

Oct. 29, 1963

G. H. GREEN
PRINTING HEAD

3,108,673

Filed Feb. 8, 1961

4 Sheets-Sheet 1

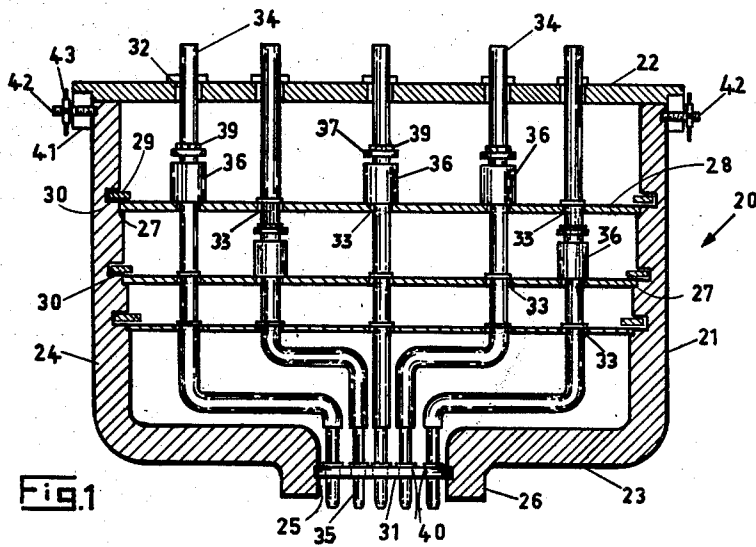


Fig. 1

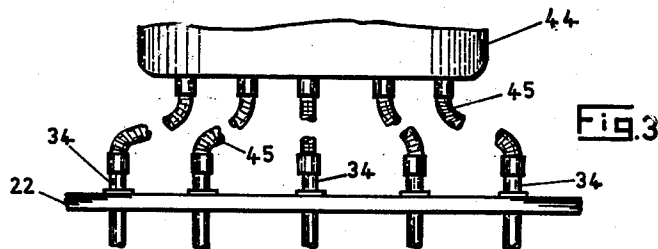


Fig. 3

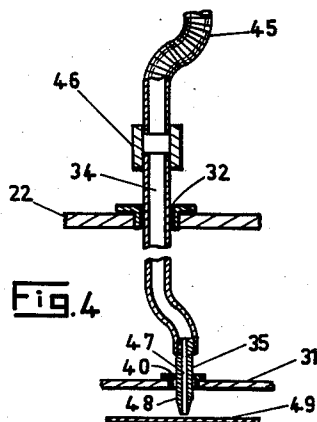


Fig. 4

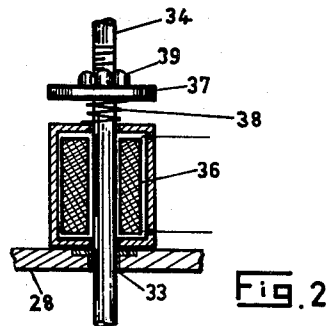


Fig. 2

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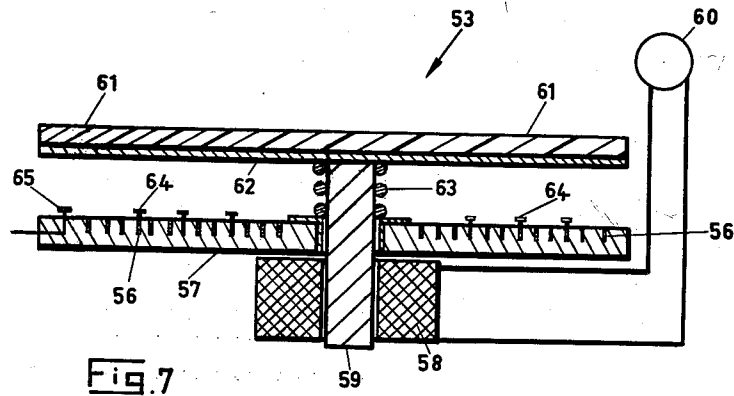
