The news is now published that one of the old dredges which has been lying in the Rio Grande for more than twenty years has been re-built at a moderate cost, and is capable of excavating 120,000 cubic yards of material per month; as much in fact as can be removed by four of the most modern 95 ton 5-yard steam shovels. Of this resurrection from the dead of the old company, competent engineers estimate, that when it is put to service at the La Boca entrance of the canal, it will do more work than a modern dipper dredge costing £20,000.

It is pathetic to read that in the reconstruction of this derelict the various parts used were all of French construction, and were found in the tropical jungles among the abandoned material which had lain exposed to the elements for over two decades. Among the lot were three boilers in excellent condition, absolutely free from corrosion; two cylinders in good shape, and the engine in the hull could not be surpassed, says a practical authority, by modern machinery, either as to adjustment or economy of operation. All of which is attributed by practical men, who have seen with their own eyes, partly to the excellence of the material and partly to the careful management which, when the work was stopped, covered up the machinery with lead and grease. The reconstructed dredge is found to compare very favourably with an old Scotch dredge which the old canal company had in use for some years, and was abandoned as the other was, and duly re-constructed, since when she has done splendid work with a record of less than forty days out of commission for repairs in five years. When these two derelicts are at work together the effect on the progress of the work will be, say the engineers, very marked. A third dredge of French construction is in hand for re-construction, and promises to be every bit as good when put together and commissioned, with the use of French materials taken from the debris by the side of the canal. Add that the material removed by the dredges now at work is all taken out and dumped into deep water by eight self-propelled barges, and it is evident that the prestige of the veteran who built the Suez Canal can be well re-established by the work he has left behind him in the canal, which he might have made a triumph, but for the malevolence of political faction, and the dishonesty of political allies. At all events the reputation of the engineers of France will emerge with the completed Panama Canal out of the darkness of the past, cleared of the grave imputations of incompetency and carelessness.

Perhaps, also, the plan of some of the best of them for a sea-level canal may also one day be vindicated. Who knows?

A Disquieting Report.

The following cable message alludes to the above:—

"New York, January 14.

"It is reported in Washington that the Panama Canal will cost thirty million sterling above the estimates, owing to revision of plans. Even then, vessels of the Dreadnought class will be unable to pass through the canal."

This is rather loose. Is it an official report or a street rumour? Are these millions of dollars, or pounds? When were the plans revised, and why, and what plans? On the whole, consideration must be deferred for further information.

The Lubrication of Bearings.

All machine users are interested in the subject of lubrication, since it so closely effects the efficiency of the machine. The subject is fully and suggestively treated by Mr. F. H. Davies, in an article in the *Electrical World*, from which we reproduce the salient passages. The writer begins by explaining the function of the lubricant.

In any bearing the function of the lubricant is to convert rubbing into rolling friction by the intervention of the minute globules of which the lubricant is composed; consequently, in a well-lubricated bearing the metallic surfaces never actually touch one another, but are separated by a film of oil, more or less thick, according to its quality and the amount used. In the case of a bearing which is loaded in a downward direction, say to a pressure of 10lb. per square inch of area, it is obvious that the oil between the lower surfaces has to transmit an equivalent force in order to keep them apart, and it therefore follows that oil cannot be fed between these surfaces unless it is supplied at the above pressure. Now, the case in point is that of an ordinary bearing fed at the top by a drip lubricator having no mechanical arrangement to put pressure upon the oil, and the question is: How does the latter get between the lower surfaces where the oil is under a pressure of 10lb. per square inch?

The result is brought about by the property of adhesion in conjunction with the velocity with which the oil is carried round by the shaft. In the above case the shaft naturally lies on the bottom surface of the bearing, leaving a small but important crescent-shaped space at the top. The oil from the lubricator falls into this space, and spreads itself thickly over the upper surface of the shaft, adhering to it; the film between the bottom surfaces is, of course, much thinner. As the shaft rotates, the freshly fed oil is carried into the gradually narrowing space, acquiring a high velocity, and by its adhesive properties still clinging to the journal. It is now, of course, considerably compressed, and the farther it is carried the greater its pressure becomes, until finally it acquires a pressure equal to that between the lower surfaces.

The question of lubricating oils is a very important one, and by far too large a subject to be more than touched on here. The chief points to be considered in the selection of an oil are the pressure on the bearing or the size of the engine, and the temperature at which it is presumed the part to be lubricated will work. What is wanted is a fluid that possesses the lowest molecular friction, and from this point of view the thinner the oil the better. On the other hand, thin oil does not lend itself very well to what may be termed adhesive action of the bearing, and as the latter heats up it gets thinner, and consequently worse and worse in this respect. On the contrary, thick or heavy oil, owing to its greater adhesiveness, will force its way in even against the greatest pressure, but when there it is not so efficient as thin oil. It is obvious that in a case like this the idea is the happy medium, and it is at this result that most manufacturers of oils aim. In an engine or any machine it is customary to use the same oil to lubricate all the external parts. It should be remembered that while this is the only method possible in practice, it is theoretically wrong, as reciprocating bearings require a heavier oil than guides or journals, in order to reduce as much as possible the flow from top to bottom of the "brass" consequent upon the alternating impacts. It is conceivable that a greater proportion of a thin oil would be forced round to the side where there is no load than would be the case where a thick oil with its superior viscosity is used,

Grooves for Oil.

