CLAIMS

What we claim is:

1. A flapper valve assembly, comprising:

a tubular forming an interior passageway;

wherein the tubular comprises an internal shoulder;

a valve seat forming a portion of the interior passageway and spaced from the internal shoulder to form a flapper chamber;

a flapper plate that is pivotably mounted to the tubular at a pivot point and positioned within the flapper chamber;

wherein the flapper plate is pivotable within the flapper chamber between a valve closed position in which the flapper plate sealingly engages the valve seat and a valve open position in which the flapper plate does not sealingly engage the valve seat; and

a first spring extending within the flapper chamber and engaging the flapper plate such that the flapper plate is biased towards the valve closed position;

wherein the first spring comprises spaced right and left arms that are in contact with the flapper plate; and

wherein, when the flapper plate moves from the valve open position to ~~is in~~ the valve closed position, each of the right and left arms ~~extends away from the flapper plate and~~ moves towards the internal shoulder.

2. The flapper valve assembly of claim 1,

wherein the flapper plate has a top portion associated with the pivot point, an opposing bottom portion, a right side portion, and an opposing left side portion;

wherein each of the right side portion and left side portion extends between the top and bottom portions; and

wherein, when the flapper plate is in the valve open position, the right arm is in contact with the right side portion of the flapper plate and the left arm is in contact with the left side portion of the flapper plate.

3. The flapper valve assembly of claim 2,
where a first groove is formed in the right side portion;
wherein a second groove is formed in the left side portion;
wherein, when the flapper plate is in the valve open position, the right arm is accommodated within the first groove; and
wherein, when the flapper plate is in the valve open position, the left arm is accommodated within the second groove.

4. The flapper valve assembly of claim 1, wherein the first spring is pinned to the tubular at a location at or near the internal shoulder.

5. The flapper valve assembly of claim 1,
wherein an end portion of the first spring is pinned to the tubular via a fulcrum assembly that comprises a pin; and
wherein the pin has a longitudinal axis that is perpendicular to a longitudinal axis of the tubular and extends between the end portion of the first spring and the pivot point to contact the right and left arms of the first spring.

6. The flapper valve assembly of claim 1,
wherein an end portion of the first spring extends between the first arm and the second arm;
wherein a cross-section of the end portion has a first shape; and
wherein a cross-section of the second arm has a second shape that is different from the first shape.

7. The flapper valve assembly of claim 1, further comprising a second spring extending within the flapper chamber and engaging the flapper plate such that the flapper plate is biased towards the valve closed position;
wherein the second spring comprises spaced right and left arms that are in contact with the flapper plate; and
wherein, when the flapper plate is in the valve closed position, each of the right and

left arms of the second spring extends away from the flapper plate and towards the internal shoulder.

8. The flapper valve assembly of claim 1,
wherein first and second pockets are formed in the flapper plate; and
wherein a portion of the right and left arms extend within the first and second pockets, respectively.

9. The flapper valve assembly of claim 2, wherein the left and right arms of the first spring contact the flapper plate at a position that is spaced, along a longitudinal axis of the flapper plate, from the pivot point.

10. The flapper valve assembly of claim 1,
wherein each of the right and left arms comprises first and opposing second end portions,
wherein the first end portions of the right and left arms are connected to the flapper plate; and
wherein the second end portions of the right and left arms are coupled to the tubular at a location such that the pivot point ~~is~~extends ~~longitudinally positioned~~ between, in longitudinal direction, the location and the internal shoulder.

11. A method of operating a flapper valve assembly, the method comprising:
providing the flapper valve assembly that comprises:
a tubular forming an interior passageway;
wherein the tubular comprises an internal shoulder;
a valve seat forming a portion of the interior passageway and spaced from the internal shoulder to form a flapper chamber; and
a flapper plate that is pivotably mounted to the tubular at a pivot point and within the flapper chamber;
wherein the flapper plate is pivotable within the flapper chamber between a valve closed position in which the flapper plate sealingly engages the valve seat and a valve open position in which the flapper

plate does not sealingly engage the valve seat;

positioning a spring within the flapper chamber to engage the flapper plate such that the flapper plate is biased towards a closed valve position;

wherein the spring comprises spaced right and left arms that are in contact with the flapper plate; and

wherein, when the flapper plate moves from the valve open position to ~~is in~~ the valve closed position, each of the right and left arms ~~extends away from the flapper plate and~~ moves towards the internal shoulder; and

forcing the flapper plate to pivot from the closed valve position to the open valve position to energize the spring.

12. The method of claim 11, wherein the spring is pinned to the tubular at a location at or near the internal shoulder; and wherein forcing the flapper plate to pivot from the closed valve position to the open valve position comprises pivoting the spring about the location.

13. The method of claim 11,

wherein an end portion of the spring is pinned to the tubular via a fulcrum assembly that comprises a pin;

wherein the pin has a longitudinal axis that is perpendicular to a longitudinal axis of the tubular and extends between the end portion of the spring and the pivot point to contact the right and left arms of the spring; and

wherein forcing the flapper plate to pivot from the closed valve position to the open valve position comprises bending the spring about the pin.

14. The method of claim 11,

wherein an end portion of the first spring extends between the first arm and the second arm;

wherein a cross-section of the end portion has a first shape; and

wherein a cross-section of the second arm has a second shape that is different from the first shape.

15. The method of claim 11,

wherein a cross-section of a portion of the first arm has a first shape; and

wherein a cross-section of another portion of the first arm has a second shape that is different from the first shape.

16. The method of claim 11,

wherein first and second pockets are formed in the flapper plate; and

wherein a portion of right and left arms extend within the first and second pockets, respectively;

wherein the portion of the right and left arms that extend within the first and second pockets extend along a longitudinal axis of the flapper plate; and

wherein forcing the flapper plate to pivot from the closed valve position to the open valve position results in twisting of the right and left arms.

17. The method of claim 11,

wherein each of the right and left arms comprises first and opposing second end portions,

wherein the first end portions of the right and left arms are connected to the flapper plate; and

wherein the second end portions of the right and left arms are coupled to the tubular at a location such that the pivot point ~~is~~extends ~~longitudinally positioned~~ between, in longitudinal direction, the location and the internal shoulder.

18. A flapper valve assembly, comprising:

a tubular forming an interior passageway;

wherein the tubular forms radially extending surface;

a valve seat forming a portion of the interior passageway;

a flapper plate that is pivotably mounted to the tubular via a hinge assembly such that the flapper plate is pivotable between a valve closed position in which the flapper plate sealingly engages the valve seat and a valve open position in which the flapper plate does not sealingly engage the valve seat; and

a spring engaging the flapper plate such that the flapper plate is biased towards the

valve closed position;

wherein the spring comprises an arm that is in contact with the flapper plate and a retainer ring coupled to the arm;

wherein the retainer ring is positioned against the radially extending surface such that the retainer ring at least partially surrounds the interior passageway; and

wherein, when the flapper plate is in the valve closed position and in the valve open position, the entirety of the spring is spaced from the hinge assembly; and

wherein, when the flapper plate moves from the valve open position to the valve closed position, each of the arms moves towards internal shoulder of the tubular.

~~19. The flapper valve assembly of claim 18,~~

~~wherein the tubular forms radially extending surface;~~

~~wherein the spring further comprises a retainer ring coupled to the arm; and~~

~~wherein the retainer ring is positioned against the radially extending surface such that the retainer ring at least partially surrounds the interior passageway.~~

~~20~~19. The flapper valve assembly of claim ~~19~~18, wherein the retainer ring surrounds at least 180 degrees of the interior passageway.