

April 29, 1969

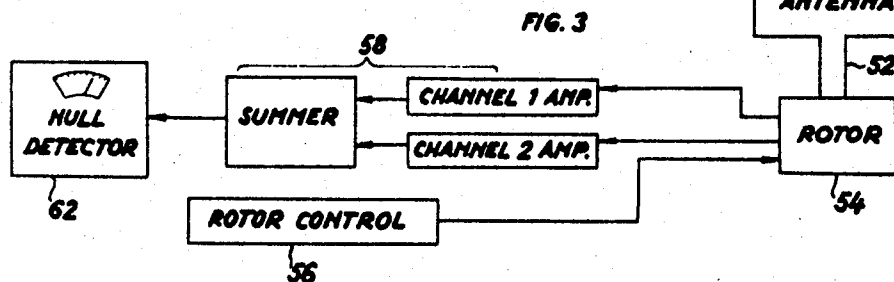
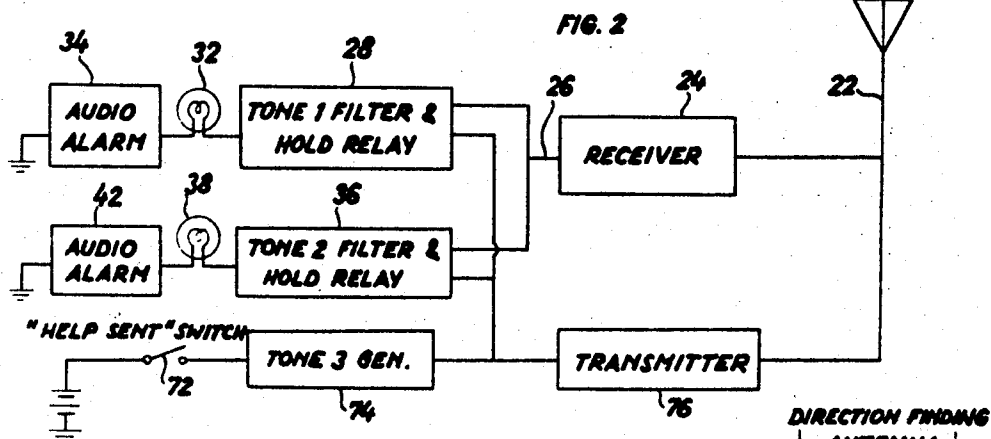
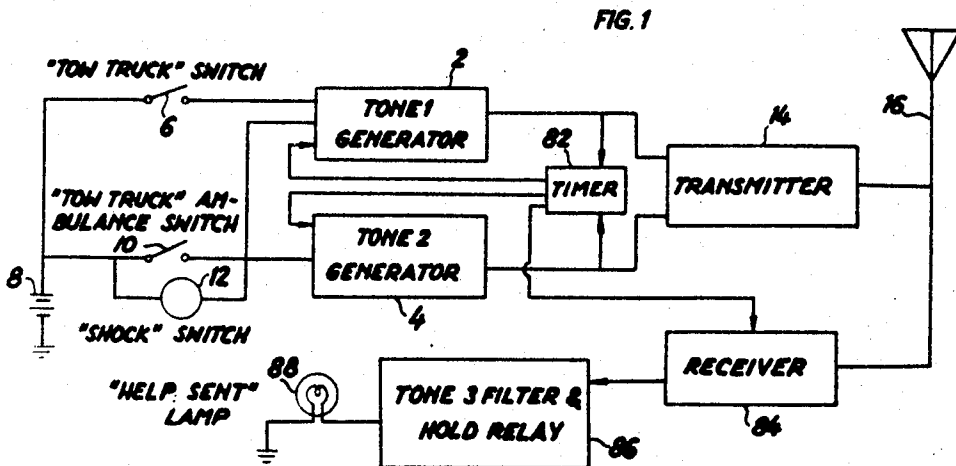
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3,441,858

