E. A. DENHAM.

SPANNER WRENCH.

APPLICATION FILED SEPT. 10, 1910.

999,968.

Patented Aug. 8, 1911.

2 SHEETS—SHEET 1.

FIG. 1.

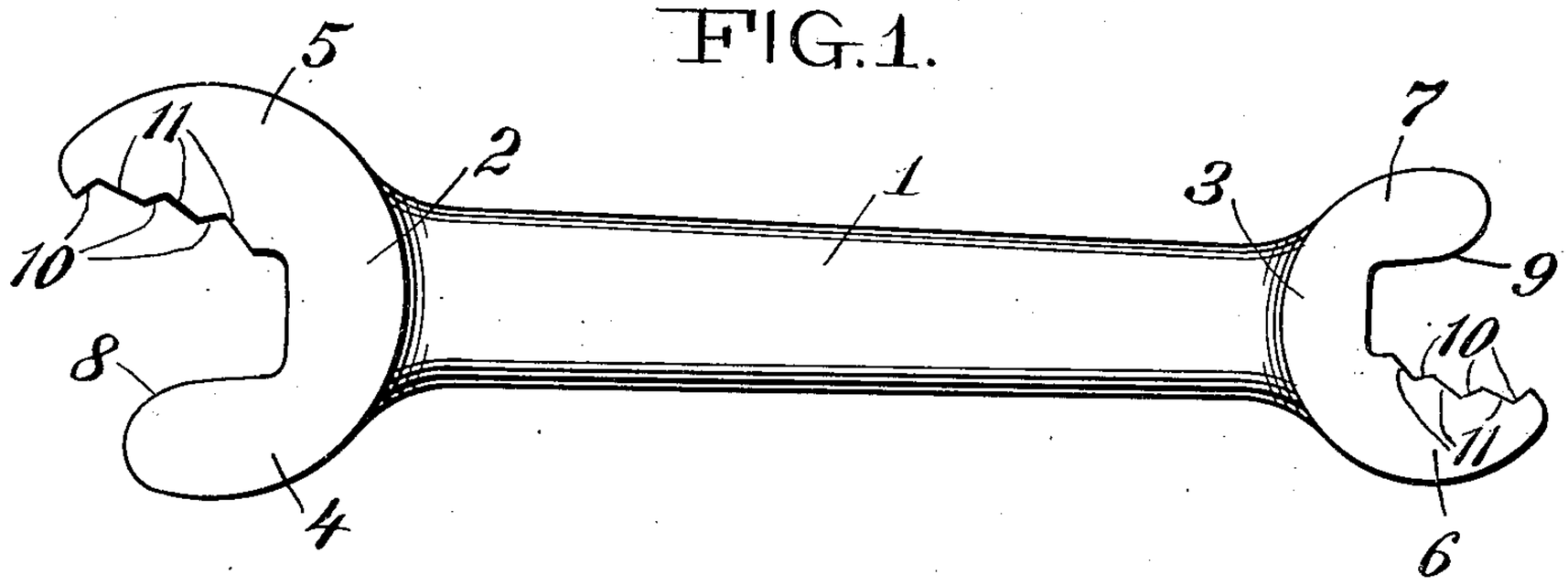


FIG. 2.

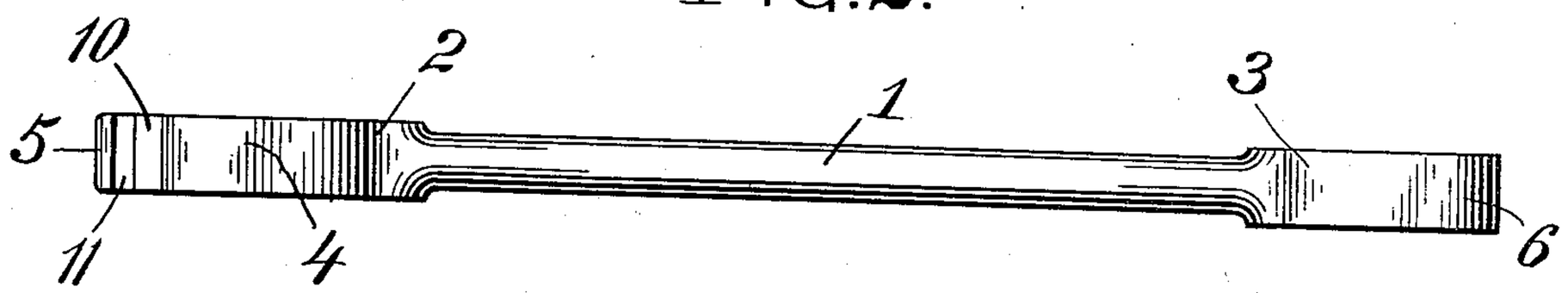


FIG. 3.

