Claims

1. A tubular pipe string element having:

a first end with a male connector formed thereon,

a second end having a female connector formed thereon which is complementary to the male connector, said male and female connectors being of the rotational connector type such that, in use, the male connector is engageable in a female connector of another pipe string element and rotatable relative thereto in a first direction in order to secure the connection and in a second direction in order to release the connection, and

complementary anti-rotation means associated with said male and female connectors which anti-rotation means cooperate to prevent unintentional relative rotation between male and female connectors in the second direction; wherein said anti-rotation means comprises:

at least one saw-tooth profiled, radially extending tooth having a shallow leading tooth flank angle facing in one of said first and second direction and a steep trailing tooth flank angle facing in the other of said first and second directions formed on the pipe string element proximate one end thereof in association with one of the male and female connectors, and

at least one detent member formed on the pipe string element proximate the other end thereof in association with the other of the male and female connectors,

said at least one saw-tooth profiled tooth and said at least one detent member being rotationally and axially fast, with the pipe string element wherein, in use upon relative rotation in the first direction between engaged male and female connectors, the leading flank of the at least one saw-tooth profiled tooth engages with the at least one detent member,

urging it to retract against biasing means and allowing the connectors to rotate into a fully connected position, the steep trailing tooth flank being trapped by the detent member when in the fully connected position so as to prevent unintentional release of the connection; wherein the or each detent member is supported by a spring arm, wherein the or each spring arm is integrally formed with the pipe string element by cut outs in the wall of the pipe string element.

2. A tubular pipe string element according to claim 1, wherein the or each detent member comprises at least one locking member supported on said other of the male and female connectors by at least one said spring arm which urges the at least one locking member into a position in which it protrudes from a surface of said other of the male and female connectors so as to lie in the rotational path of the at least one saw-tooth profiled tooth, said locking member being retractable out of said path against the spring force upon engagement with the leading flank of the at least one tooth.

~~3. A tubular pipe string element according to claim 2, wherein a through opening is formed in the tubular wall of said other of the male and female connectors in which the locking member engages.~~

~~4. A tubular pipe string element according to claim 3, wherein the or each spring arm is integrally formed with the pipe string element by cut outs in the wall of the pipe string element.~~

3~~5~~. A tubular pipe string element according to ~~any of claims 2 to 4~~claim 1 or claim 2, wherein the or each detent member is supported by a single cantilever spring arm.

46. A tubular pipe string element according to ~~any of claims 2 to 4~~claim 1 or claim 2, wherein the or each detent member is supported between the ends of a pair of spring arms.

57. A tubular pipe string element according to any of the preceding claims, wherein a plurality of detent ~~means~~ members are provided on said other of the male and female connectors equi-angularly distributed about the circumference thereof.

68. A tubular pipe string element according to any of the preceding claims, wherein the or each detent member includes at least one saw-tooth profiled tooth having a shallow leading edge and a steep trailing edge, said at least one tooth being oriented to engage, in use, the leading edge of a tooth associated with the one end of a mating pipe string element.

79. A tubular pipe string element according to any of the preceding claims, wherein a plurality of saw-tooth profiled teeth are provided on the one end of the pipe string element in association with said one of the male and female connectors extending circumferentially around the surface thereof.

810. A tubular pipe string element according to claim 79, wherein said plurality of teeth extend continuously around the entire circumference of the pipe string element.

911. A tubular pipe string element according to claim 79, wherein said plurality of teeth are arranged into a plurality of separate groups corresponding in number to the number of detent members located

proximate said other end, said groups of teeth being equi-angularly distributed around the circumference of the pipe string element.

10~~12~~. A tubular pipe string element according to any of the preceding claims, wherein the male and female connectors are threaded connectors.

11~~13~~. A tubular pipe string element according to any of the preceding claims, wherein the anti-rotation means are located proximate a tip end of the female connector and proximate the root end of the male connector.

12~~14~~. A tubular pipe string element according to any of the preceding claims, wherein the at least one saw-tooth profiled tooth is provided on the outer surface of the male connector and the at least one detent member is provided in the tubular wall of the female connector.

13~~15~~. A tubular pipe string element according to any of the preceding claims, wherein the trailing edge of the or each saw-tooth profiled tooth is inclined backwards to form an undercut.

14~~16~~. A tubular pipe string element according to any of the preceding claims, wherein the or each detent member includes an opening therein into which means associated with a release ~~tooth~~ tool ~~any~~ can be engaged to enable the or each detent member to be manually retracted against the loading of the biasing means.

15~~17~~. A tubular pipe string element according to claim ~~16m~~ 14, wherein the opening is a threaded opening in which is engageable a threaded stud so as to enable the at least one detent member to be retracted by pulling on the head of the threaded stud.

16~~18~~. A release tool for releasing a connection between adjacent ends of a pair of tubular pipe string elements each in accordance with any of the preceding claims, comprising a collar having at least one ramped slot provided on an inner surface thereof in which, in use, is engageable a head of a peg which is engaged in an opening in the at least one detent member of the pipe string element.

17~~19~~. A release tool according to claim 16~~18~~, wherein the or each slot extends axially along the collar.

18~~20~~. A release tool according to claim 16~~18~~, where the or each slot extends circumferentially around the inner surface of the collar.