July 17, 1923. 1,461,787

F. E. STEBBINS

KINETIC ENERGY TRANSFORMING MEANS FOR CARS

Filed March 16, 1920 5 Sheets-Sheet 1

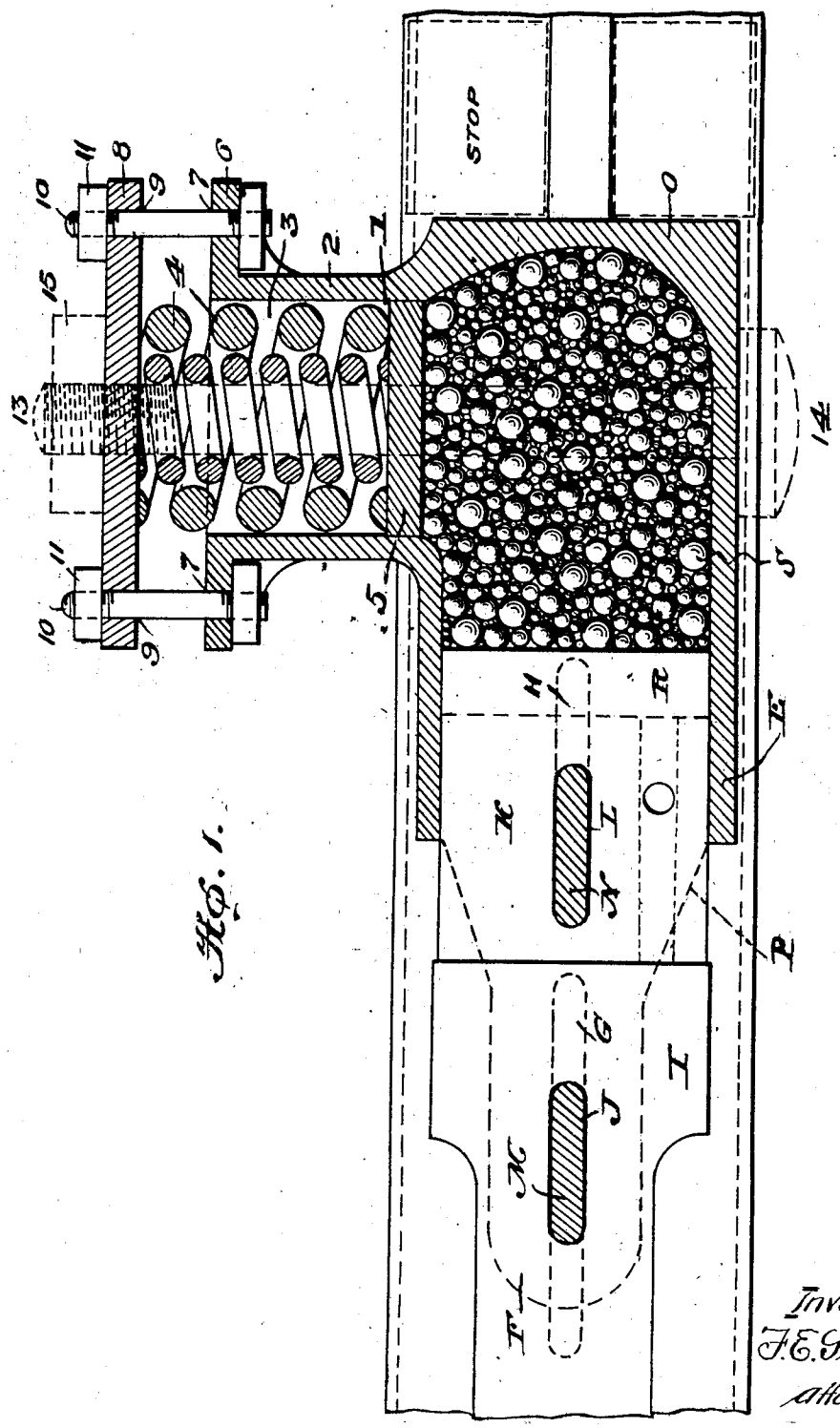


Fig. 1.

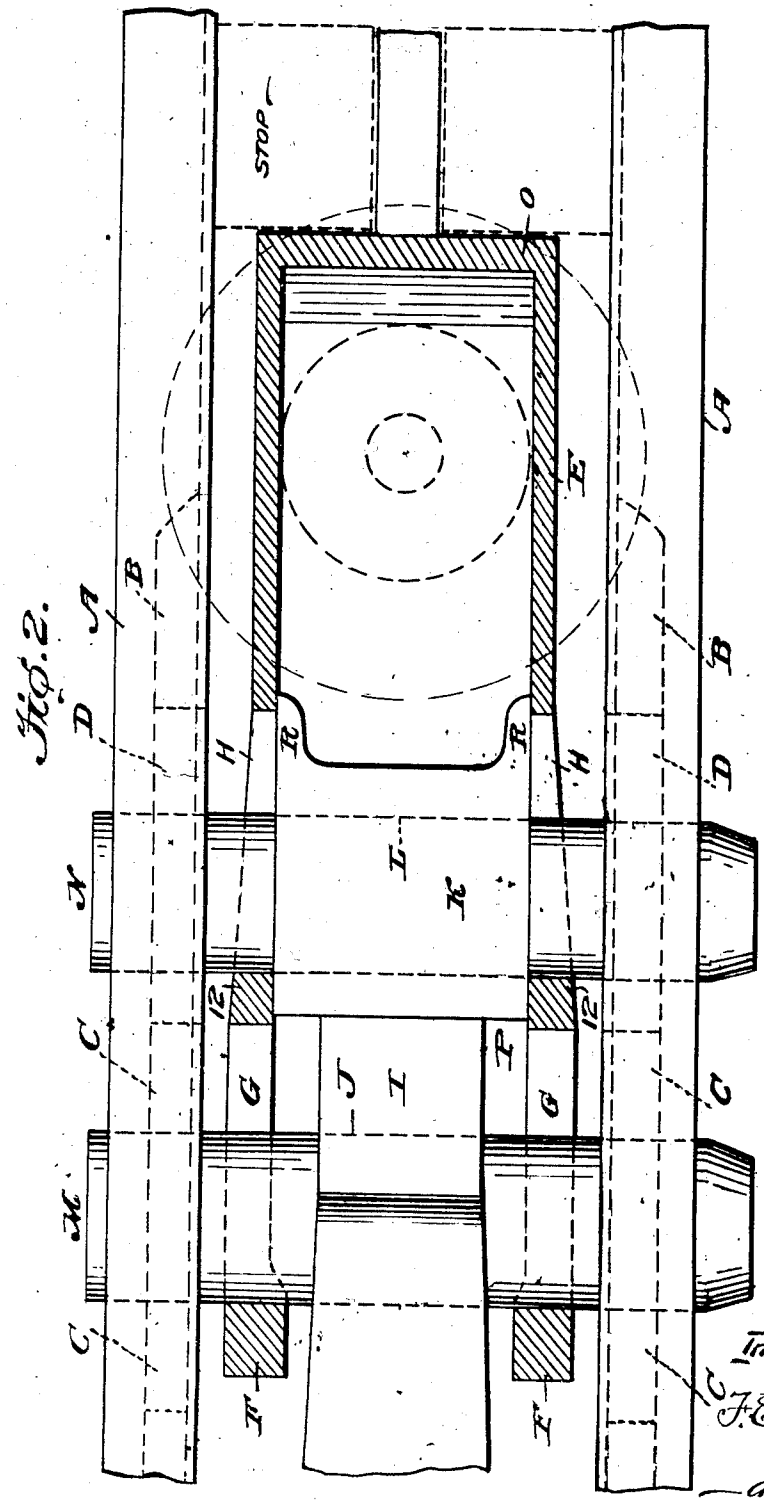
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KINETIC ENERGY TRANSFORMING MEANS FOR CARS