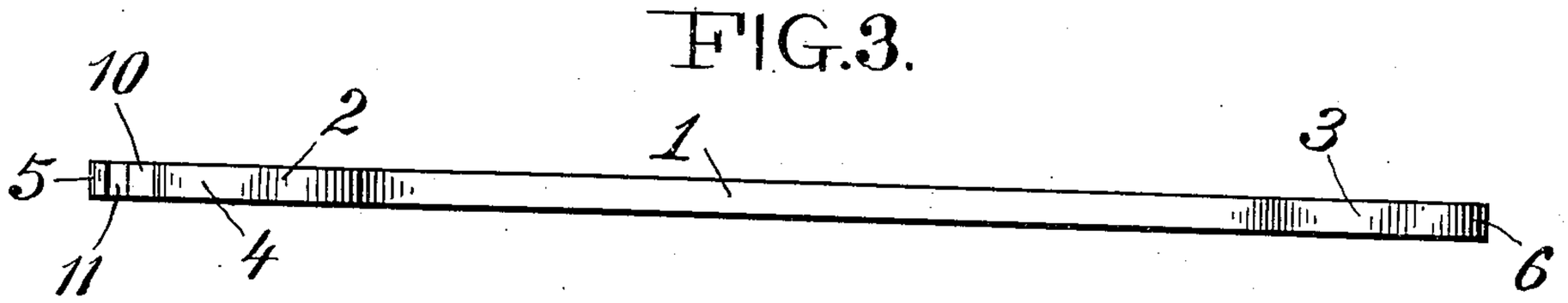
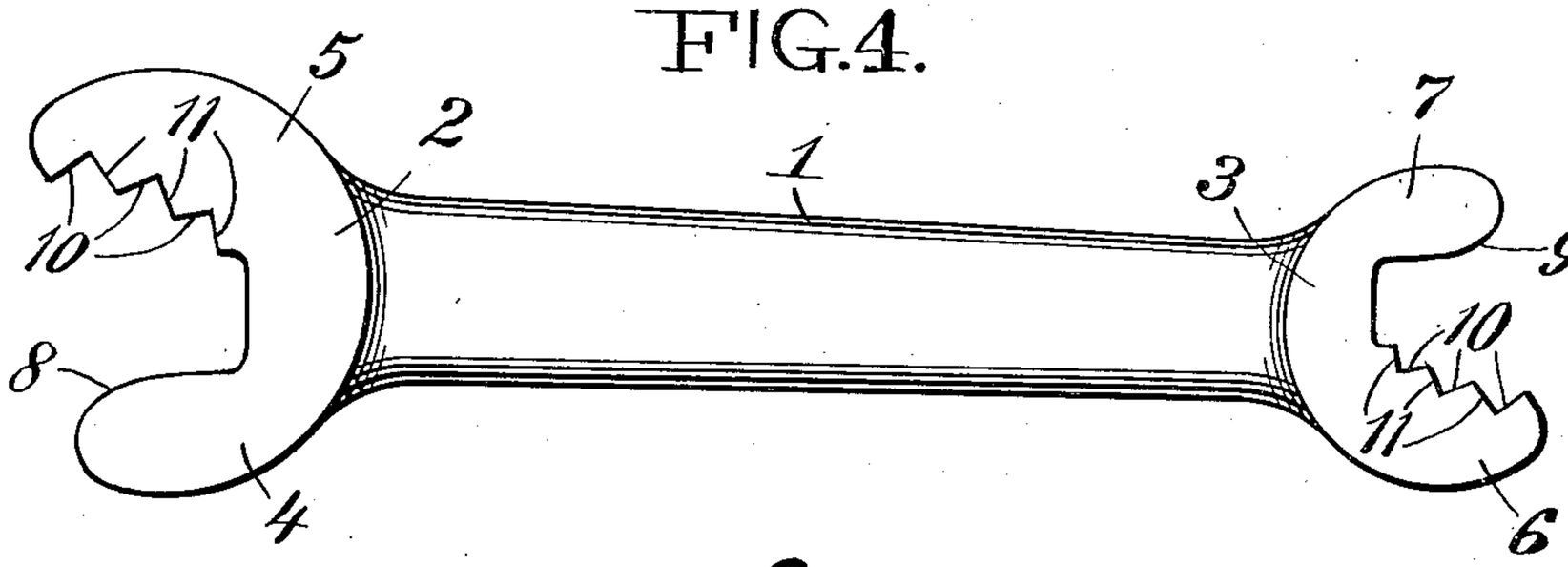


FIG. 4.