ELECTRONIC CALLING AND REPLY SYSTEM

Filed Dec. 9, 1965

Sheet 1 of 2



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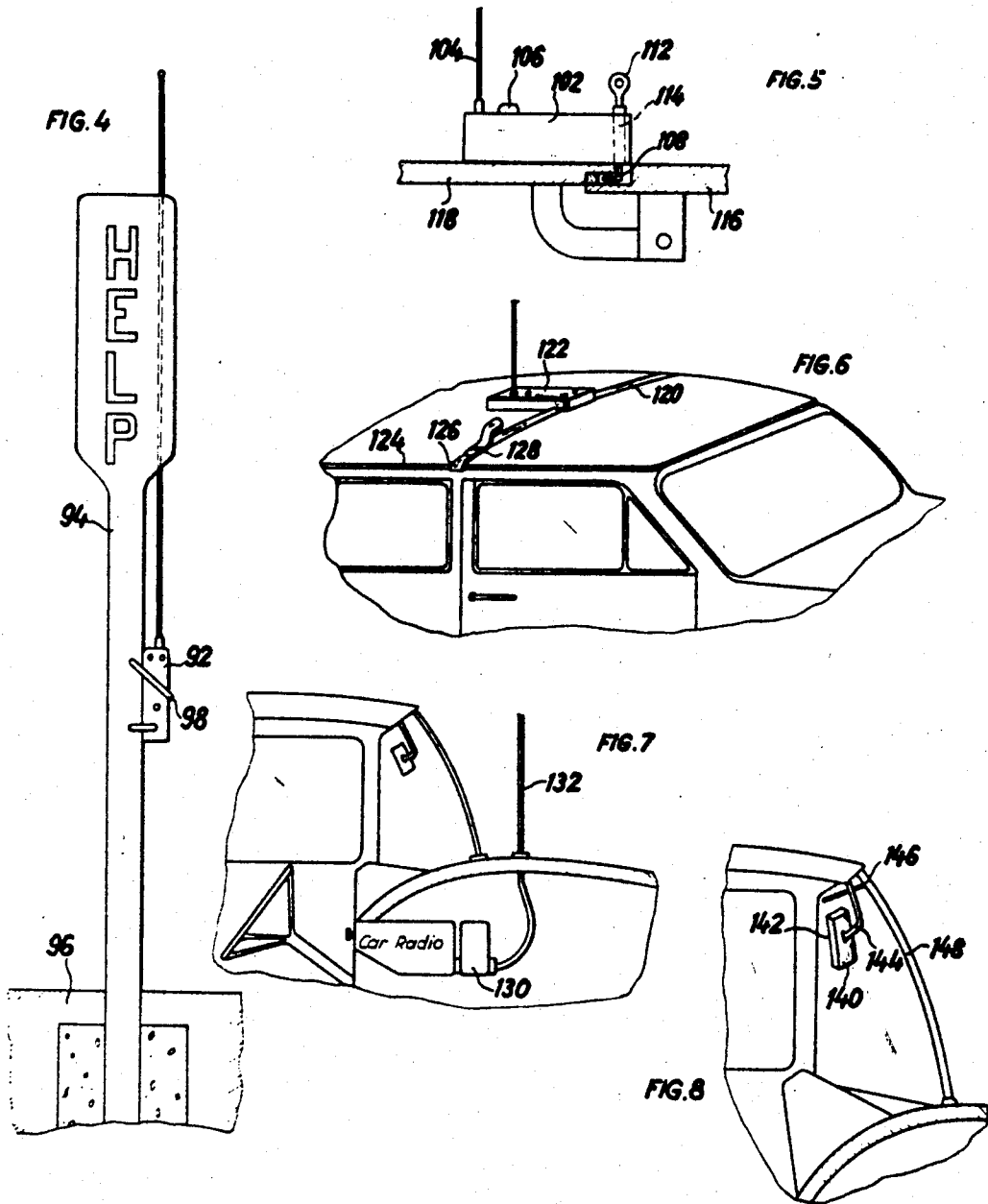
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Sheet 2 of 2



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3,441,858 ELECTRONIC CALLING AND REPLY SYSTEM

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Filed Dec. 9, 1965, Ser. No. 513,150

Int. Cl. H04b 7/20; G08g 1/08

U.S. Cl. 325—55

6 Claims

ABSTRACT OF THE DISCLOSURE

The system includes a transceiver unit which may be actuated, either manually or automatically, to broadcast a selected one of a plurality of coded signals to a central station unit. After locating the broadcasting transceiver, the central station unit responds by transmitting a unique coded signal, and the transceiver continuously indicates this response even after transmission has ceased.