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Fig. 2.



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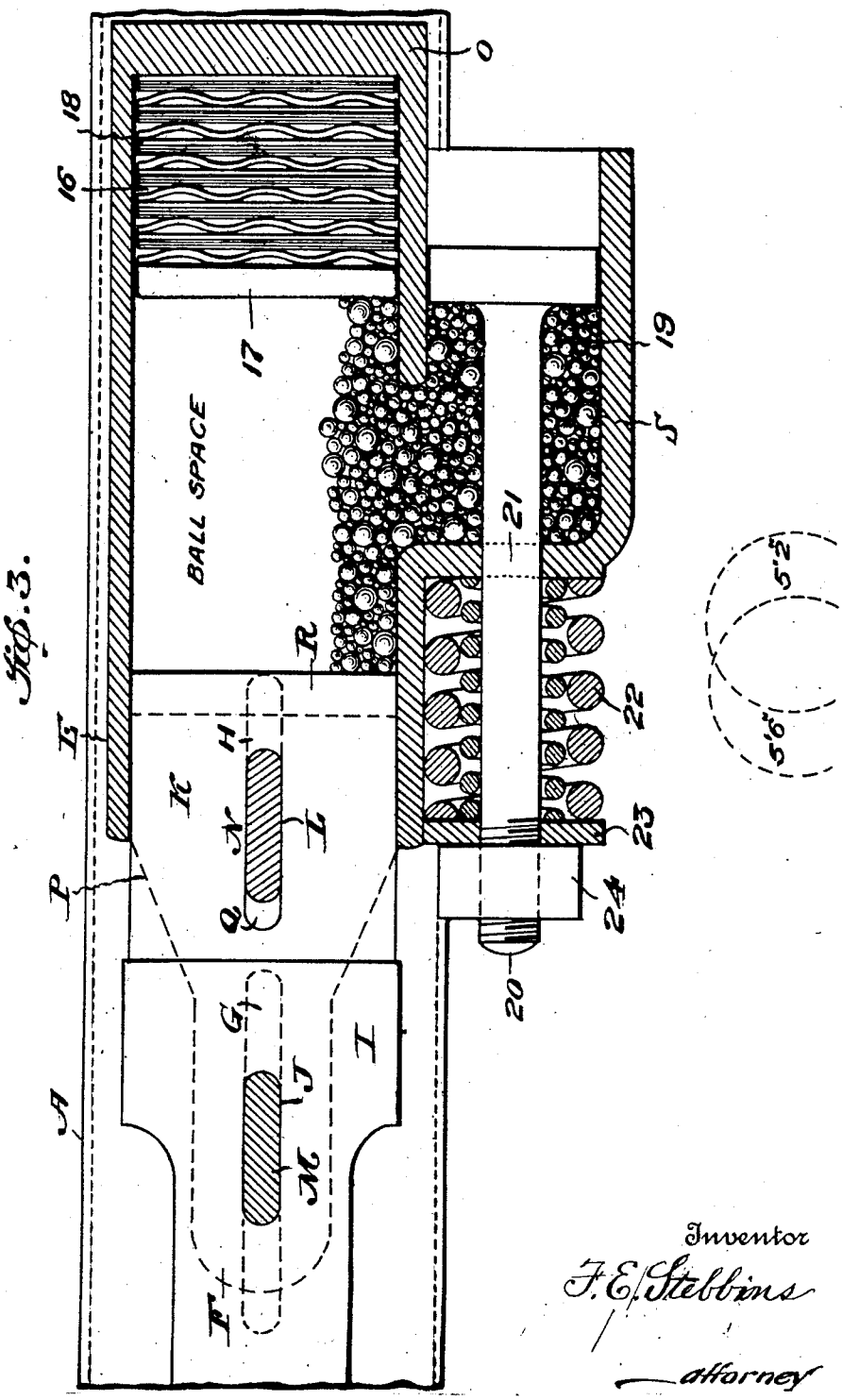


Fig. 3.