WITNESSES:

Karl S. Dietz

Gerald E. Terwilliger

Edwin A. Denham
INVENTOR

BY

Seward Davis his ATTORNEY

E. A. DENHAM.

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2 SHEETS—SHEET 2.

FIG. 5.

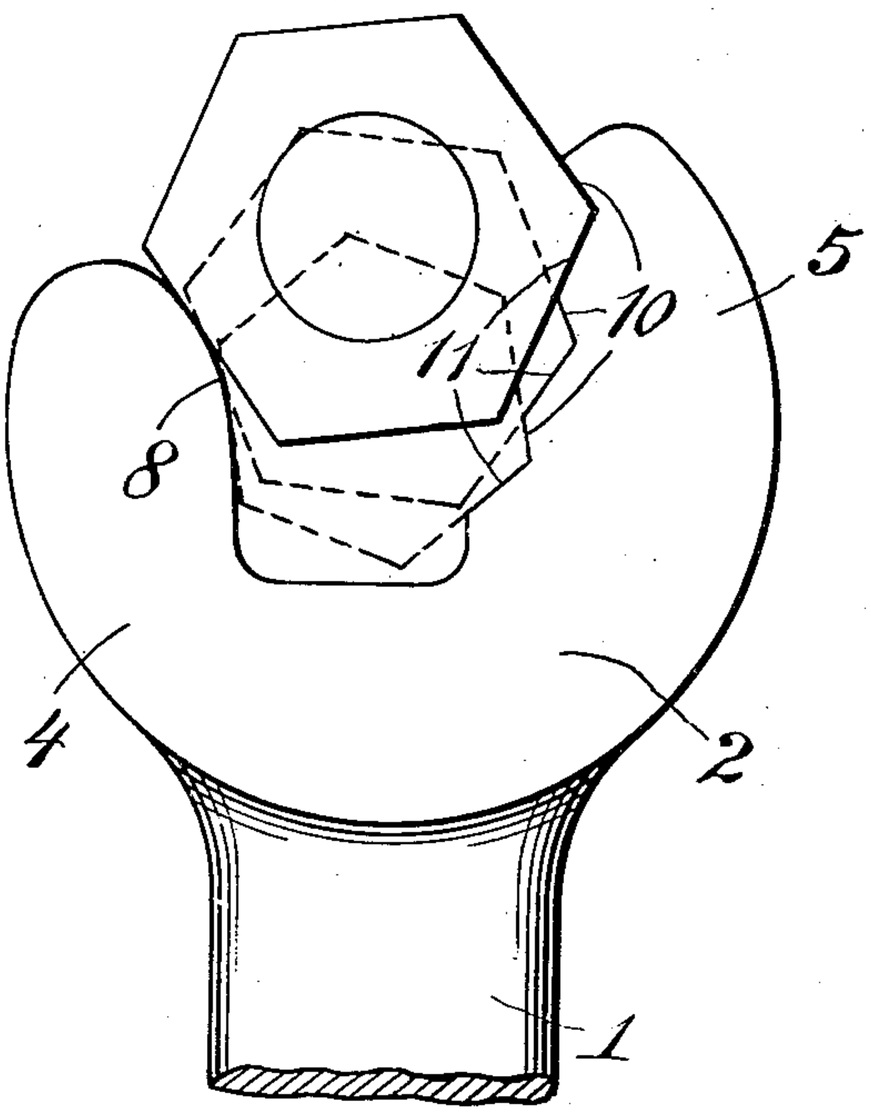


FIG. 6.