The invention relates to an electronic calling system, and more particularly to an electronic system designed to locate and reply to a broadcast call for aid.

In recent years concern has spread for the growing number of motorists stranded by mechanical failure or accident along the predominantly rural sections of modern, high-speed, limited access highways. A number of systems have been designed in response to this concern, specifically to aid stranded motorists, while also aiding others as well, such as hikers and hunters, who find themselves in a similar plight. While early efforts made use of wired systems similar to a fire alarm box type of system, because of their cost more recent efforts have turned to radio broadcasting devices.

One such recent radio system includes a series of transmitting field units mounted along the highway, and a receiving unit installed in a central station. When one of the highway units is activated by a motorist who has walked to it along the highway from his disabled car, the unit transmits a coded radio signal. The central station unit receives and decodes the transmitted signal to determine the location of the activated highway unit. The central station attendant then notes the location of the activated highway unit and dispatches aid.

Another type of recent system, a voluntary system, contemplates highway units which are purchased by motorists and installed in their cars, and monitoring or central station units maintained by such groups as service stations, police departments and hospital emergency units. Should a motorist who has such a highway unit require assistance, he turns his unit on and calls for help until a monitoring station answers. He then tells the monitoring station where he is and what he needs, if he knows. If the monitoring station can fill his need and has a vehicle free to send to his aid, presumably they will do so.

All of these systems have inherent disadvantages, which preclude them from fulfilling the growing need for an emergency calling system. They are designed either to be mounted along a highway, which requires the stranded motorist to walk along the highway and find a unit; or to be mounted in the automobile, limiting the service to those motorists who have purchased and installed the appropriate unit in their car. No present system functions where it is really needed—in a severe accident. Either the unit is mounted down the expressway, or in one of the cars involved, in which case most likely either it, the occupants, or the electrical power system of the car has been damaged enough to prevent operation of the unit. In addition to these drawbacks, no present automobile unit indicates to the motorist that aid has been dispatched.

The electronic emergency calling system of the present

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invention overcomes all of these disadvantages, while at the same time being economically feasible, reliable, versatile, and adaptable to either fixed highway or mobile car installation. It also automatically calls aid to the scene of an accident.

The system of the present invention contemplates two transceiver units (a transceiver is an electronic device which both transmits and receives radio signals). One transceiver unit, the field or highway unit, is designed either to be attached to an automobile or to be attached to a post set alongside the highway. It may be manually actuated to broadcast one of two coded signals—one which calls for a tow truck, the other which calls for both a tow truck and an ambulance. The other transceiver unit, the central station unit, automatically responds to receipt of either of the two coded signals to alert an attendant who then locates the highway unit broadcasting the signal by using the direction-finding equipment of the central station unit. After locating the highway unit, the attendant dispatches the required aid and actuates the central station unit to broadcast a third coded signal which is received by the actuated highway unit and indicates to the motorist that help is on the way. The automobile mounted highway unit, besides being manually actuated, preferably is also automatically actuated by the shock of an accident to broadcast the tow truck-ambulance coded signal and summon aid to the scene of the accident, regardless of the damage to the car or its occupants. Because of the unique construction and mounting of the self contained highway unit on the automobile, the unit may be quickly, easily and securely attached to and detached from an automobile, making it possible to lease the highway units to motorists for short periods of time, such as for the duration of their travel along the highway.

The invention will be further described in connection with the accompanying drawings, in which:

FIGURE 1 is a schematic block diagram of the highway transceiver unit,

FIGURES 2 and 3 are schematic block diagrams of portions of the central station unit,

FIGURE 4 is a perspective view of the highway unit mounted on a post set alongside the highway, and

FIGURES 5 through 8 are views of various mountings for attaching the highway unit to the car.

