 and then the above-indicated shearing action between shearing land 43 and notch wall 51. Immediately upon occurrence of shearing, the loaded spring 39 releases and effects rapid acceleration of rod 12 rearwardly to cause notch 45 to move into the barrel 11. The notch 45 is shifted into the barrel sufficiently far that a substantially or fully closed chamber will be defined by the notch walls and by the interior barrel wall. Stated otherwise, the outer notch wall 51 is shifted sufficiently far rearwardly that it will be disposed either between holding land 44 and the handle, or so close to the holding land 44 that pieces disposed in the notch will not drop therefrom during movement of the tool.

It is to be understood that the short pieces severed from the wire tend to fly toward the handle, or toward the notch wall 52, because of the shearing action. Such flying action tends to cause the pieces to remain in the notch 45. Because of the extremely rapid shifting of the notch 45 into the barrel to form a substantial or fully closed chamber, the severed ends may not carom back out of the tool and drop into the equipment where they might create undesired short circuits. Even in situations where the severed ends do not fly rearwardly, the rapid rearward acceleration of notch wall 51 tends to draw the pieces rearwardly and maintain them in the notch 45 and thus in the chamber.

The pieces in the closed chamber defined by the notch walls and by the interior barrel wall may be extremely small, on the order of the size of a pin head or even a pin point, but are loosely contained within the chamber instead of being crushed or pinched therein. Because such severed ends are loosely contained, they will readily drop from the tool as soon as the tool has been removed from the equipment and the trigger means 13 released. This is important, and is to be compared with the crushing or pinching which occurs with certain other types of hand tools.

It is to be understood that the notch wall 51 is disposed further rearwardly when an extremely short piece is contained in the notch than when a longer piece is being held and the holding land 44 is employed. This is because the pinching action between the holding land 44 and notch wall 51 causes the stopping of rearward movement of rod 12 at such a position that the notch wall 51 is spaced from holding land 44 by the diameter of the wire. Spring 39 then loads slightly upon continued squeezing of trigger means 13. However, where there is an extremely short piece in the notch 45, so that the holding land 44 is not employed, the rearward shifting of rod 12 continues until trigger portion 32 engages handle portion 17. In such a situation there is no appreciable loading of spring 39, and the rod 12 is accordingly shifted rearwardly to such a position that notch wall 51 is inwardly of, or very close to, the bottom of holding land 44 to provide a fully or substantially closed chamber for the severed end.

The tool is readily assembled by merely inserting barrel 11 outwardly through its handle opening, before the handle casting 18 is assembled with casting 17 and mounting nut 28. The trigger means 13 are then mounted in position, with pivot portion 23 resting in journal element 22. Rod 12 is then inserted outwardly into the barrel 11 after mounting of the spring 39 and other elements thereon. The handle casting 18 is then assembled with casting 17, and at the same time the return spring 42 is seated between washer 29 and the casting 18 around screw 31. It is then merely necessary to insert the single screw 21 to hold all the parts in assembled relationship.

It is to be understood that the trigger or lever means 13 may be constructed of several components, connected either rigidly or in such manner that relative motion therebetween may occur. Also, it is to be understood that impact or power storage means may be incorporated in the device in order to permit cutting of relatively large or strong wire (such as made of iron) without requiring excessively hard squeezing on the trigger.

Various embodiments of the present invention, in addition to what has been illustrated and described in detail, may be employed without departing from the scope of the accompanying claims.

I claim:

1. A hand tool for cutting and holding wire, which comprises a handle shaped to be grasped by one hand of an operator, a generally tubular barrel connected at one end to said handle and projecting therefrom for a substantial distance, an actuating rod mounted in said barrel and extending for substantially the full length thereof, said rod being in surface engagement with the interior wall of said barrel but being longitudinally slidable relative thereto, lever or trigger means mounted on said handle and associated with said rod, said lever means being adapted to slide said rod toward said handle when squeezed toward said handle by said one hand of the operator, a shearing land formed on the other end of said barrel transversely of the axis thereof, a holding land formed on said barrel transversely of said axis, said holding land being adjacent said shearing land but closer to said handle, said shearing and holding lands being circumferentially offset to such positions that one section of wire severed by said shearing land will engage said holding land when shifted toward said handle, and means formed in said rod to effect shifting of said wire first against said shearing land and then against said holding land upon said sliding of said rod toward said handle.