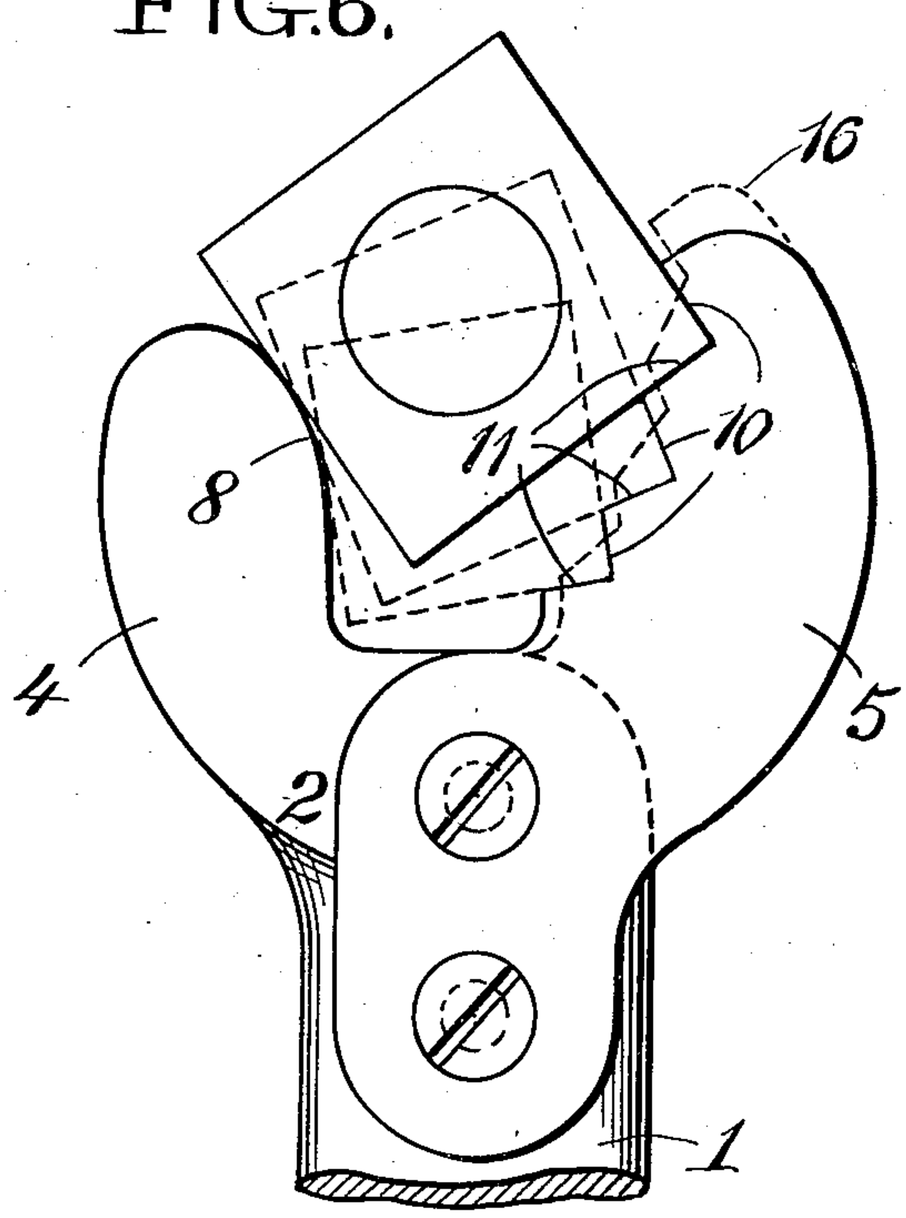


FIG. 7.

