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L. B. COOKE

1,956,709

CALLING CIRCUIT

Filed April 12, 1930

2 Sheets-Sheet 1

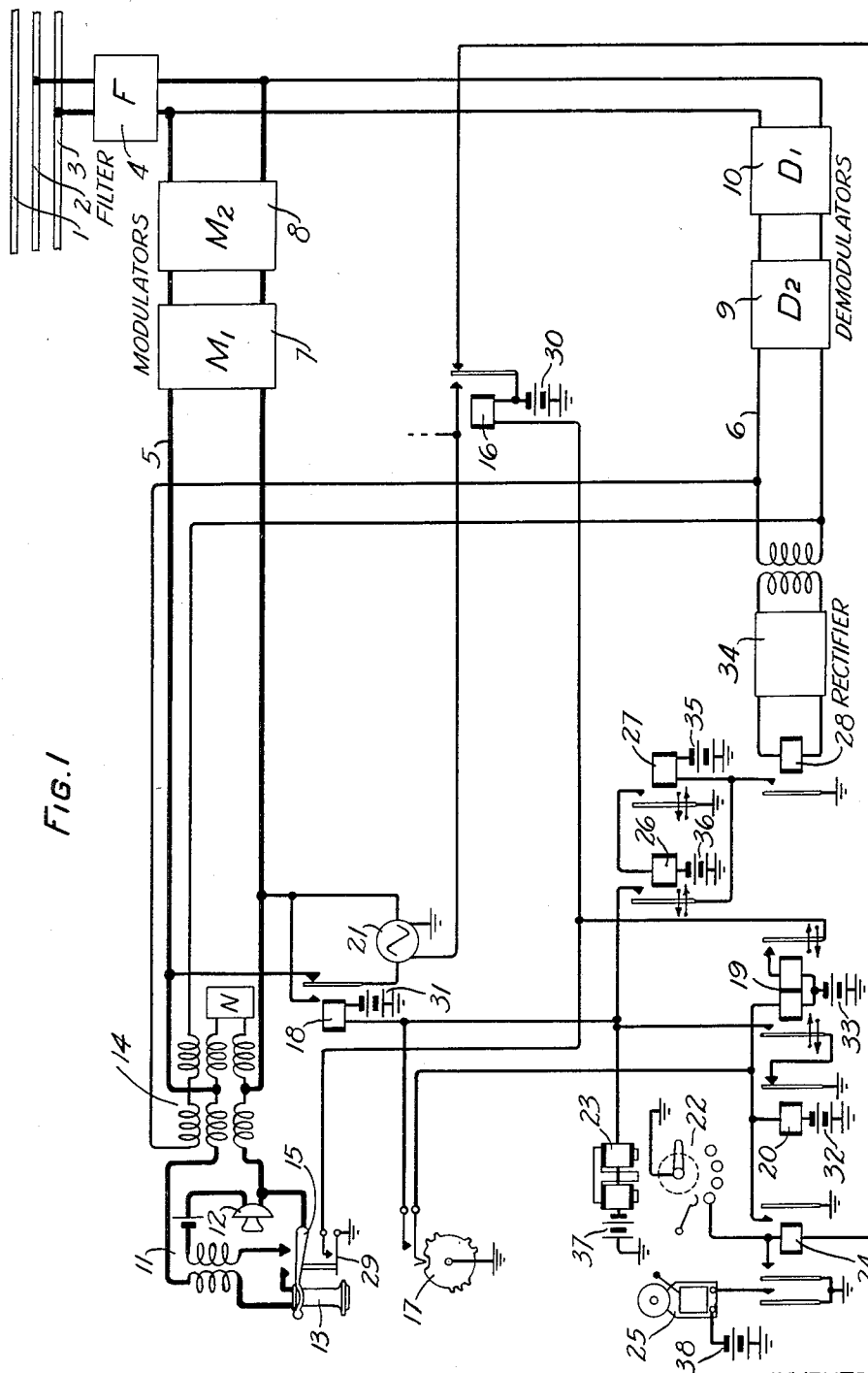


Fig. 1

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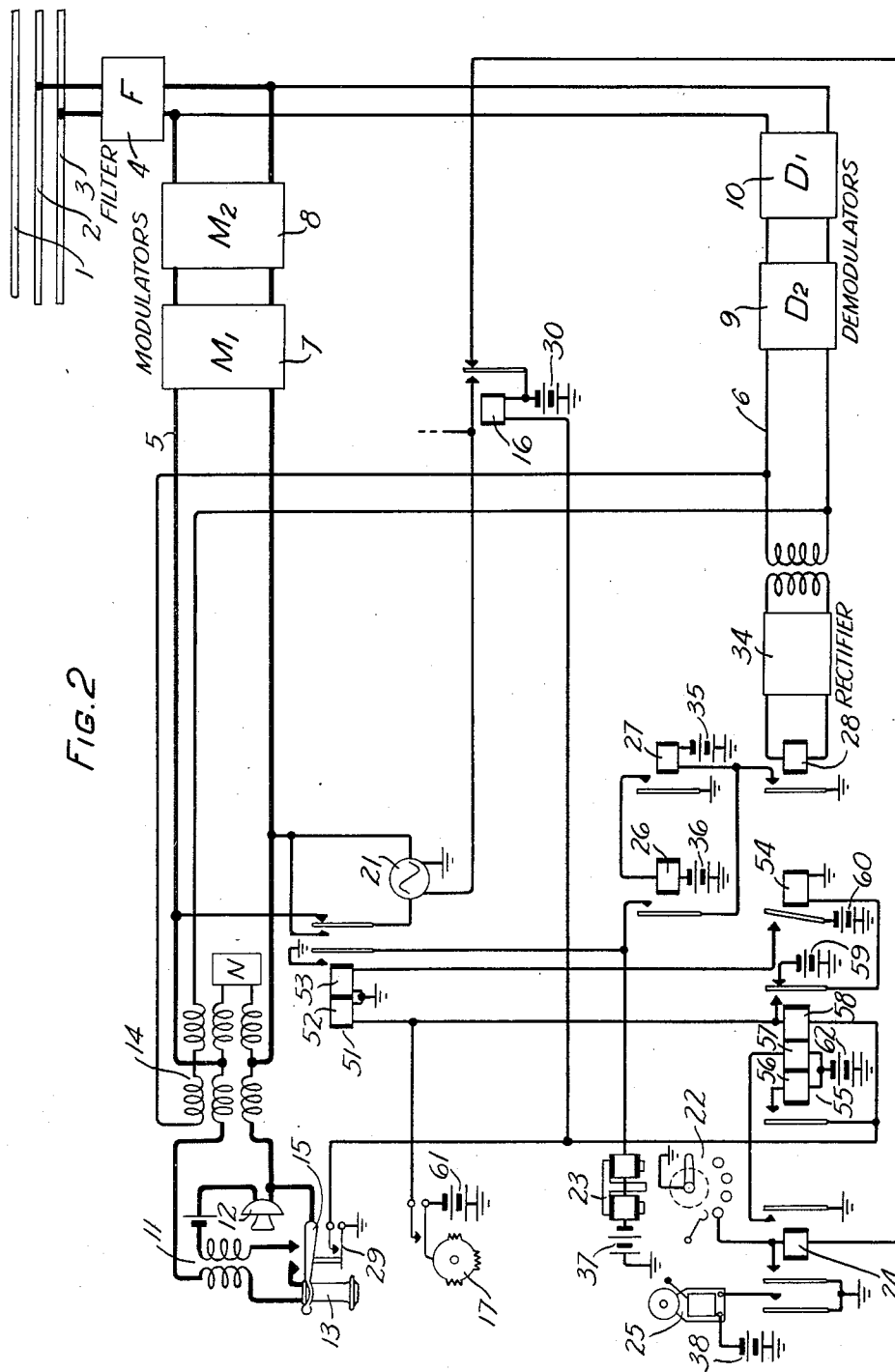
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CALLING CIRCUIT

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7 Claims. (Cl. 179—2.5)

This invention relates to selective calling circuits for communication systems and particularly to selective calling circuits for power-line carrier-wave communication systems.