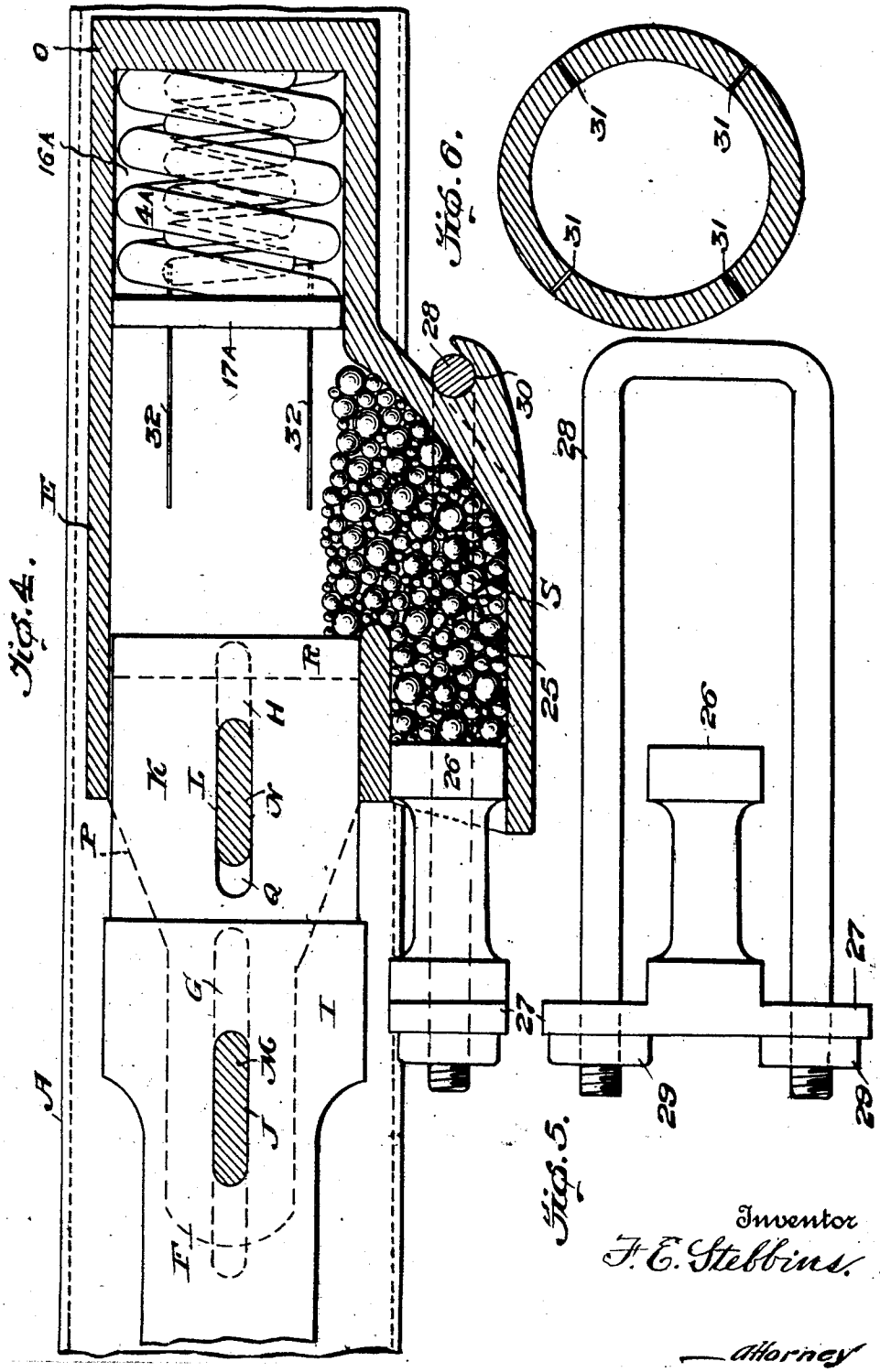
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KINETIC ENERGY TRANSFORMING MEANS FOR CARS

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KINETIC ENERGY TRANSFORMING MEANS FOR CARS

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Fig. 7.

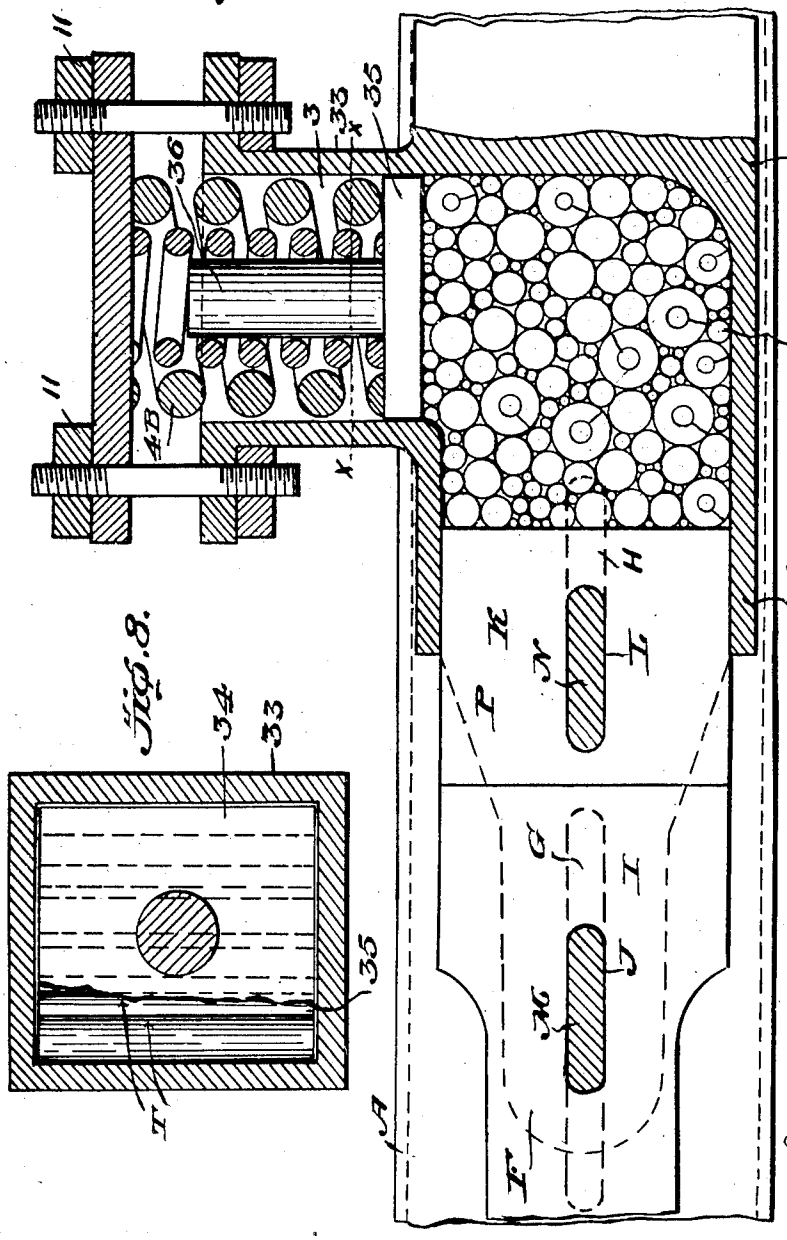


Fig. 9.



Fig. 8.

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UNITED STATES PATENT OFFICE.

FRANK E. STEBBINS, OF WASHINGTON, DISTRICT OF COLUMBIA.

KINETIC-ENERGY-TRANSFORMING MEANS FOR CARS.

Application filed March 16, 1920. Serial No. 366,380.

To all whom it may concern:

Be it known that I, FRANK E. STEBBINS, a citizen of the United States, residing at Washington, District of Columbia, have invented certain new and useful Improvements in Kinetic-Energy-Transforming Means for Cars; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The object of the invention broadly is the provision of efficient means for transforming the energy of motion or kinetic energy of a moving body into work, that is, inducing changes in other bodies which correspond to and equal as far as possible the kinetic energy of the moving body.