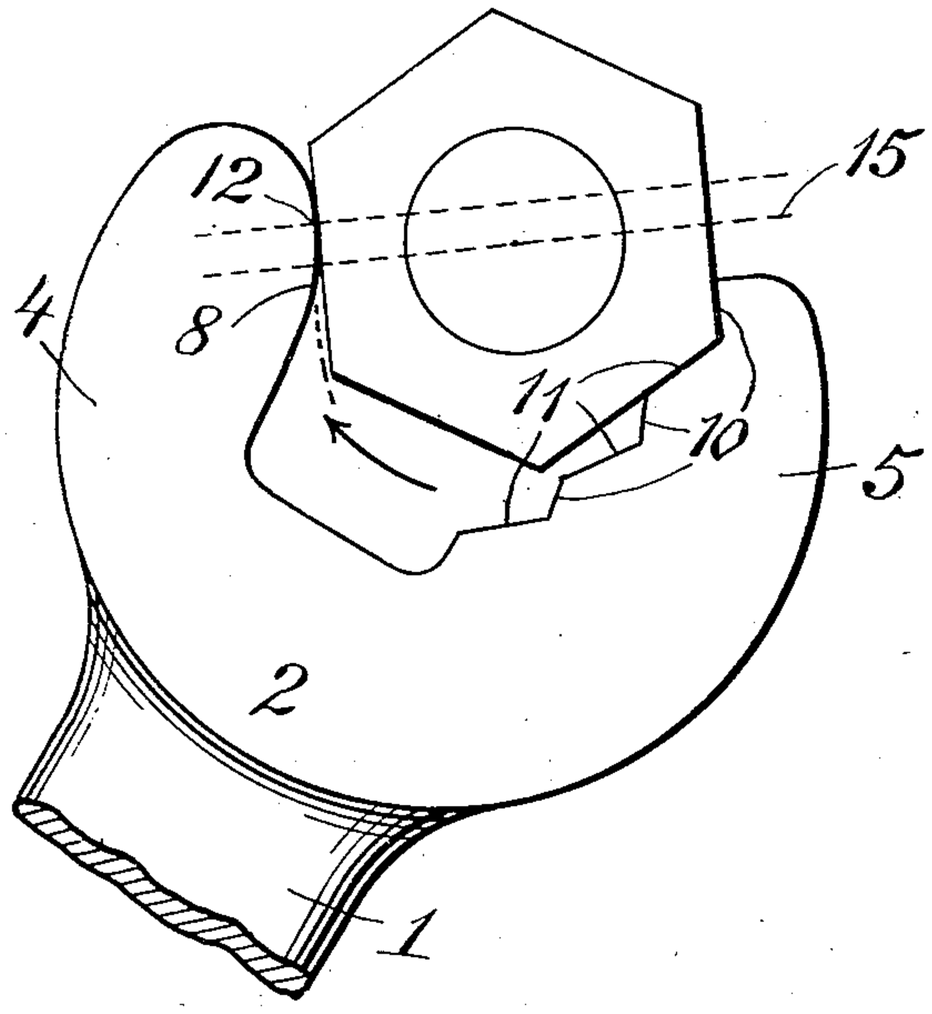
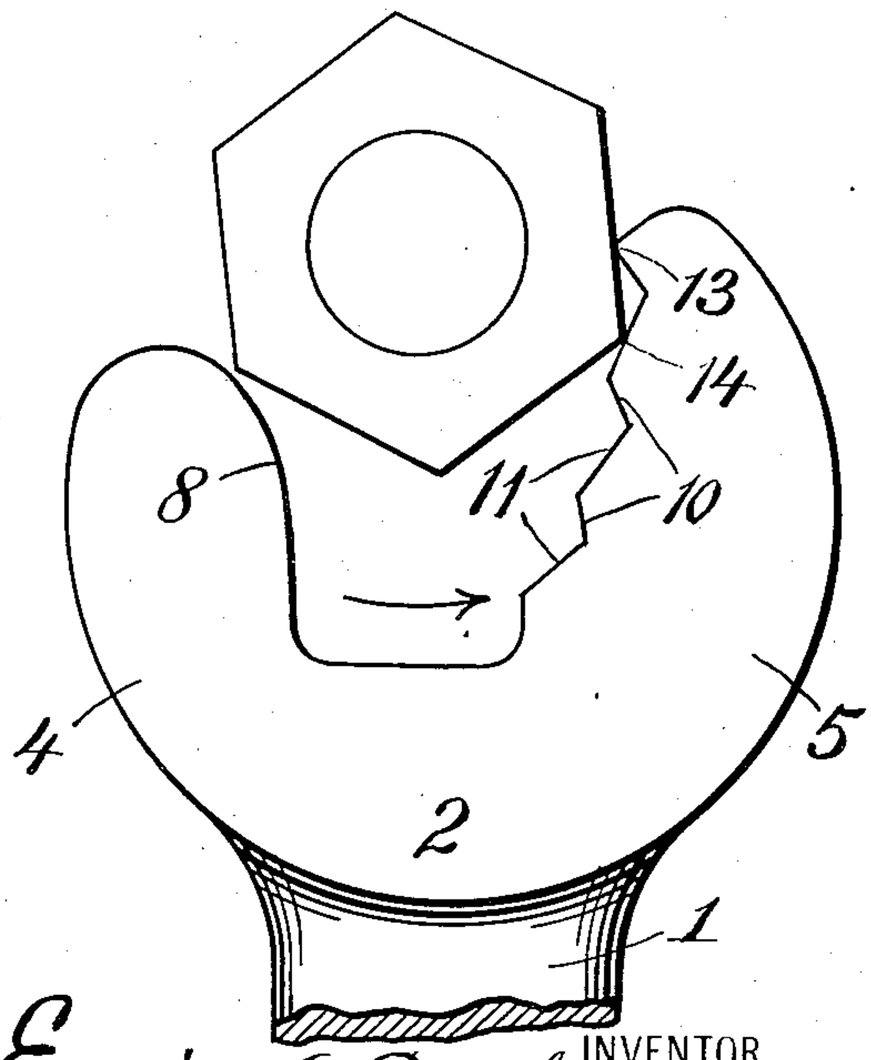