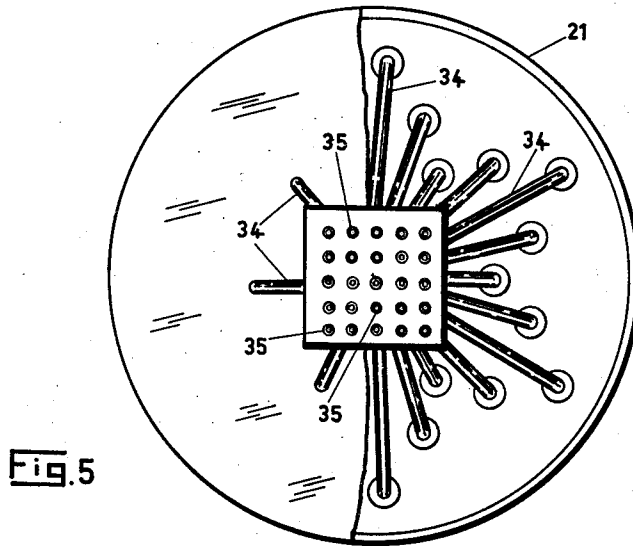
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4 Sheets-Sheet 3

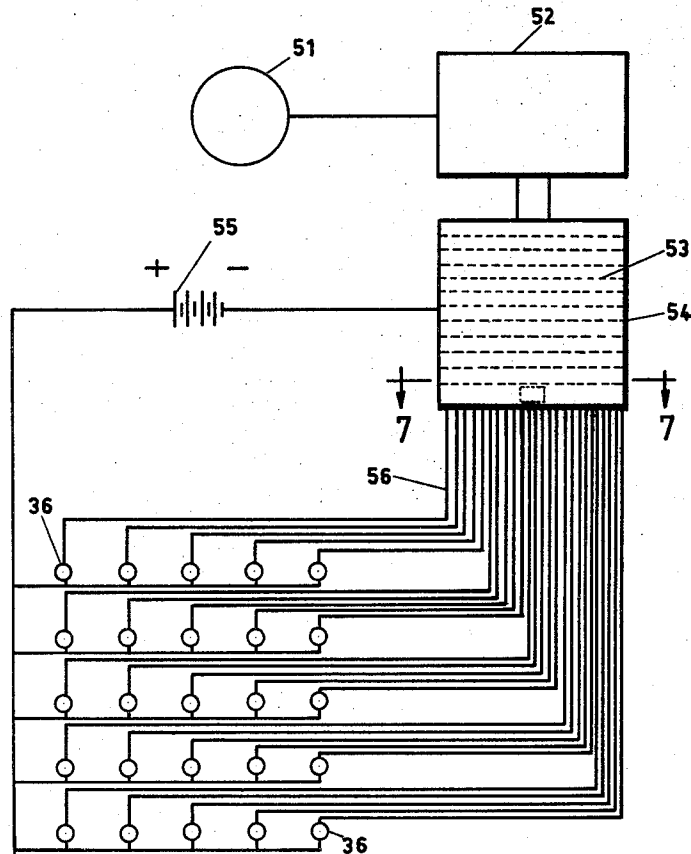


Fig. 6

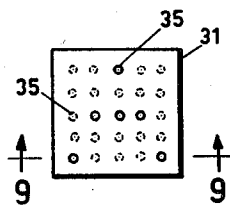


Fig. 8

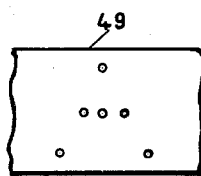


Fig. 10

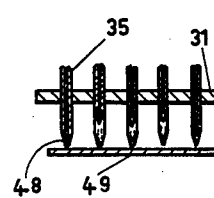


Fig. 9

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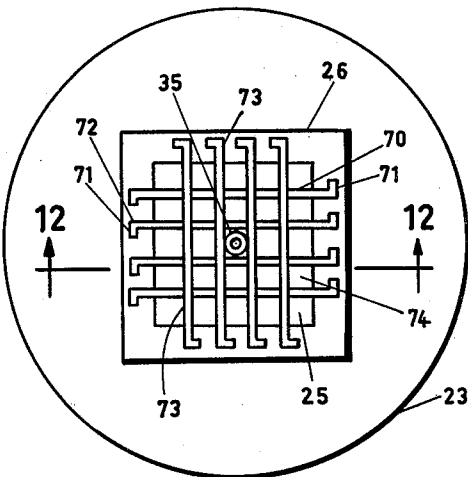