Specifically the object is the provision of means for transforming the kinetic energy of a car or cars into the work of moving a plurality of friction elements or bodies, preferably substantially non-friable in use when subjected to the pressure intended, assembled to form a mobile mass, relative to one another and a casing or housing within which said mobile mass is confined and thus producing frictional resistances, percussions, vibrations, and pressures; also into the work of expanding an elastic casing or housing containing the mobile mass of bodies, when the casing is expansible; and, further, when desired, compressing a spring or springs; that is, providing kinetic energy transforming means for cars or bumpers.

A further object is the construction and arrangement of said means so that initially the main resisting elements or bodies shall yield quickly to impacts either light or heavy; so the recoil shall be small, but sufficient to return the mass when moved to its normal position; so the areas of the bearing surfaces of the elements will be as large as possible to distribute the wear of the parts; and so that but little machining of the elements or bodies or parts constituting the means shall be necessary.

Generally stated, the invention consists in confining within a metallic casing or housing, preferably of elastic steel or other suitable material, preferably of varying capacity, a plurality of friction elements or bodies forming a mobile mass, said elements or bodies preferably consisting of metallic balls or cylindrically shaped bodies of different diameters or dimensions, or other substantially non-friable elements as specified, a plurality of said elements or bodies being in contact with and capable of moving relative to others and the casing; providing a slidable follower or plunger movable in the casing to compress the mass of friction elements or bodies; providing, when desired, a spring yieldably pressing against the mass of balls, cylindrical bodies, or other friction elements or bodies; and combining said casing with a car under frame and movable drawbar. However, when the casing or housing is itself expansible, the separate spring may be omitted.

It further consists in a "take-up" or means for forcing the frictional elements or bodies into a substantially compact, mobile mass within the casing or housing, the degree of compactness of the mass to be determined by the character of the friction elements, the force applied, and the construction or character of the casing or housing.

It further consists in certain novelties of construction and the combination of parts as herein set forth.

The accompanying drawings illustrate several examples of the physical embodiment of the invention constructed, combined and arranged according to the best modes of procedure I have so far devised for the purpose. The solid, rigid or substantially non-friable elements or bodies illustrated consist of a plurality or mass of metallic balls of different diameters, and metallic cylinders or rollers of different dimensions in parallel positions, inasmuch as experiments prove that a plurality or mass of balls or parallel cylinders of different diameters when combined and subjected to impact or pressure will move like a fluid, the balls pressing equally in all directions, and the cylinders or rollers pressing equally in all directions in a plane at right angles to the lengths of the cylinders. Of course, other substantially non-friable or substantially rigid elements may be employed and in some instances balls and cylinders of the same diameter, especially when of relatively small diameters, but as balls and cylinders

of different diameters in a mass possess a greater degree of fluidity and are not liable to interlock or wedge one with another as are those of the same diameter, I have illustrated the former as embodying the invention in the best modes.

Figure 1 is a vertical sectional view of one embodiment of the invention, the elastic steel casing or housing, keys and springs being in section and the balls, drawbar butt and slidable follower or plunger in elevation.

Figure 2 is a top plan view of the draft sills, coupler butt, keys and slidable plunger, and the casing and draft arms in horizontal section.

Figure 3 is a view of a modification, similar to Figure 1, showing corrugated plate springs and a "take-up" or arrangement for compressing the balls into a compact mass within the inclosed chamber or space of the casing and pressing against the inner surface of the casing, the follower and the springs.

Figure 4 is a second modification, similar to Figure 3, showing another form of "take-up" for compressing the balls into a substantially compact mass, also in elevation a helical spring.

Figure 5 is a plan view of the rod and plunger forming part of the "take-up."

Figure 6 is a cross section of an elastic steel shell or housing for inclosing the balls or other frictional elements in a mass, the wall being of relatively great thickness and slotted longitudinally between the ends for a certain distance to permit more facile expansion of the same under pressure.

Figure 7 is a view similar to Figure 1 in which the mobile mass of elements consists of metallic cylindrical bodies preferably of different diameters in cross section.

Figure 8 is a horizontal section of the projecting part of the casing on line x—x, Figure 7, showing the spring follower plate partly broken away and one of the cylindrical bodies or rollers in full lines, the spring being omitted.

Figure 9 illustrates a flexible spring roller or cylindrical body which may be used in place of one more rigid.

The shell, casing or housing in each example preferably is of elastic steel so it can expand under pressure within the elastic limit of the material, and also contract, and with the plunger and "take-up" device and movable spring follower forms a substantially closed chamber or inclosed space of variable capacity within which are located the substantially rigid balls, cylindrical bodies or other like elements in a mobile mass.

Referring to the four examples the parts common to all are designated as follows:

A are the steel channel draft sills or beams; B, the cheek castings (Figure 2); C, the front slots in the channel beams and castings; D, the rear slots in the same; E, the elastic steel casing or housing; F, the draft arms; G, the front elongated slots in the arms; H, the rear longitudinal slots in the casing; I, the drawbar butt; J, the slot therethrough; K, the slidable follower or plunger; L, the slot therethrough; M, the front keys, each fixed within the slot in the drawbar and movable within the slots of the channel beams and cheek castings and slots in the draft arms; N, the rear keys, each within a slot in the slidable follower or plunger and rearwardly movable within the slots in the channel beams and cheek castings and slots in the casing; O, the rear wall of each casing or housing; and P designates the open end of each casing within which is located the slidable follower or plunger adapted to be engaged by the coupler butt in buffing.

In Figures 3 and 4, it will be noted, the slots in the plungers are slightly elongated at Q so they can move rearwardly about an inch before contacting with the keys. The followers in the first three examples have extended edges R which cover the otherwise open spaces or parts of the slots H in the casing through which some of the balls or friction elements otherwise might pass.

In the first three examples S in each designates the elastic or substantially rigid steel balls, preferably of different diameters, or other substantially nonfriable elements mainly substantially rigid and in a mobile mass within the inclosed chamber of variable capacity. In the fourth example, Figures 7 and 8, T designates the metallic roller or cylindrical bodies, preferably of different diameters in cross section, in a mass movable or mobile at right angles to their lengths.