FIG. 8.



WITNESSES:

Karl S. Drith

Gerald E. Tennilliger

INVENTOR

Edwin A. Denham

BY

Seward Davis

ATTORNEY

UNITED STATES PATENT OFFICE.

EDWIN A. DENHAM, OF NEW YORK, N. Y., ASSIGNOR TO THE ERIE WRENCH COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

SPANNER-WRENCH.

999,968. Specification of Letters Patent. Patented Aug. 8, 1911.

Application filed September 10, 1910. Serial No. 581,362.

To all whom it may concern:

Be it known that I, EDWIN A. DENHAM, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Spanner-Wrenches, of which the following is a specification.

My invention relates broadly to spanner wrenches and particularly to that type known as a ratcheting wrench so proportioned and designed that it is unnecessary to remove the wrench from the nut in order to obtain a fresh hold upon a new face, the wrench tending to grip the nut only when rotated in one direction. My invention provides a wrench of this class, the jaws of which are peculiarly well adapted for the reception of a series of nuts without adjustment, and so designed that their faces contact with the faces of the nuts gripped.

A specific feature of my invention is the provision of a number of independent serrated jaws, attachable to and detachable from the handle and fixed jaw. By this means an almost unlimited series of nuts can be accommodated in a single wrench.

One great objection to ratchet wrenches of the fixed jaw type has been their tendency to grip the corners instead of the faces of the nuts. In order to minimize mutilation of the corners of the nuts it has heretofore been necessary to make the wrench of heavy stock, generally forged. Since my wrench when in operative position is always in engagement with a substantial area of the faces of the nut instead of the corners thereof, I find it possible to construct the wrench of thin stock, at a much lower cost than that of a forged wrench. Thus a double-ended wrench can readily be made to fit as many as six or eight nuts without alteration, and by the replaceable jaw hereafter described, an extended series of nuts may be accommodated. By my novel construction I am further enabled to make a multiple wrench having all the manifold advantages of the so-called ratchet type at a cost no greater than that of an accurately made spanner wrench of prior type.

In the accompanying drawings which form a part of this specification, Figure 1 is a side elevation of my improved wrench; Fig. 2 is a bottom view thereof; Fig. 3 is a view similar to Fig. 2, showing a modification; Fig. 4 is a view similar to Fig. 1, showing a modification; Fig. 5 is a diagrammatic view of one end of the wrench engaging a nut; Fig. 6 is a similar view of a modification; Fig. 7 is a diagrammatic view illustrating the action of the wrench in rotating the nut; Fig. 8 is a diagrammatic view illustrating the ratcheting action of the wrench about a nut.