One object of the invention is to provide a selective calling circuit for a communication system that shall use currents in the same frequency range employed during communication between stations and be unresponsive to the communication currents.

Another object of the invention is to provide a power-line carrier-wave transmission system with selective calling circuits that shall employ carrier current modulated with a code signal of voice frequency currents to selectively call signal stations connected to the power line and that shall insure against operation of the calling selector at any station by means of the currents transmitted during communication between stations.

A further object of the invention is to provide a selective calling circuit for power-line carrier-wave communication systems that shall employ a selective code signal of impulses of carrier current modulated with current within the voice frequency range and preceded by a prolonged impulse of the same character to operate a selector at a called station and that shall insure against operation of the selector by the currents transmitted during communication between stations.

In selectively calling stations on a power-line communication system of the type disclosed in the patent to C. N. Nebel No. 1,733,553 dated Oct. 29, 1929, it is desirable to employ a code signal of carrier current modulated with impulses within the voice frequency range. However, when carrier current modulated with impulses of current within the voice frequency range are employed for selective calling purposes, care must be taken to insure against operation of the selector at the signal stations by the currents transmitted during communication between stations.

In the systems employed to disclose the invention each code signal of carrier current modulated with impulses of current within the voice frequency range is preceded by a prolonged impulse of the same character. The prolonged impulse preceding the code signal prepares apparatus at the called station for operation of the selector by the code signal. The apparatus operated by the prolonged impulse insures against operation of the selector by the currents employed during communication between stations.

In the preferred system employed to disclose

the invention, an oscillator having a frequency within the voice frequency range is provided at each station for calling purposes. Normally, the calling oscillator is connected to a transmitting channel of the type disclosed in the patent to C. N. Nebel No. 1,733,553. In the transmitting channel disclosed in the Nebel patent voice frequency currents are modulated twice and a single side band from the second modulator is transmitted over the power line.

When the operator at a calling station removes his receiver from the switchhook, the calling oscillator is automatically energized to transmit a prolonged impulse of carrier current modulated with current within the voice frequency range to the distant called station. A selector key is then operated for selectively disconnecting the calling oscillator from the transmitting channel to transmit a calling code signal. At the conclusion of the code signal, relay means is provided for automatically disconnecting the calling oscillator from the transmitting channel.

The calling signal transmitted to a distant called station is demodulated in the manner disclosed in the above mentioned Nebel patent to obtain calling impulses within the voice frequency range. The prolonged impulse which precedes the code signal serves to operate slow acting relays to insure the operation of the selector at the called station by the transmitted calling code signal. The selector at the called station operates a calling bell which is released when the operator at the called station removes his receiver from the switchhook. Upon removal of the receiver from the switchhook at the called station automatic means is provided for disconnecting the calling oscillator at the called station from the transmitting channel at that station.

The prolonged impulse which is transmitted to the called station prior to the transmission of the code signal, serves to insure the operation of slow acting relays which cannot be operated by the currents normally transmitted during communication between stations. The slow acting relays which are operated by the prolonged impulse, serve to insure against operation of the selectors during communication between stations.

In the accompanying drawings Figure 1 is a diagrammatic view of a calling circuit constructed in accordance with the invention.

Fig. 2 is a diagrammatic view of a modified calling circuit.

Referring to Fig. 1 of the drawings a high tension power line is shown comprising conductors

1, 2 and 3. A number of signal stations are connected to the power conductors 1, 2 and 3 in the manner disclosed in the patent to C. N. Nebel No. 1,733,553. In Fig. 1 of the drawings one signal station is shown connected to the power conductors 2 and 3 by means of a coupling filter 4. The signal station connected to the power conductors 2 and 3 comprises a transmitting channel 5 and a receiving channel 6. Two modulators 7 and 8 are shown in the transmitting channel and two demodulators 9 and 10 are shown in the receiving channel. The modulators and demodulators included in the transmitting and receiving channels operate in the manner disclosed in the above mentioned patent to C. N. Nebel.