The constructions specific to each of the examples are as follows:

In Figures 1 and 2 an opening 1 in the side of the casing it provided and the extended wall 2 forms a pocket 3 for a helical spring 4 which rests against a perforated spring follower 5. To form a "take-up" the wall 2 has a flange 6 with holes 7, and the spring projects above the flange and engages a plate 8 having holes 9. Threaded bolts 10 and nuts 11 connect the flange 6 and the plate 8. Obviously, by screwing down the top nuts the spring and follower will compress the balls into a substantially compact mass, the follower or plunger being held against forward movement relative to the casing by the key engaging the solid walls 12, 12 of the casing. A threaded bolt 13 having a head 14 and nut 15 is passed through the casing, mass of balls, loosely through the spring follower plate, spring and top plate, the bolt serving to deflect the balls sideways and create additional friction. Screwing down the nut compresses the spring and

mass of balls. The bolt with the top plate constitutes another or additional "take-up" and either or both "take-up" means may be used. In Figure 3 a pocket 16 is formed by the movable follower 17 and in the pocket are located corrugated plates 18, the corrugations of alternate plates being at right angles to the adjacent plates, thus forming a spring in a well known way. The "take-up" means consists of a pocket 19 at the lower edge of the casing having an opening in communication with the main chamber, as shown. A headed and threaded bolt 20 is inserted loosely in the open end of the pocket, the shank passed through a hole 21 in the vertical wall, a helical spring 22 placed on the shank of the bolt, and a plate 23 and nut 24 on the bolt end. The mass of balls in this pocket can pass through the opening to the main chamber. Turning the nut advances the head of the bolt against the balls in the pocket and forces some of them through the opening and compresses the mass of balls in the main chamber. The spring may or may not be present. When used, it is compressed under impact strains imparted to the mobile mass of balls.

In Figures 4 and 5 the "take-up" comprises a pocket 25 in open communication with the main chamber, as shown, a follower 26 with perforated flanges 27, 27, a U-shaped rod 28 with threaded ends, and nuts 29, 29. At the back of the pocket wall is a seat 30 for the U-shaped rod. Screwing down the nuts advances the follower into the open end of the pocket and forces some of the balls into the main chamber, compressing the mass of balls, as is obvious.

A pocket 16^A is formed by the spring follower 17^A within which is a helical spring 4^A.

Figure 6 shows in cross section a tensile or elastic metallic casing or housing for the balls with slots 31 to facilitate the expansion of the same under pressure. The slots are similar to those designated by 32 in Figure 4, and they may be present when the wall of the casing is relatively of great thickness. However, when the casing is of steel possessing relatively great elasticity and tensile strength the expansion of the casing wall will be sufficient to allow the mobile mass of substantially rigid elements or balls under impact to move relative to each other and the casing a sufficient distance for the purpose designed.

In Figures 7 and 8 the casing and the wall 33 defining the pocket 34 are rectangular in cross section, as shown by Figure 8. The slidable follower or plunger also rectangular, loosely fits the inner surface of the casing. The metallic cylindrical bodies T, preferably of varying diameters in cross section within the inclosed chamber of variable capacity, are arranged parallel to each other crosswise of the casing and bear against the spring follower plate 35 which may have a guide pin 36 located within the helical spring 4^B. The "take-up" device is similar to that first described in the description of Figure 1 and need not be repeated. Obviously, by turning the nuts downwardly the plurality of rollers or cylindrical bodies will be forced into a substantially compact mass mobile under impact at right angles to the lengths of the said elements or rollers. The roller or cylindrical bodies when relatively small may be of approximately the same diameter. When of larger diameter some may be hollow, as shown. The essential requisite is that they shall not lock together or wedge under impact. Figure 9 shows a flexible steel spring roller or cylinder which may be used in place of the type illustrated.

The examples of the gear shown by Figures 1 and 7 are adapted for use with hopper bottom or other cars where there is an open space above the draft beams or sills. They may be applied with the spring extended below the draft sills and located so as not to engage an axle of a truck or the brake rigging.

The general mode of operation or action of the mobile mass of friction elements or bodies under pressure and independent of the change of shape of the chamber under pressure in all the species shown is alike and substantially as follows: It has been found in actual trial that the friction bodies when assembled in a mobile mass in a casing or shell have interstices between the bodies and, therefore, the mass is capable of greater compactness. When sufficient pressure upon the mass is applied the friction elements comprising the mass move relatively one upon another, filling the interstices and thus the mass occupies a less space than previously. In fact, the degree of compactness of the mass varies with the pressure. The movement of the bodies one upon the other in forming a more compact mass and occupying less space performs a large amount of work or transformation of energy, the follower at the same time moving some distance into the casing or shell. When the mobile mass of friction bodies is large enough no additional yielding means supplemental to the expansion of the elastic steel casing is necessary. As the pressure upon the mobile mass increases and becomes great enough the yielding parts of the apparatus act and the shape of the inclosing chamber is changed, occasioning further shifting of the friction bodies relative to one another.

The modes of operation of the examples of the gears shown by Figures 1 to 6 are substantially identical. When in buffing or drawing the follower or plunger moves into the casing the balls are forced against one another and against the casing and spring

follower, the mobile mass acting like a fluid, in accordance with Pascal's law, pressing equally in all directions upon one another and against the inner surface of the casing and the spring follower. The balls being relatively small or of unequal diameters, the lines of force radiate from the center of each ball so they are in equilibrium when confined by the casing. As the pressure increases the spring follower moves outwardly into the pocket and compresses the spring. This movement of the spring follower occasions a change in the lines of force and causes an unstable equilibrium of the balls in mass and they move one upon another in the directions of the least resistance along the inner surface of the casing, sliding and turning one upon another and upon the casing until the spring follower stops, when the mass of balls is momentarily in equilibrium until the recoil of the spring forces the metallic spring follower and mass of balls to their normal positions, the plunger moving outwardly. The kinetic energy of the car transmitted through the drawbar and the follower or plunger in the form of impact is transformed into the pressure and percussion of the balls against the casing, the motion of the balls relative to one another and along the casing in frictional contact with one another and the casing, and into deforming the spring. The percussions, pressures, and sliding and rolling friction induce throughout the mobile mass of balls and the parts in contact with them, vibrations or "a mode of motion" appearing to the senses as heat. The excess of kinetic energy of the car not thus transformed is transmitted to the frame of the car supporting the gear.

The mode of operation of the example of the gear shown by Figures 7 and 8 is substantially the same as those described. However, the cylinders or rollers of unequal diameters move like a fluid only in a plane at right angles to the lengths of the cylinders, and therein the action differs from the balls which press equally in all directions under impact.

The mode of operation of the gear when the casing or shell is of elastic steel, as in the examples described, or with the wall slotted, as in Figure 6, is substantially the same as in the other examples in allowing the change in shape of the mass of friction bodies to correspond to the change in shape of the inclosed chamber. Pressure upon the confined mass of friction bodies is transmitted to the elastic wall or walls of the casing or shell inclosing the chamber and the elastic wall of the chamber expands changing the shape of the inclosed chamber, the mobile mass of friction bodies also changing its shape practically simultaneously and correspondingly.

Obviously, substantially non-friable or rigid metallic elements or bodies of different shapes may be substituted for balls or cylinders or rollers, and in a relatively large casing balls or cylinders of equal diameters may be used which will perform the requisite functions without wedging or interlocking.

Preferably the balls and cylinders are unground, and the balls need not be perfect spheres or the cylinders of equal diameters throughout their lengths to preserve the mobility of the mass. The object is to increase friction within limits and such irregularities and shapes will increase the friction.