Fig. 11

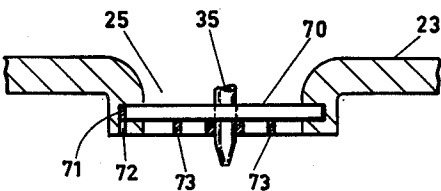


Fig. 12

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2 Claims. (Cl. 197—1)

This invention relates to improvements in printing devices, and more particularly, to improvements in printing heads adapted to impress characters or the like upon tape or paper upon being actuated by an electrical control device.

It is conventional practice to utilize teletype machines in the transmission of messages between distant points. These machines have the disadvantages that they are very expensive, they are extremely complicated and, on being used in combination with a typewriter mechanism, are limited in their speed of operation by the mechanical limitations of the typewriting machinery. Yet another disadvantage of this conventional method lies in the fact that transmission of messages must be made by an operator skilled in the art and is therefore limited in scope and mobility.

It is also conventional practice to utilize printing devices to transcribe information emanating from electronic calculating machines and the like, the disadvantage here being in the fact that the calculator supplies information many times faster than the printing device can transcribe it. Printing heads adapted to operate at much greater speeds than those in current use have been developed, but they have the disadvantage of being highly complicated and extremely expensive.

It is an object of this invention to provide a printing head that may receive and translate electrical signals, either by wire or radio, the translation being in the form of printed characters on a sheet of paper or the like or other printing media.

It is another object of this invention to provide a printing head that will be able to print at high speed by utilizing the minimum number of moving parts.

It is yet another object of this invention to provide a printing head that will cause messages to be printed in ink upon a sheet of paper or the like.

It is a further object of this invention to provide a printing head that will be substantially compact and easily portable.

It is yet another object of this invention to provide a printing head, the operation of which is controlled by varying the frequencies of a radio or electrical signal.

It is yet another object of this invention to provide a printing head that may be actuated by signals emanating from a tape recording.

It is still another object of this invention to provide a printing head that will record and store information supplied to it, thereby allowing for slower transcription and also providing an extremely compact method of information storage and retrieval.

It is a further object of this invention to provide a printing head that may be actuated by radio frequency signals emanating from space vehicles or the like, thereby providing a visual translation of the signals which may be quickly and easily decoded.

It is yet another object of this invention to provide a printing head which is far simpler in operation and far less expensive than conventional printing devices.

These and other objects and features of this invention will become apparent when taken in conjunction with the accompanying drawings in which:

FIG. 1 is a sectional view of a printing head embody-

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ing this invention, only five pens being illustrated for purposes of clarity.

FIG. 2 is a fractional, sectional, side elevation of the actuating mechanism for a pen assembly as illustrated in FIG. 1.

FIG. 3 is a fractional, side elevation of the upper end of the printing head as illustrated in FIG. 1, showing particularly the method by which the pen assemblies are connected with an ink reservoir.

FIG. 4 is a fractional, sectional, side elevation of a pen assembly as illustrated in FIG. 1, showing particularly the method by which the pen is connected to the ink reservoir at the upper end, and to the stylus at the lower end thereof.

FIG. 5 is an end view of the printing head as illustrated in FIG. 1 having the supporting discs partly cut away, thereby illustrating the relative positions of a plurality of pen assemblies contained therein.

FIG. 6 is a diagrammatic sketch and wiring diagram illustrating the method by which a printing head as illustrated in FIG. 1, is actuated by the changes in frequency of an electrical current.

FIG. 7 is a sectional view of the multiple switch assembly, taken on the line 7—7 of FIG. 6.

FIG. 8 is a plan view of a printing head as illustrated in FIG. 1, upon the letter "A" being transmitted through the switch assembly as illustrated in FIGS. 6 and 7 causing a plurality of pens to descend, the non-actuated pens being shown in phantom.

