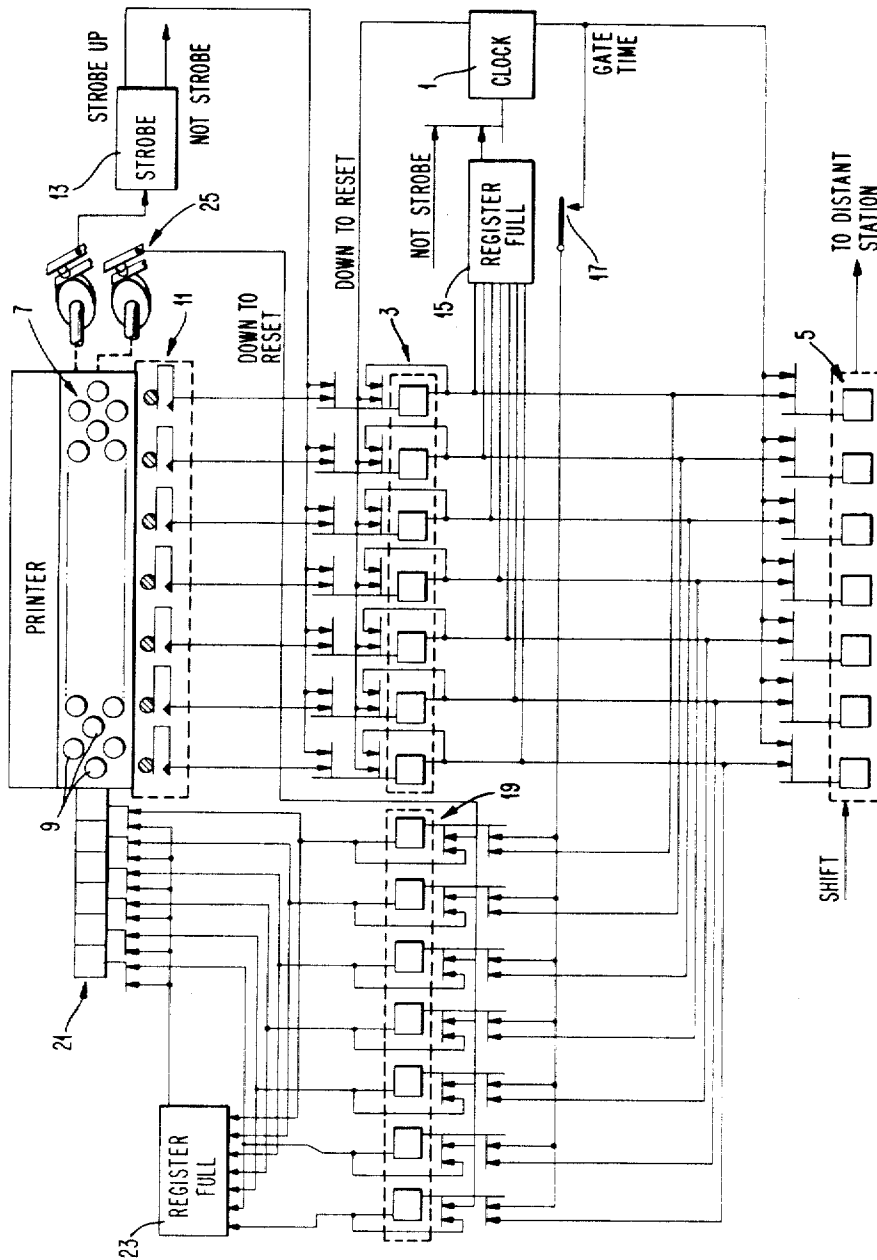


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COMMUNICATIONS TERMINAL WITH INTERNAL  
CIRCULATION OF DATA  
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1

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## COMMUNICATIONS TERMINAL WITH INTERNAL CIRCULATION OF DATA

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### ABSTRACT OF THE DISCLOSURE

A home loop for maintenance purposes or for type-a-matic operation is provided in a communications terminal. A data path is provided whereby signals generated by the terminal as they are transferred from a first buffer register to a transmitting register can, by the operation of a control, be sent also to a second register and hence to the terminal's recording means such as a printer. The printer then prints the data and regenerates the same signals thus providing a repetitive operation so long as the control is actuated.