As shown in FIGURE 1, the field or highway transceiver unit includes two tone generators, a tone generator 2 which electromagnetically generates a first tone for calling a tow truck for example, and a tone generator 4 which electromagnetically generates a second tone for calling an ambulance for example, when actuated. To actuate the first "tow truck" tone generator, a first manual switch 6 selectively connects the generator to the source of electrical power 8 contained in the unit. To actuate the both first and second tones, a second manual switch 10, the "tow truck-ambulance" switch, selectively connects both the first and second tone generator to the source of electrical power. A third, shock actuated switch 12 is connected in parallel with the second switch. Should the highway transceiver unit be subjected to a violent shock, as would occur in an accident, the third switch 12 closes, automatically connecting both the first and second tone generators to the source of electrical power, and causing them to generate their tones.

The tone generators are both connected to the transmitter input of the transceiver, to apply their tones and electrical power to the transmitter circuitry 14. The transmitter circuitry electronically modulates a radio frequency carrier with the applied tones, and supplies the modulated radio frequency carrier to an antenna 16 electrically connected thereto, the antenna electromagnetically broadcasting the modulated carrier.

The signal broadcast by the highway unit is received by the circuitry of the central station unit schematically shown in FIGURE 2, over antenna 22. The receiver circuitry 24, electrically connected to the antenna, electronically amplifies and detects the received signal, and presents at its output 26 the transmitted tone or tones. Should only the first, or tow truck, tone have been transmitted by the highway unit, only the tone 1 filter and hold relay circuitry 28, electrically connected to output 26, will be actuated to energize a lamp 32 and sound an alarm 34 connected thereto. Should the second, or ambulance, tone also have been transmitted, the tone 2 filter and hold relay circuitry 36, electrically connected to output 26, also will be actuated to energize a lamp 38 and sound an alarm 42 connected thereto.

These audio and visual alarms, broadcast by the receiver circuitry of FIGURE 2 in response to reception of the appropriate tone modulated carrier from the highway unit, will call an attendant to the central station circuitry. The attendant then tunes the direction-finding circuitry schematically shown in FIGURE 3 to determine the direction from which the highway signal is being received, and thus the bearing of the highway unit. While most any direction-finding circuitry will be generally satisfactory for this purpose, an "Adcock" antenna system presently is preferred due to the accuracy of its resolution. This system includes an "Adcock" antenna 52 mounted for rotation on a rotor 54 whose bearing is determined and controlled by either an electrical or a mechanical mechanism 56, depending generally on the spacing of the antenna from the central station circuitry. The signals received by the "Adcock" antenna are compared in a conventional fashion in circuitry 58, whose output is applied to a meter 62. By rotating the antenna 52 using control 56, while observing the meter 62, the attendant is able to determine rather precisely the direction from which the signal is being transmitted, and the bearing of the highway unit.

While two spaced direction finding systems, as illustrated in FIGURE 3, could be provided at the central station, and their respective readings triangulated to precisely locate the transmitting highway unit, another procedure is preferred. The present electronic calling system contemplates installing the system, at least initially, only on limited access highways. Because of this, the central station attendant only needs one directional bearing on the highway unit, for the intersection of this bearing with a limited access highway will locate the transmitting highway unit.

When the transmitting highway unit has been so located, the attendant then closes a switch 72, included in the central station circuitry shown in FIGURE 2, to apply electrical power to a third tone generator 74, and to a transmitter circuitry 76 to which the output of the tone generator 74 is connected. The transmitter circuitry electronically modulates a radio frequency carrier with the third tone and applies this modulated carrier to the antenna 22, to which it is connected, and the modulated carrier is broadcast. The third tone is also applied to the two tone filters and hold relays 28 and 36 to open the hold relays, turn off the alarms, and return the central station unit to a standby condition when the switch 72 is released.

