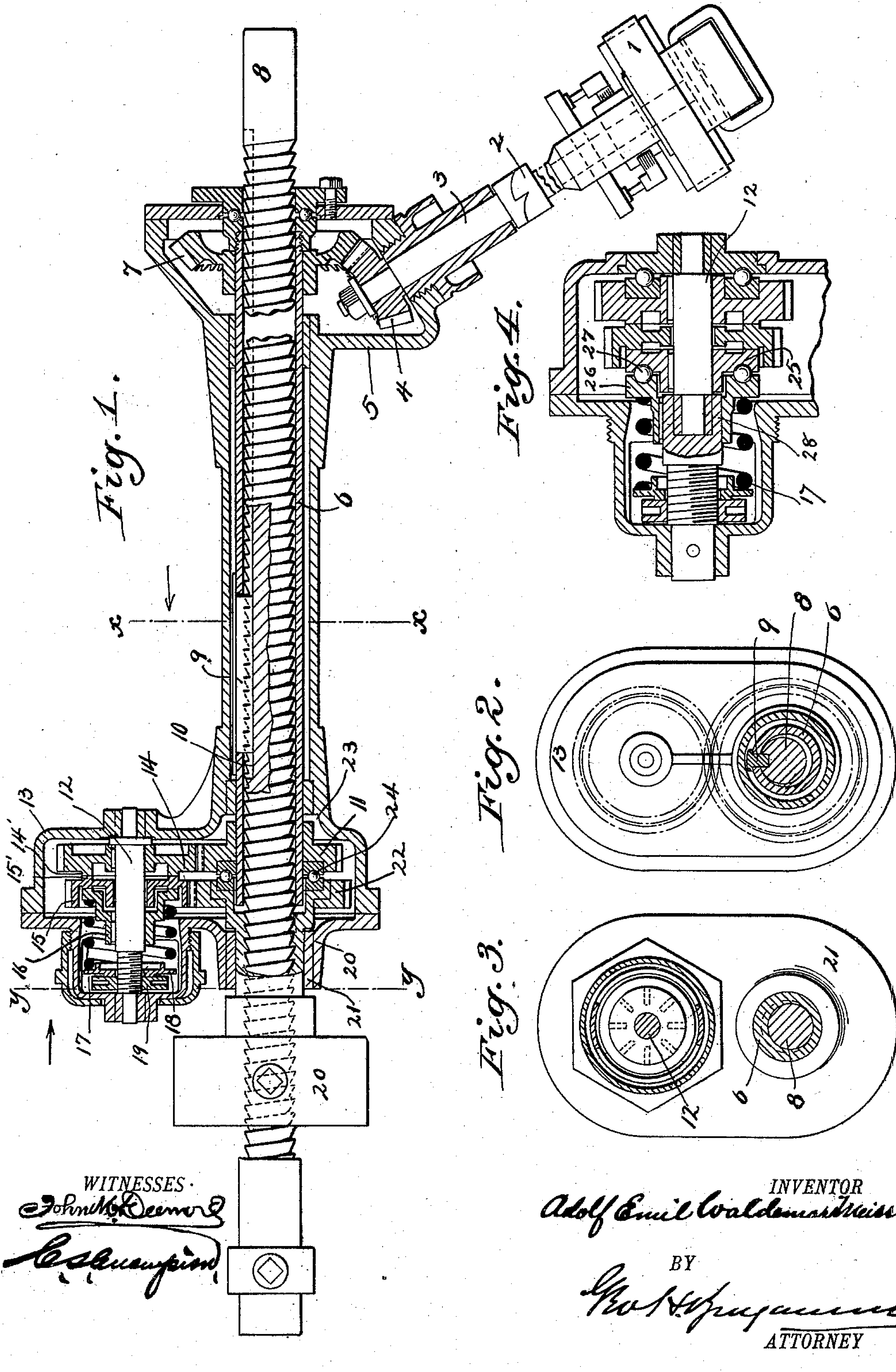
(No Model.)

A. E. W. MEISSNER.

SAFETY FEEDING DEVICE FOR ROTARY TOOLS, &c.

No. 535,451. Patented Mar. 12, 1895.



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SAFETY FEEDING DEVICE FOR ROTARY TOOLS, &c.