FIG. 9 is a fractional, sectional, side elevation of the stylus portion of the pens as illustrated in FIG. 8, taken on the line 9—9 of FIG. 8.

FIG. 10 is a fractional, plan view of a piece of paper or the like upon which the pen assemblies as illustrated in FIG. 8 have descended to form the letter "A."

FIG. 11 is a plan view of an alternative method of construction of the guide means for the stylus portions of the pen assemblies as illustrated in FIG. 1.

FIG. 12 is a mid sectional view of the guide means as illustrated in FIG. 11, taken on the line 12—12.

Referring to FIG. 1, a printing head, indicated generally by arrow 20, comprises a hollow, cylindrical housing 21 having its upper end closed by an end cap 22 and its lower end by a disc 23 integral with walls 24 of housing 21.

A square aperture 25 is formed substantially centrally in end disc 23 and is surrounded by a wall 26 depending therefrom.

A plurality of shoulders 27 are formed on the inner surface of wall 24 by means of wall 24 being stepped downwardly and inwardly, the maximum internal diameter of housing 21 being adjacent cap 22 and the minimum diameter being adjacent end disc 23. Shoulders 27 are in parallel, spaced apart relationship with each other and with the upper and lower surfaces of housing 21, each shoulder 27 being adapted to support a rigid diaphragm 28, and each diaphragm 28 being retained thereon by means of a spring ring 29, removably located within a mating groove 30 formed in the walls 24 adjacent to and above each shoulder 27.

A square guide plate 31 is groovedly retained within aperture 25 in parallel, spaced apart relationship with diaphragms 28.

A plurality of suitably bushed holes 32 are formed in cap 22 similar bushed holes 33 being formed in diaphragms 28 in vertical alignment with holes 32 in cap 22. Each vertically aligned set of holes 32 and 33 is adapted to slidably receive a rigid tube 34 therethrough, tubes 34 extending upwardly beyond the upper surface of cap 22 and, at their lower extremities, being suitably bent so that a stylus 35 permanently inserted in the open lower end

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thereof will be permitted to slide vertically through a bushed hole 40 formed in plate 31.

It may be seen that, due to the rigidity of tubes 34 vertical movement thereof will automatically result in similar vertical movement of the corresponding stylus 35.

Referring to FIGS. 1 and 2, it may be seen that each tube 34 also passes vertically through the centre of a hollow core electromagnet 36. Each electromagnet 36 is permanently attached to the upper surface of a diaphragm 28, a plurality of electromagnets 36 being substantially equally disposed on varying levels of diaphragms 28 to permit overlapping thereof and greater compactness of the printing head 20.

A steel disc 37 is threadably engaged on each tube 34 and is adapted to remain in parallel, spaced apart relationship with the upper surface of electromagnet 36 upon electromagnet 36 being at rest. A coil spring 38 is located around tube 34 and interposed between the upper surface of electromagnet 36 and the lower surface of steel disc 37. A lock nut 39 is adapted also to threadably engage tube 34 and maintain disc 37 at a predetermined distance above electromagnet 36.

It may be seen, therefore, that upon an electromagnet 36 becoming energized, its adjacent steel washer 37 will be attracted to it, overcoming spring 38, and the whole of tube 34 and stylus 35 caused to move vertically downwardly.

It should be noted that cap 22 as illustrated in FIG. 1 is detachably attached to the upper edge of walls 24 by suitable means such as, for instance, a slotted flange 41 extending downwardly from the outer edge of cap 22 to engage over horizontal bolts 42 extending outwardly of walls 24, wing nuts 43 being adapted to threadably engage bolts 42, and, by exerting a pressure on the side of flange 41, restrain cap 22 from vertical movement. Flange 41, being a close fit on walls 24, serves to locate cap 22 horizontally thereupon.

Referring to FIG. 3, viscous ink is supplied to tubes 34 from a pressurized container 44 through a plurality of flexible tubes 45.