Referring to the drawings in detail, the numeral 1 designates a wrench having the two ends 2 and 3 provided, respectively, with jaws 4 and 5, and 6 and 7. The jaws 4 and 7 are provided, respectively, with internal curvilinear faces 8 and 9, while upon the inner faces of the jaws 5 and 6 are formed a series of rests. These rests comprise a series of faces 10 having the same general direction as the axis of the wrench, but each bearing a different angular relation thereto, which faces may be termed the longitudinal faces or grips. Intersecting these faces at a definite angle, depending upon the character of the nut for which the wrench is designed, is a second series of faces 11, which may be termed the transverse faces. The angle between any transverse face and its corresponding adjacent longitudinal face will be 90 degrees in case the wrench is designed for use with square nuts, and will be 120 degrees in case the wrench is designed for use with hexagonal nuts. The curvature of the faces 4 and 7 and the angular relation of any pair of rests to the next pair are mutually dependent, as is best illustrated in the diagrammatic Figs. 5, 7 and 8. In designing a multiple wrench in which no ratcheting action is desired, it would be only necessary to have the curvature of the faces 4 and 7 conform to the requirement that the point of tangency between the curve and the nut, two of whose faces engage a pair of rests shall lie above the axis of the nut with relation to the two particular faces then in engagement with the other jaw of the wrench. To rotate a nut it is necessary to impress a "couple" upon it; that is, two equal and opposite forces acting at equal distances from the center of rotation, and the described structure accomplishes this result, as illustrated in Fig. 7. When it is also desired that the multiple wrench should be so designed as to have a ratcheting effect, the proportions must be such that when the direction of rotation of the wrench is reversed, as shown by the ar-

row in Fig. 8, the wrench will then slide on the two points of contact, as 13 and 14, and in this case the effective radius of rotation must be sufficient to permit the opposite or curved jaw to clear the opposite corner of the nut, as there illustrated. To accomplish this effect it is necessary to make the first rest of each pair short. This does not, however, interfere with the operation, since the effective force at that side in any case is all applied below the axis 15 of the nut, as shown in Fig. 7. Therefore, by designing my wrench so that tangents to the curvilinear face at such a distance from one of the longitudinal rests as will just admit a nut, will be parallel to such rests, I am enabled to construct a wrench combining the desirable characteristics of the multiple wrench, with those of the ratchet wrench. I find that I can readily make a wrench to accommodate as many as three or four different sizes of nuts in one pair of jaws, as illustrated in full and dotted lines of Fig. 5, without departing from a design which will give adequate strength to the wrench and at the same time be readily manufactured.

It is obvious that my invention may be applied with equal facility either to square, hexagonal or other shaped nuts.

Fig. 4 illustrates a wrench similar in all respects to the wrench which I have described with the exception that it is designed for use with square nuts instead of hexagonal.

In Fig. 6 I have illustrated a modification wherein the jaw having the rectilinear rests is made removable. I find that by providing a number of jaws having rectilinear rests of various design, I can accommodate a large series of nuts, both square and hexagonal, in a wrench having a single fixed curved jaw. To illustrate this feature of advantage more clearly, the fixed jaw is shown in Fig. 6 as having exactly the same curvature as the curvilinear face of Fig. 5, but I have provided the wrench of Fig. 6 with a removable jaw in which the rectilinear rests are slightly modified so as to accommodate a series of square nuts in place of the hexagonal nuts. The dotted line 16 indicates how this wrench might be equipped with a removable jaw having the same configuration as the right-hand jaw of the wrench of Fig. 5. It would then perform all the functions of that wrench as efficiently as does that structure.

Because of the fact that my improved wrench does not tend to mutilate the corners of the nuts, but has surface contact throughout its operation, I am enabled to use a thin wrench such as is illustrated in Fig. 3, which may be identical, so far as the configuration of the jaws is concerned, with any of the wrenches illustrated in the other figures, but which is made of comparatively thin stock, which may be stamped or punched instead of forged. In all cases the design must be such that the tangents to the curve at the point where the nut strikes it must be parallel to one of the faces of the rest receiving that nut.

While I have illustrated several modifications of my improved device, my features of invention are capable of extended application, and I do not wish to be limited to the specific structures shown and described.

Having thus described my invention, I claim:

1. A wrench for accommodating nuts of different sizes having a jaw with a convexly curved face adapted to engage a facet of the nut to be operated, between the corners thereof, and a second jaw having a plurality of substantially plane grip faces, each adapted to engage a nut of appropriate size upon a facet diametrically opposite to the nut facet engaged by the curved face of the first jaw, each of said grip faces on said second jaw being substantially parallel to the tangent to the curved jaw face at the point of engagement of said jaw face with a facet of that nut with which the corresponding grip face is adapted to engage.

