Abstract: Telephone sets can be fitted with auxiliary headset features but they will still require mechanical lifters to raise and lower the handset in response to a call. The lifter needs to be in circuit with some portion of the telephone set but it is impractical to modify an unlimited number of disparate set types. To solve this problem, the audio line cord, which is easily detachable, is passed through the lifter system and manually operable remote switch. The switch issues signals in tandem with audio signals on the handset cord and the lifter system differentiates the signals to respond only to switching signals intended to lift or lower the handset from its cradle.
RETROFIT SWITCH ACTIVATED HANDSET LIFTER

Field of the Invention
The present invention is directed generally to a telephone headset apparatus and more particularly to a manually switch activated handset lifter apparatus which can be retrofitted to existing telephone sets without modification.

Background
Communication systems for interconnection of a headset or other receiver with telephone systems are well known. Wireless systems add a new dimension to the use of specialized and report receivers interconnected into telephone, including Voice over IP (VoIP) networks. Such systems include a fixed transceiver which is connected to a telephone line with associated hardware to relay signals to and from a remote device. Wireless systems allow substantial freedom of movement during a telephone conversation since the user is not anchored to a telephone cord line. Such wireless systems typically include a base station inserted between the handset and the telephone itself, in effect tapping off the audio signals for transmission to and from the headset. Because the handset remains indirectly connected to the telephone via the wireless base that may contain switching circuits for selecting wireless headset or handset, the user still retains the ability to use the both the original handset and the wireless device.

In many cases, the user may be located near the telephone set (e.g. to make an outgoing call from the telephone keypad), in which case the user could manually lift the handset to initiate the phone call. However this may be an inconvenience, as it also requires the user to manually replace the handset at the end of the call.
Summary of the Invention

Generally, the present invention relates to a system and method of retrofitting an existing telephone set to have a lifter responsive to a switch and being able to install such equipment onto such existing phone set without material modification thereof.

For example, there is disclosed a method of retrofitting a telephone set having a base unit, a handset, a handset cord connecting the handset to the base unit, and an electrically responsive handset lifter, having the steps of: electrically connecting the handset to the base unit via said handset cord through the lifter; and electrically connecting a lifter up/down actuator in said handset cord; and the configuring said lifter to sense the signal from said actuator through said headset cord with quick disconnect and thereby lifting or lowering the handset in response thereto.

There is also disclosed a system for retrofitting a telephone set for remotely actuating a handset lifter, said telephone set having a base unit, a handset, a handset cord configured to carry audio signals between said base unit and said handset, and a lifter, which includes a command unit for configured to issue an actuation signal to said lifter, said unit being configured to transmit said actuation signal along said audio signal wires in said handset cord, and a sensor associated with said lifter and in circuit with said wires in said handset cord, for detecting said actuation signal from said unit and configured to reject audio signals carried on said wires, and passing said actuation signal through to said lifter for lifting and replacing the handset in response to said command unit.

Numerous other inventive concepts and embodiments are disclosed and claimed in this document. This summary does not endeavor to touch on all of them. Reference should be had to the full specification and claims.
**Brief Description of the Drawings**

The invention may be more completely understood in consideration of the following detailed description of various embodiments of the invention in connection with the accompanying drawings, in which:

FIG. 1 depicts a functional block diagram of the circuitry to implement a push button activated handset lifter apparatus.

While the invention is amenable to various modifications and alternative forms, specifics thereof have been shown by way of example in the drawings and will be described in detail. It should be understood, however, that the intention is not to limit the invention to the particular embodiments described. On the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention as defined by the appended claims.

**Detailed Description**

In general, the present invention is directed to a system, method and apparatus of a push button activated handset lifter device. It is well known that wireless or wired telephone headsets and associated amplifiers normally tap the analog line of a telephone handset than the line cord. The advantage of this arrangement is that, particularly, in digital telephone sets, the proprietary codes used by each set manufacturer need not be know. Furthermore, tapping into the line cord, means that the headset must be a complete phone, not just a handset replacement and the features of the telephone set would also have to be replicated.