It should be noted here that it is quite as possible for a reciprocating bearing to run hot through being too slack as through being too tight. A very slack bearing will knock heavily, and the impacts of the surfaces will naturally evolve heat. In practical working, when such a case occurs, the only remedy short of tightening the bearing is to keep it over-supplied with oil, thus producing a cushion for the blow.

Guides do not need grooves if the surfaces are properly prepared; and they are certainly undesirable in bearings of reciprocating machines, where it is so essential to keep as much oil between the loaded surfaces as possible. In this case the channels only aid it to pass to the unloaded side where it is not needed. Where grooves are used, it is important that the edges should be rounded, for if they are left sharp they tend to wipe off the oil and keep it in all the channels.

Rubbing and Rolling Friction.

It may be taken as an axiom that so long as rolling friction only, as defined above, is present in a bearing there will be no appreciable heating; but the moment rubbing friction between metal and metal occurs warming up begins. This may be due to three causes: (1) Insufficient supply or poor quality of oil; (2) the presence of a foreign substance, such as grit in the bearing; or (3) badly prepared surfaces. In the first case rubbing friction will occur all round with disastrous results in a very short time; the shaft or pin expands with the heat, making matters worse, and finally becomes such a tight fit that the engine pulls up or something breaks. In the second case, rubbing friction is only set up in the small area affected by the grit; but the heat generated there soon spreads, causing the bearing to close up as before, and the result will be bad scoring of the brass, particularly in the place where the grit is present.

Another point to be remembered in regard to hot bearings is that above a certain temperature the oil chars, losing its lubricating properties. When this stage is reached, under ordinary systems of lubrication no amount of oil will cool a bearing, and the engine must be shut down.

In the Workshop.

The following are the principal kinds of hone and oil-stone from which a workman is likely to be able to make his selection—the order in which they are placed being approximately that of their abrading power; those at the top of the list being the "fastest cutting," a quality which is generally accompanied by a want of fineness in the edge produced.

1. Washita Oilstone.—A very compact white sandstone, of rather recent introduction, almost resembling Carrara marble in appearance. Although it does not greatly differ in price from Turkey stone, its much greater uniformity and slightly more rapid cutting property cause it to be in more favour with carpenters and others, with whom coarseness of edge is not an objection.

2. Turkey oilstone.—When of good quality no better substance can be employed for setting tools for which great fineness of edge is not required, since it cuts the hardest steel with avidity even when but little pressure is applied. At the same time it is of a close grain, and is not easily scratched. Unfortunately, it is very variable in quality, as it is also in colour; the latter which is called white, grey, or black being generally a veined mixture of different shades of bluish and brownish greys. Its cost is about three times that of the stone next mentioned.

3. Charnley Forest Stone.—Found near Mount Sorrel, in Leicestershire. This is the best of the British oilstones, and has long been a favourite with carpenters and others, that from the Whittle Hill Quarries, which is of grey colour, dappled or streaked with red, being considered to be the best. Till lately this has hardly been obtainable, the only representative of Charnley Forest stone being a rather inferior one with a decidedly green tint. Both of them, however, give a very fairly fine edge, but do not cut quite so rapidly or with as slight pressure as Turkey.

4. Canada Oilstone.—A very fine porous sandstone of a greyish white colour, which has been recently introduced. Being much less compact than any of the preceding stones, it is much more rapidly worn away. Its first cost, is, however, rather less than that of Charnley stone.

5. Grecian Hone.—Under this name a slaty stone is imported which is of a greenish colour, and, although said to be superior to Welsh oilstone, does not greatly differ from it in appearance.

6. Welsh Oilstone.—A hardish stone of a green colour and slaty texture, inferior to the Charnley Forest for joiners' use. In price it is about the same, as also is the Grecian hone, No. 5.

7. Arkansas Oilstone.—Cuts slowly, but is very superior to all those above mentioned for giving a fine edge to surgical instruments, &c. Although extremely costly—its price being about four times that of Turkey stone—it is extensively used for such purposes. In colour it resembles Washita oilstone, but it is of very much finer grain and wears away very slowly.

8. German Hone.—Thin slabs of a very soft yellow stone, cemented upon a rather harder but similar material of a slate-blue colour, are imported and sold under this name. The extreme softness of the former renders it almost useless for such edge-tools as we have been considering, although it is well adapted for setting razors, to which it imparts an edge of great smoothness and delicacy.