2. A wrench for accommodating nuts of different sizes having a jaw with a convexly curved face adapted to engage a facet of the nut to be operated, between the corners thereof, and at a point beyond, in the direction in which the nut is to be rotated, the line of intersection of a plane passing through the axis of rotation of said nut and normal to the plane of said facet, with the plane of said facet, and a second jaw having a plurality of substantially plane grip faces, each adapted to engage a nut of appropriate size upon a facet diametrically opposite to the nut facet engaged by the curved face of the first jaw, each of said grip faces on said second jaw being substantially parallel to the tangent to the curved jaw face at the point of engagement of said jaw face with a facet of that nut with which the corresponding grip face is adapted to engage.

3. A wrench for accommodating nuts of different sizes having a jaw with a convexly curved face adapted to engage a facet of the nut to be operated, between the corners thereof, and a second jaw having a plurality of substantially plane grip faces, each adapted to engage a nut of appropriate size upon a facet diametrically opposite to the nut facet engaged by the curved face of the first jaw, each of said grip faces on said second jaw being substantially parallel to the tangent to the curved jaw face at the point of engagement of said jaw face with a facet of that nut with which the corresponding grip face is adapted to engage, said curved jaw face and grip face engaging their respective nut facets at points located upon opposite

sides of a line passing through the center of rotation of the nut and normal to the planes of said facets.

4. A wrench for accommodating nuts of different sizes having a jaw with a convexly curved face adapted to engage a facet of the nut to be operated, between the corners thereof, and a second jaw having a plurality of rests comprising substantially plane grip faces and transverse faces, each grip face adapted to engage a nut of appropriate size upon a facet diametrically opposite to the nut facet engaged by the curved face of the first jaw, each of said grip faces on said second jaw being substantially parallel to the tangent to the curved jaw face at the point of engagement of said jaw face with a facet of that nut with which the corresponding grip face is adapted to engage, the transverse faces of said rests being disposed to the corresponding grip faces at angles equal to the angles between adjacent facets of the nuts to be received by the rests, whereby adjacent facets of said nuts will be closely engaged by said rests.

5. A wrench for accommodating nuts of different sizes having a jaw with a convexly curved face adapted to engage a facet of the nut to be operated, between the corners thereof, and a second jaw having a plurality of substantially plane grip faces, each adapted to engage a nut of appropriate size upon a facet diametrically opposite to the nut facet engaged by the curved face of the first jaw, each of said grip faces on said second jaw being substantially parallel to the tangent to the curved jaw face at the point of engagement of said jaw face with a facet of that nut with which the corresponding grip face is adapted to engage, the proportions of said jaws being such that the wrench will rotate freely about the nut in one direction.

6. A wrench for accommodating nuts of different sizes having a jaw with a convexly curved face adapted to engage a facet of the nut to be operated, a removable jaw having a plurality of substantially plane grip faces, each adapted to engage a nut of appropriate size upon a facet diametrically opposite to the nut facet engaged by the curved face of the first jaw, each of said grip faces on said second jaw being substantially parallel to the tangent to the curved jaw face at the point of engagement of said jaw face with a facet of that nut with which the corresponding grip face is adapted to engage, and means for detachably securing said removable jaw to said wrench.

7. A wrench for accommodating nuts of different sizes having a jaw with a single face adapted to engage a facet of a nut of any of the sizes which the wrench is designed to operate, and a second jaw having a plurality of rests, each comprising a substantially plane grip face adapted to engage a nut of appropriate size upon a facet diametrically opposite to the nut facet engaged by the face of the first jaw, and a substantially plane transverse face disposed at an angle to the corresponding grip face equal to the angle between adjacent facets of the nut to be received by said grip and transverse faces, whereby said transverse face will engage a facet of said nut adjacent to that engaged by the corresponding grip face, said first jaw face and said grip face engaging their respective nut facets at points located upon opposite sides of a line passing through the center of rotation of the nut and normal to the planes of said facets, the parts being so proportioned that the wrench will rotate freely about the nut in one direction.

8. A wrench having a jaw with a convexly curved face adapted to engage a facet of a nut between the corners thereof, and a second jaw having a substantially plane grip face adapted to engage a diametrically opposite facet of the nut, said grip face being substantially parallel to the tangent to the curved jaw face at the point of engagement of said jaw face with the nut facet, said curved jaw face and grip face engaging their respective nut facets at points located upon opposite sides of a line passing through the center of rotation of the nut and normal to the planes of said facets, the parts being so proportioned that the wrench will rotate freely about the nut in one direction.

EDWIN A. DENHAM.

Witnesses:
F. C. NAGLE,
J. J. MCMAHON.