An operator's telephone set 11 comprising a transmitter 12 and a receiver 13 is connected to the transmitting channel 5 and receiving channel 6 by means of a hybrid coil 14 provided with the customary balancing impedance. A switchhook 15 governs a switch 29 to control the operation of a filament control relay 16. A selector key 17 which is preferably of the type disclosed in the patent to J. C. Field, No. 1,354,814, dated October 5, 1920, is provided for controlling the operation of a pulsing relay 18, a holding relay 19 and a control relay 20. An oscillator 21 which generates a current of a frequency within the voice frequency range is connected to the transmitting channel in accordance with the operation of the pulsing relay 18. The oscillator 21 is energized upon operation of the filament relay 16.

A call selector 22 of the type disclosed in the patent to J. C. Field No. 1,343,256 dated June 15, 1920 is operated by a selector magnet 23 for controlling the operation of a relay 24 to operate a call bell 25. The selector magnet 23 is operated by two slow operating relays 26 and 27 and receiving relay 28.

Assuming that the operator at a calling station desires to selectively call an operator at a distant station, the receiver 13 is first removed from the switchhook at the calling station. The switch 29 operated by the switchhook completes a circuit from a battery 30 for operating the filament relay 16. The filament relay at the calling station supplies current from the battery 30 for energizing the oscillator 21. The oscillator 21 is normally connected across the transmitting channel 5 so that upon removal of the receiver from the switchhook a prolonged impulse of current within the voice frequency range is supplied to the first modulator 7. One side band from the second modulation operation is transmitted over the power conductors 2 and 3 to the called station in the manner disclosed in the above mentioned patent to C. N. Nebel.

The selector key 17 is then operated for selectively operating the pulsing relay 18 to intermittently connect the oscillator 21 to the first modulator 7 in accordance with the code signal desired to be transmitted to the called station. The pulsing contacts of the selector key 17 complete a circuit for operating pulsing relay 18 from battery 31. The off normal contacts of the selector key complete a circuit from battery 32 for operating control relay 20 and a circuit from battery 33 for operating the holding relay 19 before the pulsing contacts are operated. Upon operation of the holding relay 19 a circuit is completed from the battery 33 through the switch 29 for retaining the holding relay in operative position. The control relay 20 and the holding relay 19 serve to effect operation of the pulsing relay 18 upon completion of a calling signal for

disconnecting the oscillator 21 from the transmitting channel 5. Upon completion of a code signal the control relay 20 is released and the holding relay is maintained in operative position by reason of the circuit completed through the switch 29. Thus during conversation the calling oscillator 21 is disconnected from the transmitting channel 5.

At the called station the prolonged impulse of modulated current is received through the filter 4 at said station and demodulated by means of the demodulators 9 and 10. The demodulated impulse is rectified by rectifier 34 to operate the receiving relay 28. The receiving relay 28 completes a circuit for operating the slow relay 27 from battery 35 and the slow relay 27 completes a circuit in turn for operating the slow relay 26 from battery 36. The relays 26 and 27 are not only slow to operate, but are slow to release so that the code signal which is received after the prolonged impulse may be utilized for operating the selector magnet 23. The receiving relay which is operated in accordance with the received code signal completes a circuit from battery 37 through the switch member of the slow relay 26 for operating the selector magnet. The selector 22 when operated by the selector magnet 23 in accordance with the code signal completes a circuit from the battery 30 for operating the relay 24. The relay 24 completes a circuit from a battery 38 for operating the call bell 25, a holding circuit from the battery 30 and circuits from the batteries 32 and 33 for operating the relays 20 and 19.

When the operator at the called station removes his receiver from the switchhook the filament relay 16 is operated for disconnecting the relay 24 from the battery 30. The relay 24 is released to stop operation of the bell 25 and to break the circuit through the relay 20 from the battery 32. The holding relay 19 upon the removal of the receiver from the switchhook and release of the relay 24 is held in operative position by a circuit extending from the battery 33 through the switch 29. Upon release of control relay 20 a circuit is completed for energizing the pulsing relay 18 at the called station to disconnect the oscillator 21 at said station from the transmitting channel.