Referring to FIGS. 3 and 4, the upper and lower extremities of a tube 34 are illustrated, in which a resilient sleeve 46 is utilized to join the upper end of tube 34 and the lower end of flexible tube 45 in fluid-tight relationship. It may also be seen that stylus 35 is tubular, having an ink passage 47 formed axially therethrough, of a much lesser diameter than the interior of tube 34, so that, upon tube 34 being charged with ink, passage 47 will also contain ink but stylus 35 will discharge ink only upon its tip 48 coming into contact with an absorbent surface such as for instance, paper 49 as illustrated.

Referring to FIGS. 1, 2, 3 and 4, therefore, it may be seen that upon electromagnet 36 becoming actuated and attracting steel disc 37 tube 34 is caused to move downwardly, this movement being translated to downward movement of stylus 35 which, in turn, causes tip 48 to contact paper 49 and imprint a dot of ink thereon.

As an alternative configuration, the tip 48 of each stylus 35 may be provided with a plurality of outlets for the ink supply from passage 47 so that a similar plurality of fine dots of ink are imprinted on paper 49 instead of one large dot as previously described. This method provides for a more even ink distribution over paper 49 and the characters imprinted thereon, therefore, present a more pleasing and legible appearance.

Referring to FIG. 5, an arrangement is illustrated in which 25 tubes 34 are contained within housing 21, their styli 35 being arranged in a five by five square pattern so that, upon a number of tubes 34 being actuated by their electromagnets 36 a number of styli 35 may protrude downwardly, placing a series of ink dots simultaneously upon paper 49, and thereby forming the outline of a letter, figure or other symbol in a predetermined pattern.

It should be noted that the five square arrangement as

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illustrated in FIG. 5 has been adopted for purposes of clarity in illustration and this is in no way intended to limit the scope of the invention, the number and arrangement of tubes 34 and styli 35 being contingent upon the density of print required by the operator.

Referring to FIG. 6, the 25 electromagnets 36 required to operate the tubes 34 as illustrated in FIG. 5 are shown in diagrammatic form, and the method by which a plurality of electromagnets 36 are activated to cause a predetermined character to become printed is also shown in diagrammatic form.

A tape recorder 51 is adapted to receive and record signals from a transmitting source, the signals being in the form of changing frequencies, each character having its own individual frequency, a coaxial cable or the like being utilized to supply a varying frequency electrical current to tape recorder 51, or tape recorder 51 may be adapted to receive and record varying radio frequencies received from a conventional transmitter.

The tape upon which the frequency changes are recorded may then be played back through a transducer 52.

Transducer 52 is adapted to utilize a particular frequency to actuate one particular solenoid switch 53 contained within a multiple switch assembly 54. A plurality of switches 53 are contained within switch assembly 54, there being one switch 53 for each character which may be desired to be imprinted by printing head 20. As previously stated, each switch 53 is actuated by its own frequency as selected by transducer 52.

One terminal of each electromagnet 36 is connected to a source of electrical energy such as, for instance, a battery 55. The opposite terminals are extended and each connected to a wire 56 so that, in this instance, 25 wires 56 are located in substantially coplanar, parallel, spaced apart relationship within the base of switch assembly 54.

Referring to FIGS. 6 and 7, wires 56 are illustrated as being retained within the insulated base 57 of switch assembly 54 and the construction and operation of one solenoid switch 53 is illustrated. As previously stated, each switch 53 is adapted to select a predetermined number of styli 35 to contact paper 49 and imprint thereon a predetermined character. Thus, the corresponding electromagnets 36 must be actuated and, therefore, the wires 56 connecting these specific electromagnets 36 must be permitted to close the electric circuit from battery 55.

Switch 53 comprises a conventional solenoid 58 having a square section core 59 activated by an actuator 60 contained within transducer 52. A narrow, flat bar 61 of rigid insulating material having a strip 62 of electrical conducting material permanently attached to the undersurface thereof is attached to the upper end of core 59 of solenoid 58. The square section of core 59 ensures that bar 61 and its attendant strip 62 remain in the same vertical plane at all times and prevents rotation thereof in the horizontal plane. A light spring 63 surrounds core 59 and is placed between the upper surface of base 57 and the lower surface of strip 62 causing strip 62 and base 57 to remain in parallel, spaced apart relationship until the pressure of spring 63 is overcome by actuation of solenoid 58. A plurality of electrically conductive studs 64, in transverse alignment, extend upwardly from selected wires 56 to terminate above the upper surface of base 57. A further connector stud 65 is also adapted to stand proud of the upper surface of base 57, its opposite end being connected to battery 55. Stud 64 and 65 are all substantially the same height above the upper surface of base 57.