SPECIFICATION forming part of Letters Patent No. 535,451, dated March 12, 1895.

Application filed February 17, 1894. Serial No. 500,494. (No model.) Patented in Germany July 14, 1893, No. 75,303.

To all whom it may concern:

Be it known that I, ADOLF EMIL WALDEMAR MEISSNER, a subject of the Emperor of Germany, residing at Charlottenburg, Germany, have invented new and useful Improvements in Safety Feeding Devices for Rotary Tools, &c., (for which I have obtained Letters Patent in Germany, No. 75,303, dated July 14, 1893,) of which the following is a specification.

My invention relates to improvements in automatic safety feeding devices for rotary tools, &c., and it has for its main object the provision of means for preventing dangerous axial pressure upon the rotating tool, spindle or shaft.

The invention is especially applicable to machinery in which the rotating parts are automatically fed from a suitable source of power, and which machinery does not usually require the constant attention of an operator. In boring or drilling stone, for instance, with a dull tool, this automatic feed is apt to become a source of positive danger should an obstruction be met in the material, or should the body of the stone suddenly become harder. The increased pressure in axial direction exerted upon the tool upon meeting such an obstruction could become so great as to endanger the tool and other operative parts of the machine. Hence, in order to prevent too great a pressure at such a moment, it is necessary to make the feed of the tool automatically variable so that the rate of feed will adapt itself to the hardness of the material through which the drill or tool has to work its way. Devices of this class, heretofore constructed, have not been able to fulfill their task and to meet the conditions of practice successfully. Their whole construction involves too much friction. Hence, they show a low efficiency; they protect the machine against overload within very narrow limits only and the only practical safeguard is the watchfulness of the attendant and regulation by hand.

To make the apparatus of a high efficiency and to overcome the disadvantages heretofore met with by rendering the feed of such tools automatically adjustable in a simple and reliable manner and to make the operation of the apparatus independent of the carelessness or judgment of the attendant, is, therefore, the object of the present invention.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a longitudinal section, partly in plan, of a drill constructed in accordance with my invention and a power transmitting device connected therewith. Fig. 2 is a cross-section of the drill taken on the line x, x thereof looking in the direction of the arrow. Fig. 3 is a cross section of the same on the line y, y, looking in the direction of the arrow. Fig. 4 is a longitudinal section of a modified detail hereinafter described.

1 is an electric motor suitably connected by means of a flexible shaft (not shown) and a coupling 2, to a shaft 3, carrying upon its end a beveled wheel 4; the shaft 3, being suitably journaled within the frame 5, for the rotation of the drill spindle. Within said frame 5 is journaled a hollow shaft 6, upon the end of which is fastened a second beveled wheel 7, meshing with and driven by the beveled wheel 4. The drill spindle 8, shown broken at a, is mounted within and operated by the hollow spindle 6, being connected therewith by means of a key 9 and slot 10.

The key 9 it will be seen is secured to the outside of the hollow shaft 6, and projects within the same and into the slot or channel 10 in the spindle 8 (see Fig. 2), whereby said spindle 8 must rotate with the same angular velocity as the hollow shaft 6, being at the same time permitted to move forward within said shaft 6. The automatic feeding of the spindle 8 is done in the manner hereinafter described.

Secured to the lower end of the shaft 6, is a gear wheel 11. A shaft 12, journaled within the offset portion 13, of the frame and of the machine, carries a similar gear wheel 14, engaging with and operated by the gear wheel 11. A second gear 15, is also mounted loosely upon shaft 12, and secured to said gear, and turning upon said shaft is a collar 16. The two gear wheels 14 and 15, are not connected together rigidly, but have a frictional contact and engagement by means of the bearing faces 14′ and 15′. A stout spring 17, surrounding the shaft 12, and held upon it by means of the washer and nut 18 and 19, ex-

erts upon said gear wheels 14 and 15, a pressure sufficient to insure their revolving together during the normal operation of the mechanism. A sleeve 20, journaled within the part 21, of the frame and upon the end of the shaft 6, has rigidly secured thereto a gear wheel 22, engaging with and operated by the gear 15. This sleeve 20 is interiorly screw-threaded to engage the corresponding exterior thread of the drill spindle, which rotates therein.