A convenient way to allow the user to take the phone off hook (i.e. raise the handset so that the headset system will able to intercept the voice signals) is to provide a manual system for direct actuation of the lifter system which can be added to the analog handset line. This may be in addition to some
wireless or other lifter actuator, such as a switch on the lifter, etc. By adding the switch in the handset line, it makes it simple to retrofit any telephone with connectors (usually the RJ modular type) and no further retrofit of the phone is required.

A functional block diagram embodiment of a push button activated, headset lifter system 100 is depicted in FIG. 1. A top level overview of the system operation follows. A standard office telephone 110 connected to a handset jack is connected to headset amplifier unit 120 by interconnect cable 130. The headset amplifier unit 120 has modular jack 140 shown with 4 leads, 140 A thru 140 D, exiting the connector jack 140. Leads 140 A & 140 B carry audio signals generated by the microphone unit 150 en route to the telephone 110, whereas, leads 140 C & 140 D carry audio signals from the phone 110 destined for the headset speaker 160. The push-button activation unit 170 houses, among other things, the user activated push-button 180, whose output signal controls the phone handset lifter unit 185. In this environment, the headset wearer can both answer (pick-up) and terminate (hang-up) phone calls without having to physically interact with the phone handset.

A problem would arise in the use of a simple push button (make/break) connected to circuitry to raise and lower the handset. An audio (such as a voice) signal, which is simultaneously carried on the line may appear to mimic a signal which the lifting/lowering circuit would see as a signal to initiate such action. Such a false actuation would render the system unreliable.

To prevent this, create a band pass filter which is configured to block audio signals which may appear as trigger signals. An example of such a signal might be the loud signal used in US telephone system to indicate that a user has left the handset off hook for a predetermined period of time, about 30
seconds. Of course it is necessary to select a bandpass value which is such that it does not interfere with normal audio signals in the narrow voice frequencies and amplitudes which the listener needs to receive.

5 Now, a more detailed examination. When the user hears the phone 110 ringing with an incoming call, the user may initiate lifting the phone handset and accepting the call by depressing the manual actuation command unit (in this embodiment a push button, though it could be many type of signal generators) 180 for a predetermined time period, say more than generally 100 milliseconds and less than 2 seconds. The 100 ms wait time is not an absolute. It could be 25 or 50 ms, for example, but the longer the time, the more likely undesirable transient signals will be rejected. The 2 second maximum is likewise not an essential upper end. 0.5 or 1 second, for example could also be selected. The objective is for a human user to hold the switch engaged long enough to send a signal which is clearly not a transient and short enough to be convenient. When push button 180 is closed, resistor 200 discharges capacitor 190 so that current can be drawn through resistor 210, which in turn activates the up logic circuitry.(capacitor 220 blocks the + DC from entering the headset amp 120). The discharging signal 230 is received and analyzed by logic circuit 240. An active signal generator could be substituted for manual command unit 180 and associated RC circuitry. In the present case a declining exponential pulse is generated with a high peak to make it easily distinguishable from a similar audio signal (although it the preferred embodiment, such signals will be substantially filtered). It is possible to use other, even more distinguishable wave forms, such as square wave pulses, specific analog patterns or even digitally encoded ID signals which can be fully separated from audio. The preferred method recognizes the cost advantages of a simple RC network.