Upon actuators 60 within transducer 52 selecting a particular character, its solenoid 58 becomes activated causing core 59 to move inwardly thereof, overcoming spring 63 and bringing conductor strip 62 into contact with the tops of studs 64 and interconnecting them with the top of connector stud 65. Thus, a plurality of parallel, electrical circuits will be completed through switch 53 causing a corresponding plurality of electromagnets 36 to be activated within printing head 20, thereby causing the related

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tubes 34 to move downwardly and their attached styli 48 to imprint the required character upon paper 49.

It should be noted that one solenoid switch 53 is utilized for each character which may require to be printed.

With reference to FIGS. 8, 9 and 10, the operation by which the letter "A" is printed is illustrated. The required styli 35, as shown in FIGS. 8 and 9, have been caused to move through guide plate 31 and extend beyond the non-activated styli 35, the tips 48 of the activated styli 35 coming into contact with the upper surface of sheet of paper 49. FIG. 10 illustrates the impression made on paper 49 and it may be seen that a plurality of dots outline the required letter "A."

Referring to FIGS. 11 and 12, an alternative means of supporting styli 35, other than by guide plate 31 as illustrated in FIGS. 1 and 2, is shown. A plurality of thin, rigid strips 70 having oppositely facing flanged ends 71 are located transversely of aperture 25 in parallel, equally spaced apart relationship, ends 71 being a tight fit within mating grooves 72 formed in two oppositely located sides of wall 26. The two remaining sides of wall 26 are similarly grooved to receive a plurality of strips 73 in parallel, equally spaced apart relationship at right angles to strips 70, the spacing being the same as that for strips 70, thereby forming a plurality of square apertures 74 in plan view. Each aperture 74 is adapted to permit a stylus 35 to pass therethrough in a sliding fit, strips 70 and 73 serving to locate all styli 35 in the horizontal plane.

It should be noted that upon a plurality of characters being required to be printed in rapid succession the actuation of solenoid switches 58 by their respective activators 60 within transducer 52 is only momentary so that the actuation of electromagnets 36 is also momentary, thus enabling characters to be printed by printing head 20 in very rapid succession.

It should also be noted that either head 20 should be moved relative to paper 49 or paper 49 moved relative to head 20 so that the characters imprinted on paper 49 will be viewed in succession and not overprinted one on the other. An added improvement, therefore, may be an electrically actuated device adapted to momentarily stop the relative movement between head 20 and paper 49 for the period during which a character is being printed.

It should also be noted that the principles explained herein may also be utilized in the manufacture of a completely electronic typewriter, thereby eliminating the large

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amount of mechanical movement which is still evident in standard electrical typewriters, and furthermore, will result in much quieter operation thereof.

The general design of the individual parts of the invention as explained above may be varied according to requirements in regards to manufacture and production thereof, while still remaining within the spirit and principle of the invention, without prejudicing the novelty thereof.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A printing head comprising a plurality of relatively rigid tubular members supported for axial movement within a housing, flexible tubular means for interiorly supplying ink to one end of each of said rigid tubular members from reservoir means at one end of said housing, each remaining end of said rigid tubular members terminating in a stylus having a restricted opening therethrough, a guide plate at an opposite end of said housing to said flexible tubular means, said styli extending through said guide plate to terminate in a single plane, electro-mechanical elements for imparting said axial movement to said rigid tubular members and thus to said styli, said guide plate serving to maintain said styli in close proximity to one another to ensure a compact printing head, said rigid tubular members spaced relatively further apart than said styli due to the presence of said electro-mechanical elements.

2. A printing head as defined in claim 1 wherein said electromechanical elements comprise ferromagnetic discs concentric with said rigid tubular members and integrally attached thereto and electrical coils concentric with said rigid tubular members, said coils supported by spacer means mounted in said housing.

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