

CLAIMS

What is claimed is:

- 1.- ~~A method of detecting occlusion of an intravenous catheter, comprising:
providing an intravenous catheter;
coupling a housing to the intravenous catheter, the housing comprising an ultrasonic transducer;
transmitting, via the ultrasonic transducer, ultrasonic waves along a length of the catheter;
converting, via the ultrasonic transducer, a portion of the ultrasonic waves that are reflected back from the intravenous catheter to a corresponding electrical signal;
receiving the electrical signal at a processor coupled to the ultrasonic transducer;
comparing the electrical signal to a baseline signal to determine a difference between the electrical signal and the baseline signal; and
in response to the difference between the electrical signal and the baseline signal meeting a threshold value, alerting a user.~~
- 2.- ~~The method of claim 1, wherein the ultrasonic transducer is encapsulated in a wall of the housing.~~
- 3.- ~~The method of claim 1, wherein the ultrasonic transducer comprises a piezoelectric element.~~
- 4.- ~~The method of claim 1, further comprising determining the baseline signal, wherein determining the baseline signal comprises transmitting, via the ultrasonic transducer, other ultrasonic waves along the length of the intravenous catheter when the intravenous catheter is unoccluded and converting a portion of the other ultrasonic waves that are reflected back from the intravenous catheter to the baseline signal.~~
- 5.- ~~The method of claim 4, wherein determining the baseline signal is performed prior to transmitting, via the ultrasonic transducer, the ultrasonic waves along the length of the~~

~~intravenous catheter of the catheter adapter and converting the portion of the ultrasonic waves that are reflected back from the intravenous catheter to the corresponding electrical signal.~~

6. ~~The method of claim 1, wherein an outer surface of a distal tip of the intravenous catheter comprises a plurality of facets.~~

7. ~~The method of claim 1, wherein a wall forming an inner lumen of the intravenous catheter comprises one or more inner curved portions that extend proximally from a portion of a distal tip of the intravenous catheter configured to contact an introducer needle.~~

8. ~~The method of claim 1, wherein a wall forming the inner lumen of the intravenous catheter comprises a plurality of facets.~~

9. ~~A system to detect occlusion of an intravenous catheter, comprising:
a wave transmitter, wherein the wave transmitter transmits energy waves along a length of an intravenous catheter of a catheter adapter;~~

~~a housing comprising a transducer, wherein the transducer detects a portion of the energy waves corresponding to the energy waves that are reflected back from the intravenous catheter;~~

~~a processor coupled to the transducer, wherein the processor receives an electrical signal corresponding to the portion of the energy waves that are reflected back from the intravenous catheter and compares the electrical signal to a baseline signal to determine a difference between the electrical signal and the baseline signal; and~~

~~an indicator unit coupled to the processor, wherein in response to the difference between the electrical signal and the baseline signal meeting a threshold value, the indicator unit alerts a user.~~

10. ~~The system of claim 9, wherein the transducer comprises an ultrasonic transducer, wherein the ultrasonic transducer converts the portion of the energy waves that are reflected back from the intravenous catheter to the electrical signal, wherein the energy waves are ultrasonic waves.~~

- ~~11. The system of claim 10, wherein the ultrasonic transducer comprises a piezoelectric crystal, wherein the piezoelectric crystal is embedded in a wall of the inner lumen.~~
- ~~12. The system of claim 9, further comprising the catheter adapter, wherein the intravenous catheter extends distally from the catheter adapter, wherein the fluid pathway extends through an inner lumen of the intravenous catheter.~~
- ~~13. A method of detecting occlusion of an intravenous catheter, comprising:
transmitting energy waves along a length of an intravenous catheter of a catheter adapter;
converting a portion of the energy waves that are reflected back from the intravenous catheter to a corresponding electrical signal;
receiving the electrical signal at a processor;
comparing the electrical signal to a baseline signal to determine a difference between the electrical signal and the baseline signal; and
in response to the difference between the electrical signal and the baseline signal meeting a threshold value, alerting a user.~~
- ~~14. The method of claim 13, further comprising providing a housing and a transducer disposed within the housing, wherein the transducer converts the portion of the energy waves that are reflected back from the intravenous catheter to the corresponding electrical signal.~~
- ~~15. The method of claim 14, wherein the transducer is embedded in a wall of the inner lumen.~~
- ~~16. The method of claim 14, further comprising coupling a catheter adapter to the housing, wherein the intravenous catheter extends distally from the catheter adapter, wherein a fluid pathway extends through the intravenous catheter, the catheter adapter, and the housing.~~
- ~~17. The method of claim 13, wherein an outer surface of a distal tip of the intravenous catheter comprises a plurality of facets.~~

~~18. The method of claim 13, further comprising determining the baseline signal, wherein determining the baseline signal comprises transmitting other energy waves along the length of the intravenous catheter when the intravenous catheter is unoccluded and converting a portion of the other energy waves that are reflected back from the intravenous catheter to the baseline signal.~~

~~19. The method of claim 13, wherein determining the baseline signal is performed prior to transmitting the energy waves along the length of the intravenous catheter of the catheter adapter and converting the portion of the energy waves that are reflected back from the intravenous catheter to the corresponding electrical signal.~~

~~20. The method of claim 13, further comprising providing an electromagnetic wave transducer, wherein the transducer is configured to detect the portion of the energy waves that are reflected back from the intravenous catheter, wherein the energy waves are electromagnetic waves.~~

CLAIMS

1. A system for detecting occlusion of a catheter comprising:
a catheter adapter having a proximal end and a distal end;
a catheter that extends distally from the distal end of the catheter adapter;
a housing having a proximal end, a distal end, and a wall comprising an inner surface forming an inner lumen of the housing that extends between the proximal end of the housing and the distal end of the housing to thereby provide a fluid pathway into the catheter when the housing is coupled to the catheter adapter;
one or more transmitters positioned in wall the one or more transmitters emitting electromagnetic signals into the inner lumen of the housing in a distal direction;
one or more transducers that receive the electromagnetic signals after the electromagnetic signals have been reflected by the catheter; and
a processor that analyses the reflected electromagnetic signals to detect when the reflected electromagnetic signals indicate that the catheter of the catheter adapter is occluded.
2. The system of claim 1, wherein the housing is integral to the catheter adapter.
3. The system of claim 1, wherein the housing is separate from but connectable to the catheter adapter.
4. The system of claim 1, wherein a distal end of the catheter includes one or more inner facets, outer facets, inner curved portions, or outer curved portions to improve the reflection of the electromagnetic signals.