From the foregoing description taken with the illustrations it will be seen; that means have been provided for transforming the energy of motion of a car or cars into physical changes in other bodies located between the drawbar and a car frame. That the means comprises a mobile mass of balls or cylinders or the like which initially will yield quickly and to the requisite degree when subjected to sudden light or heavy blows or impacts, a desirable potentiality of action, inasmuch as friction between elements is greater at the start than after motion has commenced. That the recoil after the compression of the mass of elements is small, but sufficient to restore the mass substantially to its normal shape. That the sum of the areas of the bearing surfaces of the elements is as large as possible, thus effectively distributing the transmitted energy and the abrasions and wear of the parts. That the means consist of parts and elements which do not require machining to fit them for performing their functions.

The extent of the dispersion of the transmitted kinetic energy under impact of the drawbar will be understood by comparing the area of the end of the plunger with the inner area of the surface of the casing or housing in contact with the balls or cylindrical bodies.

The elements or bodies comprising the mass obviously need not be solid or entirely rigid units without elasticity, but each unit or body may in itself be yielding and capable of deformation without destroying the characteristic action of the mass; however, solid or rigid elements are sometimes preferable. Extended experiments have proved that substantially non-friable rigid metallic balls and cylindrically shaped bodies of different diameters are satisfactory elements for forming the mobile mass.

When a metallic or elastic steel shell or casing is used the wall or walls should be of sufficient thickness to prevent the expansion of the shell beyond the elastic limit of the metal.

The use of these massed friction units or

bodies in a substantially rigid casing will form a very efficient gear or means for performing the requisite functions, as it is impossible to pack the mass so compactly that impacts will not move the units or bodies of the mass relative to one another.

What I claim is:

1. A friction draft or buffing apparatus comprising a hollow metallic casing or housing and a follower or plunger forming an inclosed space or chamber, one of said parts being slidable relative to the other under impact, and a mobile mass of bodies having frictional contact with one another within the chamber, said mass being adapted to transmit part of the kinetic energy of the impact to the inner area of the casing defining the chamber; said apparatus being so constructed and the parts combined that the inclosed space or chamber is variable in shape under variations of pressure to permit corresponding change of shape of the mobile mass under such variations of pressure.

2. The subject-matter of claim 1 when the casing is provided with pocketing means for receiving part of the mass of friction bodies under impact.

3. The subject-matter of claim 1 when the casing is provided with a pocket the capacity of which is controlled by spring means and which allows a change in shape of the mobile mass of friction bodies under impact.

4. The subject-matter of claim 1 when the casing is provided with a pocket with spring means in the pocket which can yield under impact to allow a change in the shape of the chamber and a corresponding change in the shape of the mass of friction bodies.

5. The subject-matter of claim 1 with the addition of a pocket structure in the casing, and a follower and spring means limiting the movement of the follower.

6. The subject-matter of claim 1 with the addition of a pocket in connection with the casing, spring means within the pocket, and a spring follower.

7. The subject-matter of claim 1 with additional means for normally limiting the outward movement of the follower or plunger relative to the casing or housing.

8. The subject-matter of claim 1 with the addition of a key passed through the casing and follower or plunger to limit the movements of the plunger.

9. The subject-matter of claim 1 with the addition of means for deflecting a portion of the mass of the bodies in their movements within the casing under impact.

10. The subject-matter of claim 1 with the addition of a rod passed through the mobile mass of bodies for deflecting a portion of the same in their movements.

11. The subject-matter of claim 1 with the addition of "take-up" means to render more compact the mass of bodies between the casing and the slidable follower.

12. The subject-matter of claim 1 with the addition of "take-up" means comprising a pocket, a follower, and bolt and nut mechanism for moving the follower to change the degree of compactness of the said mass of bodies.

13. The subject-matter of claim 1 with the addition of "take-up" means comprising a pocket, a follower, a spring, and bolt and nut mechanism.

14. The subject-matter of claim 1 with the addition of "take-up" means comprising a pocket, a follower, a spring within the pocket, and means for forcing the spring against the follower and moving the latter.

15. The subject-matter of claim 1 with the addition of a pocket structure at the side of the casing, a movable element as a follower or plunger, and means for moving said follower or plunger and compacting the mobile mass of bodies to different degrees.

16. A friction draft or buffing apparatus comprising a hollow elastic casing or housing and a plunger or follower forming a chamber of variable shape, one of said parts being slidable relative to the other under impact to change the shape of the chamber, and a mobile mass of separate manufactured friction bodies having friction contact with one another within the chamber, each body being subject to wear in its movements in contact with other bodies of the mass, said mass being adapted to change its shape or form under the impact and correspond to the changed shape of the chamber.

17. A friction draft gear or buffing apparatus comprising a hollow casing or housing and a plunger one of said parts being slidable relative to the other and forming an inclosed space or chamber, and a mobile mass of manufactured bodies within the casing and having frictional contact with each other and with the inner surface of the casing; said casing being designed to change its shape and capacity and allow a corresponding change in the shape of the mobile mass of bodies under impact.

18. The combination in a draft and buffing gear, of draft beams, a coupler shank, a casing, a plunger, friction elements within the casing, and means for holding the casing relative to the draft beams and permitting motion of the same relative to said beams; said casing having an opening at the top surface thereof, spring means at said opening, and means for compressing the said spring means, and the friction elements beneath the same; the combination of parts being such that some of the frictional elements under impact are shifted and caused to travel at right angles to the length of the gear and compress the spring.

19. A friction draw gear or buffing apparatus comprising a plurality of substantially rigid friction bodies shaped and assembled to form a mobile mass, a yieldable means co-operating with said bodies to resist a change in their assembled form, and means also co-operating with said bodies to cause their changing their assembled form against the resistance of said yieldable means under load.

20. A friction draw gear or buffing apparatus comprising a plurality of solid friction bodies shaped and assembled to form a mobile mass, and means capable of changing its form under load for housing said bodies to correspondingly change the assembled form of said mobile mass.

21. A friction draw gear or buffing apparatus comprising a plurality of solid friction bodies shaped and assembled to form a mobile mass, resilient means for resisting change of assembled form of said bodies, and means for holding said resilient means and friction bodies in their assembled relation.

22. A friction draw gear or buffing apparatus comprising a housing structure, a plurality of solid friction bodies shaped and assembled to form a mobile mass located within said structure, and means whereby said friction bodies are given a relative movement under load.

23. The subject-matter of claim 22 when said friction bodies consist of metallic balls.

24. The subject-matter of claim 22 when said friction bodies consist of metallic balls of different sizes or diameters.

25. The subject-matter of claim 22 when said friction bodies consist of metallic elements substantially circular in cross section.