### Disclosure of the invention

This invention relates to communications terminals such as teletypewriter terminals and is particularly concerned with the circulation of data within the terminal. The circulation of data within the terminal makes possible the checking for error internally in the terminal and also makes possible the repetitive printing or transmission of information from the single depression of a key on the terminal.

In teletypewriter terminals it is very desirable to provide means to progress locally generated data through all or most of the usually operative structures of the terminal and then to the printing means of the same terminal. This progression of data or "home loop" is a valuable assistance in maintenance and repair of the terminal. Since most of the structures of the terminal are utilized, and since the data originally inserted in the terminal is known and the print out can be readily checked, it is immediately possible for the repairman to deduce important information having to do with malfunctions which are observed.

Applicant knows of no "home loop" checking specifically suited for maintenance purposes in the prior art. It is known to locally generate a series of different signals, each representative of data from a specially provided generator or special purpose record. Thus, in the prior art, the information stored and generated from a special purpose character generator is known, and it is moved by the terminal through the structures of the terminal and then recorded by the terminal. By observing the recorded information in a mental comparison with the known information put into the system by the special purpose record, malfunctions in the terminal could be defined by the difference between the contents of the record and the recorded display, but applicant knows of no prior art particularly suited for this purpose.

The special purpose record used in the prior art could add cost and structural complications to the system. However, no alternative was readily available. This invention provides for internal circulation of data, but basically the terminals under consideration are built to either transmit data from a keyboard or similar input and to receive data and progress the received data to a printer or similar recorder. This invention, therefore, differs basically over prior structures in that it visualizes redesigning the terminal as required to give the terminal an internal circulation capability which may be "switched in" by the machine operator at his convenience.

It is an object of this invention to provide a com-

2

munications terminal having improved capabilities to transfer data for maintenance purposes.

It is an object of this invention to provide a communications terminal having transfer of data or "home loop" in which the use of a special purpose data generator is avoided.

A feature which was doubtless considered by the prior art is the repetitive printing from a single keyboard key depression, or what is sometimes known in different environments as type-a-matic operation. Although the desirability of repetitive printing from a single keyboard depression or type-a-matic operation is known, applicant knows of this feature being successfully incorporated into a teletypewriter transmitter only in such terminals in which the printer repeats at speeds slower than the transmission capabilities of the terminal. The feature is known in typewriters, and when the type-a-matic operation is desired in typewriters, it is known to provide structures which respond to a key depression greater in distance than the normal key depression to thereby bring structures into play which cause repeated mechanical response to the depressed key.

A specific type-a-matic operation is made possible in accordance with this invention in a terminal system in which the printer cycle time is faster than the speed capabilities of the transmitter. With regard to the type-a-matic system herein disclosed, it is very desirable that the key depressed be linked to appropriate switch means so that release of the depressed key will terminate the repetitive generation of data having to do with the key. I cannot claim this specifically, even though it is described here to fully elucidate every capability of the circulation mode which I have invented. It will be clear, however, that the circulation mode herein described immediately makes possible the type-a-matic operation.

It is a feature of the preferred aspects of this invention that both the "home loop" operation and the type-a-matic operation are implemented by basically the same structures and basically the same approach to thereby provide both the features in a truly practical and economic system.

In accordance with this invention selectable switch or similar means are provided to put the terminal into an operation mode in which data is circulated. In this circulation mode, signals originated by key depression or other inputs are progressed as though they are to be transmitted and are stored in a first register. This is all implemented by the structures which are used to transmit signals during normal operation of the terminal as a transmitter. In this circulation mode, however, means are provided to automatically extract signals from the first register and to connect those signals into those structures adapted to process received signals to thereby print or otherwise record the received signals. If the printing mechanisms of the terminal are of the kind in which new signals to be transmitted are automatically generated by the movements of the printer as it prints, then a circulating loop is provided which can automatically be used for type-a-matic operation.

To achieve the circulation mode, I provide switching or mode change means for the operator as a convenient means to change the internal structuring of the transmitter into the circulation mode. If the circulation of data is automatic due to the creation of signals as each print function occurs, then it has been pointed out to me that it is desirable to provide a second switch associated with each key or similar input device, that second switch being adapted to inhibit the circulation mode when the key is released.