Upon replacing of the receiver on the switchhook at the calling station the switch 29 is opened for breaking the holding circuit through the relay 19. This insures the return of the various relays to normal position. A like operation occurs at the called station when the receiver is returned to the switchhook. At the calling station when the pulsing relay 18 is operated by the selector key for transmitting a code signal over the power line the selector magnet 23 at said station is operated from the battery 37 for stepping the calling operator's selector to control the call bell at an extension station (not shown).

Referring to Fig. 2 of the drawings, a system is illustrated which is operated by the same type of code signal as the system illustrated in Fig. 1 of the drawings. A prolonged impulse followed by a code signal is necessary to operate the selector at any called station. In Fig. 2 of the drawings similar parts to those shown in Fig. 1 of the drawings would be indicated by like reference characters. A pulsing relay 51 having two windings 52 and 53 is provided for controlling the connection of the calling oscillator 21 to the transmitting channel 5. Two relays 54 and 55 are provided for insuring opera-

tion of the pulsing relay 51 to disconnect the oscillator 21 from the transmitting channel during conversation. The relay 55 is provided with three coils 56, 57 and 58.

5 In normal position all the relays are released except relay 54 which is operated from a battery 59 through one switch member of the relay 55. The relay 54 is normally held in operative position in order to insure against operation of the pulsing relay 51 by completing a circuit from the battery 60 through the coil 53.

10 Assuming the system in Fig. 2 to be in the position shown and the operator at a calling station desires to call an operator at a distant station, the receiver 13 is removed from the switchhook. Upon removal of the receiver from the switchhook a circuit is completed from the battery 30 through the switch 29 for operating the filament relay 16. The filament relay 16 effects energization of the oscillator 21 and insures the transmission of a prolonged impulse to the distant called station. The selector key 17 is operated for intermittently operating the pulsing relay 51 according to the code signal desired to be transmitted to the distant station. The selector key completes a circuit from a battery 61 through the coil 52 of the pulsing relay 51. The pulsing relay 51 similarly to the pulsing relay 18 shown in Fig. 1 of the drawings disconnects the oscillator 21 from the transmitting channel when in an operative position. A circuit is completed from the battery 61 and the pulsing contacts of the selector for operating the relay 55. The relay 55 upon operation establishes a holding circuit from the battery 62 through the coil 56 and the switch 29 operated by the switchhook. The holding circuit for the relay 54 from the battery 59 is open upon operation of the relay 55. However, the relay 54 is slow in releasing and does not complete a circuit from battery 60 through the coil 54 through the pulse relay 51 until after the selector key has completed its operation. When the code signal has been transmitted and the slow acting relay 54 is released the coil 53 of the pulsing relay 51 is energized to insure disconnecting the oscillator 21 from the transmitting channel. The relay 51 is provided with a second armature for operating the selector magnet 23 according to the code signal being transmitted. The selector magnet 23 is operated by the relay 51 to call an extension station (not shown).

At the distant called station the receiving relay 28 and the slow acting relays 26 and 27 are operated in the same manner as described when reference was made to Fig. 1 of the drawings. The selector magnet 23, the selector 22 and the relay 24 are also operated in the same manner as described when reference was made to the system shown in Fig. 1 of the drawings. Upon operation of the relay 24 a circuit is completed for operating the bell 25. A holding circuit for the relay 24 is completed from the battery 30 and an operating circuit for the relay 55 is completed from the battery 62 through the coil 57. The relay 55 is operated to open the holding circuit from the battery 59 through the coil of the relay 54 and to establish a holding circuit through the coil 56 of the relay 55 when the operator at the called station removes his receiver from the switchhook.

When the operator removes his receiver from the switchhook switch 29 operates filament relay 16 to break the holding circuit through the coil of the relay 24. Relay 24 is released to stop the operation of the bell 25 and break the operating

circuit through the coil 57 of relay 55. The relay 55, however, is held in position by reason of the holding circuit established through the coil 56. The relay 54 is slow acting and establishes a holding circuit from the battery 60 through the coil 53 of the pulsing relay 51 for holding the pulsing relay 51 in an operated position to insure disconnecting the oscillator 21 from the transmitting channel during conversation. Upon completion of conversation when the receivers at the transmitting and receiving stations are returned to their switchhooks, the relays 16 and 55 are released to insure returning all relays to their normal position.

