

CLAIMS

1. A catheter system comprising:
 - a needle assembly comprising:
 - an introducer needle; and
 - a needle hub coupled to the introducer needle;
 - a driving spring coupled to the needle hub, the driving spring comprising:
 - a superior portion comprising:
 - a first spring arm;
 - a second spring arm; and
 - a first cross-member coupling the first spring arm to the second spring arm;
 - an inferior portion comprising:
 - a third spring arm;
 - a fourth spring arm; and
 - a second cross-member coupling the third spring arm to the fourth spring arm;
 - a first resilient portion; and
 - a second resilient portion;wherein:
 - the second resilient portion couples the first spring arm to the third spring arm;
 - the first resilient portion couples the second spring arm to the fourth spring arm; and
 - the first and second resilient portions apply a bias force to the first and second cross-members to urge the first and second cross-members toward each other; and
- a needle-safety shield comprising:
 - a contact surface disposed at a distal end of the needle-safety shield, the needle-safety shield configured to slidably receive the introducer needle therein; and
 - a ramp member disposed at a proximal end of the needle-safety shield, the ramp member comprising:

a first ramp surface configured to receive a first guide surface of the first cross-member;

a second ramp surface configured to receive a second guide surface of the first cross-member;

a third ramp surface configured to receive a third guide surface of the second cross-member; and

a fourth ramp surface configured to receive a fourth guide surface of the second cross-member.

wherein:

the driving spring is configured to engage the ramp member and impart a force on the needle-safety shield to urge the needle-safety shield in a distal direction relative to the needle hub;

the contact surface of the needle-safety shield engages a proximal surface of a catheter adapter body and urges the catheter adapter body in the distal direction relative to the needle hub; and

a catheter projecting from a distal end of the catheter adapter body is urged in the distal direction relative to the introducer needle.

2. The catheter system of claim 1, wherein the first and second cross-members are configured to grasp the introducer needle between the first and second cross-members as the first and second cross-members are urged together.

3. The catheter system of claim 1, wherein the first ramp surface comprises a first concave surface portion, the second ramp surface comprises a second concave surface portion, the third ramp surface comprises a third concave surface portion, and the fourth ramp surface comprises a fourth concave surface portion.

4. The catheter system of claim 3, wherein the first concave surface portion comprises a first radius, the second concave surface portion comprises a second radius, the third concave surface portion comprises a third radius, and the fourth ramp surface comprises a fourth radius.

5. The catheter system of claim 4, wherein the first radius, the second radius, the third radius, and the fourth radius are substantially equal to each other.
6. The catheter system of claim 1, wherein the ramp member comprises at least one plateau portion.
7. The catheter system of claim 6, wherein the ramp member comprises at least one stop bump adjacent to the at least one plateau portion.
8. A catheter assembly comprising:
an introducer needle coupled to a needle hub;
an intermediate member comprising a contact surface disposed at a distal end of the intermediate member, the intermediate member configured to slidably receive the introducer needle therethrough;
a resilient member coupled to one of the needle hub and the intermediate member; and
a ramp member coupled to the other one of the needle hub and the intermediate member;
wherein:
the resilient member is configured to engage at least one ramp surface of the ramp member and impart a force on the intermediate member to urge the intermediate member in a distal direction relative to the needle hub;
the contact surface of the intermediate member engages a proximal surface of a catheter adapter body and urges the catheter adapter body in the distal direction relative to the needle hub; and
a catheter projecting from a distal end of the catheter adapter body is urged in the distal direction relative to the introducer needle.
9. The catheter assembly of claim 8, wherein the resilient member comprises a driving spring, the driving spring comprising:
a superior portion comprising:
a first spring arm;
a second spring arm; and

a first cross-member coupling the first spring arm to the second spring arm;
an inferior portion comprising:
a third spring arm;
a fourth spring arm; and
a second cross-member coupling the third spring arm to the fourth spring arm;
a first resilient portion; and
a second resilient portion;
wherein:
the second resilient portion couples the first spring arm to the third spring arm;
the first resilient portion couples the second spring arm to the fourth spring arm;
and
the first and second resilient portions apply a bias force to the first and second cross-members to urge the first and second cross-members toward each other.

