that the oil should preserve it without thickening. If attention were bestowed simply to the inconvenience occasioned by the resistance on the pivots, the most fluid would only be used, especially for the latter moveable parts, whose velocity is greater and power less; but we have on this side the fact that too fluid an oil does not keep. Thus, if one too fluid in consistency were used on cylinders, the parts would very soon run dry, but the same kind of oil would answer very well for the smaller pivots, by reason of their greater adaptability to the sinks. The consistency of the oil should therefore be in proportion to the pressure, and a thicker oil will be found better adapted for the first moveable parts. It is rare however, that the watchmaker uses all the care requisite, chronometers excepted; the same kind of oil is used at all train parts.

Animal oils, being generally thicker, are better adapted for large clocks; they could be well used for lubricating the blade and pivots of the mainspring. Some chronometers makers prefer them to that from olives, and think it is better preserved at sea.

Freezing.—Olive oil shows a very variable manner under the action of cold, even when appearing to be identical in their nature. It is not good to judge of the quality by the temperature in which it congeals. This change of state occurs from 4° to 20.?

Congealed oils neither have the same appearance nor the same state. Thickened oils are more viscid than fresh ones under the action of cold, and offer greater perturbations in the rate than the latter. In general, an oil curdling with an average degree of cold is not objectionable for the first wheels; it suffices it hould preserve its fluidity with—4°. The rate of the timepiece is not affected thereby. A contact with metal will keep oil fluid; and it may still be so at the pivots while that in the bottle from which it has been taken has already become congealed.

Many causes contribute to degenerate oil. Thus,

1. The nature of the oil itself. Every oil deteriorates after a while of itself, independent of foreign influences.

2. A contact with the air. The elements in the air combine little by little with it, and modify its nature.

3. An action of light. This influence singularly favors a degeneration.

4. Humidity.

5. A rise of temperature, or an intense cold; in fact, every sudden variation of temperature.

6. Emanations arising either from persons or localities; chronometers frequently deteriorate at sea, and on some vessels more than on others. Some persons are obliged to have their watches cleaned oftener than others.

8. Clocks enclosed in not thoroughly seasoned oak timber; the tanic acid given off slowly decomposes the oil.

8. The nature or composition of the metal or alloy employed.

9. The state of the lubricating surfaces.

10. The kind of friction. A pivot badly rounded or polished, or working in too large a hole, is liable to wear; also a high pressure, etc.

The different kinds of brass do not behave alike with oil; certain ones alter more or less, and are more or less affected by others; simple cast brass is very inferior to the drawn or hammered article. The same kind of brass even acts differently, in accordance with having been hammered more or less in a cold state.

The gilding of watch trains by means of mercury serves the double purpose of stopping the oxidation and keeping the oil from spreading; it is caused by the graining left by the gold amalgam on the parts.

Gold, of all metals, preserves oil best; next to gold, gilt brass. Brass of good quality, well hammered, also gives good results. When simply cast, it alters the oil very rapidly. All other metals tried up to date, copper included, are inferior to brass, as far as regards their oil preserving qualities.

PRESERVATION OF OIL IN THE RUBBING PARTS.

It now remains to examine how oil behaves on subjects, and what precautions must be taken to prevent its spreading. This action, altogether mechanical, is regulated by natural laws, and may be determined beforehand; but these questions appear to have little engaged the attention of artisans, and we are forced to collate them from works of different authors, who have barely spoken of them.

The interior cylinder walls retain the oil well. This fact favored by the form of the club teeth of the scapewheel, has eminently contributed to the success of the cylinder escapement, and explains in a great measure the universal regard in which it is held. A number of escapements, obsolete to-day, do not deserve their fate, but for the difficulty with which they retain oil. A lack of this is followed by the wearing of the rubbing parts; destruction progresses, and the timepiece soon becomes *unfit for use, giving* rise to frequent repairs. Thus, a service of only short duration is obtained, which of itself is a capital offense of the mechanism subject to many other accidents. The cylinder escapement, if executed on sound principles, will go a long time without wear.

If the *scapewheel teeth are pointed,* the oil is kept from spreading by filing on the face of each tooth a little groove; it is well to extend it to the other side, it may be cleaned with greater dispatch. The oil tending to run to the wheel's center, is forced to stop at or near the point. Th. Reid, an English horologer, practised this disposition with success. Others have found it practicable to file a little cleft at the end of each tooth, to serve as sink. Mr. Robert, in his carefully constructed timepieces, pierces each tooth of the scapewheel for the same purpose.

Others make these teeth of concave form; the oil being driven from the two sides finds a place to lodge.

Cavities introduced for the purpose of *storing oil at the pivot holes, to lubricate* the rubbing part, are known by the name of sinks. Their forms must comply with three conditions, viz., Maintain the oil at the same place—without running; inclose the largest possible quantity; prevent an exposure to air of the oil.

A certain amount of oil, put into the *sink will remain there without spreading;* by increasing the quantity, it will run out and the pivot runs dry. Only use sufficient, for fear of running out.

As a contact with air changes the oil and forms a pellicle over it, this destructive agent must be guarded against by offering the least surface possible.

To apply oil intelligently, plunge a clean steel rod into the bottle, and withdraw it quickly; the oil remaining attached thereto is put into the oil cup; and with a little steel staff or drill apply it to the parts; put it exactly to the bottom of the hole, only in a quantity sufficient to be contained within the sink; taking care not to touch it elsewhere, it might call out the other oil, by offering it a facility to run.

Preservation.—It is not sufficient that the watchmaker be provided with good oil, he must seek to preserve it, as follows: