THE CLAIMS:

1. A spool winding assembly for winding a composite strip onto a spool having a hub, the composite strip including: an elongate plastic strip having a flat base portion and a plurality of laterally spaced apart lengthwise extending rib portions upstanding from the base portion; and a plurality of elongate reinforcing members extending lengthwise within respective rib portions, the rib portions and the reinforcing members forming composite ribs, the spool winding assembly including:

a main frame;

a spool holder for rotatably supporting the spool relative to the main frame;

a spool drive unit for driving the spool with respect to the main frame;

a carriage mounted for lateral movement with respect to the spool;

a bender mounted to the carriage for receiving the strip as it is fed towards the hub of the spool and for deforming the strip to give it a curved base portion; and

a bender drive unit operably connected to the bender for driving the strip through the bender.

2. A spool winding assembly as claimed in claim 1 wherein the bender includes:

a bender frame;

a pair of parallel spaced apart support rollers rotatably mounted to the bender frame, at least one of the support rollers defining grooves for receiving the composite ribs of the composite strip; and

a set roller parallel to the support rollers, rotatably mounted to the bender frame and arranged to roll on an inner side of the composite strip, the inner side being a side of the base portion opposite the side from which the

ribs extend, the set roller positioned or positionable such that as composite strip is driven between the support rollers and the set roller, the composite strip is deformed such that it exits the bender with a curved base portion.

3. A spool winding assembly as claimed in claim 2 further including a composite strip having an elongate plastic strip having a flat base portion and a plurality of laterally spaced apart lengthwise extending rib portions upstanding from the base portion; and a plurality of elongate reinforcing members extending lengthwise within respective rib portions, the rib portions and the reinforcing members forming composite ribs, wherein the grooves of the support roller are shaped and sized complementary to the composite ribs such that as the composite strip is driven between the support rollers and the set roller, the composite ribs are held against any substantial lateral movement with respect to the base portion.

4. A spool winding assembly for winding a composite strip onto a spool having a hub, the composite strip including: an elongate plastic strip having a flat base portion and a plurality of laterally spaced apart lengthwise extending rib portions upstanding from the base portion; and a plurality of elongate reinforcing members extending lengthwise within respective rib portions, the rib portions and the reinforcing members forming composite ribs, the spool winding assembly including:

a main frame;

a spool holder for rotatably supporting the spool relative to the main frame;

a spool drive unit for driving the spool with respect to the main frame;

a bender mounted under the spool for movement radially away from the hub as a spool of wound strip grows in diameter, the bender receiving the strip as it is fed towards the underside of the spool and plastically deforming

the strip to give it a curved base portion while maintaining the reinforcing strips in a substantially perpendicular orientation with respect to the base portion; and

a spool drive unit for driving the strip through the bender.

5. A spool winding assembly as claimed in claim 4 wherein the bender includes:

a bender frame;

a pair of parallel spaced apart support rollers rotatably mounted to the bender frame, at least one of the support rollers defining grooves for receiving the composite ribs of the composite strip; and

a set roller parallel to the support rollers, rotatably mounted to the bender frame and arranged to roll on an inner side of the composite strip, the inner side being a side of the base portion opposite the side from which the ribs extend, the set roller positioned or positionable such that as composite strip is driven between the support rollers and the set roller, the composite strip is deformed such that it exits the bender with a curved base portion.

6. A spool winding assembly as claimed in claim 5 further including a composite strip having an elongate plastic strip having a flat base portion and a plurality of laterally spaced apart lengthwise extending rib portions upstanding from the base portion; and a plurality of elongate reinforcing members extending lengthwise within respective rib portions, the rib portions and the reinforcing members forming composite ribs, wherein the grooves of the support roller are shaped and sized complementary to the composite ribs such that as the composite strip is driven between the support rollers and the set roller, the composite ribs are held against any substantial lateral movement with respect to the base portion.

7. An assembly as claimed in any one of claims 4, 5 or 6 including:

a carriage mounted for lateral movement with respect to the spool;

a pair of support arms, each support arm having a lower end slidably mounted to the carriage, an intermediate section and an upper end pivotally connected to the bender; and

a first tie arm, the first tie arm having a lower end connected to the carriage and an upper end connected to the intermediate section of one of the support arms,

wherein the support arms and the first tie arm allow the bender to move radially away from the hub as a spool of wound strip grows in diameter without rotating the bender with respect to the main frame.

8. An assembly as claimed in claim 7 wherein the lower ends of the support arms are connected by a second tie arm so as to maintain their relative spacing.

9. An apparatus for winding an elongate strip having a plurality of upstanding ribs onto a spool having a hub, the apparatus including:

a frame;

a spool holder for rotatably supporting the spool relative to the frame;

a guide assembly for guiding the strip generally tangentially towards the hub, the guide assembly movable relative to the spool in a direction parallel to an axis of spool rotation;

a string of grooved rollers arranged so as to rotate about spaced apart parallel axes, each roller held in a spaced apart relationship from an adjacent roller by a pair of links, each pair of links pivotally movable with respect to an adjacent pair of links, the string extending partially around the hub and having first and second ends connected to the guide assembly for movement with the guide assembly relative to the spool; and

a means for maintaining a substantially constant tension in the string as the spool is wound;

wherein the rollers press the strip radially inwards towards the axis of the spool and the grooves surround the ribs of the strip as it is curved around the spool thereby supporting the ribs.