2. The invention as claimed in claim 1, in which means are provided to prevent rotation of said rod in said barrel to thus maintain said last-named means in the desired rotated position relative to said lands.

3. The invention as claimed in claim 1, in which the last-named means comprises a notch in said rod.

4. A hand tool for cutting and holding wire, which comprises a hollow handle shaped like a gun handle for grasping by one hand of the operator, a tubular barrel rigidly connected to said handle and extending forwardly therefrom for a substantial distance, an actuating rod slidably mounted in said barrel in close-fitting relationship and extending into said handle, a flange rigidly associated with the end of said actuating rod disposed in said handle, return spring means provided between said handle and said flange, a lever or trigger pivotably connected to said handle and having a portion adapted to engage a washer slidably mounted on said actuating rod forwardly of said flange, said lever being adapted to be gripped by the said one hand of the operator to effect movement of said washer rearwardly toward said flange, a compression spring seated between said washer and flange, said spring being stronger than said return spring means, means to prevent rotation of said actuating rod in said barrel, and shearing and holding means formed on said actuating rod and said barrel at the ends thereof remote from said handle.

5. The invention as claimed in claim 4, in which said shearing and holding means comprises two longitudinal faces formed at the extreme outer end of said barrel and lying in a plane containing the axis of said barrel and the axis of said handle, a shearing land formed in said barrel and lying generally in a plane perpendicular to the axis of said barrel and connected to the rear end of the upper one of said faces, said shearing land extending for approximately 90° away from said upper face, a holding land formed in said barrel and extending from the end of said shearing land remote from said upper face toward said handle and then merging at its other end with the lower one of said faces, and a transverse notch formed in said actuating rod in axial alignment with said shearing and holding lands and having a bottom wall in substantially the same plane as said faces.

6. The invention as claimed in claim 4, in which said lever or trigger has one end portion pivotably connected to a journal portion of said handle and interiorly of said handle, and another portion extended outwardly through an opening in said handle for grasping by one hand of the operator.

7. The invention as claimed in claim 4, in which said handle is formed of two metal components connected together by a single screw.

8. The invention as claimed in claim 4, in which said shearing and holding means comprises a transverse notch formed in said actuating rod and having a wall disposed relatively remote from said handle, said wall being generally perpendicular to the axis of said barrel and actuating rod, a shearing land provided on the end portion of said barrel transversely of said axis and adapted to be associated with one end of said notch in a shearing action, and a holding land formed transversely of said axis relatively adjacent said handle as compared to said shearing land, said holding land being disposed and adapted to co-operate with the other end of said notch in a holding action after completion of shearing.

9. The invention as claimed in claim 8, in which rod may be shifted until said notch is substantially entirely inside of said barrel to provide a substantially closed chamber for short pieces cut from a wire end.

10. A hand tool for cutting and holding wire, which comprises a rod having a transverse notch in one portion thereof, said rod being formed of hard material at said notch, a barrel or sleeve enclosing said rod in slidable relationship and having a portion formed of hardened material, said barrel or sleeve being provided at said hardened portion with shearing and holding lands disposed transversely of said barrel and rod and circumferentially offset from each other for co-operation with a wall of said notch to provide a shearing action between said shearing land and one portion of said notch wall and a holding action between said holding land and another portion of said notch wall, said shearing land and said holding land being offset from each other longitudinally of said barrel, and means disposed relatively remote from said lands and said notch to effect longitudinal movement of said barrel relative to said rod to bring said notch wall into the region first of said shearing land and thereafter of said holding land to thus effect shearing of a wire and holding of one of the ends sheared.

11. The invention as claimed in claim 10, in which said last-named means includes resilient means adapted to be loaded during the shearing action between said notch wall and said shearing land, and released immediately upon completion of shearing to effect rapid movement of said notch wall and said holding land toward each other for substantially instantaneous gripping of one sheared end between said notch wall and said holding land.

12. The invention as claimed in claim 11, in which said resilient means is adapted to effect relative movement between said notch and barrel until said notch is substantially completely enclosed in said barrel in the absence of a holding action between said holding land and said notch wall, thereby to enclose extremely short pieces of severed wire in a substantially closed chamber defined by the notch walls and said barrel without effecting crushing or pinching of the severed piece.

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