Modifications in the system and in the arrangement and location of parts may be made within the spirit and scope of the invention and such modifications are intended to be covered by the appended claims.

What is claimed is:

1. In a signal system, a plurality of signal stations connected to a transmission line, calling oscillators and calling selectors at said stations, said oscillators being normally connected to said line and de-energized, means automatically operated at a calling station for energizing the calling oscillator at the station upon removal of the receiver from the switchhook to transmit a signal impulse over the line, means for transmitting a code signal of calling impulses from the oscillator and for removing the oscillator from the line upon completion of the calling signal, and means at the called station for removing the oscillator at this station from the line upon receipt of a calling signal and removal of the receiver from the switchhook.

2. In a signal system, a plurality of signal stations connected to a transmission line, a calling selector at each of said stations, a calling oscillator at each of said stations normally connected to the line and de-energized, said oscillators developing a frequency within the voice frequency range, means at a calling station for energizing the associated calling oscillator to transmit a prolonged impulse of carrier current modulated with current from the oscillator followed by a code signal of modulated impulses, means for operating the selector at the called station responsive to said transmitted signal and unresponsive to the currents received during communication between stations and means for automatically removing the calling oscillator at the called station from the line upon removal of the receiver from the switchhook at the called station.

3. In a signal system, a power line having a plurality of signal stations connected thereto, calling selectors at said stations, signaling oscillators at said stations each having a frequency within the voice frequency range and normally de-energized and connected to the power line, means automatically operated at a calling station to energize the signaling oscillator and to transmit a prolonged impulse of carrier current modulated with current from said oscillator to a called station upon removal of the receiver from the switchhook, means comprising a selector key for transmitting a code signal of carrier current modulated with impulses from said oscillator at the calling station, means at the calling station for insuring the removal of the calling oscillator from the power line upon completion of the calling signal, and means at the called station responsive to the prolonged im-

pulse and the code signal for operating the selector at the called station.

4. In a power line carrier current communication system, a plurality of signal stations connected to the power line, means for communicating between said stations by currents having frequencies included within a single side band, a selector at each of said stations, means comprising a line relay, two slow acting relays and a selector relay for operating each of said selectors, said line relay operating the selector relay by means of said slow acting relays, a calling oscillator, means automatically operated upon removal of the receiver from the switchhook at the calling station for transmitting a prolonged impulse from said oscillator to effect operation of said slow acting relays, and means comprising a selector key for transmitting impulses from said oscillator to operate the selector by means of the line relays, said slow acting relays and the selector relay.

5. In a signal system, a plurality of signal stations connected to a transmission line, calling oscillators normally deenergized and connected to the line at said stations, means automatically operated upon removal of the receiver from the switchhook at a calling station for energizing the calling oscillator at the station and for transmitting a prolonged signal impulse over said line, means at the calling station for transmitting a code signal of calling impulses from the calling oscillator and for disconnecting the calling oscillator from the line upon completion of the code signal, and call means at a called station responsive to the prolonged impulse and the code signal.

6. In a signal system, a plurality of signal stations connected to a transmission line, calling oscillators at said stations, means automatically operated upon removal of the receiver from the switchhook at a calling station for transmitting a prolonged impulse over said line from the call oscillator at the calling station, means at the calling station for transmitting a code signal of calling impulses from the calling oscillator, call means comprising a slow-operating relay at a called station responsive to the prolonged impulse, a selector at the called station, and means comprising a circuit prepared by said slow-operating relay for operating said selector by the code signal.

7. In a signal system, a transmission line having a plurality of signal stations connected thereto, calling selectors at said stations, signaling oscillators at said stations normally deenergized and connected to the transmission line, means automatically operated at a calling station to energize the signaling oscillator and to transmit a prolonged impulse of current from said oscillator to a called station upon removal of the receiver from the switchhook, means comprising a selector key for transmitting a code signal of current impulses from said oscillator at the calling station, means at the calling station for insuring the removal of the calling oscillator from the line upon completion of the calling signal, and means at the called station responsive to the prolonged impulse and the code signal for operating the selector at the called station.

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