In accordance with preferred aspects of the more specific form of this invention, data signals generated by the

depression of a key are first stepped into a first buffer register in a manner and using the structures identical to that used when the terminal is in the transmit mode. These data signals may be stepped into a transmitting register and will automatically be so stepped into that register during transmission. In the circulation mode, electrical gating and similar connections lead from the first buffer register to the second buffer register. The second buffer register is a part of the normal receiving structures of the terminal. From the second buffer register the terminal is structured to automatically transmit the data from the register into print operating means for the printer. Specifically, electrically operated magnet drivers are driven from the second buffer register. In its specific implementation the printer is one in which, as it goes through a print cycle in response to information obtained from the buffer register, the printing movements actuate mechanical switches which are closed to thereby create electrical signals which represent the print movement occurring in a permutation code. Thus, a cycle of operations begins immediately and will be continued repetitively until the circulation mode is terminated. This repetitive cycle inherently and automatically gives type-a-matic operation. Switch means may be associated with the key depressed so that the circulation as described continues, but is shut off or inhibited by the opening of the switch means in response to the movement of the finger from a key or some similar termination of an input condition. The entire system is controlled in its timing and stepping of data by appropriate clocks and logical circuits.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of a preferred embodiment of the invention, as illustrated in the accompanying drawings.

The drawing shows an illustrative block diagram of the structural features of the invention herein described and claimed.

Although the communications terminal herein described is new, it is similar in many ways and is to be compatible with the 1050 data communication system presently marketed by the assignee of this invention. Reference is made to "System Operation Reference Manual, IBM 1050 Data Communications System," File Number 1050-9, Form A24-3020-3, Major Revision, January 1965, a copyrighted publication which describes the 1050 system. Where structures associated with the invention described herein are not specifically noted, it is intended to imply that one skilled in the art could refer to the structures taught and adequately suggested by the 1050 system.

The terminal herein described is entirely electronic and logic responsive, except for the recording unit. The recording unit is preferably an input/output version of the IBM "Selectric" (single element typehead) typewriter. Other recording units may be equally useful, but in the type-a-matic mode it would be necessary that the recording unit have the capability of generating signals in response to the mechanical movements of recording in a manner which will be fully discussed herein.

The basic I/O, "Selectric" keyboard printer is in public use and has been described in various readily available publications. For purposes of this description, applicant will cite U.S. Patent 3,082,854 since as a patent it is easily obtained, and since the description there, even though incident to describing a completely different invention, is believed to be fully sufficient.

In the keyboard printer used, upon depression of a character key or a function key for a usual typing function (the functions are carrier return, shift, etc.) mechanical linkages cause a shaft to be rotated. The shaft then drives the printer through a single cycle. More specifically, one of the initial physical movements from the keys mentioned frees a spring clutch which overlaps a continuously rotating drive shaft and a normally non-rotating cycle shaft. The cycle shaft then begins a single revolution,

which will be automatically terminated by the disengagement of a spring clutch after the single revolution.

A cycle shaft carries a number of properly formed cams, all of which cams interact with cam followers in a manner required by the purpose of each cam. Thus, six cams interact with six bails to produce a combination of rotation and tilting in the mechanism to thereby select for printing a proper character on the single element, spherical type head. Additionally, one other cam is allocated to each function such as carriage return and tabulation. The functions, however, are not a specific concern of the instant invention.

Of some importance with regard to this invention are the timing cams and the timing cam followers. This can be at least one cam which is followed in every cycle by a cam follower associated with it. This cam follower is used to close a switch, the closed switch being used solely to describe or "clock" each cycle of operation. Use of clock cams in this way in this technology is well known. The assemblies are called circuit breakers or CB's. One signal generated by a CB will herein be dominated as strobe pulses. For the purposes of this invention, it can be assumed that at least one CB exists, that the switch associated with that one CB closes at about 85 degrees of each printer cycle and opens at about 130 degrees.