10. A method of winding a composite strip onto a spool having a hub, the strip having a plurality of laterally spaced apart lengthwise extending rib portions upstanding from the base portion, the method comprising the steps of:

feeding the strip towards the hub of the spool;

driving the fed strip through a roller set so as to plastically deform the strip to give it a curved base portion; and

winding the deformed strip onto the hub to form spooled strip, the winding creating tension in the strip,

wherein the plastic deformation of the strip through the roller set substantially reduces the tension in the strip that would otherwise occur.

11. A method as claimed in claim 10 wherein the rib portions are held upstanding from the base portion as they are driven through the roller set,

whereby the orientation of the rib portions with respect to the base portion remains substantially unchanged.

12. A method as claimed in claim 11 further comprising varying the axial position on the spool to which the strip is guided.

13. A method as claimed in claim 11 wherein the step of driving and deforming the strip to give it a curved base portion produces a radius of curvature of between 120% and 80% of a radius of the hub.

14. A method of winding an elongate ribbed strip onto a spool having a hub, the method including the steps of:

guiding the strip generally tangentially towards the hub;

winding the strip around the hub; and

supporting the ribs of the strip while the strip is bent around the hub.

15. A method as claimed in claim 14 further comprising varying the axial position on the spool to which the strip is guided.

16. A spool winding assembly for winding a composite strip onto a spool having a hub, the assembly substantially as hereinbefore described with reference to and as illustrated in the accompanying figures 8 to 13b.

17. A spool winding assembly for winding a composite strip onto a spool having a hub, the assembly substantially as hereinbefore described with reference to and as illustrated in the accompanying figures 14 to 16.

CLAIMS

1. A spool winding assembly (200) for winding a composite strip (10) onto a spool (50)having a hub (55), the composite strip (10) including: an elongate plastic strip (11) having a flat base portion (12) and a plurality of laterally spaced apart lengthwise extending rib portions (20) upstanding from the base portion (12); and a plurality of elongate reinforcing members (30) extending lengthwise within respective rib portions (20), the rib portions (20) and the reinforcing members (30) forming composite ribs, the spool winding assembly (200) including:

a main frame (202);

a spool holder (204) for rotatably supporting the spool (50) relative to the main frame (202);

a spool drive unit (206) for driving the spool (50) with respect to the main frame (202);

a carriage (240) mounted for lateral movement with respect to the spool (50), **characterised in that** the spool winding assembly further includes:

a bender (90) mounted to the carriage for receiving the strip (10) as it is fed towards the hub (55) of the spool (50) and for deforming the strip (10) to give it a curved base portion (12); and

a bender drive unit (210) operably connected to the bender (90) for driving the strip (11) through the bender (90), wherein the bender (90) includes:

a bender frame (92);

a pair of parallel spaced apart support rollers (94, 94) rotatably mounted to the bender frame (92) at least one of the support rollers defining grooves (96) for receiving the composite ribs of the composite strip (11); and

a set roller (98) parallel to the support rollers (94, 94'), rotatably mounted to the bender frame (92) and arranged to roll on an inner side of the composite strip (11), the inner side being a side of the base portion (12) opposite the side from which the ribs extend, the set roller (98) positioned or positionable such that as composite strip (11) is driven between the support rollers (94, 94') and the set roller (98), the composite strip (11) is deformed such that it exits the bender (90) with a curved base portion (12).

2. A spool winding assembly (200) as claimed in claim 1 **characterised in that** the assembly further includes a composite strip (11) having an elongate plastic strip having a flat base portion (12) and a plurality of laterally spaced apart lengthwise extending rib portions (20) upstanding from the base portion (12); and a plurality of elongate reinforcing members (30) extending lengthwise within respective rib portions (20), the rib portions (20) and the reinforcing members (30) forming composite ribs, wherein the grooves (96) of the support roller (94) are shaped and sized complementary to the composite ribs such that as the composite strip (11) is driven between the support rollers (94, 94') and the set roller (98), the composite ribs are held against any substantial lateral movement with respect to the base portion (12).