The transmitting ratio between the first and the last gear wheels of the series 11, 14, 15, 22 is such as to give the screw-threaded sleeve or collar 20 an angular velocity differing from that of the spindle 8; and it is by the difference of the angular velocities of these parts that the feeding of the spindle 8 is automatically done. The rate of feeding depends upon the ratio existing between the gears. This value may be greater or less than unity, which will depend upon the direction of rotation of the spindle and whether its screw-thread is right or left handed.

The axial pressure upon the drill or tool is transmitted to the sleeve 20 and wheel 22, preferably by means of a ball bearing 24 to the hollow shaft 6, and at the rear end of this shaft also by means of a ball bearing 28 to the frame of the machine.

In the operation of my invention it will be seen that the differences of speed of rotation between the collar 20 and spindle 8 are occasioned by the axial pressure of the drill or tool, plus the friction between the screw-threads of the spindle 8 and collar 20. If the sum of these forces or pressures exceeds a predetermined limit, which is determined by the adjustment of the spring 17, the gear wheels 14 and 15, will not rotate together, but, while the speed of wheel 14 will remain the same, the gear 15 will slide by its bearing face 15′, upon the bearing face 14′ of the wheel 14, and impart to the gear 22, a reduced speed of rotation, which will in turn be imparted to the collar 20, and thence to the spindle 8, which will yield longitudinally by reason of its key and slot connection 9, 10 with respect to the shaft 6.

In an extreme case, when the tool meets an impassable obstruction in the path of its feed, the parts 20 and 8 must rotate at the same speed, and the gear wheels 14 and 15 will slide upon each other with the greatest possible speed and produce the greatest amount of friction. By properly proportioning the pitch of the spindle thread 8 and the thread of the collar, and by properly proportioning the ratio between the gear wheels, the energy wasted in friction can be kept so low that the wear and tear upon the friction surfaces and the resulting heating effects will remain within permissible limits. By properly setting the spring 17 before operations are commenced, a maximum axial pressure can be predetermined at which the automatic safety device should commence to operate.

The adjustment of the spring may remain the same for certain conditions of working. Before commencement of operations, it is preferable to leave the adjusting of the spring pressure to the judgement of the superintendent, so that the operator can go ahead without further adjustment of the machine. As it is under most working conditions much easier to make this first adjustment of the spring while the machine is in actual operation it might be advantageous to employ the arrangement shown in Fig. 4. In this view the spring 17, is not placed upon the rotating shaft 12, and hence, it does not act directly with said shaft upon the rotating disk 25, but on the intermediate part or sleeve 26. In order to best take up the pressure in this arrangement of devices, a ball bearing 27 is provided between the disk or collar 25, and the sleeve 26.

Having thus described my invention, I claim—

1. The combination, with a screw-threaded drill-spindle, a threaded collar in which said spindle turns, gear wheels rotating with said spindle and collar respectively, a frame for the drill having an off-set portion opposite said gear-wheels, a shaft, parallel with said spindle, in said off-set portion, and auxiliary gear-wheels on said shaft, one of them loose thereon, meshing with the main gear-wheels and having frictional contact with each other, of a compressed spring in said off-set portion exerting its pressure upon one of said auxiliary gear wheels and thereby determining the magnitude of the surface pressure between the said gear wheels, and means for regulating the compression of the spring, substantially as described.

2. The combination, with a screw-threaded drill-spindle, a threaded collar in which said spindle turns, main gear wheels rotating with said spindle and nut respectively, a frame for the drill having an off-set portion opposite said gear wheels, a shaft, parallel with said spindle, in said off-set portion, and auxiliary gear wheels on said shaft, one of them loose thereon, meshing with the main gear wheels and having frictional contact with each other, of a sleeve around said shaft, means for securing the same against rotation, a collar capable of sliding upon said sleeve, but held thereby against rotation, anti-frictional bearings between said collar and one of said auxiliary gear wheels, a compressed spring exerting its pressure upon said collar and so determining the magnitude of the surface pressure between the auxiliary gear wheels, and means for regulating the compression of the spring, substantially as described.

In testimony whereof I affix my signature in the presence of two witnesses.

ADOLF EMIL WALDEMAR MEISSNER.

Witnesses:
OSCAR BIELEFELD,
GUSTAV STENZEL.