#### *The system*

Reference is made to the drawing. The electronics of the transmitting terminal are composed essentially of latch circuits and logical connections to the latch circuits to thereby implement the Boolean logical functions of AND, OR, and similar logical functions. Clock 1 produces a series of timing pulses displaced in time which are used to initiate the transfer of signals out of first buffer register 3 into the transmit register 5 and to step signals out of transmit register 5. This is part of the normal operation in the transmit mode of the terminal. As will be described, other logical results represented by circuit outputs also participate in the stepping of data through the system in a manner in which data is prevented from overlap or other structurally undesirable circumstances. It is standard in this art to compartmentalize the transfer and the operations upon binary data with electrical circuits by use of discrete timing pulses and logical relationships within the circuit. On the other hand, signals from the depression of a key on keyboard 7 are connected directly into the inputs of first buffer register 3 and are controlled by a strobe as will be described, but not timed by a clock since it is desired that first buffer register 3 receive such key signals as soon as they are reasonably available.

The terminal includes a keyboard 7 and the keyboard contains the usual character and printer function keys 9 of a typewriter. The keyboard also contains special keys to create special signals having to do with the communications net, but such keys and such signals are not a significant part of the instant invention. The character and printer function keys 9 are mechanically linked to the printer to provide the usual typing display actions such as the print of an alphabetic symbol or the initiation of a function such as carrier return or tabulate. The normal flow of information from depression of one of the keys 9 is: first, the depression of a key is linked mechanically to cause movement of the printer in a manner to record or act upon the information represented by the key; second, the mechanically moving mechanisms having to do with recording and functioning close selection contacts 11 (simply, electrical switches); thus, movements of the printer, as distinguished from a switch closed by a key, causes the function to be generated as an electrical code.

Then the electrical signals are read into register 3. More specifically, this operation is as follows: depression of a key 9 is mechanically linked to both clutch operating means and to latches which hold six bails in an inopera-

tive position. The clutch activated by depression of a key 9 begins the print cycle by clutching in a driven shaft containing cams which can depress the various bails. A specific combination of latches is freed by direct mechanical linkage from each specific key 9 depressed. Assuming that a character key is depressed, six bails with their associated latches are pertinent, and by proper selection in a manner already familiar in the well known "Selectric" typewriter, a specific permutation of rotation and tilt is defined from which the proper character is found by rotating and printing the single element type head. Hurling of the single element typehead into the paper to affect printing is a part of the printing sequence caused by the driving of the driven shaft as above described. A switch 11 exists under each bail and the proper permutation of specific ones of the six bails is depressed as part of the rotation tilting of the mechanical printer. Thus, a specific switch is closed which is directly associated with a bail which is depressed in the print cycle. These switches 11 close circuits to thereby create the electrical signals directly describing the mechanical functions of the printer. In this manner a combination of contacts 11 are simultaneously closed to thereby describe in a code the particular character initiated by the key depressed. The data then flows to first buffer register 3 by essentially direct electrical connection between selection contacts 11 and the first buffer register 3.

It is necessary to assure that information written into first buffer register 3 from selection contacts 11 is transferred at a time during which contacts 11 closed by a previous cycle have opened and contacts 11 to be closed by the current cycle have closed. Therefore, the strobe signal from CB strobe 13 is used and is connected in an AND relationship as shown in the drawing. The logical AND relationship thereby required by the structures assures that the selection contacts 11 are read only at times in a printer cycle during which only the proper contacts will be depressed because the strobe 13 comes up only at a point well into the printer cycle. The CB strobe 13 is a signal as discussed above which is mechanically created by the cycling mechanism of the printer and which is produced for a continuous time during the middle of a character or printer function cycle. As mentioned and as illustrated in conventional form in the drawing, first buffer register 3 is composed of latches. These latches are basically of a well known kind in which a bistable electrical circuit is connected with a feedback from the output to the input so that the feedback signal maintains the circuit in the switched condition after it has been switched by some other signal. A second signal is required to be in a logical AND relationship with the feedback signal so that the register can be cleared of data by simply bringing the second signal to a DOWN level.

First buffer register 3 comprises seven essentially independent latch circuits as described. Selection contacts 11 are also seven in number because six are directly related to the description of a character and the seventh is automatically closed or not closed to create a predefined parity or error check relationship in the permutation code generated. Each switch of selection contacts 11 is in a logical AND configuration with a signal from CB strobe 13. Thus, the AND situation above mentioned is implemented by a number of different input configurations as just described.