The highway transceiver unit preferably includes a timer 82. When either of the tone generators 2 and 4 are actuated, their output to the transmitter 14 keys the timer to a first state in which it applies power to the actuated tone generator, one or both, holding them on and maintaining transmission of the tone or tones irrespective of the condition of the switches. After expiration of an interval predetermined by the timer, preferably about a minute, the timer automatically switches to a second state in which power is applied only to the receiver circuitry 84 of the highway unit. This terminates energization of the tone generators 2 and 4, and the transmitter circuitry 14,

thereby terminating broadcast of the coded signal, and by simultaneously energizing the receiver circuitry 84 readies the highway transceiver unit for reception of the third tone, broadcast by the central station transmitter. When the receiver 84 receives this third tone signal from the antenna 16, to which it is electrically connected, it amplifies and then detects it, all in a conventional fashion. The detected tone signal is electrically applied to the tone 3 filter and hold relay 86 which, upon receipt only of the proper third tone, energizes lamp 88 connected thereto. The hold relay continues to hold this lamp in an energized condition after the third tone signal has stopped. The energized lamp 88 visually tells the stranded motorist at the highway unit that help is on the way, and continues to reassure him even after transmission of the third tone has stopped. If the third tone is not received, the motorist may reactivate transmission after a few minutes by actuating the appropriate switch, and repeat the procedure until aid is dispatched and the third tone received.

To review the operation of the system, when the tone generators of the highway unit are actuated, either manually by a motorist in need of aid or automatically by the shock of an accident, the highway unit broadcasts a discrete coded signal. This signal is received by the central station unit, and both visually and audibly alerts an attendant. The attendant then determines the bearing of the broadcasting highway unit with the direction finding circuitry, and dispatches aid to the location. He also actuates a tone generator at the central station to broadcast a discrete coded signal. The highway unit after a predetermined interval of transmission automatically switches to a receiving state, and when the coded signal broadcast by the central station is received, energizes a lamp and holds the lamp on, indicating to the motorist that help is on the way. After transmitting the third tone, the central station automatically returns to a standby condition awaiting receipt of another highway unit signal.

While all the highway units could be alike in construction and operation, it is preferred to construct them according to their location and function. Many of the highway units will be mounted along the highway, preferably approximately at mile intervals along the dividing strip between the lanes. In these units the shock actuated switch 12 may be omitted, for it will not be necessary. Since the direction finding circuitry of the central station unit can only resolve the bearing of the highway unit to within a few degrees, for all practical purposes, the first tone generator 2 preferably is constructed to generate a particular code or combination of discrete tones, and units generating different combinations placed in sequence along the highway. The central station unit then may detect and use the particular combination of tones being transmitted to resolve between adjacent units within the bearing indicated by the direction finding circuitry. For example, the first tone generator may broadcast a combination of discrete tones in a band between 400 and 800 cycles, the tone 1 filter 28 at the central station unit responds to any tone within this band, and the direction finding circuitry 58 determines both the bearing of the signal broadcast by the highway unit and its particular combination of discrete tones. It is feasible, if the area to be covered by the system is relatively small and all the highway units are to be installed along the highway, to construct each highway unit installed in the area to generate a tone code different from the rest, and use only the tone coding to determine the location of the actuated highway unit. The highway unit designed to be carried by a car may broadcast a combination of tones differing from all the fixed highway units, to further aid the attendant at the central station unit in distinguishing one highway unit from another. All the highway units should include a readily accessible battery pack, so the batteries may be periodically tested and changed without undue effort.

The physical construction of the highway units also should reflect their differing functions. As shown in FIG-

FIGURE 4, the highway unit 92 designed to be mounted on a post 94 bedded in the ground 96, should be physically locked to the post, as by a cable 98, and should be sufficiently rugged to withstand attack by vandals, wild animals, and the elements. The highway units designed to be removably attached to automobiles should also be sufficiently rugged to withstand similar attacks, as well as the shock of an accident. In addition they should be mounted to broadcast a non-directional signal; they should be capable of quick and easy attachment and detachment; and they should be capable of being mounted on a wide variety of automobiles. Such requirements are difficult to meet. Nevertheless, the mountings illustrated in FIGURES 5 and 6 do so.

In the mounting illustrated in FIGURE 5, the highway unit 102, from which projects the antenna 104 and the "help-sent" lamp 106, includes two downwardly extending prongs 108. The prongs may be turned by a key 112 in a lock 114 contained in the unit from a position in which their ends are in line with one another to a position in which their ends define generally parallel lines and point towards the other end of the unit, as shown. These prongs, when in line, may be slipped into the joint between a car body 116 and its trunk 118, or its hood if so desired. Then by turning key 112 the prongs may be brought into a parallel relation to hold or clamp the unit to the car, as shown, and the key removed, locking the unit to the car. Because tolerances are one of the most universally common characteristic among automobiles, such a trunk joint mounting fits most all cars, except some station wagons. Further, such a mounting utilizes the flat plane of the trunk as a ground plane for the antenna 104, to enhance its electrical characteristics. And when so mounted the unit is protected from direct collision in most all accidents.