26. A friction draft or buffing apparatus comprising two members one of them being hollow and one having a sliding movement relative to the other, a mobile mass of friction bodies disposed between said members, and means permitting displacement of said mass of units within one of said members when impact pressure is applied to one of said members.

27. A friction draft or buffing device comprising two members one of them having a chamber, and one having a sliding movement relative to the other member, a promiscuously assembled mass of relatively movable rigid friction units closely confined between said members, and means permitting relative movement of said friction units and a change in shape of the said mass when impact pressure is applied to one of said members.

28. A friction draft or buffing device comprising a hollow casing member, a plunger member slidable in said casing member, a mobile mass of friction bodies closely confined within the casing member, and means permitting relative movements of said friction units and a change in shape of the said mass when impact pressure is applied to the plunger or casing member.

29. A friction draft gear or buffing apparatus comprising a housing structure, a plurality of solid friction bodies in a mobile mass confined within said structure, and a supplemental pocketing structure into which portions of said bodies are forced under load.

30. A friction draft or buffing gear apparatus comprising a housing, a plunger slidable within said housing, and a plurality of relatively small friction bodies operatively confined in a mobile mass between the plunger and said casing, said casing and said plunger being constructed relatively to prevent the escape of any of said bodies.

31. A friction draft gear or buffing apparatus comprising a housing structure, a plurality of solid friction units in a mobile mass confined within said structure, a supplemental pocketing structure into which a portion of said units are forced under load, and means for clearing said pocket structure of said units when the gear is unloaded.

32. Means for transforming the energy of motion into work comprising in combination a metallic casing having a variable interior capacity and a follower one slidable relative to the other, and friction elements or bodies confined in a compact mobile mass within the casing, the said elements being movable one relative to others within the mass under variations of pressure.

33. The subject-matter of claim 32 when the metal of the casing is elastic to allow the casing to expand and vary its capacity.

34. The subject-matter of claim 32 when the friction elements or bodies are of different sizes.

35. The subject-matter of claim 32 when some of the friction elements or bodies are substantially circular in cross section.

36. The subject-matter of claim 32 when some of the friction elements consists of metallic balls.

37. The subject-matter of claim 32 when said casing is provided with a pocket with yielding means in connection therewith.

38. The combination in a draft and buffing gear, of a casing having relatively movable ends and an outwardly extensible side portion, and said casing filled with a mass of balls of unequal diameters.

39. The combination of a hollow casing, a follower slidable relative to the casing, means for limiting the movement of the follower outwardly relative to the casing but allowing it to move inwardly, a mass

of friction elements within the casing between the casing and follower, and means for forcing the said friction elements into close contact within the casing when the follower occupies its extreme outward position relative to the casing.

40. Means for transforming kinetic energy into work comprising in combination a metallic casing and a follower one slidable relative to the other, a spring, and friction elements held in a compact mobile mass within the casing by the casing, follower and spring; said elements being movable each relative to others under variations of pressure within the mass.

41. Means for transforming kinetic energy into work comprising in combination a casing and a follower one movable relative to the other, a spring, and substantially non-friable elements of different sizes held in a compact mass within the casing by the casing, follower and spring; said elements being movable each relative to others under variations of pressures within the mass.

42. Means for transforming kinetic energy into work comprising in combination a casing and a follower one movable relative to the other, a spring, and substantially non-friable elements substantially circular in cross section held in contact within the casing by the casing, follower and spring; said elements being movable each relative to others under variations of pressure.

43. Means for transforming kinetic energy into work comprising in combination a yieldable casing and a follower one movable relative to the other, a spring, and metallic balls held in a compact mass within the casing by the casing, follower and spring; said balls being movable each relative to others under variations of pressure.

44. Means for transforming kinetic energy into work comprising in combination a casing and a follower one slidable relative to the other, a spring, and balls of different sizes held in a compact mass within the casing by the casing, follower and spring; said balls being movable each relative to others under variations of pressure.

45. In a draft and buffing gear, the combination of a casing and a follower, substantially non-friable metallic elements promiscuously assembled in a mobile mass both in buffing and drawing within the casing, said elements being movable each relative to others under variations of pressure within the mass, a spring pressed against by said mass of elements, and a reciprocating drawbar connected with the casing and follower, which drawbar when moved in either direction compresses the mass of elements and the spring.

46. In a draft and buffing gear, the combination of a casing and a follower, substantially non-friable friction elements of different sizes promiscuously assembled in a mobile mass within the casing, said elements being movable each relative to others under variations of pressure within the mass, a spring pressed against by said mass of elements and a reciprocating drawbar connected with the casing and the follower, which drawbar when moved in either direction compresses the mass of elements and the spring.

47. In a draft and buffing gear, the combination of a casing and a follower one movable relative to the other, metallic elements substantially circular in cross section in frictional contact within the casing, a spring pressed against by said metallic elements, and a reciprocating drawbar connected with the casing and follower.

48. In a draft and buffing gear, the combination of a casing and a follower one movable relative to the other, balls of different sizes within the casing, a spring pressed against by said balls, and a reciprocating drawbar connected with the casing and follower.

49. Means for transforming kinetic energy into work comprising in combination a movable casing, a plurality of substantially non-friable elements some of which consist of balls, a follower movable relative to the casing, a spring adapted to be compressed by the pressure of the balls, and a reciprocating drawbar connected to the casing to move it relative to the follower in one direction.

50. Means for transforming kinetic energy into work comprising in combination a casing, a plurality of balls of different diameters within the casing, a follower slidable relative to the casing to vary the space inclosed between the same and the casing, a spring adapted to be compressed by the pressure of the balls, and a key passed through the follower and casing.

51. The combination in a draft and buffing gear, of a reciprocating drawbar, a metallic casing, substantially non-friable friction elements within the casing freely movable one upon another, a spring, a movable wall between the said elements and the spring, and a follower having a reciprocating motion relative to the casing; said spring being disposed with its axis at an angle to the axis of the drawbar whereby the said elements move sidewise in compressing the spring.

52. The combination in a draft and buffing gear, of a reciprocating drawbar, a metallic casing, balls of different diameters or sizes within the casing, a spring, a movable wall between the balls and the spring, and a follower; the spring being suitably supported with its axis at an angle to the axis of the drawbar.

53. Means for transforming kinetic energy into work comprising in combination a casing, disconnected elements substantially cir-

cular in cross section freely movable one upon another within the casing, a spring in connection with the casing and adapted to be compressed by the said elements, a follower in connection with the casing, and a drawbar slidably supported relative to the casing and follower for compressing the said elements and the spring.