10. The catheter assembly of claim 9, wherein the first and second cross-members are configured to grasp the introducer needle between the first and second cross-members as the first and second cross-members are urged together.

11. The catheter assembly of claim 9, wherein the at least one ramp surface of the ramp member comprises:

a first ramp surface configured to receive a first guide surface of the first cross-member;
a second ramp surface configured to receive a second guide surface of the first cross-member;
a third ramp surface configured to receive a third guide surface of the second cross-member; and
a fourth ramp surface configured to receive a fourth guide surface of the second cross-member.

12. The catheter assembly of claim 8, wherein the at least one ramp surface comprises a concave surface portion having a first radius.

13. The catheter assembly of claim 12, wherein the at least one ramp surface comprises a plateau portion.
14. The catheter assembly of claim 13, wherein the at least one ramp surface comprises a stop bump intermediate the concave surface portion and the plateau portion.
15. A method of inserting a catheter into a blood vessel of a patient through use of a catheter assembly comprising: an introducer needle coupled to a needle hub; an intermediate member having a contact surface disposed at a distal end of the intermediate member; a resilient member coupled to one of the needle hub and the intermediate member; and a ramp member coupled to the other one of the needle hub and the intermediate member, the method comprising:
- inserting a distal end of the introducer needle within a blood vessel of the patient; and
 - advancing the intermediate member proximally relative to the introducer needle, thereby:
 - engaging the resilient member with a ramp surface of the ramp member to impart a force on the intermediate member and urge the intermediate member in a distal direction relative to the needle hub;
 - engaging the contact surface of the intermediate member with a proximal surface of a catheter adapter body to urge the catheter adapter body in the distal direction relative to the needle hub; and
 - urging the catheter coupled to the catheter adapter body in the distal direction relative to the introducer needle.
16. The method of claim 15, further comprising:
- moving the needle hub and the introducer needle in a proximal direction relative to the catheter; and
 - withdrawing the introducer needle from the catheter.
17. The method of claim 16, wherein the resilient member comprises a driving spring, the driving spring comprising:
- a superior portion comprising:
 - a first spring arm;

a second spring arm; and
a first cross-member coupling the first spring arm to the second spring arm;
an inferior portion comprising:
a third spring arm;
a fourth spring arm; and
a second cross-member coupling the third spring arm to the fourth spring arm;
a first resilient portion; and
a second resilient portion;
wherein:
the second resilient portion couples the first spring arm to the third spring arm;
the first resilient portion couples the second spring arm to the fourth spring arm;
and
the first and second resilient portions apply a bias force to the first and second cross-members to urge the first and second cross-members toward each other.

18. The method of claim 17, wherein the first and second cross-members are configured to grasp the introducer needle between the first and second cross-members as the first and second cross-members are urged toward each other, the method further comprising:

grasping the introducer needle between the first and second cross-members of the driving spring as the introducer needle is at least partially withdrawn from the catheter.

19. The method of claim 17, wherein:

the ramp surface comprises:

a first ramp surface configured to receive a first guide surface of the first cross-member;

a second ramp surface configured to receive a second guide surface of the first cross-member;

a third ramp surface configured to receive a third guide surface of the second cross-member; and

a fourth ramp surface configured to receive a fourth guide surface of the second cross-member;

the method further comprising:

engaging the first guide surface with the first ramp surface and imparting a first force that urges the intermediate member in a distal direction relative to the needle hub;

engaging the second guide surface with the second ramp surface and imparting a second force that urges the intermediate member in a distal direction relative to the needle hub;

engaging the third guide surface with the third ramp surface and imparting a third force that urges the intermediate member in a distal direction relative to the needle hub; and

engaging the fourth guide surface with the fourth ramp surface and imparting a fourth force that urges the intermediate member in a distal direction relative to the needle hub.

20. The method of claim 15, wherein the ramp surface comprises a concave surface portion having a first radius, the method further comprising:

engaging the resilient member with the concave surface portion to impart the force on the intermediate member and urge the intermediate member in the distal direction relative to the needle hub.