In the mounting illustrated in FIGURE 6, a strap 120 extends through the highway unit 122 and between the longitudinally-extending rain gutters 124 of the car. The strap passes through two rain-gutter clamps 126, one for each rain gutter, and a buckler or lock 128 to secure the strap tensioned on the roof of the car between the clamps hooked to the rain gutters, and with the highway unit held down approximately centered on the roof. In this mounting the roof serves as the ground plane for the antenna, and the antenna has a highly uniform radiating pattern. Yet when so mounted, the unit is somewhat more vulnerable than in the mounting shown in FIGURE 5 to damage during an automobile accident, particularly when the car overturns. Also this mounting is not readily adaptable to convertibles.

Should it be desired to permanently install the highway unit in an automobile it may be incorporated as part of the car radio either by being built with it as a single unit, or by being attached to the concealed rearward portion of the radio as shown in FIGURE 7, and only the controls exposed. The transceiver unit 130 may use the same aerial 132 as the radio, although the aerial should be reinforced, and the transceiver unit encased in a shock resistant housing, to withstand damage from an accident. Alternatively, the transceiver unit may replace the car's interior rear-view mirror, as shown in FIGURE 8, the transceiver unit 140 being faced with a mirror 142 and mounted to a post 144 with a ball joint to permit it to be adjusted somewhat in all directions to suit different drivers. An aerial 146 may be attached along the top marginal portion of the windshield 148, or extend through the windshield or roof to a point well above the roof if desired, for a more uniform radiating pattern.

Because various modifications of both the electrical and physical characteristics of the described electronic calling system will be apparent to those skilled in this art who are familiar with the foregoing teachings, while a preferred embodiment of the invention has been described, the scope of the invention is defined by the following claims.

I claim:

1. An electronic calling system for summoning assistance to motorists in distress, the system including a central unit and a plurality of highway units, the system comprising means in the highway unit for electronically generating and broadcasting a selected one of a plurality of first coded signals, means in the central unit for receiving and detecting the particular first coded signal broadcast by the highway unit, means in the central unit for electronically generating and broadcasting a second coded signal to indicate that the requested assistance has been dispatched, and means in the highway unit for receiving and visually indicating reception of this second coded signal both during and for a substantial period of time following its transmission.

2. An electronic calling system as set forth in claim 1 including means in the field unit for broadcasting the first coded signal for a predetermined period of time and then automatically switching the field unit to a condition for receiving the second coded signal broadcast by the central unit.

3. An electronic calling system as set forth in claim 1 in which the means in the central unit for receiving and detecting the first coded signal includes means for detecting the bearing of the received first coded signal.

4. An electronic calling system as set forth in claim 1 in which the first coded signals broadcast by the different highway units include a characteristic identifying and distinguishing the broadcasting highway unit from other highway units, said means in the central unit for receiving and detecting the first coded signals including means responsive to the broadcast identifying characteristic for distinguishing the broadcasting highway unit from other highway units.

5. An electronic calling system as set forth in claim 1 in which at least one highway unit includes means for automatically broadcasting a selected one of the first coded signals in response to a shock exceeding a predetermined intensity.

6. A highway unit for an electronic calling system designed to summon assistance to a motorist in distress, the system also including a central unit, the highway unit comprising means for electronically generating and broadcasting a selected one of a plurality of first coded signals, means for detecting a second coded signal broadcast by the central unit, means for automatically deactivating the means for generating and broadcasting the first coded signals and energizing the means for detecting the second coded signal, means for indicating receipt of the second coded signal both during and following its reception, and means for automatically broadcasting a selected one of the first coded signals in response to a shock exceeding a predetermined intensity.

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U.S. Cl. X.R.

325—64, 66, 117; 340—33, 224