25 If the logic circuit 240 determines the discharging signal 230 meets the predetermined criterion (time window) to initiate a call answer—i.e. lift UP
signal (again, at time delay of more than 100 milliseconds and less than 2
seconds in duration), the logic circuit 240 will output an up command 250
which in turn activates the up switch 260 allowing current 270 to flow through
the lifter motor 280 in the appropriate direction to begin physically lifting the
phone handset. The lifter motor 280 may lift the phone handset until the Up
Cycle Stop Sensor 290 senses the handset has reached a predetermined
height (which may be determined by any number of sensor devices known in
the art) and may then initiate a stop command 300 which may disengage the
up switch 260 and halt the lifter motor 280. With the handset now lifted (i.e.
off hook state) above the threshold to allow for an incoming call to be
received, the audio signal exits the phone 110 and traverses interconnect
cable 130 to the headset amplifier 120. The incoming audio signal is then
routed from the headset amp 120 as a differential output signal applied to
leads 140 C & 140 D. The audio signal on leads 140 C & 140 D traverses in
order the headset connector 310, coiled wire 320, and the push-button
activation unit 170 en route to headset speaker unit 160. Wherein, capacitor
220 on wire lead 140 D serves as a coupling capacitor to pass the audio
signal and block D.C. and/or transient discharging signals 230 generated by
the push-button activation unit 170 as explained earlier, and resistor 410 on
wire lead 140 C has a sufficiently large resistance, typically much greater
than 300 ohms, so as not load down the audio signal en route to speaker
160. And furthermore, the low pass filter circuitry comprised of resistor 210
and capacitor 330 shunts the audio signal on lead 140 D to ground just prior
to the phone handset lifter unit 185, thereby ensuring the audio signal might
not inadvertently trigger the logic unit 240 to issue an erroneous handset
up/down command.

Note that a digital (i.e., non-analog) version of this system is possible. The
RC circuit would be replaced by known switching circuits with timers.
Similarly, the user can hang-up and terminate phone calls by depressing the same push button 180 used to pick-up the original call. In this scenario, when the user wishes to terminate the call and replace the handset to its resting "down" position, the user may depress the push button 180 for a predetermined time period, say greater than 200 milliseconds (ms), but there are other options. The UP signal could be say 100 ms to 2 sec (or others as mentioned above) and a DOWN signal could be issued when the switch is activated for longer than the down signal (in this case > 2 second). Another scenario is the UP and DOWN signals are of the same length (for example >100ms ,<2 seconds, but toggle between up and down. This is a simpler construction but can be a bit confusing for the user. As before, this action discharges the energy stored in capacitor 190 through resistors 200 and 210, (capacitor 220 blocks the discharging signal from entering the headset amp 120). The discharging signal 230 is received and analyzed by logic circuit 240.

If the logic circuit 240 determines the discharging signal 230 meets the predetermined criterion to initiate a call hang-up (time period greater than 2 ms in duration), the logic circuit 240 will output a down command 340 which in turn activates the down switch 350 allowing current 360 to flow through the lifter motor 280 in the appropriate direction to begin physically lowering the phone handset. The lifter motor 280 may then lower the phone handset until the Down Cycle Stop Sensor 370 senses the handset has reached a predetermined height and may then initiate a stop command 380 which may disengage the down switch 260 and halt the lifter motor 280. In the example described above, the DOWN signal is inhibited during the lifting of the headset, and similarly, the UP signal is inhibited while the lifter device 100 is going down. This may, for example, ensure that the user does not mistakenly terminate a call pick-up by inadvertently hitting the push button 180 while the lifter is raising the handset.
The above embodiment describes the push button activated, headset lifter
device 100 utilizing analog electronics. A digital embodiment can also be
evisioned where, for example, the logic circuit 240 in digital format may be
programmed to recognize a single depression of the push button 180 as a
request to answer the phone 110 when ringing, and a rapid sequence of two
or more depressions of the push button 180 to signal a request to terminate
the call and hang up. Many other variations can also be envisioned, for
example a hybrid system part analog/part digital wherein the discharging
signal via capacitor 190 may be digitized within the push button activation
unit 170, prior to transmission to a digital logic unit 240.

Another important feature of the present invention are the quick disconnect
connectors 390 and 400 as incorporated in the push button activation unit
170.

These quick disconnect connectors may allow for the push button activation
unit 170 to be easily retro-fitted into pre-existing telephone headset systems
originally sold without the push-button activated call answering/call hang-up
capability.