54. Means for transforming kinetic energy into work comprising in combination a casing, a reciprocating drawbar, disconnected substantially non-friable friction elements within the casing freely movable in contact one upon another, a helical spring in connection with the said elements, a threaded rod or bolt with a nut passed through the spring and casing, and a follower reciprocating relative to the casing.

55. The combination in a draft and buffing gear, of a reciprocating drawbar, a casing open at an end, frictional elements disconnected and movable within the casing, a movable wall for the casing, a spring in connection with the movable wall, and a follower independent and separate from the drawbar and movable at the open end of the casing; said spring being located at one side of the axial line of the casing.

56. The combination in a draft and buffing gear, of a reciprocating drawbar, a casing with an open end an opening in the wall a mobile mass of friction elements within the casing and movable relative thereto, a spring with its axis at an angle to the axis of the drawbar, a movable wall within the opening in the casing and adjacent the spring, a follower independent and separate from the drawbar, and means in connection with the spring and casing for holding the spring and movable wall so that the movement of the said elements can compress the spring.

57. The combination in a draft and buffing gear, of a reciprocating drawbar, a casing with an open end and an opening in the wall, friction bodies assembled in a mobile mass within the casing, a helical spring, a movable wall within the opening in the casing, a bolt or rod in connection with the casing and spring, and a follower independent of the reciprocating drawbar.

58. The combination in a draft and buffing gear, of a reciprocating drawbar, a casing with an open end and an opening in the wall, substantially non-friable elements within the casing movable one upon another, a helical spring, a movable wall within the opening in the casing, a threaded bolt or rod passed through the casing movable wall and spring, a threaded nut on the bolt or rod, and a follower.

59. The combination in a draft and buffing gear, of a reciprocating drawbar, a casing open at one end and having an opening in the wall, balls within the casing, a helical spring, a movable wall, a bolt or rod passed through the casing, movable wall and spring, and a follower separate from the drawbar.

60. The combination in a draft and buffing gear, of a casing, a mobile mass of non-friable elements one movable relative to others under variations of pressure within the casing, a spring pressed against by the said elements, a follower, a reciprocating draw-bar, and means for taking up lost motion and maintaining the said elements in a substantially compact mass.

61. The combination in a draft and buffing gear, of a casing, metallic elements substantially circular in cross section within the casing, a follower, a spring, a reciprocating drawbar, and means for taking up lost motion and holding the said metallic elements in contact and pressing against the spring.

62. The combination of a frame, a gear casing having an opening at the side, means for supporting the casing on the frame so it can have a limited reciprocating movement relative thereto, metallic frictional elements in mass and in contact and movable one upon another when subjected to pressure in the casing, a spring in connection with the opening at the side coacting with the friction elements, a slotted drawbar, and a key uniting the slotted drawbar and the casing.

63. The combination of a frame, a gear casing having an opening or pocket in the wall thereof between the ends, and slotted arms, means for supporting the casing on the frame so it can have a limited reciprocating movement relative thereto, metallic frictional elements in mass within the casing, a spring in connection with the opening or pocket in the wall, a slotted drawbar, and a key uniting the slotted drawbar and the slotted arms.

64. The combination with a casing having an opening or pocket between the ends of the casing, slotted arms and slots in the sides, of a follower and a key, frictional elements in mass in the casing back of the follower, and a spring supported at the opening or pocket in the casing between the ends thereof and co-acting with the frictional elements.

65. The combination with a casing having two openings one of them between the ends, and slotted arms, of a follower at one of said openings and a spring at the other opening, frictional elements in mass between the follower and spring, and means for supporting the casing on a frame so it can have a limited reciprocating motion relative thereto.

66. The combination with a casing for a draft and buffing gear having an opening at the end, slots in the sides for a key, and arms each with a slot to receive a key for

attaching the arms to a slotted drawbar, of a follower, a mobile mass of friction elements in the casing, and yieldable means allowing the mass to change its shape within the casing.

67. The combination of a casing having a pocket at the side and elongated slots for a key adjacent the open end of the casing, resilient yielding means within the pocket, a slidable slotted follower, a key within the elongated slots in the casing and the slot in the follower, and frictional elements in mass within the casing, which elements under pressure move relative to the pocket and compress the resilient yieldable means.

68. A friction draft or buffing apparatus comprising in combination a hollow metallic casing with an open end and a plunger at the said open end, one slidable relative to the other and thus forming an inclosed chamber of variable capacity, means for limiting the outward movement of the plunger relative to the casing, a mobile mass of friction elements within the said chamber said mass being capable of change of shape under pressure, and means for compacting the mass of mobile friction elements between the casing and the plunger when the latter is in its extreme outward position relative to the casing, whereby the extreme operative length of the combined casing and plunger may be maintained.

69. A friction draft or buffing apparatus comprising a hollow elastic metallic shell, casing or housing and a follower plunger forming an inclosed chamber, one of the said parts being slidable relative to the other under impact, and a mobile mass of friction elements having frictional contact with one another within the chamber with interstices between said elements, whereby under impact pressure the casing will expand, the elements of the mobile mass move one relative to another, and the mobile mass be made more compact and occupy less space than prior to said pressure of impact.

70. A friction draw gear or buffing apparatus comprising a casing, a plunger movable in connection therewith, a plurality of metallic frictional bodies shaped and promiscuously assembled to form a mobile mass located between said casing and plunger, and a spring; both said mobile mass and spring being adapted to be actuated by the movement of the plunger in drawing or buffing.

71. Means for transforming kinetic energy into work comprising in combination an elastic expansible metallic shell or casing, a plunger freely slidable relative to said shell or casing under impact, and a promiscuously assembled mobile mass of metallic friction bodies within said shell or casing; said mobile mass of bodies being adapted under impact to transmit energy to the inner surface of said shell or casing and expand the same.

72. A friction draft or buffing apparatus comprising a housing, a follower freely slidable relative to the housing and forming with said housing a substantially inclosed space, and a plurality of separate metallic friction bodies fashioned and assembled to form a mobile mass within said inclosed space; said apparatus being so constructed that it can change its shape with a corresponding change in shape of the inclosed space under pressure of the mobile mass of friction bodies when actuated by the follower under impact, the bodies of the mobile mass in frictional contact shifting their relative positions in the mass with the change in shape of the inclosed space.

73. A friction draft or buffing apparatus comprising a housing, a follower freely slidable relative to the housing and forming with said housing a substantially inclosed space, and a mobile mass of friction bodies, some of them being separately fashioned metallic bodies, within said housing; said housing apparatus being constructed so as to permit change in shape of said inclosed space under impact pressure of the mobile mass, whereby the mobile mass of friction bodies correspondingly changes its shape and occasions movements of the said bodies relative to one another in frictional contact.

In testimony whereof I affix my signature.

FRANK E. STEBBINS.