

ATTITUDE OF THE MEN.

We do not believe that our workmen as individuals are opposed to piecework. It is only when we come in contact with the organizations to which some of our employees belong that we find an antagonistic feeling towards this method of shop organization. This statement is proved to be true from the fact that since September 1, 1904, when we first commenced to introduce piecework in all shops along the line we have had no trouble whatever with our blacksmiths, boilermakers, tin and pipe fitters, tank men, painters and carpenters.

None of the above classes of labor have been organized within the time specified except the blacksmiths. This department had the remains of an organization when we commenced the introduction of the present piecework system, but as the piecework went into effect the organization gradually went out of business.

ORGANIZATION'S OBJECTIONS TO PIECEWORK.

The Machinists' Union objects to piecework because, as it claims, it puts one man against another, father against son and son against father in the scramble to increase their daily earnings. As a matter of fact, it simply places every man, regardless of relation, on his own merits. When the piecework price is once fairly established, it presents to all alike an equal opportunity to

increase their daily earnings in direct proportion to the effort. Labor organizations always have maintained that a uniform day rate should prevail for each individual class of mechanics. Piecework, of course, is diametrically opposed to this proposition, because it fixes a fair price on the individual operation and then leaves it open for each workman to earn wages in proportion to his ability.

The foregoing tables clearly demonstrate this fact, because while the piecework prices are practically the same and in many respects the conditions are the same, a study of the figures will show that some shops earn much more than others on the same class of work. This is directly due to the intelligence, mechanical ability and efforts of the workmen. The principal effect, however, of a piecework organization is that it reduces to a minimum the number of mechanics required in the different departments of the shop, because the number of men must be reduced in direct proportion to the increase in efficiency of each individual mechanic.

It is a self-evident fact, however, that the more mechanics a shop employs in a certain line of work, the more money there is in it for the labor organizations, and it is therefore to their interest to maintain a stubborn fight against the further introduction of a fixed price for a given amount of work.

The Gear Hobbing Machine and Its Work*

Description of the Machine and Hob—Trouble in Making Hobs—Method of Avoiding Undercutting of Pinion by Hob—Advantages and Disadvantages of Hobbing Principle—Grinding Gear Teeth Advocated

By THOMAS HUMPAGE

In all gear cutting machines with the exception of the hobbing machine one tooth must be finished before another is begun. With the gear hobbing machine, however, the teeth are generated in circles, and they are all begun and finished practically simultaneously. The cutter or hob consists of a cylinder having wound around it a single right-hand thread. The thread has straight sides inclined to each other at an angle of 30 degrees. This thread is divided into teeth by spiral slots cut through it at right angles to the thread, and the tops, sides and bottoms of the teeth are backed off. The cutter is fed down through the blank, and the blank and cutter are geared together by change-wheels, so that they revolve at the correct ratio between the number of teeth to be cut and the thread of the hob. That is to say, for one revolution of the blank the hob must make as many revolutions as there are teeth to be cut. The action is the same as that of an endless rack which is moved along in gear with the wheel that is being cut. It is clear that the pitch line of the rack must move at exactly the same rate as the pitch line of the wheel. All the metal which interferes with the rack teeth is removed. Thus the teeth of the wheel are generated to the true involute form, and only one hob is required for all wheels of the same pitch.

In order to cut a correct spur-tooth, the axis of the hob must be tilted to the angle of spiral of the thread. Otherwise, as the cutter is fed downward, the spaces would be cut too wide. It is also necessary that one tooth should be set exactly on the centre line of the

machine. This is the tooth which finishes the bottoms of all the teeth in the wheel. If no tooth in the hob is set exactly on the centre line, the wheel teeth will be cut slightly out of upright.

In the first gear hobbing machines, which were built, which was about 1893, the gear blank was carried on a horizontal mandrel, and the hobbing cutter was fed horizontally. By far the greater number are now, however, of the vertical type, and the cutter is fed vertically downwards.

TROUBLE IN THE MANUFACTURE OF HOBBS.

The chief trouble of this system of generating gears lies in the manufacture of the hobs. The hob is made out of one solid piece of steel, which is bored and turned and the keyway cut. Then the thread is roughly milled out and also the spiral slots between the teeth. Next the teeth are relieved or backed off in a special lathe, and the lathe tool is carried in a rest which has a multiple motion. For every tooth, the tool is moved in and out by means of a cam, and at the same time it is fed forwards to follow the thread of the hob. During this process an allowance can be made for expansion or contraction anticipated in the hardening of the hob. After the teeth have been relieved, the hob goes into the tempering department. This is the most dreaded part of the process, for the work which has been done so carefully may be spoiled in the fire or in cooling even with the most experienced men. To complete the hob it is necessary to grind out the bore and over the tops of the teeth to true them up. Finally the cutting faces of the teeth are ground back sufficiently to remove the grinding marks on the tops of the teeth.

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