As noted above, the present invention is applicable to telephone headset
systems and is believed to be particularly useful for a quick disconnect push
button activated headset lifter apparatus. The present invention should not
be considered limited to the particular examples described above, but rather
should be understood to cover all aspects of the invention as fairly set out in
the attached claims. Various modifications, equivalent processes, as well as
numerous structures to which the present invention may be applicable will
be readily apparent to those of skill in the art to which the present invention
is directed upon review of the present specification. The claims are intended
to cover such modifications and devices.
CLAIM:

1. A method of retrofitting a telephone set having a base unit, a handset, a handset cord connecting the handset to the base unit, and an electrically responsive handset lifter, comprising the steps of:

   a. electrically connecting the handset to the base unit via said handset cord through the lifter;
   
   b. electrically connecting a lifter up/down actuator in said handset cord; and
   
   c. configuring said lifter to sense the signal from said actuator through said handset cord and thereby lifting or lowering the handset in response thereto.

2. The method according to claim 1 further including the step of: filtering signals received by said lifter coming through said handset to attenuate voice signals which would mimic the actuation signal, so that voice signals do not cause false actuation of said lifter.

3. The method of claim 2 wherein said filtering step includes the step of shunting audio signals prior to entering said lifter.

4. The method of claim 2 wherein said filtering step includes band pass filtration of audio signals.

5. The method of claim 2 wherein said filtering step includes a time delay circuit for rejecting transient signals which appear during the time delay.

6. The method of claim 5 wherein said filtering step includes a time window in which the lifter is permitted to sense an actuation signal.
7. The method of claim 1 further including the step of configuring the lifter to reject any signal which does not meet specific criteria for actuation.

8. The method of claim 7 wherein said specific criteria are signals not generally shorter than a first predetermined time and not greater than a second predetermined time span.

9. The method of claim 7 wherein said specific criteria are a first signals not generally shorter than a first predetermined time and not greater than a second predetermined time span, to initiate a command to accuate said lifter in one direction and a second signal of length longer than said second predetermined time to actuate said lifter in another direction.

10. A system for retrofitting a telephone set for remotely actuating a handset lifter, said telephone set having a base unit, a handset, a handset cord configured to carry audio signals between said base unit and said handset, and a lifter, comprising:

   a. a command unit for configured to issue an actuation signal to said lifter, said unit being configured to transmit said actuation signal along said audio signal wires in said handset cord; and

   b. a sensor associated with said lifter and in circuit with said wires in said handset cord, for detecting said actuation signal from said unit and configured to reject audio signals carried on said wires, and passing said actuation signal through to said lifter for lifting and replacing the handset in response to said command unit.

11. The system of claim 10 wherein said sensor in said lifter includes a band pass filter.
12. The system of claim 11 wherein said sensor includes a filter which passes a pulse of generally not less than predetermined time to block transient signals.

13. The system of claim 10 wherein said sensor includes a first filter capable of sensing a predetermined minimum time delay to reject signals of duration shorter than said delay and a second maximum signal duration to reject signals of duration longer than a second predetermined maximum time span, so that only signals of duration falling within said predetermined minimum and maximum times will be passed to said lifter.

14. The system of claim 10 wherein said sensor includes a first filter capable of sensing a predetermined minimum time delay to reject signals of duration shorter than said delay and a second maximum signal duration to operate said lifter in one direction in response to a signal longer than said minimum and shorter than said maximum, and a second filter to actuate said lifter in another direction for signals longer than said maximum, so that signals of different duration will result in selective up and down actuation of the lifter in response to signal duration.

15. The system of claim 14 wherein said minimum time is generally 20 ms and said maximum time generally not more than 200 milliseconds.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04M 1/06
ADD. H04M 1/654

According to International Patent Classification (IPC) or to both national classification and IPC.

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched.

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<th>Citation of document with indication where appropriate of the relevant passages</th>
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□ Further documents are listed in the continuation of Box C  X See patent family annex

Special categories of cited documents

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"O" document referring to an oral disclosure, use, exhibition or other means

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Date of the actual completion of the international search

1 December 2006

Date of mailing of the international search report

11/12/2006

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