Register full logic 15 is provided as part of the clocking and cycling of data in this embodiment. Register full logic 15 is permanently connected to the output of all seven latches making up first buffer register 3. A single UP signal from one of the stages of register 3 produces a continuing UP level from logic 15. This pulse will start clock 1, but only when the NOT STROBE signal from circuit 13 also exists. As is conventional, clock 1 is composed of latches driven by an oscillator, and various

differently spaced pulses are defined by the latch conditions to thereby provide signals at different points in time. The first clock signal, therefore, occurs at the termination of strobe from CB strobe 13.

Signals from the clock may be used for various purposes not specifically related to this invention. One such signal is shown in the drawings since that signal is of some importance to the preferred aspects of this invention. This is simply the register 3 reset signal which, after data is extracted from register 3 as required, goes to a DOWN level. This eliminates the AND condition required in the feedback loops of register 3 and thereby clears or eliminates data from register 3. Before register 3 is reset, however, a gate time pulse is generated by clock 1. That gate time pulse is effective as an AND input to transmitting register 5. The input of signals to transmitting register 5 is much as that of first buffer register 3, that is, the various stages of register 5 are directly connected to each output of each stage in a one-to-one relationship with first buffer register 3 and an AND configuration from clock 1 is demanded before data will be transferred. Transmitting register 5 is also a shift register so that after the transfer of data into transmitting register 5, the data is transmitted serially and automatically in a manner adequately taught by the 1050 data communications system above mentioned. The data remains in the various stages of register 5 automatically and is generally cleared as an incident to its transmission to a distant station.

In accordance with this invention, a switch 17 is provided by which the gate time clock pulse may connect to the second buffer register 19. Second buffer register 19 is very similar in form to register 3. That is, it is a series of seven independent latches each capable of being switched. Each latch of register 19 is in direct connection with one latch of first buffer register 3, and each latch requires a logical AND input to effectuate the switching. In accordance with this invention, switch means 17 and the electrical connections associated with switch 17 as herein described are provided to give a control of the input of second buffer register 19 from clock 1.

A series of magnet drivers 21 are provided which are directly associated with the printing terminal. These magnet drivers are conventional to the "Selectric" I/O typewriter. Electronically they are of the power amplifier type, the activation of which results in a magnetic pull which moves mechanical linkages to start the cycle and free the latches to effectuate printing of a selected character or function. A register full circuit 23 is provided to assist in spacing of data in the system. Register full circuit 23 creates a signal only at the time when a permutation code representing information is in second buffer register 19. At that time the AND configuration as shown in the drawing connecting second buffer register 19 and magnet drivers 21 become activated and the magnet drivers 21 are, therefore, electrically driven. Each of the six magnet drivers is connected to one of the six stages of buffer register 19 by direct electrical contact. The seventh stage is not so connected because that contains only the parity or check bit. The code in register 19 is thus directly retained by the driving of six magnets.

A CB 25 is used to clear register 19 of data. As discussed, the CB's are linked to the cycling mechanisms of the printer and, therefore, describe the status of the printer. CB 25 is positioned and adapted to give a DOWN level signal at the time when a printer action is fully initiated and, therefore, cannot normally be terminated. At that time it is desirable to clear buffer register 19 so that new data can be received immediately. The signal at this time from CB 25 eliminates the AND conditions in all of the feedback loops of register 19 and the data stored is then immediately lost in favor of the status of the latches which are automatically assumed in the absence of the feedback signal.

The printer shown is primarily used with the switch 17 open. In this event, applicant claims no novelty over the prior art and invention of others. Information is entered into the system by a keyboard operation, at which time selection contacts 11 close and data is entered into first buffer register 3 under the control of strobe 13. Under the control of a clock 1 information is transferred into the transmitting units and stepped serially out to the distant station. The existence of second buffer register 19 is also not claimed as novel over the prior art and inventions of others. The second buffer register 19 is used in the receive mode to provide increased buffer storage against a slow printer response in relation to the speed of data received from a distant station transmitting to the terminal. Thus, the second buffer register 19 connected as shown, but without regard to clock 1, receives information from first buffer register 3 upon the concurrence of signals indicating that the terminal is receiving, that register 3 is full, and that register 19 is empty. It is thus always from second buffer register 19 that the printing is effected. In the prior terminal the clearing of register 19 from CB 25 was as herein described. In accordance with this invention means are provided to create a cycle path in which the information from the keyboard is progressed, either back to the printer only or out on the line and back to the printer.