3. A spool winding assembly (200) for winding a composite stripe (10) onto a spool (50) having a hub (55), the composite strip (10) including: an elongate plastic strip (11) having a flat base portion (12) and a plurality of laterally spaced apart lengthwise extending rib portions (20) upstanding from the base portion (12); and a plurality of elongate reinforcing members (30) extending lengthwise within respective rib portions (20), the rib portions (20) and the reinforcing members (30) forming composite ribs, the spool winding assembly including:

a main frame (202);

a spool holder (204) for rotatably supporting the spool (50) relative to the main frame (202);

a spool drive unit (206) for driving the spool (50) with respect to the main frame (202), **characterised in that** the spool winding assembly further includes:

a bender (90) mounted under the spool (50) for movement radially away from the hub (55) as a spool of wound strip grows in diameter, the bender (90) receiving the strip as it is fed towards the underside of the spool (50) and plastically deforming the strip (10) to give it a curved base portion (12) while maintaining the reinforcing strips in a substantially perpendicular orientation with respect to the base portion; and

a spool drive unit (206) for driving the strip (10) through the bender (90), wherein the bender (90) includes:

a bender frame (92);

a pair of parallel spaced apart support rollers (94, 94') rotatably mounted to the bender frame (92) at least one of the support rollers (94) defining grooves (96) for receiving the composite ribs of the composite strip (10); and

a set roller (98) parallel to the support rollers (94, 94'), rotatably mounted to the bender frame (92) and arranged to roll on an inner side of the composite strip (10), the inner side being a side of the base portion (12) opposite the side from which the ribs extend, the set roller (98) positioned or positionable such that as composite strip (10) is driven between the support rollers (94, 94') and the set roller (98), the composite strip (10) is deformed such that it exits the bender (90) with a curved base portion (12).

4. A spool winding assembly (200) as claimed in claim 3 **characterised in that** the assembly further includes a composite strip (10) having an elongate plastic strip (11) having a flat base portion (12) and a plurality of laterally spaced apart lengthwise extending rib portions (20) upstanding from the base portion (12); and a plurality of elongate reinforcing members (30) extending lengthwise within respective rib portions (20), the rib portions (20) and the reinforcing members (30) forming composite ribs, wherein the grooves (96) of the support roller (94) are shaped and sized complementary to the composite ribs such that as the composite stripe (10) is driven between the support rollers (94, 94') and the set roller (98), the composite ribs are held against any substantial

lateral movement with respect to the base portion(12).

5. An assembly as claimed in any one of claims 3 or 4 **characterised in that** the assembly includes:

a carriage (240) mounted for lateral movement with respect to the spool (50);

a pair of support arms (212, 212'), each support arm having a lower end (214, 214') slidably mounted to the carriage (240), an intermediate section (215) and an upper end (216) pivotally connected to the bender (90); and

a first tie arm (220), the first tie arm (220) having a lower end (222) connected to the carriage (240) and an upper end (224) connected to the intermediate section (215) of one of the support arms (212, 212');

wherein the support arms (212, 212') and the first tie arm (220) allow the bender (90) to move radially away from the hub (55) as a spool of wound strip grows in diameter without rotating the bender (90) with respect to the main frame (202).

6. An assembly as claimed in claim 5 **characterised in that** the lower ends (214, 214') of the support arms (212, 212') are connected by a second tie arm (220) so as to maintain their relative spacing.

7. An apparatus (60) for winding an elongate strip (10) having a plurality of upstanding ribs onto a spool (50) having a hub (55), the apparatus including:

a frame (62);

a spool holder (70) for rotatably supporting the spool (50) relative to the frame (62);

a guide assembly (80) for guiding the strip (10) generally tangentially towards the hub (55), the guide assembly (80) movable relative to the spool (50) in a direction parallel to an axis of spool rotation (75); **characterised in that** the apparatus further includes:

a string (100) of grooved rollers arranged so as to rotate about spaced apart parallel axes, each roller held in a spaced apart relationship from an adjacent roller by a pair of links (228), each pair of links (228) pivotally movable with respect to an adjacent pair of links, the string (100) extending partially around the hub (55) and having first and second ends (102, 198) connected to the guide assembly (80) for movement with the guide assembly relative to the spool (50); and

a means for maintaining a substantially constant tension in the string (100) as the spool (50) is wound;

wherein the rollers press the strip radially inwards towards the axis of the spool (50) and the grooves surround the ribs of the strip (10) as it is curved around the spool (50) thereby supporting the ribs.

8. A method of winding a composite strip onto a spool (50) having a hub (55), the strip (10) having a plurality of laterally spaced apart lengthwise extending rib portions (20) upstanding from the base portion (12), the method comprising the steps of:

feeding the strip (10) towards the hub (55) of the spool (50),

driving the fed strip through a roller set while holding the rib portions (20) upstanding from the base portion (12) within grooves (96) defined by at least one roller of the roller set, so as to plastically deform the strip (10) to give it a curved base portion (12) so that the orientation of the rib portions (20) with respect to the base portion (12) remains substantially unchanged; and

winding the deformed strip onto the hub (55) to form spooled strip, the winding creating tension in the strip (10)

wherein the plastic deformation of the strip (10) through the roller set substantially reduces the tension in the strip that would otherwise occur.

9. A method as claimed in claim 8 **characterised in that** the method further comprises varying the axial position on the spool (50) to which the strip (10) is guided.

10. A method as claimed in claim 8 **characterised in that** the step of driving and deforming the strip (10) to give it a curved base portion (12) produces a radius of curvature of between 120% and 80% of radius of the hub (55).