For the "home loop" used only for checking and maintenance of the terminal, it is not desired to transmit to a distant station. In this event the transmitting unit is disabled in some fashion. The most direct method of disabling the transmitting unit would be to simply ground the output of the transmitter. In any event, a signal keyed in by a key 9 is linked mechanically to cause printing representative of the key depressed. The signal produced is circulated electrically as described and the circulated signal is printed. A mental comparison of the printed displays with operations which should occur during normal functioning immediately gives information valuable for purposes of maintenance and repair. Such information can be useful for many purposes, and especially to localize a malfunction at one station so that an expert repairman can be dispatched to the proper one of a plurality of widely separated terminals.

For a type-a-matic use, the repetitive operation is specifically desired. In this operation the depression of selection contacts 11 because of a print operation caused by magnet drivers 21 is a necessary feature. The signals thus created by contacts 11 are the same as those created by the first depression of a key 9 and are circulated as above described to create the same print response repetitively.

It may or may not be desired to inhibit transmission during type-a-matic operation. If transmission to a distant station is desired, this is accomplished by opening a switch which, when closed, grounds or otherwise inhibits the output of the machine. For both "home loop" and type-a-matic, one switch at the keyboard could be provided to close the connection shown in the drawings as the connections to register 19 from clock 1 through switch 17. With switch 17 closed, any key depressed begins a print cycle and transmit operation which is normal to the transmitter. A data character is entered into first buffer register 3. Since switch 17 is closed, that character is transferred from buffer register 3 to second buffer register 19 and is then operative on the magnet drivers 21 to cause another print cycle.

Although it is not a specific part of this invention, preferably for type-a-matic operation, structures are provided so that one or more of the keyboard keys 9 closes

switch 17. A switch to do this would be located keyend the normal travel of a keyboard key 9. Thus, depression of such a key 9 below its normal position would close switch 17 and the type-a-matic operation would begin. The data would circulate and print, and it could be transmitted repetitively as long as the key 9 is depressed. Raising of the key 9 would open switch 17 and thereby terminate the type-a-matic operation.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.

I claim:

1. In a terminal adapted to transmit signals locally generated and to receive signals from a distant station including recording means to record received signals, a first buffer register to receive and store locally generated signals, a second buffer register to receive and store signals received from a distant station, a transmitting register adapted to receive signals from said first buffer register for transfer to a distant station, a data path for periodically transferring signals from said first buffer register to said transmitting register, the improvement of providing a home loop signal circulating capability for maintenance check purposes comprising transfer means for selectively circulating signals from said first buffer register to said second buffer as they are being transferred to said transmitting register along said data path, and switch means for selectively placing said transfer means in an operable or inoperable mode such that when said transfer means is in an operable mode locally generated signals are circulated to said recording means.

2. In a terminal adapted to locally generate and transmit signals and to receive and record signals from a distant station having a first buffer register to receive and store locally generated signals, a second buffer register to receive and store signals from a distant station, a transmitting register adapted to receive signals from said first buffer register for transmission to a distant station, and a data path for periodically transferring signals from said first register to said transmitting register; the improvement which comprises means for repetitively circulating the signals corresponding to a character to provide a type-a-matic operation including printing means adapted to print said character and to automatically regenerate the signals corresponding to said printed character in response to the mechanical movements of printing, transfer means for selectively circulating said signals from said first buffer register to said second buffer register as they are being transferred to said transmitting register along said data path, and switch means for selectively placing said transfer means in either an operable or an inoperable mode such that when said transfer means is placed in an operable mode, locally generated signals are circulated to said printing means which prints the character and regenerates the signals corresponding to said character resulting in a type-a-matic operation so long as said transfer means is maintained in an operable mode.

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